

# Set 3

## Model Question -3

**Grade: XII Subject: Physics (102)**

**Full marks: 75 (11 marks Obj+ 64 marks Sub)**

**Time: 3 Hours**

**Attempt all the questions:**

### Group "A"

**Rewrite the correct option in your answer sheet:**

**11X1=11**

- 1) The spokes are used in bicycle wheel to
  - a) Increases frictional force
  - b) Decreases frictional force
  - c) Increases moment of inertia
  - d) Increase angular momentum
- 2) An iceberg floats in sea water of density of 1g/cc. the % of volume outside water is if density of iceberg is 0.9 g/cc
  - a. 90%
  - b. 10%
  - c.45%
  - d. 5%

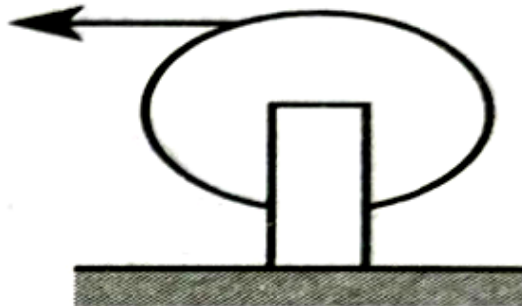
- 3) Two solids A and B floats in water. A floats with  $\frac{2}{3}$  of its volume immersed and B floats with half of its volume immersed. The ratio of density of A and B is  
 a. 4:3      b. 3:4      c. 1:3      d. 3:1
- 4) The weight of 1kg block of iron having volume  $1.3 \times 10^{-4} \text{m}^3$  immersed in water is measured by spring balance is  
 a. 6.7N      b. 6N      c. 9.7 N      d. 7.7N
- 5) The efficiency of heat engine can be increased by  
 a) Decreasing sink temperature  
 b) Increasing source temperature  
 c) Increasing difference between source and sink temperature  
 d) All of these
- 6) The displacement of a particle is given by  $5 \times 10 \sin (100 t - 50 x)$  where x and y are metre. The velocity of the wave is  
 a. 2m/s      b. 150m/s      c. 500 m/s      d. 2500 m/s
- 7) The fact that light can be polarized establish the light  
 a) Travels in the form of particles.  
 b) Is an electromagnetic wave  
 c) Is a longitudinal wave  
 d) Is a transverse wave
- 8) Kirchhoff's second law is based on the law of conservation of:  
 a. Momentum      b. Charge      c. Mass      d. Energy
- 9) A resistance of  $5\Omega$  is connected in the left gap of a meter bridge and  $15\Omega$  in the other gap. The position of the balancing point is  
 a. 25 cm      b. 15 cm      c. 60 cm      d. 75 cm
- 10) A potentiometer wire is 10 m long. It has a resistance  $20\Omega$ . It is connected in series with a battery of 3V and negligible internal resistance and resistance of  $10\Omega$ . The potential gradient along the wire in volt/meter is  
 a. 0.02      b. 0.1      c. 0.2      d. 1.2
- 11) An electron of mass m and charge e accelerated from rest through a potential difference of v volts in vacuum. The speed of electron will be  
 a.  $\sqrt{\frac{m}{eV}}$       b.  $\sqrt{\frac{eV}{m}}$       c.  $\sqrt{\frac{eV}{m}}$       d.  $\sqrt{\frac{2eV}{m}}$

**Group "B"**

**Short answer questions:**

**8X5=40**

- 1)
- a) Define angular momentum .
- b) A plane revolves around a massive star in a high elliptical orbit. Is its angular momentum constant over the entire orbit?
- c) A string is wrapped around the rim of a wheel of moment of inertia  $0.20 \text{ kg m}^2$  and radius 20 cm. The wheel is free to rotate about its axis as in Fig. initially, the wheel is in rest. The string is now pulled by a force of 2N. Find the angular velocity of the wheel after 5.0 seconds.



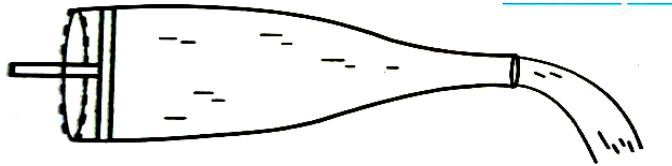
**OR**

- a) Define simple harmonic motion and state it's equation.

- b) The displacement of an oscillating object as a function of time shown in Fig. Calculate its  
 (i) time period (ii) frequency and the amplitude? 2+3

2)

- a) Define the term centre of buoyancy and meta centre. Why should the meta centre lie above the centre of gravity of floating body?
- b) Explain the equation of continuity and its application.
- c) Fig. shows a liquid being pushed out of tube by pressing a piston. The area of cross-section of the piston is  $1.0 \text{ cm}^2$  and that of the tube at the outlet is  $20 \text{ mm}^2$ . If the piston is pushed at a speed of  $2 \text{ cm/s}^{-1}$ . What is the speed of the outgoing liquid? 2+1+2



3)

- a) Explain the meaning of work done by system and work done on the system.
- b) Describe how work done by gas during expansion can be calculated from indicator (P-V) diagram.
- c) A tyre pumped to a pressure of 6 atmosphere bursts suddenly. Calculate the temperature of escaping air. Given initial room temperature is  $150 \text{ C}$  and  $\gamma$  for air is 1.4.

4)

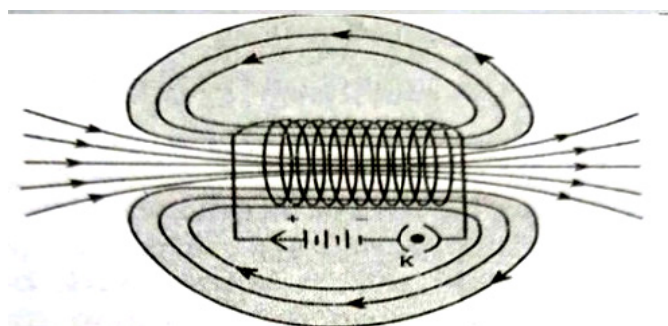
- a) What are the factors on which velocity sound in the open air depends and in what may they do so?
- b) It is noticed that a sharp made in front of a flight of stone steps gives to a ringing sound.
- c) Explain this assuming that each step is  $0.25 \text{ m}$  dip estimate the frequency fo the sound. (Velocity of sound may be taken to be  $340 \text{ ms}^{-1}$ ) 2+1+2

5)

- a) Describe the concept of perfect conductors.
- b) Distinguish them from superconductors.
- c) A moving coil galvanometer of resistance  $10$  produces full scale deflection when a current  $25 \text{ mA}$  is passed through it. How will you convert the galvanometer into a voltmeter range  $(0-120\text{V})$ ? 1+1+3

6)

- a) Differentiate between solenoid and tofold.
- b) Magnetic field lines produced by a current carrying solenoid is as shown in Fig. Describe the nature of the magnetic field lines through and around the current carrying solenoid.



- c) A solenoid is designed to produce a magnetic field of 0.027 T at its centre. It has radius 1.4 cm and length 40.0 cm, and the wire carry a maximum current of 12.0 A. What minimum number of turns must the solenoid have? 1+2+2
- 7)
- a) Write an expression for energy stored in inductor.  
 b) Soft iron is used in making core of a transformer, why? Explain.  
 c) The ratio of number of turns in the primary and secondary windings of a step-up transformer is 1:200. It is connected at a.c. mains of 2 V. Calculate:  
 i) Voltage developed in secondary  
 ii) The current in the secondary when primary current is 2A. 1+2+2
- 8)
- a) Which property of a semiconductor does permit it to be used as a rectifier? Explain the working of a PN diode when forward biased and reverse biased. What is a truth table? Draw such a table for two inputs AND gate. 1+2+2  
 b) Define radio isotopes.  
 c) A radioactive source has decayed to  $1/128^{\text{th}}$  of its initial activity after 50 days. What is its half-life? What are medical uses of nuclear radiation? 1+3+1

### Group "C"

#### Long answer questions:

3X8=24

- 9)
- a) Discuss Huygen's principle. Use it to explain reflection of light.  
 b) Light travels through a pool of water in a parallel beam incident on the horizontal surface. Its speed in water is  $2.2 \times 10^8$  m/s. Calculate the maximum angle which the beam can make with the vertical if light is to escape into the air  $3 \times 10^8$  m/s. Ans:  $47.2^\circ$
- 10)
- a) Write the cause of thermoelectricity.  
 b) Distinguish between Seebeck effect and Peltier effect. Define inversion temperature and write the factors on which it depends.  
 c) Thermoe.m.f. of Cu-Fe thermocouple varies with temperature at  $\theta^\circ\text{C}$  as,  
 $E(\mu\text{V}) = 14\theta - 0.02\theta^2$ . Determine neutral and inversion temperature. 2+3+3
- OR**
- a) Discuss series resonance condition.  
 b) Describe series resonance condition.  
 c) A 100 V a.c. source of frequency 50 Hz is connected to a LCR circuit with  $L = 8.1 \times 10^{-3}$  H,  $C = 12.5 \mu\text{F}$  and  $R = 10 \Omega$ , all connected in series. Find the potential difference across the resistance. 3+2+3
- 11)
- a) State Bohr's postulates for the atom model.  
 b) Calculate the energy of an electron in the  $n^{\text{th}}$  orbit of a hydrogen atom.  
 c) Compare the velocity of the electron in the 9<sup>th</sup> Bohr orbit. How many times does the electron revolve around the orbit in 1s? 2+3+3