(Air force Bal Bharti)

Kartik

FIRST TERM (2014-2015)

BB

CLASS XI

SUBJECT : PHYSICS

Time : 3 Hours **M.M. : 70**

Instructions:

1. All questions are compulsory.
2. Q. 1 to Q. 5 carry one mark each.
3. Q. 6 to Q. 10 carry two marks each.
4. Q. 11 to Q. 22 carry three marks each.
5. Q. 23 carries four marks.
6. Q. 24 to Q. 26 carry five marks each.
7. Use of Calculator is not allowed.
8. Internal choice is given in two, three and five marks questions.

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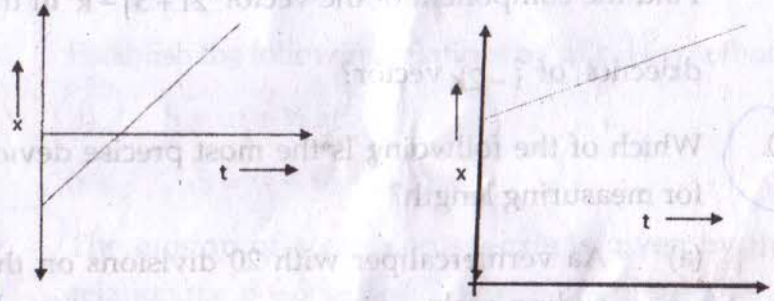
1. Define one parsec.

2. What is the common between the two graphs shown in the fig.



3. What is the angle between the directions of velocity and acceleration at highest point of the trajectory of the projectile?

90°

4. A pilot does not fall down when his aeroplane loops the loop. Why?

5. A lighter and heavy body have equal momenta. Which body will have more kinetic energy? Why?

6. A man of mass 60 kg runs up a flight of 30 steps in 40 seconds. If each step is 20 cm high, calculate the power of the man.

7. Draw the graph of variation of acceleration due to gravity with the depth and height from the surface of the earth, assuming the density of earth is constant?

8. Calculate the impulse necessary to stop a 1500 kg car travelling at 90 km/h?

9. Determine a unit vector which is perpendicular to both the vectors $2\hat{i}+\hat{j}+\hat{k}$ and $\hat{i}-\hat{j}+2\hat{k}$?

OR

Find the component of the vector $2\hat{i}+3\hat{j}-\hat{k}$ in the driection of $\hat{i}-2\hat{k}$ vector?

10. Which of the follwoing is the most precise device for measuring length?

(a) Aa verniercaliper with 20 divisions on the sliding scale.

(b) a screw gauge of pitch 1 mm and 100 division on the circular scale?

11. Obtain by the method of dimension analysis an expression for the surface tension of a liquid rising in a capillary tube. Assuming that the surface tension depends on mass m of the liquid, pressure P of the liquid and radius r of the capillary tube. The constant K = 1/2.

12. The period of oscillation of a simple pendulum is $T = 2\pi\sqrt{l/g}$. l is about 20 cm and is known to 1 mm accuracy. The time for 100 oscillations is found to be 90s using a wrist watch of 1s resolution. Find the percentage error in determination of g.

13. 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?

14. Establish the following relations by calculus method:

(i) $S = ut + \frac{1}{2}at^2$

(ii) $2aS = v^2 - u^2$

15. The motion of a car along y-axis is given by the relation $y = t^3 - 6t^2 + 9t + 5$, where y is in metre and t is in second. Calculate position, acceleration and total distance travelled at t = 5 second.

16. A cyclist is riding with a speed of 27 km/h. As he approaches a circular turn on the road of redius 80 m. He applies brakes and reduces his speed at the constant rate of 0.5 m/s every second. What is the magnitude and direction of the net acceleration of the cyclist on the circular turn?

17. Prove that there are two times for which the projectile travel the same vertical distance. Also prove that the sum of the two times is equal to the time of flight.

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

19. A bomb at rest explodes into three fragments of equal masses. Two fragments fly off at right angle to each other, with velocities 9 m/s and 12 m/s. Calculate the speed of the third fragment.

OR

A body of mass 4 kg lying on a rough plans inclined at 30° to the horizontal has an acceleration of 2 m/s² when pulled directly up the plane by a force of 6 kgwt. Calculate its acceleration when a force of 3 kgwt. it applied down the plane. Given g = 10 m/s².

20. Prove that the minimum velocity of a particle at the lowest point of a vertical circle for looping the loop is $\sqrt{5gr}$, where r is the radius of the circle.

21. State and prove work-energy theorem.

22. A force F = 0.5x + 10 acts on a particle. Here F is in newton and x is in metre. Calculate the work done by the force during the displacement of the particle from x = 0 to x = 2m.

23. Having seen a big stone falling from the top of a tower Ravi pulled his friend Kiran away. The stone hit Ravi slightly and he got hurt. But he was saved from a major accident.

(a) What made Ravi act in such a way.

(b) From the top of a tower 100 m in height, a ball is dropped and at the same time another ball is projected vertically upward from the ground with velocity 25 m/s. Find when and where the two balls meet.

24. Discuss the elastic collision of two bodies in one dimension. Calculate the velocities of the bodies after the collision. Discuss what happens when both the bodies are of equal mass.

OR

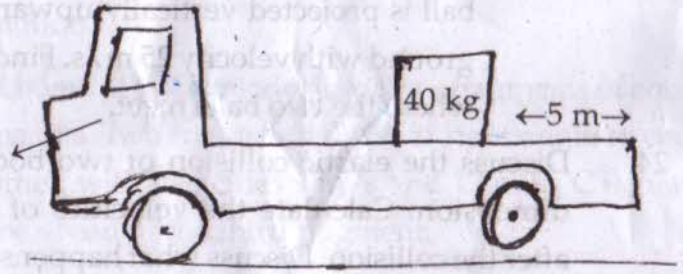
Show that in a head-on collision between two balls of equal masses moving along a straight line, the balls simply exchange their velocities.

25. Derive the expression for the maximum velocity of a car on rough banked circular track. Also discuss the condition for minimum wear and tear of the tyres.

OR

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

(b) The rear side of a truck is open and a box of 40 kg mass is placed 5 m away from the open end as shown in the figure. 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 m/s². At what distance from the starting point does the box fall off the truck? (Take g = 10 m/s²)



26. What do you mean by a projectile? A projectile is fired with velocity u making an angle θ with the horizontal. Show that its path is parabolic. Also, find the expression for:

(i) maximum height attained and

(ii) time of flight

OR

(a) There are two angles of projection for which the horizontal range is the same. Prove that the sum of the maximum heights for these two angles does not depends upon the angle of projection.

(b) Two projectiles P and Q are projected with velocities $\sqrt{2}v$ and v respectively. They have the same range. If P is thrown at an angle of 15° with the horizontal, then what is the angle of elevation of Q?