ROLL NUMBER				

SET	A

INDIAN SCHOOL MUSCAT
HALF YEARLY EXAMINATION 2023
PHYSICS-042

CLASS : XI
DATE: 24.09.2023

TIME ALLOTED : 3 HRS.
MAXIMUM MARKS: 70

GENERAL INSTRUCTIONS:

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

2. This question paper has five sections: Section A, Section B, Section C, Section D and Section E.

3. Section A contains sixteen questions, twelve Multiple Choice Questions 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 case study-based questions in Section D and all three questions in Section E. You have to attempt only one of the choices in such questions.

SECTION A

1. The pair of the quantities having same dimensions is 1

   (a) Displacement, velocity
   (b) Time, frequency
   (c) Wavelength, focal length
   (d) Force, acceleration

2. A boy starts from a point P, travels to a point Q at a distance of 1.5km and returns to P. If he takes 2hours to do so, his average velocity is 1

   (a) 1.5km/hr

(b) 3km/hr

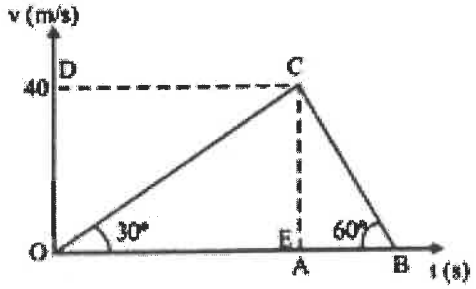
(c) Zero

(d) 0.66km/hr

3. Meena moves along a circular track of radius R. She starts from one end of the diameter of the circular track and reaches the other end of its diameter. The ratio of distance travelled to the displacement made by her is 1

(a) π (b) $\pi/2$ (c) 2π (d)4π

4. What is the ratio of the average acceleration during the intervals OA and AB in the velocity-time graph as shown below? 1



(a) ½ (b) 1/3 (c) 1 (d) 3

5. The slope of velocity-time graph for an object moving with uniform velocity is equal to 1

(a) zero

(b) final velocity

(c) initial velocity

(d) infinity

6. A stone of mass 'm' is tied to a string of length 'l' and rotated in a circle with a constant speed 'v'. If the string is released, the stone flies 1

(a) Radially outward

(b) Radially inward

(c) Tangentially outward

(d) With an acceleration mv^2/l

7. The angle of projection, for which the horizontal range and the maximum height of a projectile are equal, is 1

(a) 45^0 (b) $\tan^{-1}(4)$ (c) $\tan^{-1}(0.25)$ (d) $\tan^{-1}(2)$

8. At the uppermost point of a projectile, its velocity and acceleration are at an angle of 1

(a)0^0 (b) 90^0 (c)45^0 (d)180^0

9. During the motion of a lift, apparent weight of a body of mass 'm' becomes twice its actual weight, when 1

(a) lift is moving down with acceleration 'g'

(b) lift is moving up with acceleration 'g'

(c) lift is moving down with uniform velocity

(d) lift is moving up with uniform velocity

10. A graph is drawn with a force along Y-axis and time along X-axis. The area under the graph represent 1

(a) Momentum

(b) Couple

(c) Moment of the force

(d) Impulse of the force

11. Two bodies with kinetic energies in the ratio 4:1 are moving with equal linear momentum. The ratio of their masses is 1

(a) 4:1 (b) 1:1 (c)1:2 (d)1:4

12. A mass of 5kg is moving along a circular path of radius 1m. If the mass moves with 300 revolutions per minute, its kinetic energy would be 1

(a) Zero

(b) $100\pi^2$

(c) $250\ \pi^2$

(d) $5\ \pi^2$

In question numbers 13 to 16, two statements are given- one labelled Assertion (A) and the other labelled Reason (R). Select the correct answer to these questions from the options (i), (ii), (iii) and (iv) as given below.

(i) Both Assertion(A)and Reason(R) are true and Reason(R) is the correct explanation of A.

(ii) Both Assertion(A)and Reason(R) are true but Reason(R) is not the correct explanation of A.

(iii) Assertion(A) is true but Reason(R) is false.

(iv) Assertion(A) is false and Reason(R) is also false

13. Assertion(A): Displacement of a body may be zero when distance travelled by it is not zero. 1
Reason(R): The displacement is the longest distance between initial and final position.

14. Assertion(A): Horizontal range is same for angle of projection θ and $(90-\theta)$. 1
Reason(R): Horizontal range is independent of angle of projection.

15. Assertion(A): Centripetal force is always required for motion in a curved path. 1
Reason(R): On a banked curved track, vertical component of normal reaction provides the necessary centripetal force.

16. Assertion(A): A spring has potential energy, both when it is compressed and stretched. 1
Reason(R): This is because in compressing or stretching work is done by the spring against the restoring force.

SECTION B

17. Write any four advantages of SI over other systems of units. 2

18. Draw the following graphs for an object projected upward with a velocity v_0, which comes back to the same point after sometime: 2
    (i) Acceleration versus time graph
    (ii) Velocity versus time graph

19. The resultant of two forces which are equal in magnitude is equal to either of two vectors in magnitude. Find the angle between the forces. 2

20. State any two laws of limiting friction. 2

21. State any two differences between conservative and non-conservative forces. 2

OR

(a)Mountain roads generally wind up gradually. Why?
(b) A man carrying a bucket of water walks on a horizontal road with uniform velocity. What is the work done by him?

SECTION C

22. Assuming that the mass M of the largest stone that can be moved by a flowing river depends upon the velocity 'v', the density of water 'ρ' and the acceleration due to gravity 'g'. show that M varies with the sixth power of the velocity of flow. 3

23. (a)Can the velocity of a particle vary even if its speed is constant? Give example. 3
(b) Derive the expression $s = ut + \frac{1}{2} at^2$ for a body in uniform acceleration, by graphical method.

24. (a)Is the rocket in flight, an example of projectile? Give reason. 3

(b)Show that the path followed by a projectile is a parabola when it is projected at an angle θ with the horizontal.

25. It is easier to pull a lawn mower than to push it. Explain it with the help of free body diagrams. 3

OR

State and verify law of conservation of linear momentum.

26. Define angle of friction. Show that the coefficient of friction is numerically equal to the tangent of angle of repose. 3

27. (a)Two protons are brought towards each other. Will the potential energy of the system decrease or increase? 3

(b)A mass of 8.4kg rests on top of a vertical spring whose base is attached to the floor. The spring compresses by 5.2cm. Calculate the spring constant of the spring. (Take $g = 9.8 m/s^2$)

28. State and prove work-energy theorem when a constant force is acting on a body. 3

SECTION D

29. Significant figures in the measured value of a physical quantity tell the number of digits in which we have confidence. Larger the number of significant figures obtained in a measurement , greater is the accuracy of measurement and vice – versa . In addition or subtraction, the number of decimal places in the result should equal the smallest number of decimal places in any term in the operation. 4

In multiplication and division, the number of significant figures in the product or in the quotient is the same as the smallest number of significant figures in any of the factors.

(i) The sum of the numbers 436.32 g, 227.2 g and 0.301 g with correct number of significant figures is

(a) 663.8g (b) 663.821g (c)663.82g (d) 663g

(ii)The number of significant figures in the measured value 4.700 m is the same as that in the value

(a) 4700 m (b) 0.047 m (c) 4070 m (d) 470.0 m

(iii) If a calculated value 2.7465 g contains only three significant figures, the two insignificant digits in it are

(a) 2 and 7 (b) 7 and 4 (c) 6 and 5 (d) 4 and 6

OR

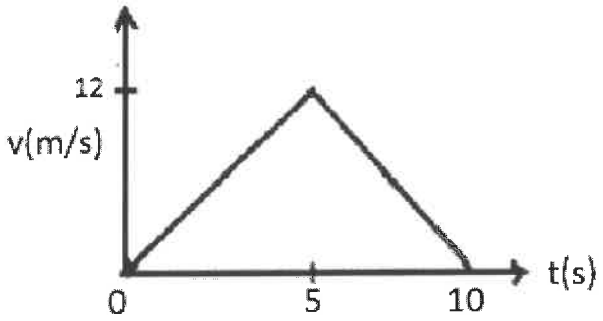
How many significant figures should the answer to this calculation contain? 76.4×180.4

(a)3 (b) 4 (c)5 (d)5

(iv) The number of significant zeroes present in the measured value 0.020040, is

(a) Five (b) Two (c) One (d) Three

30. The time rate of change of position of the object in any direction is called speed of the object 4
If an object covers equal distances in equal intervals of time, then its speed is called uniform speed and if it covers unequal distances in equal intervals of time, then its speed is called non-uniform or variable speed. The ratio of the total distance travelled by the object to the total time taken is called average speed of the object. The speed may be positive or zero but never negative.
The speed-time graph of a particle moving along a fixed direction is shown in following figure.



(i) Distance travelled by the particle between 0 to 10 seconds

(a) 60 m (b) 50 m (c) 120 m (d) zero

OR

The distance travelled by the particle between 0 to 5 seconds

(a) 60 m (b) 30 m (c) 12 m (d)120m

(ii) Average speed between time interval 0 to 10 s

(a) 12 m/s (b) 6 m/s (c) 10 m/s (d) 60 m/s

(iii) The acceleration of the particle between time interval 0 to 5 s

(a) $12m/s^2$ (b) $2.4m/s^2$ (c) 2.4m/s (d) zero

(iv) The slope of the graph is negative at time interval

(a) $t = 0$ to $t = 5$ s

(b) $t = 5$ to $t = 10$ s

(c) $t = 0$ to $t = 10$ s

(d) At 5second

SECTION E

31. (a) What is projectile? Obtain an expression for the maximum height and time of flight when it is projected at an angle θ with the horizontal. 5

(b) A projectile is fired horizontally with a velocity of 98m/s from the top of a hill 490m high. Find (i) the time taken to reach the ground and (ii) the distance of the target from the hill.(Take $g = 9.8m/s^2$)

OR

(a) Derive an expression for centripetal acceleration of an object in uniform circular motion in a plane.

(b)An insect trapped in a circular groove of radius 12cm moves along the groove steadily and completes 7 revolutions in 100 s. What is the angular speed and the linear speed of the motion?

32. (a)Prove that Newton's second law is the real law of motion. 5

(b) Ten one-rupee coins are put on top of each other on a table. Each coin has a mass m. Give the magnitude and direction of

(i) The force on the 7th coin (counted from the bottom) due to all the coins on its top.

(ii) The reaction of the 6th coin on the 7th coin.

OR

(a)Explain the motion of a vehicle on a level road having circular turn with the help of necessary diagram and obtain an expression for maximum speed with which the vehicle can move on a level road having circular turn without skidding.

(b)A bob of mass 0.1 kg hung from the ceiling of a room by a string 2 m long is set into oscillation. The speed of the bob at its mean position is 1 ms^{-1}. What is the trajectory of the bob if the string is cut when the bob is (i) at one of its extreme positions, (ii) at its mean position?

33. (a)Prove that in case of one-dimensional elastic collision of two bodies, the relative velocity of separation after collision is equal to the relative velocity of approach before collision. 5

(b) A molecule in a gas container hits the wall with speed 100m/s at an angle of 35^0 with the normal, and rebounds with the same speed. State whether linear momentum is conserved or not. What type of collision is it?

OR

(a) State the law of conservation of mechanical energy.

(b) Show that the total mechanical energy of freely falling body under gravity is conserved.

(c)Show the variations in kinetic energy, potential energy and total mechanical energy with the variation of height of the body from the surface of the earth graphically.

******END OF THE QUESTION PAPER******

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SET	B

INDIAN SCHOOL MUSCAT
HALF YEARLY EXAMINATION 2023
PHYSICS-042

CLASS: XI
DATE: 24.09.2023

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GENERAL INSTRUCTIONS:

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

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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 case study-based questions in Section D and all three questions in Section E. You have to attempt only one of the choices in such questions.

SECTION A

1. The angle of projection, for which the horizontal range and the maximum height of a projectile are equal, is 1

(a) 45^0 (b) $\tan^{-1}(4)$ (c) $\tan^{-1}(0.25)$ (d) $\tan^{-1}(2)$

2. At the uppermost point of a projectile, its velocity and acceleration are at an angle of 1

(a) 0^0 (b) 90^0 (c) 45^0 (d) 180^0

3. During the motion of a lift, apparent weight of a body of mass 'm' becomes twice its actual weight, when 1

(a) lift is moving down with acceleration 'g'

(b) lift is moving up with acceleration 'g'

(c) lift is moving down with uniform velocity

(d) lift is moving up with uniform velocity

4. A graph is drawn with a force along Y-axis and time along X-axis. The area under the graph represent 1

(a) Momentum

(b) Couple

(c) Moment of the force

(d) Impulse of the force

5. Two bodies with kinetic energies in the ratio 4:1 are moving with equal linear momentum. The ratio of their masses is 1

(a)4:1 (b) 1:1 (c)1:2 (d)1:4

6. A mass of 5kg is moving along a circular path of radius 1m. If the mass moves with 300 revolutions per minute, its kinetic energy would be 1

(a) Zero

(b) $100\pi^2$

(c) $250\ \pi^2$

(d) $5\ \pi^2$

7. The pair of the quantities having same dimensions is 1

(a) Displacement, velocity

(b) Time, frequency

(c) Wavelength, focal length

(d) Force, acceleration

8. A boy starts from a point P, travels to a point Q at a distance of 1.5km and returns to P. If he takes 2hours to do so, his average velocity is 1

(a) 1.5km/hr

(b) 3km/hr

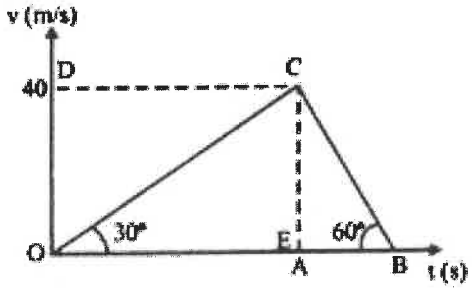
(c) Zero

(d) 0.66km/hr

9. Meena moves along a circular track of radius R. She starts from one end of the diameter of the circular track and reaches the other end of its diameter. The ratio of distance travelled to the displacement made by her is 1

(a)π (b) $\pi/2$ (c) 2π (d)4π

10. What is the ratio of the average acceleration during the intervals OA and AB in the velocity-time graph as shown below? 1



(a)½ (b) 1/3 (c) 1 (d) 3

11. The slope of velocity-time graph for an object moving with uniform velocity is equal to 1

(a) zero

(b) final velocity

(c) initial velocity

(d) infinity

12. A stone of mass 'm' is tied to a string of length '*l*' and rotated in a circle with a constant speed 'v'. If the string is released, the stone flies 1

(a) Radially outward

(b) Radially inward

(c) Tangentially outward

(d) With an acceleration mv^2/l

In question numbers 14 to 18, two statements are given- one labelled Assertion (A) and the other labelled Reason (R). Select the correct answer to these questions from the options (i), (ii), (iii) and (iv) as given below.

(i) Both Assertion(A)and Reason(R) are true and Reason(R) is the correct explanation of A.

(ii) Both Assertion(A)and Reason(R) are true but Reason(R) is not the correct explanation of A.

(iii) Assertion(A) is true but Reason(R) is false.

(iv) Assertion(A) is false and Reason(R) is also false

13. Assertion(A): A spring has potential energy, both when it is compressed and stretched. 1
Reason(R): This is because in compressing or stretching work is done by the spring against the restoring force.

14. Assertion(A): Centripetal force is always required for motion in a curved path. 1
Reason(R): On a banked curved track, vertical component of normal reaction provides the necessary centripetal force.

15. Assertion(A): Displacement of a body may be zero when distance travelled by it is not zero. 1
Reason(R): The displacement is the longest distance between initial and final position

16. Assertion(A): Horizontal range is same for angle of projection Θ and $(90-\Theta)$. 1
Reason(R): Horizontal range is independent of angle of projection.

SECTION B

17. Write any four limitations of dimensional analysis. 2

18. Draw velocity-time graph for a body which accelerates uniformly from rest and then moves with uniform velocity. 2

19. The resultant of two forces which are equal in magnitude is equal to either of two vectors in magnitude. Find the angle between the forces. 2

20. State any two laws of limiting friction. 2

21. State any two differences between conservative and non-conservative forces. 2

OR

(a)Mountain roads generally wind up gradually. Why?

(b) A man carrying a bucket of water walks on a horizontal road with uniform velocity. What is the work done by him?

SECTION C

22. A planet moves around the sun in nearly circular orbit. Its period of revolution T depends upon (i) radius 'r' of the orbit (ii) mass 'M' of the sun and gravitational constant 'G'. show dimensionally that $T^2 \alpha r^3$. 3

23. (a)Can a body have a zero velocity, but still have acceleration? Explain with suitable example. 3

(b) Derive the expression $v^2 = u^2 + 2as$ for a body in uniform acceleration, by graphical method.

24. (a)State parallelogram law of vector addition. 3

(b)Show that the vector addition is commutative in nature.

25. It is easier to pull a lawn mower than to push it. Explain it with the help of free body diagrams. 3

OR

State and verify law of conservation of linear momentum.

26. Draw a neat free body diagram to show various forces acting on a body moving down a rough inclined plane with uniform acceleration and derive an expression for the acceleration. 3

27. State and prove work-energy theorem when a constant force is acting on a body. 3

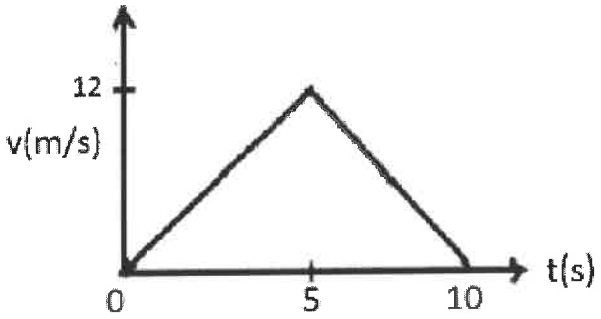
28. (a)An electron and a proton are brought towards each other. Will the potential energy of the system decrease or increase? 3

(b)A ball at rest is dropped from a height of 12m. If it loses 25% of kinetic energy on striking the ground, find the height to which it bounces?

SECTION D

29. The time rate of change of position of the object in any direction is called speed of the object If an object covers equal distances in equal intervals of time, then its speed is called uniform speed and if it covers unequal distances in equal intervals of time, then its speed is called non-uniform or variable speed. The ratio of the total distance travelled by the object to the total time taken is called average speed of the object. The speed may be positive or zero but never negative. 4

The speed-time graph of a particle moving along a fixed direction is shown in following figure.



(i) Distance travelled by the particle between 0 to 10 seconds

(a) 60 m (b) 50 m (c) 120 m (d) zero

OR

The distance travelled by the particle between 0 to 5 seconds

(a) 60 m (b) 30 m (c) 12 m (d)120m

(ii) Average speed between time interval 0 to 10 s

(a) 12 m/s (b) 6 m/s (c) 10 m/s (d) 60 m/s

(iii) The acceleration of the particle between time interval 0 to 5 s

(a) $12 m/s^2$ (b) $2.4 m/s^2$ (c) 2.4m/s (d) zero

(iv) The slope of the graph is negative at time interval

(a) t = 0 to t = 5 s

(b) t = 5 to t = 10 s

(c) t = 0 to t = 10 s

(d) At 5second

30. Significant figures in the measured value of a physical quantity tell the number of digits in which we have confidence. Larger the number of significant figures obtained in a measurement , greater is the accuracy of measurement and vice – versa . In addition or subtraction, the number of decimal places in the result should equal the smallest number of decimal places in any term in the operation. 4

In multiplication and division, the number of significant figures in the product or in the quotient is the same as the smallest number of significant figures in any of the factors.

(i) The sum of the numbers 1.6 g, 7.32 g and 4.248 g with correct number of significant figures is

(a) 13.168 g (b) 13.2 g (c) 13.1 g (d) 13.16 g

(ii)The number of significant figures in the measured value 2.50 m is the same as that in the value

(a) 2500 m (b) 0.025 m (c) 2050 m (d) 250.0 m

(iii) If a calculated value 59.382 g contains only three significant figures, the two insignificant digits in it are

(a) 5 and 9 (b) 9 and 3 (c) 3 and 8 (d) 8 and 2

OR

How many significant figures should the answer to this calculation contain? 25×393.4

(a)4 (b) 2 (c)3 (d)5

(iv) The number of significant zeroes present in the measured value 260040, is

(a) Five (b) Two (c) One (d) Three

SECTION E

31. (a)Prove that Newton's second law is the real law of motion. 5

(b) Ten one-rupee coins are put on top of each other on a table. Each coin has a mass m. Give the magnitude and direction of

(i) The force on the 7th coin (counted from the bottom) due to all the coins on its top.

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OR

(a)Explain the motion of a vehicle on a level road having circular turn with the help of necessary diagram and obtain an expression for maximum speed with which the vehicle can move on a level road having circular turn without skidding.

(b)A bob of mass 0.1 kg hung from the ceiling of a room by a string 2 m long is set into oscillation. The speed of the bob at its mean position is 1 ms^{-1}. What is the trajectory of the

bob if the string is cut when the bob is (i) at one of its extreme positions, (ii) at its mean position?

32. (a)Prove that in case of one-dimensional elastic collision of two bodies, the relative velocity of separation after collision is equal to the relative velocity of approach before collision. 5

(b) A molecule in a gas container hits the wall with speed 100m/s at an angle of 35^0 with the normal, and rebounds with the same speed. State whether linear momentum is conserved or not. What type of collision is it?

OR

(a) State the law of conservation of mechanical energy.

(b) Show that the total mechanical energy of freely falling body under gravity is conserved.

(c)Show the variations in kinetic energy, potential energy and total mechanical energy with the variation of height of the body from the surface of the earth graphically.

33. (a) What is projectile? Obtain an expression for the maximum height and time of flight when 5

it is projected at an angle θ with the horizontal.

(b) A projectile is fired horizontally with a velocity of 98m/s from the top of a hill 490m high. Find (i) the time taken to reach the ground and (ii) the distance of the target from the hill.(Take $g = 9.8m/s^2$)

OR

(a) Derive an expression for centripetal acceleration of an object in uniform circular motion in a plane.

(b)An insect trapped in a circular groove of radius 12cm moves along the groove steadily and completes 7 revolutions in 100 s. What is the angular speed and the linear speed of the motion?

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SECTION A

1. A graph is drawn with a force along Y-axis and time along X-axis. The area under the graph represent 1
   (a) Momentum
   (b) Couple
   (c) Moment of the force
   (d) Impulse of the force

2. Two bodies with kinetic energies in the ratio 4:1 are moving with equal linear momentum. The ratio of their masses is 1
   (a)4:1 (b) 1:1 (c)1:2 (d)1:4

3. A mass of 5kg is moving along a circular path of radius 1m. If the mass moves with 1

300 revolutions per minute, its kinetic energy would be

(a) Zero

(b) $100\pi^2$

(c) $250\ \pi^2$

(d) $5\ \pi^2$

4. The pair of the quantities having same dimensions is 1

(a) Displacement, velocity

(b) Time, frequency

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5. A boy starts from a point P, travels to a point Q at a distance of 1.5km and returns to P. If he takes 2hours to do so, his average velocity is 1

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(b) 3km/hr

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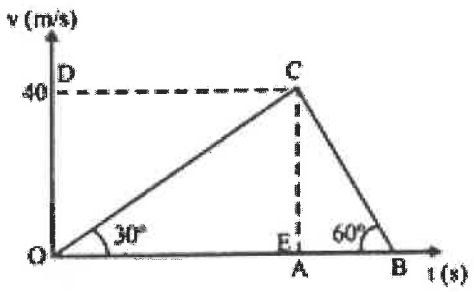
(d) 0.66km/hr

6. Meena moves along a circular track of radius R. She starts from one end of the diameter of the circular track and reaches the other end of its diameter. The ratio of distance travelled to the displacement made by her is 1

(a)π (b) $\pi/2$ (c) 2π (d)$4\ \pi$

7. What is the ratio of the average acceleration during the intervals OA and AB in the velocity-time graph as shown below? 1



(a)½ (b) 1/3 (c) 1 (d) 3

8. The slope of velocity-time graph for an object moving with uniform velocity is equal to 1

(a) zero

(b) final velocity

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9. A stone of mass 'm' is tied to a string of length 'l' and rotated in a circle with a constant speed 'v'. If the string is released, the stone flies 1

(a) Radially outward

(b) Radially inward

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10. The angle of projection, for which the horizontal range and the maximum height of a projectile are equal, is 1

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11. At the uppermost point of a projectile, its velocity and acceleration are at an angle of 1

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12. During the motion of a lift, apparent weight of a body of mass 'm' becomes twice its actual weight, when 1

(a) lift is moving down with acceleration 'g'

(b) lift is moving up with acceleration 'g'

(c) lift is moving down with uniform velocity

(d) lift is moving up with uniform velocity

In question numbers 14 to 18, two statements are given- one labelled Assertion (A) and the other labelled Reason (R). Select the correct answer to these questions from the options (i), (ii), (iii) and (iv) as given below.

(i) Both Assertion(A)and Reason(R) are true and Reason(R) is the correct explanation of A.

(ii) Both Assertion(A)and Reason(R) are true but Reason(R) is not the correct explanation of A.

(iii) Assertion(A) is true but Reason(R) is false.

(iv) Assertion(A) is false and Reason(R) is also false

13. Assertion(A): Centripetal force is always required for motion in a curved path. 1

Reason(R): On a banked curved track, vertical component of normal reaction provides the necessary centripetal force.

14. Assertion(A): A spring has potential energy, both when it is compressed and stretched. 1

Reason(R): This is because in compressing or stretching work is done by the spring against the restoring force.

15. Assertion(A): Displacement of a body may be zero when distance travelled by it is not zero. 1

Reason(R): The displacement is the longest distance between initial and final position.

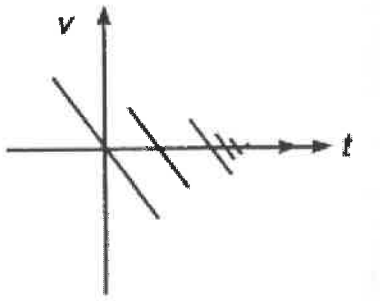
16. Assertion(A): Horizontal range is same for angle of projection Θ and $(90-\Theta)$. 1

Reason(R): Horizontal range is independent of angle of projection.

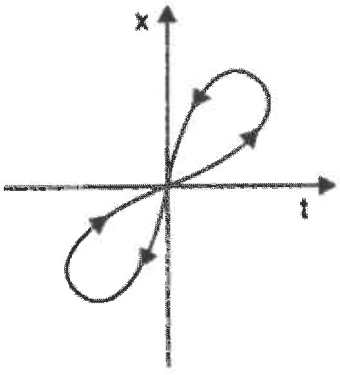
SECTION B

17. Write any four limitations of dimensional analysis. 2

18. (a)Suggest a suitable physical situation for the following velocity-time graph. 2



(b)Look at the position- graph given below carefully and state, with reasons, why does it cannot possibly represent one-dimensional motion of a particle?



19. The resultant of two forces which are equal in magnitude is equal to either of two vectors in magnitude. Find the angle between the forces. 2

20. State any two laws of limiting friction. 2

21. State any two differences between elastic and inelastic collision. 2

OR

(a) What are the advantages of banking of a curved road?

(b) What should be the angle between force and displacement so that no work is done?

SECTION C

22. A planet moves around the sun in nearly circular orbit. Its period of revolution T depends upon (i) radius 'r' of the orbit (ii) mass 'M' of the sun and gravitational constant 'G'. show dimensionally that $T^2 \alpha r^3$. 3

23. (a)Can a body have a zero velocity, but still have acceleration? Explain with suitable example. 3

(b) Derive the expression $v^2 = u^2 + 2as$ for a body in uniform acceleration, by graphical method.

24. (a)State triangle law of vector addition. 3

(b)Show that the vector addition is associative in nature.

25. It is easier to pull a lawn mower than to push it. Explain it with the help of free body diagrams. 3

OR

State and verify law of conservation of linear momentum.

26. Draw a neat free body diagram to show various forces acting on a body moving down a rough inclined plane with uniform acceleration and derive an expression for the acceleration. 3

27. State and prove work-energy theorem when a constant force is acting on a body. 3

28. (a)Two electrons are brought towards each other. Will the potential energy of the system decrease or increase? 3

(b)A mass of 2kg attached to a spring is vibrated horizontally by displacing the mass 40cm from its equilibrium position and releasing it. Find the maximum velocity of the mass. Spring constant is 24.5N/m.

SECTION D

29. Significant figures in the measured value of a physical quantity tell the number of digits in which we have confidence. Larger the number of significant figures obtained in a measurement , greater is the accuracy of measurement and vice – versa . In addition or subtraction, the number of decimal places in the result should equal the smallest number of decimal places in any term in the operation. 4

In multiplication and division, the number of significant figures in the product or in the quotient is the same as the smallest number of significant figures in any of the factors.

(i) The sum of the numbers 1.6 g, 7.32 g and 4.248 g with correct number of significant figures is

(a) 13.168 g (b) 13.2 g (c) 13.1 g (d) 13.16 g

(ii)The number of significant figures in the measured value 2.50 m is the same as that in the value

(a) 2500 m (b) 0.025 m (c) 2050 m (d) 250.0 m

(iii) If a calculated value 59.382 g contains only three significant figures, the two insignificant digits in it are

(a) 5 and 9 (b) 9 and 3 (c) 3 and 8 (d) 8 and 2

OR

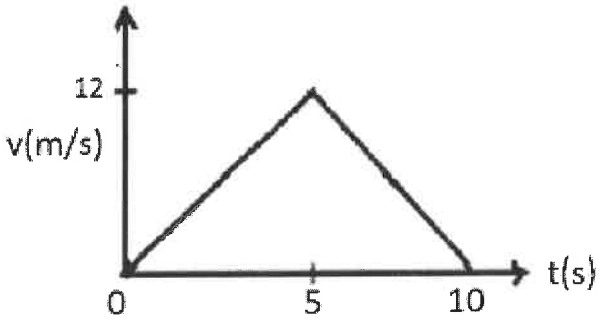
How many significant figures should the answer to this calculation contain? 25×393.4

(a)4 (b) 2 (c)3 (d)5

(iv) The number of significant zeroes present in the measured value 260040, is

(a) Five (b) Two (c) One (d) Three

30. The time rate of change of position of the object in any direction is called speed of the object 4
If an object covers equal distances in equal intervals of time, then its speed is called uniform speed and if it covers unequal distances in equal intervals of time, then its speed is called non-uniform or variable speed. The ratio of the total distance travelled by the object to the total time taken is called average speed of the object. The speed may be positive or zero but never negative.
The speed-time graph of a particle moving along a fixed direction is shown in following figure.



(i) Distance travelled by the particle between 0 to 10 seconds

(a) 60 m (b) 50 m (c) 120 m (d) zero

OR

The distance travelled by the particle between 0 to 5 seconds

(a) 60 m (b) 30 m (c) 12 m (d)120m

(ii) Average speed between time interval 0 to 10 s

(a) 12 m/s (b) 6 m/s (c) 10 m/s (d) 60 m/s

(iii) The acceleration of the particle between time interval 0 to 5 s

(a) $12 m/s^2$ (b) $2.4 m/s^2$ (c) 2.4m/s (d) zero

(iv) The slope of the graph is negative at time interval

(a) t = 0 to t = 5 s

(b) t = 5 to t = 10 s

(c) t = 0 to t = 10 s

(d) At 5second

SECTION E

31. (a)Prove that in case of one-dimensional elastic collision of two bodies, the relative velocity of separation after collision is equal to the relative velocity of approach before collision. 5

(b) A molecule in a gas container hits the wall with speed 100m/s at an angle of 35^0 with the normal, and rebounds with the same speed. State whether linear momentum is conserved or not. What type of collision is it?

OR

(a) State the law of conservation of mechanical energy.

(b) Show that the total mechanical energy of freely falling body under gravity is conserved.

(c)Show the variations in kinetic energy, potential energy and total mechanical energy with the variation of height of the body from the surface of the earth graphically.

32. (a) What is projectile? Obtain an expression for the maximum height and time of flight when it is projected at an angle θ with the horizontal. 5

(b) A projectile is fired horizontally with a velocity of 98m/s from the top of a hill 490m high. Find (i) the time taken to reach the ground and (ii) the distance of the target from the hill.(Take $g = 9.8 m/s^2$)

OR

(a) Derive an expression for centripetal acceleration of an object in uniform circular motion in a plane.

(b)An insect trapped in a circular groove of radius 12cm moves along the groove steadily and completes 7 revolutions in 100 s. What is the angular speed and the linear speed of the motion?

33. (a)Prove that Newton's second law is the real law of motion. 5

(b) Ten one-rupee coins are put on top of each other on a table. Each coin has a mass m. Give the magnitude and direction of

(i) The force on the 7th coin (counted from the bottom) due to all the coins on its top.

(ii) The reaction of the 6th coin on the 7th coin.

OR

(a)Explain the motion of a vehicle on a level road having circular turn with the help of necessary diagram and obtain an expression for maximum speed with which the vehicle can move on a level road having circular turn without skidding.

(b)A bob of mass 0.1 kg hung from the ceiling of a room by a string 2 m long is set into oscillation. The speed of the bob at its mean position is 1 ms^{-1}. What is the trajectory of the bob if the string is cut when the bob is (i) at one of its extreme positions, (ii) at its mean position?

******END OF THE QUESTION PAPER******