FIRST TERM EXAMINATION 2024-2025

CLASS 11 – PHYSICS (Theory) (042)

Max Marks:-70

Max 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 sixteen questions, twelve MCQ and four assertion reasoning based of 1mark each, Section B contains five questions of 2 marks each, Section C contains seven questions of 3 marks each, Section D contains two case study based questions of 4 marks each and Section E contains three long questions of 5 marks each.
5. There is no overall choice. However, an internal choice has been provided.
6. Use of calculators is not allowed.

Section-A

Q1 Which of the following is not dimensionless variable?

(a) Strain   (b) Angle   (c) Relative density   (d) π

Q2 Which of the following quantities is dimensionless?
(v=velocity, r=radius, g=acceleration due to gravity)

(a) v^2rg (b) v^2/rg (c) v^2r/g (d) v^2g/r

Q3 A heavy body and light body are dropped from the top of a tower. Which will reach the ground first?

(a) Heavy   (b) light   (c) both   (d) not known

Q4 The equation of motion of a particle is $x=t^2-t^3$. The particle is moving with

(a) Uniform velocity   (c) variable retardation
(b) uniform acceleration   (d) uniform retardation.

Q5 A particle moves with a velocity $v= 6\hat{i}+4\hat{j}-3\hat{k}$ m/s under the influence of a constant force $F =20\hat{i}+15\hat{j}-5\hat{k}$ N. The instantaneous power applied to the particle is

(a) 35 J/s   (b) 45 J/s   (c) 25 J/s   (d) 195J/s.

Q6 The horizontal range of a projectile fired at an angle of 15 degree is 50m. If it is fired with the same speed at an angle of 45 degree, its range will be

(a) 60m   (b) 200m   (c) 100m   (d) 150m

Q7 To avoid slipping while walking on ice one should take smaller steps because of the

(a) Larger friction   (c) Smaller friction
(b) Larger normal reaction   (d) Smaller normal reaction

Q8 A body starts sliding down at an angle θ to the horizontal. The coefficient of friction is

(a) $\tan \theta$ (b) $\sin \theta$ (c) $\cos \theta$ (d) $\operatorname{cosec} \theta$

Q9 If the momentum of a body is doubled the kinetic energy is

(a) Halved   (b) Unchanged   (c) Doubled   (d) Increases four times

Q10 Internal forces can change

(a) the linear momentum not the kinetic energy
(b) the kinetic energy not the linear momentum
(c) linear momentum as well as kinetic energy
(d) neither the linear momentum nor the kinetic energy

Q11 Which of the following is not the unit of power?

(a) watt   (b)horse power   (c) joule/s   (d) Kilowatt hour

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Q12 Two balls of different masses have same K.E. Then
    (a) the heavier ball has greater momentum than the lighter ball
    (b) the lighter ball has greater momentum than the heavier ball
    (c) both the balls have equal momentum
    (d) both the balls have zero momentum

For question numbers 13,14,15,16 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) 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~~ true

Q13 A: A man squatting on the ground gets straight up and stand. The force of reaction of ground on the man during the process remains same.
    R: At first the reaction force is greater than "mg" and later becomes equal to "mg".

Q14 A: At the highest point of a projectile, the velocity of a body is zero.
    R: The vertical component of velocity becomes zero at the highest point of the projectile.

Q15 A: Tension in a string having mass is different at different cross-sections of its length.
    R: This is because of the mass of the string.

Q16 A: Work done by centripetal force in rotating a body in a circular path in one ~~quadrant~~ rotation is zero.
    R: The angle between the centripetal force and displacement is zero.

Section-B

Q17 The displacement of a progressive wave is represented by $y = A \sin(\omega t - kx)$. Where x is displacement and t is time. Write the dimension of ω and k.

Q18 A student slides freely down a frictionless inclined plane while his bag having weight one tenth of the student falls down vertically from the same height. Find the relation of final speeds of the student and the bag.

Q19 The position of a particle is given by $r = 3t\hat{\imath} + 2t^2\hat{\jmath} + 5\hat{k}$. Where t is in seconds and r is in meters. Find the velocity and acceleration of the particle in magnitude and direction at time $t = 3s$.

    OR

The kinetic energy of a projectile at the highest point is half of the initial kinetic energy, What is the angle of projection with the horizontal?

Q20 Explain why:
    (a) It is easier to make a body roll over the surface of another than to make it slide
    (b) Lubricants are used to reduce friction between two surfaces.

Q21 Find the dimensions of a, b in
    (i) $P = (t^2 - a)/bx$ (ii) $E = (b-x)/at$ (P=pressure, t=time, x=distance, E=energy)

Section-C

22 A pebble of mass 0.05 kg is thrown vertically upwards. Give the direction and magnitude of the force acting on it (a) during its upward motion, (b) during its downward motion, (c) at the highest point.
What if that was thrown at an angle of 45 degree with the horizontal direction? Ignore air resistance.

Q23 On a certain day, rain was falling vertically with a speed of 35 m/s. A wind started blowing after some time with a speed of 12 m/s in east to west direction. In which direction should a student waiting at a bus stop hold her/his umbrella? Draw the relevant diagram.

Q24 Why does a cyclist lean inward when moving along a curved path? Determine the angle through which a cyclist bends from the vertical while negotiating a circular path.

OR

(a) Find an expression for the maximum speed of circular motion of a car in a circular horizontal track.

(b) What is meant by banking of a road? Why is it needed?

Q25 (a) Which of the two: velocity or acceleration, gives the direction of motion of a body? Justify with example.

(b) Define inertia. What is its SI unit?

OR

State the parallelogram law of vector addition. Apply it to find unknown weight.

Q26 The wavelength (λ) associates with a moving particle depend upon its mass (m), velocity of motion (v), Planck constant (h). Dimensionally find out the expression of wavelength (λ). Also mention drawbacks of this method.

Q27 A metro train starts from a station with an acceleration of $2m/s^2$ for 8 seconds. It then runs for 12 seconds with the speed acquired. Finally, it retards at a uniform rate of $4m/s^2$ and stops. Find the total distance travelled.

Q28 Show that the horizontal range is same for two complementary angles of projection. What is the kinetic energy at the highest point of the projectile?

OR

A shot is fired with a velocity of 100m/s in a direction making an angle 60 degree with the vertical. Calculate the time of flight and the maximum height attained by it.

Section-D (Case based questions)

After reading the above passage, answer the following questions:

Q29 Physics is at work in amusement park rides. Let us take example of a Ferris wheel. A Ferris wheel is a large structure that rotates about a central axis. Seats are fixed at outer rim of the wheel. During the ride, the wheel rotates about its axis, you feel lighter when your seat starts coming down and feel heavier you are at the bottom.

(a) What is centripetal acceleration?

(b) What is the formula of centripetal acceleration in terms of time periods in a uniform circular motion?

(c) What is the formula for the centripetal force in terms of angular velocity in a uniform circular motion?

(d) Which physical quantity remains constant and which one changes in case?

Q30 Apparent weight is the weight measured by a weighing machine. This weight is the normal reaction that the man exerts on the weighing machine and may not be equal to the real weight (mg) of the body. Let us consider a man of mass 49 kg standing on a weighing machine kept on the floor of an elevator. Find the apparent weight of the man when the elevator is :

(i) rising with an acceleration of 1 m/s

(ii) going down with the same acceleration

(iii) falling freely under gravity

(iv) going up with constant velocity
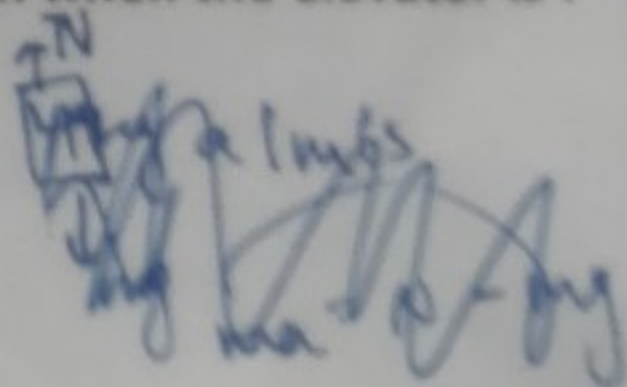
Q31 (a) Define impulse and impulsive force. Mention SI unit of each.

(b) State Impulse-Momentum Theorem.

(c) Apply the same to explain lowering hands while catching a fast moving cricket ball.

OR

(a) Why do action and reaction not cancel each other?

(b) Discuss the motion of horse and cart as a two body system with diagram.

Q32 (a) Find the dot product and cross product of any two unit orthogonal vectors.

(b) Are the dot product and cross product of any two vectors commutative in nature? Explain.

(c) What is the dot product of two equal and antiparallel vectors?

OR

(a) When is the magnitude of $(\vec{A} + \vec{B})$ equal to the magnitude of $(\vec{A} - \vec{B})$?

(b) What is the minimum number of non collinear forces acting on an object in a plane that can produce a zero resultant force?

(c) What is the angle between $(\vec{A} + \vec{B})$ and $(\vec{A} \times \vec{B})$?

(d) What is meant by null vector?

(e) Find a unit vector parallel to the vector $3\hat{i}+7\hat{j}+4\hat{k}$.

Q33 (a) Compare conservative forces and non-conservative forces with examples.

(b) State and prove the law of conservation of energy.

(c) Discuss the same for the free-falling body.

(d) Draw energy-height graph for a free-falling body.

OR

(a) State work-energy theorem and prove it for a variable force.

(b) Find the potential energy stored in a spring.

(c) Show graphically the interconversion of kinetic and potential energies of an oscillating block connected with a horizontal spring kept on a table.