Physics – First Year

PAPER – I (MARCH – 2009)

Time : 3 Hours Max.Marks : 60

SECTION – A

Note : i) Answer **all** the questions. $10\times2=20$

ii) Every correct answer carries 2 marks.

1. The length and breadth of a rectangular object are 25.2 cm and 16.8 cm respectively and have been measured to an accuracy of 0.1 cm. Find the relative error and percentage error in the area of the object.
2. Define scalar product and give any one example.
3. A ball of mass 0.1 kg is dropped down vertically from a height of 1 m above the ground. If it rebounds to a height of 0.81 m, find the coefficient of restitution between the surface of the ball and the ground.
4. A horse has to exert a greater force during the start of the motion than later. Explain.
5. A 3 cm long copper wire is stretched to increase its length by 0.3 cm. Find the lateral strain in the wire. (The Poisson's ratio for copper is 0.26).
6. The radius of mercury drop at 20°C is 3 mm. If the surface tension of mercury at this temperature is $4.65\times10^{-1}\,\mathrm{Nm}^{-1}$, find the excess pressure inside the mercury drop.
7. Show that the Reynolds number $\mathrm{R}=\frac{\rho v_0 d}{\eta}$ is a dimensionless quantity.
8. Why are gaps left between rails on a railway track? Explain
9. Explain anomalous expansion of a water.
10. What is heat capacity? What is specific heat?

SECTION – B

Note : i) Answer any **six** questions. $6\times4=24$

ii) Every correct answer carries 4 marks.

11. State the parallelogram law of a vector. Derive an expression with a diagram for the magnitude and direction of the resultant vector with a diagram.
12. With a neat diagram, show that the trajectory of an object thrown at a certain angle with the horizontal is a parabola
13. Can you change the centre of mass of your body by pulling your hair up ? Mention any three characteristics of the

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centre of mass.

14. Explain the methods used to decrease friction.

15. State and prove perpendicular axes theorem with a neat diagram.

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

17. Show that $C_P - C_V = R$ in the case of one mole of ideal gas.

18. Explain Stefan's law for a black body with mathematical expression. Explain Stefan's - Boltzman's law with a mathematical expression

SECTION – C

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

ii) Every correct answer carries 8 marks.

19. If a nucleus at rest disintegrates into two smaller nuclei, the products should travel in opposite directions. Why?

State the law of conservation of energy and verify it in the case of a freely falling body with a neat diagram.machine gun fires 240 bullets per minute with a velocity of $500\,ms^{-1}$. If the mass of each bullet is $5 \times 10^{-2}\,kg$, find the power of the gun.

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

What is the length of the pendulum of a clock which beats seconds, given that the acceleration due to gravity at the place is equal to $9.8\,ms^{-2}$?

21. Mercury is preferred as the thermometric liquid of all liquids. Why ? State Boyle's law and Charles' law. Derive ideal gas equation for one mole of an ideal gas. Convert 0°K into the Fahrenheit scale.