Physics – Firs Year

PAPER – I (MARCH – 2010)

Time : 3 Hours Max.Marks : 60

SECTION – A

Note : i) Answer all the questions. $10 \times 2 = 20$

ii) Every correct answer carries 2 marks.

iii) All are Very short answer type questions.

1. Prove that Planck's constant and angular momentum have same dimensions.
2. If force vector, $\vec{F} = 3\hat{i} + 4\hat{j} + 5\hat{k}$ and displacement vector $\vec{S} = 6\hat{i} + 2\hat{j} + 5\hat{k}$, find the work done by the force.
3. Define coefficient of restitution. What are its practical values?
4. What is the normal reaction of the body when it is at rest on (i) a horizontal surface and (ii) an inclined surface?
5. A steel wire of 2 mm in diameter is stretched by applying a force of 72 N. Find the stress in the wire.
6. Define surface tension and give its dimensional formula.
7. Write the statement of Bernoulli's principle.
8. Convert the normal temperature of human body 98.4ºF into Celsius scale.
9. What is anomalous expansion of water? At what temperature has water maximum density?
10. State Zeroth law of thermodynamics. What is its significance?

SECTION – B

Note : i) Answer any six questions. $6 \times 4 = 24$

ii) Every correct answer carries 4 marks.

iii) All are Short answer type questions.

11. State parallelogram law of vectors. Derive an expression for the magnitude of the resultant vector of given two vectors, with a neat diagram.
12. Show that the trajectory of an object thrown horizontally from certain height is a parabola.

13. Define centre of mass. The position vectors of three particles of mass $m_1 = 1kg, m_2 = 2kg$ and $m_3 = 4kg$ and $\vec{r}_1 = \left(\hat{i} + 4\hat{j} + \hat{k}\right)m$, $\vec{r}_2 = \left(\hat{i} + \hat{j} + \hat{k}\right)m$ and $\vec{r}_3 = \left(2\hat{i} - \hat{j} - 2\hat{k}\right)m$ respectively. Find the position vector of their centre of mass.

14. Explain why pulling the lawn roller is preferred to pushing the lawn roller.

15. State and prove parallel axes theorem of Moments of Inertia.

16. What is Orbital velocity? Obtain an expression for it.

17. What is triple point? Write short note on the triple point of water with a phase diagram.

18. Explain Stefan's law of radiation. Write Boltzmann's explanation to it.

SECTION – C

Note : i) Answer any two of the following questions. $2 \times 8 = 16$

ii) Every correct answer carries 8 marks.

iii) All are Long answer type questions.

19. State the law of conservation of energy and verify it in case of a body projected vertically upwards.

A machine gun fires 240 bullets per minute with a velocity of $500\,ms^{-1}$. If the mass of each of the bullet is $5 \times 10^{-2}\,kg$, find the power of the gun.

20. Define simple harmonic motion. Show that the projection of uniform circular motion on any diameter is simple harmonic.

Obtain the equation of simple harmonic motion of a particle whose amplitude is 0.04 m and whose frequency is 50 Hz. The initial phase is $\frac{\pi}{3}$.

21. Define volume coefficient of a gas and describe Regnault's method to determine the volume coefficient of a gas.

Why do we not distinguish between apparent and real expansion in the case of gases as we do in the case of liquids ?