S2020

No. of Printed Pages : 4

Register Number

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PART – III

, அஇஇஇஇ; / **PHYSICS**

(English Version)

Time Allowed : 3.00 Hours]   [Maximum Marks : 70

Instructions : (1) Check the question paper for fairness of printing. If there is any lack of fairness, inform the Hall Supervisor immediately.

(2) Use **Blue** or **Black** ink to write and underline and pencil to draw diagrams.

PART – I

Note : (i) Answer **all** the questions.   15x1=15

(ii) Choose the most appropriate answer from the given **four** alternatives and write the option code and the corresponding answer.

1. If the error in the measurement of radius of a sphere is 2%, then the error in the determination of its volume will be :
    (a) 8 %   (b) 2 %   (c) 4 %   (d) 6 %

2. A stone of mass 0.5 kg tied to a string executes uniform circular motion in a circle of radius 2 m with a speed of 4 ms^{-1}. The magnitude of tension acting on the stone will be :
    (a) 3 N   (b) 10 N   (c) 0.5 N   (d) 4 N

3. If a particle executes uniform circular motion in the xy plane in clockwise direction, then the angular velocity is in:
    (a) + y direction   (b) + z direction
    (c) – z direction   (d) – x direction

4. The velocity – time (v-t) graph representing motion of particle moving with uniform velocity is :
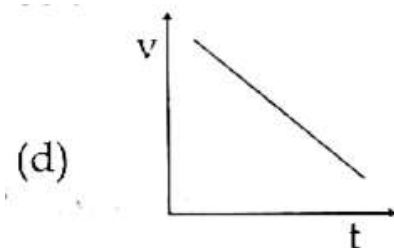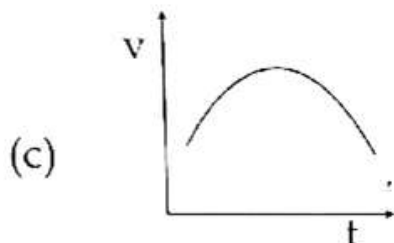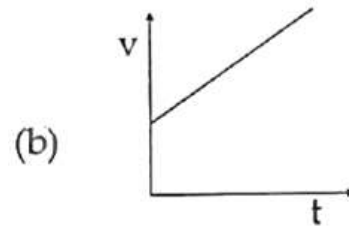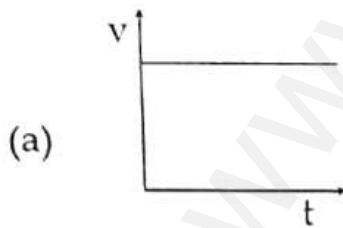
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5. A rigid body rotates with an angular momentum L. If its kinetic energy is halved, then angular momentum becomes:

    (a)   L   (b) $\dfrac{L}{2}$ (c)   2L   (d) $\dfrac{L}{\sqrt{2}}$

6. The energy consumed in electrical units when a 60 W fan is used for 8 hours daily one month (30 days) is nearly :

    (a)   14 units   (b)   18 units   (c)   16 units   (d)   20 units

7. In a vertical circular motion, the minimum speed at the lowest point required by the mass to complete circular motion is (Radius of the circular path is r) :

    (a) $\sqrt{2gr}$ (b)   2gr   (c) $\sqrt{5gr}$ (d)   5gr

8. The wettability of a surface by a liquid depends primary on :

    (a)   viscosity   (b)   surface tension

    (c)   density   (d)   angle of contact between surface and the liquid

9. An object of mass 10 kg is hanging from a spring scale which is attached to the roof of a lift. If the lift is in free fall, the reading in the spring scale is :

    (a)   98 N   (b)   zero   (c)   49 N   (d)   9.8 N

10. All natural processes occur such that entropy should:

    (a)   always increase   (b)   always decrease

    (c)   first increase and then decrease   (d)   does not change

11. The graph between volume of a given mass of gas and temperature when its pressure remains constant is :

    (a)   an ellipse   (b)   a circle   (c)   a straight line   (d)   a parabola

12. When a damped harmonic oscillator completes 100 oscillations, its amplitude is reduced to $\dfrac{1}{3}$ of its initial value. What will be its amplitude when it completes 200 oscillations?

    (a) $\dfrac{1}{5}$ (b) $\dfrac{2}{3}$ (c) $\dfrac{1}{6}$ (d) $\dfrac{1}{9}$

13. Which of the following is an example of non-linear triatomic molecule?

    (a)   Water   (b)   Hydrogen   (c)   Helium   (d)   Nitrogen

14. If S_P and S_V denote the specific heats of nitrogen gas per unit mass at constant pressure and constant volume respectively, then :

    (a) $S_P - S_V = 28\,R$ (b) $S_P - S_V = R/28$

    (c) $S_P - S_V = R/14$ (d) $S_P - S_V = R$

15. The first three frequencies of harmonics of a closed organ pipe will be in the ratio :

    (a)   1 : 2 : 3   (b)   1 : 3 : 5   (c)   1 : 4 : 9   (d)   2 : 4 : 6

PART – II

Note : Answer **any six** questions. Question No. **24** is **compulsory.**   6x2=12

16. What are fundamental quantities? Give an example.

17. The position vector and angular velocity vector of a particle executing uniform circular motion at an instant are $2\hat{\imath}$ and $4\hat{k}$ respectively. Find its linear velocity at that instant.

18. When walking on ice one should take short steps. Why?

19. What is radius of gyration?

20. State Newton's Universal Law of Gravitation.

21. Explain red shift and blue shift in Doppler effect.

22. What is P-V diagram?

23. List the factors affecting the mean free path.

24. A metal cube of side 0.20 m is subjected to a shearing force of 4000 N. The top surface is displaced through 0.50 cm with respect to the bottom. Calculate the shear modulus of elasticity of the metal.

PART – III

Note : Answer **any six** questions. Question No. **33** is **compulsory.**   6x3=18

25. Write about dimensional variables and dimensionless variables with an example.

26. A train was moving at the rate of 54 kmh^{-1} when brakes were applied. It came to rest within a distance of 225 m. Calculate the retardation produced in the train.

27. Compare elastic and inelastic collisions.

28. Derive an expression for kinetic energy of a rigid body in rotational motion.

29. Suppose we go 200 km above and below the surface of the Earth, what are the g values at these two points? In which case, is the value of g small?

30. Write any three applications of Surface Tension.

31. Why does heat flow from a hot object to cold object?

32. Write any six postulates of kinetic theory of gases.

33. Calculate the amplitude, angular frequency, frequency, time period and initial phase of the simple harmonic oscillation for the given equation y = 0.3 sin (40πt + 1.1).

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PART – IV

Note :   Answer **all** the questions.   **5x5=25**

34. (a) Prove the law of conservation of linear momentum. Use it to find the recoil velocity of a gun when a bullet is fired from it.

(OR)

   (b) What is meant by angular harmonic oscillation? Derive an expression for the time period of angular harmonic oscillation.

35. (a) (i) What are the applications of dimensional analysis?
   (ii) Express 76 cm of mercury pressure in terms of Nm^{-2} using the method of dimensions.

(OR)

   (b) (i) Obtain a relation between momentum and kinetic energy.
   (ii) Two objects of masses 2 kg and 4 kg are moving with same momentum of 20 $kgms^{-1}$.
   (A) Will they have same kinetic energy?
   (B) Will they have same speed?

36. (a) Derive the linear kinematic equations of motion for constant accelerated motion.

(OR)

   (b) Explain the types of equilibrium with suitable examples.

37. (a) What is thermal expansion? Explain the three types of thermal expansion and obtain the relation between them.

(OR)

   (b) What are stationary waves? Explain the formation of stationary waves.

38. (a) Derive an expression for Orbital Velocity and Time Period of the satellite.

(OR)

   (b) Derive Poiseuille's formula for the volume of a liquid flowing per second through a pipe under stream lined flow.

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