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**INDIAN SCHOOL MUSCAT
SECOND TERM EXAMINATION
PHYSICS (042)**

CLASS: XI

28.02.2022

Time Allotted: 2 hrs.

Max. Marks: 35

GENERAL INSTRUCTIONS:

- (i) There are 12 questions in all. All questions are compulsory.
- (ii) This question paper has three sections: Section A, Section B and Section C.
- (iii) Section A contains three questions of two marks each, Section B contains eight questions of three marks each, Section C contains one case study-based question of five marks.
- (iv) There is no overall choice. However, an internal choice has been provided in one question of two marks and two questions of three marks. You have to attempt only one of the choices in such questions.
- (v) You may use log tables if necessary but use of calculator is not allowed.

SECTION A

1. Give any four differences between Isothermal and adiabatic process. 2
 2. (a) Sound travels faster on rainy day than on a dry day. Why? 1
(b) What is the distance between a node and nearest antinode? 1
 3. (a) State Wien's displacement law. 1
(b) Define latent heat of Fusion. 1
- (OR)**
- (a) State Stefan's law.
 - (b) Define latent heat of Vaporization.

SECTION B

4. Show that for small oscillations the motion of a simple pendulum is simple harmonic. Derive an expression for its time period. 3

(OR)

Derive an expression for total energy of the particle executing simple harmonic motion and show graphically the variation of kinetic energy and potential energy with displacement.

5. (a) Define degrees of freedom. 1
(b) Calculate the degrees of freedom of monoatomic and diatomic gas molecules. 2

6. Molar volume is the volume occupied by 1 mole of any (ideal) gas at standard temperature and pressure (STP: 1 atmospheric pressure = 1.013×10^5 Pa, 0° C). Show that it is 22.4 litres. 3
7. (a) State and explain first law of thermodynamics. 2
(b) What do you mean by internal energy of thermodynamic system? 1
8. State and prove Bernoulli's theorem. 3
9. In a car lift, compressed air exerts a force F_1 on a small piston having a radius of 5 cm. This pressure is transmitted to a second piston of radius 15 cm. If the mass of the car to be lifted is 1350 kg what is F_1 ? What is the pressure necessary to accomplish this task? Take $g = 9.8 \text{ m/s}^2$. 3

(OR)

A liquid rise to a height of 7 cm in a capillary tube of radius 0.1 mm. The density of the liquid is $0.8 \times 10^3 \text{ kg/m}^3$. If the angle of contact between the liquid and the surface of the tube be zero, Calculate the surface tension of the liquid. Take $g = 10 \text{ m/s}^2$.

10. Derive an expression for the ascent of a liquid in capillary tube. 3
11. (a) Define modulus of elasticity and write its SI unit. 1
(b) Define Young's modulus and Bulk modulus of elasticity. 1
(c) Why bridges are declared unsafe after long use? 1

SECTION C

12. Read the passage given below and answer the following questions

Surface Tension:

The property due to which the free surface of liquid tends to have minimum surface area and behaves like a stretched membrane is called surface tension. It is a force per unit length acting in the plane of interface between the liquid and the bounding surface i.e., $S = F/L$, where F = force acting on either side of imaginary line on surface and L = length of imaginary line. Surface tension decreases with rise in temperature. Highly soluble impurities increase surface tension and sparingly soluble impurities decreases surface tension.

ANSWER THE FOLLOWING QUESTION

- (i) The excess pressure inside a soap bubble is three times than excess pressure inside a second soap bubble, then the ratio of their surface area is 1
(a) 9 : 1 (b) 1 : 3 (c) 1 : 9 (d) 3 : 1
- (ii) Which of the following statements is not true about surface tension? 1
(a) A small liquid drop takes spherical shape due to surface tension.
(b) Surface tension is a vector quantity.

- (c) Surface tension of liquid is a molecular phenomenon.
- (d) Surface tension of liquid depends on length but not on the area.

(iii) Which of the following statement is not true about angle of contact?

1

- (a) The value of angle of contact for pure water and glass is zero.
- (b) Angle of contact increases with increase in temperature of liquid.
- (c) If the angle of contact of a liquid and a solid surface is less than 90° , then the liquid spreads on the surface of solid.
- (d) Angle of contact does not depend upon the inclination of the solid surface to the liquid surface.

(iv) Which of the following statements is correct?

1

- (a) Viscosity is a vector quantity.
- (b) Surface tension is a vector quantity.
- (c) Reynolds number is a dimension quantity.
- (d) Surface tension of liquids decreases, when water surface has dust and oil.

(v) A liquid does not wet the solid surface if the angle of contact is

1

- (a) 0°
- (b) equal to 45°
- (c) equal to 90°
- (d) greater than 90° .

End of the Question Paper

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- (v) You may use log tables if necessary but use of calculator is not allowed.

SECTION A

1. State first law of thermodynamics. Write mathematical equation of first law of thermodynamics. 2
2. (a) State Stefan's law. 1
(b) Define latent heat of Fusion. 1
(OR)
(a) State Wien's displacement law.
(b) Define latent heat of Vaporization.
3. Distinguish between transverse and longitudinal waves. 2

SECTION B

4. Show that for small oscillations the motion of a simple pendulum is simple harmonic. Derive an expression for its time period. 3
(OR)
Derive an expression for total energy of the particle executing simple harmonic motion and show graphically the variation of kinetic energy and potential energy with displacement.
5. (a) State any four postulates of kinetic theory of Gases. 2
(b) State the law of equipartition of energy. 1

6. At what temperature is the root mean square speed of an atom in an argon gas cylinder equal to the rms speed of a helium gas atom at -20°C ? 3
(Atomic mass of argon = **39.9 u**, and that of helium = **4.0 u**).
7. (a) State zeroth law of thermodynamics 1
(b) State the second law of thermodynamics. 1
(c) Out of the parameters: temperature, pressure, work and volume, which parameter does not characterize the thermodynamic state of matter? 1
8. Define terminal velocity. Derive an expression for terminal velocity attained by spherical body falling through a viscous medium. 3
9. Derive an expression for the ascent of a liquid in capillary tube. 3
10. Represent graphically the variation of extension with load in an elastic body. On the graph mark: 3
(a) Hooke's law region (b) Elastic limit
(c) Yield point. (d) Breaking point.
11. In a car lift, compressed air exerts a force F_1 on a small piston having a radius of **5 cm**. This pressure is transmitted to a second piston of radius **15 cm**. if the mass of the car to be lifted is **1350 kg** what is F_1 ? What is the pressure necessary to accomplish this task? Take $g = 9.8 \text{ m/s}^2$. 3

(OR)

A liquid rise to a height of **7 cm** in a capillary tube of radius **0.1 mm**. The density of the liquid is **$0.8 \times 10^3 \text{ kg/m}^3$** . If the angle of contact between the liquid and the surface of the tube be zero, Calculate the surface tension of the liquid. Take $g = 10 \text{ m/s}^2$.

SECTION C

12. Read the passage given below and answer the following questions:

Bernoulli's Theorem

It states that for the streamline flow of an ideal liquid through a tube, the total energy (the sum of pressure energy, the potential energy and kinetic energy) per unit volume remains constant at every cross-section throughout the tube.

$$\frac{P}{\rho g} + h + \frac{1}{2} \frac{v^2}{g} = \text{another constant}$$

Bernoulli's theorem is based on law of conservation of energy.

ANSWER THE FOLLOWING

- (i) Bernoulli's equation for steady, non-viscous, incompressible flow expresses the 1
(a) conservation of linear momentum
(b) conservation of angular momentum
(c) conservation of energy
(d) conservation of mass

- (ii) Applications of Bernoulli's theorem can be seen in 1
- (a) dynamic lift of aeroplane
 - (b) hydraulic press
 - (c) moving train
 - (d) none of these
- (iii) A tank filled with fresh water has a hole in its bottom and water is flowing out of it. If the size of the hole is increased, then 1
- (a) the volume of water flowing out per second will decrease.
 - (b) the velocity of outflow of water remains unchanged
 - (c) the volume of water flowing out per second remains zero
 - (d) Both (b) and (c)
- (iv) In old age arteries carrying blood in the human body become narrow resulting in an increase in the blood pressure. This follows from 1
- (a) Pascal's law
 - (b) Stokes' law
 - (c) Bernoulli's principle
 - (d) Archimedes' principle
- (v) Along a streamline flow of liquid 1
- (a) the velocity of a liquid particle remains constant.
 - (b) the velocity of all liquid particles crossing a given position is constant.
 - (c) the velocity of all liquid particles at a given instant is constant.
 - (d) the speed of a liquid particle remains constant.

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(b) Define latent heat of Fusion. 1
(OR)
(a) State Stefan's law.
(b) Define latent heat of Vaporization.
2. Give any four differences between isothermal and adiabatic process. 2
3. (a) If the pressure of a gas at constant temperature is increased four times, how the velocity of sound in the gas will be affected? 1
(b) How far the consecutive nodes are separated from each other? 1

SECTION B

4. State and prove Bernoulli's theorem. 3
5. (a) Define modulus of elasticity and write its SI unit. 1
(b) Define Young's modulus and Bulk modulus of elasticity. 1
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(b) Surface tension is a vector quantity.
(c) Reynolds number is a dimensionless quantity.
(d) Surface tension of liquids decreases, when water surface has dust and oil.
- (v) A liquid does not wet the solid surface if the angle of contact is 1
(a) 0° (b) equal to 45° (c) equal to 90° (d) greater than 90° .

End of the Question Paper