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CLASS: XI

SUBJECT: PHYSICS

TIME: 3 Hours Max Marks: 70

General Instructions:

(1) There are 35 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. All the sections are compulsory.

(3) Section A contains eighteen MCQ of 1 mark each, Section B contains seven questions of two marks each, Section C contains five questions of three marks each, section D contains three long questions of five marks each and Section E contains two case study based questions of 4 marks each.

(4) There is no overall choice. However, an internal choice has been provided in section B, C, D and E. You have to attempt only one of the choices in such questions.

(5). Use of calculators is not allowed.

SECTION A (1 mark each)

Q1. It is not a unit of distance

(a) light year (c) amu

(b) Parallactic second (d) AU

Q2. The numbers 2.785 and 2.775 on rounding off to 3 significant figures will give

(a) 2.78, 2.77 (c) 2.79, 2.78

(b) 2.78, 2.78 (d) 2.77, 2.78

Q3. If in case of a motion, displacement is directly proportional to the square of time elapsed, what will you can say about its acceleration?

(a) constant (c) variable

(b) insufficient data (d) None of these

Q4. This quantity remains constant in UCM

(a) Linear momentum (c) direction of centripetal acceleration

(b) Velocity (d) Kinetic Energy

Q5. If $|\vec{A}+\vec{B}| = |\vec{A}-\vec{B}|$, what is the angle between $\vec{A}$ and $\vec{B}$?

(a) 30^0 (c) 90^0

(b) 60^0 (d) 120^0

Q6. A body is thrown upward with a velocity u. What is its velocity and acceleration at the highest point of the path?

(a) u, g(upward) (c) 0, g(upward)

(b) u, g(downward) (d) 0, g(downward)

Q7. In equilibrium of particle when net external force of the particle is zero. Then, the particle is

(a) at rest (c) moving with uniform acceleration

(b) moving with uniform velocity (d) Both (a) and (b)

Q8. A mass of 1 kg is suspended by a thread. It is (i) lifted up with an acceleration of 4.9 m/s^2. (ii) Lowered with an acceleration of 4.9 m/s^2. The ratio of tension is

(a) 1:3 (c) 1:2

(b) 3:1 (d) 1:1

Q9. When a horse pulls a cart, the force that helps the horse to move forward is the force exerted by

(a) The cart on the house (c) The ground on the horse

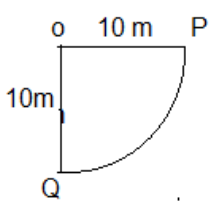
(b) The ground on the cart (d) The horse on the ground

Q10. A body constrained to move in the Y direction, is subjected to a force F = $(-2\hat{i} +3\hat{j}+\sqrt{3}\ \hat{k})$ N. What is the work done by this force to move the body through a distance of 10m along the Y axis?

(a) -20 J (c) 40 J

(b) $(-20\hat{i} +30\ \hat{j} +10\sqrt{3}\hat{k})$J (d) 30 J

Q11. The bob of a pendulum of length 10 m lies at P. As it is released, the speed at Q



(a) Zero (c) 10 m/s
(b) 14 m/s (d) $\sqrt{200}$ m/s

Q12. Two bodies of masses 1 kg and 2 kg are lying on x-y plane at (1, 2) and (- 1, 3) respectively. What are the coordinates of centre of mass?
(a) (2,-1) (c) (8/3, -1/3)
(b) (-1/3, 8/3) (d) None of these

Q13. Two lenses of same mass and same radius are given. One is convex and other is concave. Which one will have greater moment of inertia, when rotating about an axis perpendicular to the plane and passing through the centre?
(a) Convex (c) Concave
(b) Both have same (d) None of these

Q14. Three point masses each of mass 'm' are located at the vertices of an equilateral triangle of length 'a'. What is the moment of inertia of the system about an axis along the altitude of triangle?
(a) $ma^2/2$ (c) $3ma^2$
(b) ma^2 (d) $ma^2/4$

Q15. A tap can be operated by using two fingers because
(a) The force available for the operation will be more
(b) This helps application of angular forces
(c) The rotational effect is produced by the couple formed
(d) The force by one finger overcomes friction and other finger provides the force for operation

Instructions: For question numbers 16 to 18, two statements are given-one labelled Assertion (A) and the other labelled Reason (R). Select the correct answer to these questions from the codes (a), (b), (c) and (d) are as given below (a) Both A and R are true and R is the correct explanation of A. (b) Both A and R are true but R is not the correct explanation of A. (c) A is true but R is false. (d) A is false and R is also false

Q16. Assertion: A body is momentarily at rest at the instant, if it reverse the direction.
Reason: A body cannot have acceleration, if its velocity is zero at a given instant of time.

Q17. Assertion: When a body moves along a circular path, no work is done by the centripetal force.
Reason: The centripetal force is used in moving the body along the circular path and hence no work is done.

Q18. Assertion: Value of radius of gyration of a body depends on axis of rotation.
Reason: Radius of gyration is root mean square distance of particles of the body from the axis of rotation.

SECTION B (2 marks each)

Q.19. Gas equation for ideal gas PV = RT is modified by the Vandar Wall for real gases as $(P+a/V^2)(V-b) = RT$, Find the dimension of constant 'a' and 'b'.

Q.20. Are equations like v = u + at, etc applicable to circular motion? Give reason for your answer.

Q21. A body of mass 5 kg is acted upon by two perpendicular forces of 8N and 6N. Find the magnitude of acceleration of the body.

OR

A bullet of mass 100 g moving with a speed of 20 m/s strikes a wooden plank and penetrates upto 20 cm. Find the resistance offered by the wooden plank.

Q22. Answer the followings:-
(i) State true or false with reason for your answer that force of action and reaction are equal and opposite so they cancel out each other.
(ii) Why Newton's second law of motion is called real law of motion.

Q23. Is it necessary that work done in the motion of a body over a closed loop is zero for every force in nature? Give reason for your answer.

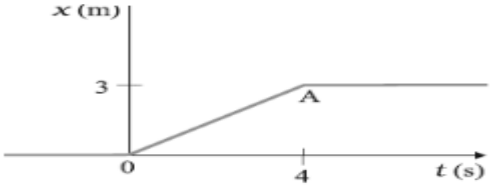
Q.24. Name the physical quantity known as (i) moment of force (ii) moment of momentum. Write the relation between these two quantities.

Q.25 What is the physical significance of moment of inertia? Write any two factors on which moment of inertia of an object depends.

SECTION C (3 marks each)

Q.26. If magnitude of vector A is 2 and magnitude of vector B is 5 and magnitude of cross product of vector A and vector B is 8 then what will be their scalar product?

Q.27. Figure shows the position-time graph of a particle of mass 4 kg. What is the (a) force on the particle for $t < 0$, $t > 4$ *s*, $0 < t < 4$ s? (b) Impulse at $t = 0$ and $t = 4$ s?



OR

A stone of mass 0.25 kg tied to one end of a string is whirled round in a circle of radius 3.5 m with a speed of 24 revolution/ minute in a horizontal plane. What is the tension in the string? What is the maximum speed with which the stone can be whirled around if the string can with stand a maximum tension of 56 N?

Q.28. The frequency 'f' of vibrations of a stretched strings depends upon its length 'l', mass per unit length 'm' and tension 'T' in the string. Find an expression for the frequency dimensionally.

Q.29. Distinguish between elastic and inelastic collision. Show that in elastic collision of two objects of same mass, object inter change their velocities.

Q.30. From a uniform disk of radius *R*, a circular hole of radius *R*/2 is cut out. The centre of the hole is at *R*/2 from the centre of the original disc. Locate the centre of gravity of the resulting flat body.

OR

State law of conservation of angular momentum. If the earth were to suddenly shrink to half of its present radius, by what duration would the day be decreased? Assume earth to be a perfect solid sphere of moment of inertia (2/5) MR^2

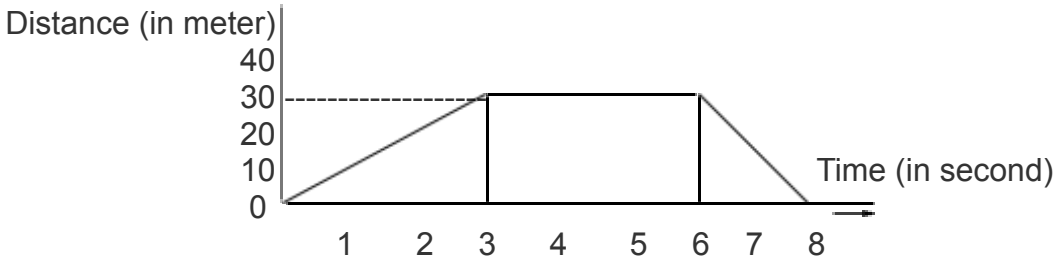
SECTION D (5 marks each)

Q.31. An object is falling freely under gravity. Show that the ratio of distance covered in first, second and third second of motion is 1:3: 5. Also draw x-t and v-t graph for the same.

OR

Prove the relation $S = ut + \frac{1}{2} at^2$. Where symbols have their usual meanings.

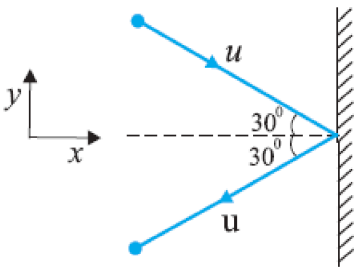
The velocity time graph for a vehicle is shown in figure. (i) Draw acceleration time graph from it (ii) total distance covered



Q.32.(a) What is meant by banking of roads? What is its importance? Obtain an expression for the maximum speed with which a vehicle can safely negotiate a curved road banked at an angle 'θ'. The coefficient of friction between the wheels and the road is 'μ'.

OR

Show that the impulse of a force is equal to the change in the momentum produced by the force. A billiard balls of mass 'm' strike a rigid wall with speed 'v' at an angle of incidence 30^0 and get reflected without any loss of speed as shown in figure. Find the impulse imparted by the ball on the wall.



Q.33. (a) Establish the relation between Kinetic energy and lir object.
(b) If the momentum of a body increases by 20%. By what pe rgy change?

OR

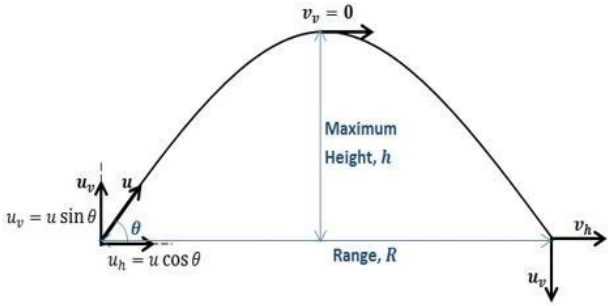
(a) State and prove work energy theorem.
(b) A uniform chain of length 'L' and mass 'm' is lying on a smooth table and one third of its length is hanging vertically down over the edge of the table. Find the work done to pull the hanging part of the chain.

SECTION E (4 marks each)

Q.34. Case Study : Projectile Motion

Read the following paragraph and answer the questions.

Projectile motion is a form of motion in which an object or particle is thrown with some initial velocity near the earth's surface and it moves along a curved path under the action of gravity alone. When a projectile is projected obliquely, then its trajectory is as shown in the figure below.



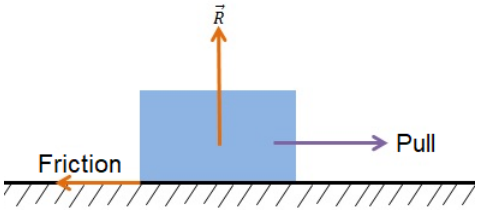
Here velocity u is resolved into two components, we get (a) u cosθ along X axis and (b) u sin θ along Y axis. In a projectile motion, horizontal component of velocity (u cos θ), acceleration (g) and mechanical energy remains constant while, speed, velocity, vertical component of velocity (u sin θ), momentum, kinetic energy and potential energy all changes. Velocity, and KE are maximum at the point of projection while minimum (but not zero) at highest point.

(i) An object is thrown in air with initial velocity 'u' making an angle 'θ' with the vertical. Write the expression for its horizontal range and height.
(ii) What is the angle between velocity and acceleration at the highest point of a projectile motion?
(iii) Show that for maximum horizontal range is four times the maximum height attained by the projectile, when it is fired at an inclination so as to have maximum range.

Q.35. Case study: Friction

Read the following paragraph and answer the questions

when one body actually moves/ slides/ rolls or even tries to move over the surface of the another body, a force comes into play which acts parallel to the surface of contact and opposes the relative motion. This opposing force is called friction.



Friction arises due to strong atomic or molecular forces of attraction between the two surfaces at the points of the actual contact. Types of friction are

Static friction: The opposing force that comes into play when one body tends to move over the surface of another, but the actual motion has not yet started. Maximum value of the static friction is called Limiting Friction. It comes to play when one body is just at the verge of moving over the surface of the other body.

Kinetic or Dynamic friction: The opposing force that comes into play when one body is actually moving over the surface of another body. It is further classified into two types (a) Sliding friction: The opposing force that comes into play when one body is actually sliding over the surface of another body. (b) Rolling Friction: The opposing force that comes into play when one body is actually rolling over the surface of another body

(i) A block placed on a rough horizontal surface is pulled by a horizontal force F. Let f be the force applied by the rough surface on the block. Plot a graph of f versus F

(ii) A car is moving in the forward direction, what is the direction of frictional force between the wheel of car and road?

(iii) A block slides down an incline of 30^0 with an acceleration of g/4. Find the coefficient of friction between block and inclined surface.