

CHINMAYA VIDYALAYA, NEW DELHI
MID TERM EXAMINATION (2024-25)
CLASS - XI

SUBJECT - PHYSICS

TIME ALLOWED: 3 HOURS

MAXIMUM MARKS: 70

General Instructions

- This question paper carries 7 number of pages.
- There are 33 questions in all. All questions are compulsory
- This question paper has five sections: Section A, Section B, Section C, Section D and Section E.
- All the sections are compulsory.
- 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.
- 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.
- Use of calculators is not allowed.

SECTION - A

1 The motion of particle of mass m is described by $y=ut+1/2 gt^2$. The force acting on the particle will be. 1

- a) $F=mg$ b) $F=dm/dt$ c) 10N d) $F=mv^2/r$ 1

2 A rocket with a lift off mass of 20000 kg is blasted upward with a net initial acceleration of 5 m/s^2 . Calculate the initial thrust of the blast. 1

- a) 300000 b) 900000 c) 180000 d) 360000

The angle

3 The magnitude of vectors A, B & C are 12, 5 & 13 respectively & $\vec{A} + \vec{B} = \vec{C}$ between \vec{A} & \vec{B} is 1

- a) 0 b) 90 c) 180 d) 360

4 In anti clockwise system 1

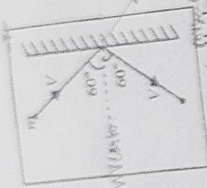
- a) $j \times k = i$ b) none of these c) $j \times j = 1$ d) $k \cdot i = 1$

5 Which of the following is a VECTOR quantity? 1

- a) electric current b) strain c) specific gravity d) none of these

$$\begin{aligned} \cos C &= 1 \\ \cos K &= 0 \\ \cos C &= 0 \end{aligned}$$

A rigid ball of mass m strikes a rigid wall at 60° and gets reflected without loss of speed as shown in the figure.



The value of impulse imparted by the wall on the ball along y direction will be

- a) $(\sqrt{3}/2) mV$ b) $2 mV$ c) $mV/2$ d) 0

The work done in stretching a spring by a distance 'x' will be

- a) 200 J b) 400 J c) 100 J d) 25 J

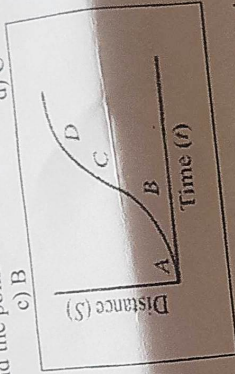
The angle between the two vectors $\vec{A} = 3\mathbf{i} + 4\mathbf{j} + 5\mathbf{k}$ and $\vec{B} = 3\mathbf{i} + 4\mathbf{j} - 5\mathbf{k}$ will be

- a) 90° b) 180° c) zero d) 45°

A particle shows the distance-time curve as given in this figure. The maximum instantaneous

- velocity of the particle is around the point

- a) A b) B c) C d) D



The total vertical distance covered by a freely falling body in a given time is directly

- proportional to

- a) time
b) square of time
c) square of acceleration due to gravity
d) product of the time and acceleration due to gravity

Choose the wrong statement(s)

- A. A dimensionally correct equation may be incorrect
B. A dimensionally correct equation may be incorrect
C. A dimensionally incorrect equation may be correct
D. A dimensionally incorrect equation may be correct

- a) A and B
b) C and D
c) A only
d) B only



The velocity v of a particle is given in terms of time t as $v = at + \frac{c}{t}$. The dimensions of c is

- a) [K] b) [T] c) [L] d) [L.T⁻²]

For Questions 13 to 16, two statements are given —one labeled Assertion (A) and other labeled 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 but 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):** The apparent weight of a body in an elevator moving with some downward acceleration is less than the actual weight of the body.

Reason (R): The part of the weight is spent in producing downward acceleration, when the body is in an elevator.

14. **Assertion (A):** The work done during a round trip is always zero.

(C)

Reason (R): No force is required to move a body in its round trip.

15. **Assertion (A):** A positive acceleration of a body can be associated with 'slowing down' of the body.

Reason (R): Acceleration acts along the direction of velocity of the body.

16. **Assertion (A):** The minimum number of vectors of unequal magnitude required to produce zero resultant is three.

Reason (R): Three vectors of unequal magnitude which can be represented by the three sides of a triangle taken in order, produce zero resultant

SECTION B

17. Explain why

- a) a horse cannot pull a cart and run in empty space.
b) it is easier to pull a lawn mower than to push it.

18. 1m, 1kg & 1min are taken as fundamental units, the magnitude of force is 36 units. What is the value of this force on the c.g.s. system?

19. A mass of 100 Kg is resting on a rough inclined plane of 30° . If the coefficient of friction is $1/\sqrt{3}$, find the greatest and least forces that acting parallel to the plane in both cases; just maintain the mass in equilibrium.

20. A player throws a ball upwards with an initial speed of 29.4 m s^{-1} .
a) Choose the $x = 0 \text{ m}$ and $t = 0 \text{ s}$ to be the location and time of the ball at its highest point, vertically downward direction to be the positive direction of x -axis, and give the signs of velocity and acceleration of the ball during its upward motion.

b) After how long does the ball return to the player's hands? (Take $g = 9.8 \text{ m s}^{-2}$ and neglect air resistance).

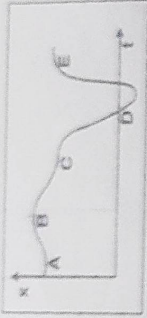
OR



REDMI NOTE 8

AI QUAD CAMERA

A graph of x versus t is shown below

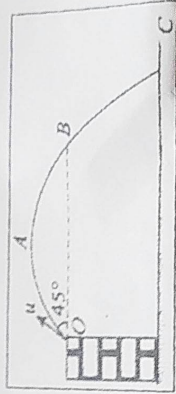


Check the correctness of the following statements and justify your answer:

- a) At B, the acceleration $a > 0$.
 - b) At C, the velocity and the acceleration vanish
- 21 A particle starts from the origin at $t=0$ with a velocity 5.0 i m/s and moves in the $x-y$ plane under action of a force which produces a constant acceleration of $(3.0 \text{ i} + 2.0 \text{ j}) \text{ m/s}^2$.
- a) What is the y -coordinate of the particle at the instant its x -coordinate is 84 m ?
 - b) What is the speed of the particle at this time?

SECTION C

- 22 A ball is thrown from a rooftop at an angle of 45° above the horizontal. It hits the ground a few seconds later.



At what point during its motion, does the ball have

- a) greatest speed.
 - b) smallest speed.
 - c) greatest acceleration?
- Explain your answer.

23 a) State work-energy theorem.

b) A body of mass 1 kg travels in a straight line with velocity $v = kx^{3/2}$ where $k = 5 \text{ m}^{-1/2} \text{ s}^{-1}$.

What is the work done by the net force during its displacement from $x = 0$ to $x = 3 \text{ m}$?

OR

Two similar springs P and Q have spring constants K_P and K_Q , such that $K_P < K_Q$. They are stretched first by the same amount, then by the same force. Calculate the ratio of work done by the springs W_P and W_Q in both cases.

24 Discuss the apparent weight of a man in a lift/elevator when

- a) Elevator is at rest
- b) Elevator is moving uniformly in an up/downward direction.
- c) Elevator is accelerating upwards.

25 Two bodies of masses 10 kg and 20 kg respectively kept on a smooth, horizontal surface are tied to the ends of a light string. A horizontal force $F = 600 \text{ N}$ is applied to (i) A, (ii) B along the direction of the string. What is the tension in the string in each case?



REDMI NOTE 8

AI QUAD CAMERA

Assuming the mass M of the largest stone that can be moved by a flowing river depends on velocity v , density d and acceleration due to gravity g . Find an expression for the mass M in terms of the mentioned quantities using dimensional analysis. 3

A monkey of mass 40 kg climbs on a rope which can stand a maximum tension of 600 N . In which of the following cases will the rope break? The monkey 3

- a) Climbs up with an acceleration of 6 m/s^2 .
- b) Climbs down with an acceleration of 4 m/s^2 .
- c) Climbs up with a uniform speed of 5 m/s .
- d) Falls down the rope nearly freely under gravity.
- e) What should be the maximum tension so that the rope does not break in any of the above case?

28 The displacement of a particle is given by $x = (t-2)^2$ where x is in meters and t in seconds. 3

- a) Find the expression of velocity of the particle as a function of time.
- b) Calculate the velocity of the body at $t=0\text{ s}, 1\text{ s}, 2\text{ s}$ and 4 s .
- c) Draw the velocity-time graph of the body using the obtained velocities.

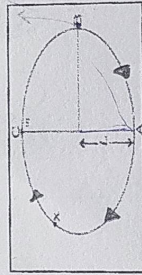
SECTION D

29 Imagine a baby girl holding a string in her hand. One end of a string is tied to a stone. She stretches her arm upfront. Keeping her hand fixed at the center, she revolves the string around in a vertical plane. If you look closely, you will notice that the stone assumes different velocities at different points of the motion; the same applies to a roller coaster ride. Such a motion can also be described as a "non-uniform" motion. 4

i. In the vertical circle of radius r , at what point in its path does a particle have tension equal to zero, if the stone is just able to complete the vertical circle

- a) Highest point
- b) Lowest point
- c) Any point
- d) At a point horizontally from the centre of the circle of radius r

ii. What will be the trajectory of the stone if the girl leaves the stone at point B?



- a) upwards
 - b) downwards
 - c) towards the centre
 - d) away from the centre
- iii The string of pendulum of length l is displaced through 90° from the vertical and released. Then the minimum strength of the string in order to withstand the tension, as the pendulum passes through the mean position is
- a) mg
 - b) 3 mg
 - c) 5 mg
 - d) 6 mg
- OR

A body with a mass of 2 kg and a weight of 20 N is travelling in a vertical circular motion with a radius of 1 m and a velocity of 5 m/s . When the string is horizontal, what is the tension?

- a) 20 N
- b) 50 N
- c) 20 N
- d) 25 N

Energy transformation is the process of changing energy from one form to another. In physics, energy is a quantity that provides the capacity to perform work (e.g. Lifting an object) or provides heat. In addition to being converted, according to the law of conservation of energy, energy is transferable to a different location or object, but it cannot be created or destroyed.

- A body of mass 20 kg is initially at a height of 3 m above the ground. It is lifted to a height of 2 m from that position. Its increase in potential energy is
- 100 J
 - 392 J
 - 60 J
 - 100 J
- Two masses 1 g and 4 g are moving with equal kinetic energies. The ratio of the magnitudes of their linear momenta is
- 4 : 1
 - 1 : 2
 - 0 : 1
 - 1 : 6

The casing of a rocket in flight burns up due to friction. At whose expense is the heat energy required for burning obtained? The rocket or the atmosphere?

OR

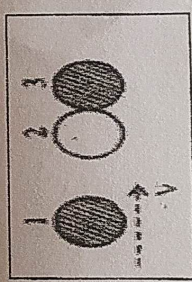
A balloon filled with helium rises against gravity increasing its potential energy. The speed of the balloon also increases as it rises. How do you reconcile this with the law of conservation of mechanical energy? You can neglect viscous drag of air and assume that density of air is constant.

SECTION E

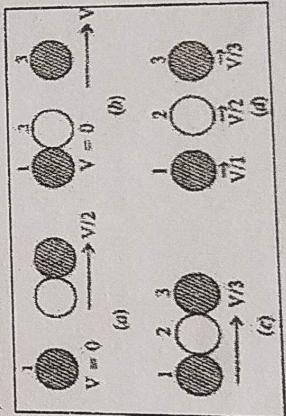
31. a) Derive the expression of potential energy of a block attached to the spring, which obeys Hooke's Law.
 b) Also, draw the graph between force and displacement for the spring.
 c) The average work done by a human heart while it beats once is 0.5 J. Calculate the power used by the heart if it beats 72 times in a minute.

OR

- a) Obtain expressions for velocities of two bodies after a perfectly elastic collision in one dimension.
 b) Two identical ball bearings in contact with each other and resting on a frictionless table are hit head-on by another ball bearing of the same mass moving initially with a speed V as shown



- 10 If the collision is elastic, which of the following is a possible result after collision?



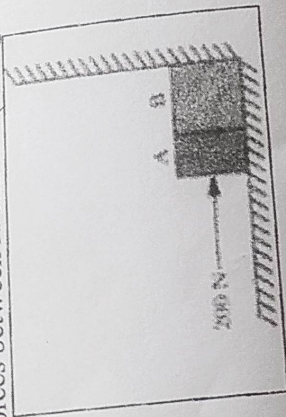
What is the importance of the packing of roads?
 b) Why is it needed?

Obtain an expression for the maximum speed with which a vehicle can safely negotiate a curved road banked at an angle θ . The coefficient of friction between the wheels and the road is μ .

OR

Define coefficient of friction. State the laws of friction.

- a) Two bodies A and B of masses 10 kg and 20 kg in contact with each other rest on a table against a rigid wall. The coefficient of friction between the bodies and the table is 0.15. A force of 200 N is applied horizontally to A. What are
- the reaction by the rigid wall
 - the action reaction forces between A and B? (Take $g=10 \text{ m/s}^2$)



a) A body of mass 'm' is thrown with velocity 'u' at an angle ' θ ' with the horizontal.

Derive an expression for

- Maximum height obtained
 - Time of flight
 - Horizontal range
- b) A person sitting in a train moving at constant velocity throws a ball vertically upwards.

How will the ball appear to move to an observer?

- Sitting inside the train
- Standing outside the train

OR

Derive an expression for centripetal acceleration.

- a) An insect trapped in a circular groove of radius 8 cm moves along the groove steadily and completes 15 revolutions in 100 s.
- What is the angular speed of the motion? Justify your answer
 - Is the acceleration vector in this case a constant vector? Justify your answer