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SET C



INDIAN SCHOOL MUSCAT FIRST TERM EXAMINATION PHYSICS

CLASS: XI

Sub. Code: 042

Time Allotted: 3 Hrs

23.09.2018

Max. Marks: 70

General Instructions:

1. All questions are compulsory. There are 27 questions in all.
2. This question paper has five sections: Section A, Section B, Section C and Section D.
3. Section A contains five questions of one mark each, Section B contains seven questions of two marks each, Section C contains twelve questions of three marks each, Section D contains three questions of five marks each.
4. There is no overall choice. However, an internal choice has been provided in one question of two marks, one question of three marks and all the three questions of five marks weightage. You have to attempt only one of the choices in such questions.
5. You may use the following values of physical constants wherever necessary.

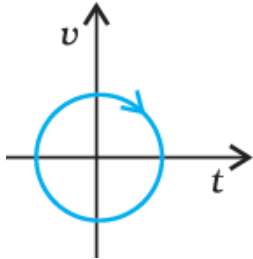
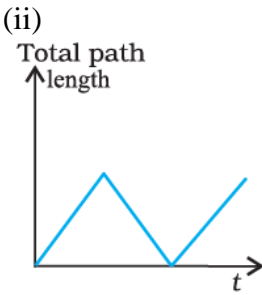
$$g = 10 \text{ m/s}^2, \text{ density of water} = 1000 \text{ kg/m}^3$$

SECTION A

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|---|--|---|
| 1 | Define instantaneous acceleration of a body. | 1 |
| 2 | Is light year a unit of time? Define light year. | 1 |
| 3 | State Newton's second law of motion. | 1 |
| 4 | The resistance $R = \frac{V}{I}$ where $V = (100 \pm 5) \text{ V}$ and $I = (10 \pm 0.2) \text{ A}$. Find the percentage error in R. | 1 |
| 5 | Two objects are dropped from different heights h_1 and h_2 simultaneously. Find the ratio of times at which they touch the ground in terms of heights. | 1 |

SECTION B

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|---|--|---|
| 6 | (i) Give any two limitations of dimensional analysis. | 2 |
| | (ii) Can a quantity have units but still be dimensionless? Give one example. | |

- 7 (i) A body is released from an aeroplane. Is it a projectile? Explain. 2
- (ii) A body of mass 'm' is thrown with a velocity 'u' at an angle of 30° . Another body is thrown with the same velocity but angle of projection is 60° . What is the ratio of horizontal range of the two bodies?
- 8 State, with reasons, whether the following three graphs represent one-dimensional motion of a particle. 2
- (i)  (ii) 
- 9 Brakes are applied to a car travelling at 30m/s. Its velocity is reduced to 20m/s in 5 seconds. Calculate the retardation produced by the brakes. Also calculate the distance covered in those 5 seconds. 2
- 10 A mass of 6kg is suspended by a rope of 2m from a ceiling. A force of 50N in the horizontal direction is applied at the midpoint of the rope. What is the angle the rope makes with the vertical in equilibrium? 2
- 11 Derive an equation for distance travelled in the n^{th} second for a uniformly accelerated motion of the particle. 2
- 12 (i) Can a bomb at rest explode into three pieces which fly in mutually perpendicular directions? 2
(ii) Carts with rubber tyres are easier to ply than those with iron wheels. Why?

SECTION C

- 13 (i) Which is the most accurate clock? 3
(ii) Check the correctness of the relation $F = \frac{mv^2}{r}$ where 'm' is the mass of the body, 'v' its speed and 'r' the radius of the circular path by dimensional method.
- 14 A car accelerates from rest at constant rate ' α ' for sometime after which it decelerates at a constant rate ' β ' to come to rest. If the total time elapsed is ' t ' second, calculate (i) the maximum velocity reached and (ii) the total distance travelled. 3

OR

On a two-lane road, car A is travelling with a speed of 36 km/h. Two cars B and C approach car A in opposite directions with a speed of 54 km/h each. At a certain instant, when the distance AB is equal to AC, both being 1 km, B decides to overtake A before C does. What minimum acceleration of car B is required to avoid an accident?

- 15 (i) Give two conditions necessary for a given quantity to be a vector. 3
(ii) Two vectors, both equal in magnitude, have their resultant equal in magnitude of the either. Find the angle between the two vectors.
- 16 (i) Why are shockers used in cars, scooters and motor cycles? 3
(ii) Define impulse and obtain the relation between impulse and momentum.
- 17 (i) A wooden block of mass 2 kg rests on a soft horizontal floor. When an iron cylinder of mass 25 kg is placed on top of the block, the floor yields steadily and the block and the cylinder together go down with an acceleration of 0.1 m/s^2 . What is the action of the block on the floor (a) before and (b) after the floor yields? 3
(ii) What are concurrent forces?
- 18 (i) Draw position – time graph of two objects moving along a straight line when their relative velocity is zero. 3
(ii) What does the slope of velocity –time graph represent?
(iii) The velocity- time graph of two objects make angles of 30° and 60° with the time axis. Find the ratio of their accelerations.
- 19 Draw velocity-time graph for the motion of a body moving with uniform acceleration. From this graph, obtain an expression $v = u + at$. 3
- 20 The frequency of vibration (ν) of a string depends upon the length (l) of the string, tension (T) in the string and mass per unit length (m) of the string. Use method of dimensions for establishing the formula for the frequency. 3
- 21 Draw a neat free body diagram to show various forces acting on a body moving down the incline with uniform acceleration and derive an expression for the acceleration. 3
- 22 Define the angle of friction and angle of repose. Derive a relation between them. 3
- 23 (i) Friction is a necessary evil. Comment on the statement. 3
(ii) Tyres are provided with irregular projections over their surfaces. Why?
- 24 Derive an expression for centripetal acceleration of an object in uniform circular motion. What will be its direction at any instant? 3

SECTION D

- 25 (i) Describe a method to determine the diameter of moon. 5
(ii) Give any two advantages of defining standard metre in terms of wavelength of light.
(iii) State principle of homogeneity of dimensions.

OR

- (i) Write any four advantages of SI system over other system of units.
(ii) Name the physical quantities represented by the following dimensional formulae:
(a) $[ML^2T^{-2}]$ (b) $[ML^{-3}T^0]$ (c) $[MLT^{-1}]$ (d) $[M^0L^0T^{-1}]$
(iii) If $x = a + bt + ct^2$, where x is in metres and t in seconds, find the unit of b .
- 26 (i) Which is easier, pushing or pulling a lawn mower? Explain with the help of free body diagrams. 5
(ii) Determine the maximum acceleration of the train in which a box lying on its floor will remain stationary, given that the co-efficient of static friction between the box and the train's floor is 0.15.

OR

- (i) State and prove law of conservation of linear momentum.
(ii) A stream of water flowing horizontally with a speed of 15m/s gushes out of a tube of cross sectional area 10^{-2} m^2 and hits at a vertical wall nearby. What is the force exerted on the wall by the impact of water, assuming it does not rebound?
- 27 i) Show that the path followed by a projectile is a parabola when it is projected at an angle θ with the horizontal. 5
ii) A projectile can have the same range R for two angles of projections. If T_1 and T_2 are the times of flight in the two cases, show that the product of the two times of flight is directly proportional to R ?

OR

- i) Derive expressions for a) time of flight b) maximum height and c) horizontal range attained by an oblique projectile.
ii) Prove that the maximum horizontal range is four times the maximum height attained by a projectile which is fired along the required oblique direction.

End of the Question Paper