CLASS: XI

SESSION: 2024-25

DAV SAMPLE QUESTION PAPER

SUBJECT: PHYSICS (THEORY)

Maximum Marks: 70 **Time Allowed: 3 hours.**

General Instructions:

(1) There are 33 questions in all. All questions are compulsory.

(2) This question paper has five sections: Section A, Section B, Section C, Section D and Section E. All the sections are compulsory.

(3) **Section A** contains sixteen questions, twelve MCQ and four Assertion Reasoning based of 1 mark each, **Section B** contains five questions of two marks each, **Section C** contains seven questions of three marks each, **Section D** contains two case study based questions of four marks each and **Section E** contains three long answer questions of five marks each.

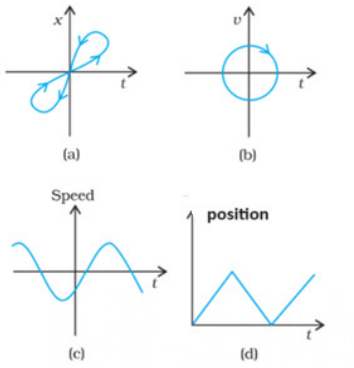
(4) There is no overall choice. However, an internal choice has been provided in one question in Section B, one question in Section C, one question in each CBQ in Section D and all three questions in Section E. You have to attempt only one of the choices in such questions.

(5) Use of calculator is not allowed.

SECTION A

1. The number of significant figures in 6.8000kg is
(a) 2
(b) 3
(c) 4
(d) 5

2. A student plots the graphs related to motion of four objects as given in figures. Which figure/ figures cannot possible represent one dimensional motion?



(a) Figure a only
(b) Figure b only
(c) Figure d only
(d) Figures (a), (b) and (c)

3. Study the following statements (For a particle moving along straight line)

(i) **F** may be along **v**

(ii) **F** may be opposite **v**

(iii) **F** may be normal to **v**

(iv) **F** may be at an angle to **v**

Force is parallel to acceleration in

(a) (i) and (ii) only

(b) (i),(ii) and (iii) only

(c) (ii) and (iv) only

(d) (i),(ii),(iii) and (iv)

4. Which of the following equations does not represent the position of an object moving in a plane with a non-zero constant acceleration?

(a) $\mathbf{r_1} = 1.0\,t\,\hat{i} + 3\,t^2\hat{j}$

(b) $\mathbf{r_2} = (5.0+3.0t)\hat{i} + 5\,t^2\hat{j}$

(c) $\mathbf{r}_3 = 5\,t\,\hat{j}$

(d) $\mathbf{r_1} = 3.0\,t^2\hat{i} - 4\,t^3\hat{j}$

5. A ball of 1 kg is projected under gravity from origin in x-y plane with a velocity $\mathbf{v} = (30\hat{i}+40\hat{j})$ m/s. The power delivered to the ball by the gravitational force at t=7s is ($g = 10 m/s^2$)

(a) +400W

(b) -400W

(c) -300W

(d) +300W

6. The moment of inertia of a solid sphere of radius (R) and mass (M) about its diameter is

(a) $MR^2/4$

(b) $2MR^2/5$

(c) $MR^2/2$

(d) MR^2

7. Two satellites $S_1$and S_2 are orbiting at a distance of 2R and 3R from the centre of the Earth, where R is the radius of the Earth. If the time period of their revolution are $T_1$and T_2respectively, then $(T_1/T_2)^{2/3}$is

(a) 4/3

(b) 3 /4

(c) 2/3

(d) 3/2

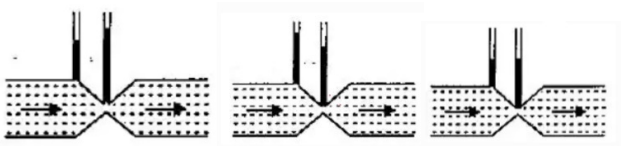
8. A source supplies heat to a system at the rate of 200 J/s. The system performs work at the rate of 80J/s. The internal energy of the system increases at the rate of

(a) 80 J/s

(b) 120 J/s
(c) 200 J/s
(d) 280 J/s

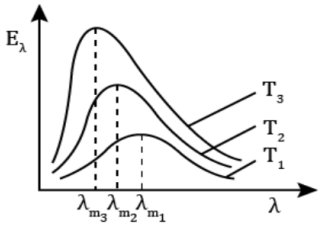
9. Figures A, B and C show study of flow of a non-viscous liquid. The correct figure is

(A) (B) (C)



(a) A only
(b) B only
(c) C only
(d) B and C both

10. The graph shows variation of radiation energy emitted per unit area per unit wavelength by three black bodies at absolute temperaturesT_1 , $T_2$and T_3. The relation between T_1 , $T_2$and T_3. Is



(a) $T_1 > T_2 > T_3$
(b) $T_1 < T_2 < T_3$
(c) $T_1 > T_2 < T_3$
(d) $T_1 < T_2 > T_3$

11. The displacement of a particle oscillating in simple harmonic motion is given by

$$X=5\sqrt{2}\sin(2\pi t+\pi/4)m$$

The speed of the body at t=1s

(a) 2πm/s
(b) 5πm/s
(c) 8π m/s
(d) 10π m/s

12. A travelling wave is represented by

$$Y(x,t) = a\sin(kx-\omega t)$$

Is incident on a rigid boundary. Which of the following equations represents the reflected wave from the rigid boundary

(a) $Y_1(x,t) = a \sin (kx+wt)$
(b) $Y_2(x,t) = -a \sin (kx - wt)$
(c) $Y_3(x,t) = a \sin (kx - wt)$
(d) $Y_4(x,t) = -a \sin (kx+wt)$

For Questions 13 to 16, two statements are given- one labelled assertion (A) and other labelled reason (R). Select the correct answer to these questions from the options as given below.

a) If both assertion and reason are true and reason is correct explanation of assertion.
b) If both assertion and reason are true and reason is not the correct explanation of assertion.
c) If assertion is true but reason is false.
d) If both assertion and reason are false.

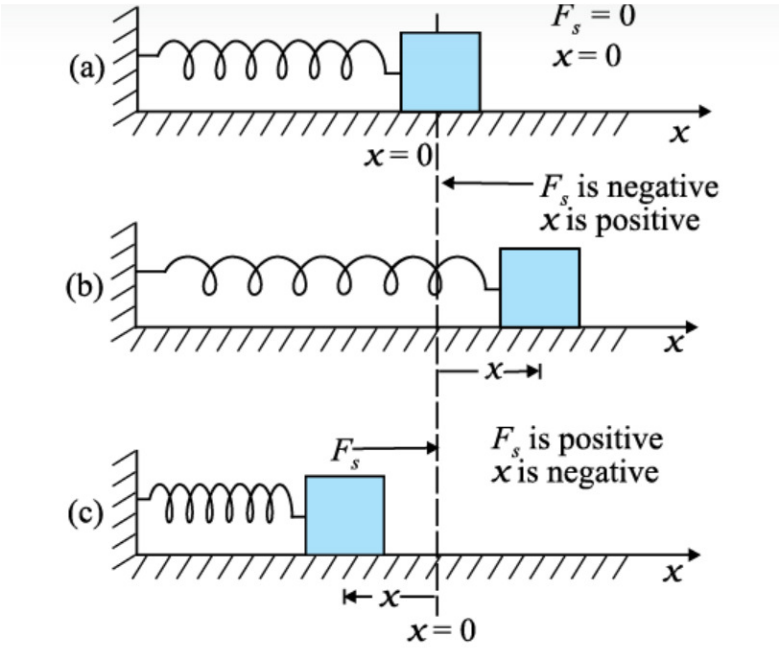
13. Assertion (A): Two bodies at different temperatures $T_1$and T_2, when brought in thermal contact do not necessarily settle to same temperature $(T_1+T_2)/2$

Reason (R): Two bodies may have different thermal capacities

14. Assertion (A): The speed of sound in a gas is not affected by change in pressure at constant temperature

Reason (R): The speed of sound in gas is given as $v=\sqrt{(YP/\rho)}$

15. Assertion (A): In case (b) and (c) both springs possess same potential energy



Reason (R): Work done against restoring force is stored as Potential energy

16. Assertion (A): Amrit Singh , world renowned cyclist is always seen bending inwards while negotiating a curve during a race which won him many laurels

Reason (R): By bending , he lowers his centre of gravity

SECTION- B

17. The rate of flow (V) of a liquid through a pipe of radius 'r' under a pressure gradient $\frac{P}{l}$

is given by the formula $V = \frac{\pi p r^4}{8\eta l}$,where η is the coefficient of viscosity. Check the dimensional correctness of the above relation.

18. A block of mass m kg, initially at rest, breaks into two parts of masses in the ratio 2:3. The velocity of smaller part is $(8\hat{\imath} + 6\hat{\jmath})$ m/s. Find the velocity of the bigger part.

19. An object projected under gravity is found to have the same range 'R' for two angles of projection. If t_1 and t_2 be the time of flight in the two cases, then find the relation between t_1, t_2 and R.

OR

The sum and the difference of two vectors **A**&**B** are perpendicular to each other. Prove that the vectors are equal in magnitude.

20. Two rods A and B made of different materials are of equal length L. Each rod has the ends at temperature T_1 and T_2 where $T_1 > T_2$. Find the condition that will ensure equal rates of flow of heat through the rods A and B.

21. A Capillary tube of diameter 2 mm is dipped in water in a beaker to a depth so that the pressure at the lower end of tube is 1.0 x 10^5 Pa. Calculate the pressure in the tube in order to blow a hemispherical bubble at its end in water. The surface tension of water at temperature of the experiments is 7.30 x 10^{-2} N/m.

SECTION -C

22. Justify the following statements:

(a) In a sound wave, a displacement node is a pressure anti- node and vice-versa

(b) A violin-note and sitar-note may have the same frequency, yet we can distinguish between the two notes

(c) Solids can support both longitudinal and transverse waves but in gases only longitudinal waves can propagate in gases.

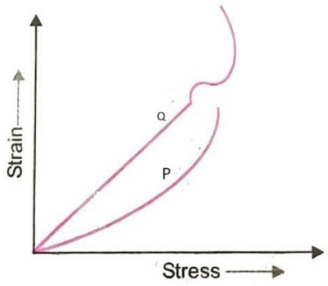
23. An insect trapped in a circular groove of radius 10cm moves along the groove of radius 10cm moves along the groove steadily and completes 7 revolutions in 44s.

(a) What is the angular speed of insect's motion?

(b) Is the acceleration vector a constant vector?

(c) Calculate the magnitude of acceleration.

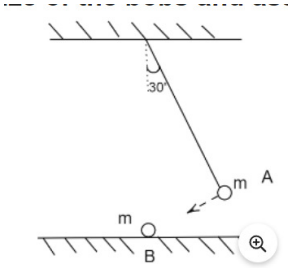
24. In plotting strain-stress graph for two material P and Q, a student by mistake puts strain on y-axis and stress on x-axis as shown in figure. Answer the following questions based on the given graph



(a) Which material amongst the two is more ductile? Justify
(b) Young's modulus of which of the two material is higher? Explain
(c) Which of the two given material has higher tensile strength? Explain

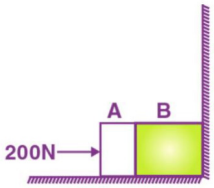
25. State Kepler's law of area for planetary motion. Show that it is the consequence of law of conservation of angular momentum

26.A bob A of a pendulum of length 2m is released from 30^0 to the vertical hits another bob B of same mass at rest on a table as shown in figure. How high does the bob A rise after collision? Justify. Calculate the velocity with which the bob B moves after collision? Neglect the size of the bobs and assume the collision to be elastic.



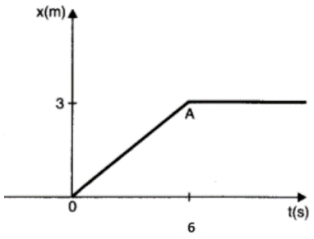
27. Torques of equal magnitude are applied to a hollow cylinder and a solid sphere both having the same mass and radius. Thecylinder is rotating about its axis and sphere is rotating about its diameter passing through centre. Find the ratio of the angular speed of cylinder to that of solid sphere after a given time.

28. Two bodies A and B of masses 5kg and 10kg in contact with each other rest on a table against a rigid wall as shown in figure. The coefficient of friction between the bodies and the table is 0.15. A force of 200N is applied horizontally to A. What is (a) the reaction of partition (b) the action-reaction forces between A and B? What happens when the wall is removed?



OR

The following figure shows the position-time graph of a particle of mass 8kg. What is the



(a) Force on a particle for t<0, t>6 , 0<t<6 s?
(b) Impulse at t=0 and t=6s (considering 1-d motion only.)

SECTION D

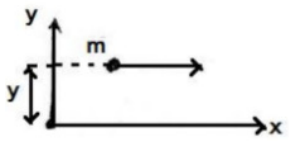
Case Study Based Questions

29.Read the following paragraph and answer the questions that follow.

The moment of a force also referred as Torque , is a rotational analogue of the force in linear motion.The quantity angular momentum is the rotational analogue of linear momentum. Like the moment of force , angular momentum is also a vector product . It could also be referred to as moment of momentum. From this term one could guess how angular momentum is defined.

(i) A force **F**= $F_0\hat{j}$ is acting on a particle moving in x-y plane. The torque acting on the particle when it is at **r**= $x_0\hat{i} + y_0\hat{j}$ will be
   (a) $x_0 f_0 k$
   (b) $-x_0 f_0 k$
   (c) $x_0 f_0 \hat{j}$
   (d) $-x_0 f_0 \hat{j}$

(ii) A point mass is moving with a constant velocity along a line parallel to the x-axis away from the origin. Its angular momentum with respect to origin



(a) is zero

(b) remains constant
(c) goes on increasing
(d) goes on decreasing

(iii)A particle performs uniform circular motion with angular momentum L. If the angular frequencyω of the particle is doubled and kinetic energy K is halved, its angular momentum becomes

(a) 4L

(b) 2L

(c) L/2

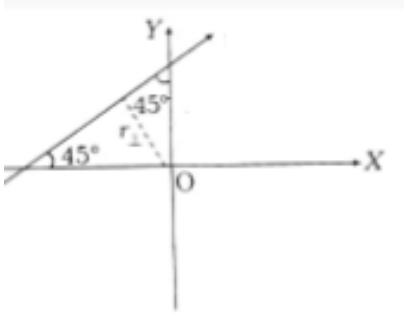
(d) L/4

OR

If rotational kinetic energies of two bodies having moments of inertia of 9kg/$m^2$and 1kg/$m^2$are the same then ratio of their angular momentum is

(a) 9:1
(b) 1:9
(c) 1:3
(d) 3:1

(iv) An object of mass m=0.6kg is moving with a uniform speed v=(5î+5ĵ) m/s in XY plane along a straight line as shown in figure



The magnitude of the angular momentum of the object at point P

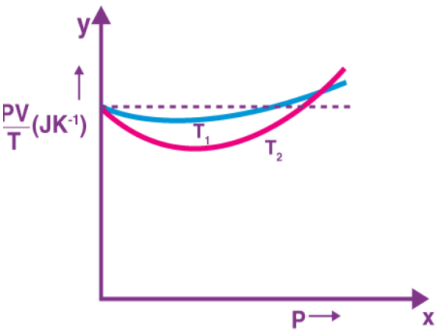
(a) 30kgm^2s^{-1}
(b) 24kgm^2s^{-1}
(c) 12kgm^2s^{-1}
(d) 15kgm^2s^{-1}

30.Read the following paragraph and answer the questions that follow.

A perfect gas equation can be written as PV=nRT

Where n is the number of moles and R= N_Ak_b is a universal constant. The temperature T is absolute temperature. Molecules of such gas are free from intermolecular attraction and have negligible volume. The gas particles are equally sized and motion of the particle follows Newton's laws of

motion. These particles do not undergo any energy loss as they have perfect elastic collision. Figure shows the plot of $\frac{PV}{T}$ versus P for one mole of oxygen gas at two different temperatures. (Given molecular mass of oxygen=32 unit).



(i) A real gas will behave like an ideal gas at

(a) high temperature (b) low temperature

(c) high temperature and low pressure (d) low temperature and high pressure

(ii) In the above diagram what does the dotted line signify?

(a)Ideal gas behaviour (b) Real gas behaviour

(c) Oxygen gas at temperature T_1 (d) Oxygen gas at temperature T_2

(iii) Which of the following is correct?

(a) $T_1<T_2$ (b)$T_1>T_2$

(c)$T_1=T_2$ (d) $T_1\geq T_2$

OR

(iii)The value of $\frac{PV}{T}$ where curves meet on y-axis is

(a) 8.31 J/K (b) 0.26 J/K

(c) 0.52 J/K (d)4.15 J/K

(iv) Relation between Boltzmann constant and universal gas constant

(a) $R=k_bN$ (b) $N=k_bR$

(c) $R=k_b/N$ (d) $k_b= NR$

SECTION E

31. (a)Derive an expression for work done during an adiabatic expansion of gas

(b) 2.2 moles of an ideal monoatomic gas occupying volume V at temperature 300K is adiabatically expanded to a volume of 2√2 V. Find

(i) Final temperature

(ii) Change in internal energy (Where R=8.31 J/K/mol), of the gas

OR

(a) If n number of little droplets of water of surface tension S, all of the same radius r combine to form a single drop of radius R. Suppose the entire energy released is converted into K.E. of the single drop, then find the velocity acquired by it?

(b) A plane is in level flight at constant speed and each of the wings has an area of $25m^2$. If the speed of the air is 180km/h over the lower wing and 234km/h over the upper wing surface. Determine mass of the plane. (Take air density to be $1kg/m^3$)

32. A progressive wave represented by

$Y(x,t) = a \sin(kx-\omega t)$

is incident on a closed organ pipe. After its reflection from the closed end a standing wave is formed in the pipe.

(a)Derive an expression for resultant displacement of standing waves.

(b) Find the frequency of n^{th} mode of vibration

(c)Show that only odd harmonics are present in closed organ pipe.

OR

Consider a particle of mass m executing S.H.M. with amplitude 'a' and constant angular frequency ω. The displacement 'y' of the particle at 't' seconds after starting from mean position is given by

$Y=a \sin \omega t$

Derive the expression for the kinetic and potential energies of the particle at time t. Hence plot a graph to show the variation of K.E. and P.E. of the particle with displacement

33. A ball is dropped from a height of 100m on a floor. At each collision with the floor the ball loses one tenth of its speed. Plot speed- time graph of its motion between t=0 to t=9s. (take $g=10m/s^2$)

OR

A man is standing on the top of a building 100m high. He throws two balls vertically upwards, one at t=0 with velocity 2u and other at t=Ts (less than 2 seconds) with a velocity u. At t=2s, the vertical gap between first and second ball is found to be 15m. The gap is found to remain constant. Calculate the value of u and T. (given $g=10m/s^2$)