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**FIRST TERM EXAMINATION, 2015-16**

**Subject : Physics**

**Time : 3 Hrs.**

**CLASS : XI**

**M.M. : 70**

**General Instructions :**

- (1) All questions are compulsory.
  - (2) Question numbers 1 to 5 are very short answer questions and carry 1 mark each.
  - (3) Question numbers 6 to 10 are short answer questions and carry 2 marks each.
  - (4) Question numbers 11 to 22 are short answer questions and carry 3 marks each.
  - (5) Question numbers 23 is a value based question and carries 4 marks.
  - (6) Question number 24 to 26 are long answer questions and carry 5 marks each.
  - (7) Use log tables, if necessary. Use of calculator is NOT permitted.
1. Determine  $\pi^2$  with due regard for significant figures. (given  $\pi = 3.14$ )
  2. When a ball hits a wall with a velocity of 5 cm/s and bounces back with the same speed, what is the change in velocity of the ball ?
  3. A unit vector is represented by  $a\hat{i} + b\hat{j} + c\hat{k}$ . If the value of a, b are 0.6 and 0.8 respectively find the value of c.
  4. When a stone breaks the window glass into pieces a bullet pierce through it without breaking it to pieces why ?
  5. What is a conservative force ?
  6. If  $x = \alpha t + \beta t^2$  where x is in metre and t is in hour, what will be the unit of  $\alpha$  and  $\beta$  ?
  7. A jet plane travelling at a speed of 500 km/h ejects its products of combustion at the speed of 1500 km/h relative to the jet plane. What is the speed of the latter with respect to an observer on the ground ?

8. The density  $\rho$  of a piece of metal of a mass  $m$  and volume  $V$  is given by the formula  $\rho = \frac{m}{V}$ .

If  $m = 375.32 \pm 0.01$  g and  $V = 136.41 \pm 0.01$  cm<sup>3</sup> find the % error in  $\rho$ .

9. A body covers half of its journey with a speed of 40 m/s and other half with a speed of 60 m/s. What is the average speed during the whole journey?

10. (a) A body 'm' is at rest on a rough surface. Draw a graph showing the variation of the force of friction experienced, with the force applied on it. Briefly explain.

OR

(b) State the laws of friction.

3. 11. The time of oscillation ( $t$ ) of a small drop of liquid, under surface tension depends upon the density  $\rho$ , radius  $r$  and surface tension  $\sigma$ . Derive an expression for  $t$ .

6. 12. A motor boat covers the distance between two spots on the river in time of 8 hours and 12 hours, downstream and upstream respectively. What is the time to required for the boat to cover the distance in still water.

9. 13. State Newtons laws of motion. Show that the second law is the actual law of motion and the other 2 laws are contained in it.

1. 14. What is banking of roads and why is banking necessary? What is the maximum velocity with which a vehicle can execute a curve on a road whose surface has a coefficient of friction  $\mu$ ? Derive an expression for the same.

15. There are 2 displacement vectors one of magnitude 3 m and other of magnitude 4 m. How should the 2 vectors be added so that the magnitude of resultant vector be (i) 7 m (ii) 1 m and (iii) 5 m?

16. When do you say that there is relative motion between 2 bodies.

Two parallel rail tracks run from north-south. Train A moves due north with a speed of 54 km/h and train B moves due south with a speed of 90 km/h. What is the relative velocity of B w.r. to A in m/s.

17. Draw the following graphs for an object under free fall :

(a) Variation of acceleration w.r. to time.

(b) Variation of velocity w.r. to time.

(c) Variation of distance w.r. to time

[3]

18. State and prove the parallelogram law of forces.

[3]

OR

Find the unit vector perpendicular to the vector  $\vec{A} = 2\hat{i} + 3\hat{j} + 2\hat{k}$  and  $\vec{B} = \hat{i} - 2\hat{j} + 5\hat{k}$ .

19. Define impulse. A cricket ball of mass 150 g moving with speed of 12 m/s is hit by a bat so that the ball is turned back with a velocity of 20 m/s. Calculate the impulse received by the ball. [3]

20. State and prove conservation of energy principle for a freely falling body.

[3]

21. What is an elastic collision? Discuss elastic collision between 2 bodies in one dimension.

22. Two bodies of masses  $m_1$  and  $m_2$  :

(a) have same kinetic energy. Find the ratio of their momenta

(b) have same momenta. Find the ratio of their kinetic energies.

[3]

23. Ram saw labourers loading heavy luggage on a truck with great difficulty. He quickly arranged for a wooden plank to be kept as an incline and helped them :

(a) What was the quality did Ram exhibit by his act?

(b) How do you think the wooden plank help in the loading?

(c) What category of device this wooden plank come under?

[4]

24. Derive an expression for

(i) Time of flight T

(ii) Maximum height H

(iii) Range (R) achieved

by an object projected from the ground at an angle  $\theta$  from the ground. Also derive an expression for the velocity at any point of its motion.

OR

(b) A cricket ball is thrown at a speed of 28 m/s in a direction  $30^\circ$  above the horizontal.

Calculate :

- (i) the maximum height
- (ii) the time taken by the ball to return to the same level
- (iii) the horizontal distance from the point of projection to the point where the ball returns to the same level.

What is the velocity of the ball at the maximum height ?

25. Define angle of repose :

(a) Discuss the motion of a body of mass  $m$  and hence the net force with which it moves :

- (i) up an inclined plane
- (ii) down an inclined plane.

with relevant free body diagrams.

OR

(b) If action and reaction balance each other there should be no motion possible. Comment.



3 blocks are connected as shown in the figure on a horizontal friction less table and pulled to the right with a force of  $T_3 = 60$  N.

If  $m_1 = 10$  kg,  $m_2 = 20$  kg and  $m_3 = 30$  kg prove that  $\frac{T_1}{T_2} = \frac{1}{3}$ .

26. Consider a mass  $m$  attached, to a string of length  $l$  performing a vertical circle. Find an expression for the :

- (i) velocity at any point
- (ii) tension at any point
- (iii) minimum velocity at the lower most point of the vertical circle.



$$(4) \quad T - mg = \frac{mv^2}{r}$$
$$T = \frac{mv^2}{r} + mg$$

- (iv) What is the difference between the motion of a body executing a horizontal and another a vertical circle.

OR

- (a) (i) Give any 2 units for power in the S.I. system of units.

- (ii) A formly uses 8 kw of power (a) Direct solar energy is incident on the horizontal surface at an average rate of 200 W/sq.m. If 20% of the energy can be converted to useful, electrical energy how large an area is needed to supply, 8 kW ? (b) Compare the area to that of the roof of a typical house.

$$400 \rightarrow 200 \text{ W/sq.m}$$

$$1 \text{ m} = \frac{200}{20} = 10 \text{ W/sq.m}$$

$$8000 = \frac{5 \times 8000}{100} = 40000 \text{ W/sq.m}$$