No. of Printed Pages/Questions: 9 / 33

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HALF YEARLY EXAMINATION - (2025 – 2026)

Class : XI **Max. Marks: 70**
Subject: Physics (042) **Time: 3 Hours**

General Instructions:

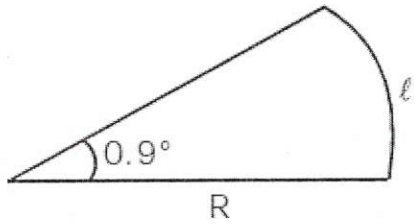
(1) There are 33 questions in all. All questions are compulsory.
(2) This question paper has five sections: Section A, Section B, Section C, Section D and Section E.
(3) All the sections are compulsory.
(4) Section A contains sixteen questions, twelve MCQ and four assertion reasoning based of 1 mark each, Section B contains five questions of two marks each, Section C contains seven 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) There is no overall choice. However, an internal choice has been provided in two question in Section B, one question in Section C and all three questions in Section E. You have to attempt only one of the choices in such questions.
(6) Use of calculators is not allowed.

SECTION A

Q1. If area (A) velocity (v) and density (ρ) are base units, then the dimensional formula of force can be represented as

(a) Avρ
(b) $Av^2\rho$
(c) $Av\rho^2$
(d) $A^2v\rho$

Q2. As shown in diagram what is the length of arc



(a) $\frac{\pi R}{100}$
(b) 0.8
(c) $\frac{\pi R}{200}$
(d) $\frac{\pi R}{300}$

Q3. $\alpha = \frac{F}{V^2}\sin(\beta t)$, Find the dimension of α and β if V= velocity and t=time.

(a) $\alpha=M^1L^1T^0$, $\beta= T^{-1}$
(b) $\alpha=M^1L^1T^{-1}$, $\beta= T^1$
(c) $\alpha=M^1L^1T^{-1}$, $\beta= T^{-1}$
(d) $\alpha=M^1L^{-1}T^0$, $\beta= T^{-1}$

Q4. Out of the following pairs, which one does not have identical dimensions ?

(a) Angular momentum and Planck's constant
(b) Impulse and momentum
(c) Moment of inertia and moment of a force
(d) Work and torque

Q5. If A= i+ j+ k and B= 2i +j , find $|A \times B|$?

(a)$3\sqrt{3}$ (b) $\sqrt{6}$

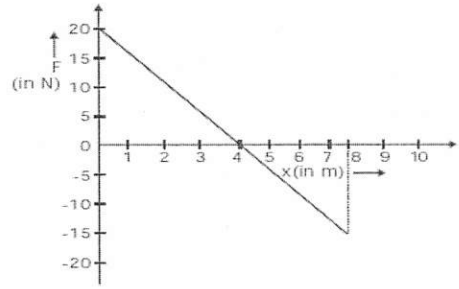
(c)$6\sqrt{3}$ (d)$3\sqrt{6}$

Q6. If $\sqrt{3}|A \times B|$=A.B , then find the angle between A and B ?

(a)75^o (b)30^o

(c)65^o (d) 45^o

Q7. A force F acting on an object varies with distance x as shown in the figure.



(a)10 J (b)80 J

(c) -40 J (d)40 J

Q8. The work done is joules in increasing the extension of a spring of stiffness 10 N/cm from 4 cm to 6 cm is :

(a) 1 (b)10

(c) 50 (d)100

Q9. If the kinetic energy of a particle is increased by 300%, the momentum of the particle will increase by

(a)20% (b)200%

(c)100% (d)50%

Q10. A rocket with a lift off mass 3×10^3 kg is blasted upwards with an initial acceleration of 10 ms^{-2}. The initial thrust of the blast is (Take g=10 ms^{-2})

(a) 2×10^5 N (b)3×10^5 N

(c)3×10^4 N (d)5×10^4 N

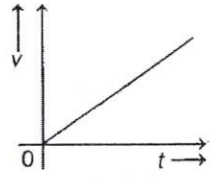
Q11. A stone falls freely under gravity. It covers distance h_1, h_2 and h_3 in the first 5 s, the next 5 s and the next 5 s, respectively. The relation between h_1, h_2 and h_3 is the car stops is

(a) $h_1=2h_2=3h_3$ (b) $h_1=\frac{h_2}{3}=\frac{h_3}{5}$

(c) $h_2=3h_1$ and $h_3=3h_2$ (d) $h_1=h_2=h_3$

Q12. An object is moving in negative direction with a negative acceleration. The velocity-time graph with constant acceleration which represents the above situation is

(a)



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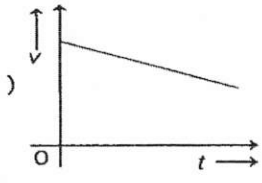

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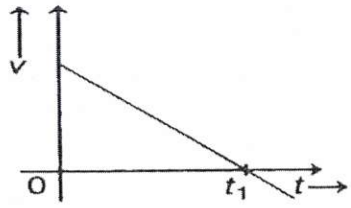
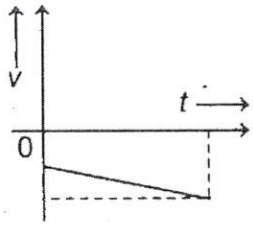


(d)



For Questions 13 to 16, two statements are given one labelled Assertion (A) and other labelled Reason (R). Select the correct answer to these questions from the options as given below.

(A) Both Assertion and Reason are true and Reason is the correct explanation of Assertion.
(B) Both Assertion and Reason are true but Reason is not the correct explanation of Assertion.
(C) Assertion is true but Reason is false.
(D) Both Assertion and Reason are false.

Q13. Assertion: The work done in moving a body over a closed loop is zero for every force in nature.
Reason : Work done depends on nature of force.

Q14. Assertion: Horizontal range is same for angle of projection θ and $(90-\theta)$.
Reason : Horizontal range is independent of angle of projection.

Q15. Assertion: The average and instantaneous velocities have same value in uniform motion.
Reason : In a uniform motion velocity of an object increases uniformly.

Q16. Assertion: Friction is always an undesirable force.
Reason : Static friction is a self-adjusting force up to its limit $\mu_s N$, where μ_s is the coefficient of static friction.

SECTION B

Q17. A man can swim at a speed of 3 km/h in still water. He wants to cross a 500 m wide river flowing at 2 km/h. He keeps himself always at an angle of 120° with the river flow while swimming.
(i) Find the time he takes to cross the river.
(ii) At what point on the opposite bank will he arrive ?

Q18. A particle starts moving along x-axis from t = 0, its position varying with time as $x = 2t^3 - 3t^2 + 1$.
(i)At which time instants is its velocity zero ?
(ii) What is the velocity when it pass through origin ?

Q19. Check the following equation is dimensionally correct or not?

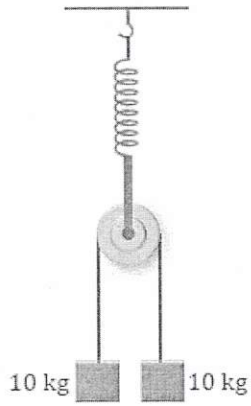
$$E = mc^2$$

where E = Energy , m= mass of particle and c is speed of light in vacuum/ air.

Q20. Attempt either **(A)** or **(B):**

(A):

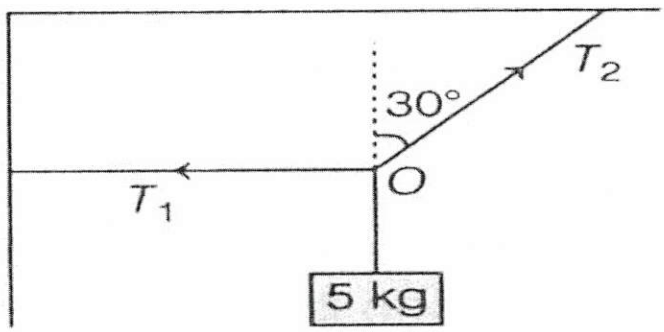
The system shown in fig. are in equilibrium. If the spring balance is calibrated in Newton, what does it record in each case? ($g = 10\ m/s^2$)



OR

(B):

A block of mass 5 kg is suspended with two strings, as shown in figure. Find the tension in each sting, if the system is in equilibrium. (Take $=10\ m/s^2$)



Q21. Attempt either **(A)** or **(B):**

(A):

A block of mass 2 kg is dropped from a of 40 cm on a spring whose spring constant is 1960 N m^{-1}. What will be the maximum distance through which the spring is compressed? (Take $g = 9.8\ ms^{-2}$)

OR

(B):

Prove that time period of conical pendulum of length L is given by:

$$T = 2\pi\sqrt{\frac{L\cos\theta}{g}}$$

SECTION C

Q22. Consider a simple pendulum , having a bob attached to a string, that oscillates under the action of force of gravity .The time period of oscillation of the simple pendulum depends on mass of the bob "m" , length "l" of the pendulum and acceleration due to gravity "g" . Derive the expression for its time period using method of dimensions.

OR

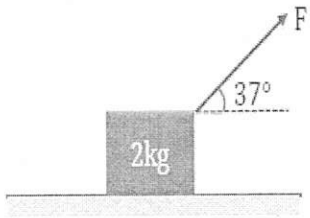
The value of universal gravitation constant is 6.67×10^{-11} Nm^2/kg^2 in S.I system. Convert its value in C.G.S system using principle of homogeneity.

Q23. Attempt either **(A)** or **(B):**

(A):

(i) Draw a graph between applied force and friction.

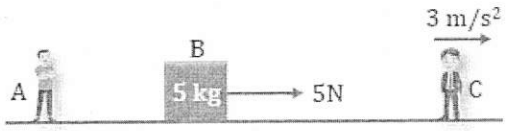
(ii) A block of mass 2 kg is kept on a rough horizontal floor and pulled with a force F. If the coefficient of friction is 0.5, then calculate the minimum force required to move the block ? (Take g= 10 ms^{-2})



OR

(B):

Find the acceleration of block with respect to A and with respect to C separately.

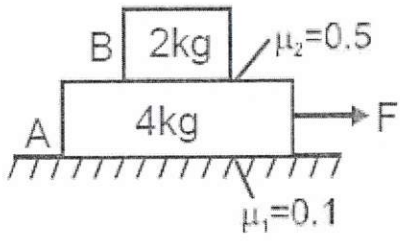


In Frame (A) In Frame (C)

Q24. Attempt either **(A)** or **(B):**

(A):

Find out the maximum value of F for which both the blocks will move together (Take g = 10 ms^{-2})



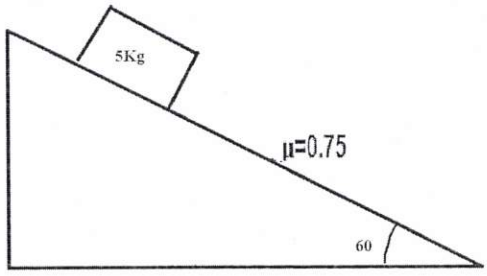
OR

(B):

A block of mass 5kg is on the inclined plane as shown in the figure below. If the coefficient of friction between the surface of block and inclined plane is 0.75, then answer the following questions.(Take g = 10 ms^{-2})

(i)Will this body slide down the plane ?

(ii)If yes , find the acceleration ?



Q25. (i) If momentum of an object is increased by 4 % find percentage change in its kinetic energy?

(ii) A uniform force of $(3i + j)$ Newton acts on a particle of mass 2 kg. The particle is displaced from position $(2i + k)$ meter to position $(4i + 3j - k)$ meter. Find the work done by the force on the particle?

Q26. Attempt either **(A)** or **(B):**

(A):

(i)What will be the projection of vector A= i + j+ k on B= i + j?

(ii) If $y = 4x^2 - 4x + 7$. Find the minimum value of y.

OR

(B):

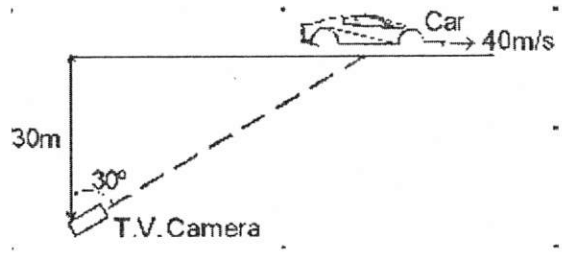
A car with a vertical wind shield moves along in a rain storm at speed of 40 km/hr. The rain drops fall vertically with a terminal speed of 20 m/sec. Prove that the angle at which the rain drops strike the wind shield is $\tan^{-1}\frac{5}{9}$.

Q27. A turn of radius 20 m is banked for the vehicles going at a speed of 36 km/h. If the coefficient of static friction between the road and the tyre is 0.4, what is the maximum speed of the vehicle while turning? (Take g = 10 ms^{-2})

Q28. Attempt either **(A)** or **(B):**

(A):

A racing car is travelling along a track at a constant speed of 40 m/s. A T.V. camera men is recording the event from a distance of 30 m directly away from the track as shown in figure. In order to keep the car under view in the position shown, find the angular speed with which the camera should be rotated?



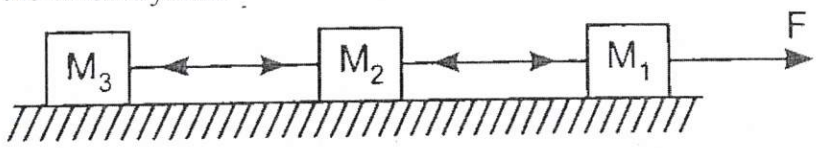
OR

(B):

A wheel is at rest. Its angular velocity increases uniformly and becomes 80 radian per second after 5 second. Calculate the total angular displacement?

SECTION D

Q29. Three blocks masses M_1 = m , M_2= 2m and M_3=3m connected by two strings are horizontal frictionless surface as shown. A horizontal force F is applied to mass M_1 to move the whole system.



(i)The common acceleration of the blocks is:

(a) $\frac{F}{m}$ (b) $\frac{F}{2m}$

(c) $\frac{F}{3m}$ (d) $\frac{F}{6m}$

(ii)The force exerted on mass M_2 is

(a)F (b)$\frac{5F}{6}$

(c)2F (d)3F

(iii)The force exerted on M_3 is :

(a)0.5 F (b) $\frac{5F}{6}$

(c)0.8F (d) $\frac{F}{3}$

(iv) The force exerted on M_1 is :

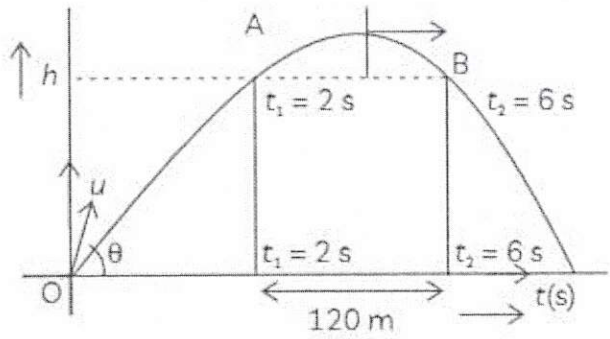
(a)F (b) $\frac{F}{6}$

(c)2F (d)3F

OR

(iv) Action and reaction force do not balance each other because
(a) all blocks has different mass.
(b) action and reaction of force always act on two different bodies.
(c) of string
(d) statement is wrong

Q30. A projectile is projected from a point O on the ground with an initial velocity u at an elevation angle θ from the horizontal direction as shown in the figure. It just crosses two walls A and B of same height h situated symmetrically at times t_1 = 2 s and t_2 = 6 s, respectively. The horizontal distance between the two walls is d = 120 m.
(take g = 10 m/s^2)



(i)The projectile motion is an example of:

(a) one-dimensional motion (b) two-dimensional motion

(c) three-dimensional motion (d) cannot say, precisely.

(ii) The total time of flight of the projectile:

(a) 8 s (b) 10 s

(c) 4 s (d) 12 s

(iii) The value of angle of projection θ of the projectile is:

(a) $\tan^{-1}\frac{3}{4}$ (b) $\tan^{-1}\frac{4}{5}$

(c) $\tan^{-1}\frac{4}{3}$ (d) $\tan^{-1}\frac{5}{4}$

(iv)The projectile velocity u of the projectile is:

(a)30 m/s (b)40 m/s

(c)50 m/s (d)$20\sqrt{3}$m/s

OR

(iv)The height h of either of two walls is :

(a)120 m (b)30 m

(c)15 m (d) 60 m

SECTION E

Q31.Attempt either **(A)** or **(B):**

(A)

(i) A student while doing an experiment finds that the velocity of an object varies with time and it can be expressed as equation:

$$v = At^2 + Bt + C .$$

If units of v and t are expressed in terms of SI units, determine the units of constants A, B and C in the given equation.

(ii) Add 7.21, 12.141, 0.0028 and express the result to appropriate number of significant figure.

(iii) Write the dimension of Impulse.

OR

(B):

(i) The density of a material in CGS system of units is 4 g cm^3. In a system of units in which unit of length is 10 cm and unit of mass is 100 g, calculate the value of density of material?

(ii)Using the principle of homogeneity of dimensions, check that following is correct of not?

$T^2 = \frac{4\pi^2 r^3}{GM}$ where T is time period , G is gravitation constant , M is mass and r is radius of orbit.

Q32. Attempt either **(A)** or **(B):**

(A):

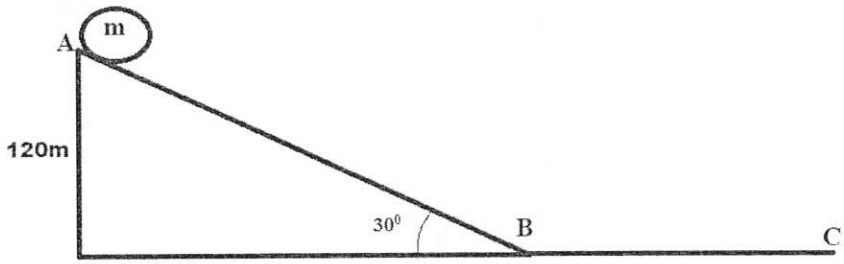
(i)Write three differences between conservative and non- conservative forces.

(ii) A 16 kg block moving on a frictionless horizontal surface with a velocity of 5m s^{-1} compresses an ideal spring and comes to rest. If the spring constant of the spring be 100N m^{-1} then how much is the spring compressed?

OR

(B):

(i) A ball of mass "m" kg is released from point A , 120m above inclined plane which is smooth and inclined at 30° as shown in the figure below. Calculate how far the ball will travel on a horizontal rough surface (BC) of coefficient 0.5 before coming to rest.



(ii) A force acts on a 30gm particle in such a way that the position of the particle as a function of time is given by $x=3t-4t^2+t^3$, where x is in metres and t is in seconds. Find the work done during the first 4 seconds.

Q33. Attempt either **(A)** or **(B):**

(A):

(i) Prove $v^2 = u^2 + 2as$ by calculus method

(ii)A ball is thrown upward from the top of a tower 40m high with a velocity 10 m/s. Find the time when it strike the ground? (Take g = 10 ms^{-2})

OR

(B):

(i)If the velocity of a particle is given by v = $(180 - 16x)^{\frac{1}{2}}$ m/s, then find its acceleration.

(ii) Length of a minute hand of a clock is 4.5 cm. Find the average velocity of the tip of minute's hand between 6 a.m. to 6:30 a.m.