

Chapter One: Oscillatory Motion

1. Define periodic Motion?

- Periodic motion is a motion of an object that regularly returns to a given position after a fixed time interval.

2. Define period?

- Period (T): is the time taken to make one complete cycle. SI unit of period is second (s). and it is found by $\frac{\text{Time taken}}{\text{Number of oscillations}}$ or $\frac{1}{f}$

3. Define Frequency?

- Frequency (f): is the number of cycles made in one second. SI unit of frequency is called Hertz (Hz). and it is found by $\frac{\text{Number of oscillations}}{\text{time taken}}$ or $\frac{1}{T}$

4. Define Simple Harmonic motion (SHM)?

- Simple Harmonic motion (SHM) is a motion in which a body moves back and forth over a fixed path, returning to each position and velocity after a definite interval of time

5. Define Simple pendulum?

- Simple pendulum is a mass on the end of a string which oscillates in harmonic motion.

6. State the formulas solving the examples related to this Chapter ?

$$a = -\frac{K}{M}x \quad a = \frac{-kx}{m} \quad K = \frac{F}{x} \quad F = kx \quad K.E = \frac{1}{2}mv^2$$

$$P.E = \frac{1}{2}Kx^2$$

$$\omega = \frac{2\pi}{T} = 2\pi f \quad v = \sqrt{\frac{k}{m}} \sqrt{A^2 - x^2} \quad \omega = \sqrt{\frac{k}{m}}$$

$$T = 2\pi \sqrt{\frac{m}{k}} \quad T = \frac{2\pi}{\omega} \quad f = \frac{\omega}{2\pi} \quad K = \frac{4\pi^2 m}{T^2} \quad m = \frac{KT^2}{4\pi^2}$$

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

a= acceleration **m**= Mass T=time ,f=frequency , $\omega = \text{omega}$,A=amplitude ,
x= displacement **K**= spring constant, $\pi = \text{pi}$,f=force , P.E=potential Energy,
K.E=kinetic Energy

- 7. Example 1:** The suspended mass makes 45 complete oscillations in 15 s. What is the period and frequency of the motion?

Given: Number of oscillations = 30, Time taken= 15s, T=?, f=?

T=time taken/number of oscillation 15/45=0.33S

F=number of oscillations/time taken 45/15=3Hz

- 8. Example2:** A 4-kg mass suspended from a spring produces a displacement of 30 cm. What is the spring constant?

Given :m=4-kg,x=0.3 k=?

K=f/x=4*9.8/0.3=130N/M

- 9. Sample3:** Find the period of simple pendulum with a length of 4000cm.

Given :l=400cm while g=10m/s

$$T = 2\pi \sqrt{\frac{L}{g}} \quad T = 2\pi \sqrt{\frac{4000cm}{10m/s}} = 4\pi \text{ sec}$$

- 10. Sample4:** A block of mass **m** attached at the end of a spring of force constant **100N/m** vibrates in SHM with a frequency of **10/π** Hz. Find the mass of the block.

Solution

$$m = \frac{KT^2}{4\pi^2} = 100(\pi/10)^2 / (4\pi^2) = 0.25\text{kg}$$

Chapter Two: Wave Motion

11. What is wave?

- A wave is disturbance that travels through a medium from one location to another location.

12. What are types of wave? And define each one?

- **Mechanical waves** are waves which propagate through a material medium. Mechanical waves require material medium.
- **Electromagnetic waves** are waves which propagate through empty space (vacuum).

13. What are mechanical waves?

- Water waves
- Sound waves
- Spring waves
- String waves
- Seismic waves

14. What are electromagnetic waves?

- Radio waves
- Infra-red radiation
- X-rays
- Gamma-rays
- Visible light
- Ultraviolet radiation
- Micro-waves

15. What is the difference between Transverse waves and A longitudinal wave?

- A transverse wave is a wave in which particles of the medium move in a direction perpendicular to the direction which the wave moves.
- A longitudinal wave is a wave in which particles of the medium move in a direction parallel to the direction which the wave moves.

16.What are Characteristics of Wave Motion?by defining each one?

- **Velocity (v)** is the distance covered by the disturbance in one second.
- **Period (T)** is the time taken to make one complete cycle of wave motion.
- **Frequency (f)** is the number of cycles or waves per second and its unit is **Hertz (Hz)**.
- **Wave length (λ)** is the distance between two consecutive crests or troughs.
- **Amplitude (A)** is the maximum displacement on either side of the undisturbed or rest position.
- **Phase (ϕ)**: There are two phases, the highest point is called **Crest** and the lowest point called **Trough**.
- The velocity of a wave is the product of the wavelength and the frequency.

17.What are properties of wave ?by defining each of them?

- **Rectilinear propagation** means waves travel in straight lines.
- **Reflection** occurs when waves strike a surface and bounces off.
- **Refraction** occurs when waves deviate from their original path while passing from one medium to another of different optical media.
- **Diffraction** is the change of wave path when passing through a slit or an aperture.
- **Interference** is the phenomenon produced from the superposition of two waves in a medium.

18.Differentiate constructive interference and destructive interference?

- Constructive interference occurs when reflected waves that are in phase with the incoming waves

- Destructive interference occurs when waves that are out of phase.

19. Differentiate node and antinodes?

- **Node** is the position at which the amplitude is zero.
- **Anti-node:** is the position at which the amplitude is maximum.

20. Define beat?

- The result is an alternation of loudness called a **beat**.

21. What are formulas related to this chapter?

Strings fixed at both ends

$$L = n \cdot \frac{\lambda}{2}$$

$$f = \frac{nV}{2L}$$

$$F_n = nf_1$$

$$f = v / \lambda \quad v = \frac{\lambda}{T} \quad v = \lambda f$$

Strings fixed at one end

$$L = \frac{n\lambda}{4}$$

$$f = \frac{nV}{4L}$$

$$F_n = nf_1$$

V= Velocity

f= frequency,

λ = wavelength

22. Example 1

The wavelength of a wave is 0.75m and its frequency is 480Hz, what is the velocity of the wave?

$$\text{Given } \lambda = 0.75\text{m} \quad f = 480\text{Hz} \quad V = ? \quad v = \lambda f = 0.75\text{m} \times 480\text{Hz} = 360\text{m/s}$$

Example 3

An iron rod has a fundamental frequency of 420Hz and it is clamped at its center. What are (a) the longest wave length and (b) the length of the wire? Assume longitudinal vibration at speed of 5km/sec?

Solution given $F_1 = 420\text{Hz}$, $V = 5\text{km/sec} = 5000\text{m/s}$

a. $\lambda = 5000\text{m/s} / 420\text{Hz} = 12\text{m}$

b. $L = \frac{n\lambda}{4} = \frac{1(12)}{4} = 3m$

Chapter Three: Sound Wave

23. What is sound?

- Sound is a longitudinal wave created by vibrating objects such as loud speakers, piano, and human vocal cords.

24. What is Sound wave?

- Sound wave is a mechanical wave that produces a sensation of hearing.

25. What are conditions that must be fulfilled for the sound?

- There must be a vibrating body.
- There must be material medium.
- There must be receiver.

26. Where the sound can travel? by which is the best?

- Sound travels through liquids, gases and solids and the solid is the best transmitter of sound.

27. What are sources of sound wave?

- **Vibrating strings**, such as guitar.
- **Vibrating surfaces**, such as drum.
- **Tubes** in which air column vibrates in musical instruments such as trumpets and saxophones.

28. What is the velocity of sound in the air?

- **330m/s** at **0°C**, for every **1°C** rise of temperature; the velocity is increased by **0.6m/s**.

29. Define echo?

- The reflection of sound wave

30. What are Conditions for formation of Echoes?

- The minimum distance between the source of sound and the reflecting body should be 17m.
- The wave length of sound should be less than the height of reflecting body.
- The intensity of sound should be sufficient so that it can be heard after reflection

31. What is Reverberation?

- is series of reflections that fall on ear from various reflectors one after another in a closed room forming a continuous rolling sound.

32. What are uses of echoes?

- Determination of the depth of ocean (sea).
- Echoes guide insect eating bats and protect them avoid colliding with objects or with one another.
- Dolphins communicate with each other.
- Echoes are used by army to locate gun positions of enemy.
- Echoes are used by geologists for mineral prospecting.

33. What are properties of sound?

- Intensity
- Frequency
- Harmonic content

34. Define intensity of sound?

- The intensity of sound is rate at which the sound energy flows through a unit area normal to the direction of sound waves.

35. Define Pitch?

- Pitch is the change of frequency.

36. What is sonic vibrations?

- Is The range of audibility as a frequency is from **20Hz** to **20,000Hz**

37. Differentiate ultrasonic sound and infrasonic sound.?

- ultrasonic sound is the frequency which exceeds 20,000Hz
- Infrasonic sound Is the frequency is below 20Hz,

38. What are uses of ultrasonic sound ?

1. Echo sounders
2. Ultrasound scanning
3. Ultrasonic Cleaning
4. Homogenizing Milk And Cosmetics
5. Sonar (Sound Navigation and Ranging)

39. Define Doppler effect?

- The change in pitch produced by relative motion of source and observer .

40. Define longitudinal standing wave ?

- Longitudinal standing wave is set up in wind instruments which produce sound by vibrating air column in a pipe.

41. Define forced vibration ?

- The setting up of vibrations in an object by a vibrating force .

42. What is resonance?

- When the frequency of an applied force matches the natural frequency of an object, energy is transferred very efficiently. The condition is called **resonance**.

43. What is sanometer?

- Is the instrument used by the properties of vibrating strings.

44. What determine by the frequency of vibrating string?

- length,
- diameter
- tension,
- Density.

45. State some formulas that are related to this chapter?

$$d = \frac{Vt}{2}$$

$$T = \frac{2d}{v}$$

$$v = 330m/s + \left(\frac{0.6m/s}{1^{\circ}C} \right) T$$

$$T = \frac{v - 330m/s}{0.6m/s^{\circ}C}$$

$$I = \frac{P}{4\pi r^2}$$

$$\beta = 10 \text{ db } \log \frac{I}{I_0}$$

$$I = \frac{P}{A}$$

V=velocity, T=temperature, d=distance,

I= intensity of sound **P** = power or rate of energy, **r**= distance or radius

A source moving (V_s) towards or away from stationary observer is determined by:

$$f' = f \frac{V}{V \mp V_s}$$

The frequency (f_o) heard by an observer moving with a velocity (V_o) towards or away a stationary is determined by:

$$f_o = f \frac{V \pm V_o}{V}$$

When observer and source moving towards each other and away from each other is determined by:

$$f'_o = f \frac{V \pm V_o}{V \mp V_s}$$

f' = frequency heard by stationary observer
 v = Speed of sound

f = Source frequency
 v_s = Source velocity

Closed Pipe

$$\lambda_n = \frac{4l}{n}$$

$$f_n = \frac{nV}{4L}$$

Law of Length

Frequency of vibrating string is inversely proportional to its length.

$$f_1 L_1 = f_2 L_2$$

Where

$$F_1 = f_2 l_2 / L_1$$

$$f_2 = f_1 L_1 / L_2$$

$$L_1 = f_2 l_2 / f_1$$

$$L_2 = f_1 L_1 / f_2$$

Law of Diameter

$$f_1 d_1 = f_2 d_2$$

Frequency of vibrating string is inversely proportional to its diameter.

$$F_1 = f_2 d_2 / d_1$$

$$F_2 = f_1 d_1 / d_2$$

$$D1 = f_2 d_2 / f_1$$

$$D2 = f_1 d_1 / f_2$$

Law of Tension

Frequency of vibrating string is directly proportional to square root of its tension.

$$f_1 \sqrt{T_2} = f_2 \sqrt{T_1}$$

$$f_1 = \frac{f_2 \sqrt{T_1}}{\sqrt{T_2}} \quad \sqrt{T_2} = \frac{f_2 \sqrt{T_1}}{f_1} \quad \sqrt{T_1} = \frac{f_1 \sqrt{T_2}}{f_2} \quad f_2 = \frac{f_1 \sqrt{T_2}}{\sqrt{T_1}}$$

Law of Density

Frequency of vibrating string is inversely proportional to the square root of its density.

$$f_1 \sqrt{\rho_1} = f_2 \sqrt{\rho_2}$$

$$f_1 \sqrt{\rho_1} = f_2 \sqrt{\rho_2}$$

$$\sqrt{\rho_2} = \frac{f_1 \sqrt{\rho_1}}{f_2} \quad f_2 = \frac{f_1 \sqrt{\rho_1}}{\sqrt{\rho_2}} \quad f_1 = \frac{f_2 \sqrt{\rho_2}}{\sqrt{\rho_1}} \quad \sqrt{\rho_1} = \frac{f_2 \sqrt{\rho_2}}{f_1}$$

Combining the above four laws, we get

$$\frac{f_1 d_1 L_1 \sqrt{\rho_1}}{\sqrt{T_1}} = \frac{f_2 d_2 L_2 \sqrt{\rho_2}}{\sqrt{T_2}}$$

L = length

T = Tension

d = diameter

f = Frequency

ρ = density

46. Sample 1: What is the velocity of sound in air at 20°C?

$$\rightarrow V = 330 \text{ m/s} \quad v = 330 \text{ m/s} + \left(\frac{0.6 \text{ m/s}}{1^\circ \text{C}} \right) T$$

$$T = 20^\circ \text{C} \quad v = 330 \text{ m/s} + \left(\frac{0.6 \text{ m/s}}{1^\circ \text{C}} \right) \times 20^\circ \text{C} = 342 \text{ m/s}$$

V = ?

47. Sample 2 speed of sound in air is 348m/s, what is the temperature?

$$\rightarrow V = 348 \text{ m/s} \quad T = ? \quad T = \frac{V - 330 \text{ m/s}}{0.6 \text{ m/s}^\circ \text{C}} = \frac{348 - 330 \text{ m/s}}{0.6 \text{ m/s}^\circ \text{C}} = 30^\circ \text{C}$$

49. An echo is heard after 5sec at 25°C . Find the distance between the source of sound and reflecting surface?

$$\rightarrow \text{Given: } v = 330 \text{ m/s} + 0.6 \text{ m/s}^\circ \text{C} (25^\circ \text{C}) = 345 \text{ m/s} \quad t = 5 \text{ sec} \quad d = ?$$

$$d = \frac{Vt}{2} = \frac{345 \text{ m/s}(5 \text{ sec})}{2} = 862.5 \text{ m}$$

51. A boy stands 66.4m in front of high wall and then blows a whistle. Find time of echo if the speed of sound is 332m/s?

Given: $v = 332\text{m/s}$ $d = 66.4\text{m}$ $t = ?$ $t = \frac{2d}{v} = \frac{2(66.4\text{m})}{332\text{m/s}} = 0.4\text{s}$

52. The power of sound is 0.02 watt. Find the intensity of the sound wave with radius of (i) 2m

➤ Solution $I = \frac{P}{4\pi r^2} = \frac{0.02\text{w}}{4\pi(2\text{m})^2} = 4 \times 10^{-4} \text{ w/m}^2$

53. Sound has an intensity of $4 \times 10^{-6} \text{ w/m}^2$. What is the intensity level?

$$\beta = 10 \text{ db} \log \frac{I}{I_0} = 10 \text{ db} \log \frac{4 \times 10^{-6} \text{ w/m}^2}{10^{-12} \text{ W/m}^2} = 66 \text{ db}$$

Chapter Four: Sound Wave

54. What is light?

➤ is the invisible energy which causes sensation of sight (vision)

55. What are properties of light ?

- Rectilinear propagation
- Reflection
- Refraction
- Diffraction
- Interference

56. What are sources of light ?

➤ Sun is the primary source of light for the mankind

57. List Definitions pertaining to Light?

- ❖ **Luminous substances:** - are substances which produce light by themselves. They include such substances as sun, stars, burning candle and electric bulb.
- ❖ **Non-luminous substance:** - are substances which do not produce light by themselves. They include such substances as the moon, and most of the objects.
- ❖ **Transparent substances:** - are substances which allow most of light to pass through them. They include such substance as vacuum, clear air, glass and diamond.

- ❖ **Translucent substances:** - are substances which partially allow light energy to pass through them. They include such substance as oiled paper, mist, and deep water.
- ❖ **Opaque substances:** - are substances which do not allow light energy to pass through them. They include such substances as wood, bricks and stone.
- ❖ **Rays of light:** - is the path along which light energy travels in a given direction.
- ❖ **Beam of light:** - is a collection of a number rays.
- ❖ **Parallel beam:** - consists of parallel rays.
- ❖ **Convergent beam:** - consists of rays that meet at a point.
- ❖ **Divergent beam:** - consists of rays that come from one point.

58. Define shadow?

- ❖ Is a dark patch formed behind an opaque body.

59. There are two kinds of shadow define each of them?

- ❖ **Umbra** is the region of total darkness formed behind an opaque body.
- ❖ **Penumbra** is a region of partial darkness formed behind an opaque body

60. What are characteristics of shadow?

- ❖ Umbra is formed only.
- ❖ The size of the umbra increases if the distance of the screen increases and vice versa.
- ❖ The size of the umbra increases if the distance of the point decreases and vice versa.

61. State three conditions for the formation of shadow?

- ❖ Source of light
- ❖ Opaque body
- ❖ Screen

62. Define eclipse?

- ❖ takes place when one heavenly body such as moon or planet moves into the shadow of another heavenly body

63. What are types of eclipse?

- ❖ Eclipse of the moon(lunar eclipse)
- ❖ Eclipse of the sun (solar eclipse)

64. Define lunar eclipse?

- ❖ Occurs when the moon passes directly behind the earth in to its umbra (shadow)

65. List types of lunar eclipse

- ❖ Partial lunar eclipse

- ❖ Central lunar eclipse
 - ❖ Penumbral eclipse
66. Define solar eclipse?
- ❖ Occurs when the moon passes between the sun and earth and when the moon fully or partially blocks (occults) the sun .
67. What are types of solar eclipses?
- ❖ Total eclipse: occurs when the dark silhouette of the moon completely obscures the intensely bright light of the sun.
 - ❖ Annular eclipse: occurs when the sun and moon are exactly in line with the earth, but the apparent size of the moon is smaller than that the sun.
 - ❖ Hybrid eclipse
 - ❖ Partial eclipse :occurs when the sun and moon are not exactly in line with the earth and the moon only partially obscures the sun
68. What are the formulas that are related this Chapter ?

$$h_i = \frac{d_i h_o}{d_o}$$
$$d_i = \frac{h_i d_o}{h_o}$$

$$M = \frac{h_i}{h_o} = \frac{d_i}{d_o}$$

$$h_o = \frac{h_i d_o}{d_i}$$
$$d_o = \frac{h_o \times d_i}{h_i}$$

h_i = Image height h_o = Object height d_o = Object distance d_i = Image distance
 M = magnification

69. **Example 1:** An object 4.5m high is placed in front of a pin-hole camera. If the width of the camera is 36cm and the size of the image is 1.8cm, find the distance of the object.

❖ $d_i = 36\text{cm}$ $h_o = 4.5\text{m}$ $h_i = 1.8\text{cm}$ $d_o = ?$

$$M = \frac{h_i}{h_o} = \frac{d_i}{d_o} \qquad d_o = \frac{h_o \times d_i}{h_i} \quad \rightarrow \quad d_o = \frac{4.5\text{m} \times 36\text{cm}}{1.8\text{cm}} = 90\text{m}$$

Chapter Five: Reflection Of Light

70. Define light?

- ❖ is an invisible energy which causes in us sensation of sight (vision).

71. Describe the General terms of pertaining to reflection of light?

- ❖ **Luminous bodies:** *The bodies which give out light energy on their own such the sun, the stars, the burning candle or a kerosene oil lamp.*
- ❖ **Non-luminous bodies:** The bodies which do not give light energy of their own, but reflect the light energy falling on them such In universe or space all planets, comets, moons, etc;
- ❖ **Optical medium:** Anything (material or non-material) through which light energy passes wholly or partially such Vacuum, air, all kinds of gases, water, glass, diamond, etc.

- ❖ **Homogeneous optical medium:** An optical medium, which has a uniform composition throughout such Vacuum, distilled water, pure alcohol, glass, clear plastics, diamond, etc.
- ❖ **Heterogeneous optical medium:** An optical medium, which has different composition at different points such Air, muddy water, fog, mist, smoke, etc.
- ❖ **Transparent medium:** An optical medium, which allows most of the light energy to pass through such Vacuum, clear air, thin layer of water or alcohol, diamond, certain kinds of clear plastics, etc.
- ❖ **Translucent medium:** An optical medium which partially allows the light energy to pass through such Butter paper, oiled paper, tissue paper, ground glass, frosted glass, deep water, fog, mist, dust laden air are examples of translucent medium.
- ❖ **Opaque bodies:** Those bodies which do not allow the light energy to pass through them such Bricks, stones, trees, wood, all kind of metals, certain kinds of plastics, etc
- ❖ **Ray of light:** The path along which light energy travels in a given direction
- ❖ **Beam of light:** *A collection (or bundle) of adjacent rays of light*
- ❖ **Parallel beam:** When the rays of light travel parallel to each other in the same direction, such a bundle of rays is called parallel beam.
- ❖ **Convergent beam:** When the rays of light coming from different directions, get closer and meet at a point, such a bundle .
- ❖ **Divergent beam:** *When the rays of light originating from a point travel in different directions, such a bundle, burning candle, or a glowing electric bulb constitute a divergent beam.*

72. What is diffraction of light?

- ❖ The effect of light is called diffraction of light

73. Who explained the phenomenon of formation of shadows, reflection and refraction on the basis of corpuscular theory of light?

- ❖ Sir Issac Newton

74. Who explain the theory of photoelectric effect?

- ❖ Albert Einstein used corpuscular theory to explain photoelectric effect in 1905.

75. Who suggest that the has transverse wave like character?

- ❖ Dutch physicist Christian Huygens (1629-1695)

76. Who proved that the wave character of visible light?

77. By Thomas Young (1773-1829) In 1801 to proved the wave character of visible light and was able to measure its wavelength and frequency.

78. Who proposed that visible light is a kind of electromagnetic wave, ?

- ❖ In 1873 Maxwell In 1873

79. What are characteristics of light?

Common Characteristics of Light

- ❖ Light is an invisible energy which on rebounding from the surface of matter cause sensation of vision.
- ❖ Light travels along a straight-line path
- ❖ Light produces shadows, when obstructed by opaque objects.
- ❖ Light gets reflected back from polished or smooth surfaces, such as mirror and metal.
- ❖ Light gets refracted when it travels from one medium to another medium.
- ❖ The velocity of light in vacuum is 3×10^8 m/s.
- ❖ Medium to another transparent medium.

80. What is reflection of light?

- ❖ When a ray of light travelling through a certain medium strikes an opaque, but a smooth polished surface, it bounces off the surface into the original medium is called *reflection of light*.

81. What are kinds of reflection?

- ❖ Regular reflection or specular reflection:
- ❖ Irregular reflection or diffused reflection

82. When the A surface is said to be rough?

- ❖ If the size of irregularities on it are larger than the wavelength of light incident on it.

83. Differentiate between Regular reflection and Irregular reflection?

- ❖ **Regular reflection :** When a parallel beam of light travelling through a certain medium on striking some smooth polished surface is reflected back in the same medium as a parallel beam of light
- ❖ **Irregular reflection:** When a parallel beam of light travelling through a certain medium on striking some rough surface is reflected back in the same medium in different directions, such that it does not constitute a parallel beam,

84. Define Terms Associated with Reflection of Light?

- ❖ **Mirror:** A smooth and highly polished reflecting surface .
- ❖ **Incident ray:** A ray of light which falls on a mirror or any polished surface
- ❖ **Reflected ray:** A ray of light which bounces off the mirror surface after reflection
- ❖ **Point of incidence:** The point on the mirror surface where an incident ray strikes
- ❖ **Normal:** A perpendicular drawn on the mirror surface at the point of incidence .
- ❖ **Angle of incidence:** The angle that the incident ray makes with the normal.
- ❖ **Angle of reflection:** The angle that the reflected ray makes with the normal.

85. What are kinds of mirror?

- ❖ **Plane mirror**
- ❖ **Curved mirror**

86. What is the difference between plane mirror and curved mirror?

- ❖ **Plane mirror:** *A highly polished plane surface while*
- ❖ **Curved mirror:** *A highly polished curved surface .*

87. Which is the best reflector used as a reflecting surface?

- ❖ Silver is the best reflector and is used as a reflecting surface

88. The mirror surface p and R what does it means?

- ❖ The surface P is called polished surface and has a deposit of silver metal, Surface R is reflecting surface.

89. What are laws of reflections?

❖ **First law of reflection:** *The angle of incidence is always equal to angle of reflection at the point of incidence. Angle of incidence = Angle of reflection, or $\angle i = \angle r$*

❖ **Second law of reflection:** *At the point of incidence, the incident ray, the reflected ray and the normal lie in the same plane.*

90. What is normal incidence?

❖ When a ray of light strikes a plane mirror at an angle 90° , i.e., its path coincides with normal, the normal incidence takes place.

91. What are Characteristics of normal incidence?

- ❖ As the incident ray coincides with normal, therefore, angle of incidence $\angle i$ is zero.
- ❖ As the $\angle i = \angle r$, therefore, angle of reflection $\angle r$ is zero.
- ❖ The incident ray of light retraces its path in opposite direction,
- ❖ The angle between the incidence and reflected ray is zero.

92. Define image?

❖ Seeing the details of an object or receiving them on screen with the help of reflection or refraction

93. What are kinds of images?

- ❖ virtual image
- ❖ real image.

94. Differentiate between virtual and real image?

- ❖ **Virtual Image:** *When the rays of light diverging from a point, after reflection or refraction appear to diverge from another point.*
- ❖ **Real Image:** *When the rays of light diverging from a point, after reflection or refraction actually converge at some other point .*

Differences between Virtual and Real Image

<i>Virtual Image</i>	<i>Real Image</i>
1. The rays of light after reflection or	• The rays of light after reflection or

refraction appear to meet at some other point or appear to diverge from some other point.	refraction actually meet at some other point.
2. It cannot be taken on a screen.	• It can always be taken on a screen.
3. It is always erect, but laterally inverted.	• It is always inverted.

95. What are an inverted Image and a laterally inverted Image?

- ❖ **Inversion** the top side of the object appears as the bottom side of the image and vice versa. In a way **the image turns around its horizontal axis through an angle of 180° .**
- ❖ **Lateral inversion** the left side of the object appears as right side of the image and vice versa. In a way the image turns through an angle of 180° about vertical axis.
- ❖ **lateral** The phenomenon due to which the image of an object turns through an angle of 180° through vertical axis rather than horizontal axis, such that the right side of the image appears as left or vice versa

96. What are Characteristics of an Image Formed in a Plane Mirror?

- ❖ Image is virtual, i.e., it cannot be taken on screen.
- ❖ Image is erect.
- ❖ Image is of same size as the size of object.
- ❖ Image is laterally inverted, i.e, the left side of object appears as right side of the image.
- ❖ Image is formed as far behind the plane mirror as the object is in front of it.

97. Define Spherical mirror?

- ❖ A mirror which is made from a part of a hollow sphere

98. What are types of spherical mirror?

- ❖ concave mirror and
- ❖ convex mirror.

99. Compare concave and convex mirror?

❖ **Concave mirror:** A mirror which is polished from the outer side of a hollow sphere, such that the reflecting side is towards its hollow side

❖ **Convex mirror:** A mirror which is polished on the hollow side of the sphere, such that the reflecting surface is towards its bulging side,

100. Define the following terms: (pole, centre of curvature, principal axis, linear aperture, diverging mirror, principal axis, principal focus, focal length, radius of curvature. Focal plane) ?

❖ **Pole:** The midpoint of a spherical mirror and . It is denoted by the letter P.

❖ **Centre of curvature:** The centre of the hollow sphere, of which the spherical mirror is a part, and It is denoted by the letter C.

❖ **Principal axis:** An imaginary line passing through the pole and the centre of curvature of a spherical .

❖ **Linear aperture:** The diameter of a spherical mirror .

❖ **diverging mirror** As convex mirror diverges rays, therefore,

❖ **Principal focus:** It is a point on the principal axis, where a parallel beam of light after reflection, either **actually meets or appears to meet**. It is denoted by the letter F.

❖ **Focal length:** The linear distance between the pole and the principal focus and It is denoted by the letter.

❖ **Radius of curvature:** The linear distance between the pole and the centre of curvature and It is denoted by the letter R.

❖ **Focal Plane:** An imaginary plane passing through principal focus, such that it is at right angles to principal axis.

101. What are Characteristics of the image?

❖ The image is real.

❖ The image is inverted.

❖ The image is diminished to a point.

❖ The image is formed at the principal focus, in front of the concave mirror.

102. What are Uses of Concave Mirrors?

❖ It is used as a shaving mirror.

- ❖ It is used as a reflector in the head lights of automobiles, such as cars; trucks; motor bikes; etc.
- ❖ It is used by doctors to focus a parallel beam of light on a small area, especially for the examination of throat; ear; nose; teeth; etc. Dentists
- ❖ Concave mirror is used as a reflector in dish type solar cookers and solar furnace.

103. What are Uses of Convex Mirrors?

- ❖ It is used as a **rear view mirror** in automobiles, because it can cover a very wide field behind the driver and hence enables to see the traffic behind him without turning his head.
- ❖ It is used as a reflector for street lights, because, it diverges rays over a large area, and hence, illuminates that area.

104. What are the formulas uses this chapter?

$$f = \frac{R}{2} \text{ or } R = 2f$$

$$\frac{1}{u} + \frac{1}{v} = \frac{1}{f}$$

Chapter Six: REFRACTION OF LIGHT

105. What is material?

- ❖ any material through which light passes is called medium

106. Define transparent medium?

- ❖ A medium which allows the light to pass through it almost completely.

107. Define refraction of light?

- ❖ The phenomenon due to which a ray of light deviates from its path, at the surface of separation of two media, when the ray of light is travelling from one optical medium to another optical medium,

108. Define terms associated with refraction of light?

- ❖ **Incident ray:** A ray of light travelling towards another optical medium
- ❖ **Point of incidence:** The point where an incident ray strikes another optical medium
- ❖ **Normal:** A perpendicular drawn at the point of incidence
- ❖ **Angle of incidence:** The angle made by the incident ray with the normal at the point of incidence
- ❖ **Refracted ray:** A ray of light which deviates from its path on entering another optical medium
- ❖ **Angle of refraction:** The angle that the refracted ray makes with the normal
- ❖ **Emergent ray:** A ray of light which emerges out from another optical medium, into the original optical medium
- ❖ **Angle of emergence:** The angle that the emergent ray makes with the normal

109. Define lateral displacement?

- ❖ The perpendicular shift in the path of incident ray, while emerging out of a rectangular optical slab

110. What are laws of refraction light?

- ❖ The incident ray, the refracted ray and the normal to the surface of the separation of two media at the point of incidence, all lie in the same plane.
- ❖ The ratio of the sine of angle of incidence to the sine of angle of refraction is a constant, for the light of given colour, for the given pair of media.

111. What means snells law?

- ❖ The law of refraction is called snells law and It was stated by Willibrod Snell in 1621.

112. Define reflective index?

- ❖ The ratio between the sine of angle of incidence in one optical medium to the sine of angle of refraction in another optical medium,

113. What are simple effects of reflective light?

- ❖ A stick appears bent and short, when immersed obliquely in water.
 - ❖ The bottom of a beaker filled with water appears raised.
114. Define lens?
- ❖ *a portion of a transparent optical material, having one or two spherical surfaces*
115. What are broad classes of lens?
- ❖ Converging lens or convex lens.
 - ❖ Diverging lens or concave lens.
116. Define convex lens?
- ❖ *A piece of transparent optical material, having one or two spherical surfaces, such that it is thicker in the middle and tapering (thinner) at the edges*
117. What are types of convex lens?
- ❖ double convex lens,
 - ❖ Plano-convex lens,
 - ❖ concavo-convex lens
118. Define diverging lens?
- ❖ A piece of transparent optical material, having one or two spherical surfaces, such that it is tapering (thinner) in the middle and thicker at its edges
119. What are classifications of diverging lens?
- ❖ double concave lens,
 - ❖ Plano-concave lens,
 - ❖ convexo-concave lens
120. Define some terms used in lens?
- ❖ **Principal Axis:** An imaginary line joining the centre of curvatures C_1 and C_2 of two spherical surfaces of the lens .
 - ❖ **Optical Centre:** A point within the lens, where a line drawn through the aperture (diameter of the lens), meets the principal axis.

❖ **Principal focus of a lens:** It is a point on the principal axis of the lens, such that a beam of light parallel to the principal axis, after refraction through the lens, either actually meet or appear to come from this point.

❖ **Focal length** The distance between the optical centre and the principal focus (first or second) of a lens

❖ **Focal plane** A vertical plane passing through the principal focus (first or second) of the lens

122. Define power of lens?

❖ Power of a lens is a measure of degree of convergence or divergence of light rays incident on it, The SI unit of power of a lens is called dioptre It is denoted by the letter D.

❖

❖ it is the ability of a lens to bend the rays of light incident on it. Mathematically, it is defined as follows:

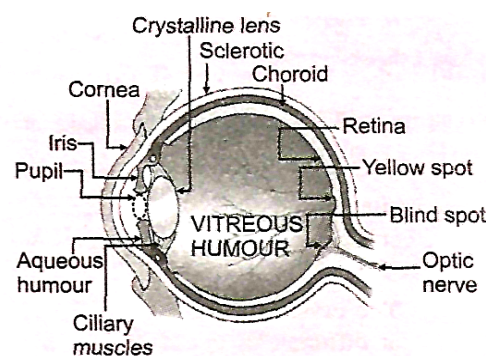
❖ *The reciprocal of focal length in metres is called power of a lens.*

123. Talk briefly Human eye?

❖ The human eye is almost a spherical ball with a slight bulge in the front part. The structure and function of each part of the eye is discussed below:

❖ The eye ball is approximately spherical in shape. Its diameter in a grown up person is 2.3cm to 2.5cm.

1. **Sclerotic:** It is the outermost covering of the eye. It consists of white tough fibrous tissue. *Its function is to protect and contain the vital internal parts of the eye.*



2. **Cornea:** It is the front bulging portion of the eye. It is made of *transparent tissues* and contains *no blood vessels*. *Its function is to act as a window to the world, i.e., to allow the light to enter the eye ball. Most of the refraction of light takes place while passing through cornea.*

3. **Choroid:** It is a grey membrane attached to the sclerotic from the inner side. ***Its function** is to darken the eye from inside, and hence, prevent any internal reflection.*
4. **Optic nerve:** It is a bundle of approximately 70,000 nerves originating from the brain and entering the eye ball from the posterior side. The left eye receives optic nerves from the right side of the brain and the right eye from the left side of the brain. ***Its function is** to carry the optical messages to the brain.*
5. **Retina:** The optic nerve on entering the eye ball spreads like a canopy and each nerve attaches itself to the choroid. The nerve endings form a kind of hemispherical screen called retina. The nerve endings are sensitive to light. Thus, any image formed on the retina is converted into optical impulses, which are then sent to the brain. The retina has two very important regions, which are called the yellow spot and the blind spot. ***The function of the retina is** to receive the optical image of an object and then convert it into electrical pulses which are finally sent to the brain through the optic nerve.*
6. **Yellow spot :** It is situated at the centre of the retina and is slightly raised. It has a little depression called ***Fovea-Centralis***, which is extremely sensitive to light. ***Its function is** to form an extremely clear image, i.e., when we want to examine an object very minutely, its image is brought to focus at this point.*
7. **Blind spot :** The region on the retina, where the optic nerve enters the eye ball is called the blind spot. It has no nerve endings, and hence, is insensitive to the light.
8. **Crystalline lens :** It is a double convex lens, more bulging on the posterior side. It is made of transparent, flexible tissues. It is held in position by a ring of muscles, commonly called ciliary muscles. It divides the eye ball into two unequal parts. The front part of the eye is called the ***anterior portion*** and the rear part is called the ***posterior portion***. ***Its function is** to focus the images of the objects at different distances, clearly on the retina.*

9. **Ciliary muscles:** It is a ring of muscles, which along with the suspensory ligament that holds the crystalline lens in position. ***Its function is to alter the focal length of the crystalline lens, so that the image of the objects at various distances is clearly focussed on the retina.***

10. **Iris:** It is a circular contractile diaphragm, suspended in front of the crystalline lens. It has a tiny hole in the middle, commonly *called the pupil*. ***Its function is to control the amount of light entering the eye.***

11. **Vitreous humour:** It is a dense, jelly like fluid, slightly grey in colour, filling the posterior part of the eye ball. It has the following functions:

- a. It prevents the eye ball from collapsing, due to the changes in the atmospheric pressure.
- b. It partially helps in focussing the image clearly on the retina.

12. **Aqueous humour:** It is a watery, saline fluid, filling the anterior portion of the eye. It has the following functions:

- a. *It prevents the anterior portion of the eye from collapsing, due to the changes in the atmospheric pressure.*
- b. *When we wink our eyes, a tiny drop of the aqueous humour flows out from the side of the eye. Then it washes the eye and keeps the cornea moist. Otherwise, the cornea will shrivel and become opaque.*

Accommodation of the Eye: is *The process by which the ciliary muscles alter the focal length of the crystalline lens, so as to focus nearer or far-off objects clearly on the retina*

Common defects of eye are:

- 1. Short-sightedness or myopia: A person suffering from this defect can ***see the nearer objects clearly, but cannot see the far-off objects clearly.***

Causes :(1) Due to some disease or age

2. Long-sightedness or hypermetropia.: A person suffering from this defect can see *far-off objects clearly, but cannot see clearly the objects situated at a distance of 25cm or at the distance of distinct vision.* Due to some disease, the eye ball becomes smaller in size,

3. Presbyopia: the eye can see neither the nearer nor the far-off objects clearly. This defect can be overcome by using two glasses.

Advantages of having Two Eyes in Humans

1. A single human eye has a horizontal field of view of 150° . However, with two eyes, separated by few centimetres, the horizontal field of view increases to 180° . Furthermore, the ability to detect faint objects is enhanced with two eyes.
2. The two eyes separated by few centimetres, in the front portion of head, no doubt limits the field of view to 180° . However, this positioning increases our ability to judge the depth, a phenomenon called stereopsis.

Chapter Seven: Dispersion of Light

124. What is the difference between dispersion and spectrum?

- ❖ **Dispersion:** is *The phenomenon due to which a white light splits into its component colours, when passed through a prism.*
- ❖ **Spectrum:** *The band of seven colours obtained on the screen, when a white light splits into its component colours.*

125. Define polychromatic light?

- ❖ polychromatic light is the light which made of two or more colours

126. What is monochromatic light?

- ❖ monochromatic light is Light of a single colour or single wavelength

127. What is scattering of light?

- ❖ *The phenomenon due to which a particular wave of light is absorbed by a particle, which is greater in diameter than the wavelength of light and then transmits it in all possible directions*

128. How to rainbow is produced?

129. *The rainbow is produced due to the dispersion of sunlight by tiny droplets of water suspended in air, just after rain.*

130. **Why do planets not twinkle?**

- ❖ Because Planets are very close to us as compared to stars. Their apparent position also changes with the change in density of different layers of atmosphere. However, the size of their apparent image is still fairly large, such that it seldom falls outside the line of sight. Hence, they do not appear to twinkle.

131. **Why does sky appear blue?**

Because the white sunlight passes through the atmosphere, the violet, indigo and blue wavelengths, encounter suspended particles in air whose diameter is more than their wavelengths. Thus, these waves are absorbed and then scattered in all possible directions. The scattered light from these particles, suspended all around in the sky reach our eyes, then the sky appears blue.

132. **Why is the sunlight reaching the earth yellowish?**

- ❖ Because when the white sunlight passes through upper atmosphere, the violet, indigo and blue colours scatter which makes the sky to appear blue. However, the white light gets deficient in violet, indigo and blue colour on account of scattering. Thus, it appears yellowish instead of white.

133. Why the sun does appear yellowish?

Because when the violet, indigo and blue colours scatter in the upper atmosphere, the resultant sunlight is yellowish in colour. When this light enters our eyes, then to us sun appears yellowish instead of white hot.

134. Why does the sky appears dark instead of blue to an astronaut?

Because In space no particles are present. Thus, no scattering of light takes place. Hence, the sky appears dark as light by its own nature is invisible, but produces in us the sensation of vision.

135. Why is red light used as a universal danger signal?

Because the red light has largest wavelength among the spectral colours, and hence, is least scattered. Thus, red light can easily pass through fog or mist or smoke without getting scattered, and hence, is visible from a long distance. Thus, it is used as universal danger signal.

136. Why do the distant hills appear blue?

- ❖ In the thick growth of trees on the hills there are always present some amount of tiny droplets of water in the air. When the white light passes through this moisture laden air, the blue light is scattered. When this scattered light reaches our eyes, the hills appear blue.

137. Why does smoke coming out of coal fired chimney appear blue on a misty day?

- ❖ The tiny particles of smoke and moisture scatter blue colour of the white light passing through it. When this scattered blue light reaches our eyes, the smoke appears blue. It is for the same reason that on a misty day, the smoke coming from an incense stick appears blue.

138. Why do motorist use orange lights, rather than normal white light on a foggy day?

- ❖ If a motorist uses white light while driving in fog, then the tiny droplets of water scatter large amount of blue light. This scattered blue light on

reaching the eyes, decreases visibility, and hence, driving becomes extremely difficult. However, when orange lights are used, they don't get scattered on account of their longer wavelengths, and hence, the driver can see ahead clearly. It is for the same reason that rescue workers wear orange coloured suits. Similarly, children's buses are painted orange, so that they are easily visible in the foggy conditions, smoke or rain.

Chapter Eight: Modern Physics

139. What are properties of electromagnetic waves?

- ❖ They travel at the speed of light, i.e., $3 \times 10^8 \text{ m/s}$ in vacuum.
- ❖ They are transverse waves.
- ❖ They are not affected by electric and magnetic fields. Carry no charge.
- ❖ They undergo reflection, refraction, polarisation and diffraction..
- ❖ They travel in straight lines.
- ❖ They transfer energy ($E = hf$)

140. Define cathode rays? A

- ❖ **Cathode rays** :are streams of electrons moving at high speed from a heated cathode.

141. What are properties of cathode rays?

- ❖ They travel in straight lines from the cathode
- ❖ They cause certain substances to fluoresce.
- ❖ They possess kinetic energy
- ❖ They are deflected by magnetic and electric fields
- ❖ They produce X-rays on striking a metal target.
- ❖ The speed of the cathode rays in the electric field is expressed as e

$$V = \frac{1}{2} mv^2, \text{ where } m \text{ is the mass of the electron, } V \text{ the voltage, } e \text{ the charge and } v$$

the speed. $v = \sqrt{\frac{2eV}{m}}$

142. What are three things consist of cathode ray oscilloscope ?

- ❖ **Electron gun**, which is composed of the cathode, the grid and the anode. It controls the brightness and focuses the beam on screen
- ❖ **Deflecting plates**, to allow horizontal and vertical deflections of the beam.
 - ❖ A **fluorescent screen**, on which the beam produces a spot of light. The screen is coated with a phosphor such as zinc sulphide, which fluoresces under the impact of the electrons.

143. What are uses of cathode rays?

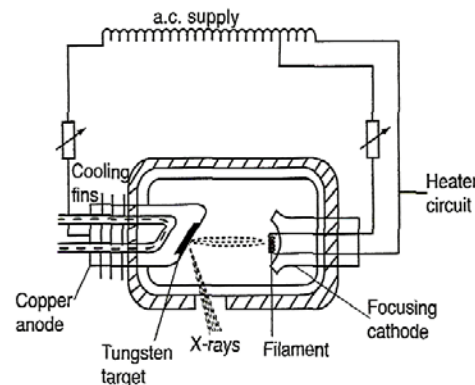
- ❖ Measuring a.c. and d.c. voltages.

- ❖ Measuring frequencies.
- ❖ Measuring phase differences.
- ❖ measuring small time intervals,
- ❖ Study wave pattern (forms).

144. Define x-ray?

- ❖ X-rays are electromagnetic radiations of short wavelengths of the order 10^{-10}m .

- ❖ An X-ray tube is usually highly evacuated and contains an anode made of copper block and on which tungsten or molybdenum (high-melting point metals) is embedded



145. What is the difference between soft x-ray and hard x-ray?

- ❖ Soft X-rays have low penetrating power, and are produced by relatively low voltage.
- ❖ **Hard** X-rays have high penetrating power, produced by high voltage.

146. What are properties of x-ray?

- ❖ They travel in straight lines, at the speed of light.
- ❖ They cannot be deflected by electric or magnetic fields.
- ❖ They readily penetrate matter. Penetration is least with materials of high density" and high atomic mass.
- ❖ They can be reflected through very large angles of incidence.
- ❖ Refractive indices of all materials are very close to unity for X-rays.
- ❖ There is no boundary. They can be diffracted.

147. What are uses for x-rays?

- ❖ locating bone fractures.
- ❖ destroying cancer cells.
- ❖ locating internal imperfections in welded joints and castings.
- ❖ studying of crystal structures.

- ❖ Very soft x-rays are used for determining the authenticity of works of art and picture restoration.
148. What is the precaution when using x-rays?
- ❖ Minimize the exposure time as much as possible.
 - ❖ Workers exposed to X-rays should always wear protective clothing.
149. What are dangers of x-ray?
- ❖ Kill living cells when overexposed
 - ❖ Interfering with gene structure.
150. Define photoelectric effect?
- ❖ is the process whereby electrons are emitted from matter when an electromagnetic radiation falls on it.
151. What are factors affecting Photoelectric emission ?
- ❖ The number of photoelectrons emitted per second is proportional to the intensity of the incident radiation.
 - ❖ The emitted electrons have various kinetic energies with velocities ranging from zero up to some maximum value, which increases as the frequency of the radiation increases.
 - ❖ Emission of electrons occurs only if the frequency of the incident radiation is above some minimum value called **threshold frequency**
152. What are photocells is used for ?
- Photocells are used in counting systems, intruder alarms, sound reproduction from film, light-meters, artificial lighting, etc.

Chapter Nine: Nuclear Physics

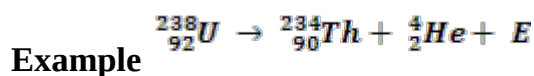
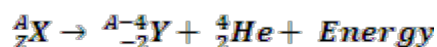
153. What Rutherford discovered?
- ❖ **Rutherford** discovered that atoms have central positively charged part known as **nucleus** of the atom and the electrons revolve in an empty space of the atom.
154. What Bohr discovered?
- ❖ **Bohr** discovered that the electrons revolve around the nucleus in a special orbit known as **the energy levels** and he proved that the angular momentum of the electron
155. What the nucleus consist of?
- ❖ A nucleus consists of nucleons comprising of protons ,neutrons and electron
 - ❖ A proton has a positive charge equal to $1.6 \times 10^{-19} \text{C}$ and its mass is $1.673 \times 10^{-27} \text{kg}$.
 - ❖ A neutron has no charge on it, but its mass is $1.675 \times 10^{-27} \text{kg}$.
156. Define Atomic Number?
- ❖ The number of protons inside a nucleus and is denoted by Z.
157. Define mass number?
- ❖ The combined number of all the protons and neutrons in a nucleus and it denoted by A.
158. What is mass spectrography?
- ❖ A device with the help of which not only the isotopes of any element can be separated from one another but their masses can also be determined quite accurately
159. Define radioactivity?
- ❖ *is the explosion of the nucleus of the atom*
160. what are the nature of radioactivity ?
- ❖ They affect photographic plates.
 - ❖ They ionize the air molecules.
 - ❖ They have a fluorescent effect.

- ❖ They have physiological effect.
- ❖ They pass through a sequence of decay.

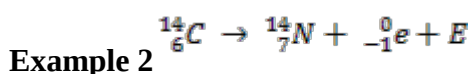
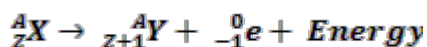
161. What are radioactive elements?

- ❖ **Alpha-particles (α):** are helium nuclei (${}^4_2\text{He}$) that are positively charged.

When the radioactive atom emits alpha particle, the atomic weight decreases by 4 a.m.u and the atomic number decreases by 2 a.m.u.



- ❖ **Beta-particles (β):** is similar to electrons with high velocity (${}^0_{-1}\text{e}$) and negatively charged. When a negatively charged. When a beta particle is emitted, the mass number is constant, but the atomic number increases by 1.



- ❖ **Gamma (γ) rays** are electromagnetic waves and are uncharged. When an atom emits γ -rays, it is changed to more stable atom.

162. What is decay constant λ ?

- ❖ The ratio of the number of atoms that decays in unit of time to the whole number of the atoms

163. What does it mean half life?

- ❖ The time in which half of the atom decays

$$\lambda = \frac{0.693}{T_{1/2}}$$

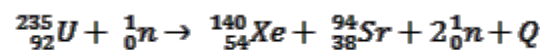
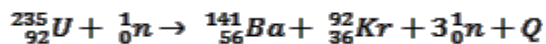
164. What are the two main nuclear reactions?

- ❖ **Fission:**
- ❖ **Fusion**

165. Differentiate the two types of nuclear reactions ?

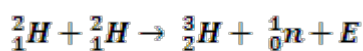
- ❖ **Fission:** The process of causing a large nucleus ($A > 120$) to split into multiple smaller nuclei, releasing energy in the process

Example



- ❖ **Fusion** is the process of causing small nuclei to stick together into a larger nucleus, in the process releasing energy or union of small atoms to form a large atom.

Example



166. Define Isotopes?

- ❖ An element which has same atomic number but differ mass number

167. Define rectification?

- ❖ Is the conversion of alternating current to direct electric current

168. What D.C supply used for?

- ❖ The D.C supply is used for charging storage batteries,field supply of D.C generators,electroplating, etc.

169. What is amplification?

- ❖ Is the process of raising the strength of weak signal

170. What is called the device that raise the strength of weak signal?

- ❖ Amplifiers

171. What Amplifiers is used for?

- ❖ used in radioset , public address system, television so that the weak signal can be heard loudly.

172. Define the fallowing terms: Control devices, Generation, Conversion of light into electricity, photo-electricity, Conversion of electricity into light and photo-electric?

- ❖ **Control devices** are devices that are widely applied in automatic control.Speed of a motor,voltage across the refrigerator can be automatically contolled with the help of such devices.
- ❖ **Generation** is an electronic device that can convert d.c power to a.c power of any frequency.
- ❖ **Conversion of light into electricity.** Electronic devices can convert light to electricity.
- ❖ **photo-electricity** coversion of light into electricity
- ❖ photo-electric devices are used in Buglar alarms,sound recording on motion pictures etc.

- ❖ **Conversion of electricity into light.** Electronic devices can convert electricity to light. This valuable property is utilized in television and radar.

173. Define semiconductors?

- ❖ is a substance which has resistivity (10^{-4} to $0.5 \Omega \text{ m}$) in between conductors and insulators e.g. germanium, silicon, selenium, carbon etc.

174. What are properties of semiconductors ?

- ❖ The resistivity of a semiconductor is less than an insulator but more than a conductor.
- ❖ Semiconductors have *negative temperature co-efficient of resistance*
- ❖ When a suitable metallic impurity (e.g. arsenic, gallium etc.) is added to a semiconductor, its current conducting properties change appreciably.

175. What are the most commonly used semiconductors?

- ❖ germanium (Ge) and silicon (Si).
- ❖ **Germanium** is an earth element and was discovered in 1886. It is recovered from the ash of certain coals or from the flue dust of zinc smelters. Generally, recovered germanium is in the form of germanium dioxide powder which is then reduced to pure germanium. The atomic number of germanium is 32. Therefore, it has 32 protons and 32 electrons.
- ❖ **Silicon.** Silicon is an element in most of the common rocks. Actually, sand is silicon dioxide. The silicon compounds are chemically reduced to silicon which is 100% pure for use as a semiconductor. The atomic number of silicon is 14. Therefore, it has 14 protons and 14 electrons.

176. Define intrinsic semiconductor ?

- ❖ *A semiconductor in an extremely pure form is known*

177. Define *doping*. ?

The process of adding impurities to a semiconductor.

178. What is n-type semiconductor?

- ❖ *When a small amount of pentavalent impurity is added to a pure semiconductor,*

179. What is p-type semiconductor?

When a small amount of trivalent impurity is added to a pure semiconductor

180. Differentiate the difference the two types of transistors?

❖ **An n-p-n transistor** is composed of two n-type semiconductors separated by a thin section of p-type

❖ **A p-n-p transistor** is formed by two p-sections separated by a thin section of n-type

181. Define Not gate?

❖ Is the NOT gate is an electronic circuit that produces an inverted version of the input at its output. It is also known as an *inverter*