

Q – 7. What will be number of Newton in one dyne of force ?

[a] 10^5

[b] 10^7

[c] 10^{-5}

[d] 10^{-7}

Q – 8. A body of mass 'm' tied to one end of a string is made to revolve in a vertical circle, then difference in the string at the lowest and the highest point is equal to

[a] mg

[b] 4 mg

[c] 6 mg

[d] 8 mg

Q – 9. An object is simultaneously given two velocities , one 30 m/sec due east and other 40 m/sec due North . what will be its resultant velocity ?

[a] 25 m/sec

[b] 10 m/sec

[c] 50 m/sec

[d] 70 m/sec

Q – 10. The force of friction between two object is

[a] Parallel to the contact surfaces

[b] Perpendicular to contact surfaces

[c] Inclined at 30° to the contact surfaces

[d] None of these

Q – 11. Calculate the Impulse necessary to stop a 1500 Kg. car travelling at 25 m/sec.

[a] 12500 N-sec.

[b] 30000 N-sec.

[c] 37500 N-sec.

[d] 75000 N-sec.

Q – 12 The dimensional formula of momentum will be same as

[a] Kinetic energy

[b] Impulse

[c] Force

[d] Work done

In the following questions (from Q No -13 to Q No -16), two statements are given – one labelled Assertion(A) and other Reason (R). select the correct answer to these questions from the options as given below :

(a) If both Assertion and Reason are true and Reason is correct explanation of Assertion.

(b) If both Assertion and Reason are true and Reason is not the correct explanation of Assertion .

(c) If Assertion is true but Reason is false .

(d) If both assertion and Reason are false.

Q – 13. [Assertion] In javelin throw, the Athlete throws the javelin at an angle 45° for maximum Range.

[Reason] The maximum Range does not depends upon Angle of Projection .

Q – 14. [Assertion] when a body moves along a circular path , no work-done 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.

Q – 15. [Assertion] At the centre of Earth , the object of some inertial mass becomes weightless .

Reason] At the centre of Earth the value of acceleration due to gravity is zero.

Q – 16. [Assertion] On a rainy day , it is difficult to drive a car or bus at high speed.

[Reason] The value of coefficient of friction is lowered due to wetting of the surface.

SECTION – B [2 mark each]

Q – 17. Write the Expression for Centripetal acceleration . A particle on the tip of a Fan blade of length 0.15 meter , rotating at 1200 revolution per minute . Calculate its frequency in r.p.s. , Angular velocity and centripetal acceleration ?

Q – 18 Define Angle of Repose ,show that coefficient of friction is numerically equal to the tangent of Angle of repose with labeled diagram .

Q – 19 write relation between Kinetic energy and momentum of a moving object . How does the kinetic energy of an object changes if momentum is doubled ?

Q – 20 A bend in a level road has a radius of 100 meter . Find the maximum speed which a car turning this bend may have without skidding . if the coefficient of friction is 0.8 between the tyres and road surface.

Q – 21 State Newton's law of Gravitation, using it define Universal Gravitational Constant .

OR

A Force $F = (4 \hat{i} + \hat{j} + 3 \hat{k})$ newton makes a body to moves through a displacement $S = (11 \hat{i} + 11 \hat{j} + 15 \hat{k})$ meter. Calculate the work – done by the Force ?

SECTION – C [3 mark each]

Q – 22 State Newton's Third Law of motion, using it derive an expression for achieved acceleration of Rocket at any instant after being fired .

Q – 23 For the given vectors $A = 5 \hat{i} + 7 \hat{j} - 3 \hat{k}$ and $B = 2 \hat{i} + 2 \hat{j} + 8 \hat{k}$, Calculate the values of

[a] Scalar (Dot) product of A and B.

[b] Vector (Cross) Product of A and B .

[c] The Angle between A and B.

Q – 24 Define Elastic Collision ,Prove that in one dimensional elastic collision the relative velocity of approach before collision is equal to the relative velocity of separation after the collision .

Q – 25 State law of conservation of linear – momentum , A 40 Kg shell is flying at a speed of 72 Km/h . It explodes into two pieces , one of the pieces of mass 15 kg stops . Calculate speed of other piece ?

Q – 26 A jet plane start from rest with an acceleration of 3 m/sec^2 and makes a run for 35 seconds before taking off. What is the minimum length of the run – way and what is the velocity of jet plane at take off ?

Q – 27 Check the correctness of following relation using Dimensional Analysis

[a] $F \cdot v = m g h$

[b] $m r \omega^2 = m v / t$

(where terms having their usual meanings)

Q – 28 State Law of conservation of Energy , If a body tied to one end of a string is made to revolve in a vertical circle . Derive the Expression for the velocity of the body and tension in the string at any point .

OR

A girl of mass 40 Kg sits in a swing formed by a rope of 6 meter length . A person pulls the swing to a side so that the rope makes an angle 60° with vertical ,Find the gain in potential energy of the girl ?

SECTION – D [4 Mark each] [Case - Study]

Read the following paragraphs and Answer the Questions:

Q – 29. The sum of two vectors of the same kind gives a new vector of the same type. The process of adding two or more vectors is called composition of vectors . two vectors A and B can be added graphically using head – to – tail method or parallelogram method . the resolution of vector is just reverse of composition of vectors i.e. a vector can be splitted in to two or three components along three axes of co – ordinate system. The head – to – tail method is also known as Triangle law of vector addition because the two vectors and their resultant form a triangle . whereas in Parallelogram law of vector addition we bring the tails of two vectors at a common point (i.e. co initial vectors) and diagonal of parallelogram formed by them passing through that common point gives the resultant of composition of these vectors .

[i] Forces F_1 and F_2 act on point mass in two mutually perpendicular directions the resultant force on the point mass is

[a] $F_1 + F_2$

[b] $F_1 - F_2$

[c] $\sqrt{F_1^2 + F_2^2}$

[d] $F_1^2 + F_2^2$

[ii] The flying bird in the sky is good example for

[a] Triangle Law

[b] Law of Parallelogram

[c] Polygon Law

[d] None of these

[iii] If $P + Q = R$ and $|P| = |Q| = |R|$, then the angle between vectors P and Q will be

[a] 30°

[b] 60°

[c] 90°

[d] 120°

[iv] A velocity of 10 m/sec has its Y – component $5/\sqrt{2}$ m/sec . what will be its X – component

[a] 100 m/sec

[b] $5\sqrt{2}$ m/sec

[c] 50 m/sec

[d] $10\sqrt{2}$ m/sec

Q – 30 To put a satellite into an orbit around the Earth, it must be given a minimum vertical velocity so that it can overcome gravity and reach a suitable height. The satellite must be given sufficient tangential velocity so that it may not fall back to the earth. Once it is done, the gravitational force provides the needed centripetal force to maintain the satellite in the orbit. The minimum vertical velocity with which a body must be projected upward in order that it may just escape the gravitational field of the earth is called the Escape – velocity. Whereas the horizontal velocity required to put a satellite in its orbit around a planet is called orbital velocity.

[i] The Escape velocity of a body from the surface of Earth is

- [a] 9.8 km/sec [b] 11.2 Km/sec [c] 6.67 km/sec [d] 2.3 km/sec

[ii] The ratio of orbital velocity of Satellite revolving close to the Earth 's Surface and Escape – velocity of a body from the Earth 's Surface (i.e. $V_O : V_E$) is

- [a] $1 : \sqrt{2}$ [b] $\sqrt{2} : 1$ [c] $2 : 3$ [d] $\sqrt{3} : \sqrt{2}$

[iii] The Geostationary Satellite completes one revolution around Earth in

- [a] 27 days [b] 7 days [c] 365 days [d] 1 days

[iv] The mass of moon is $1 / 81$ of Earth's mass and its radius $1 / 4$ of that of Earth. Find the value of Escape velocity from the Surface of moon?

- [a] 11.2 Km / sec [b] 2.45 Km / sec [c] 5.28 Km / sec [d] None of these

SECTION – E [5 Mark each]

Q – 31. [a] State and prove work – Energy Theorem using Integration method with help of labeled diagram.

[b] A body of mass 4 kg initially at rest, a force of 16 Newton is subjected on it. What is the kinetic – energy acquired by the body at the end of 10 seconds ?

OR

[a] What are the conservative forces? Show that mathematically the Gravitational force is a conservative force using a labeled diagram.

[b] A lift is designed to carry a load of 400 kg through 10 floors of a building in 10 seconds. The height of each floor is 6 meter. Calculate the power of the lift in Kilowatt ?

Q – 32. [a] Derive Third equation of motion for uniformly accelerated object by using Calculus method and labeled diagram .

[b] A body covers 10 meter in 2nd second and 25 meter in 5th second of its uniformly accelerated motion along straight line. Calculate its initial velocity and uniform acceleration ?

OR

[a] What do you mean by Projectile motion ,Obtain Expression for Flight – Time (T), height (H) and Horizontal Range (R) . if an object projected with initial velocity 'u' making an angle θ with horizontal .

[b] An aircraft executes a horizontal loop of radius 1 Km. with a steady speed of 900 km/h . Find the centripetal acceleration acting on it ?

Q – 33. [a] Using Binomial - theorem, derive Expression for variation in the value of acceleration due to gravity for effect of height with labeled diagram.

[b] Assuming the Earth to be a sphere of uniform mass density, How much would a body weigh half way down to the centre of the Earth if it weighed 250 Newton on the surface of Earth ?

OR

[a] State Kepler's laws for Planetary – motion using labeled diagram .

[b] If the diameter of Earth becomes twice its present value but its mass remains unchanged, then how would be the weight of an object on the surface of the Earth affected ?