M2020

No. of Printed Pages : 4

Register Number

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PART – III

, awg|ay; / **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.   Identify the unit vector in the following

(a) $\frac{\hat{\imath}+\hat{\jmath}}{\sqrt{2}}$ (b) $\hat{\imath}+\hat{\jmath}$ (c) $\frac{\hat{\imath}}{\sqrt{2}}$ (d) $\hat{k}-\frac{\hat{\jmath}}{\sqrt{2}}$

2.   Human audible wavelength range (velocity of sound in air = 340 ms⁻¹) is :

(a)   17 m to 170 m   (b)   0.17 m to 17 m

(c)   0.017 m to 17 m   (d)   1.7 m to 17 m

3.   An air column in a pipe which is closed at one end, is in resonance with the vibrating body of frequency 83 Hz. Then the length of the air column is :

(velocity of sound in air = 332 ms⁻¹)

(a)   1.5 m   (b)   0.5 m   (c)   2.0 m   (d)   1.0 m

4.   rms speed of hydrogen molecule at 27⁰ C:

(a)   193 kms⁻¹   (b)   1.93 kms⁻¹   (c)   19.3 kms⁻¹   (d)   0.193 kms⁻¹

5.   Which one of the following is a scalar quantity?

(a)   Speed   (b)   Velocity

(c)   Displacement   (d)   Linear momentum

6.   The length of a body is measured as 3.51 m. If the accuracy is 0.01m, then the percentage error in the measurement is :

(a)   0.035 %   (b)   351 %   (c)   1 %   (d)   0.28 %

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7. A body of mass 20 kg moving with a speed of 10 ms^{-1} on a horizontal smooth surface collides with a massless spring of spring constant 5 N/m. If the mass stops after collision, distance of compression of the spring will be :

   (a)   10 m   (b)   50 m   (c)   5 m   (d)   20 m

8. When a car takes a sudden left turn on a curved road, passengers are pushed towards the right due to :

   (a)   absence of inertia   (b)   inertia of direction

   (c)   inertia of motion   (d)   inertia of rest

9. The efficiency of a heat engine working between the freezing point and boiling point of water is :

   (a)   12.5 %   (b)   6.25 %   (c)   20 %   (d)   26.8 %

10. A spring of force constant k is cut into two pieces such that the length of one piece is double the length of the other. Then the longer piece will have a force constant of :

    (a)   6 k   (b) $\frac{2}{3}$ k   (c) $\frac{3}{2}$ k   (d)   3k

11. The dimensional formula for Moment of Inertia:

    (a) $ML^{-1}T^{-1}$ (b) ML^2T^{-2} (c) MLT^2 (d) ML^2

12. Which one of the following P-V diagrams correspondents to isobaric compression?

c
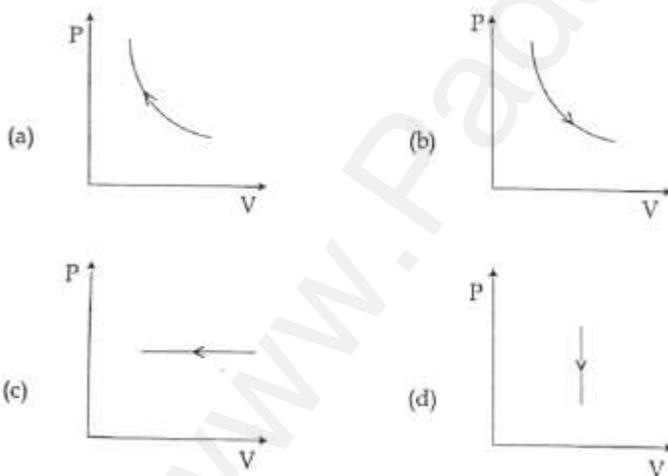
13. The ratio between the rms speed and most probable speed of gas molecules at a given temperature is :

    (a) $2\sqrt{2}:\sqrt{1}$ (b) $\sqrt{3}:\sqrt{2}$ (c) $\sqrt{2}:\sqrt{3}$ (d) $\sqrt{1}:2\sqrt{2}$

14. If the distance between the Earth and Sun is twice its present value, the number of days in a year will be :

    (a)   730   (b)   1032   (c)   64.5   (d)   182.5

15.   Moment of inertia of a solid of Mass M, length l and radius r about its own axis is :

(a) $M\left(\dfrac{r^2}{2} + \dfrac{l^2}{12}\right)$ (b) Mr^2 (c) $\dfrac{1}{4}Mr^2$ (d) $\dfrac{1}{2}Mr^2$

PART – II

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

16.   Check the correctness of the equation ½ mv² = mgh using dimensional analysis.

17.   Define distance and displacement.

18.   Why there is no lunar eclipse and solar eclipse every month?

19.   State the law of conservation of angular momentum.

20.   What is coefficient of restitution?

21.   During a cyclic process, a heat engine absorbs 500 J of heat from a hot reservoir, does work and ejects an amount of heat 300 J into the surroundings (cold reservoir). Calculate the efficiency of the heat engine.

22.   Why there is no hydrogen in the earth's atmosphere?

23.   Write down the factors affecting velocity of sound in gases.

24.   If the length of the simple pendulum is increased by 44% from its original length, calculate the percentage increase in time period of the pendulum.

PART – III

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

25.   Explain RADAR pulse method for determining large distances.

26.   An object is thrown with initial speed 5ms⁻¹ with an angle of projection 30⁰. Calculate the maximum height reached and the horizontal range.

27.   When a cricket player catches the ball, he pulls his hands in the direction of the ball's motion. Why?

28.   State Kepler's three laws.

29.   Write the differences between transverse and longitudinal waves.

30.   We use straw to suck soft drinks. Why?

31.   Explain Resonance. Give an example.

32.   What are the conditions for reversible process?

33.   A force of $(4\hat{\imath} - 3\hat{\jmath} + 5\hat{k})$ N is applied at a point whose position vector is $(7\hat{\imath} + 4\hat{\jmath} - 2\hat{k})$m. Find the torque of force about the origin.

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PART – IV

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

34. (a) Derive the expression for centripetal acceleration.

(OR)

(b) State and explain work energy theorem. Mention any three examples for it.

35. (a) What do you mean by propagation of errors? Explain propagation of errors in division of two quantities.

(OR)

(b) Derive the work done in an adiabatic process.

36. (a) (i) Derive the expression for the variation of acceleration due to gravity (g) with depth from the surface of the earth (d).

(ii) Find the ratio of the acceleration due to gravity at a height R/2 from the surface of the earth to the value at a depth R/2 from the surface of the earth (R – radius of the earth).

(OR)

(b Explain bending of cyclist in curves and arrive at an expression for angle of bending.

37. (a) Derive the expression for moment of inertia of a thin uniform rod about an axis passing through the centre and perpendicular to its length.

(OR)

(b) Explain in detail the four different types of oscillations.

38. (a) (i) Determine the height of an accessible object using Triangulation method.

(ii) From a point on the ground, the top of a tree is seen to have an angle of elevation 60⁰. The distance between the tree and a point is 50 m. Calculate the height of the tree.

(OR)

(b) Derive the expression for the terminal velocity of a sphere moving in a high viscous fluid, using Stoke's formula.

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RAJENDRAN M, M.Sc., B.Ed., C.C.A., P.G. TEACHER IN PHYSICS, SRMMHSS, KAVERIYAMPOONDI, TIRUVANNAMALAI.