

AL-SANA

**09
BOARDS**

SPPS
SOLVED PAST PAPER SERIES

PHYSICS

Lahore, Gujranwala, Multan, Bahawalpur, Faisalabad
Rawalpindi, Sargodha, DG Khan, Sahiwal

10th

- ◆ Chapter Wise Solved MCQ's of PCTB.
- ◆ Chapter Wise Solved MCQ's from Past Papers.
- ◆ Chapter Wise Short Questions of PCTB.
- ◆ Chapter Wise Short Questions from Past Papers.
- ◆ Chapter Wise Long Questions from Past Papers.
- ◆ Chapter Wise Solved Numericals from Exercises of PCTB.
- ◆ Board Papers 2018, 2019

AL-SANA PUBLICATIONS

Al-Habib Educational Centre, 38 Urdu Bazar Lahore Ph: 042-37232129

Website: www.azeemgroups.com

Email: info@azeemgroups.com

Stockist

Azeem Academy

22 Urdu Bazar Lahore

Ph: 042-37231448

Smart Syllabus

Chapter 10: Simple Harmonic Motion and Waves

Simple Harmonic Motion, Motion of Mass Attached to a Spring, Motion of a Simple Pendulum, Wave Motion, Ripple Tank

Activity: 10.2, Types of Mechanical Waves, Relation between Velocity, Frequency and Wavelength ($v=f\lambda$),

Examples: 10.1, 10.2

Exercise:

Class Work: MCQs: (i-vi, viii, ix), Review Questions: (10.1, 10.4, 10.5), Numerical Problems: (10.1-10.3, 10.9, 10.10)

Home Work: Review Questions: (10.2, 10.7), Numerical Problems: (10.4)

Chapter 11: Sound Waves

Sound Waves, Sound is produced by a Vibrating Body Activity 11.1, Sound Requires Material Medium for its Propagation, Longitudinal Nature of Sound Waves, Characteristics of Sound, Loudness, Pitch, Quality, Intensity, Sound Intensity Level, Speed of Sound, Audible Frequency Range, Ultrasound, Examples:

11.1, 11.2

Exercise:

Class Work: Review Questions: (11.4, 11.5, 11.7-11.11, 11.15, 11.18), Numerical Problems: (11.1-11.6)

Home Work: MCQs: (i-vii), Review Questions: (11.1, 11.2), Numerical Problems: (11.9)

Chapter 12: Geometrical Optics

Spherical Mirrors, Image Location by Spherical Mirrors, Sign Conventions, Refraction of Light, Laws of Refraction, Refractive Index, Total Internal Reflection, Refraction through Prism, Lenses, Image Location by Lens Equation, Sign Conventions for Lenses, Examples: 12.1-12.6

Exercise:

Class Work: MCQs: (ix, x), Review Questions: (12.6, 12.8-12.10), Numerical Problems: (12.2-12.5, 12.7-12.10)

Home Work: MCQs: (i-vii), Review Questions: (12.4, 12.7, 12.12), Numerical Problems: (12.1)

Chapter 13: Electrostatics

Electrostatic Induction, Coulomb's Law, Electric Field and Electric Field Intensity, Electrostatic Potential, Capacitors and Capacitance, Combination of Capacitors, Capacitors in Parallel, Capacitors in Series, Uses of Capacitors, Examples: 13.1-13.4

Exercise:

Class Work: MCQs: (i, vi-xi), Review Questions: (13.2, 13.8-13.14), Numerical Problems: (13.1-13.8)

Home Work: Review Questions: (13.17), Numerical Problems: (13.9, 13.10)

Chapter 14: Current Electricity

Electric Current, The Measurement of Current, Potential Difference, Electromotive Force (e.m.f), The Measurements of Potential Difference and Electromotive Force, Ohm's Law, V-I Characteristics of Ohmic and Non-Ohmic Conductors, Combination of Resistors, Series Combination, Parallel Combination, Electrical Energy and Joule's Law, Electric Power, Kilowatt-Hour, Examples: 14.1, 14.2, 14.4, 14.5, 14.7, 14.8

Exercise:

Home Work: MCQs: (i-ix), Review Questions: (14.3-14.5, 14.10, 14.11), Numerical Problems (14.1, 14.2, 14.4-14.7)

Class Work: Review Questions: (14.1, 14.6, 14.8), Numerical Problems (14.3)

Chapter 15: Electromagnetism

Magnetic Effects of a Steady Current, Direction of Magnetic Field, Magnetic Field of a Solenoid, Electromagnetic Induction, Direction of Induced e.m.f - Lenz's Law, Mutual Induction, Transformer, Working of a Transformer, Example: 15.1

Exercise:

Class Work: MCQs: (iii-vii), Review Questions: (15.1, 15.3, 15.7, 15.9), Numerical Problems: (15.3, 15.4)

Home Work: MCQs: (i, ii, viii, ix), Review Questions: (15.11, 15.12), Numerical Problems: (15.1, 15.2)

Chapter 16: Basic Electronics

Analogue and Digital Electronics, Basic Operations of Digital Electronics - Logic Gates, AND Operation, OR Operation, NOT Operation, NAND Gate, NOR Gate, Uses of Logic Gates, House Safety Alarm

Exercise:

Class Work: Review Questions: (16.8, 16.9)

Home Work: MCQs: (iii-vii), Review Questions: (16.7, 16.10)

Chapter 17: Information and Communication Technology

Information and Communication Technology, Components of Computer Based Information (CBIS), Transmission of Light Signals through Optical Fibres only, Internet, Internet Services, Browsers, Electronic Mail

Exercise:

Class Work: Review Questions: (17.2, 17.11)

Home Work: MCQs: (i, iii, vi, vii), Review Questions: (17.1, 17.3, 17.7)

Chapter 18: Atomic and Nuclear Physics

Atom and Atomic Nucleus, Isotopes, Natural Radioactivity, Background Radiations, Nuclear Transmutations, Half-Life and its Measurement, Radioisotopes and their Uses, Fission Reaction, Nuclear Fusion, Examples: 18.1, 18.2

Exercise:

Class Work: MCQs: (i-ix), Review Questions: (18.1, 18.3, 18.5-18.9, 18.11-18.13),

Numerical Problems: (18.1-18.3, 18.5, 18.7, 18.9)

Home Work: Review Questions: (18.2, 18.4, 18.10)

EXPERIMENTS:

- To verify the Laws of Refraction by using a Glass Slab.
- To determine the Critical Angle of Glass using a Semi Circular Slab and a Light Ray Box or by Prism.
- To trace the path of a ray of light through Glass Prism and measure the Angle of Deviation.
- To find the Focal Length of a Convex Lens by Parallax Method.
- Verify Ohm's Law (using Wire as Conductor).
- To study Resistors in Series Circuit.
- To study Resistors in Parallel Circuit.
- To find the Resistance of Galvanometer by Half Deflection Method.
- To verify the Truth Tables of OR, AND, NOT, NOR and NAND Gates.

CONTENTS

Ch. #	Subject	Page #
10.	Simple Harmonic Motion and Waves	01 – 13
11.	Sound	14 – 24
12.	Geometrical Optics	25 – 42
13.	Electrostatics	43 – 59
14.	Current Electricity	60 – 75
15.	Electromagnetism	76 – 83
16.	Basic Electronics	84 – 90
17.	Information and Communication Technology	91 – 94
18.	Atomic and Nuclear Physics	95 – 105

SECTION I**MULTIPLE CHOICE QUESTIONS****CHAPTER 10****SIMPLE HARMONIC MOTION AND WAVES****PCTB EXERCISE**

- ♦ Choose the correct answer from the following choices:
- Which of the following is an example of simple harmonic motion?
 - ☒ the motion of simple pendulum
 - ☐ the motion of ceiling fan
 - ☐ the spinning of the Earth on its axis
 - ☐ a bouncing ball on a floor
 - If the mass of the bob of a pendulum is increased by a factor of 3, the period of pendulum's motion will
 - ☐ be increased by a factor of 2
 - ☒ remain the same
 - ☐ be decreased by a factor of 2
 - ☐ be decreased by a factor of 4
 - Which of the following devices can be used to produce both transverse and longitudinal waves?
 - ☐ a string
 - ☐ a ripple tank
 - ☒ a helical spring (slinky)
 - ☐ a tuning fork
 - Waves transfer
 - ☒ energy
 - ☐ frequency
 - ☐ wavelength
 - ☐ velocity
 - Which of the following characteristics of a wave is independent of the others?
 - ☐ speed
 - ☐ frequency
 - ☒ amplitude
 - ☐ wavelength
 - The relation between v , f and λ of a wave is:
 - ☐ $v f = \lambda$
 - ☒ $f \lambda = v$
 - ☐ $v \lambda = f$
 - ☐ $v = \lambda / f$

FROM PUNJAB BOARDS**(2014, 15, 16, 17, 18 & 19)**

- In simple pendulum motion force is provide by: (LHR-GI-14)(MTN-GII-14)
 - ☐ air resistance
 - ☐ tension in the string
 - ☒ inertia
 - ☐ weight of body
- Wave transfer: (LHR-GI-14)(BWP-GI-16) (GUJ-GI-16, GII-17)(DGK-GI-15)(SWL-GII-17) (FBD-GI-15, GII-16, GII-17, GI-19) (RWP-GII-16, GI-17)
 - ☐ frequency
 - ☐ wavelength
 - ☐ velocity
 - ☒ energy
- The example of shock absorber of the vehicle are: (LHR-GI-14)
 - ☐ simple harmonic
 - ☐ vibratory
 - ☒ damped motion
 - ☐ linear motion
- The SI unit of amplitude is: (LHR-GI-14)
 - ☐ sec
 - ☐ H₂
 - ☒ m
 - ☐ cm
- If mass of the bob of a pendulum is increases by a factor of 3, the time period of pendulum's motion will: (LHR-GII-16)
 - ☐ Be increased by factor of 2
 - ☒ Remain the same
 - ☐ Be decreased
 - ☐ Be decreased by a factor of 4
- The spring's constant is: (LHR-GI-16)
 - ☒ $k = -\frac{F}{x}$
 - ☐ $F = ma$
 - ☐ $w = mg$
 - ☐ $k = -\frac{x}{m}$
- Formula for the time period of mass attached to spring is: (LHR-GII-15) (MTN-GII-16,17)(BWP-GI-15)(SGD-GI-16)
 - ☐ $T = 2\pi \sqrt{\frac{k}{m}}$
 - ☒ $T = 2\pi \sqrt{\frac{m}{k}}$
 - ☐ $T = 2\pi \sqrt{\frac{\lambda}{m}}$
 - ☐ $T = 4\pi \sqrt{\frac{m}{4}}$
- Frequency is equal to: (LHR-GI-16)
 - ☐ $f = \frac{1}{g}$
 - ☒ $f = \frac{1}{T}$
 - ☐ $f = kn$
 - ☐ $f = 2\pi \sqrt{\frac{\lambda}{g}}$

9. Which of the following is method of energy transfer? (LHR-GII-15)
(GUJ-GI-15,16)(RWP-GII-17)(SGD-GI-15,17)
(a) Conduction (b) Radiation
(c) Wave motion (d) all of these
10. The relation between velocity, frequency and wave length for wave in gem by.
(LHR-GI-15,18)(GUJ-GI-15, 16, GII-18)(FBD-GII-16)
(MTN-GII-15, GI-16,18) (RWP-GI-15,16)(SWL-GII-18)
(a) $v f = \lambda$ (b) $f \lambda = v$
(c) $v \lambda = f$ (d) $v = \frac{\lambda}{f}$
11. The main types of waves are: OR(LHR-GI-17)
Types of waves are: MTN(G-II-15, 16)
(BWP-GII-16)(DGK-GI-17)(SWL-GII-14)
(a) 1 (b) 2 (c) 3 (d) 4
12. The number of waves passing through a point in one second is called:
(LHR-GI-17)(GUJ-GI-17)
(a) frequency (b) displacement
(c) wave length (d) amplitude
13. The example of longitudinal waves is:
(LHR-GI-15)
(a) Sound waves (b) Light waves
(c) Radio waves (d) Water waves
14. The equation for the Time Period of Simple Pendulum is:
(GUJ-GII-16, 19)(MTN-GII-16)(SGD-GII-14)
(a) $T = 2\sqrt{\frac{\lambda}{g}}$ (b) $T = 2\pi\sqrt{\frac{\lambda}{g}}$
(c) $T = 2\sqrt{\frac{g}{K}}$ (d) $T = 2\pi\sqrt{\frac{g}{K}}$
15. The product of frequency (f) and wavelength λ is equal to:
(LHR-GII-15)(GUJ-GII-15)(DGK-GII-16)
(a) Time period (b) amplitude
(c) Wave speed (d) wave energy
16. Ripple tank is used to study the characterises of: (MTN-GI-14)
(FBD-GI-14)(RWP-GI-15)(SGD-GI-14)
(a) Mechanical waves (b) Light waves
(c) Radio waves (d) Electromagnetic waves
17. ----- method is/are used to transfer the energy.(MTN-GI-16)(BWP-GII-17)(RWP-GII-17)
(SGD-GII-14, GI-15)(GUJ-GI-15, 16, 17)
(a) Conduction (b) Radiation
(c) Wave motion (d) All of these
18. Which wave do not required medium for their propagation. (MTN-GII-16)
(a) Sound wave (b) Mechanical waves
(c) Electromagnetic wave (d) all of them
19. In Motion of a Simple Pendulum, Restoring Force is provided by:
(BWP-GII-16)
(a) Air Resistance
(b) Tension in the String
(c) Force of Gravity
(d) Inertia
20. When $L = 1.0$ m, Then the time period of simple pendulum is. (BWP-GI-14, 15)
(a) 1.99 sec (b) 2.115 sec
(c) 1.89 sec (d) 1.88 sec
21. SI unit of frequency is: (BWP-GII-15)
(a) meter (b) radian
(c) Neutron (d) Hertz
22. Categories of wave are:
(FBD-GII-14)(RWP-GII-14)
(a) 2 (b) 3 (c) 4 (d) 6
23. Which of the following is method of energy transfer? (FBD-GI-15)
(a) Conduction (b) Radiation
(c) wave motion (d) all of these
24. The formula of Hooke's law is:
(FBD-GII-18)
(a) $F = kx$ (b) $F = -kx$
(c) $k = \frac{x}{F}$ (d) $x = -Fk$
25. When did Christian Huygens invent the pendulum clock? (FBD-GI-18)
(a) 1856 (b) 1656 (c) 1756 (d) 1956
26. Wavelength of waves can also be defined as ratio of: (RWP-GII-14)
(a) speed and frequency (b) time period
(c) distance speed (d) frequency speed
27. If length of a pendulum is one meter on earth, then its time period will be:
(RWP-GII-14, 18)
(a) 2s (b) 10s (c) 1s (d) 6s

28. Time period of simple pendulum of 1m long is: (RWP-GI-18)

- (a) 1.99S (b) 2.11S
(c) 1.89S (d) 1.88S

29. The characterises wave is independence of the other. (SGD-GI,II-14)

- (a) speed (b) frequency
(c) amplitude (d) wave length

30. If the time period is given then frequency is calculated. (SGD-GI-15)

- (a) $f = \frac{1}{T}$ (b) $f = \frac{2}{T}$ (c) $f = \frac{3}{T}$ (d) $f = \frac{4}{f}$

31. One earth a pendulum has length of 1 m what will be its time period. (SGD-GI-17)

- (a) 2 s (b) 10 s
(c) 15 s (d) 6 s

32. The endoscope which is used to examine throat is called: (SGD-GII-18)

- (a) Gastroscope (b) Cystoscope
(c) Bronchoscope (d) None of these

33. The relation between v , f and λ of wave is: (SGD-GII-16, 17)(MTN-GII-19)

- (a) $\lambda = v f$ (b) $v = \frac{\lambda}{f}$ (c) $v = f \lambda$ (d) $f = v \lambda$

34. Which of the following characteristic of wave is independent of the others:

(DGK-GI-16)(FBD-GI-15, GII-16)(MTN-GI-14)
(RWP-GI-15, GII-19)(SWL-GI-15)(SGD-GI-19)

- (a) Speed (b) Frequency
(c) Amplitude (d) Wavelength

35. SI unit of Frequency. (DGK-GI,II-15)

- (a) Hertz (b) meti
(c) Raction (d) Neuton

36. When water wave enters the region of shallow water the wave length.

(DGK-GI-15, 16)

- (a) Decrease (b) Increase
(c) Become zero (d) Remain same

37. Formula of Hook's law is: (DGK-GII-18)

- (a) $F = kx^2$ (b) $F = -kx$
(c) $k = \frac{x}{F}$ (d) $x = -Fk$

38. If the length of simple pendulum is doubled its time period will be: (DGK-GI-18)

- (a) $\sqrt{2} T$ (b) $\frac{T}{\sqrt{2}}$
(c) $2T$ (d) $\frac{T}{2}$

39. The relation between velocity (v); frequency (f) and wavelength (λ) is:

(DGK-GII-16)(SGD-16, 17)(SWL-GI-19)

- (a) $\lambda = V/f$ (b) $V = f \lambda$
(c) $f = V\lambda$ (d) $\lambda = v f$

40. Wave equation is: (SWL-GI-15, 16, GII-14)

- (a) $f\lambda = v$ (b) $\lambda v = f$
(c) $\frac{1}{\lambda v}$ (d) $\frac{v}{\lambda} = \frac{1}{f}$

41. When $L = 1.0$ m, Then the time period of simple pendulum is. (SWL-GI-14)

- (a) 1.99 sec (b) 2.115 sec
(c) 1.89 sec (d) 1.88 sec

42. Which of the following devices can be used to produce both transverse and longitudinal waves?

(SGD-GII-15)(MTN-GI-14)(FBD-GII-15)(DGK-GI-19)

- (a) a string (b) a ripple tank
(c) a helical spring (slinky) (d) a tuning fork

43. If the mass of the bob of a pendulum is increased by a factor of 3, the period of pendulum's motion will

(LHR-GII-16, GI-19)

- (a) be increased by a factor of 2
(b) remain the same
(c) be decreased by a factor of 2
(d) be decreased by a factor of 4

44. Which of the following characteristics of a wave is independent of the others?

(MTN-GI-14)(RWP-GI-15)(SWL-GI-15)(SGD-GI-19)

- (a) speed (b) frequency
(c) amplitude (d) wavelength

45. The formula for the time period of a simple pendulum: (LHR-GII-19)

(a) $T = 2\pi \sqrt{\frac{g}{\lambda}}$

(b) $T = 2\pi \sqrt{\frac{\lambda}{g}}$

(c) $T = 2\pi \sqrt{\frac{m}{k}}$

(d) $T = 2\pi \sqrt{\frac{k}{m}}$

46. The part of wave, where the particles of medium are lowest from the mean position is called: (GUJ-GII-19)

(a) crest

(b) trough

(c) wave front

(d) wave length

47. The wave in which the particles of the medium move back and forth along the direction of propagation of wave is called: (GUJ-GI-19)

(a) water wave

(b) sound wave

(c) radio wave

(d) light wave

48. The bending of Waves around obstacles or sharp edges, this phenomenon is called: (BWP-GI-19)

(a) Reflection

(b) Refraction

(c) Interference

(d) Diffraction

49. The time period of vibrating mass spring system, when its mass become doubled: (MTN-GI-19)

(a) Remain same

(b) Become half

(c) Increased

(d) Decreased

50. The part of a wave, where the particles of medium are highest from the mean position is called: (FBD-GII-19)

(a) Crest

(b) Trough

(c) Wavefront

(d) Wavelength

51. Release of energy by the sun is due to: (SGD-GII-19)

(a) Nuclear fission

(b) Burning of gases

(c) Particle waves

(d) Mechanical waves

SECTION II

SHORT QUESTIONS ANSWERS

PCTB EXERCISE

PCTB NO SHORT QUESTIONS

FROM PUNJAB BOARDS

(2014, 15, 16, 17, 18 & 19)

1. With respect to simple pendulum, what is difference between vibration and amplitude? (LHR-GI-14)

Ans. **Vibration:** One complete round trip of a vibrating body about its mean position is called one vibration.

Amplitude (A): The maximum displacement of a vibrating body on either side from its mean position is called its amplitude.

2. Write the difference between longitude and transverse waves. (LHR-GII-14)

(GUJ-GII-15)(MTN-GI-17)(SGD-GII-19)
(DGK-GII-14)(RWP-GI-18)

Ans. **Longitudinal waves:** In longitudinal waves the particles of the medium move back and forth along the direction of propagation of wave.

Transverse waves: In case of transverse waves, the vibratory motion of particles of the medium is perpendicular to the direction of propagation of waves.

Example: Waves on the surface of water and light waves are examples of transverse waves.

3. State Hook's Law. (LHR-GII-15)
(GUJ-GII-19)(MTN-GI-19)(GUJ-GI-19)

Ans. A law stating that the stress applied to a material is directly proportional to the strain on that material with in the elastic limit is called Hook's Law. $F = -kx$

4. Write mechanical waves and write name of its types. (LHR-GI-15, GII-19)

(BWP-GI-14, GII-17,18)(GUJ-GII-16)(SGD-GI-15)

Ans. **Mechanical Waves:** Waves which require any medium for their propagation are called mechanical waves.

Example: Examples of mechanical waves are water waves, sound waves and waves produced on the strings and springs.

Types of mechanical waves.

- (i) Longitudinal wave.
- (ii) Transverse wave.

5. Define refraction of waves.

(LHR-GI-16, GII-19)(BWP-GI-19)(FBD-GII-18)

Ans. When a wave from one medium enters into the second medium at some angle, its direction of travel changes is called refraction of wave.

6. Define longitude waves.

(LHR-GI-17)(DGK-GII-14)(RWP-GII-17,18)
(FBD-GII-19)(SGD-GI-14)(FBD-GI-18)

Ans. In longitudinal waves the particles of the medium move back and forth along the direction of propagation of wave.

7. What do you mean by Amplitude.

(LHR-GI-17)(MTN-GII-17, 18)(DGK-GI-18)
(BWP-GI-18)

Ans. The maximum displacement of a vibrating body on either side from its mean position is called its amplitude.

8. Define simple pendulum and write the formula of its time period. (LHR-GII-17)

(BWP-GII-17)(RWP-GII-18)

Ans. A simple pendulum consists of a small bob of mass 'm' suspended from a light string of length 'λ' fixed at its upper end.

$$\text{Formula: } T = 2\pi \sqrt{\frac{\lambda}{g}}$$

9. Write two characteristics of simple harmonic motion. (LHR-GII-17, GI-19)

(SWL-GII-17)(GUJ-GI-16)(MTN-GII-14)

Ans. Important features of SHM are summarized as:

- i. A body executing SHM always vibrates about a fixed position.
- ii. Its acceleration is always directed towards the mean position.

10. How can you defined the Term Wave?

(LHR-GII-18)(MTN-GII-16)(SGD-GII-17)
(DGK-GII-17)

Ans. A wave is a disturbance in the medium which causes the particles of the medium to undergo vibratory motion about their mean position in equal intervals of time.

11. What is meant by the diffraction of waves? OR

Define diffraction of waves and write an example. (LHR-GII-18)(SWL-GI-19)

(GUJ-GI-17, GII-18)(DGK-GI-18)(SGD-GII-15)

Ans. The bending or spreading of waves around the sharp edge or corners of obstacles or slits is called diffraction.

12. What is meant by the time period?

(BWP-GI-16)(LHR-GI-18)

Ans. Time period (T):

The time taken by a vibrating body to complete one vibration is called time period.

13. Define Simple Harmonic motion.

(GUJ-GII-14)(MTN-GII-15)(BWP-GI-14,15)
(SWL-GII-14, GI-15)(DGK-GII-15, GI-14)
(SGD-GII-14, GI-17)(SWL-GII-19)

Ans. Simple harmonic motion occurs when the net force is directly proportional to the displacement from the mean position and is always directed towards the mean position.

14. Define time period and frequency.

(BWP-GI-19)(DGK-GII-19)(GUJ-GI-14, GII-18)

Ans. Time period (T):

The time taken by a vibrating body to complete one vibration is called time period.

Frequency (f):

The number of vibrations or cycles of a vibrating body in one second is called its frequency. It is reciprocal of time period i.e., $f = 1/T$

15. Define spring constant and Write its formula. (GUJ-GI-17)(MTN-GI-15)

Ans. According to Hooke's:

$$F = -kx$$

x is the displacement of the mass from its mean position O, and k is a constant called the spring constant define as

$$k = \frac{-F}{x}$$

The value of k is a measure of the stiffness of the spring.

16. What is difference between Mechanical waves and electromagnetic waves.

(GUJ-GII-17)(MTN-GI-16, GII-18)

(BWP-GI-14)(FBD-GI-16)(SWL-GI-19)

Ans. Mechanical Waves: Waves which require any medium for their propagation are called mechanical waves.

Example: Examples of mechanical waves are water waves, sound waves and waves produced on the strings and springs.

Electromagnetic Waves: Waves which do not require any medium for their propagation are called electromagnetic waves.

Examples: Radio waves, television waves, X-rays, heat and light waves are some examples of electromagnetic waves.

17. What is meant by Compression.

(LHR-GII-19)(GUJ-GI-18)

Ans. A series of disturbance in the form of waves will start moving along the length of the slinky. Such a wave consists of regions called compression.

18. Define Restoring Force. (MTN-GI-14)

(SWL-GII-18)(DGK-GII-16,18)

(SGD-GII-16, GI-17) (BWP-GII-16, GI-17,18)

(FBD-GII-15, GI-19)(RWP-GII-16, GI-17, GII-19)

Ans. A restoring force always pushes or pulls the object performing oscillatory motion towards the mean position.

19. If the length of simple pendulum is doubled what will be the change in its time period? (MTN-GI-17)(DGK-GII-17)

(FBD-GI-19)(RWP-GII-19)

Ans. If the length of a sample pendulum is increased its time period also increased. It moves slowly.

$$\text{Equation } T = 2\pi \sqrt{\frac{\lambda}{g}} \quad \text{_____ (1)}$$

According to the condition

$\lambda = 2\lambda$ putting the value _____ eq (1)

Then the equation become

$$T^1 = 2\pi \sqrt{\frac{2\lambda}{g}}$$

$$T^1 = 2\pi \sqrt{2} \sqrt{\frac{\lambda}{g}}$$

$$T^1 = \sqrt{2} \cdot 2\pi \sqrt{\frac{\lambda}{g}}$$

$$T^1 = \sqrt{2} \cdot T$$

$$T^1 = \sqrt{2} \cdot T. \quad \text{Ans.}$$

20. Find the time period of a Simple pendulum of 1.0m long at a location where $g = 10.0 \text{ ms}^{-2}$ (MTN-GI-18)

Ans. Given, $\lambda = 1.0 \text{ m}$, $g = 10.0 \text{ ms}^{-2}$

Using the formula,

$$T = 2\pi \sqrt{\frac{\lambda}{g}}$$

By putting the values

$$T = 2 \times 3.14 \times \sqrt{\frac{1.0 \text{ m}}{10.0 \text{ m s}^{-2}}} = 1.99 \text{ s}$$

21. Define diffraction of waves.

(BWP-GI-14)(FBD-GI-19)

Ans. The bending or spreading of waves around the sharp edges or corners of obstacles or slits is called diffraction.

22. Define crest and trough.**OR**

Differentiate between crest and trough of transverse waves.

(BWP-GI-14)(RWP-GI-19)(DGK-GI-19)

Ans. Crest: The crest are the highest points of the particles of the medium from the mean position.

Trough: The trough are the lowest points of the particles of the medium from the mean position.

23. What is mean is by wavelength?

(BWP-GI-16)

Ans. The distance between two consecutive crests or troughs is called wavelength.

If $f = 4 \text{ Hz}$ and $\pi = 0.4 \text{ m}$ Final the value of V .

24. A wave moves on a slinky with frequency 4 Hz and wavelength of 0.4m what is the speed of waves.

(BWP-GII-18)(SWL-GI-19)

Sol: Give that $f = 4 \text{ Hz}$, $\lambda = 0.4 \text{ m}$

$$V = f \lambda$$

$$V = (4 \text{ Hz})(0.4) = 1.6 \text{ ms}^{-1}$$

25. Define simple pendulum. Write down its time period equation. (FBD-GI-14, GII-18)

Ans. A simple pendulum consists of a small bob of mass 'm' suspended from a light string of length 'λ' fixed at its upper end.

$$\text{Formula: } T = 2\pi \sqrt{\frac{\lambda}{g}}$$

26. Define transverse waves.

(FBD-GII-14, 19, GII-17)

(DGK-GI-17, 19)(RWP-GII-18)

Ans. In case of transverse waves, the vibratory motion of particles of the medium is perpendicular to the direction of propagation of waves.

Examples: Waves on the surface of water and light waves are examples of transverse waves.

27. Define electromagnetic waves also give an example. (FBD-GII-17)

Ans. Electromagnetic Waves: Waves which do not require any medium for their propagation are called electromagnetic waves.

Examples: Radio waves, television waves, X-rays, heat and light waves are some examples of electromagnetic waves.

28. If the time period of a simple pendulum is 1.99 second find its frequency.

(FBD-GI-17, GII-19)(GUJ-GI-19)

Ans. Time period = $T = 1.99 \text{ sec}$

$f = ?$

formula

$$f = \frac{1}{T}$$

$$= \frac{1}{1.99}$$

$$= 0.50 \text{ sec. Ans.}$$

29. A ball is dropped from a certain height on to the floor and keeps bouncing. Is the motion of the ball is simple harmonic? explain. (RWP-GII-14)

Ans. No! The ball is dropped from a certain height it does not executing simple harmonic motion because during its bouncing its P.E and time period is not constant more over its amplitude is not constant.

30. Define waves equation and write its formula. (RWP-GI-14)

Ans. **Wave equation:** The relation between the velocity (v), frequency(f) and wave length(λ) is known as wave equation,

$$\text{Formula: } v = f\lambda$$

31. What is meant vibration?

(RWP-GI-16,17)

Ans. **Vibration:** One complete round trip of a vibrating body about its mean position is called one vibration.

32. Define frequency. (RWP-GII-17)(SGD-GII-16)

Ans. **Frequency:** The number of vibration or cycles of vibrating body in one second is called its frequency. It is reciprocal of time

$$\text{period i.e } f = \frac{1}{T}$$

33. Define time period. Write the formula of time period of a simple pendulum.

(DGK-GII-14)

Ans. **Time period (T):** The time taken by a vibrating body to complete one vibration is called time period.

Time period of simple pendulum.

$$\text{Formula:- } T = 2\pi \sqrt{\frac{\lambda}{g}}$$

34. Prove that $v = f\lambda$

OR Derive a relation between velocity frequency and wavelength of a wave.

(LHR-GI-19)(SGD-GI-19)(DGK-GI-14, GII-19)

(SWL-GI-17, GII-19)

Ans. The velocity of wave which given

Velocity = distance/time

$$v = \frac{d}{t}$$

If time taken by the wave in moving from one point to another is equal to its time period T, then the distance covered by the wave will be equal to one wavelength λ, hence we can write:

$$v = \frac{\lambda}{T}$$

But time period T, is reciprocal of the

$$\text{frequency } f, \text{ i.e., } T = \frac{1}{f}$$

Therefore, $v = f\lambda$

- 35. What is the function of ripple tank. OR Define the use of ripple tank. OR What do you know about Ripple Tank?**

(DGK-GI-19, GII-15)(MTN-GII-19)

Ans. Ripple Tank: Ripple tank is a device to produce water waves and to study their characteristics.

- 36. Define two basic Types of waves.**

(DGK-GII-18)

Ans. Mechanical Waves:

Waves which require any medium for their propagation are called mechanical waves.

Examples of mechanical waves are water waves, sound waves and waves produced on the strings and springs.

Electromagnetic Waves:

Waves which do not require any medium for their propagation are called electromagnetic waves.

Examples: Radio waves, television waves, X-rays, heat and light waves are some examples of electromagnetic waves.

- 37. Differentiate between vibration and frequency.**

(DGK-GI-18)

Ans. Vibration: One complete round trip of a vibrating body about its mean position is called one vibration.

Frequency (f): The number of vibrations or cycles of a vibrating body in one second is called its frequency. It is reciprocal of time period i.e., $f = 1/T$

- 38. What is difference between Mechanical waves and electromagnetic waves.**

(SWL-GI-14)

Ans. Mechanical Waves: Waves which require any medium for their propagation are called mechanical waves.

Examples of Mechanical Waves: Examples of mechanical waves are water waves, sound waves and waves produced on the strings and springs.

Electromagnetic Waves: Waves which do not require any medium for their propagation are called electromagnetic waves.

Examples: Radio waves, television waves, X-rays, heat and light waves are some examples of electromagnetic waves.

- 39. Define spring constant.** (SWL-GI-17)

Ans. According to Hooke's:

$$F = -kx$$

x is the displacement of the mass from its mean position O , and k is a constant called the spring constant define as

$$k = \frac{-F}{x}$$

The value of k is a measure of the stiffness of the spring.

- 40. What is meant by Compression.**

(LHR-GII-19)(SWL-GII-17)

Ans. A series of disturbance in the form of waves will start moving along the length of the slinky. Such a wave consists of regions called compression.

- 41. Define Restoring force in vibratory motion of simple pendulum which component of weight act as restoring force.** (SGD-GI-19)

Ans. A restoring force always pushes or pulls the object performing oscillatory motion towards the mean position.

The component of the weight $mg \sin \theta$ is directed towards the mean position and act as a restoring force.

- 42. A wave moves on a slinky with frequency of 4 Hz and wavelength of 40cm. What speed of the wave.**

(SGD-GI-19)

Sol: $f = 4\text{Hz}$

$$\lambda = 40\text{cm}$$

$$= f \lambda$$

putting the value

$$V = (4\text{Hz})(0.4\text{m})$$

$$v = 1.6\text{ms}^{-1}$$

so the speed of wave is 1.6ms^{-1}

- 43. Write an activity that shows that water waves transfer energy without transfer of medium.** (SGD-GII-19)

Ans. Drop a stone into a pond of water. Water waves will be produced on the surface of water and will travel outwards. Place a cork at some distance from the falling stone. When waves reach the cork, it will move up and down along with the motion of the water particles by getting energy from the waves.

This activity shows that water waves like other waves transfer energy from one place to another without transferring matter, i.e., water.

44. Write four names of electromagnetic wave. (DGK-GII-19)

Ans. Examples of electromagnetic wave are

- (i) Radio waves
- (ii) Television waves
- (iii) X-rays
- (iv) Heat and light waves.

45. If $\lambda = 1.0\text{m}$, $g = 10.0\text{ms}^{-2}$

Then find the value of T. (BWP-GII-19)

Ans. $\lambda = 1\text{m}$
 $g = 10\text{ms}^{-2}$

we know

$$T = 2\pi\sqrt{\frac{\lambda}{g}}$$

Putting the value

$$T = 2 \times 3.14 \sqrt{\frac{10\text{m}}{10\text{ms}^{-2}}}$$

$$T = 6.28\text{ s}$$

46. Name two categories of Waves.

(BWP-GI-19)

Ans. There are two categories of wave

- (1) Mechanical waves
- (2) Electromagnetic waves

47. What do you know about Ripple Tank.

(LHR-GI-19)

Ans. Ripple tank is a device to produce water waves and to study their characteristics.

This apparatus consists of rectangular tray having glass bottom and is placed nearly half metre above the surface of a table. Waves can be produced on the surface of water present in the tray by means of a vibrator (paddle).

This vibrator is an oscillating electric motor fixed on a wooden plate over the tray such that lower surface just touches the surface of water. On setting the vibrator ON, this wooden plate starts vibrating to generate water waves consisting of straight wave fronts. An electric bulb is hung above the tray to

observe the image of water waves on the paper or screen. The crests and troughs of the waves appear as bright and dark lines respectively, on the screen.

48. Calculate the speed of the waves, when frequency is 2 Hz and wave length is 0.1m. (LHR-GII-19)

Ans. $f = 2\text{Hz}$

$$\lambda = 0.1\text{m}$$

$$v = f\lambda$$

putting the values

$$v = (2\text{ Hz})(0.1\text{m})$$

$$v = 0.2\text{s}^{-1}$$

49. What is Reciprocal of time period? Define it? (MTN-GI-19)

Ans. Frequency is the Reciprocal of time period, it desire re Frequency. The number of vibrations or cycles of a vibrating body in one second is called its frequency.

SECTION III

LONG QUESTIONS

FROM PUNJAB BOARDS

1. Write a note on the waves as a carries of energy. OR

Describe wave as carrier energy with detail.

(LHR-GII-14)(BWP-GII-15)

2. A simple pendulum complete one vibration in two seconds. Calculate its length when $g = 10\text{ms}^{-1}$. (LHR-GI-14)
3. The time period of a simple pendulum is 2s. What will be its length on the moon if $g_m = g/6$. (LHR-GII-14)
4. Define simple harmonic motion and prove that motion of ball and bowl system is simple harmonic motion.

(LHR-GII-16)(GUJ-GI-16,17)

5. How can you define the term wave motion? Also elaborate the difference between mechanical waves and electromagnetic waves with suitable examples. (LHR-GII-17)
6. What are mechanical waves? Describe its types with examples. (LHR-GI-18)
7. Prove that motion of a mass attached to a spring is simple harmonic motion.

(LHR-GII-18)(FBD-GI-14)(SWL-GI-17)

(BWP-GII-14)(MTN-GII-14, GI-16)

(RWP-GI-14,17, GII-19)(DGK-GI-17)

8. Drive a relation between speed, frequency and wavelength of a wave. (GUJ-GII-15)
(SGD-GII-16)(DGK-GII-16)
9. Explain wave as a carrier of energy and prove that $V = f \lambda$. (GUJ-GI-17)
10. What is ripple tank. Explain the reflection of water waves. (GUJ-GI-18)
11. Derive the relationship between velocity, frequency and wave length of wave. Write a formula relating velocity of a wave to its time period and wave length. (GUJ-GII-18)
12. A pendulum of length 0.99m is taken the moon by an astronaut. The period of pendulum is 4.9s. What is the value of g on the surface of moon. (MTN-GII-15)(DGK-GI-19)(SGD-GII-19)
13. Explain types of mechanical Waves. (MTN-GII-17)
14. What is wave velocity? Derive it. (MTN-GI-18)(BWP-GII-16)
15. Derive wave equation. (MTN-GII-18)
16. What is simple harmonic motion? What are the necessary conditions for a body to execute simple harmonic motion? (BWP-GI-16)
17. Define wave and explain its basic type with examples. (BWP-GII-15)
18. Define Reflection of Waves. Discuss this phenomenon with the help of Ripple Tank. (BWP-GI,II-17)
19. Prove that Motion of a Simple Pendulum is Simple Harmonic Motion. (BWP-GII-18)
20. A simple pendulum complete one vibration in two seconds. Calculate its length when $g = 10\text{ms}^{-2}$. (DGK-GI-14)(FBD-GII-14, GI-15)
21. Prove that the motion of simple pendulum is simple harmonic motion. (FBD-GI-16)
22. Find the time period and frequency of a simple pendulum 1.0m long where $g = 10\text{ms}^{-2}$. (FBD-GI-18)
23. Define simple harmonic motion (SHM) and explain motion of mass attached to a spring. (FBD-GI-17)
24. What is meant by ripple tank? Explain refraction of water waves with the help of ripple tank. (FBD-GI-18)
25. Derive a relationship between velocity, frequency and wavelength of a waves. Write a formula relating velocity of a wave its time period and wavelength. (RWP-GII-18)
26. A simple pendulum completes one vibration in two seconds. Calculate its length. when: $g = 10\text{ms}^{-2}$. (RWP-GII-16)(BWP-GI-19)
27. Describe four features of simple harmonic motion. (RWP-GII-16)
28. What is ripple tank? Explain refraction waves with reference to ripple tank. (RWP-GII-17)
29. Define waves motion. Explain the types of mechanical waves in detail. (RWP-GI-18)
30. Write down important features of S.H..M and explain it with ball and bowl system. (RWP-GII-18)
31. Define simple harmonic motion and prove that motion of ball and bowl system is simple harmonic motion. (SGD-GII-16)
32. Prove that motion of simple pendulum is simple harmonic motion. (DGK-GI-16)
33. What is simple harmonic motion? What are the necessary conditions for a body to execute simple harmonic motion? (DGK-GI-16)
34. A block of mass 0.5kg is attached to a spring placed on a horizontal frictionless surface. If the spring constant of this spring is 8Nm^{-1} . Find its time period. (DGK-GI-15)
35. Describe four characteristics of simple harmonic motion. (DGK-GII-17)
36. Distinguish between longitudinal and transverse waves with suitable examples. (SWL-GII-16)
37. Define simple harmonic motion explain it with example of simple pendulum. (SWL-GI,II-14)
38. Explain the following properties of waves with reference to Ripe tank experiment. (SWL-GI-18)
39. A wave moves on a slinky with frequency of 4 HZ and wave length of 0.4 m. What is the speed of the wave? (DGK-GII-19)
40. Find the time period and frequency of a simple pendulum 1 meter long at a location where $g = 10\text{ms}^{-2}$. (GUJ-GI-19)

SECTION IV**SOLVED NUMERICALS****PCTB EXAMPLES**

Examples 10.1: Find the time period and frequency of a simple pendulum 1.0m long at a location where $g = 10.0 \text{ ms}^{-2}$ (MTN-G-18)

Solution: Given, $l = 1.0 \text{ m}$, $g = 10.0 \text{ ms}^{-2}$

Using the formula,

$$T \approx 2\pi \sqrt{\frac{l}{g}}$$

By putting the values

$$T = 2 \times 3.14 \times \sqrt{\frac{1.0 \text{ m}}{10.0 \text{ m s}^{-2}}} = 1.99 \text{ s}$$

Frequency of simple pendulum is given by

$$f = 1/T = 1/1.99 \text{ s} = 0.50 \text{ Hz}$$

Examples 10.2: A wave moves on a slinky with frequency of 4 Hz and wavelength of 0.4m. What is the speed of the wave? (BWP-GII-18)

Solution: Given that, $f = 4 \text{ Hz}$, $\lambda = 0.4 \text{ m}$

Wave speed

$$\begin{aligned} v &= f \lambda \\ &= (4 \text{ Hz}) (0.4 \text{ m}) \\ v &= 1.6 \text{ m s}^{-1} \end{aligned}$$

PCTB NUMERICAL PROBLEMS

10.1: The time period of a simple pendulum is 2 s. What will be its length on the Earth? What will be its length on the Moon if $g_m = g_e/6$? Where $g_e = 10 \text{ m s}^{-2}$ (FBD-GI-19, GII-14,15)(LHR-GII-14) (DGK-GI-14)(RWP-GII-16)(MTN-GI-19)

Ans. Time period = $T = 2 \text{ Sec}$.

$$\text{Gravitational acceleration on earth} \approx g_e = \frac{10 \text{ m}}{\text{sec}^2}$$

$$\text{Gravitational acceleration on Moon} = g_m = g_e/6$$

$$(i) \text{ Length of pendulum on Earth} = l_e = ?$$

$$(ii) \text{ Length of pendulum on Moon} = l_m = ?$$

(i) We know

$$T = 2\pi \sqrt{\frac{l}{g}}$$

By putting values

$$2 = 2\pi \sqrt{\frac{l_e}{10}}$$

Taking square both side, we get.

$$(2)^2 = (2\pi)^2 \left(\sqrt{\frac{l_e}{10}} \right)^2$$

$$4 = 4 (3.14)^2 \left(\frac{l_e}{10} \right)$$

$$l_e = \frac{4}{4(3.14)^2} \times 10$$

$$l_e \approx \frac{4}{39.43} \times 10$$

$$l_e = (1.02 \text{ m}) \text{ which is required.}$$

(ii) given that

$$g_m = \frac{g_e}{6}$$

$$g_m = \frac{10}{6} = 1.67 \text{ m/s}^2$$

we know that

$$T = 2\pi \sqrt{\frac{l_m}{g_m}}$$

$$\frac{T}{2\pi} = \sqrt{\frac{l_m}{g_m}}$$

Squaring both side.

$$\left(\frac{T}{2\pi} \right)^2 = \left(\sqrt{\frac{l_m}{g_m}} \right)^2$$

$$\left(\frac{2}{2(3.14)} \right)^2 = \frac{l_m}{g_m}$$

$$\left(\frac{2}{2(3.14)} \right)^2 g_m = l_m$$

$$\left(\frac{2}{6.28} \right)^2 \times 1.67 = l_m$$

$$l_m = 0.169$$

$$\text{or } l_m = 0.17 \text{ m which is required.}$$

10.2: A pendulum of length 0.99 m is taken to the Moon by an astronaut. The period of the pendulum is 4.9 s. What is the value of g on the surface of the Moon?

(MTN-GI-15, GII-19)

Ans. Length of pendulum at moon = $l_m = 0.99 \text{ m}$.

Time period of pendulum = $T = 4.9 \text{ sec}$.

Value of g on surface of moon = $g_m = ?$

we know

$$T = 2\pi \sqrt{\frac{l}{g}}$$

Modifying this formula for moon

$$T_m = 2\pi \sqrt{\frac{l_m}{g_m}}$$

Rearrange its formula we get

$$g_m = \left(\frac{2\pi}{T_m} \right)^2 \times l_m$$

Putting the values.

$$g_m = \left(\frac{4\pi}{4.9}\right)^2 (0.99)$$

$$g_m = \left(\frac{2(3.14)}{4.9}\right)^2 (0.99)$$

$$g_m = \frac{39.44}{24.01} \times (0.99)$$

$$g_m = 1.626 \text{ m/s}$$

∴ The value of g on the surface of moon = $g_m = 1.63 \text{ m/s}$.

10.3: Find the time periods of a simple pendulum of 1 metre length, placed on Earth and on Moon. The value of g on the surface of Moon is $1/6^{\text{th}}$ of its value on Earth, where is 10 m s^{-2} .

Ans. Length of simple pendulum = $\lambda = \lambda_m$

Value of g on the surface of moon = $g_m = \frac{1}{6} g_e$.

⇒ Value of g on earth = 10 m/s^2

value of g on moon = $g_m = \frac{1}{6} (10) = 1.67 \text{ m/s}^2$

(i) Time period of pendulum on earth = $T_e = ?$

(ii) Time period of pendulum on moon = $T_m = ?$
we know,

$$T = 2\pi \sqrt{\frac{\lambda}{g}}$$

(i) Time period of pendulum of Earth.

Modifying the formula

$$T_e = 2\pi \sqrt{\frac{\lambda}{g_e}}$$

Putting the values.

$$T_e = 2\pi \sqrt{\frac{1}{10}}$$

$$T_e = 2(3.14) \sqrt{(0.1)}$$

$$T_e = (6.28)(0.316)$$

$$T_e = 1.98 \text{ s or } 2 \text{ S. Ans.}$$

(ii) Time period of the simple pendulum on the surface of moon.

we know that

$$T = 2\pi \sqrt{\frac{\lambda}{g}}$$

Modifying the formula

$$T_m = 2\pi \sqrt{\frac{\pi}{g_m}}$$

putting the values

$$T_m = 2(3.14) \sqrt{\frac{1}{1.67}}$$

$$T_m = 2(3.14)(0.773)$$

$$T_m = (6.28)(0.773)$$

$$T_m = 4.85 \text{ sec}$$

10.4: A simple pendulum completes one vibration in two seconds. Calculate its length, when $g = 10.0 \text{ m s}^{-2}$

Ans. Time of completion of one vibration of simple pendulum = $T = 2 \text{ s}$.

(i) The length of simple pendulum = $\lambda = ?$

we know

$$T = 2\pi \sqrt{\frac{\lambda}{g}}$$

Rearrange the formula

Taking squaring both side.

$$(T)^2 = \left(2\pi \sqrt{\frac{\lambda}{g}}\right)^2$$

$$T^2 = (2(\pi))^2 \left(\frac{\lambda}{g}\right)$$

$$\frac{(T^2)(g)}{(2\pi)^2} = \lambda$$

$$\lambda = \left(\frac{T}{2\pi}\right)^2 \times 10$$

$$\lambda = \frac{(2)^2}{(2)^2 (3.14)^2} \times 10$$

$$\lambda = \left(\frac{4}{39.43}\right) \times 10$$

$$\lambda = 1.02 \text{ m} \quad \text{Ans.}$$

10.9: At one end of a ripple tank 80 cm across, a 5 Hz vibrator produces waves whose wavelength is 40 mm. Find the time the waves need to cross the tank.

SWL(GII-19)

Ans. Distance of ripple tank = $d = 80 \text{ cm} = \frac{80}{100} = 0.8 \text{ m}$.

Frequency of vibrator = $f = 5 \text{ Hz}$

wave length of wave = $\lambda = 40 \text{ mm} = \frac{40}{1000} = 0.04 \text{ m}$.

we know

$$v = \frac{d}{T}$$

$$v = f \lambda$$

$$T = \frac{1}{f}$$

$$v = \frac{d}{T}$$

$$T = \frac{d}{v} \quad \text{--- (i)}$$

We know that $v = f \lambda$ --- (ii)

putting the value of equation (ii)

$$v = (5) (0.04)$$

$$v = 0.2 \text{ ms}^{-1}$$

putting the value of v in equation (i)

$$T = \frac{0.08}{0.2} \quad T = \frac{d}{v}$$

$$T = 4 \text{ s}$$

10.10: What is the wavelength of the radio waves transmitted by an FM station at 90 MHz? Where $1\text{M} = 10^6$, and speed of radio wave is $3 \times 10^8 \text{ ms}^{-1}$

Ans. Frequency of radio wave = $f = 90\text{MHz}$.

$$\text{we know } 1\text{m} = 10^6$$

$$f = 90 \times 10^6 \text{ Hz}$$

$$\text{Wavelength of radio wave } = \lambda = ?$$

we know

$$v = f \lambda$$

$$\lambda = \frac{v}{f}$$

putting the value

$$\lambda = \frac{3 \times 10^8}{90 \times 10^6}$$

$$\lambda = \frac{3 \times 10^{8-6}}{90}$$

$$\lambda = 0.0333 \times 10^2$$

$$\lambda \approx 3.33\text{m Ans.}$$



SECTION I**MULTIPLE CHOICE QUESTIONS****CHAPTER 11****SOUND****PCTB EXERCISE**

- ♦ Choose the correct answer from the following choices:
- Which is an example of a longitudinal wave?
 (a) sound wave (b) light wave
 (c) radiowave (d) water wave
 - How does sound travel from its source to your ear?
 (a) by changes in air pressure
 (b) by vibrations in wires or strings
 (c) by electromagnetic wave
 (d) by infrared waves
 - Which form energy is sound?
 (a) electrical (b) mechanical
 (c) thermal (d) chemical
 - Astronauts in space need to communicate with each other by radio links because
 (a) Sound waves travel very slowly in space
 (b) sound waves travel very fast in space
 (c) sound waves cannot travel in space
 (d) sound waves have low frequency in space
 - The loudness of a sound is most closely related to its
 (a) frequency (b) period
 (c) wavelength (d) amplitude
 - For a normal person, audible frequency range for sound wave lies between
 (a) 10 Hz and 10 kHz (b) 20 Hz and 20 kHz
 (c) 25 Hz and 25 kHz (d) 30 Hz and 30 kHz
 - When the frequency of a sound wave is increased, which of the following will decrease?
 i. wavelength ii. period iii. amplitude
 (a) i only (b) iii only
 (c) i and ii only (d) i and iii only

FROM PUNJAB BOARDS**(2014, 15, 16, 17, 18 & 19)**

- The intensity level of train siren is:
 (LHR-GI-14)(BWP-GI-14,16, GI-II-15)
 (DGK-GI-17)(SWL-GI-15)
 (a) 150 db (b) 130 db
 (c) 100 db (d) 120 db
- For a normal person, audible frequency range for sound wave lie between: OR
 For a normal person audible frequency range for sound wave is:
 (LHR-GII-14, 18)(MTN-GI-16)(BWP-GI,II-18)
 (FBD-GI-16, 17)(RWP-GI-16)(SGD-GII-14, 18)
 (SWL-GII-14, GI-17)(RWP-GII-19)
 (a) 20 Hz – 20kHz (b) 10 Hz – 10Hz
 (c) 30Hz – 25 kHz (d) 25Hz – 25 kHz
- The speed of sound in air at 0°C is:(LHR-GI-15)
 (GUJ-GI-15)(DGK-GII-18)(SWL-GII-16)
 (a) 386ms^{-1} (b) $83-90\text{ms}^{-1}$
 (c) 231ms^{-1} (d) 331ms^{-1}
- The sound level of whisper is:
 (LHR-GI-14)(GUJ-GI-14)(BWP-GI-15)
 (a) 10 dB (b) 30 dB
 (c) 40 dB (d) 70 dB
- The characteristic of sound by which we can distinguish between two sounds of same loudness and pitch is called:
 (LHR-GII-16)(SGD-GI-19)
 (a) Intensity (b) Quality
 (c) Loudness (d) Pitch
- The speed of sound in air at 25°C is:
 (LHR-GI-14)(FBD-GI-18)(SGD-GI-16)
 (GUJ-GII-14)(RWP-GII-14)
 (a) 1246 kmh^{-1} (b) 1264 kmh^{-1}
 (c) 1462 kmh^{-1} (d) 121462 kmh^{-1}
- The unit of sound intensity is: (LHR-GI-17)
 (BWP-GI-14, 16, GI-II-15)(SWL-GII-18)(MTN-GI-17)
 (a) Wm (b) Wm^{-1}
 (c) Wm^2 (d) Wm^{-2}
- The intensity level of rusting of leaves is:
 (LHR-GI-17)(MTN-GII-14,16)(BWP-GI-16)
 (a) 10 dB (b) 20 dB
 (c) 30 dB (d) 40 dB

9. Which is an example of a longitudinal wave? OR

The Example of longitudinal waves is:

_____ is an example of longitudinal wave.

(LHR-GI-18)(MTN-GI-16)(GUJ-GI-14, 18 GII-17)

(FBD-GI-14, 15)(RWP-GII-16, 17)(SWL-GI-15, 17)

(SGD-GI-14, GII-15, GII-19)

(DGK-GI-16, 17, 18, 19, GII-17)

- (a) Sound wave (b) Light wave
(c) Radio wave (d) Water wave

10. Which form of energy is sound. OR
Sound is form of energy.

(MTN-GI-14, GII-15, 17, 18)(SWL-GI-16, 17, 18)

(BWP-GI-16)(GUJ-GI-15, 17, GI-14)

(FBD-GII-14, 15, 19)(DGK-GI-15, GII-17)

- (a) electrical (b) mechanical
(c) thermal (d) chemical

11. Formula for finding the speed of sound is:
(LHR-GI-16)(RWP-GI-16)

(a) $v = f \lambda$ (b) $f = v \lambda$

(c) $v = \frac{v}{\lambda}$ (d) $f = \frac{v}{\lambda}$

12. Which of these wave consists of compression and rarefaction:

(GUJ-GI-16)(SWL-GII-16)

- (a) radio wave (b) sound wave
(c) television wave (d) x-rays

13. How does sound travel from its source to your ear? (GUJ-GII-18)(SWL-GI-19)

- (a) by changes in air pressure
(b) by vibrations in wires or strings
(c) by electromagnetic wave
(d) by infrared waves

14. The loudness of a sound is most closely related to its:

(MTN-GII-18)(GUJ-GII-19)(BWP-GI-19)

- (a) Frequency (b) Period
(c) Amplitude (d) Wavelength

15. Waves transfer: (BWP-GI-18)

- (a) Energy (b) Frequency
(c) Wavelength (d) Velocity

16. Waves transfer: (FBD-GII-16)(SGD-GII-16)(DGK-GII-15)

- (a) Energy (b) Frequency
(c) Wavelength (d) Velocity

17. In general, the speed of sound is greater in: (FBD-GI-17)(MTN-GI-19)

OR The speed of sound is greater in:

- (a) solids (b) liquids
(c) gases (d) none of these

18. One bel is equal to: (FBD-GII-17)(RWP-GI-18)

- (a) 40 dB (b) 20 dB
(c) 90 dB (d) 10 dB

19. Calculate the frequency of sound wave of speed 340ms⁻¹ and wavelength 0.5m: (FBD-GII-17)

- (a) 340 Hz (b) 0.5 Hz
(c) 170 Hz (d) 680 Hz

20. The speed of sound in air at 0°C is: (FBD-GII-18, GI-19)

- (a) 331 ms⁻¹ (b) 346 ms⁻¹
(c) 327 ms⁻¹ (d) 386 ms⁻¹

21. Sound level in db is given by: (RWP-GI-14)

- (a) $10 \log I/I_0$ dB (b) $\log I/10$ dB
(c) $10 \log 10/I$ dB (d) $\log 10/I$ dB

22. If speed of a sound is 320 ms⁻¹ the distance covered in a time of 105s will be: (RWP-GII-14)

- (a) 331.5m (b) 33.5m
(c) 480m (d) 221m

23. The speed of sound is distilled water 25°C is: (RWP-GII-15)

- (a) 7478 (b) 74188
(c) 1498 (d) 1508

24. The loudness of a sound is most closely related to its:

(RWP-GII-17)(SGD-GI-17)(SWL-GII-17)

- (a) Frequency (b) Period
(c) Wavelength (d) Amplitude

25. The example of longitudinal waves is: (RWP-GI-17)

- (a) Sound waves (b) Light waves
(c) Radio waves (d) Water waves

26. The sensation of sound persists in our mind is: (RWP-GII-17)

- (a) 0.01S (b) 0.1S (c) 0.02S (d) 0.2S

27. Sound level of rustling of leaves is:

(RWP-GII-18)

- (a) 20 dB (b) 10 dB (c) 30 dB (d) 60 dB

28. At 25°C speed of sound in wood:

(RWP-GII-18)

- (a) 2500mSec⁻¹ (b) 2000mSec⁻¹
(c) 3000mSec⁻¹ (d) 4000mSec⁻¹

29. Frequency of tuning fork depends upon:

(RWP-GI-18)

- (a) Length (b) Mass
(c) Force (d) Amplitude

30. SI unit of intensity is:

(SGD-GII-16,18)(DGK-GI-14)

- (a) Wm⁻¹ (b) Wm⁻²
(c) Wm (d) Wm²

31. Two consecutive wave compression and rarefaction is called.

(SGD-GII-15)

- (a) Time period (b) Frequency
(c) Wavelength (d) Focal length

32. Sound is form of energy. OR

Which form of energy is sound.

(SGD-GI,II-15, GII-17)

- (a) Chemical (b) Thermal
(c) Electrical (d) Mechanical

33. Which waves do not require medium for their propagation:

(DGK-GII-16)

- (a) Sound waves (b) Mechanical waves
(c) Electromagnetic waves
(d) All of these waves

34. Which of these waves consist of compressions are rarefactions?

(DGK-GII-16)

- (a) Radio waves (b) Sound waves
(c) Television waves (d) X-Rays

35. Vibrating bodies produces:

(DGK-GII-15)

- (a) transverse wave
(b) electromagnetic waves
(c) compressional wave (d) radio wave

36. The loudness of sound mostly depends upon:

(SWL-GII-15)

- (a) frequency (b) period
(c) wavelength (d) amplitude

37. We can distinguish between a shrill and grave sound by its:

(LHR-GI-19)

- (a) Intensity (b) Quality
(c) Loudness (d) Pitch

38. Speed of sound in steel at 25°C:

(LHR-GII-19)

- (a) 3880 m/s (b) 5950 m/s
(c) 6040 m/s (d) 5960 m/s

39. The speed of sound in solid is _____ times greater as compared to gases.

(GUJ-GI-19)

- (a) 2 (b) 5 (c) 10 (d) 15

40. The S.I. Unit of Sound Intensity Level is:

(BWP-GII-19)

- (a) Wm⁻² (b) Bell
(c) Deci Bell (d) None of these

41. Speed of sound at 25°C in Flint glass is:

(MTN-GI-19)(DGK-GII-19)

- (a) 5950 m/s (b) 6040 m/s
(c) 5960 m/s (d) 3980 m/s

SECTION II

SHORT QUESTIONS ANSWERS

PCTB EXERCISE

PCTB NO SHORT QUESTIONS

FROM PUNJAB BOARDS

(2014, 15, 16, 17, 18 & 19)

1. Define loudness. On what factor it can depend?

(LHR-GII-15)

(MTN-GI-14, GII-15,18)(BWP-GII-14,18)

(DGK-GII-14)(SGD-GI-14,17, GII-14,15)

Ans. **Loudness:** Loudness is the characteristic of sound by which loud and faint sounds can be distinguished. Factors on which loudness depends upon:

- Amplitude of vibrating body.
- Area of vibrating body.
- Distance from vibrating body.
- Physical condition of ear.

2. Differentiate between the pitch and quality of sound.

OR Write two characteristics of sound's.

(LHR-GII-14)(SGD-GII-14)

Ans. Pitch: Pitch is the characteristic of sound by which we can distinguish between a shrill and a grave sound.

Example of Pitch: The frequency of the voice of ladies and Children is higher than that of men therefore. The voice of ladies and children is shrill and of high pitch.

Quality: The characteristic of sound by which we can distinguish between two sounds of same loudness and pitch is called quality.

Examples of Quality:

While standing outside a room, we can distinguish between the note of a piano and a flute being played inside the room.

This is due to the difference in the quality of these notes.

3. Explain the Quality of sound.

OR What is meant by Quality of Sound.

(LHR-GI-16)(BWP-GI-17)(FBD-GI-14, GII-15, 17)

(RWP-GI-15, 16, GII-17)(SGD-GI-17)

(DGK-GI-16)(BWP-GI-19)

Ans. The characteristic of sound by which we can distinguish between two sounds of same loudness and pitch is called quality.

Example: While stranding outside a room, we can distinguish between the notes of a piano and flute being played inside the room. This is due to difference in the quality of these notes.

4. What is meant by intensity of sound? write its unit.

OR Define intensity of sound and write its unit.

(LHR-GII-14, GI-17, 18)

(GUJ-GII-14, 17, GI-18, 19) (MTN-GII-18)

(BWP-GI-II-14, GII-19) (FBD-GI-18, G-II-17)

(RWP-GI-14, 18)(SWL-GII-15)

(SGD-GII-16, 19, GI-17)(DGK-GII-14, GI-19)

Ans. Intensity of sound: Sound energy passing per second through a unit area held perpendicular to the direction of

propagation of sound waves is called intensity of sound. Intensity is a physical quantity and can be measured accurately.

Unit: Its unit is watt per square meter

$$(Wm^{-2})$$

5. Define reflection of sound. (LHR-GI-15)

(GUJ-GI-II-15)(MTN-GII-14)(RWP-GII-17)

(RWP-GII-19)

Ans. When sound incident on the surface of a medium bounces back into the first medium. This phenomenon is called echo or reflection of sound.

6. Calculate the frequency of sound waves of speed $340ms^{-1}$ and wavelength $0.5m$.

OR Give speed of wave that wavelength.

OR If $v = 340ms^{-1}$ and $p = 0.5m$ then $f = \dots$

OR Differentiate between noise and musical sound.

(LHR-GI-II-14, GII-17, 18)(GUJ-GI-14)

(MTN-GI-17, GII-18)(BWP-GI-14, GII-18)

(FBD-GI-17)(RWP-GI-15)(DGK-GII-19)

Ans. $v = 340ms^{-1}$

$$\lambda = 0.5m$$

$$f = ?$$

$$v = f \lambda$$

$$f = \frac{v}{\lambda}$$

$$f = \frac{340ms^{-1}}{0.5m}$$

$$f = 680Hz$$

7. What is difference between Musical Sound and Noise?

(LHR-GI-14, 18, GII-15, 19)(GUJ-GII-19)

(FBD-GI-II-17)(RWP-GI-14, 17, GII-18, 19)

(SGD-GII-17)(DGK-GI-17)

Ans. Musical Sound: Sound which are pleasant to our ears are called musical sounds.

Example: of musical sound

Flute, harmonium, violin, drum etc.

Noise: Sounds which have jarring and unpleasant effect on our ears are called noise.

Examples of noise:

(i) Sound of machinery

(ii) Sound of traffic

8. Describe the factors on which a safe level of noise depends. (LHR-GII-14)

Ans. A safe level of noise depends on the following two factors:

- (i) The level (volume) of the noise.
- (ii) The period of exposure to the noise.

9. What are audible frequency range for young children and old people?

(LHR-GI-14)(GUJ-GII-15, GI-17)

(MTN-GI-14, GII-15, 18)

Ans. Young children can hear sounds of 20,000Hz old people cannot hear sounds even above 15,000Hz.

10. What is meant by audible frequency range? (LHR-GI-14,18)(GUJ-GII-15,16)

(BWP-GII-17)(RWP-GI-17)

Ans. Definition: The range of the frequencies which an human ear can hear is called the audible frequency range.

Frequency range of human's ear: A normal human ear can hear a sound only if its frequency lies between 20Hz and 20,000 Hz.

11. Write two uses of ultrasound in medical field.

OR State the two uses of ultrasound in medical field. (LHR-GI-17, 19)

(MTN-GI,II-16, GII-19)(DGK-GI-19)(SWL-GII-19)

(BWP-GII-15, 16)(RWP-GI-14, GII-15)

Ans. Two uses of ultra sound:

- (i) Powerful ultrasound is being used to remove blood clots formed in arteries.
- (ii) Ultrasound is used to get the pictures of thyroid gland for diagnosis purposes.

12. Define Pitch? (LHR-GI-17)

Ans. Pitch: Pitch is the characteristic of sound by which we can distinguish between a shrill and a grave sound. It depends upon the frequency. A higher pitch means a higher frequency.

Example of Pitch: The frequency of the voice of ladies and Children is higher than that of men therefore. The voice of ladies and children is shrill and of high pitch.

13. Name the two characteristics of sound.

OR Differentiate between the pitch and quality of sound.

OR Define pitch and quality of sound.

(LHR-GI-17)(GUJ-GI-15)(BWP-GII-14)(MTN-GI,II-14)

(RWP-GI-18)(DGK-GI,II-15, GII-16)(SWL-GII-15)

Ans. Pitch: Pitch is the characteristic of sound by which we can distinguish between a shrill and a grave sound.

Quality: The characteristic of sound by which we can distinguish between two sounds of same loudness and pitch is called quality.

14. Differentiate between frequency and Pitch? (LHR-GII-17,18)(GUJ-GI-16)

(BWP-GI-15)(SGD-GI,II-15)(DGK-GI,II-15, GI-16)

(SWL-GII-17)

Ans. Frequency: The number of vibrations or cycle of vibrating body in one second is called frequency. Its SI unit is Hz.

Pitch:

Pitch is the characteristic of sound by which we can distinguish between a shrill and a grave sound. It depends upon the frequency. A higher pitch means a higher frequency.

15. What is meant by sound level.

(GUJ-GII-16)

Ans. Sound level difference of two loudness of sound is called sound level.

16. Write a brief note on audible frequency range. (GUJ-GI-14)

Ans. Audible frequency Range: Sound is produced by a vibrating body. A normal human ear can hear a sound only if its frequency lies between 20Hz and 20,000 Hz. In other words, a human ear neither hears a sound of frequency less than 20Hz nor a sound of frequency more than 20,000 Hz. Different people have different range of audibility. It also decreases with age. Young children can hear sounds of 20,000 Hz but old people cannot hear sounds even oboe 15,000 Hz.

17. Why ultrasound is useful in medical field? (GUJ-GII-16)

Ans. Ultrasound is useful in medical field because in medical field, ultrasound waves are used to diagnose and treat different

ailments. Ultrasonic wave are made to enter the human body through transmitters. These waves are reflected differently by different organs tissues or tumors each. The reflected waves are then amplified to form an image of the internal organs of the body on the screen.

18. What is meant by decibel scale.

(GUJ-GII-17)

Ans. The decibel scale is a logarithmic measure of the amplitude of sound wave. In a logarithmic scale equal intervals correspond to multiplying by 10 instead of adding equal amount.

19. What is speed of sound through bass and iron at 25°C.

(MTN-GI-16)

Ans. Speed of sound through bass and iron 25°C is 4700ms^{-1} and speed of sound through iron at 25°C is 5950ms^{-1} .

20. Define Ultrasound and give its use.

OR What is meant by ultrasound.

(MTN-GII-14, GII-17)(RWP-GII-19)

(BWP-GI-17, GII-18)(RWP-GII-14)(DGK-GII-16)

Ans. **Ultrasound:** Sounds of frequency higher than 20,000 Hz which are inaudible to normal ear are called ultrasound or ultrasonic sounds.

Uses: Ultra sounds are utilized in medical and technical field.

21. What is meant by Reverberation.

(MTN-GII-17)(DGK-GI-16)

Ans. Sometimes, when sound reflects from the walls, ceiling and floor of a room, the reflecting surface are too reflective and the sound becomes garbled. Multiple reflections are reverberations.

22. Describe properties of musical sound.

(BWP-GI-14)

Ans. Such sounds which are pleasant to our ears are called musical sounds properties.

- The have specific waveform.
- These sounds has pleasant effect on our ear.

23. Define "Bel".

(BWP-GI-16)

Ans. A unit for comparing two power levels, equal to the logarithm to the base ten of the ratio of the two powers is called bel.

24. Define acoustics.

(GUJ-GII-19)

(BWP-GII-16)(FBD-GII-18)(RWP-GII-17)

Ans. The technique or method used to absorb undesirable sounds by soft and porous surface is called acoustic protection.

25. Why the sound of women is shrill as compared to men.

(BWP-GII-17)

Ans. **Pitch:** Pitch is the characteristic of sound by which we can distinguish between a shrill and a grave sound. It depends upon the frequency. A higher pitch means a higher frequency and vice versa. The frequency of the voice of ladies and children is higher than that of men. Therefore, the voice of ladies and children is shrill and of high pitch.

26. What is pitch? Give its an example?

(BWP-GII-18)

Ans. **Pitch:** Pitch is the characteristic of Sound by which we can distinguish between a still and grave sound.

Example: The frequency of the voice of ladies and children is higher than that of men.

27. What is the difference between loudness and intensity of sound?

(FBD-GI-14)

Ans. **Loudness:** Loudness is the characteristic of sound by which loud and faint sounds can be distinguished.

Intensity: Sound energy passing per second through a unit area held perpendicular to the direction of propagation of sound waves is called intensity of sound.

28. In which sound waves faster is solid or liquid? why?

(FBD-GII-14)(RWP-GII-18)

Ans. In solids speed of sound is faster than speed of sound in liquids. It is due to the fact that in solid, the particles of medium are very closely bond and by vibrations, sound energy is quickly transferred.

29. On what factors does the loudness depend?

(FBD-GI-17)

Ans. Factors on which loudness depends upon:

- Amplitude of vibrating body.
- Area of vibrating body.
- Distance from vibrating body.
- Physical condition of ear.

30. Define resonance. (RWP-GI-16)

Ans. the increase in amplitude of oscillation of an electric or mechanical system exposed to a periodic force whose frequency is equal or very close to the natural frequency of the system.

31. In which sound waves faster is solid or liquid? why? (GII-14)

Ans. In solids speed of sound is faster than speed of sound in liquids. It is due to the fact that in solid, the particles of medium are very closely bonded and by vibrations, sound energy is quickly transferred.

32. What is the speed of sound in air at 25°C? (SGD-GII-14)

Ans. Speed of sound in air at 25°C is 345 ms^{-1} .

33. Define Ultrasound and give its use. (SGD-GI-16, 17)

Ans. **Ultrasound:** Sounds of frequency higher than 20,000 Hz which are inaudible to normal ear are called ultrasound or ultrasonic sounds.

Uses: Ultra sounds are utilized in medical and technical field.

34. You can listen to your friend sound a corner, but you cannot watch him, why? (SGD-GI-17)

Ans. We can listen our friend sound a corner but we not watch him because sound waves travel through medium in all direction. Sound shows diffraction across the obstacle sound waves are listened to us by diffraction.

35. What is meant by musical sound. (DGK-GII-16)

Ans. Sound which is pleasant to our ears is called musical sound.

Example: Sound of flute, violin drum and harmonium etc.

36. Define reflection of sound. OR What is the reflection of sound. (DGK-GII-15)(SWL-GI-19)

Ans. When sound is incident on the surface of a medium bounces back into the first medium. This phenomenon is called echo or reflection of sound.

37. Write a brief note on audible frequency range. (DGK-GI-15)

Ans. **Audible frequency Range:** Sound is produced by a vibrating body. A normal human ear can hear a sound only if its frequency lies between 20 Hz and 20,000 Hz. In other words, a human ear neither hears a sound of frequency less than 20 Hz nor a sound of frequency more than 20,000 Hz. Different people have different range of audibility. It also decreases with age. Young children can hear sounds of 20,000 Hz but old people cannot hear sounds even above 15,000 Hz.

38. What is the difference between loudness and intensity of sound? (MTN-GII-18)(FBD-GI-19)(SWL-GII-14)

Ans. **Loudness:** Loudness is the characteristic of sound by which loud and faint sounds can be distinguished.

Intensity: Sound energy passing per second through a unit area held perpendicular to the direction of propagation of sound waves is called intensity of sound.

39. Why are sound waves called mechanical waves. (GUJ-GI-19)(SWL-GII-17)(RWP-GII-18)

Ans. **Sound waves called:** Mechanical waves the reason is that mechanical waves travel through a medium i.e. solid, fluid. Sound also needs medium to travel. Therefore sound waves are called mechanical waves.

40. How is sound produced. (SWL-GII-18)

Ans. Sound is produced by vibrating body.

41. Which equation is used to find the speed of sound. (MTN-GI-19)

Ans. The following equation is used to find the speed of sound.

$$v = f \lambda$$

42. What is the audible frequency range for human ear. (SGD-GI-19)

Ans. A normal human ear can hear a sound only if its frequency lies between 20 Hz and 20,000 Hz.

43. How can we hear the sound. Produced by Tuning Fork? (RWP-GI-19)

Ans. If we strike the tuning fork against rubber hammer, the tuning fork will begin to vibrate. We can hear the sound produced by tuning fork by bringing it near our ear.

So we can hear the sound produced by Tuning Fork by vibration because sound is produced by vibrating bodies.

44. Calculate the intensity level of faintest audible sound of intensity 10^{-12} Wm^{-2} .

(SWL-GII-19)

Ans. Intensity level = $10 \log \frac{1}{10}$

$$\text{Intensity level} = 10 \log \frac{10^{-12} \text{ Wm}^{-2}}{10^{-12} \text{ Wm}^{-2}}$$

$$= 0 \text{ dB}$$

45. What is silent whistle? Write its frequency limits. (LHR-GII-19)(BWP-GI-18)

Ans. Some people use silent whistle to call dogs whose frequency lies between 20,000 Hz to 25,000 Hz. It is silent for human but not for dogs because the audible frequency range for dogs is much higher.

SECTION III**LONG QUESTIONS****FROM PUNJAB BOARDS****(2014, 15, 16, 17, 18 & 19)**

- What is ultrasound? what are its benefits.
(LHR-GI-14)(GUI-GII-14)(FBD-GII-14)
- If at Anarkali Bazar Lahore. The sound level is 80db. What will be the intensity level of sound there.
(LHR-GII-14, 19)(RWP-GII-15)
(FBD-GI-14)(SWL-GI-14, 19, GII-16)
(SGD-GI-19)(DGK-GII-15)
- A sound wave has a frequency of 2KHz and wave length 35cm. How long will it take to travel 1.5km?
(LHR-GI-16, GII-15)
(SGD-GII-14)(MTN-GI-14)
- A marine ship sends a sound wave straight to the sea bed. It receives an echo 1.5sec. later.

The speed of sound in sea water is 1500 ms^{-1} . Find the depth of the sea at this position.

(LHR-GII-16)

- Calculate the frequency of sound wave of speed 340 ms^{-1} and wavelength 0.5m.

(LHR-GI-15)

- Write a note on characteristics of sound.

(LHR-GI-17)(MTN-GI-17)

- A doctor counts 72 heart beats in 1 min. Calculate the frequency and period of heart beats.

(GUJ-GI,II-15)

- A marine survey ship sends a sound wave straight to the sea bed. It receives an echo 1.55 later. The speed of sound in sea water is 1500 ms^{-1} . Find the depth of the sea at that position.

(BWP-GII-14, 16)

- Define loudness of sound upon which factors does it depends.

(FBD-GII-15)

- What is intensity level of sound? Write the name of its unit.

(RWP-GII-16)

- Calculate the intensity level of sound? Write the name of its unit.

(RWP-GII-16)

- Calculate the intensity level of suiting.

(RWP-GI-15)

- What is the loudness of sound? On which factors localness of sound depends.

(SGD-GII-14)

- A normal conversation involves sound intensities about $3.0 \times 10^{-6} \text{ Wm}^{-2}$. What is the decibel level for this intensity.

(SGD-GII-15)

- Calculate the intensity level of rustling of leaves.

(SGD-GI-17)

- Calculate the intensity level of faintest audible sound.

(DGK-GII-16)

SECTION IV**SOLVED NUMERICALS****PCTB EXAMPLES**

Examples 11.1: Calculate the intensity levels of the (a) faintest audible sound (b) rustling of leaves.

Solution: (a) Intensity level of faintest audible sound can be calculated by substituting $I = I_0 = 10^{-12} \text{ W m}^{-2}$ Intensity level of faintest audible sound

$$= 10 \log \frac{10^{-12}}{10^{-12}} \text{ dB}$$

$$= 0 \text{ dB}$$

(b) As the intensity of the rustle of leaves is $I = 10^{-11} \text{ W m}^{-2}$, therefore,

Intensity level due to rustling of leaves

$$= 10 \log 10^{-11}/10^{-12} \text{ dB}$$

$$= 10 \log 10 \text{ dB}$$

$$= 10 \text{ dB}$$

Examples 11.2: Calculate the frequency of a sound wave of speed 340 ms^{-1} and wavelength 0.5 m . (LHR-GI-15)(BWP-GI-18)(BWP-GII-15)

Solution: Given that; speed of waves $v = 340 \text{ ms}^{-1}$

$$\text{Wavelength } \lambda = 0.5 \text{ m}$$

$$\text{Using the formula } v = f \lambda$$

Putting the values

$$f = 340 \text{ m s}^{-1} / 0.5 \text{ m} = 680 \text{ Hz}$$

PCTB NUMERICAL PROBLEMS

11.1: A normal conversation involves sound intensities of about $3.0 \times 10^{-6} \text{ W m}^{-2}$. What is the decibel level for this intensity? What is the intensity of the sound for 100 dB?

(SGD-GII-15)(GUJ-GI-16)

Ans. Intensities of sound $= I = 3.0 \times 10^{-6} \text{ W m}^{-2}$
level of sound = 100dB

(i) Decibel level for $3.0 \times 10^{-6} \text{ W m}^{-2}$ intensity=?

(ii) Intensity of the sound for 100dB
we know

$$\text{Intensity level} = 10 \log \frac{I}{I_0} \text{ (i)}$$

$$\text{where } I_0 = 10^{-12} \text{ W m}^{-2}$$

putting the value in eq (i)

$$\text{Intensity level} = 10 \log \left(\frac{3 \times 10^{-6}}{10^{-12}} \right) \text{ dB}$$

$$= 10 \log (3 \times 10^{-6} \times 10^{12}) \text{ dB}$$

$$= 10 \log [3 \times 10^6] \text{ dB}$$

$$= 10 (\log 3 + 6 \log 10) \text{ dB}$$

$$= 10 [0.477 + 6(1)] \text{ dB}$$

$$\text{Intensity level} = 10 (6.477)$$

$$= 64.8 \text{ dB}$$

(ii) Sound level = 100 dB
we know

$$\text{Intensity level} = 10 \log \frac{I}{I_0} \text{ dB}$$

Rearrange the formula.

$$I = I_0 \text{ in } \left(\frac{\text{Intensity level}}{10} \right)$$

value of faintest sound

$$I_0 = 10^{-12} \text{ W m}^{-2}$$

putting the value

$$I_0 = 10^{-12} \log^{-1} \left(\frac{100}{10} \right)$$

$$I = 10^{-12} \log^{-1} (10)$$

$$I = (10^{-12}) (10^{10})$$

$$I = 10^{-12+10}$$

$$I = 10^{-2} \text{ W m}^{-2}$$

$$I = 0.01 \text{ W m}^{-2}$$

11.2: If at Anarkali Bazar Lahore, intensity level of sound is 80 dB, what will be the intensity of sound there?

(LHR-GI,II-14)(FBD-GII-14, GII-16)(LHR-GI-14)

(RWP-GII-15)(DGK-GII-15)(MTN-GI,II-16)

Ans. Sound level = 80 dB

Intensity of sound $= I = ?$

$$\text{Intensity level} = 10 \log \frac{I}{I_0}$$

we know

$$I_0 = 10^{-12} \text{ W m}^{-2}$$

$$\text{Intensity level} = 10 \log \frac{I}{I_0} \text{ dB}$$

Rearranging the above formula

$$= \log^{-1} \left(\frac{\text{Intensity level}}{10} \right) = \frac{I}{I_0}$$

$$I = I_0 \text{ in } \left(\frac{\text{Intensity level}}{10} \right)$$

putting the value

$$I = 10^{-12} \log^{-1} \left(\frac{80}{10} \right)$$

$$I = 10^{-12} \log^{-1} (8)$$

$$I = 10^{-4} \text{ Wm}^{-2} \quad \text{Ans.}$$

11.3: At a particular temperature, the speed of sound in air is 330 m s⁻¹. If the wavelength of a note is 5 cm, calculate the frequency of the sound wave. Is this frequency in the audible range of the human ear?

Ans. Speed of sound = $v = 330 \text{ m s}^{-1}$
wavelength of note

$$\lambda = 5 \text{ cm} = \frac{5}{100} = 0.05 \text{ m}$$

(i) frequency of sound = $f \approx ?$

(ii) range of frequency = ?

we know that

$$v = f \lambda$$

$$f = \frac{v}{\lambda}$$

putting the value.

$$f = \frac{330}{0.05}$$

$$= f = 660 \text{ Hz.}$$

$$\text{or } f = 6.6 \times 10^3 \text{ Hz}$$

This is the frequency which lies in audible range.

11.4: A doctor counts 72 heartbeats in 1 min. Calculate the frequency and period of the heartbeats.

(GUJ-GI-II-15)(GUJ-GII-16)(SGD-GII-16)

Ans. No of heart beat = 72

Time of 72 heart beat = 1 min = 60s

(i) Frequency of heart beat = $f = ?$

(ii) time period heart beat $\approx T = ?$

In 60sec No of heart beat 72

Frequency = $f = n_2$ In 1 sec no of heart beat

$$\frac{72}{60}$$

frequency = 1.2 Hz

Time period

we know

$$T = \frac{1}{f}$$

putting the value

$$T = \frac{1}{1.2}$$

$$T = 0.83 \text{ s}$$

(i) Frequency of $f = 1.2 \text{ Hz}$

Time period = 0.83 s.

11.5: A marine survey ship sends a sound wave straight to the seabed. it receives an echo 1.5 s later. The speed of sound in seawater is 1500 m s⁻¹. Find the depth of the sea at this position.

(BWP-GI-II-14)(LHR-GII-18)(BWP-GII-16)

Ans. Time to receive echo = $T = 1.5 \text{ s}$

Speed of sound in sea water = $v = 1500 \text{ m s}^{-1}$

Depth of sea = $d = ?$

we know

$$v = \frac{d}{t}$$

Rearrange the formula

$$d = v \times t$$

putting the value

$$d = (1500) (1.5)$$

$$d = 2250 \text{ m}$$

The sound is covered the double distance to the depth of sea.

Reason

The distance covered by sound straight into sea bed and again come back to the sea.

$$\text{Depth of sea} = \frac{d}{2}$$

$$\text{P Depth of sea} = \frac{2250}{2}$$

$$= 1125 \text{ m.}$$

11.6: A student clapped his hands near a cliff and heard the echo after 5 s. What is the distance of the cliff from the student if the speed of the sound is taken as 346 m s^{-1} .

(MTN-GI-16)(SGD-GI-16)

Ans. Time for return of Echo = $t = 5 \text{ sec}$

speed of sound = $v = 346 \text{ m s}^{-1}$

Distance of cliff from person $\approx d \approx ?$

we know

$$v \approx \frac{d}{t}$$

Rearrange the formula

$$d = v \times t$$

putting the value

$$d = (346) (5)$$

$$= 1730 \text{ m}$$

The required distance is half of the distance.

Reason:

The distance covered by sound & go to strike the cliff and after reflection come back to the person 40.

$$\begin{aligned} \text{Distance between cliff and person} &= \frac{1730}{2} \\ &= 865 \text{ m} \end{aligned}$$

11.9: A sound wave has a frequency of 2 kHz and wavelength 35 cm. How long will its take to travel 1.5 km?

(SGD-GII-14)(MTN-GII-14)(RWP-GI-14)

(DGK-GI-15)(LHR-GI-16)

Ans. Frequency of sound wave = 2 kHz

$$= 2 \times 10^3 \text{ Hz}$$

wavelength of sound wave = $\lambda = 35 \text{ cm}$

$$= \frac{35}{100} = 0.35 \text{ m}$$

distance travelled = $d = 1.5 \text{ km}$

$$= 1.5 \times 1000 \text{ m}$$

$$= 1.5 \times 10^3 \text{ m}$$

Time $t = ?$

we know

$$v = f \lambda \quad \text{--- (i)}$$

$$v = \frac{d}{t} \quad \text{--- (ii)}$$

we know

$$v = f \lambda$$

putting the value

$$v = (2 \times 10^3) (0.35)$$

$$v = 700 \text{ m s}^{-1}$$

$$\text{(ii)} \quad v = \frac{d}{t}$$

$$t = \frac{d}{v}$$

putting the value

$$t = \frac{1.5 \times 10^3}{700}$$

$$t = \frac{1.5 \times 10^{3-2}}{7}$$

$$t = \frac{1.5 \times 10}{7}$$

$$\boxed{t = 2.14 \text{ s}} \quad \text{Ans.}$$



SECTION I**MULTIPLE CHOICE QUESTIONS****CHAPTER 12****GEOMETRICAL OPTICS****PCTB EXERCISE**

- ♦ Choose the correct answer from the following choices:
- Which of the following quantity is not changed during refraction of light?
(a) its direction (b) its speed
(c) its frequency (d) its wavelength
 - A converging mirror with a radius of 20cm creates a real image 30cm from the mirror. What is the object distance?
(a) -5.0 cm (b) -7.5 cm
(c) -15 cm (d) -20
 - An object is placed at the centre of curvature of a concave mirror. The image produced by the mirror is located
(a) out beyond the centre of curvature.
(b) at the centre of curvature.
(c) between the centre of curvature and the focal point
(d) at the focal point
 - An object is 14 cm in front of a convex mirror. The image is 5.8 cm behind the mirror. What is the focal length of the mirror?
(a) -4.1 cm (b) -8.2 cm
(c) -9.9 cm (d) -20 cm
 - The index of refraction depends on
(a) the focal length **(b) the speed of light**
(c) the image distance (d) the object distance
 - Which type of image is formed by a convex lens on a screen?
(a) inverted and real (b) inverted and virtual
(c) upright and real **(d) upright and virtual**

vii. Which type of image is produced by the converging lens of human eye if it views a distance object?

- (a)** real, inverted, and diminished
(b) virtual, upright and diminished
(c) virtual, upright and magnified
(d) real, inverted and magnified
- ix. If a ray of light in glass is incident on an air surface at an angle greater than the critical angle, the ray will
(a) refract only
(b) reflect only
(c) partially refract and partially reflect
(d) diffract only
- x. The critical angle for a beam of light passing from water into air is 48.8 degrees. This means that all light rays with an angle of incidence greater than this angle will be
(a) absorbed
(b) totally reflected
(c) partially reflected and partially transmitted
(d) totally transmitted

FROM PUNJAB BOARDS**(2014, 15, 16, 17, 18 & 19)**

- The speed of light in water is approximately:
(LHR-GI-14,18)(FBD-GI-19)(SGD-GII-19)
(a) $3.3 \times 10^8 \text{ ms}^{-1}$ **(b) $2.3 \times 10^8 \text{ ms}^{-1}$**
(c) $2 \times 10^8 \text{ ms}^{-1}$ (d) $2.6 \times 10^8 \text{ ms}^{-1}$
- The critical angle of water is:
(LHR-GI-15)(FBD-GII-18)(DGK-GII-18)
(a) 48.8° (b) 488° (c) 90° (d) 95°
- The refractive index of ice is:
(LHR-GI-16)(BWP-GII-18)(RWP-GI-14)(SGD-GII-19)
(a) 1.00 (b) 1.33
(c) 1.31 (d) 2.42
- Formula for focal length is:
(LHR-GII-15)(SWL-GI-17)(RWP-GI-15)
(a) $f = \frac{R}{2}$ (b) $f = \frac{R}{4}$
(c) $f = \frac{R}{3}$ (d) $f = \frac{R}{5}$

5. An object is 14cm in front of a convex mirror. The image is 5.8cm behind the mirror. What is the focal length of the mirror?

(LHR-GII-14)(FBD-GII-16, GI-18)

- (a) -4.1cm (b) -8.2cm
(c) -9.9cm (d) -20cm

6. Index of refraction depend on:

(LHR-GI-15)(GUJ-GII-17)(MTN-GI-16)

(BWP-GI-16, 19)(FBD-GI-14, 15, GI-16)

(DGK-GII-17)(RWP-GII-16)

- (a) Focal length **(b)** speed of light
 (c) distance of image (d) distance of object

7. The focal length (f) is related to radius of curvature (R) as:

(LHR-GII-16)

- (a) $f = 2R$ (b) $R = \frac{f}{2}$
(c) $f = \frac{R}{2}$ (d) $fR = 2$

8. The types of spherical mirrors are:

(LHR-GII-18)

- (a)** 2 (b) 4 (c) 6 (d) 8

9. Which of the following quantity is not changed during refraction of light:

(LHR-GI,II-18)(SGD-GI-17)(SWL-GI-14, 19, GII-18)

(GUJ-GII-19)(FBD-GI-17)

- (a) Its direction (b) Its speed
(c) Its frequency (d) Its wavelength

10. The speed as light in water is:

(GUJ-GI-14)(MTN-GI-15)(SWL-GI-14, GII-18)

- (a) $3.3 \times 10^8 \text{ ms}^{-1}$ (b) $2.5 \times 10^8 \text{ ms}^{-1}$
(c) $2.3 \times 10^8 \text{ ms}^{-1}$ (d) $2.6 \times 10^8 \text{ ms}^{-1}$

11. If a ray of light in glass is incident on an air surface at an angle greater than the critical angle, the ray will:

(GUJ-GI,II-18)(RWP-GI-17)

- (a)** reflect only
 (b) reflect only
 (c) partially reflect and partially reflect
 (d) diffract only

12. Refractive index of air is:

(GUJ-GII-18)

(MTN-GII-19)

- (a)** 1.00 (b) 1.31 (c) 1.33 (d) 1.36

13. The value of refractive index of air is:

(MTN-GI-14)(SGD-GI-16)(BWP-GI-14, 15)

(RWP-GI-18)

- (a) 2 (b) 3 **(c)** 1 (d) 4

14. The Refractive index of Water is:

(MTN-GII-16, GI-18, GII-19)

- (a) 2.42 (b) 1.00
 (c) 2.21 **(d)** 1.33

15. The refractive angle of diamond is:

(LHR-GI-14, 18)(MTN-GII-18)

(SGD-GI-14, GII-17)(DGK-GII-19)

- (a)** 2.42 (b) 2.21
 (c) 1.66 (d) 1.52

16. A converging mirror which a radius of 20cm creates a real 30cm from the mirror that mirror what is the object distance.

(BWP-GII-14)

- (a) 5cm (b) 7.5cm **(c)** 15cm (d) 20cm

17. Conditions for total internal reflection are:

(BWP-GII-14)

- (a)** 2 (b) 3 (c) 4 (d) 5

18. If the image is virtual then its distance from lens is taken:

- (BWP-GI-14)(DGK-GI-15)
 (a) positive **(b)** negative
 (c) double (d) half

19. The Index of Refraction of Ice is:

(BWP-GI-18)

- (a) 1.52 **(b)** 1.31
 (c) 1.00 (d) 2.42

20. Which type of image is formed by a Convex Lens on a Screen:

(BWP-GII-17, 18)(RWP-GI-16)

- (a) inverted and real (b) inverted and virtual
 (c) upright and real **(d)** upright and virtual

21. Wave Theory of Light is formulated by:

(BWP-GII-18)

- (a) Newton (b) Faraday
(c) Maxwell (d) Bell

21. The speed of light in glass is:

(FBD-GII-18)(LHR-GII-19)(DGK-GI-14, GII-18)

- (a)** $2 \times 10^8 \text{ ms}^{-1}$ (b) $2 \times 10^{-8} \text{ ms}^{-1}$
 (c) $3 \times 10^{-6} \text{ ms}^{-1}$ (d) $3 \times 10^{-8} \text{ ms}^{-1}$

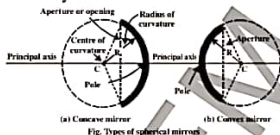
- 22. The Index of Refraction of ethyl Alcohol is:** (FBD-GI-18)(RWP-GII-18)
 (a) 2.42 (b) 2.21
 (c) 1.31 **(d) 1.36**
- 23. The power of lens is reciprocal of:** (RWP-GI-14)
(a) focal length (b) Dioptre
 (c) focal point (d) principal focus
- 24. In convex mirror focus is:** (RWP-GII-14)
 (a) centre the mirror (b) in front of mirror
 (c) on the mirror **(d)** behind the mirror
- 25. The critical angle of glass is.** (SGD-GII-16)
 (a) 42° **(b)** 45° (c) 90° (d) 0°
- 26. The power of lens is equal to:** (SGD-GI-15)
(a) $\frac{1}{f}$ (b) $\frac{2}{f}$ (c) $\frac{1}{3}$ (d) $\frac{4}{f}$
- 27. The index of refraction depends on:** (DGK-GII-16, GI-19)(MTN-GII-19)
 (a) Focal length **(b)** The speed of light
 (c) The image distance
 (d) The object distance
- 28. The image formed by convex mirror is:** (DGK-GI-18)
 (a) real and erect (b) real and inverted
(c) virtual and erect (d) virtual and inverted
- 29. The refractive index of crown glass is:** (SWL-GI-15)
 (a) 2.42 (b) 2.21 (c) 1.66 **(d)** 1.52
- 30. Power of lens is equal to:** (SWL-GI-17)
(a) $\frac{1}{f}$ (b) $\frac{2}{f}$ (c) $\frac{3}{f}$ (d) $\frac{4}{f}$
- 31. To get virtual image from a convex lens the object is kept:** (LHR-GI-19)
 (a) On F / F (b) Between F and 2F
(c) Between lens and F (d) Beyond 2F
- 32. Index of refraction of ice:** (LHR-GII-19)
 (a) 1.00 **(b)** 1.33 (c) 1.31 (d) 1.36
- 33. The speed of light in water:** (GUJ-GII-19)
 (a) $3 \times 10^8 \text{ ms}^{-1}$ **(b)** $2.3 \times 10^8 \text{ ms}^{-1}$
 (c) $2 \times 10^8 \text{ ms}^{-1}$ (d) $1 \times 10^8 \text{ ms}^{-1}$
- 34. The radius of curvature of a converging mirror is 20 cm. Its focal length will be _____ cm.** (GUJ-GI-19)
 (a) 10 (b) -10 (c) 20 **(d)** -20
- 35. The speed of light in air is approximately equal to _____ ms^{-1} .** (GUJ-GI-19)
 (a) 3×10^5 (b) 3×10^6
(c) 3×10^8 (d) 3×10^9
- 36. Which type of Image is formed in concave Mirror:** (BWP-GII-19)
 (a) Real (b) Virtual
(c) Real and Virtual (d) None of these
- 37. An object is placed at a distance 30 cm from a concave lens. Its image forms at 10 cm from lens. The magnification of lens.** (MTN-GI-19)
(a) $\frac{1}{3}$ (b) 3 (c) 10 (d) 15
- 38. Light rays are reflected in a plane mirror, causing us to see image:** (FBD-GII-19)
 (a) Larger (b) Smaller
(c) Inverted (d) Erect
- 39. Optical fibers work on the principle of:** (FBD-GII-19)
 (a) Reflection (b) Refraction
 (c) Diffraction
(d) Total internal reflection
- 40. The SI unit of power of lens is:** (FBD-GI-19)
 (a) Harts (b) Volt
(c) Diopter (d) Decibel
- 41. Power of a lens is the reciprocal of:** (RWP-GII-19)
 (a) Speed (b) Frequency
 (c) Amplitude **(d)** focallength
- 42. Number of lenses used in a slide projector is:** (SGD-GI-19)
 (a) 2 (b) 3 (c) 0 **(d)** 2
- 43. Speed of light in air:** (DGK-GII-19)
 (a) $2.0 \times 10^8 \text{ m/s}$ **(b)** $3.0 \times 10^8 \text{ m/s}$
 (c) $2.3 \times 10^8 \text{ m/s}$ (d) $4.0 \times 10^8 \text{ m/s}$
- 44. The refractive index of medium is:** (DGK-GI-19)
 (a) $n = cv$ (b) $v = cn$
 (c) $c = \frac{v}{n}$ **(d)** $n = \frac{c}{v}$
- 45. Index of refraction of water is:** (SWL-GI-19)
 (a) 1.31 (b) 1.00 **(c)** 1.33 (d) 1.52

SECTION II**SHORT QUESTIONS ANSWERS****PCTB EXERCISE****PCTB NO SHORT QUESTIONS****FROM PUNJAB BOARDS****(2014, 15, 16, 17, 18 & 19)**

1. **Difference between convex and concave mirror.** (LHR-GII-14, 17, GI-16)(GUJ-GI-18)
(MTN-GI-14, 18)(RWP-GI-16, GII-18)
(DGK-GII-14, 18)(RWP-GI-14)(SGD-GI,II-15)

Ans. (i) Concave mirror: A spherical mirror whose inner curved surface is reflecting is called concave mirror. In concave mirror the size of the image depends on the position of the object. Both virtual and real images can be formed by a concave mirror.

(ii) Convex Mirror: A spherical mirror whose outer curved surface is reflecting is called convex mirror. In convex mirror the size of the image is always smaller than the object. Only virtual and erect image is formed by a convex mirror.



2. **Define refractive index. What is its unit?**
(LHR-GI-14, GII-19)(BWP-GI-19)

Ans. Refractive Index: The refractive index 'n' of a medium is the ratio of the speed of light 'c' in air to the speed 'v' of light in the medium:

$$\text{Refractive Index} = \frac{\text{Speed of light in air}}{\text{Speed of light in medium}}$$

$$\text{or } n = \frac{c}{v}$$

3. **Define refraction of light?** (LHR-GII-14)

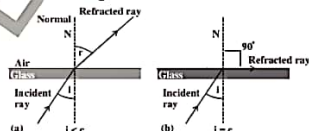
Ans. The process of bending of light as it passes from air into glass and vice versa is called refraction of light.

4. **What is difference between critical angle and total internal reflection?**

(LHR-GII-15)(GUJ-GII-14)(RWP-GI-16)
(BWP-GI-14, GII-18)(SGD-GI-14,15)
(DGK-GI,II-15)(SWL-GII-14, GII-15)

Ans. Critical angle: When a ray of light travelling in denser medium enters into a rarer medium, it bends away from the normal. If the angle of incidence 'i' increases, the angle of refraction 'r' also increases. For a particular value of the angle of incidence, that causes the refracted ray in the rarer medium to bend through 90° is called critical angle.

Total internal reflection: When the angle of incidence becomes larger than the critical angle, no refraction occurs. The entire light is reflected back into the denser medium. This is known as total internal reflection of light.



5. **What is prism?** (LHR-GII-15)(GUJ-GI-17)

Ans. Prism is a transparent object (made of optical glass) with at least two polished plane faces inclined towards each other from which light is refracted.

6. **Define power of lens. write its unit.**

(LHR-GI-16, 19)(GUJ-GI-15)(SWD-GII-18)
(MTN-GII-19)(SGD-GII-19)(DGK-GI-19)

Ans. Power of a lens is defined as the reciprocal of its focal length in metres.

formula: Power of a lens is defined. Power of a lens = 1/focal length (metre) $P = \frac{1}{f}$.

Unit: The SI unit of power of a lens is "Diopter" denoted by a symbol D.

7. **Define optical centre of lens.**

(LHR-GII-14)

Ans. A point on the principal axis at the centre of lens is called optical centre.

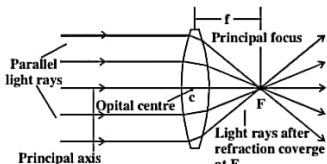


Fig. Convex lens

8. State Laws of refraction.

OR Write two Laws of refractions of light.

(LHR-GI-17)(GUJ-GII-16, GI-18)(BWP-GI-18)
(FBD-GI-17)(RWP-GI-15, GII-17)
(SGD-GII-17, 19)(DGK-GII-19)

Ans.(i) The incident ray, the refracted ray, and the normal at the point of incidence all lie in the same plane.

(ii) The ratio of the sine of the angle of incidence 'i' to the sine of the angle of refraction 'r' is always equal to a constant i.e., $\sin i / \sin r = \text{constant} = n$.

9. Define Cystoscope and Gastroscope.
(LHR-GI-17)

Ans. **Gastroscope:** The gastro scope is used to examine the stomach internally.

Cystoscope: Cystoscope is used to examine the bladder.

10. Define critical angle.

(LHR-GII-17, GI-18)(GUJ-GII-17)(MTN-GI-17)
(FBD-GII-17)(RWP-GI-17, 18)

Ans. **Critical angle:** When a ray of light travelling in denser medium enters into a rarer medium, it bends away from the normal. If the angle of incidence 'i' increases, the angle of refraction 'r' also increases. For a particular value of the angle of incidence, that causes the refracted ray in the rarer medium to bend through 90° is called critical angle.

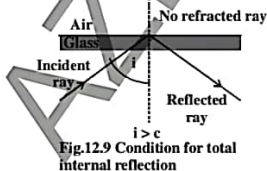


Fig.12.9 Condition for total internal reflection

11. Define resolving power of an instrument?
(LHR-GII-18)

Ans. The resolving power of an instrument is its ability of distinguish between two closely placed objects or point sources.

12. Write two uses of optical fibre.

(LHR-GI-18)

Ans. 1. It is used in telecommunication.
2. We can listen thousand of phone calls without any disturbance.

13. Define optical fibre?
(GUJ-GII-16,17)
(BWP-GI-16)(FBD-GI-15)

Ans. It is a hair size thread made up of glass or plastic through which light can be traveled.

- The inner part of fibre optic is called core that carries light.
- The outer part is concentric shell is called cladding.

14. Define following terms for lens.

(i) Principle axis (ii) Optical centre

(GUJ-GI-14)

Ans. (i) **Optical centre:** A point on the principal axis at the centre of lens is called optical centre.

(ii) **Principle axis:** Each of the two surfaces of a spherical lens is a section of a sphere. the line passing through the two centres of curvatures of the lens is called principal axis.

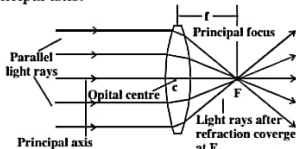


Fig. Convex lens

15. What is difference between real and virtual images?

(BWP-GI-19)(GUJ-GI-16)(MTN-GI-17)

Ans. **Virtual image:**

- A virtual image is an image found. When the outgoing rays from a point an object always diverge.
- The image appears to be located at the point of apparent divergence. Because the rays never really converge a virtual image cannot be projected on to be screen.
- Your image in a mirror is example of virtual image.

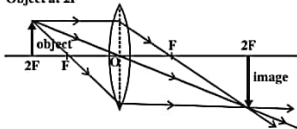
Example:**Real image:**

- (i) A real image is an image which is located in the plane of convergence from a given object.
- (ii) If a screen is placed in the place of a real image the image will general become invisible on the screen real image.
- (iii) Include the image seen on a cinema screen. The image produced on an eye ball retina etc.
- 16. Describe the image formation in convex lens with the help of three basic rays when the object is at 2F.**

(GUJ-GI-14)(MTN-GII-16)(BWP-GI-15)

Ans.

Object at 2F



The image is at 2F real inverted the same size as the object.

- 17. What is the unit of power of lens? Define it?**

(GUJ-GI-18)

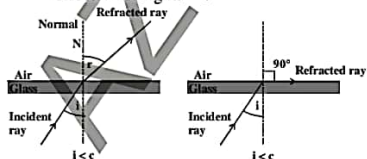
Ans. The SI unit of power of a lens is "Diopter" denoted by a symbol D. If f is expressed in metres so that $1D = 1m^{-1}$. Thus 1 Dioptre is the power of a lens. Whose focal length is 1 metre.

- 18. What is meant by total internal reflection?**

(GUJ-GII-18)(BWP-GII-18)

(FBD-GII-19)

Ans. Total internal reflection: When the angle of incidence becomes larger than the critical angle, no refraction occurs. The entire light is reflected back into the denser medium. This is known as total internal reflection of light.



- 19. Write the two uses of lenses.**

(GUJ-GII-18)

Ans. Lenses are used in many optical devices:

- (i) In compound microscope two lenses are used to investigate the structure of small object.
- (ii) A magnifying glass or simple microscope is a convex lens which is used to produce magnifying images of small object.

- 20. What is meant by irregular reflection of light?**

(MTN-GII-16,18)

Ans. Rough surface reflected rays of light into different directions this type of reflection is called irregular reflection.

Explanation: Most of objects in every day worlds are not smooth on the microscopic level. The rough surfaces of these object reflect the rays of light in many directions such a type of reflections is called irregular reflection.

- 21. Define pole and radius of curvature of a mirror.**

(MTN-GI-16)

Ans. Pole: It is the midpoint of the curved surface of spherical mirror. It is also called vertex.

Radius of Curvature: It is the radius of the sphere of which spherical mirror is a part.

- 22. What is spherical mirror?**

(MTN-GII-16)(DGK-GII-16)

Ans. A mirror whose polished, reflecting surface is apart of a hollow sphere of glass or plastic is called a spherical mirror.

- 23. Differentiate between core and cladding of an optional fibre.**

(MTN-GI-16)

Ans. Core:

- (i) The inner part of the fibre optics is called core that carries the light.
- (ii) The core is made from glass or plastic of relatively high index of refraction.

Cladding:

- (i) An outer concentric shell of a fiber is called cladding.
- (ii) The cladding is made of glass or plastic, but of relatively low refractive index.

24. Define power of lens. write its unit.

(GUJ-GI-19)(MTN-GII-14,17, GI-18)

Ans. Power of a lens is defined as the reciprocal of its focal length in metres.

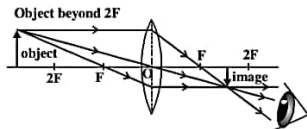
formula: Power of a lens is defined. Power of a lens = $1/\text{focal length (metre)}$ $P = \frac{1}{f}$.

Unit: The SI unit of power of a lens is "Diopter" denoted by a symbol D.

25. Draw ray diagram for image formation in convex lens when object is beyond 2F.

(MTN-GI-17)

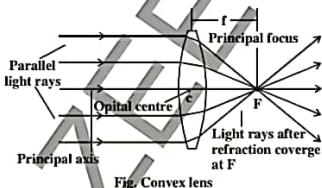
Ans. Image formation in Convex Lens:

**26. Define principle axis? (MTN-GII-18)**

Ans. It is the line joining centre of curvature and pole of the spherical mirror.

27. Define principal axis and principle focus. (BWP-GI-14,15, GII-18)

Ans. (i) **Principle axis:** Each of the two surfaces of a spherical lens is a section of a sphere. the line passing through the two centres of curvatures of the lens is called principal axis.



Principal Focus, F: The light rays traveling parallel to the principal axis of a convex lens after refraction meet at a point on the principal axis, called principal focus or focal point F as in fig

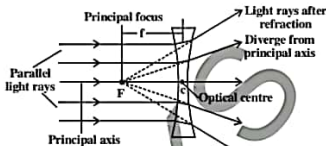


Fig. Concave lens

28. Define centre of curvature with diagram (BWP-GII-14)

Ans. A spherical mirror is a part of a sphere. The centre of this sphere is called centre of curvature.

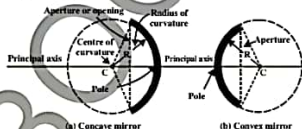


Fig. Types of spherical mirrors

29. Define radius of curvature.

(BWP-GI-16)

Ans. **Radius of Curvature:** It is the radius of the sphere of which spherical mirror is a part.

30. Why the position of fish inside the water seems to be at less depth than that of its actual position? (BWP-GII-15)

Ans. Due to refraction of light the position of fish inside the water seems to be at less depth than that its actual position.

31. Define refraction of light? (BWP-GI-15)

Ans. The process of bending of light as it passes from air into glass and vice versa is called refraction of light.

32. Define lens, write names of its two types. (BWP-GI-14)(FBD-GI-15)

Ans. A lens is any transparent material having two surfaces, of which at least one is curved. Lenses refract light in such a way that an image of the object is formed.

Type of lenses:

(i) Concave lens (ii) Convex lens

33. Write the formula of magnification of spherical mirror. (BWP-GII-14)

Ans. $m = \frac{h_i}{h_o}$

34. Write down the refractive index of ice and water? (BWP-GI-17)

Ans. The refractive index⁽ⁿ⁾ of ice⁽ⁿ⁾ = 1.31,
refractive index⁽ⁿ⁾ of water $\approx$ 1.33

35. What is pole and show it in diagram? (FBD-GI-14)

Ans. Pole: It is the midpoint of the curved surface of spherical mirror. It is also called vertex.



Fig. Types of spherical mirrors

36. What is spherical mirror? (FBD-GII-15)

Ans. A mirror whose polished, reflecting surface is a part of a hollow sphere of glass or plastic is called a spherical mirror.

37. Define radius of curvature. (FBD-GII-14)(SGD-GII-16)

Ans. Radius of Curvature: It is the radius of the sphere of which spherical mirror is a part.

38. Define refraction? Explain with diagrams. (FBD-GII-15)

Ans. This bending of light as it passes from one transparent medium into another is called refraction.

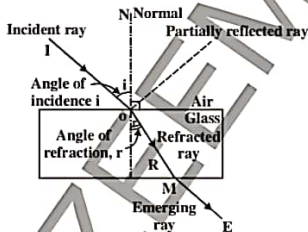


Fig. Refraction of light by a glass block

39. How thickness of lens effects its focal length? (FBD-GI-16)

Ans. (i) A lens with a long focal length is thin, its surface are not very strongly curved.
(ii) A lens with short focal length is fatter, its surface are more strongly curved.

40. Define principal focus and focal length. (FBD-GII-17)

Ans. Principal Focus, F: The light rays traveling parallel to the principal axis of a convex lens after refraction meet at a point on the principal axis, called principal focus or focal point F. Hence, convex lens is also called converging lens.

Focal Length, f: This is the distance between the optical center and the principal focus (Fig.).

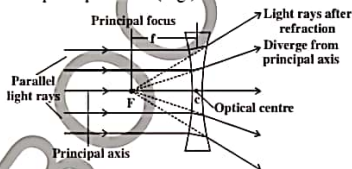


Fig. Convex lens

41. Find the focal length of convex lens if its power is 5 D. (FBD-GII-17)(RWP-GII-19)

Ans. $p = \frac{1}{f}$

$$f = \frac{1}{p}$$

$$f = \frac{1}{5} = 2\text{m}$$

42. Define mirror formula? (RWP-GII-16)

OR What is mirror formula? (RWP-GII-19)

OR Write its mathematical formula.

Ans. Mirror formula is the relationship between object distance p, image distance q from the mirror and focal length f of the mirror.

Thus we can write mirror formula as:

$$\frac{1}{f} = \frac{1}{p} + \frac{1}{q}$$

This equation is true both concave and convex mirror.

43. How light travels with the use of total internal reflection in optic fibre. (RWP-GI-14)(SWL-GI-17)

Ans. In optic fibre light entering from one end of the core strikes the core cladding boundary at an angle of incidence greater

than critical angle and is reflected back into the core. In this way light travels many kilometres with small loss of energy.

44. What is meant by resolving power.

OR Define resolving power.

(GUJ-GII-19)(SGD-GI-15)(SWL-GII-14, GI-17)

(RWP-GI-14, GII-19)(DGK-GII-14, 16, GII-19)

Ans. The resolving power of an instrument is its ability of distinguish between two closely placed objects or point sources.

45. Define terms resolving and magnifying power. (MTN-GI-19)(RWP-GI-14)

Ans. Resolving power:

The resolving power of an instrument is its ability of distinguish between two closely placed objects or point sources.

Magnifying power: The magnifying power is defined as "the ratio of the angle subtended by the image as seen through the optical device to that subtended by the object at the unaided eye".

46. What is meant by light pipe?

(RWP-GI-17)(DGK-GII-17)(SGD-GI-15)

(SWL-GII-14)

Ans. Light pipe is a bundle of thousands of optical fibres bounded together. They are used to illuminate the inaccessible places by the doctors or engineers. For example, doctors view inside the human body. They can also be used to transmit images from one place to another.

47. Define Concave and Convex mirror.

OR What is difference between Convex mirror. (RWP-GII-17)(DGK-GII-14, 18)

(DGK-GII-19)(RWP-GII-19)

Ans. (i) Concave mirror: A spherical mirror whose inner curved surface is reflecting is called concave mirror. In concave mirror the size of the image depends on the position of the object. Both virtual and real images can be formed by a concave mirror.

(ii) Convex Mirror: A spherical mirror whose outer curved surface is reflecting is called convex mirror. In convex mirror the size of the image is always smaller than the object. Only virtual and erect image is formed by a convex mirror.

48. Define Critical angle. (RWP-GII-18)

Ans. Critical angle: When a ray of light travelling in denser medium enters into a rarer medium, it bends away from the normal. If the angle of incidence 'i' increases, the angle of refraction 'r' also increases. For a particular value of the angle of incidence, that causes the refracted ray in the rarer medium to bend through 90° is called critical angle.

49. An object is front of convex at distance of 14cm. The image is 5.8cm behind the mirror, find force length. (SGD-GII-14)

Ans. P = 14cm

q = -5.8cm

f = ? Mirror focal length.

Find

Mirror formula:

$$\frac{1}{f} = \frac{1}{p} + \frac{1}{q}, \quad \frac{1}{f} = \frac{1}{14} + \frac{1}{-5.8}$$

$$\frac{1}{f} = \frac{1}{14} - \frac{1}{5.8}, \quad \frac{1}{f} = 0.0714 - 0.1724$$

$$\frac{1}{f} = -0.1010, \quad \frac{1}{f} = \frac{1}{-0.1010}$$

So, focal length is 10cm

50. What is meant by concave lens?

(SGD-GI-14)

Ans. Concave mirror: A spherical mirror whose inner curved surface is reflecting is called concave mirror. In concave mirror the size of the image depends on the position of the object. Both virtual and real images can be formed by a concave mirror.

51. Define power of lens. Write its unit.

(SGD-GI-16)

Ans. Power of a lens is defined as the reciprocal of its focal length in metres.

formula: Power of a lens is defined. Power of a lens = 1/focal length (metre) $P = \frac{1}{f}$.

Unit: The SI unit of power of a lens is "Diopter" denoted by a symbol D.

52. Define terms resolving and magnifying power. (SGD-GII-15)

Ans. Magnifying power: The magnifying power is the ratio of angular size with lens 'Q' and angular size with out lens 'Q'.

$$M = \frac{Q}{Q'} = 1 + \frac{d}{f}$$

Resolving power:

The resolving power of an instrument is its ability of distinguish between two closely placed objects or point sources.

53. Write conditions of total internal reflection. (DGK-GII-14)

Ans. There are two conditions for total internal reflection.

- Angle of incidence is greater than critical angle i.e., $i > C$
- Ray of light enters from denser to rare medium.

54. What is meant by principle focus of a convex and concave lenses?

(DGK-GII-14)(SWL-GI-15)

Ans. (i) The light rays travelling parallel to the parallel to the principle axis of a convex lens after refraction meet at a point on the principal axis called principal focus or focal point F. Hence, convex lens is also called converging lens.

(ii) For a concave lens, the parallel rays appear to come from a point behind the lens called principal focus F. Hence concave lens is also called diverging.

55. Write down two uses of lenses?

(DGK-GII-15)(SWL-GI-19)

Ans. Lenses are used in many optical devices:

- In compound microscope two lenses are used to investigate the structure of small object.
- A magnifying glass or simple microscope is a convex lens which is used to produce magnifying images of small object.

56. Define convex mirror. (DGK-GI-17)

Ans. **Convex Mirror:** A spherical mirror whose outer curved surface is reflecting is called convex mirror. In convex mirror the size of the image is always smaller than the object. Only virtual and erect image is formed by a convex mirror.

57. What is meant by principal focus or focal point. (DGK-GI-17)

Ans. **Principal Focus, F:** The light rays traveling parallel to the principal axis of a convex lens after refraction meet at a point on the principal axis, called principal focus or focal point F.

58. Define Radius of Curvature.

(DGK-GII-17)

Ans. **Radius of Curvature:** It is the radius of the sphere of which spherical mirror is a part.

59. Write two uses of optical fibre.

(DGK-GI-18)

Ans. 1. It is used in telecommunication.

2. We can listen thousand of phone calls without any disturbance.

60. What is meant by focal length of spherical mirror. (DGK-GII-18)

Ans. It is distance between the optical centre and the principal focus.

61. Define Optical Fibres. (SWL-GI-17)

Ans. It is a hair size thread made up of glass or plastic through which light can be traveled.

- The inner part of fibre optic is called core that carries light.
- The outer part is concentric shell caused cladding.

62. Enlist at least four type of Lenses.

(BWP-GII-19)

- Ans.** (i) Double convex
(ii) Plano convex
(iii) Concavo convex
(iv) Double concave
(v) Plano concave
(vi) Convexo concave

63. State Lens formula in words.

(BWP-GII-19)

Ans. The relation between the object and image distance from the lense in term of the focal length of the lens is called lens formula:

$$\frac{1}{f} = \frac{1}{p} + \frac{1}{q}$$

64. What is the difference between converging lens and diverging lens?

(FBD-GII-19)

Ans. **Converging lens:** The lens which causes incident parallel rays to converge at a point is known as convex or converging lens.

Diverging lens: The lens which causes the parallel rays of light to diverge from a point. This is called concave or diverging lens.

65. What is Bronchoscope? (FBD-GII-19)

Ans. Bronchoscope is an instrument which use to examine the throat.

66. An object and its image in a concave mirror are of the same height, yet inverted, when the object is 20 cm from the mirror. What is the focal length of the mirror? (DGK-GI-19)

Ans. Objected its image having same height = $h_1 = h_0$

Object distance of object from concave mirror $p = 20$ cm

Focal length of mirror $= f = ?$

we know

$$\frac{1}{f} = \frac{1}{q} + \frac{1}{p} \quad \text{--- (i)}$$

The height of image is same as that of object so.

$$\frac{h_1}{h_0} = 1$$

putting $\frac{h_1}{h_0}$ in equation --- (i)

$$1 = \frac{q}{p}$$

$$p = q$$

$$q = 20 \text{ cm}$$

For focal length of the mirror

$$\frac{1}{f} = \frac{1}{p} + \frac{1}{q}$$

putting the values

$$\frac{1}{f} = \frac{1}{20} + \frac{1}{20}$$

$$\frac{1}{f} = \frac{1+1}{20}$$

$$\frac{1}{f} = \frac{2}{20}$$

$$\frac{1}{f} = \frac{1}{10}$$

$$f = .1$$

$$f = 10 \text{ cm}$$

67. What is difference between centre of curvature and Radius of curvature? (SGD-GI-14)

Ans. Aspherical mirror is a part of sphere. The centre of this sphere is called centre of curvature and the radius of the sphere of which spherical mirror is a part.

68. The power of a convex lens is 5D, calculate its focal length. (SGD-GI-19)

Ans. Power of a convex $p = \frac{1}{\text{focal length}}$

$$5 = \frac{1}{\text{focal length}}$$

$$\text{focal length} = \frac{1}{5}$$

$$= 2 \text{ cm}$$

69. Differentiate between Angle of incident and Angle of Reflection. (MTN-GI-19)

Ans. The angle between incident ray AO and normal M, i.e. AON is called. The angle of incident represented by 'i'. The angle between the angle between the normal and the reflected ray OB, i.e. $\angle NOB$ is called angle of reflection represented by r.

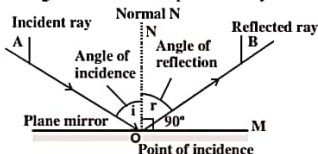


Fig. Reflection of light

70. What is the Refractive index of ice and water. (LHR-GII-19)

Ans. Refractive index of ice = 1.31n

Refractive index of water = 1.33m

Differentiate between the pole and optical centre.

SECTION III**LONG QUESTIONS****FROM PUNJAB BOARDS****(2014, 15, 16, 17, 18 & 19)**

1. A convex lens of focal length 6cm is to be used to form a virtual image. Three times the size of the object. Where must the lens be placed. **LHR(GI-14, GII-16)**

RWP(GII-14, 17, 19), DGK(GI-17)

2. What are optical fibers? Describe how total internal reflection is used in light propagation through optical fibers.

LHR(GI-16, 15), GUJ(GI-19), DGK(GII-16)**SGD(GII-16), FBD(GII-15)**

3. The power of a convex lens is 5D. At what distance the object should be placed from the lens so that its real and two time larger image is formed? **LHR(GI-16), RWP(GI-19)**

4. The power of a convex lens is 5D. At what distance the object should be placed from lens so that is real and two time large image is formed. **LHR(GI-16)**

5. An object and its image in a concave mirror are of the same height, yet inverted when the object is 20.0 cm from the mirror. What is the focal length of the mirror? **LHR(GI-17)**

6. An object 30 cm tall is located 10.5 cm from a concave mirror with focal length 16 cm. **LHR(GII-17)**

7. An object 30 cm tall is located 10.5 cm from a concave mirror with focal length 16cm. Find the location and height of the image. **LHR(GI-18)**

8. A concave lens has focal length of 15cm. At what distance should the object from the lens be placed so that it forms an image at 10cm from the lens? Also find the magnification of lens. **LHR(GII-18)**

9. A ray of light enters from air into the glass surface. The angle of incidence is 30°. If the refractive index. **GUJ(GII-14)**

10. A concave lens has focal length of 15 cm. At what distance should the object from the lens be placed so that it forms an image at 10 cm from the lens? Also find the magnification of the lens. **GUJ(GI-17)**

11. Find the focal length of mirror that forms an image 5.66 cm behind a mirror of an object placed at 34.4 cm in front of the mirror. **GUJ(GII-17)**

12. Find the focal length of a mirror that forms an image 5.66cm behind the mirror of an object placed at 34.4cm in front of the mirror. Is the mirror concave or convex? **GUJ(GI-18)**

13. A ray of light enters from air into glass, the angle of incident is 30°. If the refractive index of glass is 1.52 then find the angle of refraction 'r'. **GUJ(GII-18)**

14. What are optical fibres? describe how total internal reflection is used in light propagation through optical fibres. **(GUJ-GI-19)**

15. An object and its image in a concave mirror are at the same height, yet inverted, when the object is 20 cm from the mirror. What is the focal length of the mirror. **MTN(GII-15)**

16. A convex mirror is used to reflect light from an object placed 66 cm in front of the mirror. The focal length of the mirror is 46 cm. Find the location of image. **MTN(GII-15)**

17. A ray of light enters from air into glass. The angle of incidence is 30°. If the refractive index of glass is 1.52. Then find angle of refraction r. **MTN(GI-14, GII-15)**

18. Explain the total internal reflection and also write its conditions. **MTN(GI-16)**

19. Find the value of critical angle for water refractive angle = 90°). The refractive index of the water is 1.33 and of that air is 1. **MTN(GI-16)**

20. The power of Convex Lens is 5D. At what distance the object should be placed from lens that its real and 2 times larger image is formed? **MTN(GI,II-17)**

21. The power of a convex lens is 5D. At what distance the object should be placed from the lens so that its real and two times larger image is formed? **MTN(GI-18)**

22. An object and its image in a concave mirror are of the same height, yet inverted, when the object is 20cm from the mirror. What is the focal length of the mirror. **MTN(GII-18)**

23. A ray of light enters from air into the glass surface. The angle of incidence is 30°. If the

- refractive index of glass is 1.52. Then find angle of refraction r. **BWP(GI-14)**
24. An object 10.0cm in front of a convex mirror forms an image 5.0cm behind the mirror. What is the focal lengths of the mirror? **BWP(GII-16)**
25. The power of a convex lens is 5D. At what distance the object should be placed from lens so that is real and two time large image is formed. **BWP(GII-15)**
26. Explain image formation in convex lens with help of four figures. **BWP(GII-15)**
27. A Concave Lens has focal length of 15cm. At what distance should the object from the lens be placed so that it forms an image at 10cm from the lens? Also find the magnification of the lens. **BWP(GII-17)**
28. An object 30cm tall is located 10.5cm from a Concave Mirror with focal Length 16cm. **BWP(GI-18)**
- i) Where is Gold Leaf Electroscope?
29. An object 10.0 in front of a convex mirror forms an image 5.0cm behind the mirror. What is the Focal Length of the Mirror. **BWP(GII-18)**
30. An object 10cm in front of a convex mirror form an image 5cm behind the mirror. What is the focal length of the mirror? **FBD(GI-16)**
31. Describe how light is refracted through convex lens. **FBD(GII-15), LHR(GII-19)**
32. A ray of light enters from air into glass. The angle of incidence is 30°. If the refractive index of glass is 1.52, then find angle of refraction. **FBD(GI-17)**
33. A concave lens has focal length of 15 cm. At what distance should the object from the lens be placed so that it forms an image at 10 cm from the lens? Also find the magnification of the lens. **FBD(GII-17)**
34. An object 10cm high is placed at a distance of 20cm from a concave lens of focal length 15cm. Calculate the position and size of the image. **FBD(GI-18)**
35. The power of a convex lens is 5D. At what distance the object should be placed from the lens so that its real and two times larger image is formed? **FBD(GII-18)**
36. What is meant by optical fibre? Write its structure and two uses. **RWP(GII-16)**
37. Find value of critical angle for water, if refractive angle is 90°. The refractive index of water is 1.33 and that of air is 1. **RWP(GII-16)**
38. An objects and its image in a concave mirror are at the same height, yet ~~inverted~~, when the object is 20 cm from the mirror. What is the focal length of the mirror. **RWP(GII-16)**
39. The power of a convex lens is 5D. At what distance the object should be placed from lens so that is real and two time large image is formed. **RWP(GII-15)**
40. What is the difference between magnifying power and resolving power? Explain. **RWP(GII-15)**
41. A convex lens of focal length 6cm is to be used to form a virtual image three times of the size of object. Where must he lens be placed? **RWP(GI-18)**
42. A convex mirror it sued to reflect light from an object placed 66cm in front of the mirror. The focal length of mirror is 46cm. Find the location of image. **RWP(GII-18)**
43. State the law of refraction of light. How can they be verified using rectangular glass slab and pins. **SGD(GI-16)**
44. A convex mirror is used to reflect light from an object placed 66cm in front of the mirror. The focal length of the mirror is $f = -46\text{cm}$. Find the location of the image. **SGD(GI-16, GII-17)**
45. An object 10cm in front of convex mirror form an image 5cm behind the mirror. What is the focal length of the mirror. **SGD(GI-15)**
46. A convex lens of focal length 6 cm is to be used to form a virtual image. Three times the size of the object, where must the lens be placed. **SGD(GII-15)**
47. Write a note on defects of vision. **SGD(GI-15)**
48. An object is placed at a distance of 20cm from a concave lens of focal length 15cm. Calculate the position of image. **SGD(GI-17)**

49. What is meant by refraction of light describe the passage of light through parallel sided transparent material. (DGK-(GI-16))
50. An object 10cm in front of a convex mirror forms an image 5cm behind the mirror. What will be its focal length. (DGK-(GI-16))
51. Find the value of critical angle for water refractive angle = 90°. The refractive index of the water is 1.33 and of that air is 1. (DGK-(GII-17))
52. A concave lens has focal length of 15cm. At what distances should the object from the lens be placed so that it from an image at 10cm from the lens? Also find magnification of the lens. (DGK-(GI-18))
53. Define total internal reflection. Also write its conditions. (SWL-(GI-16))
54. An object is placed 6cm in front of a concave mirror that has 10cm focal length. Determine the location of the image. (SWL-(GI-16))
55. An object 10cm in front of convex mirror forms an image 5.0 cm behind the mirror. What is the focal length of the mirror? (SWL-(GI-17))
56. A convex lens of focal length 6cm is to be used to form a virtual image three times the size of the object. Where must the lens be placed? (SWL-(GII-17), RWP-(GII-19))
57. What is meant by total internal reflection? Explain it with diagram. (DGK-(GI-19))
58. What is meant by Refraction of light? Explain the laws of refraction. (DGK-(GII-19))
59. What is Total Internal Reflection? Explain with Ray diagram. (MTN-(GII-19))
60. Define Refraction of Light. Also explain Refraction of Light by a Glass Block with diagram. (BWP-(GI-19))
61. Explain refraction of light through a glass slab with the help of diagram. (SGD-(GII-19))
62. State the conditions for total internal reflection. (SWL-(GI-19))
63. Define refraction of light and write its laws. (SWL-(GII-19))

SECTION IV

SOLVED NUMERICALS

PCTB EXAMPLES

Examples 12.1: A convex mirror is used to reflect light from an object placed 66cm in front of the mirror. The focal length of the mirror is 46cm. Find the location of the image. (MTN-(GI-15)(RWP-(GI-16))

Solution: Given that, $p = 66\text{cm}$ and $f = -46\text{cm}$
Using mirror formula,

$$\frac{1}{q} = \frac{1}{f} - \frac{1}{p}$$

$$\frac{1}{q} = -\frac{1}{46\text{ cm}} - \frac{1}{66\text{ cm}}$$

$$\frac{1}{q} = -\frac{1}{27\text{ cm}}$$

$$q = -27\text{ cm}$$

The negative sign indicates that the image is behind the mirror and, therefore, is a virtual image.

Examples 12.2: An object is placed 6cm in front of a concave mirror that has focal length 10cm. Determine the location of the image. (GUJ-(GI-15)(DGK-(GI-15)(BWP-(GI-16)(FBD-(GII-15)(SWL-(GII-16))

Solution: Given that, $p = 6\text{cm}$ and $f = 10\text{cm}$
Using the mirror formula,

$$\frac{1}{q} = \frac{1}{f} - \frac{1}{p}$$

$$\frac{1}{q} = \frac{1}{10\text{ cm}} - \frac{1}{6\text{ cm}}$$

$$\frac{1}{q} = -\frac{1}{15\text{ cm}}$$

$$q = -15\text{ cm}$$

The negative sign indicates that the image is virtual i.e., behind the mirror.

Examples 13.3: A ray of light enters from air into glass. The angle of incidence is 30°. If the refractive index of glass is 1.52, then find the angle of refraction 'r'. (FBD-(GI-15)(MTN-(GII-15))

Solution: Given that, $i = 30^\circ$, $n = 1.52$

Using Snell's law, $\frac{\sin i}{\sin r} = n$

$$1.52 \sin r = \sin 30^\circ$$

$$\text{or } \sin r = \sin 30^\circ / 1.52$$

$$\sin r = 0.33$$

$$r = \sin^{-1}(0.33)$$

$$r = 19.3^\circ$$

Hence, angle of refraction is 19.3° .

Examples 12.4: Find the value of critical angle for water (refracted angle = 90°). The refractive index of water is 1.33 and that of air is 1.

(LHR-GII-15)(SWL-GI-15)(BWP-GI-15)
(FBD-GII-16)(RWP-GII-16)

Solution: When light enters in air from water, Snell's law becomes

$$\frac{\sin r}{\sin i} = n$$

$$\text{or } n \sin i = \sin r$$

$$n \sin i = \sin 90^\circ$$

$$n \sin i = 1$$

$$\text{But } n = 1.33$$

Therefore,

$$\sin i = (1/1.33)$$

$$\text{or } i = \sin^{-1}(0.752) = 48.8^\circ$$

$$\text{Critical angle } C = 48.8^\circ$$

Therefore, critical angle of water is 48.8° .

Examples 12.5: A person 1.7 m tall is standing 2.5 m in front of a camera. The camera uses a convex lens whose focal length is 0.05m. Find the image distance (the distance between the lens and the film) and determine whether the image is real or virtual. (RWP-GI-15)

Solution: To find image distance q , we use the thin lens equation with $p = 25\text{m}$ and $f = 0.05\text{m}$.

Using the mirror formula

$$\frac{1}{q} = \frac{1}{f} - \frac{1}{p}$$

$$\frac{1}{q} = \frac{1}{0.05\text{m}} - \frac{1}{2.5\text{m}}$$

$$\frac{1}{q} = 19.6\text{ m}^{-1}$$

$$\text{or } q = 0.05\text{ m}$$

Since the image distance is positive, so a real image is formed on the film at the focal point of the lens.

Examples 12.6: A concave lens has focal length of 15cm. At what distance should the object from the lens be placed so that it forms an image at 10cm from the lens? Also find the magnification of the lens. (LHR-GII-18)

Solution: A concave lens always forms a virtual, erect image on the same side of the object. Given that, $q = -10\text{cm}$ $f = -15\text{cm}$, $p = ?$

$$\begin{aligned} \text{Using the lens formula: } \frac{1}{f} &= \frac{1}{p} + \frac{1}{q} \\ \frac{1}{p} &= -\frac{1}{q} + \frac{1}{f} \\ &= -\frac{1}{-10\text{cm}} + \frac{1}{-15\text{cm}} \\ \frac{1}{p} &= \frac{3\text{cm} - 2\text{cm}}{30\text{cm}^2} \\ \frac{1}{p} &= \frac{1}{30\text{cm}} \\ p &= 30\text{cm} \end{aligned}$$

Thus, the object distance is 30 cm, on the left side from the concave lens.

$$\text{Magnification of the lens is } m = \frac{q}{p} = \frac{10\text{ cm}}{30\text{ cm}} = \frac{1}{3}$$

(Ignore negative sign)

The image is reduced to one-third in size than the object.

PCTB NUMERICAL PROBLEMS

12.1: An object 10.0 cm in front of a convex mirror forms an image 5.0 cm behind the mirror. What is the focal length of the mirror?

(SGD-GI-15)(DGK-GII-15)(MTN-GII-16)

(SGD-GI-16)(DGK-GII-16)(BWP-GII-16)

Ans. Distance of image from convex mirror

$$= q = 5\text{cm.}$$

Distance of object from convex mirror

$$= p = 10\text{cm}$$

Focal length of the mirror = $f = ?$

we know

$$\frac{1}{f} = \frac{1}{q} + \frac{1}{p} \quad \text{--- (i)}$$

Image distance from mirror is as negative.

Reason

Focal length of convex mirror is negative
putting the value in eq (i)

$$\frac{1}{f} = -\frac{1}{5} + \frac{1}{10}$$

$$\frac{1}{f} = -0.2 + 0.1$$

$$\frac{1}{f} = -0.1$$

$$f = -10\text{cm}$$

-ve shows that the focus point is virtual.

- 12.2:** An object 30 cm tall is located 10.5 cm from a concave mirror with focal length 16 cm. (a) Where is the image located? (b) How high is it?

Ans. Focal length of convex mirror = $f = 16\text{cm}$

Distance of object from convex mirror
= $p = 10.5\text{cm}$

Height of the object $\approx h_0 = 30\text{cm}$

- (i) Where is the image located = $q = ?$
(ii) Height of image $h_1 = ?$
(i) Where is the image located = $q = ?$

we know

$$\frac{1}{f} = \frac{1}{q} + \frac{1}{p}$$

Rearrange the formula

$$\frac{1}{q} = \frac{1}{f} - \frac{1}{p}$$

putting the value

$$\frac{1}{q} = \frac{1}{16} - \frac{1}{10.5}$$

$$\frac{1}{q} = 0.0625 - 0.0952$$

$$\text{or } q = 30.54\text{cm}$$

$$q = \boxed{-30.54\text{cm}} \quad \text{Ans.}$$

- (ii) Height of image $h_1 = ?$

we know

$$m = \frac{h_1}{h_0} = \frac{q}{p} \quad \text{--- (i)}$$

h_1 = height of image

h_0 = height of object

Rearrange the formulae --- (i)

$$h_1 = \frac{q}{p} \times h_0$$

putting the value

$$h_1 = \frac{30.54}{10.5} \times 30$$

$$h_1 = 2.9 \times 3$$

$$h_1 = 87.26\text{cm} \quad \text{Ans.}$$

- 12.3:** An object and its image in a concave mirror are of the same height, yet inverted, when the object is 20 cm from the mirror. What is the focal length of the mirror? (LHR-GI-17)

Ans. Objected its image having same height = $h_1 = h_0$

Object distance of object from concave mirror $p = 20\text{cm}$

Focal length of mirror = $f = ?$

we know

$$\frac{1}{f} = \frac{1}{q} + \frac{1}{p} \quad \text{--- (i)}$$

The height of image is same as that of object so.

$$\frac{h_1}{h_0} = 1$$

putting $\frac{h_1}{h_0}$ in equation --- (i)

$$1 = \frac{q}{p}$$

$$p = q$$

$$q = 20\text{cm}$$

For focal length of the mirror

$$\frac{1}{f} = \frac{1}{p} + \frac{1}{q}$$

putting the values

$$\frac{1}{f} = \frac{1}{20} + \frac{1}{20}$$

$$\frac{1}{f} = \frac{1+1}{20}$$

$$\frac{1}{f} = \frac{2}{20}$$

$$\frac{1}{f} = \frac{1}{10}$$

$$f = .1$$

$$f = 10\text{cm}$$

12.4: Find the focal length of a mirror that forms an image 5.66 cm behind the mirror of an object placed at 34.4 cm in front of the mirror. Is the mirror concave or convex? (SWL-GI-16)

Ans. Distance of the object from mirror = $p = 34.4\text{cm}$

distance of the image from the mirror = $q = -5.66\text{cm}$ -v sigma shows that the image behind the mirror

Focal length of the mirror = ?

we know

$$\frac{1}{f} = \frac{1}{q} + \frac{1}{p} \quad \text{--- (i)}$$

q and f are both negative reason.

Because the image is formed behind the mirror so

$$q = -5.66\text{cm}$$

$$p = +34.4\text{cm}$$

putting the value in eq (i)

$$\frac{1}{f} = -\frac{1}{5.66} + \frac{1}{34.4}$$

$$\frac{1}{f} = -0.177 + 0.029$$

$$\frac{1}{f} = -0.148$$

$$-\frac{1}{0.148} = f$$

$$f = -6.77\text{cm}$$

12.5: An image of a statue appears to be 11.5 cm behind convex mirror with focal length 13.5 cm. Find the distance from the statue to the mirror.

Ans. Focal length of the mirror = $f = 13.5\text{cm}$

Distance of image of convex mirror = $q = -11.5\text{cm}$ -v sigma shows that image is formula behind the mirror

Distance from the mirror = $p = ?$

we know

$$\frac{1}{f} = \frac{1}{p} + \frac{1}{q}$$

rearrange the formula

$$\frac{1}{p} = \frac{1}{f} - \frac{1}{q}$$

putting the value

$$\frac{1}{p} = -\frac{1}{13.5} - \frac{1}{(-11.5)}$$

$$\frac{1}{p} = -0.074 + 0.087$$

$$\frac{1}{p} = 0.013$$

$$p = \frac{1}{0.013}$$

$$p = 77\text{cm}$$

12.7: Nabeela uses a concave mirror when doing her makeup. The mirror has a radius of the curvature of 38 cm. (a) What is the focal length of the mirror? (b) Nabeela is located 50 cm from the mirror. Where will her image appear? (c) Will the image be upright or inverted?

Sol. Radius of curvature = $R = 38\text{cm}$

Distance of Nabeela from the mirror = 50cm

(i) Focal length of mirror = ?

location of image = $q = ?$

(ii) Image is upright or inverted = ?

(i) Focal length of mirror

we know

$$f = \frac{R}{2}$$

$$\frac{1}{f} = \frac{1}{q} + \frac{1}{p} \quad f = \frac{R}{2}$$

putting the value

$$f = \frac{38}{2}$$

$$f = 19\text{cm Ans.}$$

(ii) $q = ?$

$$\frac{1}{f} = \frac{1}{q} + \frac{1}{p}$$

$$\frac{1}{q} = \frac{1}{f} - \frac{1}{p}$$

putting the value

$$\frac{1}{q} = \frac{1}{19} - \frac{1}{50}$$

$$\frac{1}{q} = 0.05263 - 0.02$$

$$\frac{1}{q} = 0.03263$$

$$q = 30.64\text{cm}$$

(iii) The image is inverted.

12.8: An object 4 cm high is placed at a distance of 12 cm from a convex lens of focal length 8 cm. Calculate the position and size of the image. Also state the nature of the image.

Ans. Height of object = $h_0 = 1\text{cm}$

Distance of object from convex lens = $p \approx 12\text{cm}$

(i) Position and size of image =

$$q = ?$$

$$h_i = ?$$

(ii) Nature of image

(i) Position of image

we know

$$\frac{1}{f} = \frac{1}{p} + \frac{1}{q}$$

$$\frac{1}{q} = \frac{1}{f} - \frac{1}{p}$$

putting the value

$$\frac{1}{q} = \frac{1}{8} - \frac{1}{12}$$

$$\frac{1}{q} = 0.125 - 0.083$$

$$\frac{1}{q} = 0.042 =$$

$$q = 24\text{cm} \quad \text{Ans.}$$

size of image = ?

$$M = \frac{h_i}{h_0} = \frac{q}{p}$$

$$h_i = \frac{q}{p} \times 4$$

putting the value

$$h_i = \frac{24}{12} \times 4$$

$$h_i = 2 \times 4$$

$$h = 8\text{cm}$$

(ii) Nature of image

The image is real and inverted, focal length and distance of image are positive.

12.9: An object 10 cm high is placed at a distance of 20 cm from a concave lens of focal length 15 cm. Calculate the position and size of the image. Also, state the nature of the image.

(LHR-GI-15)(SWL-GII-15)(SGD-GII-16)

(GUJ-GI,II-16)(FBD-GI-16)

Ans. Height of object = $h_0 = 10\text{cm}$

Distance of object from concave lens

$$= p = 20\text{cm}$$

Focal length of concave lens = $f = 15\text{cm}$

position of image = $q = ?$

Size of image = $h_i = ?$

State the nature of image = ?

(i) Position of image.

we know

$$\frac{1}{f} = \frac{1}{p} + \frac{1}{q}$$

$$M = \frac{h_i}{h_0} = \frac{q}{p}$$

position of image

$$\frac{1}{f} = \frac{1}{p} + \frac{1}{q} \Rightarrow \frac{1}{q} = \frac{1}{f} - \frac{1}{p}$$

putting the value

$$\frac{1}{q} = \frac{-1}{15} - \frac{1}{12} \quad \therefore (f \text{ is negative})$$

$$\frac{1}{q} = -0.6667 - 0.05$$

$$\frac{1}{q} = -0.11667$$

$$q = -8.57\text{cm}$$

(ii) Size of image

$$M = \frac{h_i}{h_0} = \frac{q}{p}$$

$$M = \frac{h_i}{h_0} = \frac{q}{p}$$

rearrange the formula

$$h_i = \frac{q}{p} \times h_0$$

putting the value

$$h_i = \frac{8.57}{20} \times 10$$

$$h_i = 4.28\text{cm}$$

(iii) Nature of image

Image is virtual, erect and diminished.

12.10: A convex lens of focal length 6 cm is to be used to form a virtual image three times the size of the object. Where must the lens be placed?

(SGD-GII-15)(LHR-GII-16)(MTN-GI-16)

Ans. $f = 6\text{cm}$

$$M = 3$$

$$p = ?$$

$$M = \frac{q}{p} \quad 3 = \frac{q}{p} \quad q = 3p$$

we know

$$\frac{1}{f} = \frac{1}{p} + \frac{1}{q}$$

putting the value

$$\frac{1}{6} = \frac{1}{p} - \frac{1}{3q} = \frac{2}{3p}$$

$$p = \frac{2}{3} \times 6 = 4\text{m}$$

$$p = 4\text{cm}$$

SECTION I**MULTIPLE CHOICE QUESTIONS****CHAPTER 13****ELECTROSTATICS****PCTB EXERCISE**

- ♦ Choose the correct answer from the following choices:
- A positive electric charge
 - attracts other positive charge
 - repels other positive charge
 - attracts a neutral charge
 - repels a neutral charge
 - An object gains excess negative charge after being rubbed against another object, which is:
 - neutral
 - negatively charged
 - positively charged
 - either a, b or c
 - Two uncharged objects A and B are rubbed against each other. When object B is placed near a negatively charged object C, the two objects repel each other. Which of the following statements is true about object A?
 - remains uncharged
 - becomes positively charged
 - becomes negatively charged
 - unpredictable
 - When you rub a plastic rod against your hair several times and put it near some bits of paper, the pieces of papers are attracted towards it. What does this observation indicate?
 - the rod and the paper are oppositely charge
 - the rod acquires a positive charge
 - the rod and the paper have the same charges
 - the rod acquires a negative charge
 - According to Coulomb's law, what happens to the attraction of two oppositely charged objects as their distance of separation increases?
 - increases
 - decreases
 - remains unchanged
 - cannot be determined

- The Coulomb's law is valid for the charges which are
 - moving and point charges
 - moving and non-point charges
 - stationary and point charges
 - stationary and large size charges
- A positive and a negative charge are initially 4 cm apart. When they are moved closer together so that they are now only 1 cm apart, the force between them is
 - 4 times smaller than before
 - 4 times larger than before
 - 8 times larger than before
 - 16 times larger than before
- Five joules of work is needed to shift 10 C of charge from one place to another. The potential difference between the places is
 - 0.5 V
 - 2 V
 - 5 V
 - 10 V
- Two small charged spheres are separated by 2 mm. Which of the following would produce the greatest attractive force?
 - +1q and +4q
 - 1q and -4q
 - +2q and +2q
 - +2q and -2q
- Electric field lines
 - always cross each other
 - never cross each other
 - cross each other in the region of strong field
 - cross each other in the region of weak field

FROM PUNJAB BOARDS**(2014, 15, 16, 17, 18 & 19)**

- Capacitance is defined as:

(LHR-GI-14, GI-II-15, GI-II-18, 19)(GUJ-GII-14,17)
(MTN-GII-15, GI-16)(SGD-GII-14, GI-17)
(FBD-GI-14, 15, 18, GI-16)(RWP-GII-16, 17)
(SWL-GII-14, 17)

 - VC
 - $\frac{Q}{V}$
 - QV
 - $\frac{V}{Q}$
- The unit of electric intensity is:

(LHR-GII-14)(GUJ-GII-16)(BWP-GII-15)
(FBD-GII-17)(SGD-GI-15)(DGK-GI-15)

 - ms⁻¹
 - Ns
 - Nm
 - NC⁻¹
- If three capacitors of 3 pF, 4pF and 5pF are connected in parallel with a battery of 6v. Total capacitance will be:

(LHR-GII-14)(FBD-GI-14)

 - 06pF
 - 12pF
 - 14pF
 - 17PF

4. In series combination of capacitors, each capacitor will have same: (LHR-GII-16)
 (a) Voltage (b) Charge
 (c) Capacitance (d) Charge and voltage
5. The value of k is coulomb law is: OR
 According to Coulomb's Law, The value of k is: (LHR-GI-14)(GUJ-GI-14)(MTN-GI-18)
 (SGD-GII-19)(DGK-GII-17)(SWL-GII-19)
 (a) $9 \times 10^9 \text{ Nm}^2 \text{C}^{-2}$ (b) $9 \times 10^9 \text{ Nm}^{-2} \text{C}^{-2}$
 (c) $9 \times 10^9 \text{ Nm}^{-2} \text{C}^{-2}$ (d) $9 \times 10^9 \text{ Nm}^2 \text{C}^{-2}$
6. Electrical field lines always: (LHR-GI-15)
 (FBD-GII-14)(SWL-GII-14)(MTN-GII-14)
 (DGK-GI-19)(RWP-GII-19)
 (a) always cross each other
 (b) never cross each other
 (c) cross each other in field
 (d) cross each other in reign
7. Five Joules of work is needed to shift 10C of charge from one place to another. The potential difference between the places is: (LHR-GI-15)(GUJ-GII-18)(SWL-GI-18)(SGD-GI-19)
 (a) 0.5 V (b) 2 V (c) 5 V (d) 10 V
8. The unit of capacitance is: (LHR-GI-17)
 (a) Ampere (b) Farad
 (c) Coulomb (d) Volt
9. Unit of charge is: (LHR-GI,II-18)
 (a) Ohm (b) Watt
 (c) Coulomb (d) Ampere
10. According to Coulomb's Law what happens to force of attraction of two oppositely charged objects as their distance of separation increases: (GUJ-GI-15)
 (a) increases (b) decreases
 (c) remain un charged
 (d) cannot be determined
11. S.I unit of Capacitance is: (GUJ-GI-15)
 (MTN-GI-15)(BWP-GI-14)(SWL-GI-14, 17)
 (a) Newton (b) Volt
 (c) Coloumb (d) Farad
12. A positive electric charge: (GUJ-GII-14, GI-17)(MTN-GI-16)(BWP-GI-16,18)
 (RWP-GI,II-16)(DGK-GII-18)
 (a) Attracts other positive charge
 (b) Repels the neutral charge
 (c) Attracts a neutral charge
 (d) Repels other positive charge
13. One nano farad is equal to: (GUJ-GII-16)
 (a) $1 \times 10^{-6} \text{ F}$ (b) $1 \times 10^{-9} \text{ F}$
 (c) $1 \times 10^{-12} \text{ F}$ (d) $1 \times 10^{-18} \text{ F}$
14. The Coulomb's law is valid for the charges which are (GUJ-GI-18)
 (a) moving and point charges
 (b) moving and non-point charges
 (c) stationary and point charges
 (d) stationary and large sized charges
15. Coulomb's Law is: (GUJ-GII-16)(BWP-GI-15)
 (SWL-GI-16, 18)
 (a) $F = K \frac{q_1 q_2}{r^2}$ (b) $F = K \frac{q_1 q_2}{r}$
 (c) $F = G \frac{m_1 m_2}{r}$ (d) $F = QE$
16. The equation of Electric intensity is: (MTN-GII-16)
 (a) $E = \frac{V}{q_0}$ (b) $E = \frac{k}{q_0}$
 (c) $E = \frac{F}{q_0}$ (d) $F = \frac{w}{v}$
17. An instrument is use for detecting charge is: (MTN-GI-16)
 (a) Stroboscope (b) Electroscop
 (c) Spectroscope (d) Microscope
18. The formula of Capacitance is: (MTN-GI-17)
 (a) VC (b) $\frac{Q}{V}$ (c) QV (d) $\frac{V}{Q}$
19. If air, is medium between two charges then the value of K in SI unit will be: (MTN-GII-16)
 (a) $9 \times 10^9 \text{ Nm}^2 \text{C}^{-2}$ (b) $9 \times 10^9 \text{ Nm}^2 \text{C}^{-2}$
 (c) $9 \times 10^{-12} \text{ Nm}^2 \text{C}^{-2}$ (d) $9 \times 10^{10} \text{ Nm}^2 \text{C}^{-2}$
20. The device used to store charge is called: (MTN-GII-18)
 (a) Resistance (b) Capacitor
 (c) Battery (d) Wire
21. The SI unit of electric field intensity is: (MTN-GII-18)
 (a) NC^{-1} (b) $\text{N}^{-1} \text{C}$ (c) $\frac{\text{N}^{-2}}{\text{C}}$ (d) $\frac{\text{C}}{\text{N}^2}$
22. In mica capacitor the dielectric is: (BWP-GI-14)
 (a) Mica (b) Plastic
 (c) Paper (d) Aluminum

23. If 4 Coulomb Charge is given to the plates of a Capacitor and Potential between the plates is 2 Volt, then its Capacitance is:

(BWP-GII-16)

- (a) 2F (b) 4F
(c) 6F (d) 6F

24. What happens to the intensity or the brightness of the lamps connected in series as more and more lamps are added:

(BWP-GII-18)

- (a) increases (b) decreases
(c) remains the same (d) cannot be predicted

25. Two small charged spheres are separated by 2 mm. Which of the following would produce the greatest attractive force:

(BWP-GII-18)(SWL-GI-19)

- (a) +1q and +4q (b) -1q and -4q
(c) +2q and +2q (d) +2q and -2q

26. Combination of capacitors are: (FBD-GI-16)

- (a) 2 (b) 3 (c) 4 (d) 5

27. The value of k is coulomb law is:

(FBD-GII-14)

- (a) $9 \times 10^9 \text{ Nm}^2\text{C}^{-2}$ (b) $9 \times 10^9 \text{ Nm}^{-2}\text{C}^{-2}$
(c) $9 \times 10^9 \text{ Nm}^2\text{C}^{-2}$ (d) $9 \times 10^9 \text{ Nm}^2\text{C}^2$

28. If the medium between two charges is air, then the value of k will be:

(FBD-GII-18)(DGK-GI-18)

- (a) $9 \times 10^{-9} \text{ Nm}^2\text{C}^{-2}$ (b) $9 \times 10^{-8} \text{ Nm}^2\text{C}^{-2}$
(c) $9 \times 10^8 \text{ Nm}^2\text{C}^{-2}$ (d) $9 \times 10^9 \text{ Nm}^2\text{C}^{-2}$

29. The electric lines of force were introduced by:

(RWP-GI-14)

- (a) Newton (b) Einstein
(c) Coulomb (d) Faraday

30. The SI unit of Coulombs constant is:

(RWP-GII-15)

- (a) Nm^2C^{-2} (b) Nm^2C^2
(c) Nm^2C^{-2} (d) Nm^2C^2

31. The formula of electric field intensity is:

(RWP-GI-15)

- (a) $\frac{F}{q_0}$ (b) Fq_0 (c) $\frac{1}{Fq_0}$ (d) $\frac{q_0}{F}$

32. The SI unit of intensity is:

(RWP-GII-16)

- (a) NC (b) NC^{-1}
(c) NC^{-2} (d) NC^{-2}

33. Which thing is used as a dielectric in mica capacitor?

(RWP-GII-18)

- (a) Mica (b) Plastic
(c) Aluminum (d) Paper

34. Capacitors are used to store:

(SGD-GI-14, 17)

- (a) Current (b) Voltage
(c) Charge (d) Resistance

35. Unit of Capacitance is:

(SGD-GI-16)

- (a) Ohm (b) Farad
(c) Joule (d) Ampere

36. The equation of Coulomb's law is.

(SGD-GII-16,18)

- (a) $F = \frac{q_1 q_2}{r^2}$ (b) $F = \frac{kq}{r^2}$
(c) $F = k \frac{q_1 q_2}{r^2}$ (d) None of these

37. The SI unit of charge is: OR

Unit of electric charge is: (SGD-GII-15,17)

- (a) Volt (b) Coulomb
(c) Ampere (d) Ohm

38. The unit of electric potential is: (SGD-GI-15)

- (a) Volt (b) Joule
(c) Ampere (d) Ohm

39. Formula of electric intensity is:

(DGK-GI-14)(SWL-GII-14,15,18)

- (a) $E = \frac{v}{q}$ (b) $E = \frac{k}{q}$
(c) $E = \frac{F}{q_0}$ (d) $E = \frac{w}{v}$

40. In parallel combination of capacitors, each capacitor will have same:

(DGK-GI-16)

- (a) Voltage (b) Capacitance
(c) Charge (d) Charge and capacitance

41. Capacitors can be used to differentiate between high frequency and low frequency signals. Such circuit is called:

(DGK-GII-16)

- (a) Series Circuit (b) Parallel Circuit
(c) Filter circuit (d) None of these

42. 1 micro Farad is equal to: (DGK-GI-15, 18)

(FBD-GI-19)

- (a) $1 \times 10^{-3} \text{F}$ (b) $1 \times 10^{-4} \text{F}$
(c) 1×10^{-5} (d) $1 \times 10^{-6} \text{F}$

43. The SI unit of Coulombs constant is:

(DGK-GI-15)

- (a) Nm^2C^{-2} (b) Nm^2C^2
(c) $\text{Nm}^{-2}\text{C}^{-2}$ (d) Nm^{-2}C^2

44. One Farad is equal to (DGK-GI-18)

- (a) $10^{-6} \mu\text{F}$ (b) $10^6 \mu\text{F}$
(c) $10^{-3} \mu\text{F}$ (d) $10^3 \mu\text{F}$

45. S.I unit of capacitance of a capacitor is:

(LHR-GI-19)

- (a) V (b) A (c) F (d) N

46. The electric field lines are used for the representation of: (GUJ-GI-19)

- (a) electric potential (b) capacitance
(c) electric field
(d) potential difference

47. The value of Constant K in Coulomb's Law depends upon: (BWP-GII-19)

- (a) Size of Charges
(b) Magnitude of Charges
(c) Distance between Charges
(d) Medium between Charges

48. The correct relation for Coulomb's Force is: (MTN-GI-19)

- (a) $F \propto K \frac{q_1 q_2}{r}$ (b) $F \propto K \frac{q_1 q_2}{r^2}$
(c) $F = \frac{1}{K} \frac{q_1 q_2}{r}$ (d) $F = \frac{1}{K} \frac{q_1 q_2}{r^2}$

49. The equation of Electric Field Intensity is:

(MTN-GII-19)

- (a) $E = \frac{q}{F}$ (b) $q_0 = \frac{E}{F}$
(c) $F = \frac{E}{q_0}$ (d) $E = \frac{F}{q_0}$

SECTION II

SHORT QUESTIONS ANSWERS

PCTB EXERCISE

NO PCTB SHORT QUESTIONS

FROM PUNJAB BOARDS

(2014, 15, 16, 17, 18 & 19)

1. What is meant by point charge?

(LHR-GII-15)

Ans. The size of charged bodies is very small as compared to the distance between them is called point charge.

2. Define electric field intensity, write unit of electric intensity.

(LHR-GII-14, 18, GI-19)(GUJ-GI,II-14, GII-15, 19)
(BWP-GI-15,16, GII-19)(RWP-GII-19)
(SGD-GII-14, 15,16)(SWL-GII-14)

Ans. The strength of an electric field at any point in space is known as electric field intensity.

Formula

$$E = \frac{F}{q_0}$$

SI unit of electric intensity is N C^{-1} .

3. What is meant by electric field line? What is its direction.

(LHR-GII-14)(GUJ-GI-16)(MTN-GI-18)
(BWP-GI-14)(RWP-GI-14, GII-15)

Ans. The direction of electric field intensity in an electric field can also be represented by drawing lines. These line are known as electric field lines of force. These lines were introduced by Michael Faraday.

4. Define capacitance and state its SI unit.

(LHR-GI-14, 18)(GUJ-GI-14)(FBD-GI-14)
(RWP-GII-16)

Ans. The ability of the capacitor to store charge is called capacitance. It is denoted 'C'. It is given by the ratio of charge and the electric potential.

Unit: S.I unit is farad (F) $C = \frac{Q}{V}$

5. What is the difference between capacitor and dielectric?

(LHR-GII-14)(DGK-GI-17)

Ans. Capacitor: A device which is used to store electric charge is called capacitor.

- b. **Dielectric:** In capacitors, The medium between the two plates is air or a sheet of some insulator. This medium is known as dielectric.

6. Define Farad.

OR What is the unit of capacitance define.

(LHR-GI-16, 19)(DGK-GII-18)(FBD-GI-15)

(MTN-GII-16)(SWL-GI-19)

Ans. SI unit of capacitance is farad(F), defined as:

"If one coulomb of charge given to the plates of a capacitor produced a potential difference of one volt between the plates of the capacitor then its capacitance would be one farad."

7. Write the formula of parallel combination of capacitors.

(LHR-GI-14)

Ans. In the case of 'n' capacitors connected in parallel, the equivalent capacitance is given by

$$C_{eq} = C_1 + C_2 + C_3 + \dots + C_n$$

8. Explain between fixed and variable capacitors?

(LHR-GI-II-15, GI-16)(GUJ-GI-14)

Ans. Capacitors: Capacitors are used in the resonant circuits that tune radio & particular frequencies.

Variable: Variable capacitors value of capacitance increased or decreased.

9. Write any two uses of capacitors?

(LHR-GI-16, 19)(GUJ-GII-14, 19, GI-17)

(MTN-GII-16, GI-19)(BWP-GII-14, 18, GI-19)

(SGD-GI-17)(DGK-GII-19)(SWL-GII-17, 19)

Ans. (i) They are used for table fans, exhaust fans, fan motors in air conditioners, coolers, motors washing machines, air conditioners and many other appliances for their smooth working.

(ii) Capacitors are also used in electronic circuits of computers etc.

10. How many methods are there of combination of capacitors? (LHR-GI-14)

Ans. There are two methods for combination of capacitors:

(i) Parallel combination

(ii) Series combination

11. Explain the variable capacitor with an example.

(LHR-GI-17)

Ans. Variable: In variable type of capacitors some arrangement is made to change the area of the plates facing each other.

Uses: Variable capacitors are usually utilize or turning in radio sets.

12. Write any two characteristics of electric field line.

(LHR-GII-17)(GUJ-GII-16)(MTN-GII-14)

Ans. (i) A field charge with a arrow head indicating the direction of force.

(ii) Field lines are always more away from positive charge towards negative charge.

(iii) The spacing between the field lines shows the straight electric field.

13. Define dielectric?

(LHR-GII-18)(BWP-GI-16, 18)

Ans. Dielectric: In capacitors, The medium between the two plates is air or a sheet of some insulator. This medium is known as dielectric.

14. Define electrical potential? (LHR-GI-18)

(GUJ-GII-14, GI-15)(FBD-GII-15, GI-16)

(MTN-GII-19)

Ans. Electric potential at a point in an electric field is equal to the amount of work done in bringing a unit positive charge from infinity to that point.

If W is the work done in moving a positive charge q from infinity to a certain point in the field, the electric potential V at this point would be given by

$$V = \frac{W}{q} \dots\dots\dots (13.6)$$

15. What is Electrostatic induction?**OR Define electrostatic induction.**

(LHR-GII-16)(GUJ-GI-II-15, GI-16,18)

(MTN-GI-16, GII-19)(BWP-GII-17)

(FBD-GI-17,18)(RWP-GII-19)(SGD-GI-15)

(DGK-GI-II-14, GI-15)(SWL-GI-14, GII-15, 19)

Ans. Electrostatic induction: Whenever a charged body is brought close to an insulator conductor, the near end of the conductor develop an unlike charge while the far end of the conductor develops a like charge. This separation of charge is called electrostatic induction.

16. Define Electric field of charge.**OR Define electric field.**

(GUJ-GII-16)(LHR-GII-14)(MTN-GI-18)(SGD-GII-19)

(FBD-GII-17)(RWP-GII-14,15,17, GI-19)

Ans. The electric field is a region around a charge in which it exerts electrostatic force on another charges.

17. One which factors does the ability of a capacitor to store charge. depends.

(GUJ-GI-15)

Ans. Three factors affects the ability of capacitors to store charge.

(i) Area of the plates

(ii) Distance between the plates.

(iii) Types of insulators used between the plates.

18. Write the names of two types of capacitors and give an example on it.

(GUJ-GII-15)(BWP-GI-14)

Ans. Types of capacitors:(i) **Fixed capacitor:**

Example: Mica capacitor is a example of fixed capacitor.

(ii) **Variable Capacitor:**

Example: Variable capacitors are usually utilize or turning in radio sets.

19. Define Charge.

(GUJ-GII-17)(MTN-GII-15, 18)

Ans. The electric field is a region around a charge in which it exerts electrostatic force on another charges.

Charge is a basic property of a material body due to which it attracts ore repels another object.

20. Define volt? (RWP-GI-17, 19)(GUJ-GII-18)

(FBD-GI-16)(BWP-GI-17)(SWL-GI-19)

Ans. If one joule of work is done against the electric field in bringing one coulomb positive charge from infinity to a point in the electric field then the potential at that point will be one volt.

21. Define Coulomb's law and write its mathematical equation.

(MTN-GII-14, GI-15)(BWP-GII-18)(FBD-GI-14,18)

(RWP-GII-15)(SGD-GII-15,17)(DGK-GI-14)

(SWL-GI-14, GII-19)

Ans. Coulomb's law: The force of attraction or repulsion between two point charges is directly proportional to the product of the magnitude of charges and inversely proportional to the square of the distance between them. Therefore,

$$F \propto q_1 q_2 \dots\dots\dots (i)$$

$$F \propto \frac{1}{r^2} \dots\dots\dots (ii)$$

Combining Eqs. (i) and (ii), we get

$$F = k \frac{q_1 q_2}{r^2} \dots\dots\dots (iii)$$

Eq (iii) is known as coulomb's Law.

22. Two bodies oppositely charged with 500 μ C and 100 μ C. Find the force of attraction between two charges. if the distance between them in air is 0.5m.

(MTN-GI-14)

Ans. $q_1 = 500_\mu \text{ C} = 500 \times 10^{-6} \text{ C}$

$$q_2 = 100_\mu \text{ C} = 100 \times 10^{-6} \text{ C}$$

$$r = 0.5_\text{m}$$

$$k = 9 \times 10^9 \text{ Nm}^2 \text{ C}^{-2}$$

Using the formula:

$$F = k \frac{q_1 q_2}{r^2}$$

Put the values:

$$F = 9 \times 10^9 \text{ Nm}^2 \text{ C}^{-2} \times$$

$$\frac{500 \times 10^{-6} \text{ C} \times 100 \times 10^{-6} \text{ C}}{(0.5\text{m})^2}$$

$$= 1800\text{N} \quad \text{Ans.}$$

23. Three capacitors with capacitors of $3\mu\text{F}$, $4\mu\text{F}$ and $5\mu\text{F}$ are arranged in parallel combination to a battery of 6V . Find total capacitance.

(MTN-GI-14)(BWP-GII-17)(FBD-GI-14)

Ans. Total capacitance is given by

$$C_{eq} = C_1 + C_2 + C_3$$

$$C_{eq} = 3.0 \times 10^{-6}\text{F} + 4.0 \times 10^{-6}\text{F} + 5.0 \times 10^{-6}\text{F}$$

$$C_{eq} = (3 + 4 + 5) \times 10^{-6}\text{F} = 12 \times 10^{-6}\text{F}$$

$$C_{eq} = 12\mu\text{F}$$

24. What do you mean by variable capacitors? Give one use. (MTN-GII-16)

Ans. **Variable:** In variable type of capacitors some arrangement is made to charge the area of the plates facing each other. It is generally a combination of many capacitors with air as dielectric. It consists of two sets of plates one set remain fixed while. The other set can rotate.

Uses: Variable capacitors are usually utilize or turning in radio sets.

25. Define mica capacitors and paper capacitors. (MTN-GI-14)

Ans. **Mica Capacitors:** is a example of fixed capacitors. In there capacitors, a thin mica sheet is used as dielectric between the two metals plates.

Paper Capacitors: is a example of fixed capacitors. The paper capacitors has a cylindrical shape. Usually an oiled or greased paper or a thin plastic sheet is used as a dielectric between two aluminium foil.

26. Describe two properties of Electric lines of Force. (MTN-GII-17)

Ans. • Field lines are always diverted from positive charge towards negative charge.
• The spacing between the filed lines shows the strength of electric field.

27. In which form a capacitor stores energy? (BWP-GII-16)

Ans. Capacitor stored energy in an electric field between two plates in the form of electrostatic potential energy.

28. What is the unit of capacitance? Define it. (BWP-GII-17,18)

Ans. **Farad:**

SI unit of capacitance is farad(F), defined as:

If one coulomb of charge given to the plates of a capacitor produced a potential difference of one volt between the plates of the capacitor then its capacitance would be one farad.

29. What is variable capacitor? (BWP-GI-18)

Ans. **Variable:** In variable type of capacitors some arrangement is made to charge the area of the plates facing each other.

Uses: Variable capacitors are usually utilize or turning in radio sets.

30. Electric intensity is a vector quantity why? (FBD-GII-14)

Ans. Electric intensity being a force is a vector quantity. Its direction is the same as that of the force acting on the positive test charge. If the test charge is free to move, it will always move in the direction of electric intensity.

31. What do you know about Electrolyte capacitors? (FBD-GII-14)

Ans. An electrolytic capacitor is often used to store large amount of charge at relatively low voltages. It consists of a metal foil in contact with an electrolyte-a solution that conducts charge by virtue of the motion of the ions contained in it. When a voltage is applied between the foil and the electrolyte, a thin layer of metal oxide (an insulator) is formed on the foil, and this layer serves as the dielectric. Very large capacitance can be attained because the dielectric layer is very thin.

32. Write the characteristics of charges.

(FBD-GI-16)(RWP-GI-16)

Ans. Characteristics:

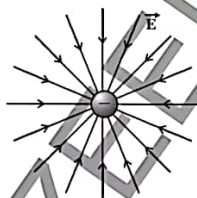
- Charge is a basic property of a material body due to which it attracts or repels another objects.
- Friction produces two different types of charges on different material.
- Like charges always repel each other.
- Unlike charges always attract each other.
- Repulsion is the sure test of charge on a body.

33. Define fixed capacitor also give an example. (FBD-GI-17, GII-19)(MTN-GI-19)**Ans. Types of capacitors:**

Fixed capacitor: In fixers area of plates can't be changed. In general, oil greance paper or plastic sheet is putted between aluminum foil is used as dielectric. It is packed in cylindrical shaped strong coding. Mica capacitor is a example of fixed capacitor.

34. Draw the electric field lines of a negative charge. (RWP-GII-16)

Ans. Due to negative charge the direction of electric field lines always into the papers.



Electric field lines for an isolated negative point charge.

35. Define Electric potential and give its mathematical equation. (RWP-GI-15,16)

Ans. Electric potential at a point in an electric field is equal to the amount of work done

in bringing a unit positive charge from infinity to that point.

If W is the work done in moving a positive charge q from infinity to a certain point in the field, the electric potential V at this point would be given by

$$V = \frac{W}{q} \dots\dots\dots (13.6)$$

36. Three capacitors with capacitors of $3\mu\text{F}$, $4\mu\text{F}$ and $5\mu\text{F}$ are arranged series combination to a battery of 6V. Find total capacitance of series combination.

(LHR-GI-19)(RWP-GI-14,16)

Ans. $\frac{1}{C_{eq}} = \frac{1}{C_1} + \frac{1}{C_2} + \frac{1}{C_3}$

$$\frac{1}{C_{eq}} = \frac{1}{3.0 \times 10^{-6} \text{ F}} + \frac{1}{4.0 \times 10^{-6} \text{ F}} + \frac{1}{5.0 \times 10^{-6} \text{ F}}$$

$$\frac{1}{C_{eq}} = \left[\frac{1}{3} + \frac{1}{4} + \frac{1}{5} \right] \times \frac{1}{10^{-6} \text{ F}}$$

$$\frac{1}{C_{eq}} = \frac{47}{60} \times \frac{1}{10^{-6} \text{ F}}$$

$$C_{eq} = 1.3\mu\text{F}$$

37. Write any two uses of capacitors?

(RWP-GII-14,16)

Ans. (i) They are used for table fans, exhaust fans, fan motors in air conditioners, coolers, motors washing machines, air conditioners and many other appliances for their smooth working.

(ii) Capacitors are also used in electronic circuits of computers etc.

38. In which direction will positively charged particle move in an electric field. (RWP-GI-17)

Ans. In field lines are always directed from positive charge toward negative charge.

39. Define electric field line who introduced them? (RWP-GII-17)

Ans. Electric field line were introduced by Michele Faraday.

The direction of electric field intensity is an electric field can also be represented by drawing line. These line are known as electric line of force. The field line are imaginary lines around a field charge with an arrow head indicating the direction of force.

40. How charge is produced? give an example. (SGD-GII-16)

Ans. A charge can be produced by rubbing one natural body to Electrostatic induction.

Example: Take a plastic rod. Rub it with fur and suspend it horizontally by a silk thread. Now take another plastic rod and rub it with fur and bring near to the suspended rod. We will observe that both the rods will repel each other. It means during the rubbing both the rods were charged.

41. What is the numerical value of 'k' in coulomb's law? (SGD-GII-14)(SWL-GII-14)

Ans. The value of k in SI units will be $9 \times 10^9 \text{ Nm}^2 \text{ C}^{-2}$.

42. In what direction will the positive charge move in an electric field? (SGD-GII-14)

Ans. "If the test charge is free to move, it will always move in the direction of electric intensity."

43. Electric intensity is a vector quantity why? (SGD-GI-16)

Ans. Electric intensity being a force is a vector quantity. Its direction is the same as that of the force acting on the positive test charge. If the test charge is free to move, it will always move in the direction of electric intensity.

44. Describe the construction of capacitor. (SGD-GII-16)

Ans. In order to store the charge, a device which is called capacitor is used. It consists of two thin metal plates, parallel to each other separated by a very small distance.

45. Define capacitor.

(SGD-GI-16)(DGK-GII-16)

Ans. Capacitors: A device used for storing electric charge is called a capacitor.

46. Why Electric bulb and Electric heater are not connected in series?

(SGD-GI-16)

Ans. It is impracticable to connect an electric bulb and an electric heater in series because it will divide the voltage.

47. Give two examples of fixed capacitors. (SGD-GII-14)

Ans. Example of Fixed capacitors:

(i) Paper Capacitors (ii) Mica capacitors

48. What is used as dielectric in paper capacitors? (SGD-GII-15)

Ans. Usually, an oiled or greased or as thin plastic sheet is used as a dielectric between two aluminum foils in paper capacitors.

49. Three capacitors C_1 , C_2 and C_3 combined parallel, Draw the diagram. (SGD-GI-17)

Ans.

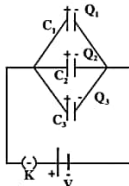


Fig. Capacitors in parallel combination.

50. Write the equation of coulomb's law and what is the value of constant in it?

(SGD-GI-14)

Ans. equation of coulomb's Law

$$F = K \frac{q_1 q_2}{r^2}$$

The value of k is.

$$K = 9 \times 10^9 \text{ Nm}^2 \text{ C}^{-2}$$

51. Define Electric field of charge.

(SGD-GI-14)

Ans. The electric field is a region around a charge in which it exerts electrostatic force on another charges.

52. Describe any two characteristics of series combination of capacitors.

(SGD-GI-15)

- Ans. (i) The potential difference across each capacitor is difference due to different values of capacitance.
(ii) The voltage of the battery has been divided among the various capacitors.
Hence

$$\begin{aligned} V &= V_1 + V_2 + V_3 \\ &= \frac{Q}{C_1} + \frac{Q}{C_2} + \frac{Q}{C_3} \\ &= Q \left[\frac{1}{C_1} + \frac{1}{C_2} + \frac{1}{C_3} \right] \\ \frac{V}{Q} &= \left[\frac{1}{C_1} + \frac{1}{C_2} + \frac{1}{C_3} \right] \end{aligned}$$

53. Write the name of any two application of electrostatics.

(SGD-GII-17)

- Ans. (i) Electrostatic air cleaner.
(ii) Electrostatic power pouting.

54. Describe the construction of electroscope.

(LHR-GI-19)

- Ans. The rod passes through an insulator that keeps the rod in place, the whole assembly is fitted in a glass jar. Charges can move freely from the disk to the leaves through the rod. A thin aluminium foil is attached on the lower portion of the inside of the jar. Usually, the aluminum foil is grounded by connecting a copper wire. This protects the leaves from the external electrical disturbances.

55. Define the SI unit of capacitance of capacitor.

(LHR-GI-19)

- Ans. SI unit of capacitance is farad(F), defined as:

If one coulomb of charge given to the plates of a capacitor produced a potential difference of one volt between the plates of the capacitor then its capacitance would be one farad.

56. Write any two characteristics of parallel combination of capacitors. Characteristics of parallel combination.

(FBD-GI-19)

- Ans. Each capacitor connected to a battery of voltage V has the same potential difference V across it i.e.

$$V_1 = V_2 = V_3 = V$$

57. Write difference between: Electric field and Electric field intensity. (DGK-GII-19)

- Ans. **Electric field:** The electric field is a region around a charge in which it exerts electrostatic force on another charges.

Electric field intensity: The strength of an electric field at any point in space is known as electric field intensity.

58. Describe the structure of paper capacitor.

(BWP-GII-19)

- Ans. Structure of paper capacitor. The paper capacitor has a cylindrical shape. Usually, an oiled or greased paper or a thin plastic. Sheet is used as a electric. Sheet is firmly rolled in the form of cylinder and is then enclosed into a plastic case.

59. What is meant by capacitance of capacitor? Define unit of capacitance.

(DGK-GI-19)

- Ans. The ability of the capacitor to store charge is called. The capacitance of capacitor, SI unit of capacitance is farad (F) defined as. If one coulomb of charge given to the plates of a capacitor produces a potential difference of one volt between the plates of the capacitor then its capacitance is one farad.

SECTION III**LONG QUESTIONS****FROM PUNJAB BOARDS****(2014, 15, 16, 17, 18 & 19)**

- Three capacitors with capacitances of $3\mu\text{F}$, $4\mu\text{F}$ and $5\mu\text{F}$ are arranged in series combination to a battery of 6V. Find the total capacitance of the series combination. **LHR(GI-16), DGK(GI-19) BWP(GI-19)**
- Write a note on Coulomb's law. **LHR(GI-II-15)**
- A capacitor holds 0.03 Coulombs of charge when fully charged by a 6 volt battery. How much voltage would be required for it to hold 2 Coulombs of a charge? **LHR(GI-17), BWP(GI-19)**
- Two capacitors of capacitances $12\mu\text{F}$ and $6\mu\text{F}$ are connected in parallel with a 12V battery. Find the equivalent capacitance of the combination. Find the charge and the potential difference across each capacitor. **LHR(GI-17)**
- Explain Coulomb's Law. **LHR(GI-16)**
- Two point charges $Q_1 = 10\mu\text{C}$ and $q_2 = 2\mu\text{C}$ are placed at a distance of 150cm. What will be the coulomb's force between them? Also find the direction of the force. **GUJ(GI-14), RWP(GI-19), LHR(GI-19)**
- Two charge repel each other with a force of 0.1N. When they are 5 cm apart. Find the forces between the same charges when they are 2 cm apart. **GUJ(GI-15)**
- Drive the formula for the effective capacitance for a series combination of a number of capacitor. **GUJ(GI-15)**
- Discuss the main features of parallel combination of resistors. **GUJ(GI-16)**
- The capacitance of a parallel plate capacitor is $100\mu\text{F}$. If the potential difference between its plates is 50V, Find the quantity of charge that capacitor can store. What will be the charge on each plate? **GUJ(GI-16), MTN(GI-19)**
- Discuss the main features of parallel combination of resistors. **GUJ(GI-18)**
- A capacitor holds 0.03 C of charge when fully charged by a 6 V battery. Now much voltage would be regulated for it hold 2C of charge. **MTN(GI-15)**
- A point charge of + 2C is transferred from a point at potential 100 V to a point potential 50 V. What would be the energy supplied by the charge. **MTN(GI-17), GUJ(GI-17, 19)**
- Two bodies are oppositely charged with 500 μC and 100 μC . **MTN(GI-17)**
- Explain Coulomb's law of electrostatics. Also write its mathematical form. **MTN(GI-18)**
- Define and explain "Coulomb's Law". **BWP(GI-14)**
- The force of repulsion between two identical positive charges is 0.8 N. When the charges are 0.1m apart. Find the value of each charge. **BWP(GI-14), DGK(GI-19), SGD(GI-19), SWL(GI-19)**
- The capacitance of a parallel plate capacitor is $100\mu\text{F}$. If the potential difference between its plates is 50V, find the quantity of charge that capacitor can store. What will be the charge on each plate? **BWP(GI-16)**
- Explain parallel combination of capacitor. **BWP(GI-16)**
- Write a note on Coulomb's law. **BWP(GI-15)**
- Describe the application of electrostatics. **BWP(GI-15)**
- Two capacitor of Capacitance $6\mu\text{F}$ and $12\mu\text{F}$ are connected in series with 12V battery. Find the equivalent capacitance of the combination. Find the charge and the potential difference across each capacitor. **BWP(GI-17)**
- A point charge of +2c transferred from a point at potential 100v to a point at potential 50v. What would be the energy supplied by the charge? **FBD(GI-16)**
- A capacitor holds 0.6 Coulombs of a charge when fully charged by 9v battery. Calculate the capacitance of capacitor. **FBD(GI-16)**
- Write a note on Coulomb's law. **FBD(GI-15)**
- Drive the formula for the effective capacitance for a series combination of a number of capacitor. **FBD(GI-15)**
- A capacitor holds 0.06C of charge whom fully charged by a 9 Volt battery. Calculate capacitance of capacitor. **FBD(GI-16)**
- Discuss the main features of parallel combination of resistors. **FBD(GI-18)**
- Define capacitance. State its units and derived the equation of capacitance. **FBD(GI-14)**

30. Describe the method of combining the capacitors. **FBD(GII-14)**
31. A point charge of +2C is transferred from a point at potential 100V to a point at potential 50V, what will be the energy supplied by the charge? **FBD(GI-16)**
32. If a current of 0.5A passes through a bulb connected across a battery of 6 Volt for 20 seconds, then find the rate of energy transferred to the bulb. **FBD(GII-16)**
33. Write a note on Coulomb's law. **FBD(GII-15)**
34. A capacitor holds 0.6 Coulombs of a charge when fully charged by 9v battery. Calculate the capacitance of capacitor. **FBD(GI-17)**
35. The charge of how many negatively charged particles would be equal to 100 μ C Assume charge on one negative particle is 1.6×10^{-19} C? **FBD(GII-17), LHR(GII-19)**
MTN(GII-19)
36. Write a note on parallel combination of resistors. **FBD(GI-18)**
37. Find equivalent resistance of a parallel circuit of resistances. **FBD(GII-18)**
38. Two bodies are oppositely charged with 500 μ C and 100 μ C charge find the force between the two charge if the distance between them in air is 0.5m. **SGD(GI-15, GII-16), FBD(GII-19)**
39. A capacitor holds 0.06C of charge whom fully charged by a 9 Volt battery. Calculate capacitance of capacitor. **SGD(GII-15)**
40. Two point charges $Q_1 = 10\mu$ C and $q_2 = 2\mu$ C are placed at a distance of 150cm. What will be the coulomb's force between them. **SGD(GI-17)**
41. Two bodies are oppositely charged with 500 μ C and 100 μ C charge. Find the force between the two charges of the distance between them in air is 0.5m. **DGK(GI-16)**
42. Two bodies are oppositely charged with 500 μ C and 100 μ C charge. Find the force between the two charges if the distance between them in air is 0.5m. **DGK(GII-16)**
43. Explain relation between electric field and electric intensity. **DGK(GII-15)**
44. Drive the formula for the effective capacitance for a series combination of a number of capacitor. **DGK(GI-15)**

45. Describe the parallel combination of capacitors. Also explain three characteristics of this combination. **DGK(GI-18)**
46. How would you define potential difference between two points? Define its unit. **DGK(GII-18)**
47. Define and explain "Coulomb's Law". **SWL(GII-14)**
48. Define different type of capacitors. **SWL(GII-15)**
49. Two capacitors of capacitances 12 μ F and 6 μ F are connected in series with 12V battery. Find the equivalent capacitance of this combination. **SWL(GI-16)**
50. The force of repulsion between two positive charges is 0.8N. When the charges are 0.1m apart. Find the value of each charge. **SWL(GII-16)**
51. If 0.5C charge passes through a wire in 10s, then what will be the value of current flowing through the wire? **RWP(GII-19)**

SECTION IV

SOLVED NUMERICALS

PCTB EXAMPLES

Examples 13.1: Two bodies are oppositely charged with 500 μ C and 100 μ C charge. Find the force between the two charges if the distance between them in air is 0.5m.

Solution: Given that, $r = 0.5$ m, $q_1 = 500\mu$ C
 $= 500 \times 10^{-6}$ C, $q_2 = 100\mu$ C $= 100 \times 10^{-6}$ C
 Substituting these values in Eq. we have

$$F = k \frac{q_1 q_2}{r^2}$$

$$= \frac{9 \times 10^9 \text{ N m}^2 \text{ C}^{-2} \times 500 \times 10^{-6} \text{ C} \times 100 \times 10^{-6} \text{ C}}{(0.5 \text{ m})^2}$$

$$F = 1800 \text{ N}$$

Examples 13.2: The capacitance of a parallel plate capacitor is 100 μ F. If the potential difference between its plates is 50 volts, find the quantity of charge stored on each plate.

Solution: Given that; $V = 50$ V, $C = 100\mu$ F
 $= 100 \times 10^{-6}$ F Using the formula
 $Q = CV$

Putting the values

$$Q = 100 \times 10^{-6} \text{ F} \times 50 \text{ V} \\ = 5 \times 10^{-3} \text{ C} = 5 \text{ mC}$$

Charge on each plate will be 5 mC, because each plate has equal amount of charge.

Examples 13.3: Three capacitors with capacitances of 3.0 μF , 4.0 μF , and 5.0 μF are arranged in parallel combination with a battery of 6V, where 1 $\mu\text{F} = 10^{-6}$ F. Find

- the total capacitance
- the voltage across each capacitor
- the quantity of charge on each plate of the capacitor

Solution: Diagram is shown on right.

- Total capacitance is given by
 $C_{eq} = C_1 + C_2 + C_3$
 $C_{eq} = 3.0 \times 10^{-6} \text{ F} + 4.0 \times 10^{-6} \text{ F} + 5.0 \times 10^{-6} \text{ F}$
 $C_{eq} = 2 \times 10^{-6} \text{ F}$
 $C_{eq} = (3+4+5) \times 10^{-6} \text{ F} = 12 \times 10^{-6} \text{ F}$
 $C_{eq} = 12 \mu\text{F}$
- As three capacitors are connected in parallel, the voltage across each capacitor will be same and is equal to the voltage of the battery i.e., 6V.
- Charge on a capacitor with capacitance, C_1
 $Q_1 = C_1 V$
 $Q_1 = 3.0 \times 10^{-6} \text{ F} \times 6 \text{ V} = (3 \times 6) \times 10^{-6} \text{ FV}$
 $Q_1 = 18 \mu\text{C}$

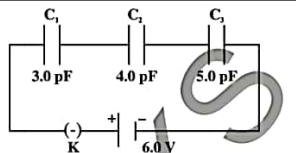
Similarly, charge on capacitors with capacitances C_2 and C_3 is 24 μC and 30 μC respectively.

Examples 13.4: Three capacitors with capacitances of 3.0 μF , 4.0 μF , and 5.0 μF are arranged in series combination to a battery of 6V, where 1 $\mu\text{F} = 10^{-6}$ F. Find

- the total capacitance of the series combination.
- the quantity of charge across each capacitor.
- the voltage across each capacitor.

Solution: (a) diagram is shown on right. For total capacitance,

$$\frac{1}{C_{eq}} = \frac{1}{C_1} + \frac{1}{C_2} + \frac{1}{C_3}$$



$$\frac{1}{C_{eq}} = \frac{1}{3.0 \times 10^{-6} \text{ F}} + \frac{1}{4.0 \times 10^{-6} \text{ F}} + \frac{1}{5.0 \times 10^{-6} \text{ F}}$$

$$\frac{1}{C_{eq}} = \left[\frac{1}{3} + \frac{1}{4} + \frac{1}{5} \right] \times \frac{1}{10^{-6} \text{ F}}$$

$$\frac{1}{C_{eq}} = \frac{47}{60} \times \frac{1}{10^{-6} \text{ F}}$$

$$C_{eq} = 1.3 \mu\text{F}$$

- In series combination, charge across each capacitor is same and can be found as:

$$Q = CV = (6.0 \text{ V})(1.3 \times 10^{-6} \text{ F}) = 7.8 \mu\text{C}$$

- Voltage across capacitor

$$C_1 = V_1 = \frac{Q}{C_1} = \frac{7.8 \times 10^{-6} \text{ C}}{3.0 \times 10^{-6} \text{ F}} = 2.6 \text{ V}$$

Voltage across capacitor

$$C_2 = V_2 = \frac{Q}{C_2} = \frac{7.8 \times 10^{-6} \text{ C}}{4.0 \times 10^{-6} \text{ F}} = 1.95 \text{ V}$$

Voltage across capacitor

$$C_3 = V_3 = \frac{Q}{C_3} = \frac{7.8 \times 10^{-6} \text{ C}}{5.0 \times 10^{-6} \text{ F}} = 1.56 \text{ V}$$

PCTB NUMERICAL PROBLEMS

13.1: The charge of how many negatively charged particles would be equal to 100 uC. Assume charge on one negative particle is 1.6×10^{-19} C ?

Ans. Charge on one negative particle = $e = 1.6 \times 10^{-19}$ C.

Total charge on n charged particle = $q = 100 \mu\text{C}$.

No of negative charge particle = $n = ?$

we know

$$n = \frac{q}{e}$$

putting the value

$$n = \frac{100 \times 10^{-6}}{1.6 \times 10^{-19}}$$

$$n = \frac{100}{1.6} \times 10^{-6+19}$$

$$n = 62.5 \times 10^{13}$$

$$= 625 \times 10^{14}$$

13.2: Two point charges $q_1 = 10 \mu\text{C}$ and $q_2 = 5 \mu\text{C}$ are placed at a distance of 150 cm. What will be the Coulomb's force between them? Also find the direction of the force.

Ans. Charge on one point charge

$$= q_1 = 10 \mu\text{C} = 10 \times 10^{-6} \text{C}$$

Charge on 2nd point charge

$$= q_2 = 5 \mu\text{C} = 5 \times 10^{-6} \text{C}.$$

Charge are placed at a distance $r = 1.5 \text{cm} =$

(i) Coulomb's force = $F = ?$

(ii) Direction of force = ?

(i) Coulomb's force

we know

$$F = k \frac{q_1 q_2}{r^2} \quad \text{--- (i)}$$

$$k = \frac{1}{4\pi\epsilon_0} = 9 \times 10^9 \text{ Nm}^2 \text{C}^{-2}$$

$$F = k \frac{q_1 q_2}{r^2}$$

putting the value

$$F =$$

$$F = \frac{9 \times 10^9 (10 \times 10^{-6}) (5 \times 10^{-6})}{(1.5)^2}$$

$$F = \frac{9 \times 10^9 \times 10^{-5} \times 5 \times 10^{-6}}{2.25}$$

$$F = \frac{45 \times 10^{9-5-6}}{2.25}$$

$$F = \frac{45 \times 10^{-2}}{2.25}$$

$$F = 0.2 \text{ N}$$

(ii) The direction is repulsion.

13.3: The force of repulsion between two identical positive charges is 0.8 N, when the charges are 0.1 m apart. Find the value of each charge.

FBD(GI-19)

Ans. The force of repulsion = $F = 0.8 \text{N}$.

Distance among the charge = $r = 0.1 \text{m}$

Charge are identical = $q_1 = q_2 = q$

value of each charge = $q = ?$

we know

$$F = k \frac{q_1 q_2}{r^2}$$

Charges are identical

$$q_1 = q_2 = q$$

$$F = k \frac{q \cdot q}{r^2}$$

$$F = k \frac{q^2}{r^2}$$

$$q^2 = \frac{Fr^2}{k}$$

putting the value

$$q^2 = \frac{0.8 \times (0.1)^2}{9 \times 10^9}$$

$$q^2 = .888 \times 10^{-12}$$

$$\sqrt{q^2} = \sqrt{.888 \times 10^{-12}}$$

Talking square both side

$$q = .942 \times 10^{-6}$$

$$q = 9.42 \times 10^{-7} \text{ C Ans.}$$

13.4: Two charges repel each other with a force of 0.1 N when they are 5 cm apart. Find the forces between the same charges when they are 2cm apart.

Ans. Force of repulsion = $F_1 = 0.1 \text{ N}$.

Distance among two charge

$$= r_1 = 5\text{cm} = 0 \times 05\text{m}$$

we know

$$F = k \frac{q_1 q_2}{r^2}$$

Charges are identical =

$$q_1 = q_2 = q$$

$$F = k \frac{q \cdot q}{r^2}$$

$$F = k \frac{q^2}{r^2}$$

when distance is 5cm

$$F_1 = 0.1\text{M.}$$

$$F_2 = \frac{kq^2}{r_1^2} \text{ (i)}$$

when distance is 2cm = 0.02m = $F_2 = ?$

$$F_2 = \frac{kq^2}{(0.02)^2} \text{ (ii)}$$

Divided eq (i) by (ii)

$$\frac{F_2}{0.1} = \frac{(0.05)^2}{(0.02)^2} = \frac{25}{4}$$

$$F_2 = \frac{25}{4} \times 0.1$$

$$F_2 = 0.62 \text{ N} \quad \text{Ans.}$$

13.5: The electric potential at a point in an electric field is 10^4 V . If a charge of $+100 \mu\text{C}$ is brought from infinity to this point. What would be the amount of work done on it? SGD(GH-19)

Ans. Electric Potential at point = $V = 10^4 \text{ V}$

Value of point charge = $q = 100 \mu\text{C}$

$$= 100 \times 10^{-6} \text{ C} \quad (1 \mu\text{C} = 10^{-6} \text{ C})$$

Amount of work done = $W = ?$

we know

$$V = \frac{W}{q}$$

$$W = V \times q$$

putting the value

$$W = 10^4 \times 100 \times 10^{-6}$$

$$W = 100 \times 10^{-2}$$

$$W = 1\text{J} \quad \text{Ans.}$$

13.6: A point charge of $+2 \text{ C}$ is transferred from a point at potential 100 V to a point at potential 50 V . What would be the energy supplied by the charge?

Ans. Value of point charge = $q = 2 \text{ C}$

potential of a point = $V_A = 100 \text{ v}$

potential of B point = $V_B = 50\text{v}$

Energy supplied to charge = $E = ?$

we know

$$E = q (V_A - V_B)$$

putting the value

$$E = 2(100 - 50)$$

$$E = 2 (50)$$

$$E = 100\text{J}$$

13.7: A capacitor holds 0.06 coulombs of charge when fully charged by a 9-volt battery. Calculate capacitance of the capacitor.

Ans. Charge hold by capacitor = $q = 0.06\text{C}$

Voltage of battery $V = 9\text{v}$

Capacitance of capacitor = $C = ?$

we know

$$Q = CV$$

$$C = \frac{q}{v}$$

putting the value

$$C = \frac{0.06}{9}$$

$$C = 6.67 \times 10^{-3} \text{ F}$$

13.8: A capacitor holds 0.03 coulombs of charge when fully charged by a 6 volt battery. How much voltage would be required for it to hold 2 coulombs of charge?

Ans. Charge hold by capacitor = $q_1 = 0.03C$
 Voltage of battery = $v_1 = 6$ volt
 How much voltage is required = $V_2 =$
 Charges $q_2 = 2C$
 we know

$$q = CV \quad \text{For one}$$

$$C = \frac{q_1}{v_1} \quad \text{--- (i)}$$

$$C = \frac{q_2}{v_2} \quad \text{--- (ii)}$$

by (i) and (ii)

$$\frac{q_1}{v_1} = \frac{q_2}{v_2}$$

$$v_2 = \frac{q_2}{q_1} \times v_1$$

$$v_2 = \frac{2 \times 6}{0.03}$$

$$v_2 = \frac{12}{0.03}$$

$$\boxed{v_2 = 400v}$$

13.9: Two capacitors of capacitances 6 μF and 12 μF are connected in series with 12 V battery. Find the equivalent capacitance of the combination. Find the charge and the potential difference across each capacitor. SWL(GH-19)

Ans. Capacitance of first capacitor = $C_1 = 6\mu F$
 $= 6 \times 10^{-6} F$

Capacitance of 2nd capacitor $C_2 = 12\mu F$
 $= 12 \times 10^{-6} F$

Voltage of battery = $V_2 = 12v$.

(i) Equivalent capacitance = $C_e = ?$

(ii) Charge of Capacitor = $Q = ?$

(iii) Potential difference across each capacitor
 $V_1 = V_2 = ?$

we know

$$(i) \quad \frac{1}{C_1} + \frac{1}{C_2} = \frac{1}{C_e}$$

$$(ii) \quad V = V_1 + V_2$$

$$(iii) \quad V = Q \left(\frac{1}{C_1} + \frac{1}{C_2} \right)$$

(i) Equivalent capacitance = $C_e = ?$

In series combination
 equivalent capacitance

$$\frac{1}{C_e} = \frac{1}{C_1} + \frac{1}{C_2}$$

putting the value

$$\frac{1}{C_e} = \frac{1}{6 \times 10^{-6}} + \frac{1}{12 \times 10^{-6}}$$

$$\frac{1}{C_e} = \frac{1}{10^{-6}} \left[\frac{1}{6} + \frac{1}{12} \right]$$

$$\frac{1}{C_e} = \frac{1}{10^{-6}} \left[\frac{2+1}{12} \right]$$

$$\frac{1}{C_e} = \frac{1}{10^{-6}} \left(\frac{3}{12} \right)$$

$$\frac{1}{C_e} = \frac{1}{10^{-6}} \left(\frac{1}{4} \right)$$

$$C_e = 4 \times 10^{-6}$$

$$C_e = 4\mu F$$

(ii) Combination of capacitor.

$$V = Q \left(\frac{1}{C_1} + \frac{1}{C_2} \right)$$

$$Q = \frac{V}{\left(\frac{1}{C_1} + \frac{1}{C_2} \right)}$$

putting the value

$$Q = \frac{12}{\frac{1}{6 \times 10^{-6}} + \frac{1}{12 \times 10^{-6}}}$$

$$Q = \frac{12}{\frac{1}{4 \times 10^{-6}}}$$

$$Q = 12 \times 4 \times 10^{-6}$$

$$Q = 48 \times 10^{-6}$$

$$Q = 48 \mu C$$

(iii) Potential difference

$$V_1 = ? , V_2 = ?$$

$$Q = CV$$

$$Q_1 = C_1 V_1$$

putting the value

$$Q = Q_1$$

$$48 = 64 \times V_1$$

$$\frac{48}{64} = V_1$$

$$V_1 = 8V$$

$$Q_2 = C_2 V_2$$

$$Q = Q_2 V_2$$

putting the value

$$Q = C_2 V_2$$

$$48 = 12 \times V_2$$

$$V_2 = \frac{48}{12}$$

$$V_2 = 4V$$

13.10: Two capacitors of capacitances 6 μF and 12 μF are connected in parallel with a 12 V battery. Find the equivalent capacitance of the combination. Find the charge and the potential difference across each capacitor.

Capacitance of first capacitor =

$$C_1 = 6 \mu\text{F} = 6 \times 10^{-6} \text{ F}$$

Capacitance of 2nd capacitor $= C_2 = 12 \mu\text{F}$

$$= 12 \times 10^{-6} \text{ F}$$

Voltage of battery = $V = 12 \text{ V}$

- Equivalent capacitance $= C_e = C_c = ?$
- Charge across each capacitor $= Q_1 = Q_2 = ?$
- Potential difference of capacitor 1 $= V_1 = ?$
- Potential difference of capacitor 2 $= V_2 = ?$

Sol: (i) Equivalent capacitance $= C_e = ?$

we know

$$C_e = C_1 + C_2$$

putting the value

$$C_e = 6 \times 10^{-6} + 12 \times 10^{-6}$$

$$C_e = 10^{-6} [6 + 12]$$

$$C_e = 18 \times \mu$$

$$C_e = 18 \mu\text{F}$$

Sol: (ii) Charge across each capacitor = ?

we know

$$Q = CV$$

For first Capacitor

$$Q_1 = C_1 V_1$$

$$V_1 = v$$

$$Q_1 = C_1 V$$

putting the value

$$Q_1 = 10^{-6} \times 12$$

$$Q_1 = 12 \mu\text{F}$$

Similarly

for 2nd capacitors

$$Q_2 = C_2 V$$

putting the value

$$Q_2 = 12 \times 10^{-6} \times 12$$

$$= 144 \mu\text{C}$$

(iii) Potential difference of capacitor = ?

we know

$$\frac{Q}{V} = C_1 + C_2$$

putting the value

$$\frac{Q_1}{V_1} = C_1 + C_2$$

$$\frac{Q_1}{V_1} = 6 + 2$$

$$\frac{72}{V_1} = 18$$

$$V_1 = \frac{72}{18}$$

(iv) Potential difference of capacitor = 2

$$\frac{Q_1}{V_2} = C_1 + C_2$$

$$\frac{144}{V_2} = 6 + 12$$

$$\frac{144}{V_2} = 18$$

$$V_2 = \frac{144}{18}$$

$$V_2 = 8V$$

$$\text{Total voltage} = V_1 + V_2 = 4V + 8V$$

$$\text{Total voltage} = V_1 12$$

◆◆◆

SECTION I**MULTIPLE CHOICE QUESTIONS****CHAPTER 14****CURRENT ELECTRICITY****PCTB EXERCISE**

- ♦ Choose the correct answer from the following choices:
- An electric current in conductors is due to the flow of
 - positive ions
 - negative ions
 - positive charges
 - ☒ free electrons
 - What is the voltage across a $6\ \Omega$ resistor when 3 A of current passes through it?
 - 2 V
 - 9 V
 - ☒ 18 V
 - 36 V
 - What happens to the intensity or the brightness of the lamps connected in series as more and more lamps are added?
 - increases
 - ☒ decreases
 - remains the same
 - cannot be predicted
 - Why should household appliances be connected in parallel with the voltage source?
 - to increase the resistance of the circuit
 - to decrease the resistance of the circuit
 - ☒ to provide each appliance the same voltage as the power source
 - to provide each appliance the same current as the power source
 - Electric potential and e.m.f
 - ☒ are the same terms
 - are the different terms
 - have different units
 - both (b) and (c)
 - When we double the voltage in a simple electric circuit, we double the
 - ☒ current
 - power
 - resistance
 - both (a) and (b)

vii. If we double both the current and the voltage in a circuit while keeping its resistance constant, the power

- remains unchanged
- halves
- ☒ doubles
- quadruples

viii. What is the power rating of a lamp connected to a 12 V source when it carries 2.5 A?

- 4.8 W
- 14.5 W
- ☒ 30 W
- 60 W

ix. The combined resistance of two identical resistors, connected in series is $8\ \Omega$. Their combined resistance in a parallel arrangement will be

- ☒ $2\ \Omega$
- $4\ \Omega$
- $8\ \Omega$
- $12\ \Omega$

FROM PUNJAB BOARDS**(2014, 15, 16, 17, 18 & 19)**

- The electric power of washing machine is: (LHR-GI-14)(GUJ-GII-15)(MTN-GII-14,15)
 - 50
 - ☒ 750
 - 100
 - 800
- What is the power rating of a lamp connected to a 12v source when it carries a current of 2.5A: (LHR-GII-14)(MTN-GII-15)(BWP-GII-17)(SGD-GII-18)(FBD-GII-16, GI-18)(DGK-GI-18)(SWL-GII-14, GI-16,17,18)
 - 4.8w
 - 14.5w
 - ☒ 30w
 - 60w
- Formula of e.m.f is equal to: (LHR-GI-15, GI-17)(MTN-GI-14)
 - $E \equiv \frac{J}{Q}$
 - $F = \frac{W}{I}$
 - ☒ $E = \frac{W}{Q}$
 - $E = \frac{Q}{I}$
- Unit of resistance is: (LHR-GII-15)(GUJ-GI-18)(FBD-GII-18)(SGD-GII-19)(DGK-GII-18)(RWP-GII-14)
 - Ampere
 - volt
 - ☒ Ohm
 - Farad
- Mathematical form of current is: (LHR-GI-16)(GUJ-GII-16)
 - $I = \frac{1}{Q}$
 - ☒ $I = \frac{Q}{t}$
 - $I = \frac{f}{q}$
 - $I \equiv VR$

6. What happens to the intensity or the brightness of lamps connected in series as more and more lamps are added:
(LHR-GI-15)(FBD-GI-16, 19)(DGK-GI-15, GII-16)
(a) increase (b) decrease
(c) remain the same (d) cannot be predicted
7. In C.R.O the potential of grid is:
(LHR-GI-17)
(a) Positive (b) Zero
(c) Neutral (d) Negative
8. What is the voltage across a 6Ω resistor when 3A of current passes through it :
(LHR-GII-18)(SWL-GII-16, 17)(RWP-GII-17)
(DGK-GI-15,16,19)(SGD-GII-15,17)
(a) 2V (b) 9V (c) 18V (d) 36V
9. Mathematical form of Ohm's Law is:
(LHR-GI-18)
(a) $P = IV$ (b) $V = IR$
(c) $Q = It$ (d) $W = \frac{Q}{V}$
10. When we double the voltage in a simple electric circuit, we double the:
(LHR-GI-18)(BWP-GII-19)(SGD-GII-18)
(a) Current (b) Power
(c) Resistance (d) Both (a) and (b)
11. What will be the voltage across the 6 Ohm resistor when 3 ampere current passes through it:
(GUJ-GI-II-15)
(a) = 2V (b) = qV
(c) 18 V (d) 36 V
12. One micro Farad is equal to:
(GUJ-GI-16)
(a) $10^{-3} F$ (b) $10^{-6} F$
(c) $10^{-12} F$ (d) $10^{-12} F$
13. The unit of electric power is: (GUJ-GI-17)
(SWL-GI-19)(BWP-GII-14, 15, GI-18)
(SGD-GII-14)(FBD-GII-14)
(a) volt (b) joule
(c) ampere (d) watt
14. The direction of induced emf in a circuit is in accordance with conservation law of:
(GUJ-GI-17)
(a) mass (b) charge
(c) energy (d) momentum
15. An electric current in conductor is due to the flow of: (GUJ-GII-17)
(a) positive ions (b) negative ions
(c) positive charges (d) free electrons
16. If we double both the current and voltage in a circuit while keeping its resistance constant, the power is (GUJ-GII-18, 19)
(RWP-GII-19)(DGK-GI-19)(SWL-GI-19)
(a) remain unchanged
(b) halves
(c) doubles
(d) quadruples
17. Electric power (P) is equal to
(BWP-GII-18)(GUJ-GII-18)(RWP-GII-19)
(a) $I^2 V$ (b) $I V^2$
(c) $I^2 R$ (d) $I R^2$
18. The rate of flow of charges is called:
(GUJ-GI-18)
(a) current (b) volt
(c) ohm (d) coulomb
19. In an electric circuit when electrons move from low to high potential they will:
(MTN-GII-14)
(a) lose energy (b) Gain energy
(c) Gain potential (d) lose their identity
20. An electric current in conductor is due to the flow of: (MTN-GI-16),
(RWP-GI-16, 17)(SGD-GII-14)(FBD-GI-15, 18)
(a) Free electrons (b) Negative ions
(c) Positive charges (d) Positive ions
21. The SI unit of e.m.f is:
(MTN-GII-16)(FBD-GI-19)(BWP-GI-19)
(a) NC^{-1} (b) NC
(c) C.J (d) JC^{-1}
22. 1 milliampere is equal to: (MTN-GI,II-18)
(a) $10^{-2} A$ (b) $10^{-3} A$
(c) $10^{-6} A$ (d) $10^{-9} A$
23. One Watt is equal to: (BWP-GI-15)
(SGD-GII-19)(DGK-GI-14, GI-16)
(a) Js (b) $J s^{-1}$ (c) $J^2 s$ (d) $S J^{-1}$
24. An ideal voltmeter has a resistance:
(BWP-GI-14)
(a) Very Low (b) Very High
(c) Nothing (d) Low

25. In Mica Capacitor, the Dielectric is:

(BWP-GI-16)

- (a) Mica (b) Plastic
(c) Paper (d) Aluminum

26. The combined resistance of two identical resistors, connected in series is $8\ \Omega$. Their combined resistance in a parallel arrangement will be:

(LHR-GI-19)(BWP-GI-18)

- (a) $2\ \Omega$ (b) $4\ \Omega$ (c) $8\ \Omega$ (d) $12\ \Omega$

27. The direction of induced emf in a circuit is in according with conservation of:

(FBD-GII-14)

- (a) mass (b) charge
(c) momentum (d) Energy

28. Formula of e.m.f is equal to e.m.f circuit is in according with conservation of:

(FBD-GI-14)

- (a) $E = \frac{J}{Q}$ (b) $F = \frac{W}{I}$ (c) $E = \frac{W}{Q}$ (d) $E = \frac{Q}{I}$

29. Unit of current is: (FBD-GII-17)

(SWL-GII-15,18)(RWP-GII-15)

- (a) Volt (b) Joule
(c) Coulomb (d) Ampere

30. SI unit of potential difference is:

(FBD-GII-18)(DGK-GII-18)(SGD-GI-19)

- (a) Ampere (b) Volt
(c) Farad (d) Pascal

31. Electrical potential and e.m.f; (RWP-GI-16)

- (a) are the same terms
(b) are the different terms
(c) have different units
(d) Both C & B

32. 1K Wh is equal to:

(RWP-GII-15)(DGK-GI-17)

- (a) 3.6×10^6 (b) 3.6×10^5
(c) 3.6×10^4 (d) 3.6×10^3

33. Specific resistance of copper is: (RWP-GII-18)

- (a) 1.99 (b) 1.69
(c) 1.50 (d) 1.20

34. Potential of neutral wire is: (RWP-GI-18)

- (a) 1V (b) 5V
(c) 0V (d) 10V

35. SI unit of electric Potential is: (SGD-GI-16)

- (a) Volt (b) Watt (c) Joule (d) Ohm

36. 1 mille Ampere is: (SGD-GI-16)

- (a) 10^{-3} A (b) 10^{-5} A (c) 10^{-6} A (d) 10^{-9} A

37. The formula to find the magnitude of current is: (SGD-GI-15)

- (a) $I = \frac{Q}{t}$ (b) $I = QV$

- (c) $I = CV$ (d) $I = \frac{C}{Q}$

38. Specific resistance of metal Nichrome is?

(SGD-GII-18)

- (a) $100 \times 10^{-8} \Omega m$ (b) $200 \times 10^{-8} \Omega m$

- (c) $300 \times 10^{-8} \Omega m$ (d) $600 \times 10^{-8} \Omega m$

39. The equivalent resistance of two resistors of $6\ K\Omega$ and $4\ K\Omega$ are connected in series across a $10V$ battery (DGK-GI-18)

- (a) $10\ K\Omega$ (b) $2\ K\Omega$ (c) $\frac{12}{5}\ K\Omega$ (d) $\frac{5}{12}\ K\Omega$

40. The rate of flow of charge is called:

(SWL-GII-15)

- (a) current (b) volt
(c) Ohm (d) Coulomb

41. Five Joules of work is needed to shift 10C charge from one place to another. The potential difference between the places is: (SWL-GI-15, 16)

- (a) 5 Volt (b) 0.5 Volt
(c) 12 Volt (d) 10 Volt

42. The symbol to denote resistance is:

(SWL-GII-18)

- (a)  (b)  (c)  (d) 

43. To measure the value of current flowing in a circuit which device is used. (LHR-GI-19)

- (a) Galvanometer (b) Ammeter
(c) Voltmeter (d) None of these

44. Power of hair dryer: (LHR-GII-19)

- (a) 5000 watts (b) 1500 watts
(c) 1000 watts (d) 800 watts

45. Specific resistance of iron: (LHR-GII-19)

- (a) $9.8 \times 10^{-8} \Omega m$ (b) $100 \times 10^{-8} \Omega m$
(c) $136 \times 10^{-8} \Omega m$ (d) $5.25 \times 10^{-8} \Omega m$

46. A 100 watts bulb is connected to 250 volts supply. The current flowing through the bulb is _____ amperes. (GUJ-GI-19)

- (a) 0.4 (b) 2.5 (c) 4.8 (d) 14.5

47. Two resistances of $6\ k\Omega$ and $12\ k\Omega$ are connected in parallel across a 6 volts battery. The potential difference across $6\ k\Omega$ resistance is _____ volts. (GUJ-GI-19)

- (a) 2 (b) 4 (c) 6 (d) 12

48. 1 KWH = _____ (BWP-GI-19)

- (a) 3.6 N (b) 3.6 W
(c) 3.6 MJ (d) 3.6 J

49. Specific Resistance of Silver is: (BWP-GII-19)

- (a) $1.69 \times 10^{-8} \Omega m$ (b) $2.75 \times 10^{-8} \Omega m$
(c) $1.7 \times 10^{-8} \Omega m$ (d) $5.25 \times 10^{-8} \Omega m$

50. If we doubled the length of mettalic wire while other factors remain same, then its resistance will be: (MTN-GI-19)

- (a) Half **(b) Doubled**
 (c) Quadruple (d) Remain same

51. Specific resistance of Graphite is: (MTN-GII-19)

- (a) $3500 \times 10^{-8} \Omega m$** (b) $100 \times 10^{-8} \Omega m$
 (c) $9.8 \times 10^{-8} \Omega m$ (d) $10.6 \times 10^{-8} \Omega m$

52. The power of small fan is: (MTN-GII-19)

- (a) 100 watts (b) 750 watts
(c) 50 watts (d) 10 watts

53. The electric meter installed in our houses measures the consumption of electric energy in the units of: (FBD-GII-19)

- (a) Watt (b) Watt hour
 (c) Mega watt hour **(d) Kilo watt hour**

54. The SI unit of emf is: (FBD-GI-19)

- (a) NC^{-1}** (b) NC (c) JC (d) JC^{-1}

55. If we increase the area of wire. Then its resistance. (SGD-GI-19)

- (a) Increases **(b) Decreases**
 (c) No change (d) Vanishes

56. The unit of volt: (DGK-GII-19)

- (a) J / C** (b) C / J
 (c) Nm^{-1} (d) Nm

57. Cross sectional area of the wire: (DGK-GII-19)

- (a) $\frac{\pi d^2}{2}$ (b) $\frac{\pi d^2}{4}$ (c) $\frac{\pi d}{4}$ **(d) $\frac{\pi d^2}{4}$**

58. Specific resistance of copper: (DGK-GII-19)

- (a) $1.7 \times 10^{-8} \Omega m$ **(b) $1.69 \times 10^{-8} \Omega m$**
 (c) $2.75 \times 10^{-8} \Omega m$ (d) $5.25 \times 10^{-8} \Omega m$

SECTION II**SHORT QUESTIONS ANSWERS****PCTB EXERCISE****NO PCTB SHORT QUESTIONS****FROM PUNJAB BOARDS****(2014, 15, 16, 17, 18 & 19)**

1. If 0.5 C have pass through a wire in 10s. then what will be the value of current flowing through wire? (LHR-GI-14,15)

(MTN-GI-14, GII-17)(FBD-GI,II-15)

(BWP-GI,II-14)(SGD-GI-15)(RWP-GI-16)

Ans. Given $Q = 0.5 C$, $t = 10s$,Find: $I = ?$

$$I = \frac{Q}{t}$$

$$I = \frac{0.5c}{10s}$$

$$I = 0.05 \text{ cs}^{-1} \quad 50\text{mA}$$

Total current flow through wire $I = 50\text{mA}$.

2. What is meant by Electric current? Write its equation.

(LHR-GII-14,16, GI-II-18)(RWP-GI-14, GII-19)

(GUJ-GI-14)(BWP-GI-14, GI,II-15, GII-17)

(FBD-GI-15,18)(MTN-GII-15, GI-16)

(SWL-GI,II-14,15, GI-17, GII-18)

Ans. The rate of flow of electric charge through any cross-sectional area is called current.

If the charge Q is passing through any area in time t , then current I flowing through it will be given by

$$\text{Current} = \frac{\text{Charge}}{\text{Time}}$$

$$\text{or } I = \frac{Q}{t}$$

3. Define Ampere or define unit of current. (LHR-GI-16,17)(GUJ-GI-14)(BWP-GI-18)

Ans. SI unit of current is ampere (A).

Ampere: If a charge of one coulomb passes through a cross-sectional area in one second, then current is one ampere.

$$mA = 10^{-3} A$$

$$1 \text{ mA} = 10^{-3} A$$

$$1 \mu A = 10^{-6} A$$

4. Which instrument is used for measurement of current.

(LHR-GI-15)(BWP-GI-14)

Ans. Am-meter is used for measurement of electric current. It always connected in series while measuring electric current.

5. Define potential Difference and write the name of unit.

(LHR-GI-14)

(SGD-GI-14)(DGK-GI-14)(RWP-GI-14, GII-17)

(GUJ-GI-15, GII-17)(MTN-GI-14)(SWL-GI-II-14)

(BWP-GI-II-14, GI-15,16)

Ans. Potential difference: Potential difference across the two ends of a conductor causes the dissipation of electrical energy into other forms of energy volt as charges flow through the circuit.

Unit: SI. Unit of potential difference is volt.

6. Define Electro Motive Force. Write its SI unit.

OR What is meant by the term Electro Motive Force.

(LHR-GI-14, 17)(MTN-GI-14,16,18,19)(FBD-GI-19)

(GUJ-GI-14, GII-15)(BWP-GI-II-14, GII-19)

(SGD-GI-16)(DGK-GI-18)(SWL-GII-14,18)

Ans. Electro Motive Force: It is the energy supplied a battery to a unit positive charge when it flows through the closed circuit. Or The energy converted from non-electrical forms to electrical form when one coulomb of positive charge passes through the battery.

$$e.m.f = \frac{\text{Energy}}{\text{Charge}}$$

$$\text{or } E = \frac{W}{Q}$$

The unit for e.m.f. is JC^{-1} which is equal to Unit: volt (V) in SI system.

7. Write the sources of emf? write names.

(LHR-GI-15,17)

Ans. Battery dry cells etc are sources of e.m.f.

8. How we measure e.m.f of a battery.

(LHR-GII-14)

Ans. In order to measure e.m.f of the battery we connect voltmeter directly with the terminal of the battery.

9. Define Ohm.

(LHR-GII-15, GI-18)(MTN-GI-19)

(RWP-GI-16)(FBD-GI-18)

Ans. When a potential difference of one volt is applied across the ends of a conductor and one ampere of current passes through it, then its resistance will be one ohm.

10. Define Resistance and give the name of its unit.

(LHR-GI-14)(DGK-GII-14, GI-17)

(MTN-GII-17,18)(GUJ-GI-17,18)

(SGD-GII-16)(BWP-GII-18)(SWL-GII-17,19)

(FBD-GI-14,16)(RWP-GII-14,18)

Ans. Resistance: The property of a substance which offers opposition to the flow of current through it is called its resistance.

Unit: The SI unit of resistance R is Ohm.

11. What do you mean by ohmic and Non-ohmic materials?

(LHR-GI-16, GII-19)

(MTN-GI-14, GII-19)(FBD-GII-18)(RWP-GII-16)

Ans. Ohmic Materials: Materials that obey Ohm's law, and hence have a constant resistance over a wide range of voltages, are said to be ohmic.

Example of Ohmic: Most metals shows ohmic behaviour.

Non-Ohmic Materials: Non Ohmic Materials having resistance that changes with voltage or current are non-ohmic materials.

Non-Ohmic: Non-ohmic materials have a non linear voltage-current relationship.

Example of non-ohmic filament lamp and thermister.

12. Define resistivity.

(LHR-GI-14)

Ans. The resistance of conductor of one metre cube is called resistivity.

formula: Its formula is $R = \rho \frac{L}{A}$

13. Define joule's law.

OR

State Joules Law.

(LHR-GII-14,17,18)(MTN-GII-18)

(RWP-GI-14, 15, 18, GII-19)(BWP-GI-II-18, GI-19)

Ans. The amount of heat generated in a resistance due to flow of charges is equal to the product of square of current I, resistance R and the time duration t.

$$W = I^2 R t = \frac{V^2 t}{R}$$

14. Write down two advantages of parallel circuit of Resistors.

OR What is the advantage of connecting the equipments in parallel circuits instead of series circuit?

(LHR-GII-14, GI-15)(DGK-GII-19)

Ans. Parallel circuits have two big advantages over series circuits.

- (i) Each device in the circuit receives the full battery voltage.
 (ii) Each device in the circuit may be turned off independently without stopping the current flowing to the other devices in the circuit. This principle is used in household wiring.

15. Define kilowatt Hour and write equation of quantity of energy in kilowatt energy. (LHR-GI-14)(DGK-GI-18)

Ans. The amount of energy delivered by a power of one kilowatt in one hour is called kilowatt-hour.

Formula: amount of energy in

$$\text{kwh} = \frac{\text{watt} \times \text{time in use in hour}}{1000}$$

16. Write down formula to calculate the value of electricity bill. (LHR-GI-15)

Ans. cost of electricity $\approx$ number of unit consumed $\times$ cost of one unit =

$$\frac{\text{watt} \times \text{time of use in hours}}{1000} \times \text{cost of one unit}$$

17. If the length of copper wire is 1m and its diameter is 2mm, Find its resistance. (LHR-GI-17)

Ans. Given that, length of the wire $L = 1$ m,
 diameter of the wire $d = 2$ mm $= 2 \times 10^{-3}$ m
 Cross sectional area of the wire

$$A = \pi d^2 / 4 = \frac{3.14 \times (2 \times 10^{-3})^2 \text{ m}^2}{4}$$

$$A = 3.14 \times 10^{-6} \text{ m}^2$$

Specific resistance of copper $\rho = 1.69 \times 10^{-8} \Omega \text{m}$

Now we have $R = \rho \times L / A$

$$= 1.69 \times 10^{-8} \Omega \text{m} \times 1 \text{ m} / 3.14 \times 10^{-6} \text{ m}^2$$

$$R = 0.54 \times 10^{-2} \Omega = 5.4 \times 10^{-3} \Omega$$

18. What is the difference between a cell and battery?

(LHR-GII-17)(GUJ-GII-17)(FBD-GII-19)

Ans. Cell: A cell is a signal unit or the base voltage.

Battery: A battery can be single cell or multiple cells connected together in series or parallel to make the voltage current rating as required.

19. Draw circuit diagram for three capacitor some circuit connected in series combination. (LHR-GII-14)

Ans.

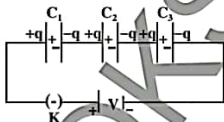


Fig. Capacitors in series combination.

$$\frac{1}{C_{eq}} = \frac{1}{C_1} + \frac{1}{C_2} + \frac{1}{C_3}$$

Variable capacitors value of capacitance can be increased or decreased.

20. A current of 3mA is flowing through a wire for 1 minute. What is the charge flowing through the wire? (GUJ-GII-14)

Ans. $I = 3\text{mA}$

$$= 3 \times 10^{-3} \text{ A}$$

$$t = 1 \text{ min} = 60 \text{ sec}$$

$$Q = ?$$

$$I = \frac{Q}{t}$$

$$\Rightarrow Q = I \times t$$

$$Q = 3 \times 10^{-3} \times 60$$

$$Q = 180 \times 10^{-3}$$

$$Q = 0.18 \text{ C}$$

21. In order to measure current is in a circuit, why ammeter is always connected in series? (GUJ-GI-14)

Ans. Like galvanometer, ammeter is also connected in series so the current flowing in the circuit also passes through the ammeter.

22. How do the jewellers identify diamonds as real or a fake one?

(GUJ-GII-14)(SGD-GII-19)

Ans. Jewellers identify diamonds as real or a fake one made from glass, by holding it to their lips. A real diamond feels very cold due to the ability of transferring heat four or five times faster than copper.

23. Which metal is used as the filament of an electric bulb? Explain. (GUJ-GII-15)

Ans. Tungsten filament is used in electric bulb. Because tungsten has the highest melting point of all metals and it does not melt even when it is glowing.

24. Prove that: $P = \frac{V^2}{R}$.

(GUJ-GI-16)(FBD-GII-18)

Ans. The amount of energy supplied by current in unit time is known as electric power.

Electric power = $\frac{\text{Electric Energy}}{\text{time}}$

$$P = \frac{w}{t}$$

Where w is the electrical energy given by.

$$w = QV$$

Put the value of W in equation.

$$P = \frac{QV}{t}$$

$$P = \frac{Q}{t} \times V \text{ (ii)}$$

we know that.

$$I = \frac{Q}{t}$$

Putting value in equation (ii)

$$P = IV \text{ (iii)}$$

We know that.

$$V = IR$$

$$I = \frac{V}{R}$$

Putting value of I in equation. (iii)

$$P = \frac{V}{R} \times V$$

$$P = \frac{V^2}{R}$$

Hence prove that

$$P = \frac{V^2}{R}$$

25. Write down colour coding of live wire and natural wire.

(GUJ-GII-16)(DGK-GI-19)

Ans. Live wire (L) Red or brown colours usually use.

Natural wire (N) black or blue colours use.

26. Define Electric power and its write unit. (GUJ-GI-15,16)(MTN-GI-14, GII-16,18) (BWP-GI-14)(FBD-GI-14,16,17, GII-15, 17)

Ans. The amount of energy supplied by current in unit time is known as electric power.

$$W = QV$$

Therefore, above equation become

$$\text{Electric power } P = \frac{QV}{t} = IV = I^2R$$

Unit: The unit of electric power is watt which is equal to the one. Joule per second. 1Js^{-1} .

27. Define kilowatt Hour.

(GUJ-GI-16, GI-16)(MTN-GII-15)(FBD-GII-15) (DGK-GI-18)

Ans. The amount of energy delivered by a power of one kilowatt in one hour is called kilowatt-hour.

28. Prove that: $36 \times 10^5 \text{ J} = 3.6 \text{ MJ}$.

OR $1 \text{ kwh} = 3.6 \text{ MJ}$.

(GUJ-GI-15)(RWP-GI-II-19)(DGK-GII-19)

Ans. $1 \text{ kwh} = 1000 \text{ w} \times 1 \text{ h}$

$$= 1000 \text{ w} \times (3600 \text{ s})$$

$$= 36 \times 10^5 \text{ J}$$

$$= 3.6 \times 10^6 \text{ J}$$

$$= 3.6 \times 10^6$$

$$= 3.6 \text{ MJ}$$

29. Write the use of relay. (GUJ-GI-17)

Ans. The relay is used to control a large current with the help of a small current.

A relay is an electrical switch that opens and closes under. The control of another electrical circuit.

30. Define specific resistance?

(GUJ-GII-18)(RWP-GII-17)

Ans. The resistance R of the wire is directly proportional to the length of the wire i.e $R \propto L$ (1)

The resistance R of the wire is inversely proportional to the area of cross section A of the wire i.e. $R \propto \frac{1}{A}$. After combining

the two equation we get $R = P \frac{L}{A}$. Where

'p' is the constant of proportionality known as specific resistant.

Unit: The unit of 'p' is ohm-metre ($\Omega \text{ m}$)

- 31. What is meant by conventional current?**
(GUJ-GI-18)(FBD-GI-17)(MTN-GI-16)(RWP-GI-16)
(DGK-GI-17)(SWL-GII-14, GI-17, 19)

Ans. Conventional current is defined as:
Current flowing from positive to negative terminal of a battery due to the flow of positive charges is called conventional current.

- 32. What is different between galvanometer and Ammeter?** (MTN-GII-14)

Ans. Galvanometer: Galvanometer is very sensitive instrument and can detect small current in a circuit.

Ammeter: After suitable modification galvanometer can be converted into an ammeter. A large current of the range such as 1 A or 10 A can be measured by means of ammeter. Like galvanometer, ammeter is also connected in series.

- 33. If two resistors of 6kΩ and 4kΩ are connected by a battery of 10V in series. Calculate equivalent resistance.**

(MTN-GII-16)(FBD-GI-14, 15)(BWP-GI-15)

Ans. (a) The equivalent resistance of the series combination is

$$R_e = R_1 + R_2 \text{ or } R_e = 6 \text{ k}\Omega + 4 \text{ k}\Omega = 10 \text{ k}\Omega$$

- 34. Define electric power and kilowatt hour.** (MTN-GII-15)

Ans. Electrical power: The amount of energy supplied by current in unit time is known as electric power.

Kilowatt hour: The amount of energy delivered by a power of one kilowatt in one hour is called kilowatt hour.

- 35. In a circuit 20Ω, 30Ω and 60Ω resistance are connected in parallel. Battery of voltage 6. calculate the equivalent resistance if the circuit.**

(MTN-GI-18)

Ans. The equivalent resistance of the series combination is

$$\begin{aligned} R_e &= R_1 + R_2 + R_3 \\ &= 20\Omega + 30\Omega + 60\Omega \\ &= 110\Omega \end{aligned}$$

- 36. Distinguish between watt and kilowatt hours while flowing between two point. IV = Ijc⁻¹** (MTN-GI-17)

Ans. Watt: The potential difference between two point will be 1 volt if 15 of energy consumed by 1c charge.

Kilowatt Hours: The amount of energy delivered by power of one kilowatt in one hour is called kilowatt-hours.

- 37. Write are sources of emf? write names.**

(BWP-GI-16)

Ans. Battery dry cells etc are sources of e.m.f.

- 38. What is meat of Ohmic Materials.**

(BWP-GI-16, GII-17)

Ans. Materials that obey Ohm's law and hence have a constant resistance over a wide range of voltages, are said to be called ohmic materials.

- 39. What are non-ohmic materials.**

(BWP-GI-16)

Ans. Materials does not obey Ohm's law called non-ohmic material and the resistance of that material varies at high range of voltages. Thermister and filament are non-ohmic.

- 40. Diamond does not conduct electricity however it is very good at conducting heat explain.** (BWP-GI-16)

Ans. Diamond does not conduct electricity however it is very good at conducting heat because its particles are very firmly bonded together.

- 41. What is the unit of electric power? define it.** (BWP-GII-16)

OR Define electric power. (SGD-GII-19)

Ans. The unit of electric power is watt (w).

One watt is a power is one joule energy used in one second.

$$\text{watt} = \frac{\text{Joule}}{\text{Second}}$$

$$w = \frac{J}{s}$$

- 42. Describe two features of series combination of Resistors.** (BWP-GI-17)

Ans. Resistors can be connected in two ways.

(i) Series Combination:

In series combination, resistors are connected end to end (Fig.) and electric current has a single path through the

circuit. This means that the current passing through each resistor is the same.

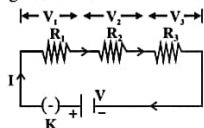


Fig. Three Resistors in series combination

43. What is SI unit of Resistance? Define it.

(BWP-GI-17,18)

Ans. The SI unit of resistance R is ohm. It is defined as ohms.

When a potential difference of one volt is applied across the ends of a conductor and one ampere of current passes through it, then its resistance will be one ohm.

44. In order to measure current is in a circuit, why ammeter is always connected in series?

(FBD-GII-14)(RWP-GI-14)

Ans. Like galvanometer, ammeter is also connected in series so the current flowing in the circuit also passes through the ammeter.

45. Define Volt. (FBD-GII-15)

Ans. The potential difference between two point will be 1 volt if 1J of energy consumed by 1 C charges while flowing between two point

$$1V = 1J C^{-1}$$

46. If the diameter of copper wire is 0.002m, then find its cross sectional area.

(GI-14)

Ans. $P = 1.69 \times 10^{-8} m$

$$d = 0.002m$$

$$d = 2 \times 10^{-3} m$$

$$L = 1m$$

$$R = ?$$

$$A = r \frac{d^2}{4}$$

$$A = (3.14) \frac{(2 \times 10^{-3})^2}{4}$$

$$A = (3.14) \frac{(4 \times 10^{-6})}{4}$$

$$A = 3.14 \times 10^{-6} m^2$$

$$P = 1.69 \times 10^{-8} \Omega m$$

$$R = P \times \frac{L}{A}$$

$$R = 1.69 \times 10^{-8} \times \frac{1}{3.14 \times 10^{-6}}$$

$$R = \frac{1.69}{3.14} \times 10^{-2} \Omega$$

$$R = 0.54 \times 10^{-2} \Omega$$

$$R = 5.4m \Omega \text{ Ans.}$$

47. Write down two features of parallel combination of resistance. (FBD-GII-14)

Ans. (i) The sum of currents in all the resistors is equal to the current supplied by the battery in parallel combination of resistors. $I = I_1 + I_2 + I_3 \dots$

(ii) The voltage across each resistance in parallel potential difference is same.

48. How many watt hours there in 1000 joules? (GUJ-GI-19)(FBD-GI-16)(RWP-GI-17)

Ans. $1kwh = 1 \times 1000w \times 3600s$

$$1kwh = 3600000 j$$

$$1kwh = 36 \times 10^5 j$$

$$1kwh = 3.6 \times 10^6 j$$

$$1wh = \frac{3.6 \times 10^6}{1000} j$$

$$1wh = \frac{3.6 \times 5 \times 10^6}{10^3} j$$

$$1wh = 3.6 \times 10^3 j$$

$$1j = \frac{1}{3.6 \times 10^3} wh$$

$$1j = \frac{1}{3.6} \times 10^{-3} wh$$

$$1j = 0.278 \times 10^{-3} wh$$

$$1000 j = 0.278 \times 10^{-3} \times 1000 wh$$

$$1000 j = 0.278 \times 5 \times 10^{-3} \times 10^3 wh$$

$$1000 j = 0.278 wh.$$

49. Convert one kilowatt hour into joules.

(FBD-GI-17)(SGD-GI-19)

Ans. One Kilowatt-hour 1kwh = 1000w × 1 hour
 = 1000w × (3600s)
 = 36×10^5 j
 = 3.5 mj

50. What is different between galvanometer and Ammeter? (RWP-GI,II-15)(DGK-GI-14)

Ans. Galvanometer: Galvanometer is very sensitive instrument and can detect small current in a circuit.

Ammeter: After suitable modification galvanometer can be converted into an ammeter. A large current of the range such as 1 A or 10 A can be measured by means of ammeter. Like galvanometer, ammeter is also connected in series.

51. How many watt-hours are there in 1000 joules. (RWP-GI-17)**OR Prove that 1 kwh = 3.6 MJ (GUJ-GI-19)****Ans.** 1kwh = $1 \times 1000w \times 3600s$

1kwh = 3600000 j

1kwh = 36×10^5 j

1kwh = 3.6×10^6 j

1wh = $\frac{3.6 \times 10^6}{1000}$ j

1 wh = $\frac{3.6 \times 5 \times 10^6}{10^3}$ j

1 wh = 3.6×10^3 j

1j = $\frac{1}{3.6 \times 10^3}$ wh

1j = $\frac{1}{3.6} \times 10^{-3}$ wh

1j = 0.278×10^{-3} wh

1000 j = $0.278 \times 10^{-3} \times 1000$ wh

1000 j = $0.278 \times 5 \times 10^{-3} \times 10^3$ wh

1000 j = 0.278 wh

52. Does a fuse in a circuit control the potential difference or the current.

(RWP-GI-17)

Ans. A fuse is a safety device that is connected in series with the live wire in the circuit to protect the equipment when excess current flows.

53. Define Resistance and write its unit.

(RWP-GII-17)

Ans. The property of a substance which offers opposition to the flow of current through it is called its resistance unit. The SI unit of resistance R is Ohm.

54. State Ohm's law and write its equation.**OR State Ohm's law. (SGD-GI-16,17)**

(GUJ-GI-II-19)(SWL-GI-19)

Ans. The amount of current passing through a conductor is directly proportional to the potential difference applied across its ends, provided the temperature and the physical state of the conductor does not change.

$$\text{i.e., } I \propto V \text{ or } V \propto I \\ \text{or } V = IR$$

55. What are the limitation on the Ohm's law? (SGD-GII-14)**Ans.** Condition of Ohm's law:

(i) Ohm's law is valid only for metals (specific metals).

56. Why does the Resistance of conductors increases with the increases in temperature? (GI-14)

Ans. The resistance of conductors increases with increase in temperature. This is due to increase in the number of collisions of electrons with themselves and with atoms of the metals.

57. Write the name of the ways to combine the resistors. (SGD-GI-17)**Ans.** Resistors can be connected in two ways.

(i) Series combination.

(ii) Parallel combination.

58. Prove that: $P = I^2 R$.

(SGD-GII-17)(DGK-GII-15)

Ans. $P = I^2 R$

$$\text{we know } P = \frac{W}{t}$$

$$\therefore \text{we } = QV \quad P = \frac{QV}{t}$$

$$P = Q \frac{V}{t} \quad P = I \frac{V}{t} \quad \therefore Q = It$$

$$P = VI \quad \therefore V = IR$$

$$P = (I R) (I) \quad P = I^2 R$$

59. A current of 3mA is flowing through a wire for 1 minute. What is the charge flowing through the wire? (DGK-GI-16)

Ans. $I = 3\text{mA}$

$$= 3 \times 10^{-3} \text{ A}$$

$$t = 1\text{min} = 60 \text{ sec}$$

$$Q = ?$$

$$I = \frac{Q}{t}$$

$$\Rightarrow Q = I \times t$$

$$Q = 3 \times 10^{-3} \times 60$$

$$Q = 180 \times 10^{-3}$$

$$Q = 0.18\text{C}$$

60. Write briefly the function of galvanometer? (DGK-GI-15)

Ans. Galvanometer is very sensitive instrument and can detect small current in a circuit. A current of few milliamperes is sufficient to cause full scale deflection in it. While making the connections polarity of the terminals of the galvanometer.

After suitable modification galvanometer can be converted into an ammeter.

61. How do the jewellers identify diamonds as real or a fake one? (DGK-GI-16)

Ans. Jewellers identify diamonds as real or a fake one made from glass, by holding it to their lips. A real diamond ability of transferring heat four or give times better than copper.

62. Write an example of use for heating effect of current. (DGK-GI-16)

Ans. We use heating effect of an electric current for different purposes. When a current flows through the filament of bulb it glows white hot and give out light. Electric heaters have very thin wires that glow red hot when current flows.

63. Define joule's law. (DGK-GII-14,18)

Ans. The amount of heat generated in a resistance due to flow of charges is equal to the product of square of current I , resistance R and the time duration t .

64. Define Electric power and its unit.

(RWP-GI-19)(DGK-GII-14,18)

Ans. The amount of energy supplied by current in unit time is known as electric power.

$$W = QV$$

Therefore, above equation become

$$\text{Electric power } P = \frac{QV}{t} = IV = I^2R$$

65. Write down two advantages of parallel circuit over series circuit.

(RWP-GI-19)(DGK-GII-17)

Ans. Parallel circuit have two big advantages over series circuit.

1. Each device in the circuit receives the full battery voltage.
2. Each device in the circuit may be turned off independently without stopping the current flowing the other devices in the circuit. This principle is used in household wiring.

66. What is difference between current flow and water flow? (SWL-GII-14)

Ans. The flow of charge in a circuit is like the flow of water in a pipe except that a conducting wire is needed in order to have a complete conducting path.

67. If 2A current is passing through 60 V battery. Find its resistance. (SWL-GI-14)

Ans. Given that, $V = 60 \text{ V}$, $I = 2 \text{ A}$

Using Ohm's law

$$V = IR$$

$$\text{or } R = \frac{V}{I} = \frac{60 \text{ V}}{2 \text{ A}} = 30 \text{ V A}^{-1} = 30 \Omega$$

68. What is the direction of conventional in a circuit? (SGD-GI-19)

Ans. The direction of conventional current in a circuit is negative terminal to positive terminal.

69. Why does the current easily flow in a conductor. (DGK-GII-19)

Ans. The conductors has the less resistance to the flow of current conductors have excess of free electrons which are not held strongly with any particular atom of metals. These free electron move randomly in all directions inside metals. When we apply an external electric field these electron can easily move in a specific direction.

This movement of free electron in a particular direction under the influence of an external field causes the flow of current in metal wires.

70. Write the SI unit of potential, difference and define it. (FBD-GII-19)

Ans. SI unit of potential difference is Volt it define as. if one Joule of work is done against the electric field in bringing One coulomb positive charge. from infinity if a point in the electric field Then the potential out that point will be one volt.

SECTION III

LONG QUESTIONS

FROM PUNJAB BOARDS

(2014, 15, 16, 17, 18 & 2019)

- 14.1. Define and explain the term electric current.
- 14.3. What do we mean by the term e.m.f? Is it really a force? Explain.
- 14.4. How can we differentiate between e.m.f. and potential difference?
- 14.5. Explain Ohm's law. What are its limitations?
- 14.6. Define resistance and its units.
- 14.8. Explain the energy dissipation in a resistance. What is Joule's law?
- 14.10. Discuss the main features of parallel combination of resistors.
- 14.11. Determine the equivalent resistance of series combination of resistors.

SECTION IV

SOLVED NUMERICALS

PCTB EXAMPLES

Examples 14.1: If 0.5 C charge passes through a wire in 10 s, then what will be the value of current flowing through the wire?

Solution: given that, $Q = 0.5 \text{ C}$, $t = 10 \text{ s}$, therefore by using

$$I = Q/t = 0.5 \text{ C}/10 \text{ s} = 0.05 \text{ A} = 50 \text{ mA}$$

Examples 14.2: Reading on voltmeter connected across a heating element is 60 V. The amount of current passing through the heating element measured by an ammeter is 2 A. What is the resistance of the heating coil of the element?

Solution: Given that, $V = 60$, $I = 2 \text{ A}$.

Using Ohm's law

$$V = IR$$

$$\begin{aligned} \text{or } R &= \frac{V}{I} \\ &= \frac{60 \text{ V}}{2 \text{ A}} \\ &= 30 \text{ V A}^{-1} \\ &= 30 \Omega \end{aligned}$$

Examples 14.4: If two resistors of $6 \text{ k}\Omega$ and $4 \text{ k}\Omega$ are connected in series across a 10V battery, then find the following quantities:

- (a) Equivalent resistance of the series combination.
- (b) The current flowing through each of the resistance.
- (c) Potential difference across each of the resistances.

Solution: Given that, $R_1 = 6 \text{ k}\Omega$ and $R_2 = 4 \text{ k}\Omega$

Ans. (a) The equivalent resistance of the series combination is $R_e = R_1 + R_2$

$$\text{or } R_e = 6 \text{ k}\Omega + 4 \text{ k}\Omega = 10 \text{ k}\Omega$$

- (b) If a battery of 10 V is connected across the equivalent resistance R_e , the current passing through it is given by

$$\begin{aligned} I &= \frac{V}{R_e} \\ &= \frac{10 \text{ V}}{10 \text{ k}\Omega} \\ &= 1.0 \times 10^{-3} \text{ A} \\ &= 1 \text{ mA} \end{aligned}$$

In the case of series combination same current would pass through each resistance. Hence, current through R_1 and R_2 would be equal 1 mA.

- (c) Potential difference across

$$R_1 = V_1 = IR = 1.0 \times 10^{-3} \text{ A} \times 6 \text{ k}\Omega = 6 \text{ V}$$

Potential difference across

$$R_2 = V_2 = IR_2 = 1.0 \times 10^{-3} \text{ A} \times 4 \text{ k}\Omega = 4 \text{ V}$$

Examples 14.5: If in the circuit (Fig. 14.13), $R_1 = 2\Omega$, $R_2 = 3\Omega$, $R_3 = 6\Omega$, and $V = 6\text{ V}$, then find the following quantities:

- equivalent resistance of the circuit.
- current passing through each resistance.
- The total current of the circuit.

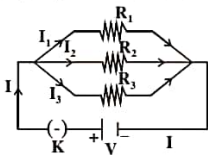


Fig. Three resistors in parallel combination

Solution: (a) As the resistors are connected in parallel, equivalent resistance R_e of the combination is given by

$$\frac{1}{R_e} = \frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3}$$

$$\frac{1}{R_e} = \frac{1}{2\Omega} + \frac{1}{3\Omega} + \frac{1}{6\Omega} = \left[\frac{1}{2} + \frac{1}{3} + \frac{1}{6} \right] \times \frac{1}{\Omega}$$

$$\frac{1}{R_e} = \frac{6}{6\Omega}$$

or $R_e = 1\Omega$

This value is smaller than the lowest value of the resistance in the combination which is always the case in parallel circuits.

- (b) In parallel combination, the potential difference across each of the resistance is same and is equal to the potential of the battery, which is 6 V . Therefore,

$$\text{Current through } R_1 \text{ is } I_1 = \frac{V}{R_1} = \frac{6\text{ V}}{2\Omega} = 3\text{ A}$$

$$\text{Current through } R_2 \text{ is } I_2 = \frac{V}{R_2} = \frac{6\text{ V}}{3\Omega} = 2\text{ A}$$

$$\text{Current through } R_3 \text{ is } I_3 = \frac{V}{R_3} = \frac{6\text{ V}}{6\Omega} = 1\text{ A}$$

- (c) Sum of the currents passing through the resistances in parallel combination is equal to the total current I of the circuit. Therefore, total current is 6 A .

Examples 14.7: The resistance of an electric bulb is 500Ω . Find the power consumed by the

bulb when a potential difference of 250 V is applied across its ends.

Solution: Given that, $R = 500\Omega$, $V = 250\text{ V}$

Using the formula, $I = V/R$

$$I = 250\text{ V}/500\Omega = 0.5\text{ A}$$

and Power $P = I^2 R$

$$= (0.5\text{ A})^2 \times 500\Omega$$

$$= 125\text{ W}$$

Examples 14.8: Calculate the one month cost of using 50 W energy saver for 8 hours daily in your study room. Assume that the price of a unit is Rs. 12 .

Solution: given that, Power = $50\text{ W} = 0.05\text{ kW}$, time = 8 hours

Number of units consumed = $8 \times 30 \times 0.05 = 12$ units

Therefore, total cost = $12 \times 12 = \text{Rs. } 144$

PCTB NUMERICAL PROBLEMS

14.1: A current of 3 mA is flowing through a wire for 1 minute. What is the charge flowing through the wire?

Ans. Electric current of the wire = $3\text{ mA} = 3 \times 10^{-3}\text{ A}$

Time to flow of current = $t = 1$ minutes.

$$t = 60 \text{ second}$$

Charge flowing through the wire = $Q = ?$

we know

$$I = \frac{Q}{t}$$

$$Q = I \times t$$

putting the values

$$Q = 3 \times 10^{-3} \times 60$$

$$= 180 \times 10^{-3}\text{ C} \quad \text{Ans.}$$

14.2: At $100,000\Omega$, how much current flows through your body if you touch the terminals of a 12 V battery? If your skin is wet, so that your resistance is only 1000Ω , how much current would you receive from the same battery?

Resistance = $R = 100,000\Omega$.

Voltage of the battery = $v = 12\text{ V}$

if your skin is wet

then your resistance = $R_2 = 1000\Omega$

- (i) Amount of current which flows through your body (when your skin is dry) = $I = ?$
 (ii) Amount of current which flows through your body (when your skin is wet) $I_2 = ?$

Sol: (i) Amount of current.

when skin is dry = $F = ?$

we know

$$V = IR$$

$$V = I_1 R$$

$$I_1 = \frac{V}{R}$$

$$I_1 = \frac{12}{100,000}$$

$$I_1 = \frac{12}{10^5}$$

$$I_1 = 12 \times 10^{-5}$$

$$I_1 = 12 \times 10^{-5}$$

$$I_1 = 1.2 \times 10^{-4} \text{ A}$$

- (ii) Amount of current when skin is wet.

we know

$$V = IR$$

$$V = I_2 R$$

$$I_2 = \frac{V}{R}$$

putting the value

$$I_2 = \frac{12}{1000}$$

$$I_2 = 12 \times 10^{-3}$$

$$I_2 = 1.2 \times 10^{-2} \text{ A}$$

14.3: The resistance of a conductor wire is 10 MΩ. If a potential difference of 100 volts is applied across its ends, then find the value of current passing through it in mA.

Ans. The resistance of the conductor

$$R = 10 \text{ M}\Omega = 10 \times 10^6 \Omega.$$

Applied potential difference = $V = 100$ volts

The amount of current passing through conductor wire = $I = ?$

we know

$$V = IR$$

$$I = \frac{V}{R} \quad \text{--- (i)}$$

putting the value in eq (i)

we get

$$I = \frac{100}{10 \times 10^6}$$

$$I = \frac{10}{10^6}$$

$$I = 10 \times 10^{-3} \times 10^{-3}$$

$$I = 0.01 \text{ mA}$$

$$I = 0.01 \text{ mA}$$

14.4: By applying a potential difference of 10 V across a conductor, a current of 1.5 A passes through it. How much energy would be obtained from the current in 2 minutes?

Ans. Potential difference = $V = 10 \text{ V}$.

Current of the conductor = $I = 1.5 \text{ A}$

Time & flow the current = $t = 2 \text{ minutes}$

$$= 2 \times 60 = 120 \text{ sec.}$$

The amount of obtained energy = $E = ?$

we know

$$P = \frac{E}{t}$$

$$E = P \times t \quad \text{--- (i)}$$

$$P = IV$$

putting the P ... equ (i)

$$E = P \times t$$

$$E = I \times V \times t$$

putting the value

$$E = (1.5) (10) (120)$$

$$E = (15) (120)$$

$$E = (800) \quad E = 1800 \text{ J}$$

14.5: Two resistances of 2 k Ω and 8 k Ω are joined in series, if a 10 V battery is connected across the ends of this combination, find the following quantities:

- The equivalent resistance of the series combination.
- Current passing through each of the resistances.
- The potential difference across each resistance.

Sol. Value of first resistance = $R_1 = 2 \text{ k}\Omega$

Value of second resistance = $R_2 = 8 \text{ k}\Omega$

Voltage of battery = $V = 10 \text{ V}$

- equivalent resistance of the series combination = ?

we know

$$R_e = R_1 + R_2$$

putting the value

$$R_e = 2 \text{ k} + 8 \text{ k}$$

$$R_e = 10 \text{ k}\Omega$$

- Current passing through each of the resistance

we know

$$I = \frac{V}{R_e} \text{ putting the value}$$

$$I = \frac{10}{10 \text{ k}\Omega}$$

$$I = \frac{10}{10 \times 10^3 \Omega}$$

$$I = 1 \times 10^{-3}$$

$$I = 1 \text{ mA}$$

- The potential difference across each resistance.

we know

$$V = IR$$

$$\text{potential across } R_1 = V_1 = IR_1$$

putting the values

$$V_1 = (1 \times 10^{-3}) (2 \times 10^3)$$

$$V_1 = 1 \times 2 \times 10^{-3} \times 10^3$$

$$V_1 = 2 \text{ V}$$

potential difference across

$$R_2 = V_2 = IR_2$$

putting the value

$$V_2 = (1 \times 10^{-3}) (8 \times 10^3)$$

$$V_2 = 8 \text{ V}$$

14.6: Two resistances of 6 k Ω and 12 k Ω are connected in parallel. A 6 V battery is connected across its ends, find the values of the following quantities:

- Equivalent resistance of the parallel combination.
- Current passing through each of the resistances.
- Potential difference across each of the resistance.

Ans. Value of one resistance = $R_1 = 6 \text{ k}\Omega$

Value of second resistance = $R_2 = 12 \text{ k}\Omega$

Voltage of battery = 6v

- Equivalent resistance of the parallel combination = $R_e = ?$
- Current passing through each of the resistances = $I = ?$
- Potential difference across each of the resistance = $V = ?$
- Equivalent resistance of the parallel combination = $R_e = ?$

we know

$$\frac{1}{R_e} = \frac{1}{R_1} + \frac{1}{R_2}$$

putting the value

$$\frac{1}{R_e} = \frac{1}{6 \text{ k}\Omega} + \frac{1}{12 \text{ k}\Omega}$$

$$\frac{1}{R_e} = \frac{1}{6} + \frac{1}{12}$$

$$\frac{1}{R_e} \approx \frac{2+1}{12}$$

$$\frac{1}{R_e} = \frac{3}{12}$$

$$\frac{1}{R_e} = \frac{1}{4}$$

$$R_e = \frac{1}{\frac{1}{4}} \text{ k}\Omega$$

- (b) Current passing through each of the resistance.

we know

$$I = \frac{V}{R}$$

Current passing through

$$R_1 = I_1 = \frac{V}{R_1}$$

$$R_1 = \frac{V}{I_1}$$

putting the value

$$I_1 = \frac{6}{6k\Omega}$$

$$I_1 = \frac{6}{6 \times 10^3}$$

$$I_1 = 1 \times 10^{-3}$$

$$I_1 = 1 \times 10^{-3} \text{ A}$$

$$\boxed{I = 1 \text{ mA}}$$

Current passing through $R_2 = I_2 = \frac{V}{R_2}$

$$I_2 = \frac{V}{R_2}$$

$$I_2 = \frac{6}{12 k\Omega}$$

$$I_2 = \frac{6}{12 \times 10^3}$$

$$I_2 = \frac{1}{2} \times 10^{-3}$$

$$I_2 = 0.5 \times 10^{-3} \text{ A}$$

$$\boxed{I = 0.5 \text{ mA}}$$

- (c) Potential difference across each of the resistance.

The resistance are connected in parallel

∴ The potential difference across each of the resistance would be equal & the potential of battery.

14.7: An electric bulb is marked with 220 V, 100 W. find the resistance of the filament of the bulb. If the bulb is used 5 hours daily, find the energy in

kilowatt-hour consumed by the bulb in one month (30 days).

Ans. Power of the electric bulb = $p = 100 \text{ w}$

Voltage of the electric bulb = $v = 220 \text{ v}$

Time used by the bulb daily = 5 hours.

Days in which bulb used light = 30 days

Total time used = $5 \times 30 = 150 \text{ hours}$ (in 30 days)

(i) Resistance of filament of bulb = $R = ?$

(ii) Energy in kilo-watt hours consumed by the bulb in one month = $E = ?$

(i) Resistance of filament of bulb

we know

$$P = \frac{V^2}{R}$$

$$R = \frac{V^2}{P}$$

putting the value

$$R = \frac{(220)^2}{100}$$

$$R = \frac{48400}{100}$$

$$R = 484 \Omega$$

(ii) Energy in kilo-watt hours consumed by the bulb in one month

we know

$$E = Pt$$

putting the value

$$E = (100 \text{ w}) 150 \text{ h}$$

$$E = 15 \times 100 \text{ wh}$$

$$\boxed{E = 15 \text{ k Wh}} \quad \text{Ans.}$$



SECTION I**MULTIPLE CHOICE QUESTIONS****CHAPTER 15****ELECTROMAGNETISM****PCTB EXERCISE**

- ♦ Choose the correct answer from the following choices:
- Which statement is true about the magnetic poles?
 - Unlike poles repel
 - like poles attract
 - magnetic poles do not effect each other
 - (d)** a single magnetic pole does not exist
 - What is the direction of the magnetic field lines inside a bar magnet?
 - from north pole to south pole
 - (b)** from south pole to north pole
 - from side to side
 - there are no magnetic field lines
 - The presence of a magnetic field can be detected by a
 - small mass
 - stationary positive charge
 - stationary negative charge
 - (d)** magnetic compass
 - If the current in a wire which is placed perpendicular to magnetic field increases, the force on the wire
 - (a)** increases
 - decreases
 - remains the same
 - will be zero
 - A D. C motor converts
 - mechanical energy into electrical energy
 - mechanical energy into chemical energy
 - (c)** electrical energy into mechanical energy
 - electrical energy into chemical energy
 - Which part of a D.C motor reverses the direction of current through the coil every half-cycle?
 - the armature
 - the commutator
 - (c)** the brushes
 - the slip rings

- The direction of induced e.m.f. in a circuit is in accordance with conservation of
 - mass
 - charge
 - momentum
 - (d)** energy
- The step-up transformer
 - increases the input current
 - (b)** increases the input voltage
 - has more turns in the primary
 - has less turns in the secondary coil
- The turn ratios of a transformer is 10. it means
 - $I_s = 10 I_p$
 - $N_s = N_p / 10$
 - $N_s = 10 N_p$
 - (d)** $V_s = V_p / 10$

FROM PUNJAB BOARDS**(2014, 15, 16, 17, 18 & 19)**

- Which thing works on the principle of electron magnetic induction in hydro electric power house?

(LHR-GI-14)(GUJ-GII-19)(SWL-GI-14)

 - Motor
 - (b)** Generator
 - Galvanic cell
 - Voltaic cell
- If the current in a wire which is placed perpendicular to a magnetic field increase the force on the wire:

(LHR-GII-14)
(SWL-GII-16, 19, GI-17)(BWP-GII-18)(RWP-GI-16)
(FBD-GI-17)(DGK-GI-16, GII-17)(MTN-GI-18)

 - (a)** Increase
 - Decrease
 - Remain same
 - Will be zero
- The presence of a magnetic field can be detected by:

(LHR-GI-14, 15)(GUJ-GI-16)
(RWP-GI-14, 17, GII-15)(MTN-GI-16, 17)
(SGD-GII-14)(BWP-GI-16)(SWL-GII-17, GI-19)

 - small mass
 - stationary positive charge
 - Stationary negative charge
 - (d)** Magnetic compass
- Turn ratio in a transformer is 1:100 it mean that:

(LHR-GI-16)(GUJ-GII-14, GI-15)
(BWP-GII-17)(RWP-GII-14, 16)(DGK-GI-14)

 - (a)** $V_s = V_p / 100$
 - $N_s = 10NP$
 - $N_s = \frac{N_p}{100}$
 - $I_s = 10/P$
- Michael faraday belonged to:

(LHR-GI-15)
(a) British (b) U.S.A (c) K.S.A (d) Russia

6. **The step up transformer:** (LHR-GI-16)
(FBD-GI-14, 19, GII-16)(SGD-GI-II-15,16, GI-18)
(a) Decreases the input current
(b) Increase the input voltage
(c) Has more turns in secondary coil
(d) Has less turns in primary coil
7. **Transformer is used for:** (LHR-GI-16)(GUJ-GII-16)
(a) Increase voltage (b) Increase resistance
(c) Both a & B (d) None of these
8. **Transformer is used to change the value of:** (LHR-GI-17)(MTN-GII-14, 15)
(BWP-GI-14,15)(FBD-GI-18)(SWL-GII-17)
(a) Charge (b) Energy
(c) Power (d) Voltage
9. **The principle of working of transformer is:** (LHR-GI-17)(BWP-GII-16)
(a) Self Induction (b) Electromagnetism
(c) Mutual Induction (d) Electrostatics
10. **Which part of a D.C motor reverses the direction of current through the coil every half-cycle?** OR
Part of D.C motor reverses the direction of current flowing the coil every half cycle.
(LHR-GI-18)(BWP-GII-14)(RWP-GII-17, 19)
(MTN-GI-14, GII-16, GI-II-19)(FBD-GII-15, GI-16)
(SGD-GI-II-17, GI-19)(SWL-GII-14, 15)
(a) Armature (b) Commutator
(c) Brushes (d) Slip rings
11. **One volt is equal to:** (LHR-GI-18)
(a) 1 J/C (b) 1 J/C^{-1}
(c) 1 J/C^2 (d) 1 NC^{-1}
12. **A device which converts electrical energy into mechanical energy is called:** (LHR-GI-18)(DGK-GI-18)
(a) D.C. motor (b) Generator
(c) Transformer (d) All of these
13. **The direction of induced e.m.f. in a circuit is in accordance with conservation of:** (LHR-GI-19)(GUJ-GI-14, GII-17)(RWP-GII-17)
(SGD-GI-14, GII-17)(DGK-GI-II-19)
(a) mass (b) charge
(c) momentum (d) energy
14. **The Laws of electromagnetic induction and electrolysis were presented by.** (GUJ-GII-15, 17)(BWP-GI-19)(SWL-GI-15)
(a) Simon ohm (b) George coulomb
(c) Neton (d) Michael Faraday

15. **A device which is used to increase the alternating voltage is called:** (GUJ-GI-17)(SWL-GI-18)
(a) motor (b) generator
(c) transformer (d) voltmeter
16. **The turn ratios of a transformer is 10. It means** (LHR-GI-19)(GUJ-GII-18)
(FBD-GI-16)(SWL-GI-17)
(a) $I_s = 10 I_p$ (b) $N_s = \frac{N_p}{10}$
(c) $N_s = 10 N_p$ (d) $V_s = \frac{V_p}{10}$
17. **The transformer works on the principle of** (GUJ-GI-18)
(a) mutual induction (b) D.C motor
(c) A.C generator (d) self induction
18. **A device which is used to increase or decrease the alternation voltage is called:** (MTN-GI-15, 17)(FBD-GI-15)
(a) transformer (b) motor
(c) generator (d) voltmeter
19. **The study of magnetic effects of current is called:** (MTN-GII-18)
(a) Electrostatics (b) Magnetism
(c) Electricity (d) Electromagnetism
20. **When number of turns in primary coil is greater than secondary coil. This transformer is called:** (BWP-GII-15)
(a) step up (b) step down
(c) step up down (d) up and down
21. **Step up transformer has:** (BWP-GI-16)
(a) $V_s > V_p$ (b) $V_s < V_p$
(c) $V_s = V_p$ (d) $I_s = I_p$
22. **An example of Mutual Induction is:** (BWP-GI-18)
(a) A.C. Generator (b) D.C. Motor
(c) Transformer (d) Relay
23. **Which statement is true about magnetic poles?** (FBD-GI-17)(DGK-GII-16, 17)
(b) unlike poles repel
(b) like poles attract
(c) a single magnetic pole does not exist
(d) magnetic poles do not effect each other
24. **The study of magnetic effect of current is called:** (DGK-GI-15)(FBD-GII-17)
(a) electricity (b) electromagnetism
(c) magnetism (d) electric capacity

25. Temporary magnet which causes to flow current through a coil is: (FBD-GII-18)
 (a) Magnetic field (b) Electric intensity
 (c) Magnet (d) Electromagnet
26. Michael Faraday belonged to: (RWP-GI-14)
 (a) British (b) U.S.A
 (c) K.S.A (d) Russia
27. On which principle induced e.m.f is produced in the secondary coil. (RWP-GI-14)
 (a) Mutual induction (b) Self induction
 (c) Electric induction (d) Induced current
28. An electric current in conductors is due to the flow of: (RWP-GII-16)
 (a) Positive ions (b) Negative ions
 (c) Positive charges (d) Free electrons
29. Who presented the laws of electromagnetic induction and electrolysis? (RWP-GI,II-18)
 (a) Ohm (b) Newton
 (c) Coulumb (d) Faraday
30. Which device is based by the principle of electromagnetism? (RWP-GII-18)(DGK-GII-15)
 (a) T.V (b) Electric motor
 (c) C.D's (d) Mobile phone
31. MRI helps in diagnose the disorder of: (RWP-GI-18)
 (a) Brain (b) Eye
 (c) Ear (d) Kidney
32. The transformer works on: (SGD-GI-15)
 (a) principle of mutual induction
 (b) principle of D.C motor
 (c) principle of A.C generator
 (d) principle of self induction
33. A Temporary magnet which causes to flow current through a coil is: (DGK-GII-18)
 (a) Magnetic field (b) Electric intensity
 (c) Magnet (d) Electromagnet
34. A device which is used to increase the alternating voltage is called: (SWL-GI-18)
 (a) transformer (b) motor generator
 (c) generator (d) voltmeter
35. A strong _____ field lies in Faraday Cage. (GUJ-GII-19)(FBD-GII-19)
 (a) electric (b) magnetic
 (c) geometric (d) gravitational

36. For an ideal transformer, we can write that: (GUJ-GI-19)(FBD-GII-19)

$$\frac{V_P}{V_S} = \frac{I_P}{I_S}$$

$$\frac{V_S}{V_P} = \frac{I_P}{I_S}$$
 (a) $\frac{V_P}{V_S} = \frac{I_P}{I_S}$ (b) $\frac{V_S}{V_P} = \frac{I_P}{I_S}$
 (c) $\frac{V_S}{I_S} = \frac{I_P}{V_P}$ (d) $\frac{V_S}{I_S} = \frac{I_P}{V_P}$
37. Lenz's law is a manifestation of the law of: (FBD-GII-19)
 (a) Mass conservation
 (b) Energy conservation
 (c) Momentum conservation
 (d) Charge conservation
38. For an ideal transformer: (SGD-GII-19)
 (a) $P_P = P_S$ (b) $P_P < P_S$
 (c) $P_P > P_S$ (d) $P_P \neq P_S$

SECTION II

SHORT QUESTIONS ANSWERS

PCTB EXERCISE

NO PCTB SHORT QUESTIONS

FROM PUNJAB BOARDS

(2014, 15, 16, 17, 18 & 19)

1. What do you mean by electromagnetic induction?
 OR Define electromagnetic induction.
 (LHR-GI-16, GII-19)(MTN-GI-14)
 (DGK-GII-14)(BWP-GII-15, 19, GII-17)
 (RWP-GI-14, 18, GII-17)(SGD-GI-17, 19)
- Ans. electromagnetic induction: The process of generating an induced current in a circuit by changing the number of magnetic lines of force passing through it is called electromagnetic induction.
2. Define Lenz's law. OR State Len's laws.
 (LHR-GI-14, 19, GII-17, 18)(MTN-GI,II-17)
 (BWP-GI-19)(GUJ-GII-18)(RWP-GI-14, 17, GII-18)
 (SGD-GII-14, 17)(DGK-GI-19)
- Ans. Lenz's Law: The direction of an induced current in a circuit is always such that it opposes the cause that produces it.
3. How many coils are used in a transformer? (LHR-GI-14)
- Ans. A transformer has two coils:
 (i) Primary coil (ii) Secondary coil

4. What is difference between step-up and step-down transformer?

(LHR-GII-15, GI-19)(GUJ-GI-19)(BWP-GI-19)
(MTN-GII-15)(SGD-GII-16)(FBD-GI-17)
(DGK-GII-17, 19)(SWL-GII-15, GI,II-17)

Ans. Step-up Transformer:

If the secondary voltage is larger than the primary voltage, the transformer is called a step up transformer.

Step-down-Transformer:

If the secondary voltage is smaller than the primary voltage, the transformer is called step down transformer.

5. State right hand rule.

(LHR-GI-17, GII-19)(BWP-GII-14)
(FBD-GII-18)(RWP-GII-19)

Ans. Grasp a wire with your right hand such that your thumb is pointed in the direction of current. Then curling fingers of your hand will point in direction of magnetic field.

6. Define electromagnet.

OR What do you mean by electromagnet.

(LHR-GI-17)(FBD-GII-19)

Ans. The type of temporary magnet, which is created when current flows through a coil, is called an electromagnet.

7. Describe Fleming's Left hand rule.

OR State Fleming's left hand rule.

(LHR-GII-18)(GUJ-GI-19, GII-15)(MTN-GI-16)
(BWP-GI-15, GII-16)(FBD-GI-15, GII-19)
(RWP-GI-15, 17)(SGD-GII-16, GII-19)
(DGK-GII-17)(SWL-GII-14, GI-17)

Ans. Fleming's Left hand rules: Stretch the thumb, forefinger and the middle finger of the left hand mutually perpendicular to each other. If the forefinger points in the direction of the magnetic field, the middle finger in the direction of the current, then the thumb would indicate the direction of the force acting on the conductor.

8. What is meant by Step Down Transformer.

(LHR-GI-18)(MTN-GI-14)(RWP-GII-17)

Ans. Step-down-Transformer:

If the secondary voltage is smaller than the primary voltage, the transformer is called step down transformer.

9. What is mutual induction?

OR Define mutual induction? (GUJ-GI-16)

(FBD-GI,II-15, GI-16, 19, GII-17)
(RWP-GII-14,15,18, GI,II-19)(BWP-GI-17)
(MTN-GII-15,16,17)(SWL-GII-17, GI-19)
(DGK-GII-14,16,19, GI-17, GII-18)

Ans. The phenomenon of production of induced current in one coil due to change of current in a neighbouring coil is called mutual induction.

10. What is transformer? On what principle it works? (BWP-GII-19)

(GUJ-GII-14, 16, GII-18)(MTN-GI-15)

Ans. Transformer: Transformer is an electrical device which is used to increase or decrease the value of an alternating voltage.

Principle: It works on the principle of mutual induction.

11. What is relay?

OR What is relay? Write its use.

(GUJ-GI,II-14, GII-15)(MTN-GII-18)(SWL-GI-19)

Ans: A relay is an electrical switch that opens and closes under. The control of another electrical circuit.

The relay is used to control a large current with the help of a small current.

12. What is meant by Solenoid?

(GUJ-GI-18)(MTN-GII-18)(FBD-GI-17)

Ans. A coil of wire consisting of many loops is called is solenoid.

13. Define the strength of magnetic field.

(GUJ-GI-18)

Ans. The strength of magnetic field is defined as number of magnetic lines of force passing through any surface.

The number of line of force is maximum when the surface is held perpendicular to the magnetic lines of force. It will be minimum when surface is held parallel to the magnetic lines of force.

14. Prove for an ideal transformer that $\frac{V_p}{V_s}$

$$= \frac{I_s}{I_p} \quad (\text{MTN-GII-14})$$

Ans. For an ideal transformer we know that power of secondary coil = Power of primary coil.

$$P_p = P_s$$

Because $P = IV$

Then $= I_p V_p = I_s V_s$

$$\frac{V_p}{V_s} = \frac{I_s}{I_p}$$

15. Name the types of Transformer.

(MTN-GII-17)

Ans. (i) Step-up Transformer

(ii) Step-down Transformer

16. How can we find the direction of magnetic field by using right hand rule?

(BWP-GII-14, GI-16)

Ans. The direction of the magnetic field is governed by the direction of the current flowing through the conductor. A simple method of finding the direction of magnetic field around the conductor is the Right Hand Grip Rule.

Grasp a wire with your right hand such that your thumb is pointed in the direction of current. Then curling fingers of your hand will point in the direction of the magnetic field.

17. Define electromagnetism.

(BWP-GII-16)(FBD-GII-17)

Ans. Electromagnetism is the study of magnetic effects of current. The use of electromagnetism in different fields of science and technology is very wide. Motors and electric meters are based on the effect of magnetism.

18. How many coils are used in a Transformer? Write their name.

(BWP-GII-17)

Ans. A transformer has two coils electrically insulated from coil other but wound around the same iron core. One coil is called the primary coil. The other coil is called the secondary coil.

19. What is the role of relay in a circuit?

OR What is the function of relay.

OR What is relay? Write its use.

(FBD-GII-18)(SWL-GI-19)

Ans. The relay is used to control a large current with the help of a small current.

A relay is an electrical switch that opens and close under the control of another electrical circuit.

20. Define electric motor.

(RWP-GI-16)

Ans. Electric motor: Electric motor is a device that converts electric energy into rotational kinetic energy.

21. Can transformer work on direct current?

(RWP-GII-16, GI-17)

Ans. No, a standard, transformer cannot work with direct current.

22. What is the magnetic resonance imaging.

(RWP-GI-18)

Ans. Weak ionic current in our body that travels along the nerves can produce the magnetic effect. This forms the basis of obtaining images of different parts of body. This is done using the technique called Magnetic Resonance Imaging (MRI).

23. Why voltages produce when conductor moved in magnetic field?

(SGD-GII-14)

Ans. When a conductor move in magnetic field, the magnetic lines of forces changes which included voltages.

24. Define Electromagnetic Induction.

(SGD-GI-17)

Ans. The process of generating an induced current in a circuit by changing the number of magnetic lines of force passing through it is called electromagnetic induction.

25. What is meant by armature?

(DGK-GII-18)

Ans. In a practical electric motor, the coil called armature is made of many loops mounted on a shaft or axle.

26. State right hand rule?

(SWL-GII-14)

Ans. Grasp a wire with your right hand such that your thumb is pointed in the direction of current. Then curling fingers of your hand will point in direction of magnetic field.

27. Describe Faraday's law about electromagnetic induction.

(SWL-GI-15)

Ans. The value of induced e.m.f. in a circuit is directly proportional to the rate of change of number of magnetic lines of force through it.

28. What is meant by Solenoid?

(SWL-GI-17)

Ans. A coil of wire consisting of many loops is called solenoid.

29. How can the total force acting on the armature in D C motor can be increased.

(SWL-GII-19)

Ans.

(i) In creasing the number of turns of the coil.

- (ii) In creasing the current in the coil.
- (iii) In creasing the strength of the magnetic field.
- (iv) In creasing the Area of the coil.

30. Define Faraday's Law of electro-magnetic induction, also state at least one factor affecting induced e.m.f.

(SGD-GII-19)

Ans. The value of induced e.m.f. in a circuit is directly proportional to the rate of change of number of magnetic lines of force through it.

The magnitude of induced e.m.f in a circuit depends on the following factors:

- Speed of relative motion of the coil and the magnet.
- Number of turns of the coil.

31. What is meant by an ideal transformer?

(SWL-GII-19)

Ans. In an ideal transformer, the electric power delivered to the secondary circuit is equal to the power supplied to the primary circuit. An ideal transformer dissipates no power itself, and for such a transformer we can write.

$$P_P = P_S$$

$$V_P I_P = V_S I_S$$

32. Len's Law is a manifestation of the Law of conservation of energy, why?

(SWL-GII-19)

Ans. If we apply the law of conservation of energy to electromagnetic induction, we realize that the electrical energy induced in a conductor comes from the kinetic energy of the moving magnet. We do some work on the magnet to bring it close to the solenoid. This work consequently appears as electrical energy in the conductor. Thus, mechanical energy of our hand used to push the magnet towards or away from the coil results into electrical energy. Hence, Len's law is a manifestation of the law of conservation of energy.

33. Describe the construction of Transformer. (DGK-GI-19)

Ans. A transformer has two coils, electrically insulated from each other, but wound around the same iron core, one coil is called the primary coil. The other coil is called the secondary coil. Numbers of turns on the primary and secondary coils are represented by M_p and N_s respectively.

34. What is Transformers? Write its types.

(DGK-GII-19)

Ans. Transformers are used to increase or decrease AC voltages.

Types:

- (i) Step-up transformer
- (ii) Step down transformer
- (iii) Ideal transformer

35. What is the function of Relay?

(MTN-GII-19)

Ans. The relay is a electrical switch used to control a large current with the help of a small current.

36. Can a transformer work on direct current.

(LHR-GII-19)

Ans. No transformer does not work on direct current. It works on the transformer is a practical application of mutual induction.

SECTION III

LONG QUESTIONS

FROM PUNJAB BOARDS

(2014, 15, 16, 17, 18 & 19)

- 15.1. Demonstrate by an experiment that a magnetic field is produced around a straight current-carrying conductor.
- 15.3. You are given an unmarked magnetized steel bar and bar magnet, its north and south ends are marked N and S respectively. State how you would determine the polarity at each end of the unmarked bar?

- 15.7. Describe a simple experiment to demonstrate that a changing magnetic field can induce e.m.f in a circuit.
- 15.9. Describe the direction of an induced e.m.f. in a circuit? How does this phenomenon relate to conservation of energy?
- 15.11. What do you understand by the term mutual induction?
- 15.12. What is a transformer? Explain the working of a transformer in connection with mutual induction.

CONCEPTUAL QUESTIONS

- 15.1. Suppose someone handed you over three similar iron bars and told you one was not a magnet, but the other two were. How would you find the iron bar that was not a magnet?
- 15.2. Suppose you have a coil of wire and a bar magnet. Describe how you could use them to generate an electric current.

SECTION IV

SOLVED NUMERICALS

PCTB EXAMPLES

Examples 15.1: If a transformer is used to supply voltage to a 12 V model train which draws a current of 0.8 A. Calculate the current in the primary if the voltage of the a.c. source is 240V.

Solution: Given that, $V_p = 240$ V

$$V_s = 12$$
 V

$$I_s = 0.8$$
 A

$$I_p = ?$$

By law of conservation of energy,

Input power of the primary = Output power of the secondary

$$\text{i.e., } I_p V_p = I_s V_s$$

$$\text{Therefore, } I_p = \frac{I_s V_s}{V_p} \text{ or } I_p = \frac{(12 \text{ V})(0.8 \text{ A})}{240 \text{ V}} = 0.04 \text{ A}$$

PCTB NUMERICAL PROBLEMS

15.3: A step-down transformer has a turns ratio of 100 : 1. An ac voltage of amplitude 170 V is applied to the primary. If the current in the primary is 1.0 mA, what is the current in the secondary?

Ans. Turn ratio of a step-down transformer = 100:1

No of turn in the primary coil = 100

No of turn in the secondary coil = 1

The voltage applied to the battery = $V_p = 170$ V

Current of primary coil = 1.0 mA

Current of secondary coil = ?

we know

$$\frac{V_s}{V_p} = \frac{N_s}{N_p} \quad \text{--- (i)}$$

$$V_p I_p = V_s I_s \quad \text{--- (ii)}$$

from (i)

$$\frac{V_s}{V_p} = \frac{N_s}{N_p}$$

$$V_s = \frac{N_s V_p}{N_p}$$

putting the value

$$V_s = \frac{1 \times 170}{100}$$

$$V_s = 1.7$$

using the formula. (ii)

Find the value of current of secondary coil.

$$V_p I_p = V_s I_s$$

$$I_s = \frac{V_p I_p}{V_s}$$

putting the value

$$I_s = \frac{170 \times 1 \times 10^{-3}}{1.7}$$

$$I_s = 100 \times 1 \times 10^{-3}$$

$$I_s = 10^2 \times 10^{-3}$$

$$I_s = 10^{2-3}$$

$$I_s = 10^{-1}$$

$$I_s = 0.1 \text{ A} \quad \text{Ans.}$$

15.4: A transformer, designed to convert the voltage from 240 V a.c mains to 12 V, has 4000 turns on the primary coil. How many turns should be on the secondary coil? If the transformer were 100% efficient, what current would flow through the primary coil when the current in the secondary coil was 0.4 A?

Ans. The primary voltage of the transformer is $V_p = 240\text{v}$

The secondary voltage of the transformer = $V_s = 12\text{v}$

No of the turn in the primary coil = $N_p = 4000$

Current in the secondary coil = $I_s = 0.4\text{ A}$

The no of turn in the secondary coil = $N_s = ?$

The current is flowing in primary coil = $I_p = ?$

we know

$$\frac{V_s}{V_p} = \frac{N_s}{N_p} \quad \text{--- (i)}$$

$$V_p I_p = V_s I_s \quad \text{--- (ii)}$$

using the formula (i)

$$\frac{V_s}{V_p} = \frac{N_s}{N_p}$$

$$N_s = \frac{V_s \times N_p}{V_p}$$

putting the value

$$N_s = \frac{V_s \times N_p}{V_p}$$

$$N_s = \frac{12 \times 4000}{240} = 200$$

$$N_s = 200$$

Now we find primary current.

$$V_p I_p = V_s I_s$$

$$I_p = \frac{V_s I_s}{V_p}$$

putting the values

$$I_p = \frac{12 \times 0.4}{240}$$

$$I_p = 0.02\text{ A} \quad \text{Ans.}$$

15.5: A power station generates 500 MW of electrical power which is fed to a transmission line. What current would flow in the transmission line, if the input voltage is 250 kV?

Ans. Generated electric power of the power station $\approx 500\text{ mw}$

Input voltage = $V = 250\text{kv}$

Amount of current flows in the transmission = ?

we know

$$R = \frac{V}{I} \quad \text{--- (i)}$$

$$P = I^2 R \quad \text{--- (ii)}$$

putting the value R eq (i) from eq (ii)

$$P = I^2 R$$

$$P = I^2 \left(\frac{V}{I} \right)$$

$$P = IV$$

we find out the current is flowing.

As we that

$P = IV$	$M = 10^6$
$I = \frac{P}{V}$	$K \approx 10^3$

putting the values

$$I = \frac{500\text{ mw}}{250\text{ kv}}$$

$$I = \frac{500 \times 10^6}{250 \times 10^3}$$

$$I = 2 \times 10^{-6-3}$$

$$\boxed{I = 2 \times 10^3\text{ A}} \quad \text{Ans.}$$

SECTION I**MULTIPLE CHOICE QUESTIONS****CHAPTER 16****BASIC ELECTRONICS****PCTB EXERCISE**

- ♦ Choose the correct answer from the following choices:

iii. The logical operation performed by this gate is

- (a) AND (b) NOR
(c) **NAND** (d) OR

iv. AND gate can be formed by using two

- (a) NOT gates (b) OR gates
(c) NOR gates (d) **NAND gates**

v. The output of a two-input Nor gate is 1 when:

- (a) A is '1' and B is '0'
(b) Both A and B are '0'
(c) **A is '0' and B is '1'**
(d) both A and B are '1'

vi. If $X = A.B$, then X is '1' when:

- (a) A and B are '1' (b) A or B is '0'
(c) A is '0' and B is '1'
(d) A is '1' and B is '0'

vii. The output of a NAND gate is '0' when

- (a) both of its inputs are '0'
(b) both of its inputs are '1'
(c) any of its inputs is '0'
(d) any of its inputs is '1'

FROM PUNJAB BOARDS**(2014, 15, 16, 17, 18 & 19)**

1. The output of OR gate will be 0 when.

(LHR-GI-14)(MTN-GII-15)

- (a) **A = 0 and B = 0** (b) A = 1, B = 1
(c) A = 0, B = 1 (d) A = 1, B = 0

2. The biggest achievement of electronics is:

(LHR-GII-14)

- (a) calculator (b) transistor
(c) **computer** (d) mobile phone

3. If $X = A.B$, then X is '1' when:

(LHR-GII-16)(SWL-GI-17, GII-18, 19)(GUJ-GI-16)
(SGD-GI-15, GII-16)(MTN-GI-16, GII-19)
(DGK-GI-14, 15)(BWP-GII-14)(RWP-GI-18)

- (a) A = 1, B = 1 (b) A = 0, B = 0
(c) A = 0, B = 1 (d) **A = 1, B = 0**

4. The equation of Not Operation is:

(LHR-GI-16)

- (a) $X = A.B$ (b) $X = A + B$
(c) $X = A - B$ (d) **$X = \bar{A}$**

5. AND gate can be formed by using two gates:

(GUJ-GII-15, 18, 19)(BWP-GI-17)

(SWL-GI-19)

- (a) NOT gates (b) OR gates
(c) NOR gates (d) **NAND gates**

6. Equation of 'Not' Operation is:

(GUJ-GII-16)

- (a) $X = A.B$ (b) $X = A + B$
(c) **$X = \bar{A}$** (d) $X = \bar{A}.B$

7. The output of NAND gate is 0 when:

(GUJ-GI-17)(MTN-GI-15, GII-19)(BWP-GI-15)
(RWP-GI-17, GII-19)(FBD-GI-16)
(DGK-GI-16, 17)(SWL-GI-14)

- (a) A=0 and B=0 (b) **A=1 and B=1**
(c) A=0 and B=1 (d) A=1 and B=0

8. If $X = A + B$ then X = 0 when:

(MTN-GII-16, 18)

- (a) **A = 0, B = 0** (b) A = 1, B = 1
(c) A = 0, B = 1 (d) A = 1, B = 0

9. Which logical operation is performed by

A  X = A + B
this gate? B

(MTN-GI-18)

- (a) AND (b) NOR (c) **NAND** (d) OR

10. In tungsten filament, the potential given to produce the beam of electron by thermionic.

(BWP-GI-14, GII-16)

- (a) 6v (b) 7v (c) 8v (d) 9v

11. Logic operation performed by the gate

A  X = A + B
B

(FBD-GI-14, GI-17)(SWL-GII-14, GI-15)

- (a) AND (b) NOR
(c) OR (d) **NAND**

12. If $X = A + B$ then $nX = 1$ when:

(FBD-GII-14, GII-17)

- (a) $A = 1$ and $B = 1$ (b) $A = 0$, $B = 0$
(c) $A = 0$, $B = 1$ (d) $A = 1$, $B = 0$

13. The basic operation performed by a computer are:

(FBD-GI-15, GI-16)

- (a) arithmetic operation
(b) logical operation
(c) non arithmetic operation
(d) arithmetic and logical operation

14. Which logical operation is performed by



(RWP-GI-16)

- (a) AND (b) NOR (c) NAND (d) OR

15. The output of a NOR gate is 1 when:

(RWP-GII-17)(DGK-GII-19)

- (a) $A \approx 1$ and $B = 0$ (b) $A = 0$ and $B = 1$
(c) $A = 0$ or $B = 0$ (d) $A = 1$ or $B = 1$

16. Number of input terminals in NOT gate is:

(RWP-GII-18)(GUJ-GII-19)

- (a) 3 (b) 1 (c) 4 (d) 2

17. Equation of "AND" operations is:

(RWP-GII-18)(SGD-GI-16)

- (a) $X = A + B$ (b) $X = A.B$
(c) $X = \bar{A}$ (d) $X = \bar{A.B}$

18. George Boole invented:

(SGD-GII-15)(BWP-GI-19)

- (a) Boolean Algebra
(b) Arithmetic Algebra
(c) Mean Algebra (d) Geometry

19. The output of a NAND gate is '0' when

(SGD-GII-18)

- (a) both of its inputs are '0'
(b) both of its inputs are '1'
(c) any of its inputs is '0'
(d) any of its inputs is '1'

20. The mathematical notation for AND operation is:

(DGK-GI-18)(FBD-GII-19)

- (a) $X = A + B$ (b) $X = \overline{A + B}$
(c) $X = A . B$ (d) $X = \overline{A . B}$

21. The basic logic operation of NOT gate is called:

(SWL-GII-15)

- (a) inversion (b) non-inversion
(c) inversion and non inversion
(d) None of these

22. The logical operation performed by this gate is:

(SWL-GII-15)(DGK-GI-19)



- (a) AND (b) NOT (c) NAND (d) OR

23. Boolean expression of AND operation:

(LHR-GII-19)

- (a) $X = A . B$ (b) $X = A + B$
(c) $X = \bar{A}$ (d) $X = \bar{A . B}$

24. If a metal (Tungsten Filament) is heated to high temperature which of the particles are emitted out?

(GUJ-GI-19)

- (a) electrons (b) protons
(c) neutrons
(d) both protons & neutrons

25. For a NOR gate Output will be "1" when inputs are:

(BWP-GII-19)

- (a) "0" and "1" (b) "1" and "0"
(c) 0 and 0 (d) 1 and 1

26. Which Gate is used in making Burglar Alarm:

(BWP-GII-19)

- (a) OR gate (b) AND gate
(c) NOT gate (d) NAND gate

27. Which of the gate is used to convert one logic level into opposite logic level?

(MTN-GI-19)

- (a) NOT gate
(b) AND gate
(c) OR gate
(d) Both AND and OR gate

28. NOT gate is also called:

(SGD-GII-19)

- (a) Conductor (b) Amplifier
(c) Transistor (d) Inverter

29. Boolean expression of NOR Gate:

DGK-GII-19)

- (a) $X = A.B$ (b) $X = \overline{A + B}$
(c) $X = \bar{A}$ (d) $X = \bar{A . B}$

30. The particles emitted from a hot metal surface are:

(SWL-GI-19)

- (a) positive ions (b) negative ions
(c) electrons (d) protons

SECTION II**SHORT QUESTIONS ANSWERS****PCTB EXERCISE****PCTB NO SHORT QUESTIONS****FROM PUNJAB BOARDS****(2014, 15, 16, 17, 18 & 2019)**

1. What is meant by analogue and digital electronics? (LHR-GII-14)(MTN-GII-19)

(FBD-GII-18)(BWP-GI-14, GII-15, 19)

(DGK-GI-14)(SWL-GI-14)(RWP-GII-18, 19)

Ans. Analogue Electronics: The branch of electronics consisting of circuits which process analogue quantities is called analogue electronics. For instance, the public address system is an analogue system.

Digital Electronics: The branch of electronics which deals with digital quantities is called digital electronics. Digital electronic use only two digits 0(zero) and 1(one) and whole data is provided in binary form.

2. Define digital electronics.

(LHR-GI-16, GII-18)(RWP-GII-17)

(SGD-GI-17)(GUJ-GI-18)

Ans. The branch of electronics which deals with digital quantities is called digital electronics. Digital electronic use only two digits 0(zero) and 1(one) and whole data is provided in binary form.

3. Make the symbol diagram and truth table of AND gate.

(LHR-GII-14)(DGK-GI-14)

Ans.

Table		
A	B	$X = A.B$
0	0	0
0	1	0
1	0	0
1	1	1

4. Make the Truth Table for Nor Gate.

(LHR-GI-14)

Ans.

A	B	$X = A+B$
0	0	1
0	1	0
1	0	0
1	1	0

5. Define electronics. (LHR-GI-17)
(GUJ-GII-17)(FBD-GI-16)(DGK-GI-17)(SWL-GII-17)

Ans. Electronics is that branch of applied physics which deals with the control of motion of electrons using different devices. Electronic devices being more effective and reliable have revolutionized the fields of telecommunication and information technology.

6. Differentiate between digital and analogue quantities.

(LHR-GII-17)(GUJ-GI,II-14)

Ans. Analogue quantities: The quantities whose value vary continuously or remain constant are known as analogue quantities.

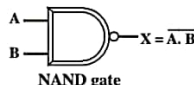
- (i) Temperature of air (ii) Pressure
(iii) Time (iv) Distance

Digital quantities: The quantities whose values vary in non-continuous manner are called digital quantities. Digital quantities are expressed in the form of digits or numbers.

Digital electronic use only two digits 0(zero) and 1(one) and whole data is provided in binary form.

7. Draw diagram of NAND Gate and write its truth table.

(LHR-GI,II-18)(MTN-GII-14)

Ans.**NAND gate**

A	B	$X = \overline{A.B}$
0	0	1
0	1	1
1	0	1
1	1	0

8. What is analogue electronics?

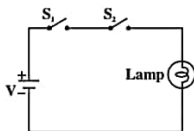
(GUJ-GII-15)(DGK-GII-17)(FBD-GI-14, GII-18)

Ans. The branch of electronics consisting of circuits which process analogue quantities is called analogue electronics.

For instant the public address system is an analogue system.

9. Draw the circuit diagram of AND operation.

(GUJ-GI,II-16)

Ans.**10. Define truth table.**

(GUJ-GII-17)

Ans. The truth table are tables which give the values of the input and outputs of the basics types of logic gates or combination of such gates.

Definition: The electronic circuit which implement the operation is known as OR gate.

11. Define OR gate, write its truth table.**OR Definition**

(GUJ-GII-17)

Ans. Truth Table.

Table		
A	B	$X = A+B$
0	0	0
0	1	1
1	0	1
1	1	1

12. Differentiate between ADC and DAC?

(MTN-GI-14)(FBD-GII-14, GII-19)

(DGK-GII-16, GI-19)

Ans. ADC: A special circuit which converts analogue signal into a digital one in the form of digits in binary form. This circuit is known as analogue to digital converter (ADC).

DAC: This binary output is then processed by a computer which also gives output in digital form. The output of the computer is again converted into an analogue form by a circuit known as digital to analogue

converter (DAC). As the output of DAC is an analogue signal, it can be readily sensed by us.

13. What are the three Universal Logic Gates?

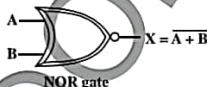
(MTN-GII-15)(SGD-GI-14)

Ans. The universal logic gates are:

(i) AND gate (ii) OR gate (iii) Not gate

14. Draw symbol for Nor gate.

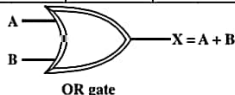
(MTN-GII-16)

Ans.**15. Write the truth table of OR-Gate and also draw. Their symbol diagram.**

(MTN-GII-17)

Ans.

Table		
A	B	$X = A+B$
0	0	0
0	1	1
1	0	1
1	1	1

**OR gate****16. Write the names of the factors increasing thermionic emission.**

OR Name two factors which can enhance Thermionic Emission.

(BWP-GII-14, GI-18)(SGD-GI-14)

Ans. Thermionic emission depends upon the following factors:

- (i) Temperature (ii) Voltage
(iii) Natural of metal

17. Define analogue quantities and give an example?

(BWP-GII-16)(RWP-GI-19)

Ans. The quantities shoes value vary continuously or remain constant are known as analogue quantities.

- (i) Temperature of air (ii) Pressure
(iii) Time (iv) Distance

18. Describe the uses of digital electronics?

(BWP-GII-14)(RWP-GI-17)

Ans. Modern telephones system, radar system, naval and other systems of military importance, devices to control the operation of industrial machines, medical equipments and many household appliances are using digital technology.

19. What is NAND Gate? Write its truth Table.

(BWP-GI-17)

Ans. **NAND GATE:** NAND operation is simple an AND operation followed by a NOT operation. For example, NAND gate is obtained by coupling a NOT gate with the output terminal of the AND gate (Fig.)

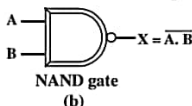


Table		
A	B	$X = \overline{A \cdot B}$
0	0	1
0	1	1
1	0	1
1	1	0

20. State Mathematical Formula Nor gate.

(BWP-GII-17)

Ans. Its Boolean expression is

$$X = A + B$$

21. Write the names of basics operations of digital electronics.

(FBD-GI-17)

Ans. (1) AND Operation. (2) OR operation.
(3) Not operation.

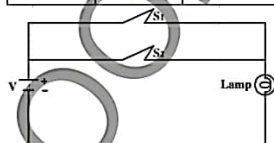
22. Define Digital quantities.

(FBD-GII-17)(DGK-GII-17)

Ans. **Digital quantities:** The quantities whose values vary in non-continues manner are called digital quantities. Digital quantities are expressed in the form of digits or numbers.

23. Write the truth table of OR gate and also draw their circuit diagram.**Ans.**

Table		
A	B	$X = A + B$
0	0	1
0	1	0
1	0	0
1	1	0

**24. Give truth table of AND gate.**

(RWP-GI-18)

Ans.

Table		
A	B	$X = A \cdot B$
0	0	0
0	1	0
1	0	0
1	1	1

25. Write the use of logic gates. Give an example.

(SGD-GI-16)(MTN-GI-19)

We can use logic gates in electronic circuits to do useful tasks. These circuits usually use light depending resistors (LDRs) to keep inputs Low.

We can use the logic gates in House Safety Alarm.

26. Make the symbol diagram and truth table of AND gate.

(SGD-GI-17)

Ans.

Table		
A	B	$X = A \cdot B$
0	0	0
0	1	0
1	0	0
1	1	1



27. What does A.D.C stands for?

OR ADC Stands for. (DGK-GI-16)

Ans. Analogue to digital converter.

28. What is meant by binary variable?

(DGK-GII-16)

Ans. A switch has only two possible states. It could be either open or closed. Similarly, a given statement would be either true or false.

29. What is meant by logic states?

(DGK-GII-14, GI-18)

Ans. A switch has only two possible states. It could be either open or closed. Similarly, a given statement would be either true or false. Such things which can have only two possible states are known as binary variables. The states of binary variables are usually represented by the digits '0' and '1'.

30. Define analogue quantities and give an example? (DGK-GII-17)

Ans. The quantities whose value vary continuously or remain constant are known as analogue quantities.

(i) Temperature of air

(ii) Pressure

(iii) Time (iv) Distance

31. Write the truth table of NAND gate.

(LHR-GI-19)

H	B	$X = A \cdot B$
0	0	1
0	1	1
1	0	1
1	1	0

32. How can you compare the logic operation $X = A \cdot B$ with usual operation of multiplication. (FBD-GI-19)

Ans. When we multiply the number with '0' the answer is zero

Example:

$$4 \times 0 = 0$$

$$X = A \cdot B$$

$$A = 0$$

$$B = 1$$

$$X = 0 \times 1 = 0$$

33. Draw a symbol of Not gate and also write its Truth Table. (MTN-GII-19)

Ans. Symbol



X	$X = A$
0	1
1	0

34. Define Analogue quantities. (SGD-GI-19)

Ans. The quantities whose values vary continuously are known as analogue quantities.

Example:

Temperature, time, pressure, distance, etc.

35. Write the truth table of 'AND' operation.

Ans.

A	B	$X = A \cdot B$
0	0	0
0	1	0
1	0	0
1	1	1

36. Draw the truth table of NAND operation. (SWL-GII-19)

Ans.

A	B	$X = \overline{A \cdot B}$
0	0	1
0	1	1
1	0	1
1	1	0

37. What is meant by analogue to digital converter (ADC)? (SWL-GII-19)

Ans. A special circuit which converts the analogue signal into a digital one in the form of digits in binary form. This circuit is known as analogue to digital converter ADC.

SECTION III**LONG QUESTIONS****FROM PUNJAB BOARDS****(2014, 15, 16, 17, 18 & 19)**

- Write down the expression and truth table of NOR gate. (LHR-GII-14)
- What is the difference between analogue and digital quantities? Write the two examples of each also. (LHR-GI-16)(GUJ-GI-16)
- What do you understand by digital and analogue quantities. (LHR-GII-15)(RWP-GII-16)
- Define NAND gate, draw its symbol and write its truth table. (LHR-GI-17), MTN(GII-19)
- What are the uses of logic gates. (GUJ-GII-14)
- Write down the symbols of AND operation and OR operation also write the truth table. (MTN-GII-14)
- What is meant by NOR gate. Explain it with diagram and truth table. (MTN-GII-15)
- Define OR operation. Given its truth table. (MTN-GI-16)
- Explain NAD gate and draw its truth table. (BWP-GII-15)
- Define OR operation. Give its truth table. (BWP-GII-16)
- Write down the benefits of using Digital Electronics Over Analogue Electronics. (BWP-GII-17)
- Write down the expression and truth table of NOR gate. (FBD-GI-14)
- What are the uses of logic gates. (FBD-GI-14)
- Draw the circuit diagram of OR operation and write its truth table. (FBD-GI-16)
- Explain OR operation. Write also symbol and truth table of OR gate. (FBD-GII-16)(GUJ-GII-19)(BWP-GII-19)
- Draw the circuit diagram and the truth table of OR gate. (RWP-GI-16)
- What is OR-gate? Draw its symbolic diagram and truth table. (RWP-GII-16)
- Write down some benefits of using digital electronics over analogue electronics. Explain. (DGK-GII-19)
- Differentiate between analogue and digital electrons. (DGK-GII-16)
- What is electron gun? Describe the process of thermionic emission. (DGK-GII-14, GI-16)
- What do you understand by Analogue and Digital Quantities? (SWL-GI-16)
- NAND gate is the reciprocal of AND gate. Discuss. (SWL-GII-16)
- Draw the circuit diagrams of AND operation and OR operation and also write the truth table of both these operations. (LHR-GII-19)
- Draw the circuit diagram of a burglar alarm and explain its working. (GUJ-GI-19)
- What are the three universal log gates? Give their symbols. (FBD-GI-19)
- Explain AND operation and write the truth table of AND gate. (SWL-GII-19)

SECTION IV**SOLVED NUMERICALS****PCTB NUMERICAL PROBLEMS****NO PCTB EXAMPLES AND PROBLEMS**

SECTION I**MULTIPLE CHOICE QUESTIONS****CHAPTER 17****INFORMATION AND
COMMUNICATION
TECHNOLOGY****PCTB EXERCISE**

♦ Choose the correct answer from the following choices:

i. In computer terminology information means

- (a) any data (b) raw data
(c) processed data (d) large data

iii. The basic operations performed by a computer are

- (a) arithmetic operations
(b) non-arithmetic operations
(c) logical operations
(d) both (a) and (c)

vi. From which of the following we can get information almost about everything.

- (a) book (b) teacher
(c) computer **(d) internet**

vii. What does the term e-mail stand for?

- (a) emergency mail **(b) electronic mail**
(c) extra mail (d) external mail

FROM PUNJAB BOARDS**(2014, 15, 16, 17, 18 & 19)**

1. What does the term e-mail stand for?

- (LHR-GI-14, 18, GII-16) (GUJ-GI-17, GII-18)
(MTN-GI-17) (BWP-GII-14) (SGD-GII-15)
(SWL-GI-14, 16, 18) (RWP-GII-16, GI-18)
(DGK-GI-14, GII-17, 18)
(a) Electronic mail (b) Emergency mail
(c) Extra mail (d) External mail

2. A mega byte has how many kilo bytes?

- (LHR-GI-14, 16) (GUJ-GII-16, GI-17) (FBD-GII-16)
(a) 1004 (b) 1014
(c) 1024 (d) 1034

3. In computer terminology information means.

- (LHR-GI-14) (GUJ-GII-14, GI-16, 17) (FBD-GI-17)
(MTN-GII-19) (DGK-GI-14, 17, 18) (RWP-GI-14, 17)
(a) Any data (b) Raw data
(c) Processed data (d) Large data

4. e-mail is abbreviation of: (LHR-GI-16)

- (a) Emergency mail **(b) Electronic mail**
(c) Urgent mail (d) None of these

5. From which of the following you can get information almost about everything:

- (LHR-GI-15) (FBD-GII-17) (RWP-GI-16, GII-17)
(DGK-GII-17, GI-18) (BWP-GI-15) (SWL-GI-17, 18)
(FBD-GI-19) (DGK-GII-19)
(a) Book (b) Teacher
(c) Computer **(d) Internet**

6. 1 kb = ?: (LHR-GII-15)

- (a) 1024 byte** (b) 1024 Kb
(c) 1024 bits (d) None of these

7. One byte is equal to: (LHR-GI-17)

- (MTN-GII-14) (GUJ-GI-15, 16) (FBD-GI-18)
(SGD-GII-19) (SWL-GI-19) (BWP-GI-19)
(a) 4 bits (b) 6 bits
(c) 8 bits (d) 10 bits

8. One mega byte has many kilobytes:

- (GUJ-GI-17)
(a) 1024 (b) 1014
(c) 1004 (d) 1034

9. The basic operations performed by a computer are:

- (GUJ-GII-18) (MTN-GI-14)
(BWP-GII-18, 19) (FBD-GII-16)
(a) arithmetic operations
(b) non arithmetic operations
(c) logical operations
(d) both a & c

10. In computer terminology the word machinery refers to: (LHR-GI-17) (MTN-GII-14)

- (BWP-GI-15) (RWP-GI-15, GII-16, GI-17)
(a) Software **(b) Hardware**
(c) Data (d) Procedure

11. 1 Kilo byte is equal to: (MTN-GII-18)

- (a) 1024 Bytes** (b) 1000 Bytes
(c) 1002 Bytes (d) 1010 Bytes

12. Working Principle of Telephone is similar to: (BWP-GII-16)

- (a) Type Writer (b) E-mail
(c) Computer **(d) Telegraph**

13. 1024 bytes are equal to: (FBD-GI-17)

- (a) 1 KB (b) 1 MB (c) 1 GB **(d) 1 mB**

14. E-mail is the abbreviation of: (FBD-GII-18)

- (a) Extra mail (b) Emergency mail
(c) Electronic mail (d) Electrical mail

15. 1024 kilo bytes are equal to:

(RWP-GI-14, GII-18)

- (a) 1 PB (b) 1 TB (c) 1 GB (d) 1 MB

16. Microwaves are used in? (SGD-GI-14)

- (a) Radio (b) T.V
(c) Mobile phone (d) All these

17. 1 mega byte is equal to:

(SGD-GII-18)(DGK-GI-16)

- (a) 1024 KB (b) 1034 KB
(c) 1044 KB (d) 1054 KB

18. In computer terminology information means: (DGK-GI-18)

- (a) Any data (b) Raw data
(c) Processed data (d) Large data

19. Information storage device working on different principles use: (SWL-GII-16)

- (a) electronics (b) magnetism
(c) laser technology (d) all of these

20. "Optical Fibres" work on the principle of ____: (BWP-GI-19)

- (a) Reflection (b) Refraction
(c) Diffraction
(d) Total Internal Reflection

21. How many metal rods in radio station transmission antenna are? (FBD-GI-19)

- (a) 8 (b) 6 (c) 4 (d) 2

SECTION II

SHORT QUESTIONS ANSWERS

PCTB EXERCISE

NO PCTB SHORT QUESTIONS

FROM PUNJAB BOARDS

(2014, 15, 16, 17, 18 & 19)

1. Define Telecommunication.

(LHR-GI-14, 18, 19, GII-15)(BWP-GI-14)

(GUJ-GII-17, GI-18)(SGD-GI-17, GII-19)

(DGK-GII-15) (SWL-GI-17)

Ans. The method that is used to communicate information to far off places instantly is called telecommunication.

2. Define information and communication technology. (LHR-GI-15, GII-18)

(MTN-GI-14)(RWP-GII-14,15)(SWL-GI-14)

Ans. Information and communication technology (ICT) is defined as the scientific methods and means to store, process and transmit vast amounts of information in seconds with the help of electronic equipments.

3. What is the relation between information technology and telecommunication?

OR Define information technology and telecommunication.

(LHR-GII-14, GI-17)(BWP-GII-18)(RWP-GII-19)

Ans. Information Technology: The scientific method used to store information, to arrange it for proper use and to communicate it to there is called information technology.

Telecommunication: The method that is used to communicate information to far off places instantly is called telecommunication.

4. Define Data Managing?

(LHR-GII-15, GI-18)(FBD-GII-15)

(DGK-GII-14, GI-15)(SWL-GII-17)(MTN-GI-18)

Ans. To collect all information regarding a subject for any purpose and to store it in the computer in more than one inter linked files which may help when needed, is called 'data managing'.

5. What is meant by global web?

(LHR-GI-16)

Ans. Internet is a global web of more than several million nets in which more than 50 million computers are operating and several millions people participate through the world. The number is increasing day by day. Contact can be made at any time during the day or night on internet.

6. Write two advantages of E-mail?

(LHR-GI-14, 18, GII-17)(MTN-GI-II-19)

(GUJ-GII-18, GII-19)(BWP-GII-15,16,17, GI-19)

(RWP-GII-15)(DGK-GII-17)(SWL-GI-17)

Ans. Advantages of e-mail are as follow

(i) **Fast Communication:** We can send messages anywhere in the world instantly.

(ii) **Cost Free Service:** If we have an internet access then we can avail the e-mail service free of cost.

7. What do you mean by software.

(LHR-GI-17, GII-18)(MTN-GI-15)

(SGD-GII-19)(SWL-GI-16)(DGK-GI-17)

Ans. Software: Software refers to the instruction, or programs, that are installed in the hardware to perform different tasks, Window and Linux operating system (OS) are examples of software's.

8. Define Data? (LHR-GII-17)

(RWP-GI-18)(SWL-GII-14)

Ans. Data: Data are facts that are used by programs to produce useful information.

9. What is meant by optical fibre?

(LHR-GII-18)

Ans. An optical fibre with a coating of lower refractive index is a thin strand of high-quality glass that absorbs very little light. An optical fibre cable is a bundle of glass fibres with thickness of a human hair.

10. What is the difference between data and information? (DGK-GI-18)(SGD-GI-19)

(GUJ-GI-14,16,17)(FBD-GI-14, GI,II-15, GI-18)

(RWP-GI-14, GII-16)(MTN-GI-16,17, GII-18)

Ans. Data: Data are facts that are used by programs to produce useful information.

Information: In computer terminology, processed data is called information.

11. State two uses of Internet?**OR Write two services of internet.**

(GUJ-GII-14,15,17,19)(BWP-GII-19)

Ans. 1. The function allows users to view web pages using a web browser.

2. This function allows us to send and receive text message.

12. Write two services of internet?

(LHR-GI-16)(DGK-GI-18)(FBD-GI-16)

Ans. The main services used on the internet include.

(i) **Web browsing:** This function allows users to view web pages.

(ii) **E-mail:** E-mail Allows people to send and receive text message.

13. What is meant by ICT in information and communication technology.

(MTN-GII-16)

Ans. ICT is basically an electronic based system of information transmission reception, processing and retrieval. ICT is a blend of two fields information technology and telecommunications.

Definition: The scientific methods means to store process and transmit vast amount of information in seconds with the help of electronic equipments.

14. How Light signal are sent through optical Fibre.

(MTN-GII-17)(FBD-GII-18)(DGK-GII-18)

Ans. Light that enters the core at one end of the optical fibre goes straight and hits the inner wall (the cladding) of fibre optics. If the angle of incidence with cladding is less than the critical angle, some of the light will escape the fibre optics and is lost. However, if the angle of incidence is greater than the critical angle, light is totally reflected into the fibre optics.

15. Write down two uses of Microwaves?

(BWP-GII-16)

Ans. (i) Transmission of cell phone through microwaves.

(ii) The use of microwave in communication satellites.

16. What is E-commerce? (FBD-GI-16)

Ans. E-commerce is the way of doing business on the web. For example we can order our favourite booth or any other items on-line.

17. What is meant by internet? (RWP-GI-16)

Ans. Internet is a network of networks, which spreads all across the globe.

18. What is difference between web-browsing and e-mail? (RWP-GII-18)

Ans. Web-Browsers: A browser is an application which provides a window to the Web. All browsers are designed to display the pages of information located at Web sites around the world.

Electronic Mail: One of the most widely used application of internet is electronic mail (or e-mail), which provides very fast delivery of messages to any enabled site on the Internet. Communication through e-mail is more quick and reliable.

19. Define operating system and give examples? (SGD-GH-16)

Ans. The operating system (OS) is software that manages your computer and the devices connected to it. Two well known operating systems are Windows and Linux operating system.

20. Define information technology. (DGK-GH-16, GI-18)

Ans. The Scientific method used to store information, to arrange it for proper use and to communicate it to others. Is called information technology.

21. What is meant by information and communication technology. In computer terminology. (SWL-GH-19)

Ans. Processed data is called information computer processes the data and then vests it into useful information. This information is transmuted distant places in the form sound, picture and computerized data.

22. BSC and MSc stand for what. (SWL-GI-19)

Ans. BSC cell and Base station.
MSC mobile switching center.

23. How can you define the term ICT? (SWL-GH-19)

Ans. Information and communication Technology (ICT) is basically on electronic based system of information transmission reception, processing and retrieval. ICT is a blend of two field information technology and telecommunication.

24. Write the storage capacity of compact disc (CD) and DVD. LHR (GH-19)

Ans. A CD can store ever 680 megabyte of computer data. A DVD the same size as traditional CD, is able to store upto 17 gigabytes of data.

25. What is meant by procedures (CBIS)? FBD(GI-19)

Ans. These are set of instruction and rules to design and use information system. These are written in manuals and documents for use. These rules or methods may change from time to time. The Information System must be flexible to incorporate these changes.

SECTION III

LONG QUESTIONS

FROM PUNJAB BOARDS

(2014, 15, 16, 17, 18 & 19)

17.1. What is difference between data and information?

17.2. What do you understand by Information and communication Technology (ICT)?

17.3. What are the components of information technology? Clearly indicate the function of each component.

17.7. How are light signals sent through optical fibre?

17.11. What is Internet? Internet is a useful source of knowledge and information. Discuss.

SECTION IV

SOLVED NUMERICALS

PCTB NUMERICAL PROBLEMS

NO PCTB EXAMPLES AND PROBLEMS



SECTION I**MULTIPLE CHOICE QUESTIONS****CHAPTER 18****ATOMIC AND
NUCLEAR PHYSICS****PTCB EXERCISE**

- ♦ Choose the correct answer from the following choices:
- Isotopes are atoms of same element with different
 - atomic mass
 - atomic number
 - number of protons
 - number of electrons
 - One of the isotopes of uranium is $^{238}_{92}\text{U}$. The number of neutrons in this isotope is
 - 92
 - 146
 - 238
 - 330
 - Which among the following radiations has more penetrating power?
 - a beta particle
 - a gamma ray
 - an alpha particle
 - all have the same penetrating ability
 - What happens to the atomic number of an element which emits one alpha particle?
 - increases by 1
 - stays the same
 - decreases by 2
 - decreases by 1
 - The half-life of a certain isotope is 1 day. What is the quantity of the isotope after 2 days?
 - one-half
 - one-quarter
 - one-eighth
 - none of these
 - When Uranium (92 protons) ejects a beta particle, how many protons will be in the remaining nucleus?
 - 89 protons
 - 90 protons
 - 91 protons
 - 93 protons
 - Release of energy by the Sun is due to
 - nuclear fission
 - nuclear fusion
 - burning of gases
 - chemical reaction
 - When a heavy nucleus splits into two lighter nuclei, the process would
 - release nuclear energy
 - absorb nuclear energy
 - release chemical energy
 - absorb chemical energy

- The reason carbon-dating works is that
 - Plants and animals are such strong emitters of carbon-14
 - after a plant or animal dies, it stops taking in fresh carbon-14
 - there is so much non-radioactive carbon dioxide in the air
 - when plants or animals die, they absorb fresh carbon-14

FROM PUNJAB BOARDS**(2014, 15, 16, 17, 18 & 19)**

- The half life of plutonium $^{236}_{94}\text{Pu}$ in year is? (LHR-GI-14)
 - 0.858
 - 1.85
 - 2.85
 - 3.85
- What happens to the atomic number of an element which emits an alpha particle: (LHR-GII-14)(FBD-GI-18)
 - Increase by one
 - Stays the same
 - Decrease by 2
 - Decrease by 1
- To diagnose the brain tumour, it is used: (LHR-GI-17)(MTN-GII-14)
 - Iodine – 131
 - Phosphorus – 32
 - Cobalt – 60
 - Carbon – 40
- In which process sun gains energy: OR Release of energy by the sun is due to. (LHR-GI-16)(FBD-GI-19)(SGD-GII-19)(SWL-GII-19)
 - Nuclear fission
 - Nuclear fusion
 - Burning of gases
 - Chemical reaction
- Generally an atom is represented by the symbol: (LHR-GI-15)(BWP-GI-14)(FBD-GII-15)
 - x
 - $^A_Z X$
 - $^A_Z Y$
 - X^A
- Safe limit of radiation exposure in one year is: (LHR-GI-15)
 - 4 rem
 - 5 rem
 - 6 rem
 - 8 rem
- Isotopes are atoms of same elements whose _____ is different: (GUJ-GI,II-15)
 - atom mass
 - atomic
 - No of proton
 - No of atoms
- Half life of 14 carbon is: (GUJ-GI-15) (LHR-GII-15)(FBD-GI-16, GII-17) (RWP-GI,II-16)(SWL-GII-16,17,18)(SGD-GII-15)
 - 7530 years
 - 5730 years
 - 5370 years
 - 3750 years
- Half life of hydrogen is: (GUJ-GI-16)
 - 12.3 years
 - 5730 years
 - 30 years
 - 2.85 years

10. Particle in the nucleus of an atom are:

(GUJ-GII-16)

- (a) protons (b) electrons
☒ (c) protons and neutrons
 (d) electrons and neutrons

11. Release of energy by the Sun is due to

(GUJ-GII-18)(SWL-GI-14)(MTN-GI-17)

(BWP-GI-15)(SGD-GII-14)

- (a) nuclear fission ☒ (b) nuclear fusion
 (c) burning of gases (d) chemical reaction

12. The half life of lead is:

(GUJ-GI-18)(RWP-GI-15)

- (a) 8.07 hours ☒ (b) 10.6 hours
 (c) 10.25 hours (d) 12.25 hours

13. One of the isotopes of Uranium is $^{238}_{92}\text{U}$. The number of Neutron in this isotope is:

(MTN-GI-16)(RWP-GII-17)(BWP-GII-15, 18)

(SWL-GI-19)

- (a) 92 ☒ (b) 146 (c) 238 (d) 330

14. The number of Neutrons in Tritium (^3_1H) is:

(MTN-GII-16)

- (a) 1 ☒ (b) 2 (c) 3 (d) 4

15. When uranium (92 protons) ejects a beta particle _____ protons will be in the remaining nucleus:

(MTN-GI-15)

(LHR-GI-19)(BWP-GI-14, 16)(FBD-GI-15)(DGK-GII-16)

- (a) 90 (b) 91 (c) 92 ☒ (d) 93

16. The number of Neutrons in C_6^{12} is:

(MTN-GII-18)

- (a) 18 (b) 12 ☒ (c) 6 (d) 2

17. When a heavy nucleus splits into two lighter nuclei, then process would:

(MTN-GI-18)(BWP-GI-18)

- (b) Releases nuclear energy
☒ (b) Absorb nuclear energy
 (c) Release chemical energy
 (d) Absorb chemical energy

18. In $^{235}_{92}\text{U}$, 92 is the number of:

(FBD-GII-14)(DGK-GII-18)

- ☒ (a) Protons (b) Neutrons
 (c) Protons and neutrons
 (d) Neutrons and electrons

19. Isotopes of hydrogen are: (FBD-GII-16)

- (a) 2 ☒ (b) 3 (c) 4 (d) 5

20. The half life of a certain isotope is 1 day. What will be the quantity of isotope after 2 days? (FBD-GI-17)(SGD-GI-14, GII-17)

- (a) one half ☒ (b) One quarter
 (c) $\frac{1}{8}$ (d) none of these

21. The number of Neutrons in Tritium (^3_1H) is: (FBD-GII-18)(DGK-GII-18)

- ☒ (a) 2 (b) 3 (c) 4 (d) 5

22. Atomic mass number can be found by relation: (RWP-GII-14)

- (a) $Z - A$ (b) $A + N$ ☒ (c) $Z + N$ (d) $Z + A$

23. Half life of Iodine I_{53}^{131} is: (RWP-GII-18)

- (a) 10.5 Days ☒ (b) 8.07 Days
 (c) 12.5 Days (d) 16.9 Days

24. The temperature at center of sun is:

(RWP-GI-18)

- ☒ (a) 20MK (b) 2MK (c) 24MK (d) 25MK

25. Alpha (' α ') particles have charge.

(SGD-GI-16)

- (a) Negative (b) Neutral
☒ (c) Positive (d) None of these

26. The half life of radium-226 is:

(SGD-GII-16)(SWL-GII-16)

- (a) 4000-Years (b) 2800-Years
☒ (c) 1620-Years (d) 5730-Years

27. The proton is heavier than an electron:

(DGK-GI-14)

- ☒ (a) 1836 (b) 1863 (c) 1870 (d) 1800

28. Isotopes are atoms of same element with different: (DGK-GI-16, GII-18)

- (a) Atomic number (b) number of protons
☒ (c) Atomic mass (d) number of electrons

29. During natural radio activity how many types of radiation are emitted: (DGK-GI-15)

- (a) 1 (b) 2 ☒ (c) 3 (d) 4

30. The half life of carbon-14 is: (DGK-GI-15)

- (a) 1646 years ☒ (b) 5730 years
 (c) 5000 years (d) 1900 years

31. One of the isotopes of Uranium is $^{238}_{92}\text{U}$. The number of neutrons in this isotope is

(MTN-GII-19)(DGK-GI-18)

- (a) 92 ☒ (b) 146 (c) 238 (d) 330

32. Half-life of isotope of cobalt $^{60}_{27}\text{Co}$:

(LHR-GII-19)

- (a) 30 years (b) 20 years (c) 15 years (d) 10 years

33. If we burn one tonne of coal then about _____ energy is released: (GUJ-GII-19)

- (a) 0.6×10^{10} J (b) 1.6×10^{10} J
(c) 2.6×10^{10} J (d) 3.6×10^{10} J

34. Which of the following option is a stream of high energy electrons? (GUJ-GI-19)

- (a) alpha particles (b) beta radiations
(c) gamma radiations (d) positive ions

35. During the Fission Reaction of 1 Kg of Uranium - 235, amount of energy is released: (BWP-GI-19)

- (a) 4.7×10^{11} J (b) 5.7×10^{11} J
(c) 6.7×10^{11} J (d) 7.7×10^{11} J

36. In Beta Decay, Nucleon Number changes by: (BWP-GII-19)

- (a) Decreases by 4 (b) Increases by 4
(c) Remains unchanged (d) Decreases by 2

37. The Isotopes of Iodine 131 is used in the treatment of: (MTN-GI-19)

- (a) Blood Cancer (b) Bone Cancer
(c) Lungs Cancer (d) Thyroid Cancer

38. The temperature at the center of the sun is nearly _____ million Kelvin. (FBD-GI-19)

- (a) 20 (b) 30 (c) 40 (d) 50

39. Radiations present in atmosphere due to different radioactive substances are called: (SGD-GI-19)

- (a) Beta Radiation (b) Alpha Radiation
(c) Background radiation
(d) Cosmic Radiation

40. $^{194}_{84}\text{Po}$ (DGK-GII-19)

- (a) 0.8 Seconds (b) 0.9 Seconds
(c) 0.7 Seconds (d) 0.6 Seconds

SECTION II

SHORT QUESTIONS ANSWERS

PCTB EXERCISE

NO PCTB SHORT QUESTIONS

FROM PUNJAB BOARDS

(2014, 15, 16, 17, 18 & 19)

1. What is atomic number? (LHR-GI-16,17)

Ans. Atomic number: The number of protons present inside a nucleus is called the charge number or the atomic number and denoted by the letter Z.

2. What is atomic mass number?

(LHR-GII-14)(RWP-GII-14, GI-16,18)(DGK-GII-15)

Ans. Atomic Mass: The sum of neutrons and protons present in a nucleus is called its atomic mass number. It is denoted by the letter A. i.e. $A = Z + N$.

3. Define Isotopes? (LHR-GI-16, GII-15,18)

(DGK-GII-15)(GUJ-GI-14)(FBD-GII-17)

(RWP-GII-14)(SGD-GI-17)(MTN-GII-17, 18)

(SWL-GII-14, GI-15)

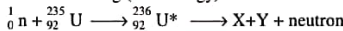
Ans. The atoms of same element with some atomic number but different atomic mass number are called isotopes.

4. Define Fission Reaction.

(LHR-GI-14, GII-17)(SWL-GI-15)

(GUJ-GII-18)(DGK-GI-18)

Ans. Nuclear fission takes place when a heavy nucleus, such as U-235, splits, or fissions, into two smaller nuclei by absorbing a slow moving (low-energy) neutron.

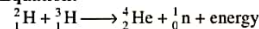


5. Write equation?

OR Define the nuclear fusion and Write equation. (LHR-GI-14, GI-18)(DGK-GI-16)

Ans. When two light nuclei combine to form a heavier nucleus, the process is called nuclear fusion.

Equation:



6. Define Half life? (LHR-GI-17,18)

(MTN-GII-15, GI-18)(FBD-GI-14, 18)(LHR-GI-17)

(GUJ-GI-18)(RWP-GI-14, 16)(SGD-GI-15)

Ans. The time during which half of the unstable radioactive nuclei disintegrate is called the half-life of the samples of radioactive element.

7. Define radioactive isotopes. (LHR-GI-17)

Ans. The stable and non-radioactive element can also change into radioactive element by bombarding them with protons, neutrons or alpha particle. Such artificially produced radioactive element called radioactive isotopes or radio isotopes.

8. What do you mean by Carbon Dating. Give example one.

(LHR-GI-17,18)(MTN-GI-18)

Ans. The age of a dead human, animal or trees can be estimated by comparing the activity of carbon-14 in the live and dead tree. This technique is called carbon dating.

Example:

When a tree dies, the radio carbon-14 present inside the plant starts decaying. Since the half-life of carbon-14 is 5730 years, the age of a dead tree can be calculated by comparing the activity of carbon-14 in the live and dead tree.

9. Write two uses Radio Isotopes?

(LHR-GII-17,18, GI-17, 19)(RWP-GII-18)
(RWP-GII-18)(SGD-GI-15, GII-19)(FBD-GI-14)
(GUJ-GI-17, 18)(SWL-GI-14, GII-17)

Ans. (i) Radioactive cobalt-60 is used for curing cancerous tumors and cells.

(ii) The diagnosis of brain tumor phosphorous-32 is used.

10. Write two characteristics of β particles. (LHR-GI-18)(BWP-GI-18)(MTN-GI-16, GI-19)(RWP-GII-17)

Ans. (i) Beta radiation is a stream of high-energy electrons.

(ii) Beta radiation have negative charge.

11. Define atom and write its basic particles? (GUJ-GI-16)

Ans. Atom: Atom is an indivisible particle of matter.

Basic Particles of atom: (i) Electron
(ii) Neutrons (iii) Proton.

12. Define atomic number and atomic mass number?

(GUJ-GII-14)(BWP-GI-17, GII-15)(SGD-GII-19)
(RWP-GI-16, 18)(DGK-GII-14, 17)(MTN-GII-17)

Ans. Atomic Number: The number of protons present inside a nucleus is called the charge number or the atomic number and is denoted by the letter z .

Atomic Mass Number: The sum of neutrons and protons present in a nucleus is called its atomic mass number. It is denoted by the letter A .

13. What is meant by Artificial Radio Activity? (GUJ-GI-14)(MTN-GI-14)

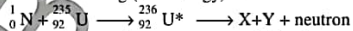
Ans. Nuclides which are not radioactive naturally, the scientists make them radioactive in lab by bombardment electrons on them and they emit radiation. it is called Artificial radio activity.

14. Define Fission Reaction.

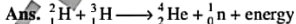
OR Define nuclear fission reaction and write its equation.

(GUJ-GI-14, GII-18)(RWP-GII-17, 19)

Ans. Nuclear fission takes place when a heavy nucleus, such as U-235, splits, or fissions, into two smaller nuclei by absorbing a slow moving (low-energy) neutron.

**15. Write equation for nucleus fusion?**

(GUJ-GI-14, GII-17)



Example: If an atom of deuterium is fused with an atom of tritium, then a Helium nucleus or alpha particle is formed as given.

16. Write down two properties of Gamma radiation? (GUJ-GII-17)

Ans. Electromagnetic radiation of very short wavelength. Their wavelengths and energies can vary. High energy gamma rays can penetrate at least 30 cm of lead or 2 km of air.

17. Define Atomic number. Write its symbol. (GUJ-GII-17)(SGD-GII-15)

Ans. Atomic number: The atomic number Z is equal to the number of protons in the nucleus.

$$\text{Symbol} = Z$$

18. What is meant by Nuclear Transmutation? OR What do you mean by nuclear transmutation. (GUJ-GI,II-18, GI-17)

(LHR-GII-18)(DGK-GI-14,17,18)(BWP-GII-16)

(MTN-GII-14, GII-17)(FBD-GII-14, GI-17)

(DGK-GII-19)

Ans. The spontaneous process in which a parent unstable nuclide change into a more stable daughter nuclide with the emission of radiations is called nuclear transmutation

- 19. Is it possible for an element to have different types of atoms? Explain:**

(MTN-GII-16)

Ans. Yes, It is possible for an element to have different types of atoms called isotopes.

Definition and example: Isotopes are atoms of an element which have same number of protons but different number of neutrons in their nuclei. Hydrogen have three isotopes (i) Protium (${}^1_1\text{H}$), (ii) Deuterium (${}^2_1\text{H}$), (iii) Tritium (${}^3_1\text{H}$).

- 20. Define Natural Radio Activity.**

(MTN-GI-14)

Ans. The spontaneous emission of radiation by unstable nuclei is called natural radioactivity.

- 21. What is meant by background radiation?**

(LHR-GI-19)(MTN-GI-15,17) (MTN-GI-15, 17)
(BWP-GI-18)(FBD-GI-17)(RWP-GI-19)

Ans. Radiations present in atmosphere due to different radioactive substances are called background radiations.

- 22. Write a note on cosmic Radiation?**

OR What is meant by cosmic. (SWL-GI-19)
(MTN-GII-14, 19)(RWP-GII-17)(DGK-GI-14, 19)

Ans. The Earth, and all living thing on it also receive radiation from outer space. This radiation is called cosmic radiation which primarily consists of protons, electrons, alpha particles and larger nuclei. The cosmic radiation interacts with atoms in the atmosphere to create a shower of secondary radiation, including X-rays, muons, alpha particles, electrons, and neutrons.

- 23. Define ionization?**

(MTN-GI-16)(DGK-GI-17)

Ans. The phenomenon by which radiations split matter into positive and negative ions is called ionization. All three kinds of radiations i.e. alpha, beta and gamma can ionize the matter.

- 24. How long would it take for complete decay of a pure radioactivity.**

(MTN-GII-17)

Ans. A constant fraction of large number of unstable radioactive nuclei decays in a certain time.

- 25. Define Penetrating Power of Radiation.**

(MTN-GII-18)(LHR-GII-14, 15) (BWP-GI-14)
(DGK-GI-15, GII-16)(SGD-GI-14)(BWP-GI-14)
(MTN-GI-15, GII-18)(FBD-GII-17)
(SWL-GI-17)(RWP-GII-16)

Ans. Definition: The strength of radiation to penetrating a certain material is called penetrating power.

The strength of radiations to penetrate a certain material is called penetrating power.

- 26. What is meant by unstable nuclei?**

(BWP-GI-14)

Ans. Those elements which emits radiations naturally are called unstable elements. All elements whose atomic mass is more than 82 are naturally unstable and converted into other elements.

- 27. What are Tracers?** (BWP-GI-16)

Ans. Radioactive tracers are chemical compounds containing some quantity of radioisotope. For example, radio iodine I¹³¹ readily accumulates in the thyroid gland and can be used for the monitoring of thyroid functioning. For the diagnosis of brain tumor phosphorus-32 is used.

- 28. Differentiate between Atomic number and Atomic Mass number.**

(BWP-GI-17, GII-18)(RWP-GI-19)

Ans. Atomic number: The atomic number Z is equal to the number of protons in the nucleus.

Atomic Mass: The atomic mass number A is equal to the number of nucleons (protons + neutrons) in the nucleolus i.e., $A = Z + N$. The mass of neutron is nearly equal to that of proton. So the mass of an atom is nearly equal to the sum of masses of protons and neutrons.

- 29. Write half life of Hydrogen Load, uranium and carbon?** (BWP-GII-17)

Ans. Half life of Hydrogen 12.3 Years
Half life of lead 10.6 Hours
Half life Uranium 4.51×10^9 Years
Half life of carbon 5730 Years

- 30. Define Isotopes?** (FBD-GII-17)

Ans. Isotopes are atoms of an element which have same number of protons but different number of neutrons in their nuclei. Three Hydrogen have three isotopes.

31. Write three isotopes of hydrogen.

OR Write the names of isotopes of hydrogen.

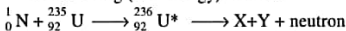
(FBD-GI-18, GII-19)

Ans. Three isotopes of hydrogen are:

1. Protium ${}^1_1\text{H}$
2. Deuterium ${}^2_1\text{H}$
3. Tritium ${}^3_1\text{H}$

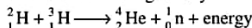
32. Write the equation for nuclear Fission Reaction. (RWP-GI-17)

Ans. Nuclear fission takes place when a heavy nucleus, such as U-235, splits, or fissions, into two smaller nuclei by absorbing a slow moving (low-energy) neutron.



33. Define Nuclear fusion. (RWP-GI-17)
(FBD-GI-19)

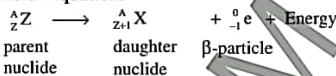
Ans. Nuclear Fusion: When two light nuclei combine to form a heavier nucleus, the process is called nuclear fusion if an atom of deuterium is fused with an atom of Tritium. Then a Helium nucleus or alpha particle is formed as given by:



34. Write general equation and an example of Beta-decay. (GUJ-GI-19)(RWP-GI-17)

Ans. Beta(B)-decay:

General Equation:



Example:



In beta (β)-decay, the parent nuclide has its proton number Z increased by 1 but its mass number or nucleon number A remains unchanged.

35. What is meant by isotopes? Write the names of isotopes of hydrogen.

(RWP-GI-18)

Ans. Isotopes are atoms of an element which have same number of protons but different number of neutrons in their nuclei.

Three isotopes of hydrogen are:

1. Protium ${}^1_1\text{H}$
2. Deuterium ${}^2_1\text{H}$
3. Tritium ${}^3_1\text{H}$

36. Describe two uses of Radio Isotopes in research. (RWP-GII-18)(BWP-GII-19)

Ans. (i) Medical Treatment: Radioisotopes are also used in nuclear medicines for curing various diseases. For example, radioactive cobalt-60 is used for curing cancerous tumors and cells.

(ii) Tracer: Radioactive tracers are chemical compounds containing some quantity of radioisotope.

For example, radio iodine 131 readily accumulates in the thyroid gland and can be used for the monitoring of thyroid functioning. For the diagnosis of brain tumor phosphorous-32 is used.

37. What is difference between natural and artificial radioactivity. (RWP-GII-18)

Ans. Natural radioactivity: The spontaneous emission of radiation by unstable nuclei is called natural radioactivity. And the elements which emit such radiations are called radioactive elements.

Artificial radioactivity: Nuclei which are not radioactive naturally, the scientists make them radioactive in lab by bombardment electrons on them and they emit radiation, it is called Artificial radio activity.

38. Write the particles present in a nucleus? (SGD-GI-16)

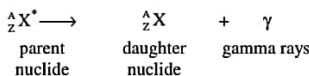
Ans. The nucleus contains protons and neutrons which are collectively called nucleons.

39. Write two properties of alpha radiations. (SGD-GII-16)

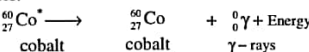
Ans. Alpha particle is a helium nucleus comprising of two protons and two neutrons with a charge of 2e. An unstable nucleus with large protons and neutron decay by e-milling alpha radiation.

40. Explain gamma rays with the help of examples. (SGD-GII-14)(SWL-GII-19)

Ans.



Example:



Gamma rays are usually emitted along with either an alpha or a beta particle.

41. What is difference between stable and unstable nuclei. (SGD-GI-14)

Ans. Stable: Nuclei which do not emit radiations naturally are called stable nuclei most of nuclei with atomic number to 82 are stable nuclei.

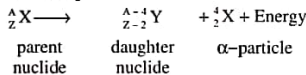
Unstable: Those elements which emits radiations naturally are called unstable elements. All elements whose atomic mass is more than 82 are naturally unstable and converted into other elements.

42. Explain Alpha Decay with Examples.

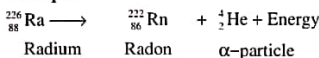
(SGD-GII-17)

Ans. Alpha (α) decay.

General Equation:



Example:



It means in alpha decay, the proton number of atomic number Z of the parent nuclide reduces by 2 and its mass number or nucleon number A decreases by 4.

43. Find the number of protons and neutrons in nuclide defined by ${}^{13}_6 \text{X}$. (DGK-GII-14)

Ans. From the symbol, we have atomic number Z = number of protons = 6 Atomic mass A = number of protons + number of neutrons = 13 But number of protons are 6, so number of neutrons will be 7. So the element is an isotope of carbon-6, and is written as ${}^{13}_6 \text{C}$.

44. Define atomic number and Mass number?

(DGK-GII-15)

Ans. Atomic number: The atomic number Z is equal to the number of protons in the nucleus.

Atomic Mass: The atomic mass number A is equal to the number of nucleons (protons + neutrons) in the nucleolus i.e., $A = Z + N$. The mass of neutron is nearly equal to that of proton. So the mass of an atom is nearly equal to the sum of masses of protons and neutrons.

45. Define Natural Radio Activity?

OR How can you define Natural Radioactivity? (MTN-GII-19)(DGK-GII-14)

Ans. The spontaneous emission of radiation by unstable nuclei is called natural radioactivity. And the elements which emit such radiations are called radioactive elements.

46. What is difference between daughter and parents elements? (DGK-GII-14)

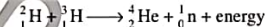
Ans.

Daughter element	Parents element
The elements obtained by parents elements are called daughter elements	The elements from which are radiations emits are called parents element.

47. Write equation for nucleus fusion?

(DGK-GI-16)

Ans. Nuclear Fusion:

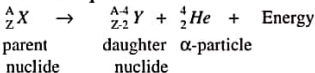


48. Describe α -decay. (DGK-GI-18)

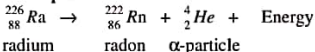
OR What is meant by Alpha Decay? Write its general equation. (SGD-GI-19)

Ans. 1. Alpha (α)-decay

General Equation:



Example:



It means in alpha decay, the proton number or atomic number Z of the parent nuclide reduces by 2 and its mass number or nucleon number A decreases by 4.

49. Define atomic number and Mass number?

(SWL-GI-14, GII-15)

Ans. Atomic number: The atomic number Z is equal to the number of protons in the nucleus.

Atomic Mass: The atomic mass number A is equal to the number of nucleons (protons + neutrons) in the nucleolus i.e., $A = Z + N$. The mass of neutron is nearly equal to that of proton. So the mass of an atom is nearly equal to the sum of masses of protons and neutrons.

50. Describe two uses of Radio isotopes in Medicine. (BWP-GI-19)

Ans. Radio iodine -131 readily accumulates in the thyroid gland and can be used, for the monitoring of thyroid, function. For the diagnosis of brain tumor Phosphorous -32 is used.

51. Draw the diagram of fission chain reaction is U-235. (BWP-GI-19)

Ans. Nuclear fission takes place when a heavy nucleus, such as U-235, splits, or fission's into two smaller nuclei by absorbing a slow moving (low-energy) neutron as represented by the equation:

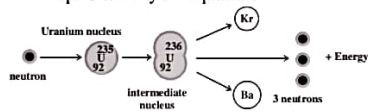
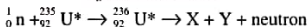


Fig. Nuclear fission reaction



52. Write two properties of α -Particle.

(SWL-GI-19)(RWP-GI-19)

Ans. (i) α -Particles, have the positive charge.
(ii) Alpha particle has a range of only a few centimeters in the air.

53. Define carbon dating? (GUJ-GII-19)

Ans. The age of a dead human, animal or tree can be estimated by comparing the activity of carbon-14 in the live and dead tree. This technique is called carbon dating.

54. How can the scientist estimate died tree age by C-14?

Ans. When a tree dies, the radio carbon-14 present inside the plant starts decaying since the half-life of carbon-14 is 5730 years, the age of a dead can be calculated by comparing the activity of carbon-14 in the live and dead trees. The activity of live tree remains almost constant as the carbon-14 is being replenished. While the carbon-14 in the dead tree is no more replenished.

55. Define atomic mass number.

(DGK-GII-19)

Ans. The nucleus contains protons and neutrons which are collectively called nucleons. The number of nucleons the nucleus is called atomic mass number.

55. Find the number of protons and neutrons in the nuclide defined by ${}_{6}^{13}\text{X}$.

(SWL-GII-19)

Ans. Find the number of protons and neutrons in the nuclide defined by ${}_{6}^{13}\text{X}$.

Sol: From the symbol, we have Atomic number $Z = \text{number of protons} = 6$ Atomic mass $A = \text{number of protons} + \text{number of neutrons} = 13$ But number of protons is 6, so number of neutrons will be 7. So the element is an isotope of carbon-6, and is written as ${}_{6}^{13}\text{C}$.

Example: The nucleus of an atom consists of protons and neutrons.

56. Write the name of isotopes of hydrogen.

(FBD-GII-19)

Ans. (1) Protium ${}_{1}^1\text{H}$
(2) Deuterium ${}_{1}^2\text{H}$
(3) Tritium ${}_{1}^3\text{H}$

57. Who discovered radioactivity.

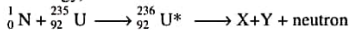
(FBD-GII-19)

Ans. In 1896, Be quarrel accidentally discovered the radioactivity.

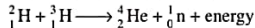
58. Write the difference between fission reaction and fusion reaction.

(LHR-GII-19)

Ans. fission reaction: Nuclear fission takes place when a heavy nucleus, such as U-235, splits, or fissions, into two smaller nuclei by absorbing a slow moving (low-energy) neutron.



fusion reaction: When two light nuclei combine to form a heavier nucleus, the process is called nuclear fusion.



Example: If an atom of deuterium is fused with an atom of tritium, then a Helium nucleus or alpha particle is formed as given.

SECTION III**LONG QUESTIONS****FROM PUNJAB BOARDS****(2014, 15, 16, 17, 18 & 19)**

- 18.1. What is the difference between atomic number and atomic mass number? Give a symbolical representation of a nuclide.
- 18.2. What do you mean by the term radioactivity? Why are some elements radioactive but some are not?
- 18.3. How can we make radioactive elements artificially? Describe with a suitable example.
- 18.4. What are the three basic radioactive decay processes and how do they differ from each other?
- 18.5. Write the alpha decay process for $^{234}_{91}\text{Pa}$. Identify the parent and daughter nuclei in this decay.
- 18.6. Explain whether the atomic number can increase during nuclear decay. Support your answer with an example.
- 18.7. What do you understand by half-life of a radioactive element?
- 18.8. Is radioactivity a spontaneous process? Elaborate your answer with a simple experiment.
- 18.9. What is meant by background radiations? Enlist some sources of background radiations.
- 18.10. Describe two uses of radioisotopes in medicine, industry or research.
- 18.11. What are two common radiation hazards? Briefly describe the precautions that are taken against them.
- 18.12. Complete this nuclear reaction: $^{235}_{92}\text{U} \rightarrow ^{140}_{54}\text{X} + ? + 2\text{}^1_0\text{n}$. Does this reaction involve fission or fusion? Justify your answer.
- 18.13. Nuclear fusion reaction is more reliable and sustainable source of energy than nuclear fission chain reaction. Justify this statement with plausible arguments.

SECTION IV**SOLVED NUMERICALS****PCTB EXAMPLES**

Examples 18.1: Find the number of protons and neutrons in the nuclide defined by $^{13}_6\text{X}$.

Solution: From the symbol, we have

Atomic number Z = number of protons = 6
 Atomic mass A = number of protons + number of neutrons = 13
 But number of protons are 6, so number of neutrons will be 7. So the element is an isotope of carbon-6, and is written as $^{13}_6\text{C}$.

Examples 18.2: The activity of sample of a radioactive bismuth decreases to one-eighth of its original activity in 15 days. Calculate the half-life of the sample.

Solution: Let $T_{1/2}$ is the half-life and A_0 is the original activity of the sample. After time $T_{1/2}$ activity will be $A_0/2$. After $2T_{1/2}$ activity will become $A_0/4$. While after time $3T_{1/2}$, i.e., after three half-lives, the activity will drop to $A_0/8$. It means activity drops to one-eighth of original activity in a time of $3T_{1/2}$.

Therefore, $3T_{1/2} = 15$. This means half-life $T_{1/2}$ of the sample will be 5 days.

PCTB NUMERICAL PROBLEMS

18.1: The half-life of ^{16}N is 7.3 s. A sample of this nuclide of nitrogen is observed for 29.2 s. Calculate the fraction of the original radioactive isotope remaining after this time.

Ans. Half life of $^{16}_7\text{N}$ = 7.35

Time for which nuclide of nitrogen is observed = 29.2s

The fraction of original radioactive isotope remaining this time = ?

Number of half lives for which sample is observed = $\frac{29.2\text{s}}{7.3\text{s}} = 4$

1st half life = $\frac{1}{2}$

Fraction of the original radioactive isotope remaining after

$$2^{\text{nd}} \text{ half life} = \frac{1}{2} \times \frac{1}{2} = \frac{1}{4}$$

Fraction of original radioactive isotope remaining 3^{rd} half life = $\frac{1}{2} \times \frac{1}{2} \times \frac{1}{2} = \frac{1}{8}$

Fraction of original radioactive isotope remaining after 4^{th} half life

$$= \frac{1}{2} \times \frac{1}{2} \times \frac{1}{2} \times \frac{1}{2} \\ = \frac{1}{16}$$

The required fraction of original radioactive isotope after 4^{th} half life is $\frac{1}{16}^{\text{th}}$

18.2: Cobalt-60 is a radioactive element with half-life of 5.25 years. What fraction of the original sample will be left after 26 years?

Ans. Half life of a cobalt - 6 = 5.25 years

Time for which this isotope of cobalt is observed = 26 years

The remaining fraction of cobalt - 60 after 26 years = ?

No of half lives for which sample of Co-60 is observed = $\frac{26}{5.25}$ years = 4.9 year or 5 years

Fraction of remaining Co-60 after 1^{st} half life = $\frac{1}{2}$

Fraction of remaining Co-60 after 2^{nd} half life = $\frac{1}{2} \times \frac{1}{2} = \frac{1}{4}$

Fraction of remaining Co-60 after 3^{rd} half life = $\frac{1}{2} \times \frac{1}{2} \times \frac{1}{2} = \frac{1}{8}$

Fraction of remaining Co-60 after 4^{th} half life = $\frac{1}{2} \times \frac{1}{2} \times \frac{1}{2} \times \frac{1}{2} = \frac{1}{16}$

Fraction of remaining Co-60 after 5^{th} half life = $\frac{1}{2} \times \frac{1}{2} \times \frac{1}{2} \times \frac{1}{2} \times \frac{1}{2} = \frac{1}{32}$

The required fraction of remaining cobalt-60 is $\frac{1}{32}$ th after 5^{th} half life

18.3: Carbon-14 has a half-life of 5730 years. How long will it take for the quantity of carbon-14 in a sample to drop to one-eighth of the initial quantity?

Ans. Half life of carbon-14 = 5730 years

Time which is taken by carbon-14 in a sample drop one-eighth of the initial quantity = ?

Fraction of C-14 after 1^{st} half life = $\frac{1}{2}$

Fraction of C-14 after 2^{nd} half life = $\frac{1}{2} \times \frac{1}{2} = \frac{1}{4}$

Fraction of C-14 after 3^{rd} half-life

$$= \frac{1}{2} \times \frac{1}{2} \times \frac{1}{2} = \frac{1}{8}$$

Number of half life of carbon-14 in a sample to drop one-eighth of initial quantity = 3^{rd} half life years.

Year of 1^{st} half-life of carbon-14 5730 years

$$= 11,460 \text{ years}$$

years of 3^{rd} half-life of carbon-14

$$= 5730 \times 3$$

years 3^{rd} half of carbon = 17190 years

$$= 1.72 \times 10^4 \text{ years}$$

18.5: Half-life of a radioactive element is 10 minutes. If the initial count rate is 368 counts per minute, find the time by which count rate reaches 23 counts per minute.

Ans. Half life of the radio-active element

$$= 10 \text{ minutes}$$

Initial count-rate of the element = 368 counts per minutes

Time for which count rates reader 23 counts per minute = ?

The initial count rate is 360 So

$$368 \xrightarrow{10 \text{ minutes}} 184 \xrightarrow{10 \text{ minutes}} 92$$

$$\xrightarrow{10 \text{ minutes}} 46 \xrightarrow{10 \text{ minutes}} 23$$

- ∴ 4 half-lives for the count rate to decrease from 368 to 23 per minutes

Time taken = number of half lives × duration of half life

putting the value

$$\text{Time taken} = 4 \times 10$$

$$\text{Time taken} = 40 \text{ minutes}$$

- 18.7:** A sample of certain radioactive element has a half-life of 1500 years. If it has an activity of 32000 counts per hour at the present time, then plot a graph of the activity of this sample over the period in which it will reduce to 1/16 of its present value.

- Sol.** Half life radioactive element = 1500 year
activity of counts per hour at the present time = 32000 per hour
plot a graph of the activity of this sample over the period in which it will reduce to $\frac{1}{16}$ of its present value = ?

Activity of counts per hour at the present time = 32000 then

$$32000 \xrightarrow{T_{1/2}} 16000 \xrightarrow{2 T_{1/2}}$$

$$8000 \xrightarrow{3 T_{1/2}} 4000 \xrightarrow{4 T_{1/2}} 2000$$

Fraction of original radioactive isotope remaining after 1st half life ($T_{1/2}$) = $\frac{1}{2}$

Fraction of original radioactive isotope remaining after 2nd half life = $(2 T_{1/2})$

$$= \frac{1}{2} \times \frac{1}{2} = \frac{1}{4}$$

Fraction of original radioactive isotope remaining after 3rd half-life

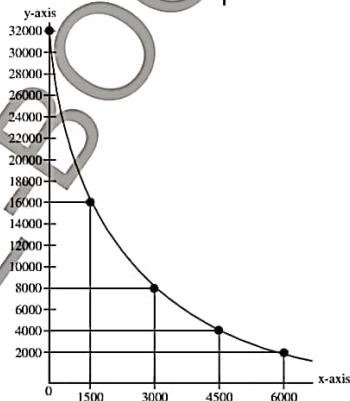
$$= \frac{1}{2} \times \frac{1}{2} \times \frac{1}{2} = \frac{1}{8}$$

Fraction of original radioactive isotope remaining after 4th half life.

$$4T_{1/2} = \frac{1}{2} \times \frac{1}{2} \times \frac{1}{2} \times \frac{1}{2} = \frac{1}{16}$$

Data for graph

count Rat per hours	Time in years
32000 count per hours	1500 years
16,000 count per hours	3,000 years
8,000 count per hours	4,500 years
4,000 count per hours.	6,000 years
2000 count per hours	7500 years



◆ ◆ ◆