Question bank

Chapter-1 Topic 1 Position, distance and displacement

Q-1 **What is a 'frame of reference'?**

Q-2 **On a graph, which is the x-axis, and which is the y-axis?**

Q-3 **Write two or three sentences, in good English, on 'formalisms'.**

Q-4 **Using graph paper, draw a set of x- and y-axes, each axis with values 0 to 10. Now, using correct procedure, plot on this graph points having co-ordinates (1,7); (2,6); (3,4); (4,2); (6,2); (7,2).**

Chapter-2 Topic 2 Vectors

Q-1 **What is the resultant of two vectors? Show how you would construct a resultant.**

Q-2 **A tortoise walks from T to H, a distance of 15 m in a straight line south. He stops to eat a cabbage leaf, and then walks east 30 m, turns north, and walks 6 m, where he beds down for the night. What is his displacement from point T? Draw a vector diagram.**

Q-3 **Write down whether the following statements are true or false. (Don't guess – some examiners take off marks for wrong answers!)**

a) There is only one correct way of constructing a resultant from two component vectors. (1)

b) As long as we use appropriate units, it is acceptable to use both force and velocity vectors in a single vector diagram. (1)

c) A vector is made up of a magnitude and a direction. (1)

Chapter-3 Topic 3 Speed, velocity and acceleration

Q-1 **What is meant by 'instantaneous velocity'?**

Q-2 **What is meant by the 'slope' of a graph? How would you calculate slope? Give a simple example.**

Q-3 **A car accelerates uniformly from rest to 60 km/h in 20 seconds. What is its average velocity during this time? Express the result in SI units. Draw a graph to show your working.**

Multiple Choice Questions

Q-1 **Muzzle velocity can correctly be described as:**

(a) The speed and direction in which the front of a gun or rifle moves, in relation to some fixed point, when it is fired.

(b) The velocity at which a bullet leaves a gun or rifle.

(c) The speed at which a bullet leaves a gun or rifle.

(d) Options (b) and (c) are correct.

Q-2 **A straight line, parallel to the x-axis in a velocity-time graph, indicates that:**

(a) Velocity is changing uniformly.

(b) Velocity is changing non-uniformly.

(c) Velocity is not changing.

(d) The answer depends on what units are used for the two axes.

Chapter-4 Topic 4 Equations of uniformly accelerated motion

Q-1 **What is a 'reaction time'? Why do you think a reaction time always exists between noticing something and responding to it?**

Q-2 **In what century was Galileo born?**

Q-3 **Explain, in your own words, the meaning of 'kinematics' and of 'dynamics'.**

Q-4 **What quantity does the ratio of delta v to delta t define? In what SI units is the quantity expressed?**

Q-5 **What is a trapezoid? What is the formula for the area of a trapezoid? Illustrate your answer with a sketch.**

Q-6 **How far does a body fall in the first second, if it starts from rest?**

Q-7 **Write down whether the following statement is true or false: The equations of motion can be derived from a velocity–time graph.**

Q-8 **A bird's egg falls from its nest in a tall tree. The nest is 8 m above the ground. Answer the following, showing your working clearly:**

a) How long does it take the egg to reach the ground, from the time it leaves the nest? (Ignore effects of air, and take $g = 10\ m/s^2$.)

b) Now bring in some wind. Assume a gentle wind is blowing at 2 m/s. How far from a point vertically beneath the nest will the egg land? Sketch a simple vector diagram to show how you arrive at your answer.

Chapter-5 Topic 5 Equilibrium of forces

Q-1 **A toy boat floats in a tank of very hot water. The boat is then transferred to a tank of very cold water. In the sketches below, which is the hot water – A or B? Explain your answer.**

Q-2 **What is an 'equilibrant force'? Draw a sketch to illustrate your answer.**

Q-3 **Here is a sketch of two people in a swimming pool. One of them is fat; the other is thin but muscular. Which is which? Explain your answer.**

Q-4 **A toy boat floats in a small tank of water. Now this system is transferred to the moon (in a suitable container, to prevent the water immediately boiling away). Will the toy boat? Explain your answer carefully.**

a) sink

b) float lower in the water

c) float higher in the water

d) float at exactly the same level

Q-5 **Will lead float in mercury?**

Q-6 **Would it be helpful to throw water on a petrol fire?**

Q-7 **State the two conditions of equilibrium.**

Q-8 **Your sister weighs exactly half of what you weigh. Explain where the two of you would sit on a see-saw to be balanced. Illustrate your answer.**

Q-9 **An ocean liner steams from port A to port B, 500 km away. The water is the same temperature in both ports, and no passengers or cargo leave the ship, but at port B the ship is floating slightly higher in the water. Suggest a probable reason for this.**

Q-10 **A seesaw is balanced when a mass of 10 kg is placed 1.2 m from the fulcrum, and a joint of meat is placed 65 cm from the fulcrum on the opposite side. What is the mass of the joint of meat? Show your working clearly.**

Multiple Choice Questions

Q-1 **A toy boat floats in a small tank of water. Now this system is transferred to the moon (in a suitable container, to prevent the water immediately boiling away). Will the toy boat**

(a) sink

(b) float lower in the water

(c) float higher in the water

(d) float at exactly the same level?

Chapter-6 Topic 6 Projectiles

Q-1 **Explain what is meant by saying that the trajectory of a projectile is symmetrical.**

Q-2 **When is the path of a projectile not a parabola?**

Q-3 **Answer this question without doing any calculations. A ball is thrown vertically upward with an initial velocity of 20 m/s. Roughly how high will it go? Roughly how long, from the time of leaving the thrower's hand, will it take to return to the ground? Explain your answer.**

Q-4 **What important contribution did Galileo make to the study of projectiles?**

Q-5 **What is the study of projectiles called?**

Q-6 **What does 'escape speed' mean? Give a value for our own planet.**

Q-7 **Have you read Jules Verne's book From the Earth to the Moon? Answer yes or no.**

Q-8 **At what angle would it be best to kick a football, from horizontal ground, to achieve the greatest range?**

Q-9 **Why do you think Question 7, above, is significant in the context of projectiles?**

Multiple Choice Questions

Q-1 **A man kicks a football off the deck of a ship, 3 m above the surface of the water. At what angle should the ball leave the deck if it is to travel the greatest possible distance before hitting the water?**

(a) 45º

(b) somewhat less than 45º

(c) somewhat more than 45º

(d) horizontally (i.e. at 0º to the deck)

Chapter-7 Topic 7 Simple harmonic motion

Q-1 **What do you understand by the term 'elasticity'?**

Q-2 **Define 'simple harmonic motion'.**

Q-3 **What is the equation for the spring constant?**

Q-4 **What is the 'period' (T) of any periodic motion? How does period relate to frequency?**

Q-5 **The motion of a pendulum is very nearly 'perfect' simple harmonic motion. Why isn't it 'perfect' simple harmonic motion?**

Q-6 **What is 'angular speed'?**

Q-7 **What is the direction of the acceleration vector in a body moving with constant speed in a circle?**

Q-8 **A bicycle wheel rotates at 40 rpm (revolutions per minute). Calculate its angular speed, in degrees per second.**

Q-9 **A pendulum of length 1.00 m swings on the top of Chappal Waddi Mountain (altitude 2 419 m). A Nigerian physics student measures the period (T) of the pendulum, using an accurate chronometer. If the value of g at this point is 9.78 N, what value is the student likely to get for T? Show your working clearly**

Chapter-8 Topic 8 Linear momentum

Q-1 **What does 'NASA' stand for? You were not told this in the text. You will need to look this up.**

Q-2 **What is Newton's third law of motion?**

Q-3 **A physicist throws an egg against a brick wall. The result is entirely as expected. She now hangs a thick blanket about 5 cm in front of the wall, puts some cushions below the blanket, and throws another egg at the blanket-shielded wall. Do you think the egg will break? Briefly explain your view.**

Q-4 **If you jump from a small height down to the ground it is important to bend your knees as you land. Why?**

Q-5 **How are the quantities force and pressure related? What is the SI unit of pressure? How is this unit defined?**

Q-6 **Your elder sister is good at maths, but does not study physics. She is taking driving lessons. Explain to her why seatbelts are important.**

Q-7 **What is the difference between a rocket and a jet?**

Q-8 **Write brief notes on 'gravitational mass' and 'inertial mass'.**

Q-9 **The moon has a mass of about one eightieth that of earth, yet moon's surface gravity is about one sixth of earth's surface gravity. Why is this?**

Chapter-9 Topic 9 Mechanical energy

Q-1 **What is the formula for kinetic energy?**

Q-2 **What is a simple definition of a 'machine'?**

Q-3 **Name four types of 'simple machine'.**

Q-4 **There are three so-called 'orders' of lever. How are they distinguished from each other?**

Q-5 **Briefly describe an Archimedes screw. What is it ordinarily used for?**

Chapter-10 Topic 10 Heat energy: Temperature and its measurement

Q-1 **The highest recorded temperature in Nigeria occurred in the city of Sokoto, where the temperature reached 47.2 °C. What is this temperature on the Kelvin scale?**

Q-2 **Give two advantages and two disadvantages of the mercury thermometer compared to the alcohol thermometer.**

Q-3 **Give one advantage and one disadvantage of the resistance thermometer compared to the thermocouple.**

Q-4 **Give reasons for the following features of a clinical thermometer:**

a) The stem is long and cylindrical and not spherical.

b) The bulb is made of thin glass.

c) The capillary has a very small cross-sectional area.

d) There is a constriction on the capillary.

Q-5 **Name six properties that a liquid must have in order for it to be used as a thermometric liquid in a liquid-in-glass thermometer. Give a reason for choosing each of the properties.**

Q-6 **Answer the following questions:**

a) Give one advantage and one disadvantage of using a gas thermometer.

b) A gas thermometer reads 320 mm Hg when placed in a beaker of ice and water, and 332 mm Hg at 27 °C. What will the pressure reading be when placed in a mixture of steam and water at 760 mm Hg?

Q-7 **A mercury-in-glass thermometer made in the school laboratory is marked 30 mm in ice-water and 110 mm in steam-water at 760 mm Hg. What will be the reading on the thermometer at 30 °C?**

Q-8 **A resistance thermometer has a resistance of 20 Ω at the lower fixed point and 55 Ω at the upper fixed point. What will be the temperature reading when its resistance is 67 Ω?**

Q-9 **The diagram below shows a maximum and minimum thermometer.**

a) Name the liquids A and B.

b) What is the room temperature being recorded?

c) What are the maximum and minimum temperatures recorded for the day?

Multiple Choice Questions

Q-1 **Temperature is a measure of the:**

(a) heat content of the molecules

(b) amount of work done on the molecules

(c) amount of expansion of the molecules

(d) average translational kinetic energy of the molecules

Q-2 **Which of the following thermometers can be used to measure temperatures ranging from –20 °C to 200 °C? (i) mercury thermometer (ii) alcohol thermometer (iii) maximum and minimum thermometer**

(a) (i), (ii) and (iii)

(b) (i) only

(c) (i) and (ii) only

(d) (i) and (iii) only

Q-3 **The lower and upper fixed points used in calibrating a thermometer respectively are**

(a) 0 K and 100 K

(b) 273 °C and 100 °C

(c) 273 K and 373 K

(d) 0 K and 373 K

Q-4 **The thermometer most suitable to measure the temperature of molten aluminium (660 °C) is a:**

(a) mercury thermometer

(b) gas thermometer

(c) resistance thermometer

(d) thermocouple

Q-5 **Mercury and not water is used in thermometers because: (i) mercury is a good conductor of heat (ii) mercury has a high expansivity (iii) mercury has a high density**

(a) (i) only

(b) (i) and (ii) only

(c) (i) and (iii) only

(d) (i), (ii) and (iii)

Q-6 **A good thermometer must have the following three properties: (i) very accurate measurements (ii) respond quickly to temperature change (iii) wide range of measurements. Which are satisfied by a resistance thermometer?**

(a) (i) only

(b) (i) and (ii) only

(c) (i) and (iii) only

(d) (i), (ii) and (iii)

Q-7 **Which one of the following statements about temperature scales is INCORRECT?**

(a) The lowest possible temperature is 0 K.

(b) A temperature change of 10 °C is the same as a change of 10 K.

(c) Absolute temperature is measured in kelvins.

(d) A temperature of 155 °C is the same as 155 K.

Q-8 **The pressure reading on a gas thermometer is 220 mm Hg at 0 °C and 310 mm Hg at 100 °C. What is the temperature when the pressure reads 200 mm Hg?**

(a) 22.2 °C

(b) –22.2 °C

(c) 45 °C

(d) –0.22 °C

Q-9 **When the temperature of a gas in a fixed container is increased:**

(a) The density of the gas increases.

(b) The volume of the gas increases.

(c) The number of collisions of molecules with the walls increases.

(d) The time between collisions increases.

Q-10 **The pressure of a gas in a cylinder at 20 °C is p. If the temperature increases to 30 °C, the new pressure will be:**

(a) 0.67 p

(b) 1.5 p

(c) 1.03 p

(d) 10 p

Chapter-11 Topic 11 Heat energy: Heat energy measurements

Q-1 **Calculate the quantity of heat required to raise the temperature of 400 cm³ of water from 25 °C to 80 °C.**

Q-2 **An immersion heater rated at 140 W is used to melt 100 g of crushed ice and raise the temperature of the melted ice to 10 °C. Determine the time taken for this process, assuming there is no heat loss.**

Q-3 **Francisca and Ayodele conducted an experiment to determine the specific heat capacity of water, using a hot block of copper and a copper calorimeter with water. They recorded: Mass of calorimeter = 53.6 g; Mass of calorimeter + water = 92.5 g; Mass of hot copper + calorimeter + water = 140.8 g; Initial temperature of water = 15.9 °C; Temperature of hot copper = 93.3 °C; Final temperature of water and copper = 23.2 °C.**

a) Why was cold water used in the experiment?

b) Determine the specific heat capacity of water (c■ = 390 J kg■¹ °C■¹ for copper).

c) If a larger-mass copper block had been used, would the results be better? Explain.

Q-4 **In an experiment to measure the specific latent heat of vaporisation of water, cold water was placed in an insulated copper calorimeter and dry steam was added. Data recorded: Mass of calorimeter = 50.5 g; Mass of calorimeter + water = 91.2 g; Temperature of steam = 100 °C; Mass of calorimeter + water + steam = 92.3 g; Final temperature of water = 25 °C.**

a) Why was dry steam used?

b) Calculate the specific latent heat of vaporisation of water.

Q-5 **Evaporation of sweat from the human body is an important method of keeping the body cool in hot weather. Determine the mass of sweat that must evaporate from the surface of a 70 kg man in order to cool him by 1 °C. Take L_v = 2.42 × 10■ J kg■¹ and c = 4 200 J kg■¹ °C■¹.**

Q-6 **Give two methods of (a) increasing the boiling point of water and (b) decreasing the melting point of water.**

Q-7 **A small refrigerator freezer has a power rating of 100 W and is 80% efficient.**

a) What quantity of heat is removed every second from the air in the freezer?

b) Calculate the quantity of heat required to convert 20 g of water at 20 °C into ice at –10 °C.

c) How long will it take the ice to reach –10 °C?

Q-8 **Allowing a liquid to evaporate in a closed pipe inside the freezer cools the air in the freezer. The vapour is then pumped through the pipe to the outside of the freezer, where it condenses again.**

a) Explain how this process cools the air in the freezer.

b) Explain why the freezer causes the room temperature to rise.

Q-9 **The hottest month in the city of Kano is April, when the average daily maximum temperature is 38 °C. If the relative humidity for April is 36% and the saturation vapour pressure is 6.63 kPa, determine the actual vapour pressure.**

Q-10 **A skin burn caused by steam at 100 °C is much worse than that caused by water at 100 °C. By calculating the quantity of heat given off by (a) 10 g of steam at 100 °C cooling to skin temperature at 34 °C, and (b) 10 g of water at 100 °C cooling to 34 °C, prove the above statement.**

Multiple Choice Questions

Q-1 **The quantity of heat required to change 1 kg of a substance by 1 °C is called:**

(a) heat of fusion

(b) heat capacity

(c) specific heat capacity

(d) specific latent heat

Q-2 **The specific latent heat of vaporisation is the quantity of heat required to change:**

(a) a liquid to a gas without a change in temperature

(b) a solid to a liquid without a change in temperature

(c) 1 kg of a liquid to a gas without a change in temperature

(d) 1 kg of a gas to a liquid without a change in temperature

Q-3 **When 2 kg of water freezes to form ice:**

(a) 6.68 × 10■ J of energy is absorbed

(b) 6.68 × 10■ J of energy is released

(c) 8.40×10^3 J of energy is released

(d) 8.40×10^3 J of energy is absorbed

Q-4 **Equal quantities of heat are given to copper, lead, aluminium and iron, all of them having the same mass and all initially at room temperature. If no change in state occurs, which of the metals will have the largest final temperature?**

(a) lead

(b) iron

(c) copper

(d) aluminium

Q-5 **Iodine sublimes because it changes from:**

(a) liquid to gas

(b) solid to liquid

(c) gas to liquid

(d) solid to gas

Q-6 **The temperature at which the water vapour in the air becomes saturated and condenses on the ground is known as:**

(a) condensation point

(b) freezing point

(c) dew point

(d) critical point

Q-7 **When a gas changes state to a liquid, the temperature is:**

(a) below the boiling point

(b) constant

(c) below the melting point

(d) equal to the freezing point

Q-8 **The condensation point of the substance is:**

(a) 150 °C

(b) 0 °C

(c) 250 °C

(d) 300 °C

Q-9 **The latent heat of fusion of the substance is:**

(a) 800 kJ

(b) 1 200 kJ

(c) 400 kJ

(d) 950 kJ

Q-10 **Which one of the following statements about evaporation is INCORRECT?**

(a) Both boiling and evaporation result in a state change from liquid to gas.

(b) Evaporation is accompanied by a decrease in temperature.

(c) Evaporation is increased with an increase in surface area of the evaporating liquid.

(d) Evaporation of water is increased with an increase in relative humidity of the surrounding air.

Chapter-12 Topic 12 Gas laws

Q-1 **A water manometer has a gauge pressure reading of 4.9 kPa when it is used to measure the pressure of a gas. What is the difference in the two water levels of the manometer?**

Q-2 **A barometer is made using water instead of mercury in the glass tube and in the basin in which the tube is inverted. What height of water will be supported in the tube if the atmospheric pressure is 98.7 kPa?**

Q-3 **The volume of a gas in a cylinder with a movable piston is doubled while keeping the temperature constant.**

a) How will the pressure of the gas change?

b) Name the law that you used in answering (a).

c) Use the kinetic theory of gases to explain why the pressure changed as in (a).

Q-4 **The volume of a fixed mass of gas is 15 cm^3 at a pressure of 750 mm Hg and at 27 °C. What will be the volume of the gas at a pressure and temperature of:**

a) 900 mm Hg and 27 °C

b) 750 mm Hg and 87 °C.

Q-5 **A balloon is filled with 500 ml of helium at a temperature of 27 °C. What will be the volume of the balloon when it is placed in a container of boiling nitrogen, whose boiling point is –195 °C?**

Q-6 **A cylinder containing an air-tight movable piston contains 10 dm^3 of oxygen gas at a temperature of 20 °C and 200 kPa. What will be the volume of the gas at STP?**

Q-7 **A fixed mass of gas at a pressure of 10■ Pa expands at a constant temperature of 27 °C to twice its volume. The volume is then kept constant, and the gas is heated to a temperature of 57 °C. Calculate the final pressure of the gas.**

Q-8 **A 15-litre cylinder contains propane gas at a pressure of 20 atmospheres. When the valve of the cylinder is opened, 30 litres of the gas is used up at atmospheric pressure (1 atmosphere). Calculate:**

a) the volume of the gas escaping from the cylinder at 20 atmospheres

b) the pressure of the gas that remains in the cylinder

Q-9 **A column of air of length 30 cm is trapped in the closed end of a long narrow capillary tube by a bead of mercury of length 10 cm, as shown in Figure A. The other end of the tube is open to the atmosphere, whose pressure is 76 cm Hg. Determine the length of the air column when the capillary tube is:**

a) inverted with the open end facing downwards as in Figure B

b) placed horizontal as in Figure C

Multiple Choice Questions

Q-1 **Which one of the following units is the SI unit for gas pressure?**

(a) millibar

(b) pascal

(c) mm Hg

(d) atmosphere

Q-2 **You are given the following instruments: (i) Bourdon gauge (ii) manometer (iii) aneroid barometer. Which can measure tyre air pressure?**

(a) (i) only

(b) (i) and (ii) only

(c) (i), (ii) and (iii)

(d) (ii) and (iii) only

Q-3 **When a mercury manometer is connected to a gas cylinder, the mercury levels differ by 0.34 m. With ρ = 1.36×10■ kg/m³, the gauge pressure is:**

(a) 4.6 kPa

(b) 45.4 kPa

(c) 55.9 kPa

(d) 146.7 kPa

Q-4 **A mercury barometer reads 76 cm Hg at sea level and is taken atop a mountain. Which reading is plausible?**

(a) 76 cm

(b) 78 cm

(c) 66 cm

(d) 88 cm

Q-5 **A student verifying a gas law draws a graph but omits axis labels. Which is correct?**

(a) Pressure vs Volume

(b) Volume vs Temperature (°C)

(c) Temperature (°C) vs Volume

(d) Temperature (K) vs Pressure

Q-6 **Which graph correctly illustrates Boyle's law ($p \propto 1/V$)?**

(a) Hyperbola in p-V plot

(b) Straight line p vs V

(c) Straight line p vs 1/V

(d) Horizontal line

Q-7 **The diagram shows bulbs X (4 dm^3, 300 kPa) and Y (2 dm^3, vacuum) connected. On opening the valve, the pressure in Y becomes:**

(a) 200 kPa

(b) 600 kPa

(c) 150 kPa

(d) 50 kPa

Q-8 **The pressure in a balloon is P. If volume and absolute temperature both double, the new pressure is:**

(a) 2P

(b) 4P

(c) ½P

(d) P

Q-9 **The pressure of an ideal gas does NOT depend on:**

(a) collision frequency

(b) momentum change per collision

(c) average kinetic energy

(d) molecular volume

Q-10 **A CO■ gas has volume 0.50 m³ at 27 °C and 120 kPa. What is its volume at STP?**

(a) 0.07 m³

(b) 0.59 m³

(c) 0.54 m³

(d) 6.0 m³

Chapter-13 Topic 13 Production and propagation of waves

Q-1 **Differentiate between a pulse and a wave.**

Q-2 **The diagram shows a wave being generated in a rope. Draw a diagram to show what the wave will look like after half of the period has elapsed. Show the red ribbon, amplitude, crest, trough and wavelength.**

Q-3 **An oscillator attached to a rope makes 50 vibrations in 30 s. A crest on the rope travels 350 cm in 15 s. Determine: a) the period of the waves in the rope; b) the speed of the waves in the rope.**

Q-4 **The following graph shows the waveform of waves travelling at 0.1 m/s in a ripple tank. Determine: a) the amplitude of the wave; b) the wave frequency; c) the wavelength of the waves.**

Q-5 **In one part of a ripple tank water waves have a velocity of 20 cm/s and a wavelength of 3 cm. In another part the same waves travel at 15 cm/s due to a change in water depth. What will be the values of the frequency and wavelength in the second part of the tank?**

Q-6 **Give two differences between water waves and light waves.**

Q-7 **Determine the frequency of red light of wavelength 700 nm.**

Q-8 **A signal generator gives off sound waves with a wavelength of 1.1 cm. Do a calculation to determine if this sound can be heard by humans. Take the speed of sound as 332 m/s.**

Q-9 **In 2004, an earthquake in South-East Asia triggered immense tidal waves (tsunami) with a crest-to-crest distance of 800 km and a period of 1.0 hour. Determine the speed of the tsunami waves in km/h and compare this speed with that of a jet aircraft travelling at 300 km/h.**

Multiple Choice Questions

Q-1 **Which one of the following waves is NOT a mechanical wave?**

(a) waves in a rope

(b) sound waves

(c) light waves

(d) water waves

Q-2 **Which of the following three statements are correct? (i) waves are caused by objects undergoing simple harmonic motion (ii) particles in a wave oscillate about their equilibrium position (iii) waves transport energy from one point to another**

(a) (i), (ii) and (iii)

(b) (i) and (ii) only

(c) (i) and (iii) only

(d) (iii) only

Q-3 **Which pair(s) of the points on the following wave are in phase? P Q R S T U Displacement Displacement**

(a) Q and R

(b) P and T

(c) P and U, and Q and S

(d) P and T, and Q and R

Q-4 **A ball-ended dipper is used to generate circular waves in a ripple tank. When the frequency of the dipper is doubled:**

(a) Both the period and wavelength of the waves will be doubled.

(b) Both the period and wavelength of the waves will be halved.

(c) The period of the waves will be doubled, but the wavelength will be halved.

(d) The period of the waves will be halved, but the wavelength will be doubled.

Q-5 **The amplitude of any wave is dependent on the _____ of the wave.**

(a) wavelength

(b) frequency

(c) speed

(d) energy

Chapter-14 Topic 14 Types of waves

Q-1 **What is the difference between a transverse wave and a longitudinal wave?**

Q-2 **Explain why longitudinal waves cannot be propagated in a vacuum.**

Q-3 **A wave in a string is described by the function Y = (0.11 m) sin(20.0 t + 8.50 x), where x is in metres and t in seconds. Calculate the following for the wave:**

a) amplitude

b) wavelength

c) period

d) speed

Q-4 **A passenger on a stationary cruiser boat on a lake observes water waves moving towards her with constant velocity. The wave function is Y = (9.25 cm) sin(0.38 x – 4.70 t), where x is in centimetres and t in seconds.**

a) What is the distance between two wave crests approaching her?

b) How many complete waves approach her in 20 s?

c) How fast are the waves approaching her?

Q-5 **A sinusoidal wave of wavelength 0.45 m and amplitude 12.0 cm travels along a string in the positive x direction. A student notes it takes 2.0 s for one wave to go past him.**

a) Are the waves transverse or longitudinal?

b) Write down the wave function to describe this wave.

c) Sketch the wave at t = 0, showing at least two waves. Label the amplitude and wavelength.

Multiple Choice Questions

Q-1 **Which one of the following are longitudinal waves?**

(a) microwaves

(b) waves in a ripple tank

(c) sound waves

(d) radio waves

Q-2 **Which of the following statements are true? (i) Light waves are transverse waves. (ii) Light waves need a medium for propagation. (iii) Light waves can be represented by the wave function $Y = A \sin(2\pi/\lambda\, x - \omega t)$**

(a) (i), (ii) and (iii)

(b) (i) only

(c) (i) and (ii) only

(d) (i) and (iii) only

Q-3 **For transverse waves moving with constant velocity, which one of the following depend on each other?**

(a) amplitude and wavelength

(b) wavelength and frequency

(c) amplitude and frequency

(d) amplitude, frequency and wavelength

Q-4 **The following diagram shows a particle P on a transverse wave travelling to the right. Which one of the following diagrams correctly shows the position of P after the wave has travelled for a time equal to one quarter of its period?**

(a) A

(b) B

(c) C

(d) D

Q-5 **A wave on a string is described by the function: Y = (0.10 m) sin(8.40x – 30.0t) where x is measured in metres and t in seconds. The wavelength of this wave is given by:**

(a) 0.10 m

(b) 0.75 m

(c) 1.34 m

(d) 4.77 m

Chapter-15 Topic 15 Properties of waves

Q-1 **Give two differences between the reflection and refraction of waves.**

Q-2 **State the two laws of reflection.**

Q-3 **The diagram shows the side view of a plane wave dipper in a tank of water of different depths. Sketch a diagram of the top view of the plane waves as they move away from the plane wave dipper. Show the effect of the depth of the water on the plane waves.**

Multiple Choice Questions

Q-1 **Which of the following is (are) necessary for reflection to occur? (i) the presence of two different media (ii) a change in direction of the reflected wave (iii) a change in speed of the reflected wave**

(a) (i), (ii) and (iii)

(b) (i) and (ii) only

(c) (ii) only

(d) (i) and (iii) only

Q-2 **You are given the following waves: (i) light waves (ii) heat waves (iii) radio waves. Which of the above waves can undergo both reflection and refraction?**

(a) (i), (ii) and (iii)

(b) (i) only

(c) (i) and (ii) only

(d) (i) and (iii) only

Q-3 **A wave is incident at a boundary such that its direction is 50° with the boundary. The angle of reflection will be:**

(a) 50°

(b) 40°

(c) 90°

(d) 10°

Q-4 **If the distance between a node and an adjacent antinode on a stationary wave on a rope is 4.0 cm, then the wavelength of the wave is:**

(a) 2.0 cm

(b) 4.0 cm

(c) 8.0 cm

(d) 16.0 cm

Q-5 **A wave in a ripple tank passes from a region of shallow water to a region of deep water. Then:**

(a) both the wavelength and speed of the wave will decrease

(b) the wavelength will decrease but the speed will increase

(c) both the wavelength and speed of the wave will increase

(d) all of the frequency, wavelength and speed will decrease

Chapter-16 Topic 16 Light waves

Q-1 **What is the Greek word for the Sun?**

Q-2 **What is the speed of light in a vacuum?**

Q-3 **Light travels at different speeds in different media. What is the main consequence of this fact?**

Q-4 **What does 'specular' mean?**

Q-5 **What are the two laws of reflection?**

Q-6 **What name is given to the problem or defect of spherical mirrors in terms of their ability to produce an image? What shape of mirror surface does not cause this problem?**

Q-7 **What is the formula for determining the refractive index of a medium?**

Q-8 **In optics, what is the 'critical angle'?**

Q-9 **Different types of spectacle lenses are used to correct 'short sight' and 'long sight'. Which of these two types of lens will produce a real image?**

Q-10 **What is the difference between a 'simple lens' and a 'compound lens'? Why are compound lenses preferred?**

Q-11 **Roughly how much matter does the Sun convert into energy every second?**

Chapter-17 Topic 17 Sound waves

Q-1 **State the three characteristics of sound and the factor on which each depends.**

Q-2 **Explain resonance as applied to sound.**

Q-3 **The speed of sound in aluminium is 6400 m/s and that in air is 330 m/s. One end of a 200 m long aluminium pipe is tapped with a hammer. If you place your ear at the other end of the pipe, you will hear two sounds, one in the pipe and the other in the air. What will be the difference in the time between the two sounds?**

Q-4 **The frequency of a tuning fork is determined by striking the tuning fork and then holding it near the open end of a glass tube partly submerged in water. The smallest value of L for which a loud resonant sound is heard from the tube is 16.7 cm. Take the speed of sound in air to be 343 m/s and ignore end-corrections.**

a) Determine the frequency of the tuning fork.

b) Determine the length L for which second resonance occurs in the glass tube.

c) Draw the waveform of the standing wave in the tube for second resonance. Mark the displacement nodes and antinodes.

Q-5 **A pipe is open at both ends and resonates at its fundamental frequency of 260 Hz. Determine the fundamental frequency if one end of the pipe is closed and the pipe is made to resonate again.**

Q-6 **A small loudspeaker having a frequency of 1020 Hz is positioned some metres away from a wall made of hardboard. Stationary or standing waves are created in the air between the loudspeaker and the wall. Starting from the wall, four successive nodes are observed between the wall and the loudspeaker. If the speed of sound in the air is 340 m/s, calculate:**

a) the wavelength of the sound waves

b) the distance between the loudspeaker and the wall.

Q-7 **The second overtone of an organ pipe which is open at both ends is 300 Hz. Take the speed of sound to be 340 m/s.**

a) Draw a diagram to show the stationary sound wave in the pipe. Indicate the displacement nodes and antinodes.

b) Determine the length of the pipe.

Q-8 **The frequency of the note from a string which is fixed at both ends and vibrating in its fundamental mode is 600 Hz. Determine the frequency of the first overtone of the string and draw a sketch to illustrate the waveform of this overtone.**

Q-9 **The diagram shows a sonometer with paper riders on its wire. The distance between the two bridges X and Y is 90 cm. When the wire is set into resonance, a standing wave is set up between X and Y in it and the paper riders at B, D and F fall off the wire.**

a) Draw a sketch to show the standing wave in the wire.

b) Determine the frequency and wavelength of the standing wave in the wire, if its fundamental frequency is 300 Hz.

c) If the speed of the surrounding air is 330 m/s, what is the frequency and wavelength of the sound wave produced in the air by the vibrating string?

Multiple Choice Questions

Q-1 **The sound carried by air from a guitar to a listener is a:**

(a) longitudinal standing wave

(b) transverse standing wave

(c) longitudinal travelling wave

(d) transverse travelling wave

Q-2 **A certain sound is twice as loud as a second sound. This implies that the first sound has twice the:**

(a) speed of the second sound

(b) wavelength of the second sound

(c) pitch of the second sound

(d) amplitude of the second sound

Q-3 **A teacher is talking to his class about sound. The sound of his voice is most likely to have a wavelength of around:**

(a) 10 m

(b) 1 m

(c) 1×10^{-2} m

(d) 1×10^{-3} m

Q-4 **Sound is transmitted in air, water and steel. Which one of the following shows the correct order of increasing speed of sound?**

(a) air (0 °C), air (20 °C), water, steel

(b) air (20 °C), air (0 °C), water, steel

(c) air (20 °C), air (0 °C), steel, water

(d) steel, water, air (20 °C), air (0 °C)

Q-5 **A sound wave travelling through air has regions where the pressure changes are minimal (negative and maximum). These regions are called:**

(a) compressions

(b) rarefactions

(c) nodes

(d) antinodes

Q-6 **The vibration with the largest wavelength that can be produced on a string fixed at both ends is the:**

(a) first harmonic

(b) first overtone

(c) fifth harmonic

(d) fifth overtone

Q-7 **Which one of the following graphs represents a noise?**

(a) Graph A

(b) Graph B

(c) Graph C

(d) Graph D

Q-8 **The quality of a note depends on its:**

(a) amplitude

(b) wavelength

(c) frequency

(d) overtones

Q-9 **Which one of the following waveforms corresponds to a low pitched and high volume sound?**

(a) A

(b) B

(c) C

(d) D

Q-10 **The air in a tube which is open at both ends is resonating at a frequency of 512 Hz in its fundamental mode. If the speed of sound is 330 m/s, the length of the tube is approximately:**

(a) 16.1 cm

(b) 32.2 cm

(c) 38.8 cm

(d) 64.5 cm

Chapter-18 Topic 18 The human eye

Q-1 **What are 'photoreceptors'? Where would you find them in an eye?**

Q-2 **What does 'vitreous' mean?**

Q-3 **In relation to the eye, what is 'accommodation'?**

Q-4 **What is a dioptre? How is it defined?**

Q-5 **In relation to eyes, what is 'cataract'?**

Chapter-19 Topic 19 Application of sound waves

Q-1 **List two similarities and two differences between a flute and a clarinet.**

Q-2 **List two similarities and two differences between a saxophone and a trumpet.**

Q-3 **List two similarities and two differences between a guitar and a piano.**

Q-4 **A flute is 66 cm long and has six tone holes. When tone holes 4, 5 and 6 are open and all the others closed, the effective length becomes 44 cm. Take the speed of sound to be 340 m/s.**

a) Calculate the fundamental frequency and the first overtone for this length.

b) How does the fundamental frequency calculated compare with the fundamental frequency when all tone holes are closed? Make an appropriate calculation to support your answer.

c) Make sketches to show the standing waves in the flute for the frequencies calculated in (a).

Q-5 **A six-string guitar has 19 frets and strings of length 65 cm from the bridge to the nut. The fundamental frequency of the full-length first string is 329.6 Hz.**

a) Calculate the speed of the waves in the first string when it is vibrating in its fundamental mode.

b) Sketch the standing waves in the string for the first overtone of the first string.

c) The second string is made to resonate with the fundamental frequency of the first string when the second string is fretted at the 5th fret. If the 5th fret is 48.69 cm from the bridge, determine the fundamental frequency of the full-length second string.

Q-6 **Explain the functions of the following parts of a piano:**

a) hammer

b) damper

c) sounding board

Q-7 **Explain the use of echoes in the construction of concert halls.**

Q-8 **The distance between the airgun and the hydrophones attached to an oil exploration ship is 150 m. If the sonar waves reflected off the sediments at the bottom of the sea arrive at the hydrophones 2 s after the sonar waves travelling through the air, calculate the depth of the sediments. Take the speed of sound in air to be 330 m/s and in seawater to be 1 500 m/s.**

Q-9 **List the parts of a hearing aid and state the function of each part.**

Multiple Choice Questions

Q-1 **Which of the following is (are) woodwind musical instruments? (i) saxophone (ii) clarinet (iii) trumpet**

(a) (i), (ii) and (iii)

(b) (i) and (ii) only

(c) (i) only

(d) (i) and (iii) only

Q-2 **The flute is a musical instrument which is:**

(a) a pipe open at both ends and uses a reed for standing waves

(b) a pipe closed at one end and uses a reed for standing waves

(c) a pipe open at both ends and uses blowing air into an opening for standing waves

(d) a pipe closed at one end and uses blowing air into an opening for standing waves

Q-3 **The tone holes in wind instruments are used to:**

(a) change the pitch of the notes by changing the length of the pipes

(b) change the pitch of the notes by changing the width of the pipes

(c) change the intensity of the notes by changing the length of the pipes

(d) change the intensity of the notes by changing the width of the pipes

Q-4 **The following diagram shows the standing waves formed in a musical instrument of length L (one antinode midway). The instrument is most likely to be a:**

(a) flute

(b) guitar

(c) trumpet

(d) saxophone

Q-5 **A guitar string is set into vibration by a guitarist. When the guitarist presses the string near a fret:**

(a) The length of the string is shortened and the frequency of the note is increased.

(b) The length of the string is increased and the frequency of the note is increased.

(c) The length of the string is shortened and the frequency of the note is decreased.

(d) The length of the string is increased and the frequency of the note is decreased.

Q-6 **The following adjustments can be made to a drum: (i) Increase the tension of the membrane. (ii) Increase the surface area of the membrane. (iii) Increase the body of the drum. Which will increase the frequency of the notes produced?**

(a) (i) only

(b) (i) and (ii)

(c) (i) and (iii)

(d) (i), (ii) and (iii)

Q-7 **Which one of the following is NOT a percussion musical instrument?**

(a) xylophone

(b) cymbals

(c) bell

(d) tuba

Q-8 **The note middle C played on a piano always differs from middle C played on a violin because of a difference in:**

(a) frequency

(b) fundamentals

(c) overtones

(d) wavelength

Q-9 **Sarki stands some distance from a cliff and blows a whistle. If he hears the echo 3 s later, how far away is the cliff? Take the speed of sound as 0.33 km/s.**

(a) 0.1 km

(b) 0.05 km

(c) 0.5 km

(d) 1 km

Q-10 **Echo sounding uses lower frequency sonar waves in oil exploration than in sea depth finding because:**

(a) shorter wavelengths travel long distances in sedimentary rock

(b) longer wavelengths travel long distances in sedimentary rock

(c) larger velocities travel long distances in sedimentary rock

(d) larger intensities travel long distances in sedimentary rock

Chapter-20 Topic 20 Molecular theory of matter

Q-1 **Use the molecular theory of matter to explain how a gas exerts pressure on the walls of its containing vessel.**

Q-2 **Use the molecular theory of matter to explain why the pressure of a fixed mass of gas increases when the volume of the gas is decreased at constant temperature.**

Q-3 **Give two examples of situations where the adhesive forces are stronger than the cohesive forces.**

Q-4 **Explain why mercury does not display capillary action.**

Q-5 **Some crystals of copper sulphate are dropped into a beaker of water.**

a) Use the molecular theory of matter to explain why the water becomes blue in colour after some time.

b) What is the name of the phenomenon which causes the change in colour?

c) What effect on the colour change will occur if the water was hot?

Multiple Choice Questions

Q-1 **The molecular theory of matter is based on: (i) the random motion of the molecules in a solid (ii) very weak forces of attraction between the molecules of gases (iii) small spaces between the molecules of a liquid. Which is/are true?**

(a) (i), (ii), and (iii)

(b) (i) and (ii) only

(c) (ii) and (iii) only

(d) (i) and (iii) only

Q-2 **When you blow up a balloon:**

(a) The volume of the balloon increases and the pressure inside the balloon decreases.

(b) The pressure inside the balloon increases because the number of air molecules inside it increases.

(c) The volume of the balloon increases but the pressure inside the balloon is always equal to atmospheric pressure.

(d) The pressure inside the balloon remains constant because the temperature of the balloon remains constant.

Q-3 **When the cohesive forces are smaller than the adhesive forces, a liquid will: (i) wet the surface on which it is dropped (ii) form a convex meniscus (iii) rise up a narrow capillary tube. Which is/are true?**

(a) (i), (ii) and (iii)

(b) (i) and (ii) only

(c) (ii) and (iii) only

(d) (i) and (iii) only

Q-4 **The diagrams show three capillary tubes in liquids: pure water, soap solution, mercury. (i) (ii) (iii) The corresponding liquids are:**

(a) (i)=water, (ii)=soap solution, (iii)=mercury

(b) (i)=water, (ii)=mercury, (iii)=soap solution

(c) (i)=mercury, (ii)=soap solution, (iii)=water

(d) (i)=soap solution, (ii)=mercury, (iii)=water

Q-5 **In which situation will the rate of diffusion be greatest?**

(a) Ammonia and fumes of hydrochloric acid diffusing into each other.

(b) Naphthalene diffusing into the atmosphere.

(c) Crystals of potassium permanganate diffusing into water.

(d) Metallic gold and metallic lead diffusing into each other.

Chapter-21 Topic 21 Application of lenses and plane mirrors

Q-1 **Name three ways in which a Galilean (terrestrial) telescope differs from an astronomical telescope.**

Q-2 **Why is the focal length of a diverging lens given as a negative value?**

Q-3 **In what circumstances, in relation to lens-object distance, will a convex lens not produce a real image of the object?**

Q-4 **The objective lens of a large telescope has a focal length (F) of 3 m. What focal length of eyepiece would be needed to give the telescope a magnification of 200 times? Show your working.**