

Ananya Sharma

FIRST TERM (2016-2017)

CLASS XI

SUBJECT : PHYSICS

BB

Time : 3 Hours

M.M. : 70

Instructions:

- All questions are compulsory and there are 26 questions. This question paper is divided into five sections: Section A, Section B, Section C, Section D, & Section E.
- **Section A** - The section have five questions which carries one marks each.
- **Section B** - The section have five questions which carries two marks each. Where question no - 8 is having option either one of them you have to choose.
- **Section C** - The section have 12 questions which carries three marks each and the questions are descriptive and application based. Where question no - 18 is having option either one of them you have to choose.
- **Section D** - Contains one value based question of four marks.
- **Section E** - The section have three questions which carries five marks each. Where the entire question no 24, 25, 26 are having options either one of them you have to choose.

### SECTION -A

1. What is the dimensional formula of  $\omega$  from the following relation

$$y = A \sin(\omega t - kx)$$

2. Is it possible that the velocity of an object be in a direction other than the direction of acceleration?
3. When a projectile is projected at an angle with the horizontal, then which of the component of the velocity remains constant throughout the trajectory?
4. Polishing beyond a certain limit may increase the friction between the surfaces. Explain why?
5. Why is the work done by centripetal force zero?

### SECTION - B

6. How will the momentum of a body change if its kinetic energy is doubled?
7. What is the acceleration of a block sliding down  $30^\circ$  slope when the coefficient of friction is 0.25.
8. Show that  $\mathbf{A} = 2\hat{i} - 3\hat{j} + 4\hat{k}$  and  $\mathbf{B} = -6\hat{i} + 9\hat{j} - 12\hat{k}$  are parallel to each other.

OR

If  $\hat{a}$  and  $\hat{b}$  are the unit vectors then prove

$$|\hat{a} - \hat{b}| = 2 \sin \theta / 2$$

9. The distance  $x$  of a particle moving in one dimension under the action of a constant force is related to time  $t$  by equation

$$t = \sqrt{x} + 3$$

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$$x = 2t + 1$$



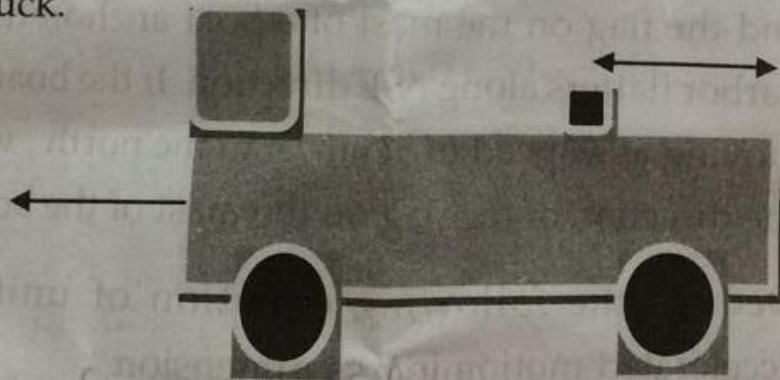
where  $x$  is in meter and  $t$  in seconds. Find the displacement of the particle when its velocity is zero.

- ✓ 10. What is the error in the density of a cube when its mass is uncertain by  $\pm 2\%$  and length of it is uncertain by  $\pm 1\%$ .

### SECTION- C

- ✓ 11. Find the value of 10J on a system having 100g, 10cm and 30s, as fundamental unit.
12. The period of oscillation of a simple pendulum is  $T = 2\pi\sqrt{L/g}$ ,  $L$  is about 15cm and is known to 1mm accuracy. The time period of oscillation is about 1s. the time of 100 oscillation is measured with a watch of 0.1s resolution. What is the accuracy in determination of  $g$ ?
13. In a harbor, wind is blowing at the speed of 72km/hr and the flag on the mast of a boat anchored in the harbor flatters along N-E direction. If the boat starts moving at a speed of 51km/h to the north, what is the direction of the flag on the mast of the boat?
- ✓ 14. Deduce the following equation of uniformly accelerated motion in one dimension
- (i)  $S = ut + \frac{1}{2} at^2$
- (ii)  $V^2 - u^2 = 2aS$

15. On a two lane road, car A is travelling with a speed of  $36\text{km/h}$ . two cars B & C approach car A in opposite directions with a speed of  $54\text{km/h}$  each. At a certain instant, when the distance AB is equal to AC, both being  $1\text{km}$ , B decide to overtake A before C does. What minimum acceleration of car B is required to avoid an accident?
16. A hunter aims his gun and fire a bullet directly at a monkey on a tree. At the instant the bullet leaves the barrel of the gun, the monkey drops. Will the bullet hits the monkey. Substantiate your answer with the proper reasoning.
17. The rear side of a truck is open and a box of  $40\text{kg}$  mass is placed  $5\text{m}$  from the open end. The coefficient of friction between the box and the surface below it is  $0.15$ . on a straight road, the truck starts from rest and accelerate with  $2\text{m/s}^2$ . At what distance from the starting point does the box fall off from the truck.



18. Show the Newton's second law of motion is real law of motion

OR



OR

- (a) An aircraft executes a horizontal loop at a speed of  $72\text{ km/h}$  with its wing banked at  $15^\circ$ . What is the radius of the loop? [ $\tan 15 = 0.2679$ ]
- (b) Prove that it is easier to pull a lawn roller than to push it.
19. State and prove work-energy Theorem.
20. Derive an expression elastic potential energy of a spring. Plot a graph to show the variation of elastic potential energy of a spring with the extension and compression of the spring.
21. Derive an expression for the position of the centre of mass of two particle system.
22. From a uniform circular disc of radius  $R$ , a circular disc of radius  $R/2$  and having centre at a distance  $R/2$  from the center of the disc is removed. Determine the center of mass of the remaining portion of the disc?

### SECTION - D

23. Two boys A and B jumped from a certain height. Boy A fell on a cemented floor and got injured. Boy B fell on a heap of sand and was not injured. Boy B stared laughing at boy A. Satish was also watching both the boys. He immediately took boy A.
- (i) Why was boy A was injured and not boy B.
- (ii) What values are shown by Satish.

## SECTION - E

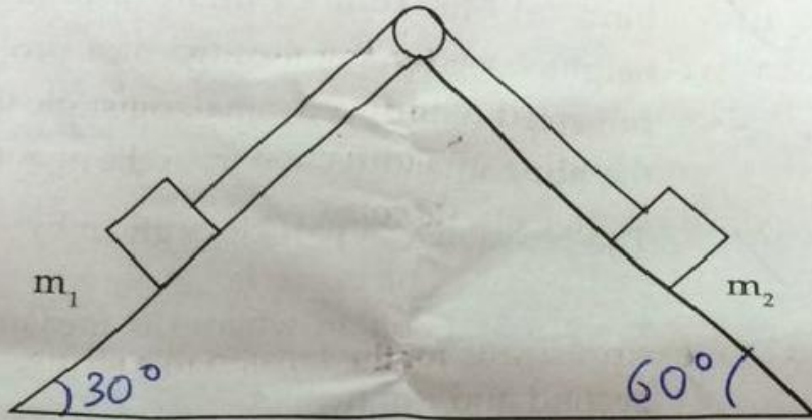
24. Derive expressions for the velocities of the two bodies after elastic one dimensional collision. Show that two bodies of same mass interchange their velocities after elastic collision.

OR

✓ Derive expressions for the tension in a string at the lowest and highest point of a vertical circular motion. Also calculate the minimum speed of the body at the lowest and highest point for looping the loop.

25. (i) Obtain the expression for the maximum speed with which a vehicle can safely negotiate a curved rough road banked at an angle  $\theta$ .
- (ii) Two blocks of mass  $m_1 = 3\text{kg}$  and  $m_2 = 1/\sqrt{3}\text{kg}$  are connected by a light inextensible string which passes over a smooth peg. The peg is fixed on the top of the wedge. The planes of the wedge supporting  $m_1$  and  $m_2$  are inclined at  $30^\circ$  and  $60^\circ$  respectively with the horizontal. Calculate the acceleration of the masses and the tension in the string.





OR

- (i) Show that impulse is equal to the change in momentum of a body
- (ii) A machine gun fires a bullet of mass  $40\text{g}$  with velocity  $1200\text{m/s}$ . The person holding it can apply maximum force of  $144\text{ N}$  on the gun. What is the maximum number of bullets that can be fired per second.
26. (i) State triangle law of vector addition. Give its analytical treatment to find the magnitude and direction of the resultant vector by using this law.
- (ii) Find a unit vector perpendicular to both the vectors  $(2\hat{i} + 3\hat{j} + \hat{k})$  and  $(\hat{i} + \hat{j} + 2\hat{k})$

OR

(i) Find (a) The Time of flight (b) Maximum height (c) Horizontal range of a projectile projected with speed  $v$  making angle  $\theta$  with the horizontal direction from the ground.

(ii) The position of a particle is given by

$$\mathbf{r} = 2\hat{i} + 3t^2\hat{j} + 5\hat{k} \text{ m where } t \text{ is measured in second and } r \text{ in meters}$$

Calculate :

- (a) velocity and acceleration of the particle
- (b) the magnitude of the velocity at  $t=5\text{s}$ .
- (c) Direction of velocity of the particle at  $t=5\text{s}$ .