



Date: 03-11-2018
Time: 01:00-04:00

Dept. No.

Max. : 100 Marks

Part – A

Answer ALL questions

(10 × 2 = 20)

1. Draw the velocity-time graph for a particle starting from rest and moving with a uniform acceleration.
2. Define simple harmonic motion.
3. Distinguish between elastic and plastic materials.
4. An air bubble of radius 0.1 mm is situated just below the surface of water. Calculate the excess of pressure inside the air bubble. Surface tension of water = $7.2 \times 10^{-2} \text{ Nm}^{-1}$
5. Explain the 'Equation of State'.
6. State the first law of thermodynamics.
7. What are Bravais lattices?
8. State the postulates of special theory of relativity.
9. A meter scale moves with a velocity of $0.8c$ parallel to its length. What is its apparent length?
10. When a wire is stretched by a mass of 5 kg the wire elongates by 0.5 mm. Calculate the work done in stretching the wire.

Part – B

Answer ANY FOUR questions

(4 × 7.5 = 30)

11. Define centripetal force. Derive an expression for it.
12. Find the time period of oscillations of two springs connected in (a) series (b) parallel.
13. (a) Define surface tension and give its dimensional formula. **(2.5)**
(b) Explain the molecular theory of surface tension. **(5)**
14. State Boyle's law and Charles law. Derive the perfect gas equation.

15. (a) What are Miller indices? Explain how are they determined. (5.5)

(b) A crystal plane cuts at $3a$, $4b$, and $2c$ along the crystallographic axes. Find the Miller Indices.

(2)

16. Derive Einstein's mass – energy relation. What is the energy associated with one gram of water?

Part – C

Answer ANY FOUR questions

(4 × 12.5 = 50)

17. (a) Derive the relation between elastic moduli. (9.5)

(b) An iron wire of length 1 m and radius 0.5 mm elongates by 0.32 mm when stretched by a force of 49 N. Find the Young's modulus of the wire. (3)

18. (a) Derive an expression for the maximum height, time of flight and horizontal range of a body projected at an angle with the horizontal. (8)

(b) A stone is projected from a point on the ground with a velocity of 49 m/s, at an elevation of 45° . Find (i) the greatest height attained (ii) the time of flight and (iii) range on the horizontal plane through the point of projection. (4.5)

19. a) What is an adiabatic process? Derive an equation for an adiabatic process. (9)

b) The volume of certain mass of gas at a pressure of 5×10^4 Pa is doubled adiabatically. What is the final pressure of the gas? ($\gamma = 1.4$) (3.5)

20. (a) Derive Poiseuille's formula for the rate of flow of liquid through a capillary tube.

(8.5)

(b) Water is flowing through a horizontal tube of length 0.25 m and radius 4×10^{-4} m, under a constant pressure head of 0.2 m of water, at a rate of 5×10^{-6} m³ per minute. Calculate the coefficient of viscosity of water. Density of water = 1000 kg m⁻³. (4)

21. State Bragg's law. Explain the powder diffraction technique to determine the crystal structure.

22. Derive Lorentz transformation equations.
