Applied Physics - II

Chapter 1: Properties of Matter

Fill in the blanks

1. The SI unit of Young's Modulus is _____.
2. The change in pressure while going from the surface to the depth 'h' in a pond is _____.
3. The stress required to double the length of a wire of Young's Modulus 'Y' is _____.
4. The principle of transmission of pressure is given by _____ law.

True or False

1. The relative density of a certain substance is 8, its density is 8 kg/m^3.
2. The atmospheric pressure acts not only on the earth's surface but over the surface of all objects including humans on the earth.
3. Young's modulus is the ratio between lateral strain and longitudinal strain.
4. The specific gravity of a body indicates how many times the body is heavier than an equal volume of water.
5. Principle of transmission of pressure inside liquid is given by Boyle's law.

Choose the correct answer

1. Principle of transmission of pressure is stated by
   (i) Newton's law
   (ii) Boyle's law
   (iii) Pascal's law
   (iv) None of the above
2. Two wires A and B are of the same length. The diameters are in the ratio 1:2 and the Young's modulus is in the ratio 2:1. If they are pulled by the same force then their elongation will be in the ratio
   (i) 1:2
   (ii) 2:1
   (iii) 4:1
   (iv) 1:4
3. Pressure at any point inside a liquid is
   (i) Directly proportional to density
   (ii) Inversely proportional to density
   (iii) Directly proportional to volume
   (iv) Inversely proportional to the temperature
4. In a hydraulic press, the piston of pump as compared to press plungers
   (i) Should have same radius
   (ii) Should have smaller radius
   (iii) Should have larger radius
   (iv) May be equal or smaller
5. Application of elasticity includes
   (i) Selection of material of high-pressure tools

(ii) Strength of ropes
(iii) Safety of bridges
(iv) All of the above

Answer the following questions:

1. A wire of length 1.5m and cross-section $1m^2$, elongates by 1.55mm, when stretched by a weight of 10kg, find the Young's modulus of the material of the wire. (4)
2. What do you mean by Buoyancy and buoyant force. (2)
3. State Pascal's law of transmission of liquid pressure. Show how this law provides the principle of multiplication of force. (2+2=4)
4. A force of 50 kgf is applied to the smaller piston of the hydraulic machine. Neglecting friction, find the force exerted on the larger piston. The diameter of the pistons being 2 cm and 10cm respectively. (4)
5. State Hooke's law. (1)
6. Young's modulus for steel is much more than that for rubber. For the same longitudinal strain which one will have greater tensile strength? (1)
7. Why can a steel wire, having greater diameter, support more weight? (2)
8. Calculate the pressure at a depth of 100m of water in the CGS unit. (1)
9. What is elasticity? Define stress and strain. (1+1=2)
10. Define Young's modulus of elasticity. (1)
11. Calculate the force required to double the length of a wire of diameter 2mm. Given $Y = 1.2 \times 10^{12}$ N/m^2. (2)
12. Explain the construction and working of a hydraulic press. (3)
13. Find the thrust on the bottom of a water tank whose length, breadth and depth are 6m, 2m and 2m respectively. (2)
14. Define: stress, strain and elastic limit. (3)
15. A wire of length 5m and diameter 4mm is loaded with 80kg. if the elongation is 1.3mm, find the Young's modulus of the material of the wire. (3)

Chapter 2: Wave and Oscillation

Fill in the blanks

1. The frequency range of audible sound is _____.
2. The loudness of the sound depends upon its _____.
3. In the case of a simple pendulum, the acceleration is proportional to _____.
4. The velocity of sound in moist air is _____ than that in dry air.
5. Waves produced in water are _____.
6. Echo is due to the _____ of sound.
7. Sound moves faster in _____ air than dry air.

True or False

1. Doppler Effect is observed due to relative motion between source and observer.
2. Hertz is the unit of wavelength.
3. Sound is an elastic wave.

Choose the correct answer

1. When the listener approaches the source the pitch
   (i) Increases
   (ii) Decreases
   (iii) Remain the same
   (iv) First increases then decreases
2. In S.H.M acceleration is proportional to
   (i) Displacement
   (ii) Velocity
   (iii) Time period
   (iv) Frequency
3. Ultrasonic means
   (i) Frequency less than 20Hz
   (ii) Frequency between 20Hz to 20,000Hz
   (iii) Frequency greater than 20,000Hz
   (iv) Something else
4. Velocity of sound is maximum in which one of the following?
   (i) Air
   (ii) Water
   (iii) Steel
   (iv) Vacuum
5. Velocity of sound in a medium depends on
   (i) Wind flowing
   (ii) Density of the medium
   (iii) Temperature of the medium
   (iv) All of the above

Answer the following questions

1. If the time period of a simple pendulum is 2s, find the length of the string. (2)
2. Define frequency and wavelength. (2)
3. Distinguish between Longitudinal wave and Transverse wave. (2)
4. What are the two types of wave motion? Illustrate with examples. (1+2=3)
5. Write Newton's formula for the velocity of sound. (1)
6. Derive Newton's formula for velocity of sound in a gas. (2)
7. Deduce a relation between wave velocity, frequency and wavelength of a wave. (3)
8. Discuss the effect of pressure, density and temperature on velocity of sound in a medium. (3)
9. State three characteristics of musical sound. (2)
10. Calculate the frequency of a note in air moving with velocity of 330m/s and wavelength 170cm. (2)
11. Define forced vibration. (1)
12. "We can have the information of an approaching train much earlier by putting our ear in contact with the rail track". Justify the statement. (1)
13. State Sabine's law. (1)
14. Calculate the frequency of a radio wave of wavelength 160m moving with velocity 330m/s. (2)

15. What is a simple pendulum? Define amplitude of a simple pendulum. (1+1=2)
16. Find the temperature of a body which has the same reading on Fahrenheit and Celsius scale. (3)
17. Calculate the velocity of sound at NTP. Given, normal pressure is 1.013 x $10^5 N/m^2$, density of air is $1.29 kg/m^3$ and γ=1.41. (3)
18. Find the Laplace's expression for velocity of sound in air. (3)
19. What is echo and reverberation? (2)
20. Explain the working of SONAR. (2)

Chapter 3: Light

Fill in the blanks

1. The focal length of a plane mirror is _____.
2. The velocity of light in water is _____ than the velocity of light in vacuum.
3. Power of a lens is given by $D = \frac{100}{\text{.....}}$
4. The power of a convex lens of focal length 25 cm is _____.
5. For a convex lens when the object is between pole and focus, the image is at _____.
6. For a concave mirror, when the object is at focus the image is formed at _____.
7. The focal length of _____ mirror is positive.

True or False

1. A convex mirror always produces a virtual image.
2. The refractive index of air is 1.
3. Fiber optics works on the principle of photoelectric emission.

Choose the correct answer

1. Which of the following mirrors always produces a virtual image of the same size of that object?

   (i) convex

   (ii) concave

   (iii) plane

   (iv) parabolic

2. A convex mirror slices an image which is

   (i) real and inverted

   (ii) real and erect

   (iii) virtual and inverted

   (iv) virtual and erect.

3. Power of a concave lens of focal length 20 cm is

   (i) -5D

   (ii) +5D

   (iii) +20D

   (iv) -20D

4. The velocity of light in solid is

   (i) maximum

   (ii) more than in air

   (iii) less than in air

   (iv) equal to that in air

5. The power of a convex of focal length 50 cm is

   (i) 5 Dioptre

   (ii) 0.5 Dioptre

   (iii) 2 Dioptre

   (iv) 0 Dioptre

6. Which of the following should be used as a rear view mirror in automobiles?

   (i) convex mirror

   (ii) plane mirror

   (iii) concave mirror

   (iv) parabolic mirror

Answer the following questions

1. Explain with a neat diagram the critical angle and hence total internal reflection of light. State the condition for total internal reflection. (3+2=5)
2. Define power of a lens. Determine the power of a convex lens of focal length 20 cm in dioptre. (1+2=3)
3. An object 10 cm long is placed from a convex lens of focal length 10 cm. Find the position, nature and size of the image. (4)
4. The refracting angle of minimum deviation of a ray through the prism is 40^o. Calculate the refractive index of the prism and angle of incidence. (4)
5. Draw a neat ray diagram to show the formation of a real image by concave mirror. (3)
6. Power of a lens is +2D. State the nature of the lens and calculate its focal length. (2)
7. Why do diamonds sparkle? (2)
8. What do you understand by the angle of deviation of a ray of light? Explain the position of minimum deviation of a prism. (2+4=6)
9. Distinguish between a real and a virtual image. (2)

10. With a neat ray diagram, show how a virtual image may be formed by a concave mirror. (2)
11. An object of size 10 cm is placed at a distance of 30 cm in front of a convex mirror of radius of curvature 40 cm. Find the position, nature and size of the image. (4)
12. Deduce the relationship between the critical angle and refractive index. (2)
13. A ray of light is incident at an angle of 40^o on one of the refracting surfaces of a prism and is refracted through the prism in the minimum deviation position. The angle of the prism is 50^o. Calculate the angle of minimum deviation and refractive index of the material of the prism. (3)
14. Establish the relation between focal length and radius of curvature of spherical mirror. (2)
15. An object is placed at a distance of 60 cm from a spherical mirror and produces a virtual image at a distance 20 cm behind the mirror. Find the focal length of the mirror. Is the mirror concave or convex? (2+1=3)

Chapter 4: Magnetism

Fill in the blanks

1. The angle of dip at the pole is _____.
2. The angle between the magnetic meridian and the geographic meridian is called _____.

Choose the correct answer

1. An uniform magnetic field is represented by a set of force which are

   (i) parallel

   (ii) convergent

   (iii) divergent

   (iv) None of the above

2. Two magnetic lines of force

   (i) are always parallel

   (ii) intersect each other

   (iii) do not intersect each other

   (iv) are never parallel

3. The angle between geographical meridian and magnetic meridian at any place is called –

   (i) dip

   (ii) declination

   (iii) angle of bending

(iv) None of the above

Answer the following questions

1. Write two properties of magnetic lines of force. (2)
2. Define neutral point. What is the unit of magnetic intensity? (2)
3. What do you mean by terrestrial magnetism? Name its elements. (2)
4. Define a uniform magnetic field. (1)
5. A small magnet is pivoted to move freely. At what place on the earth's surface will the magnet be vertical? Explain
6. Explain the terms – declination, dip and horizontal intensity of the earth's magnetic field at that point. (6)
7. Define magnetic intensity. Calculate the magnetic intensity at a point on the axial line of a bar magnet. (1+4=5)
8. What is earth's magnetism? Mention the element of earth's magnetism. (3)
9. What are the elements of terrestrial magnetism? Explain each one. (3)
10. What is reinform magnetic field? (1)

Chapter 5: Modern Physics

Fill in the blanks

1. The kinetic energy of a photoelectron emitted depends on the _____ of the incident light.
2. The particle of light is called _____.
3. Frequency of X-rays is _____ than the frequency of visible light.
4. Photo-electric emission depends upon the _____ of the incident of light.
5. X-rays have _____ charge.
6. The number of photo-electrons emitted depends upon the _____ of incident wave.
7. The number of protons in ${}_{92}U^{238}$ is _____.
8. Photoelectric current increases with the increase in _____ of incident light.
9. β-ray is nothing but the streams of _____.
10. The particle emitted by metal under the action of light is _____.

True or False

1. X-rays are deflected by electric fields.
2. Fiber Optics work on the principle of photoelectric emission.
3. The photo-electric effect proves that light is quantum.

Choose the correct answer

1. X-ray consists of __

   (i) photon

   (ii) positron

   (iii) electron

(iv) positively charged particles

2. Which of the following radiations possess the maximum penetrating power?

   (i) α rays

   (ii) β rays

   (iii) γ rays

   (iv) ζ rays

3. A photoelectric cell converts

   (i) electrical energy into light energy

   (ii) light energy into heat energy

   (iii) light energy into electrical energy

   (iv) chemical energy into electrical energy

4. The velocity of γ rays is

   (i) more than that of light

   (ii) same as that of light

   (iii) less than that of light

   (iv) cannot compare with light

5. The nature of the nucleus is not affected by the emission of

   (i) α - rays

   (ii) β - rays

   (iii) γ - rays

   (iv) positron

Answer the following questions

1. What do you mean by photoelectric effect? Deduce Einstein's photoelectric equation. What is work function of metal? (1+3=4)
2. Define mass defect and binding energy. (3)
3. What is X-ray? Mention some uses of X-ray in the medical and technical field. (4)
4. What is radioactivity? State some properties of alpha particle. (3)
5. The work function of a metal is 3.3eV. Calculate the threshold frequency for it. Given $h = 6.6 \times 10^{-34}$Js.
6. State two properties each of α , β and γ rays. (2)
7. What is binding energy of a nucleus? (2)
8. What is work function? (1)
9. What do you understand by atomic mass unit? (1)

10. Photo-electrons are emitted by a sodium surface when UV light of wavelength $3 \times 10^{-31} m$ fall on its surface. Calculate the velocity of photo-electrons assuming the work function of sodium to be negligible.

    Here mass of electron= $9.1 \times 10^{-31} kg$,

    Plank's constant= $6.6 \times 10^{-34} Js$

11. What are photoelectrons. (1)
12. Calculate the frequency of a radiation whose photon has an energy 66.24 eV.

    $h = 6.624 \times 10^{-34} Js,\ 1eV = 1.6 \times 10^{-19} J$ (2)

13. Convert 1 amu into eV. (2)
14. What is a mass defect? Give the expression with its symbolic meaning. (2)
15. Calculate the energy of a photon of radio waves of wavelength 30 metres.

    Given $h = 6.62 \times 10^{-27} erg\ sec$ (3)

16. Give two properties of Beta and Gamma rays. (2+2=4)
17. What are the types of lasers based on the laser medium used? (2)

Chapter 6: Heat and Thermodynamics

Fill in the blanks

1. The latent heat of fusion of ice is _____.
2. _____ is the process of change of state from liquid to gas at any temperature.
3. From 0°C to 4°C volume of water _____.
4. The amount of mechanical work done to completely melt one gram of ice is _____.
5. SI unit of heat is _____.
6. Two bodies are said to be in thermal equilibrium if they have the same _____.
7. The quantity of heat required to raise the temperature of 5kg of water through 20°C is _____ calorie.
8. Thermal capacity of the body is equal to the product of mass and _____.

True or False

1. During the change of state the temperature of material remains constant.
2. Heat comes from the sun to earth by conduction process.
3. Thermometer is a device to measure the heat of a body.
4. Evaporation takes place at any temperature.
5. Latent heat of fusion of ice is 90kcal/g.
6. Temperature is a form of energy.
7. Barometer is used to measure temperature.
8. Kelvin scale is also known as Absolute scale of temperature.
9. Evaporation is a slow process.
10. The temperature at which the Celsius and Fahrenheit scale reads the same is +40°C.
11. Coefficient of linear expansion depends on unit of length.

Choose the correct answer

1. The temperature of a patient is 40°C, his temperature of Fahrenheit scale will be

   (i) 104F

   (ii) 72F

   (iii) 96F

   (iv) 100F

2. Which of the following is equivalent to a temperature of 68F ?

   (i) 40°C

   (ii) 30°R

   (iii) 293K

   (iv) 30°C

3. If the temperature in Celsius scale is 20°c, in the Kelvin scale it is

   (i) 290K

   (ii) 320K

   (iii) 293.15K

   (iv) 293K

4. Water is used in hot water bags because

   (i) it has the lowest specific heat

   (ii) it has the highest specific heat

   (iii) it is not related to specific heat

   (iv) None of the above

5. A gap is left between two rails to allow

   (i) surface expansion

   (ii) linear expansion

   (iii) None of the above

Answer the following questions

1. Distinguish between sensible heat and latent heat. (2)
2. Define co-efficient of linear expansion. Show that co-efficient of superficial expansion is twice of co-efficient of linear expansion. (1+3=4)
3. "The latent heat of fusion of ice is 80 cal/g." What do you understand by this statement? (2)
4. What are the different modes of transmission of heat? (2)
5. What is anomalous expansion of water? (1)

6. Does co-efficient of linear expansion depend on unit of length and unit of temperature? (2)
7. Distinguish between evaporation and boiling. (2)
8. 40gm of water at 60°C is poured into a calorimeter whose temperature is 20°C. The final temperature of the two is 45^0C. Find the water equivalent of the calorimeter. (2)
9. Define specific heat and express it mathematically. What is its unit? (3+1=4)
10. Write the difference between heat and temperature. Name the commonly used scales of temperature. (2+1=3)
11. State the Zeroth's law of thermodynamics. (1)
12. Write the first law and the second laws of thermodynamics. (2)
13. Find the amount of heat required to increase the temperature of 100g water at 10°C to vapour at 100°C. Specific heat of water is 1cal/g°C and latent heat of vaporization of water is 540cal/g. (4)
14. Define: specific heat, thermal capacity and water equivalent with their SI units. (3)
15. An iron ball weighing 100gm and heated to 98.5°C are dropped in a calorimeter weighing 46 gm and containing 85.4gm of water at 15°C. the final temperature of the mixture becomes 22°C. Calculate the specific heat of iron. (Given, specific heat of calorimeter material = 0.1cal/gm) (3)
16. Define co-efficient of linear expansion of solid and hence show that $\alpha = \frac{1}{2}\beta$. (3)