BUDHA DAL PUBLIC SCHOOL, PATIALA
First Term Examination (15 September 2025)

Class XI (Science)

Subject –Physics - 042(Set-A) M.M.70

Time: 3hrs

General Instructions:

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

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

(3) All the sections are compulsory.

(4) **Section A** contains 16 questions, 12 MCQ and 4 Assertion Reasoning based of 1 mark each, **Section B** contains 5 questions of two marks each, **Section C** contains 7 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.

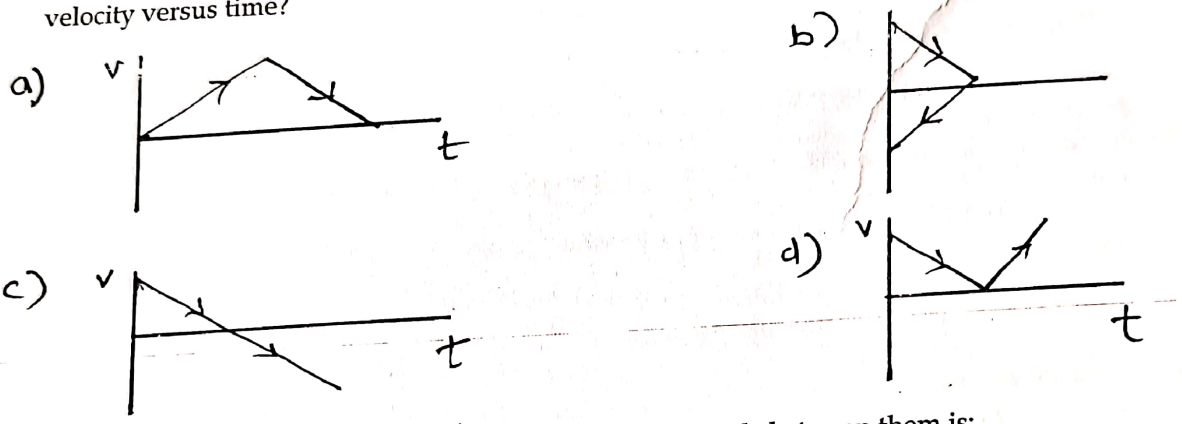
(5) Use of calculators is not allowed.

Section - A

Q1. Momentum per unit volume has dimensions

a) $[MLT^{-1}]$ b) $[MLT^{-2}]$ c) $[ML^{-2}T^{-1}]$ d) $[ML^{2}T^{-1}]$

Q2. A body is thrown vertically upwards. Which one of the following graphs correctly represent the velocity versus time?



3. Two equal vectors have a resultant equal to either. The angle between them is:

a) 60^0 b) 90^0 c) 100^0 d) 120^0

4. A particle moves in a circle of radius 5 cm with constant speed and time period 0.2 πs. The acceleration of the particle is

a) 15 m/s^2 b) 25 m/s^2 c) 36 m/s^2 d) 5 m/s^2

A man weights 80 kg. He stands on a weighing scale in the lift, which is moving upward with a uniform acceleration 5 m/s^2. What would be the reading on the weighing scale?

a) zero b) 400 N c) 800 N d) 1200 N

Angle of repose for a rough inclined plane is 60^0. The coefficient of friction is

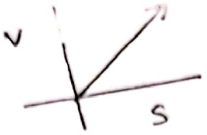
a) $\sqrt{3}$ b) $1/\sqrt{3}$ c) 1 d) zero

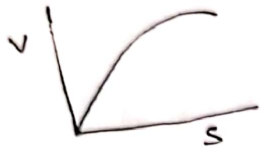
For which of the following does the centre of mass lie outside the body?

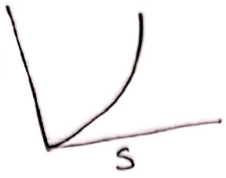
a) Solid sphere b) Solid cylinder c) a disc d) a ring

A body starting from rest moves along a straight line with a constant acceleration. The variation of speed (v) with distance (s) is represented by the graph

a) 

b) 

c) 

d) 

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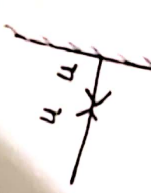


Q9. An arrow is projected in air. Its time of flight is 5s and range 200m. What is the maximum height reached by it? (Take g = 10m s^{-2})

a) 31.25 m b) 24.5 m c) 18.25 m d) 46.75 m

Q10. The mudguards over the wheels of a motorcycle work on the basis of

a) inertia of rest b) inertia of motion c) inertia of direction d) none of these

Q11. A boy stands on a weighing machine inside a lift. When the list is going down with acceleration g/4, the machine shows a reading 30 kgf. When the list goes upwards with acceleration g/4, the reading would be

a) 18 kgf b) 37.5 kgf c) 50kgf d) 67.5 kgf

Q12. A light and heavy body have equal momentum which one has greater K.E.?

a) A light body b) A heavy body c) Both have equal K.E. d) Data given is incomplete

In the following questions, a statement of Assertion (A) is followed by a statement of Reason (R). Mark the correct choice as:

a) **Both Assertion (A) and Reason (R) true and Reason (R) is the correct explanation of Assertion (A).**
b) **Both Assertion (A) and Reason (R) are true but Reason (R) is not a correct explanation of Assertion (A).**
c) **Assertion (A) is true but Reason (R) is false.**
d) **Assertion (A) is falseand Reason (R) is also false.**

Q13. **Assertion (A) :**Two balls of different masses are thrown vertically upward with the same speed. They will pass through their point of projection in the downward direction with the same speed.

Reason (R) : The maximum height and downward velocity attained at the point of projection are independent of mass of the ball.

Q14. **Assertion (A) :**Graph between potential energy of a spring versus the extension/compression (x) of the spring is a straight line.

Reason (R) : This is because potential energy is directly proportional to x.

Q15. **Assertion (A) :**It is difficult to move a cycle along the road with brakes on.

Reason (R) : Sliding friction is greater than rolling friction.

Q16. **Assertion (A) :**Specific gravity of a fluid is a dimensionless quantity.

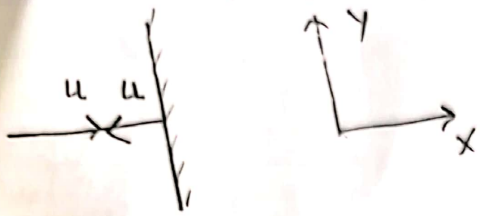
Reason (R) : It is the ratio of density of the fluid to the density of water.

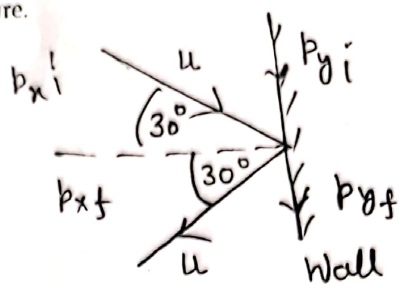
Section - B

Q17. A planet moves round the Sun in a circular orbit. Assuming that the period of revolution t of the planet depends upon radius (R) of its orbit, mass of the Sun (M) and universal gravitational constant (G) then prove dimensionally $t^2 \propto \frac{R^3}{GM}$ *or* $t = 2\pi\sqrt{\frac{R^3}{GM}}$ *where* 2π is value of constant.

Q18. Define vector or cross product of two vectors. How the direction of resultant vector is determined?

Two identical billiard balls strike a rigid wall with a same speed but at different angles, and get reflected without any change in speed as shown in figure.

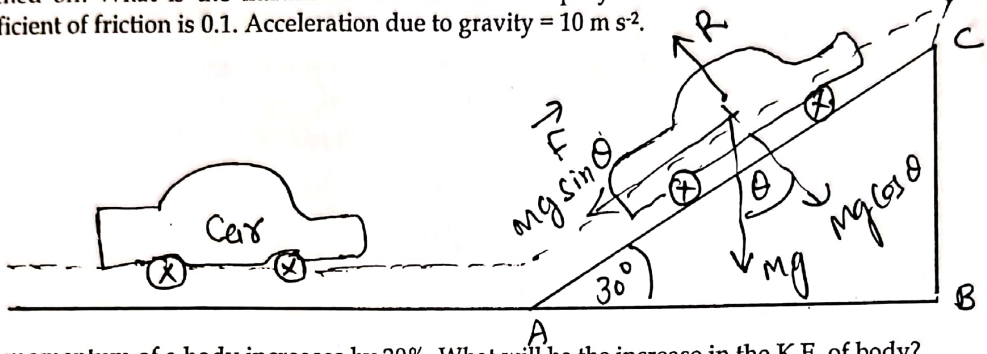




What is (i) the directions of the force on the wall due to each ball? (ii) the ratio of the magnitude of impulses imparted to the balls by the wall?

OR

A car moving with a speed of 36 km h-1 reaches upward inclined road of angle 30^0, its engine is switched off. What is the maximum distance moved up by the car before it starts sliding down? Coefficient of friction is 0.1. Acceleration due to gravity = 10 m s^{-2}.



Q20. If the momentum of a body increases by 20%. What will be the increase in the K.E. of body?

Q21. Define centripetal acceleration. Derive an expression for the centripetal acceleration of a particle moving in a circle. Discuss the direction of acceleration.

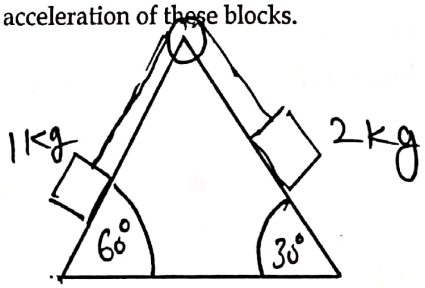
Section - C

Q22. Derive 2nd equation of motion by calculus method.

Q23. A ball is thrown from the ground so that it just crosses a wall 10m in height at a distance of 10 m and falls at a distance of 30m from the wall. Find the velocity and the direction of projection of the ball. Assume g = 10 m s^{-2}.

Q24. Determine the sine of the angles between the vector $\vec{A} = (3\hat{\imath} - 4\hat{\jmath} + 5\hat{k})$ and $\vec{B} = \hat{\imath} - \hat{\jmath} + \hat{k}$

Q25. Two blocks of mass 1 kg and 2 kg are connected to an inextensible string passes over a friction less pulley as shown in figure. Calculate the acceleration of these blocks.



OR

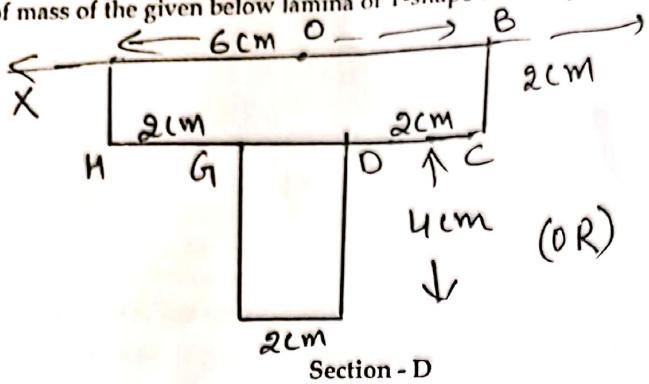
Discuss the motion of a car on levelled circular road. Determine the maximum speed with which the vehicle can go on levelled circular road without skidding.

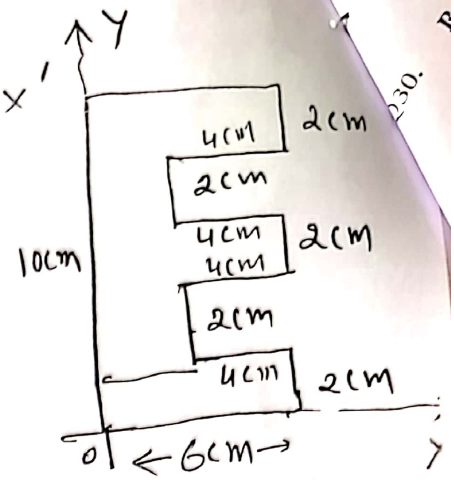
Q26. Show that gravitational force is conservative force.

Q27. Discuss the elastic collision in one dimension, hence derive an expression for the velocities of two bodies after elastic one dimensional collision. Show that in elastic one dimensional collision the bodies

just interchange their velocities when they have equal masses.

Q28. Find the centre of mass of the given below lamina of T-shape or E-shape

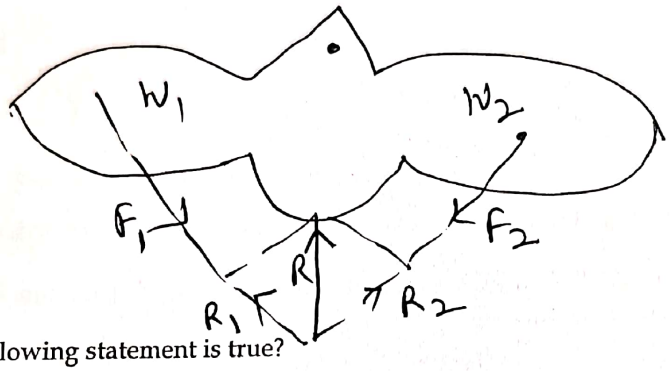




Section - D

Q29. **Read the following paragraph and answer the questions that follow.**

When a bird flies, its wings W1 and W2 pushes the air downwards with forces F1 and F2 respectively. The air offers equal and opposite reactions R1 and R2 in accordance with Newton's third law of motion. According to parallelogram law of vectors the resultant R of R1 and R2 acts on the bird in the upward direction as shown in figure. It will help the bird to fly upwards.



(i) Which of the following statement is true?

(a) Three vectors not lying in a plane give zero resultant

(b) Three vectors lying in a plane give zero resultant.

(c) Two vectors of different magnitudes be combined to give a zero resultant

(d) None of these

(ii) The flight of a bird is an example of composition of vectors. Which of the following statement is true?

(a) When a bird flies the air is pushed downwards by its wings.

(b) When a bird flies the air is pushed upwards by its wings

(c) When a bird flies the air is pushed in all the direction by its wings

(d) None of these

(iii) The angle between a 3 N and 4 N force such that resultant in 5N is :

(a) 0^0(b) 30^0(b)60^0(d) 90^0

OR

(iii) The resultant of two vectors $\vec{A}$ *and* $\vec{B}$ inclined at an angle θ is $\vec{C}$, then angle θ will be given $|\vec{A} = |\vec{B}| = |\vec{C}|$

a) 90^0 b) 120^0 c) 180^0 d) 0

Read the following paragraph and answer the questions that follow.

Friction between any two surfaces in contact is the opposing force that comes into play whenever a body moves or tends to move over the surface of another body. The force of limiting friction (F) between any two surfaces in contact is directly proportional to the normal reaction (R) between them i.e.

$F \propto R$ or $F = \mu R$, where μ is coefficient of limiting friction. If $\theta$is the angle of friction, then $\mu = \tan\theta$. The value of coefficient of friction depends on nature of surfaces in contact, material of the surfaces in contact and temperature of surfaces in contact. Friction is actually necessary evil. We can sometimes increase and sometimes decrease friction.

(i) Direction of force of friction is

(a) perpendicular to the motion of body(b) along the direction of motion

(c) opposite to the direction of motion (d) none of these

(ii) What will be the angle of friction between two bodies in contact if coefficient of friction is $\frac{1}{\sqrt{3}}$?

(a) 0^0(b) 30^0(c) 45^0(d) 90^0

(iii) If μ_s, μ_k *and* μ_r be the coefficient of static, kinetic and rolling friction respectively then

(a) $\mu_s > \mu_k > \mu_r$(b) $\mu_s < \mu_k < \mu_r$(c) $\mu_s < \mu_k > \mu_r$(d) $\mu_s > \mu_k > \mu_r$

(iv) A body of weight (W) rests on a frictional surface. Angle between force of friction and normal reaction (R) is

(a) 0^0 b) 90^0 c) 60^0 d) 30^0

OR

(iv) It is difficult to walk on slippery road. Sand to thrown on slippery roads so that people can walk easily on slippery roads. When sand is thrown on road

(a) force of friction increases
(b) force of friction decreases
(c) force of friction is not affected
(d) road looks good

Q31. Discuss the Dynamies of vertical circular motion and hence find the following :

a) Expression of velocity of highest and lowest point.
b) Equation of tensions at highest and lowest point.

OR

A body of mass M at rest is struck by a moving body of mass m. Prove that fraction of initial K.E. of the mass m transferred to the struck body is $\frac{4mM}{(m+M)^2}$ in an elastic collision.