BUDHA DAL PUBLIC SCHOOL, PATIALA

First Term Examination (15September 2025)

Class XI (Science)

Subject –Physics - 042(Set-B)

Time: 3hrs M.M.70

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.

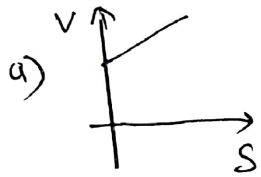
(5) Use of calculators is not allowed.

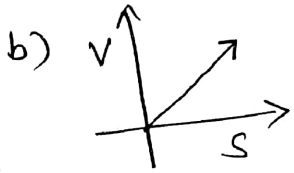
Section - A

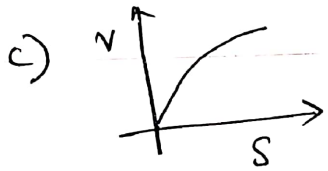
Q1. The dimensional formula of pressure gradient is

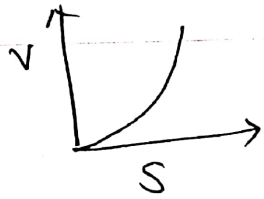
a) $[M^0LT^{-1}]$ b) $[ML^0T^{-1}]$ c) $[ML^2T^{-2}]$ d) $[M^0L^0T\ ]$

Q2. 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) 



Q3. If R and H represent the horizontal range and maximum height achieved by a projectile, then which of the following relation holds?

a) $\frac{H}{R} = 4\cot\theta$ b) $\frac{R}{H} = 4\cot\theta$ c) $\frac{H}{R} = 4\tan\theta$ d) $\frac{R}{H} = 4\tan\theta$

Q4. 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/s² b) 25 m/s² c) 36 m/s²d) 5 m/s²

Q5. A cricketer catches a ball of mass 150 g in 0.1s moving with speed 20 m s^{-1} then the force experienced is

a) 300 Nb) 30 Nc) 3 Nd) 0.3 N

Q6. Angle of repose for a rough inclined plane is 60^0. The coefficient of friction is

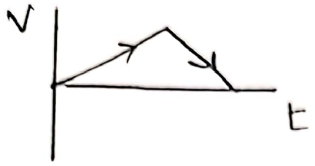
a) $\sqrt{3}$ b) $1/\sqrt{3}$ c) 1 d) zero

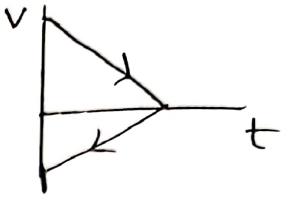
Q7. For which of the following does the C.M. lies outside the body?

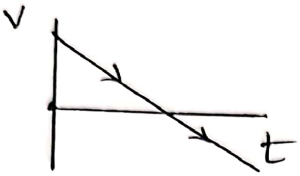
a) Pencil b)A dice c) a bangle d) a shotput

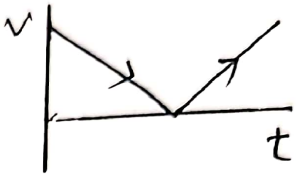
Q8. A body is thrown vertically upwards. Which one of the following graphs correctly represent the velocity versus time?

B-1

a) 

b) 

c) 

d) 

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 $g = 10\ s^{-2}$)

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

Q10. An object moving in a circle at constant speed

a) Must have only one force acting on it
b) Is not accelerating
c) Is held to its path by centrifugal force
d) Has an acceleration of constant magnitude

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 false and Reason (R) is also false.

Q13. **Assertion (A) :**The cross product of a vector with itself is a null vector.

Reason (R) : The cross product of two vectors results in a vector quantity.

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.

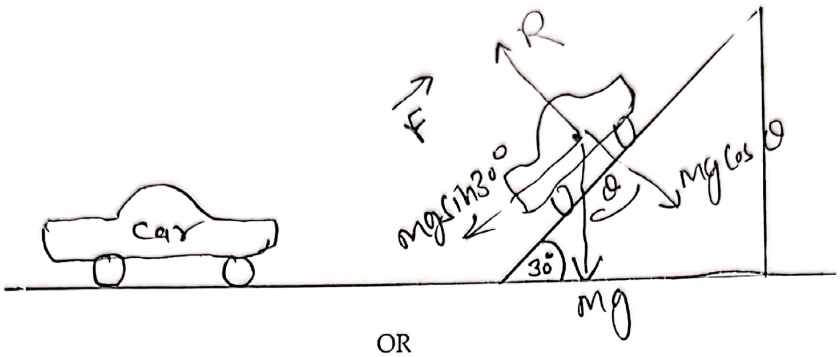
Reason (R) : It is the ratio of density of the fluid to the density of water.

Section - B

Q17. Using method of dimensions derive an expression for the energy of a body executing SHM ; assuming this energy depends on its mass (m), frequency (v) and amplitude of vibrations (r).

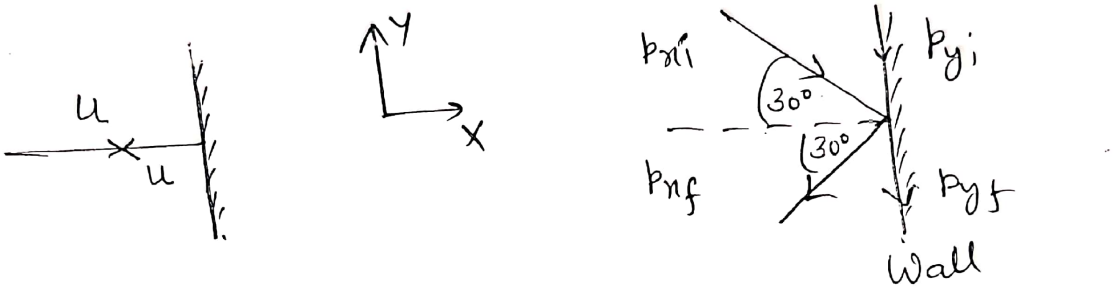
Find the vector product of two vectors in terms of its components.

9. A car moving with a speed of 36 km/hr reaches upward inclined road of angle 30°, 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}.



OR

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?

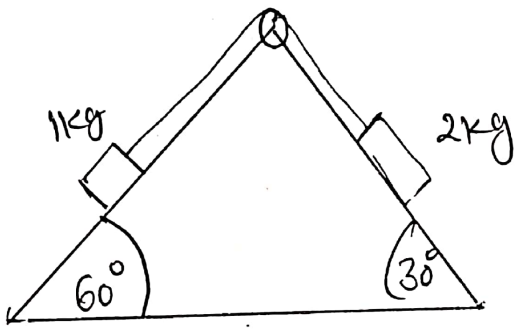
Q20. K.E. of particle in increased by (a) 100% (b) 1%. Find the percentage change in momentum.

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. 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.

Q23. Two blocks of mass 1 kg and 2 kg are connected b 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.

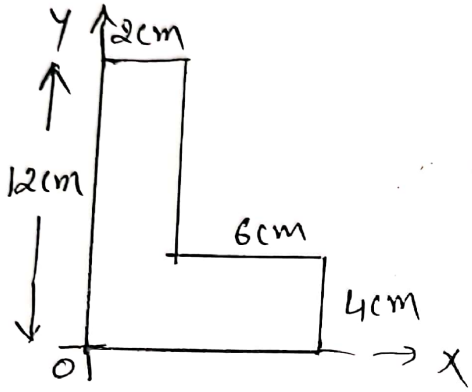
Q24. Prove that the vector $\vec{A} = 4\hat{i} + 3\hat{j} + \hat{k}$ and $\vec{B} = 12\hat{i} + 9\hat{j} + 3\hat{k}$ are parallel to each other.

Q25. A person stands at 39.2 m from a house and throw a stone which just passes through a window 19.6m above the ground. Calculate the velocity of projection of the stone.

Q26. What do you mean by potential energy. Find an expression for potential energy of stretched spring.

Q27. Derive 3rd equation of motion by calculus method.

Q28. Find the centre of mass of the uniform L-shaped or T-shape lamina with dimension shown in figure.



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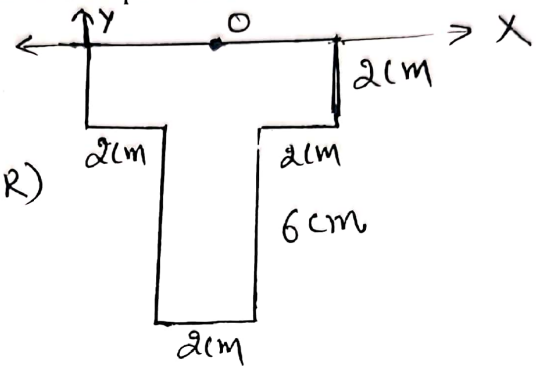


Section - D

Q29. 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 θ 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

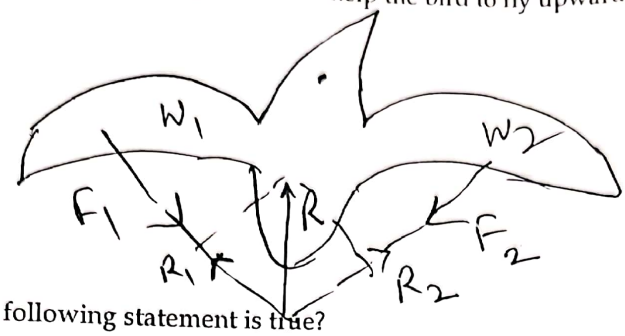
OR

(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

Read the following paragraph and answer the questions that follow.

When a bird flies, its wings W_1 and W_2 pushes the air downwards with forces F_1 and F_2 respectively. The air offers equal and opposite reactions R_1 and R_2 in accordance with Newton's third law of motion. According to parallelogram law of vectors the resultant R of R_1 and R_2 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

Q31. a) Find the angle of projection at which horizontal range and maximum vertical range are equal.

b) Show that there are two values of time for which a projectile is at the same height. Also show that the sum of the maximum heights for two angles is independent of angle of projection.

OR

a) State and prove parallelogram law of vector additions.

b) Rain is falling vertically with a speed of 35 ms^{-1}. A woman rides a bicycle with a speed of 12 ms^{-1} from east to west direction. What is the direction in which she should hold the umbrella?

Q32. Discuss the Dynamics of vertical circular motion and hence find the following :

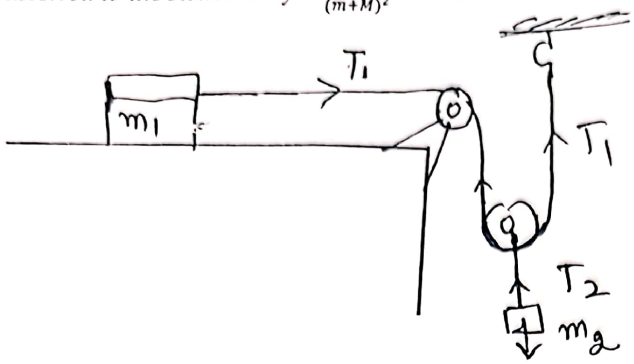
a) Expression of velocity of highest and lowest point.

b) Equation of tensions at highest and lowest point.

OR

B-5

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.



Q33.

a) In terms of masses m_1, m_2 and g, find the acceleration of both the blocks as shown in figure. above. Neglect all friction and masses of the pulley.

b) State and prove Law of conservation of Linear momentum by Newton's third Law of motion.

OR

a) A ball rolls off the top of a stairway with a constant horizontal velocity u. If the steps are h metre high and w metre wide, show that the ball will just hit the edge of the nth step if $n = \frac{2hu^2}{gw^2}$

b) A light string passing over a smooth light pulley connects two blocks of masses m1 and m2 (vertically). Calculate the ratio of the masses if the acceleration of system is $\frac{g}{8}$