PHYS 215 - Mechanics I - Remake Quiz

2019-2020

Full Name:..... KEY

Note: Each Question is 2 marks.

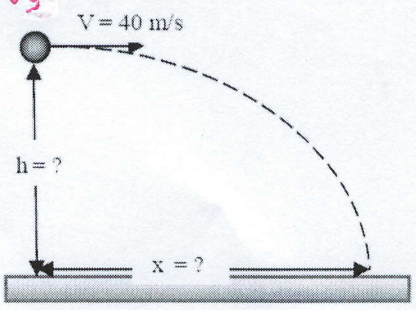
Question 1

A ball is horizontally thrown with a speed of 40 m/s as shown in the figure. The ball falls down in 3 seconds. (Take g= - 10 m/s^2)

A) Calculate the distance x.

B) Calculate the hight, h=?

$V_{y_0}=0$ at max height.



a) $X = V_x \cdot t_{fall}$

$V_x = 40$ m/s

$t_{fall} = 3$s

$= 40\frac{m}{s} \cdot 3s$

$X = 120$m

$\Delta y = h = V_{y_0} t_{fall} + \frac{1}{2} g t_{fall}^2$

$\Delta y = h = 0 + \frac{1}{2}(-10)3^2$

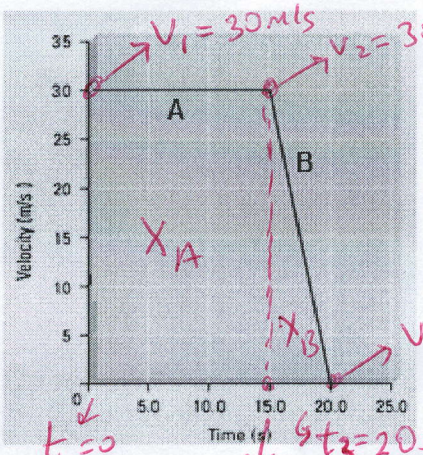
$h = -45$m

Question 2

The graph below shows the change in the velocity of a car with time.

A) Calculate the distance taken by the car for 20 seconds.

B) Calculate the acceleration of the car for a) 0 - 15 seconds and b) 15 – 20 seconds.



A) $X_A = 30 \times 15 = 450$m

$X_B = \frac{30 \cdot (20-15)}{2}$

$X_B = \frac{30 \cdot 5}{2} = 75$m

The area under the v-t graph gives the distance taken.

$X_T = X_A + X_B = 450 + 75$

$= 525$m

B) $a = \frac{\Delta v}{\Delta t} \Rightarrow a_A = \frac{V_2 - V_1}{t_2 - t_1} = \frac{30-30}{15-0} = 0$ m/s^2

$a_A = 0$

$a_B = \frac{V_3 - V_2}{t_3 - t_2} = \frac{0-30}{20-15} = \frac{-30}{5}$

$a_B = -6\frac{m}{s^2}$

Question 3

A ball thrown up with an initial velocity of 20 m/s.

A) How long does it take the ball take to reach its maximum height?

B) What is the max height the ball reaches?

$V_{y_0} = 20$ m/s

A) $V_{yf} = V_{y_0} + gt$

$V_{yf} = 0 = 20 + (-10)t$

$-20 = -10t \Rightarrow t = \frac{-20}{-10} = 2$s

$t = 2$s

B) $\Delta y = h = V_{y_0} t + \frac{1}{2} g t^2$

$= 20 \cdot 2 + \frac{1}{2}(-10)2^2$

$= 40 - 20$

$\Delta y = 20$m

Question 4

A car initially at rest starts to move with a constant acceleration of 4 m/s^2. If it accelerates for 12 seconds,

A) How far will it move during this time?

B) What will be its final velocity?

$V_{x0} = 0 \quad a = 4\,m/s^2 \quad t = 12s$

A) $\Delta x = v_{x0}\cancel{t^0} + \frac{1}{2}at^2 = \frac{1}{2}4(12)^2$

$\boxed{\Delta x = 288\,m}$

B) $V_{xf} = \cancel{V_{x0}^0} + at$

$\boxed{V_{xf} = 4 \cdot 12 = 48\,m/s}$

Question 5

The position of a particle moving on an x axis is given by $\mathbf{x = 4t^2 - 6t + 10}$

A) Find the velocity of the particle at t = 2 s?

B) Find the acceleration of the particle.

A) $V = \frac{dx}{dt} = \frac{d(4t^2 - 6t + 10)}{dt}$

$V = 8t - 6 \Rightarrow$ at $t = 2s$ $\quad V = 8.2 - 6 = 16 - 6$

$\boxed{V = 10\,m/s}$

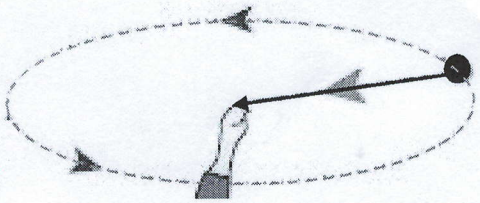
B) $a = \frac{dv}{dt} = \frac{d(8t-6)}{d} = 8$ $\quad \boxed{a = 8\,m/s^2}$

Question 6

A ball rotates at a constant speed of 2 m/s at the end of 2 m long string. The string makes a horizontal circle.

A) Calculate the centripetal acceleration of the ball

B) Calculate the period of the motion.



A) $a_c = \frac{v^2}{R}$ $\quad \boxed{a_c = \frac{2^2}{2} = 2\,m/s^2}$

B) $T = ?$ $\quad v = \frac{x}{T} \Rightarrow T = \frac{x}{v} = \frac{2\pi r}{v}$

$T = \frac{2 \cdot (3.14) \cdot \cancel{2}}{\cancel{2}} = 6.28\,s$

Question 7

The position vector for a particle is initially $\vec{r}_i = (-4.0\,m)\hat{i} - (1.0\,m)\hat{j} + (2.0\,m)\hat{k}$

and then later is $\vec{r}_f = (3.0\,m)\hat{i} - (1.0\,m)\hat{j} + (3.0\,m)\hat{k}$

What is the particle's displacement $\vec{r}$ from $\vec{r}_i$ to $\vec{r}_f$?

$\Delta r = r_f - r_i = (x_f - x_i)\hat{i} + (y_f - y_i)\hat{j} + (z_f - z_i)\hat{k}$

$= (3 - (-4))\hat{i} + (-1 - (-1))\hat{j} + (3 - 2)\hat{k}$

$= 7\hat{i} + 0\hat{j} + \hat{k}$

$\boxed{\Delta r = 7\hat{i} + \hat{k}}$