INDIAN SCHOOL AL WADI AL KABIR

FIRST ASSESSMENT (2023 - 24)

Class: XI | Sub: PHYSICS (042) | Max Marks: 70

Date:26.09.2023 | Set - 1 | 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 one question in Section B, one question in Section C, one question in each CBQ in Section D 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 [1 MARK]

[1] The dimensional formula $[MLT^{-1}]$ represents
[a] work [b] Gravitational constant [c] impulse[d] force.

[2] Dimensional analysis can't be applied to

[a] to check the correctness of a physical equation.

[b] to derive the relationship between different physical quantities.

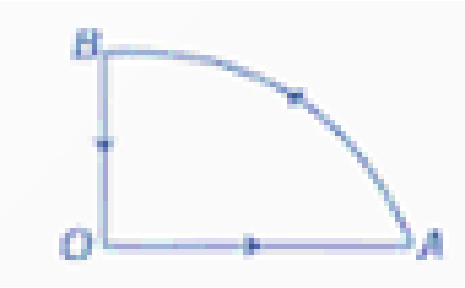
[c] to find the correct value of constants

[d] All of the above

[3] The velocity of a body is given by the equation: $V = \frac{b}{t} + ct^2 + dt^3$.
Where 't' is the time and b,c,d are constants. The dimensional formula for b is

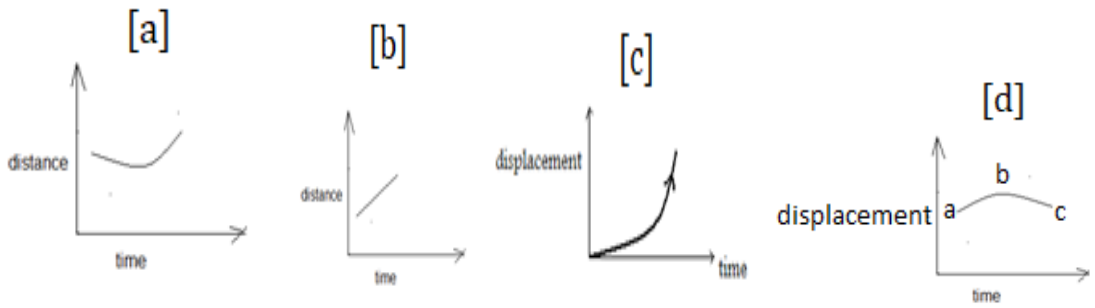
[a] $[M^3LT^0]$ [b] $[ML^2T^0]$ [c] $[M^0LT^0]$ [d] $[MLT^0]$

[4] An object is moving along a path OABO with constant speed,



then
[a] the acceleration of the object while moving along the path OABO is zero
[b] the acceleration of the object along the path OA is zero
[c] there must be some acceleration along the path AB
[d] both [b] & [c]

[5] Select the graph for a body moving with negative acceleration [retardation]



[a] graph a [b] graph b [c] graph c [d] graph d

[6] A body is released from the top of a tower of height 'h'. It takes 't' sec to reach the ground. Where will be the ball after time $\frac{t}{2}$ s ?

[a] At $\frac{h}{2}$ from the ground

[b] At $\frac{h}{4}$ from the ground

[c] Depends upon the mass of the body

[d] At $\frac{3h}{4}$ from the ground

[7] What is the angle between the velocity vector and acc. vector in uniform circular motion

[a] 0^0 $[b] 90^0$ $[c]$ 45^0 $[d] 60^0$

[8] Select the correct equation

[a] V = $r^2\omega$ [b] a = r $\propto$ [c] ω = rV [d] $\propto = ar$

[9] A person can throw a ball to a maximum horizontal distance of 60m .What is the maximum vertical height he can throw the same ball?

[a] 25 m [b] 30m [c] 35m [d] 40m

[10] A man of mass 60kg in a lift is moving downwards with a uniform acceleration of 4 $\frac{m}{s^2}$ .Then the normal reaction acting is [g =10m/s^2]

[a] 360N [b] 420N [c] 400N [d] 340 N

[11] A light and a heavy body have equal momenta. Which one has greater K.E.

[a] the light body

[b] the heavy body

[c] the K.E. are equal

[d]data is incomplete

[12] An automobile moving horizontally at a speed of 10$\frac{m}{s}$ reaches the foot of an inclined smooth plane and the engine is switched off. How much distance does the automobile go up the incline before coming to rest? The inclination of the plane to the horizontal is 30° [g =10m/s^2]

[a] 12m [b] 18m [c]20m [d] 22m

ASSERTION-REASON

Questions number 13 to 16 are Assertion (A) and Reason (R) type questions. Two statements are given one labelled Assertion (A) and the other labelled Reason (R).

Select the correct answer from the codes (a), (b), (c) and (d) as given below.

(a) Both Assertion (A) and Reason (R) are true and Reason (R) is the correct explanation of the Assertion (A).

(b) Both Assertion (A) and Reason (R) are true, but Reason (R) is not the correct explanation of the Assertion (A).

(c) Assertion (A) is true, but Reason (R) is false.

(d) Assertion (A) is false and Reason (R) is also false

[13] Assertion: Angle and angular displacement are dimensionless quantities

Reason: Angle is equal in arc length divided by radius

[14] Assertion: A ball 'A' of mass 'm' is dropped from the top a tower and another ball 'B' of mass '2m' is projected horizontally from the same point. Then the ball B will reach the ground first.

Reason : The time taken depends upon mass of the body

[15] Assertion: While catching a ball a player lowers his hand

Reason: This is to increase the change in momentum

[16] Assertion: A light body and heavy body have same momentum. Then they also have same kinetic energy

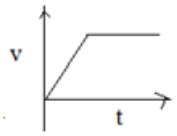
Reason: Momentum depends only upon mass

SECTION B [2 MARKS]

[17] What are the dimensional formula of a,b in the equation,

$[P + a/V^2] [V-b] = RT$, where P =pressure, V = volume, T = temperature. R = gas constant

[18][a] The velocity- time graph for a body is shown below. Plot the corresponding acceleration -time graph



[b] A stone is thrown vertically upwards and received by the thrower at the same place. Draw the corresponding velocity - time graph.

[19] If the magnitude of two vectors are 2 and 3 and the magnitude of their scalar product is $3\sqrt{2}$, then find the angle between the vectors ?

OR

Given that $\vec{P}$ = 12 , $\vec{Q}$ = 5 , $\vec{R}$ = 13. Also $\vec{P}$ + $\vec{Q}$ = $\vec{R}$
Find the angle between the vectors P and Q ?

[20] State and prove[derive] the law of conservation of momentum of two bodies of masses m1 and m2

[21]A man raises a mass 10 kg vertically upwards to a height 2m and then shifts it horizontally through a distance of 4m .What is the work done against the force of gravity during [i] the vertical upward displacement[ii] the Horizontal displacement [g = 10 $\frac{\mathrm{m}}{\mathrm{s}^2}$]

SECTION C [3 MARKS]

[22] It is observed that, the centripetal force 'F' acting on a body executing circular motion depends mass 'm', velocity of the body 'v' and radius of the circular path 'r'. By the method of dimensions, derive the expression for Centripetal force

[23] A wooden block of mass 10g is dropped from the top of a cliff 100m high. Simultaneously, a bullet of mass 10g is fired from the foot of the cliff vertically upwards with a velocity 100m/s. After what time the bullet and the block meet?[g = 9.8$\frac{\mathrm{m}}{\mathrm{s}^2}$]

OR

The engine of motor cycle can produce maximum acceleration of 5m/s^2.lts brakes can produce a maximum retardation of l0m/s^2.What is the minimum time in which it can cover a distance of 1.5km?

[24] A dive bomber, diving at an angle of 53° with the vertical release a bomb at an altitude of 3000m.The bomb hits the ground 5s after being released [i] what is the speed of the bomber? [ii] How far did the bomb travel horizontally during its flight ? [Given: cos37° =0.8 and sin 37° =0.6, g= 10 m/s^2]

[25] What is a projectile ? Derive the expression for [i] time taken to reach the maximum height , [ii]maximum height reached [iii] horizontal range

[26] A bullet mass 0.01kgm is fired from a gun of mass 5kg with a velocity 100m/s. Find the velocity of recoil of the gun. Find the force require to stop the gun in a distance of 0.4m.

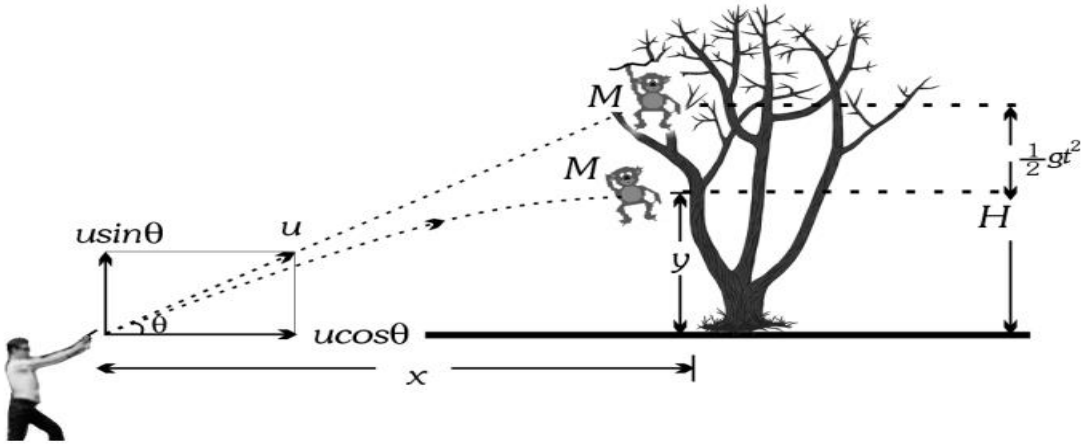
[27] [i] What is impulse. [ii] Show that impulse is equal to change in momentum.

[28] State and derive work energy theorem.

SECTION D[4 MARKS] CASE STUDY

[29] A hunter aims his gun and fires a bullet directly towards a monkey sitting on a distant tree. If the monkey remains in his position, he will be safe but at the instant the bullet leaves the barrel of gun, if the monkey drops from the tree, the bullet will hit the monkey because the bullet will not follow the linear path. The path of motion of a bullet will be parabolic and this motion of bullet is defined as projectile motion. If the force acting on a particle is oblique with initial velocity then the motion of particle is called projectile motion.

Find the followings…



[i] With reference to the diagram above, what is the horizontal component of the velocity of the bullet just before the bullet hit the monkey .

[a] equal to usinθ [b] greater than usinθ [c] equal to ucosθ [d] greater than ucosθ

[ii] If the bullet didn't hit the monkey, the bullet will follow a parabolic path. Let the maximum height reached is 'H'. Then at what point , the velocity of the bullet becomes perpendicular to the acceleration due to gravity.

[a] at H [b] at $\frac{H}{2}$ [c] at $\frac{H}{4}$ [d] at $\frac{H}{3}$

[iii] If the velocity of the bullet is 10m/s and the angle of projection is 45^0,then what is the range of the bullet ? [g = $10\frac{m}{s^2}$]

[a] 5m [b] 10m [c] 15 m [d] 20m

OR

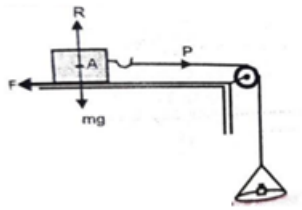
An athlete throws a javelin with an angle of projection 50^0,covers a horizontal distance of 70m.What should be the other angle of projection with the same velocity to get the same range of 70m.

[a] $20^0[b]30^0$ $[c]$ $40^0[d]60^0$

[iv] For an object thrown at 45^0 to horizontal , the maximum height [H] and horizontal range [R] are related as

[a] R = 16 H
[b] R = 8 H
[c] R = 4 H
[d] R = 2H

[30] To verify the laws of limiting friction, We take a wooden block A of weight 2N. This block is placed on a horizontal table provided with a frictionless pulley on one side. One end of a string is attached to the hook of the block. The string is then passed over the pulley and a pan is attached to the free end of the string. Any number of weights can be added to the pan. We added the weight one by one like 4N,8N and 10N ,14N --- and when the weight added is 10N, the body just begins to move.



[i] Laws of friction states that

[a] limiting friction is neither created nor destroyed

[b] limiting friction is directly proportional to normal reaction

[c] friction is inversely proportional to normal reaction

[d] limiting friction does not depends on normal reaction

[ii] In the above experiment, what is the magnitude of limiting friction ?

[a] 8N [b] 10N [c] 14N [d] 4N

[iii] A block of given mass is held against a wall by applying a horizontal force of 5N on the block. If the coefficient of friction between the block and the wall is 0.3N, Find the magnitude of the frictional force acting on the block ?

[a] 0.5N [b]1N [c] 1.5N [d] 2N

OR

A body of mass 50kg is kept on a horizontal surface of coefficient of static friction 0.5. Find the least horizontal force required to just start the motion.

[g = 10 $\frac{m}{s^2}$]

[a] 210N [b] 198 N [c] 250N [d] 225N

[iv] Which one is easier ? To pull a lawn mover or to push a lawn mover by applying same force 'F' in both the cases.

[a] pull , because the frictional force acting is μ{ mg- FsinΘ}

[b] pull , because the frictional force acting is μ FcosΘ

[c] push , because the frictional force acting is μ mg

[d] push , because the frictional force acting is μ R

SECTION E [5 MARKS]

[31] [a] What are the 2 uses of velocity- time graph

[b] Using the velocity- time graph, derive the equations of motion:

[i] $v^2 = u^2 + 2as$

[ii] S = ut + $\frac{1}{2}$ at^2

[c] Two bodies of masses 20 kg and 30 kg are dropped from the top of a tower of height 50 m simultaneously. Which body will reach the ground first. Why?

OR

[a] What is the use of displacement- time graph ?

[b] With the help of velocity- time graph , derive the equation V = u + at

[c] A body starts from rest accelerates uniformly along a straight line at the rate of 6m/s^2 for 5s. lt then moves for 4s with uniform velocity. Then retarded

uniformly and comes to rest in 6s [i]Draw a velocity —time graph of the body [ii] find the retardation produced during its journey

[32] [a]What is a projectile?

[b] Show that the path traced by a projectile is a parabola.

[c] A projectile is thrown upwards with an initial horizontal component of velocity 4 cos 30^0,What is its corresponding vertical component of velocity.

OR

[a] A body which is in uniform circular motion is accelerated or not ? Why?

[b] Derive an expression to find the centripetal acceleration acting on a body of mass 'm' when it is executing circular motion of radius 'r' with speed 'v'

[33][a] Derive the expression for the maximum velocity with which a vehicle can turn on a banked road.

[b] What is the advantage of banked road than a level road

OR

[a] Derive an expression to find the maximum safe speed with which a vehicle can turn on a level road.

[b] What is limiting friction ?

[c] A car is moving along a level road at a speed of 72km/h. Find the shortest distance in which the car can be stopped by switching off the engine. Given: Co-efficient of rolling friction between the road and the tyre =0.4, g = 10 $\frac{m}{s^2}$