21K-3186
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BS(CS) Sec: J

Answer 1:

Data:

a) $V_0 = 15 m/s$

At 1s: $y = ?$ $t = 1s$

$V_f = ?$

At 4s: $y' = ?$

$V_f' = ?$

$t' = 4s$

b)

$V_f = ?$

$y = 5m$

c)

$y_{max} = ?$

d)

at max height $a_y = ?$

Solution:

a) At 1s:

$$y = v_0 t - \frac{1}{2} g t^2 \qquad \therefore \left\{\begin{matrix} v_i = v_0 \\ a = -g \\ s = y \end{matrix}\right\}$$

$$y = (15)(1) - \frac{1}{2}(9.8)(1)^2$$

$$y = 15 - 4.9$$

$$\boxed{y = 10.1\,m}$$

$$v_f = v_i + at$$
$$v_f = v_0 - gt$$
$$v_f = 15 - (9.8)(1)$$
$$\boxed{v_f = 5.2\,m/s}$$

At 1 s, the ball's position is 10.1 m and ball's velocity is 5.2 m/s after leaving the hand.

At 4s:

$$y' = v_0 t' - \frac{1}{2} g t^2$$

$$y' = 15(4) - \frac{1}{2}(9.8)(4)^2$$

$y' = 60 - 78.4$

$\boxed{y' = -18.4m}$

$vf = v_i + at$

$v_f' = v_o - gt'$

$v_f' = 15 - (9.8)(4)$

$\boxed{v_f' = -24.2 m/s}$

At 4 s, the ball's position is −18.4m and ball's velocity is −24.2 m/s after leaving the hand.

b)

$2aS = v_f^2 - v_i^2$

$\because a = -g, \quad v_i = v_o, \quad S = y = 5m$

$-2gy = v_f^2 - v_o^2$

$v_o^2 - 2gy = v_f^2$

$vf^2 = (15)^2 - 2(9.8)(5)$

$v_f^2 = 127$

$\sqrt{v_f^2} = \sqrt{127}$

$\boxed{v_f = 11.27 m/s}$

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c)

$$2as = v_f^2 - v_i^2$$

Here

$a = -g$, $S = y_{max}$, $v_i = v_0 = 15$

at maximum height $v_f = 0$.

$$-2g\,y_{max} = 0 - (15)^2$$

$$-2g\,y_{max} = -225$$

$$y_{max} = \frac{-225}{-2g}$$

$$y_{max} = \frac{225}{2(9.8)}$$

$$\boxed{y_{max} = 11.48m}$$

The maximum height reached by ball is 11.48m.

d)

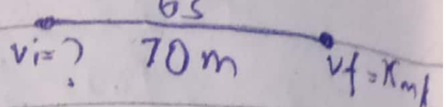
At maximum height the ball's acceleration is $-9.8m/s^2$ as it is constant.

$$a_y = -g$$

$$\boxed{a_y = -9.8m/s^2}$$

Answer 2:

Data:



$S = 70m$

$t = 6s$

$v = 15 m/s$

$u = ?$

$a = ?$

Solution a) For u: (initial velocity)

$S = \bar{v}t$

$S = \left(\frac{u+v}{2}\right)t$

$\frac{S}{t} = \frac{u+V}{2}$

$\frac{2S}{t} - V = u$

$u = \frac{2(70)}{6} - 15$

$\boxed{u = 8.333 m/s}$ The speed of antelope at first point is 8.33m/s

b) For acceleration (a):

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

$\because u = v - at$

By solving

$S = vt - \frac{1}{2}at^2$

$70 = (15)(6) - \frac{1}{2}a(6)^2$

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$$\frac{1}{\cancel{2}} a(\cancel{36}^{18}) = 90 - 70$$

$$18a = 20$$

$$a = 20/18$$

$$\boxed{a = 1.11 m/s^2}$$

Its acceleration is $1.11 m/s^2$.

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Answer: 3

Data:

$h = 0.440\,m$

a) $u = ?$

$v = 0\ m/s$

b) Total time in air $= T = ?$

Solution:

a) We know that,

$2aS = v_f^2 - v_i^2$

$\therefore a = -g,\ S = h,\ v_f = v,\ v_i = u$

$-2gh = v^2 - u^2$

$u^2 = v^2 + 2gh$

$u^2 = (0)^2 + 2(9.8)(0.440)$

$u^2 = 8.624$

$\sqrt{u^2} = \sqrt{8.624}$

$\boxed{u = 2.94\,m/s}$

The initial speed of the flea when it left the ground was $2.94\ m/s$

b) $v_f = v_i + at$

$\therefore v_f = v,\ v_i = u,\ a = -g$

$v = u - gt$

$0 = 2.94 - 9.8t$

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$$9.8t = 2.94$$

$$t = \frac{2.94}{9.8}$$

$$\boxed{t = 0.3 s}$$

This is the time to reach the height of 0.440m.

To reach the ~~ground~~ initial position it will take same time. So, total time in air will be

$$T = 2(t)$$

$$T = 2(0.3)$$

$$\boxed{T = 0.6 s}$$

The flea was 0.6s in the air.

Answer 4

Velocity vector:

$\vec{v} = v_x \hat{i} + 0 \hat{j}$

$\boxed{\vec{V} = V\cos\theta \hat{i} + 0 \hat{j}}$ $\therefore V_y = 0$ at max height

Speed:

~~The~~ Its speed is equal to magnitude of ~~the~~ velocity vector.

Acceleration Vector.

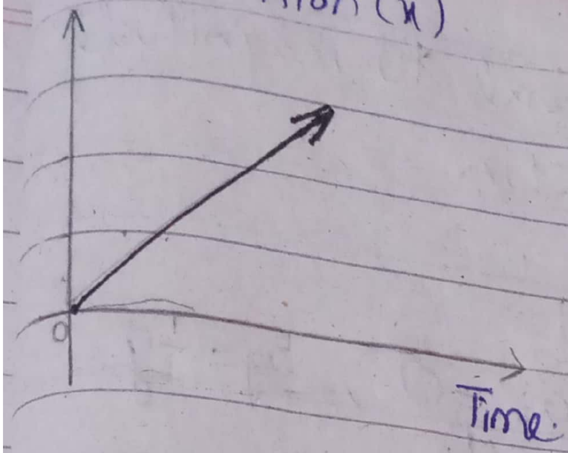
we know that $a_x = 0$, $a_y = -g$

$$\boxed{\vec{a} = 0\hat{i} - 9.8\hat{j}}$$

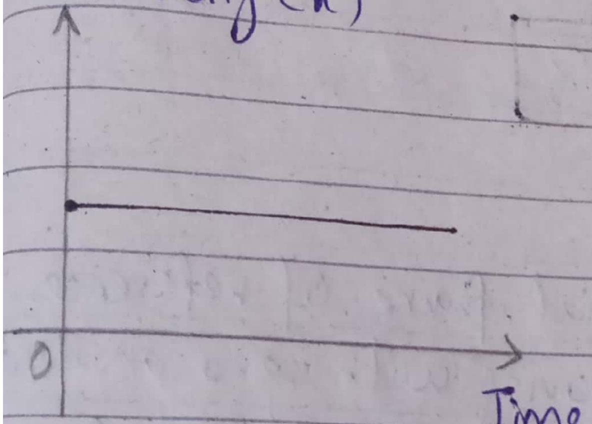
Answer 5

x-component

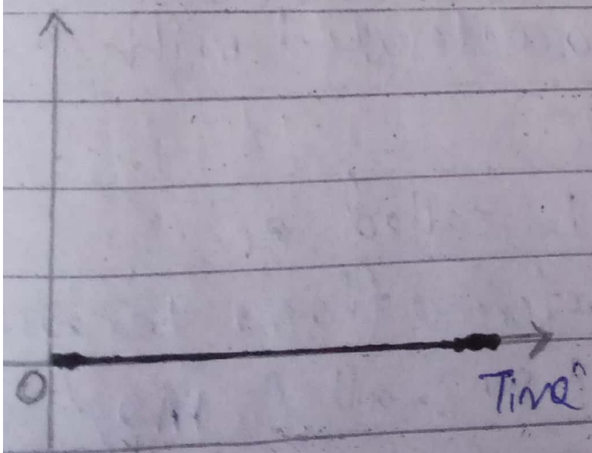
Position (x)



Velocity (x)

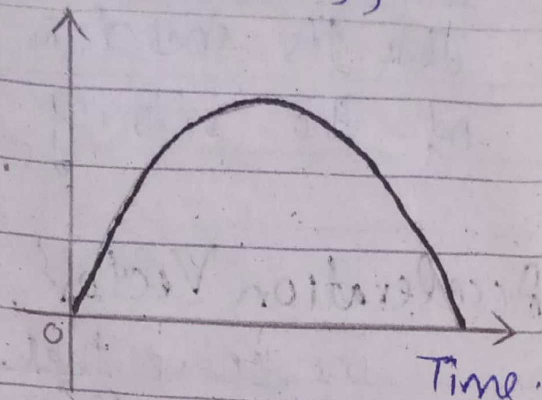


Acceleration (x)

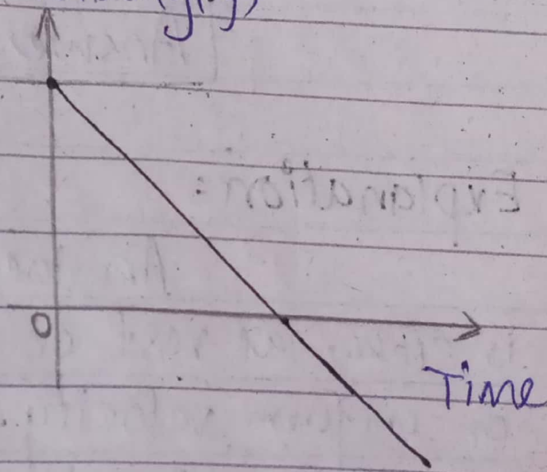


y-component

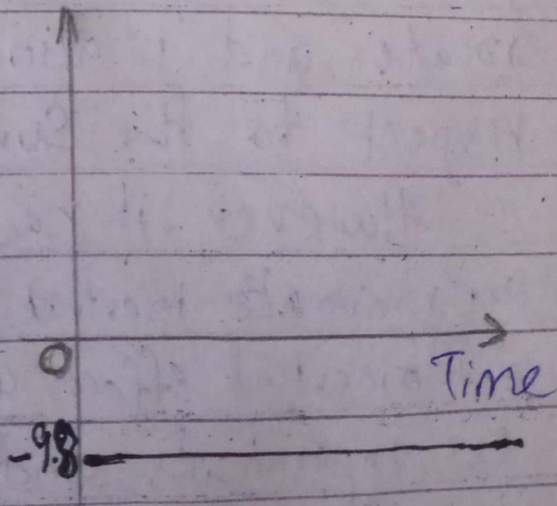
Position (y)



Velocity (y)



Acceleration (y)



Answer : 6

Data:

For equipment:

$V_0 = 15 m/s$

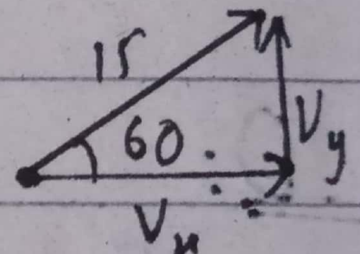
$\theta = 60^\circ$

$y = -8.75 m$

For ship

$V' = 45 \, cm/s$

$V' = \frac{45}{100} = 0.45 \, m/s$



Solution:

$$y = (V_0 \sin\theta)t - \frac{1}{2}gt^2$$

$$-8.75 = (15 \sin 60)t - \frac{1}{2}(9.81)t^2$$

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$$-8.75 = 12.99t - 4.905t^2$$

$$4.905t^2 - 12.99t - 8.75 = 0$$

$$t = \frac{-(-12.99) \pm \sqrt{(-12.99)^2 - 4(4.905)(-8.75)}}{2(4.905)}$$

$$t = \frac{12.99 \pm 18.45}{9.81}$$

Either

$$t = \frac{12.99 + 18.45}{9.81} \quad \text{or} \quad t = \frac{12.99 - 18.45}{9.81}$$

$$\boxed{t = 3.20s} \qquad t = -0.5s$$

$$x = (V_o \cos\theta)t$$

$$x = (15\cos 60^\circ)(3.20)$$

$$x = (7.5)(3.20)$$

$$\boxed{x = 24m}$$

$$S = V't$$

$$S = (0.45)(3.20)$$

$$\boxed{S = 1.44m}$$

For D:

$$D = x + S$$

$$D = 24 + 1.44$$

$$\boxed{D = 25.44m}$$

The ship should 25.44m from the dock.

Answer 7.

When we fly in an airplane and the plane moves with constant velocity. So we (sitting in the plane) are in inertial frame of reference) and cannot sense the motion of plane until the velocity changes.

Secondly, at night, mostly we cannot see anything outside the plane except darkness. So, we cannot refer to anything as stationary or moving object, this makes us believe that we are stationary.

Also,
When airplane is flying in smooth air, there will be less movement of air, which results ~~to~~ in less friction between ~~air~~ and airplane. Due to this there will be less vibration hence we fell no sense of motion.

Answer 8

Explanation:

An inertial frame of reference is either at rest or moving with zero acceleration or uniform velocity. In an inertial frame of reference, Newton's laws are valid.

Earth cannot be called an inertial frame of reference because the Earth rotates and is also accelerated with respect to the Sun.

However, it can be called an approximate inertial reference frame because ~~most~~ inertial effects are so small for most of our experiments ~~and~~ acceleration due to Earth's rotation and orbiting around the Sun is negligible compared to the acceleration due to gravity.

Answer 9

No.

Explanation:

Equilibrium means that the net effect of all forces acting on an object is zero or the net acceleration of the object is zero.

there will be no force to cancel it

If a force acts on an object, then object will have some acceleration so it will not be in equilibrium.

If the force acting on the ~~object~~ object is zero, then its acceleration will have to be zero (because mass cannot be zero). So Technically, there will be no force acting on the object.

Answer 10:

Spaceship will continue to move with the same velocity i.e 1x104 m/s.

Explanation:

The spaceship is in space and far from all other objects. Since there is no gravity ~~IA~~ ~~space~~ there, hence no force will be acting on the spaceship. So according to Newton's first law of motion it will maintain its velocity.