Mechanics I - Question Bank – 9

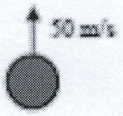
2018-2019 Fall Semester – 20/12/2018

KEY

Full name: .....

Question 1

A ball is thrown upward as in the figure with an initial velocity of 50 m/s. (Take g= 10 m/s²)



a) How much time does it take to reach the highest point?
b) What is the max high that the ball can reach?
c) What is the velocity of the ball after 7 seconds?
d) What is the position of the ball after 7 seconds?

$\downarrow g = -10 \frac{m}{s^2}$

a) $V_f = 0$, $t = ?$

$V_f = V_0 + g t$

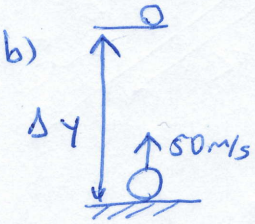
$0 = 50 + (-10) \cdot t$

$t = \frac{-50}{-10} = 5\,s$

$\boxed{t = 5s}$

$V_0 = \uparrow 50 m/s$

b)



$\Delta y = V_0 \cdot t + \frac{1}{2} g t^2$

$\Delta y = 50 \cdot 5 + \frac{1}{2}(-10)(5)^2$

$= 250 - 125$

$= 125 m$

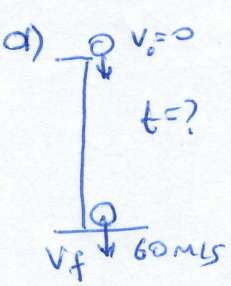
c) $V_f = V_0 + (-10) t$

$V_f = 50 - 10 \cdot 7 = -20$

Question 2

A stone falls off a tall building and hits the ground with 60 m/s. (Take g= 10 m/s2)
a) How much time does it take to hit the ground?
b) What is the velocity of the stone just after 3 seconds from the beginning?
c) How high is the building?

a)



$V_f = V_0 + g t$

$V_f = (-10) \cdot t$

$-60 = -10 \cdot t$

$t = \frac{60}{10} = 6s$

b) $V_f = V_0 + g t$

$V_f = 0 + (-10) \cdot 3$

$V_f = -30 m/s$

c) $\Delta y = V_0 \cdot t + \frac{1}{2} g t^2$

$= \frac{1}{2}(-10) \cdot 6^2$

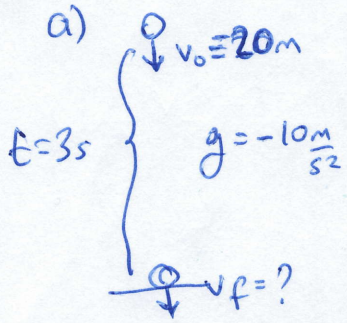
$\Delta y = -180 m$

$h = 180 m$

Question 3

An object is thrown downward with an initial velocity of 20 m/s. It hits the ground after 3 seconds.
a) What is the velocity of the object when it hits the ground? (Take g= 10 m/s2)
b) How many meters does it fall down?

a)



$V_f = V_0 + g t$

$= -20 + (-10) 3$

$V_f = -50 m/s$

b) $\Delta y = V_0 \cdot t + \frac{1}{2} g t^2$

$= -20 \cdot 3 + \frac{1}{2}(-10) 3^2$

$= -60 + (-5) \cdot 9$

$= -60 - 45$

$= -105 m$

$h = 105 m$

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Question 4

A ball thrown vertically upward with an initial velocity of 40 m/s, after 3 s what will be the final velocity?

v_f ↑ =?

$t=?$ $\quad g=-10\frac{m}{s^2}$

v_0 ↑ $40\frac{m}{s}$

$v_f = v_0 + gt$

$= 40 + (-10)\cdot 3$

$= 40 - 30 = 10\ m/s$

Question 5

An object is thrown upward. It reaches the highest point in 6 seconds. (Take g= - 10 m/s2)

a) What is the initial velocity of the object?

b) What will be the final velocity of the object after 10 seconds from the beginning?

c) What will be the height of the object after 10 seconds from the beginning?

a) $v_f = 0$, $t = 6s$, h, v_0 ↑

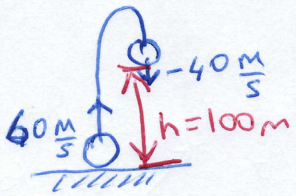
$v_f = v_0 + gt$

$0 = v_0 + (-10)\cdot 6$

$v_0 = 60\ \frac{m}{s}$

b) $v_f = v_0 + gt$

$v_f = 60 + (-10)\cdot 10 = 60 - 100 = -40\ m/s$



c) $\Delta y = v_0 t + \frac{1}{2} g t^2$

$\Delta y = 60\cdot 10 + \frac{1}{2}(-10)\,10^2$

$= 600 - 5\cdot 100$

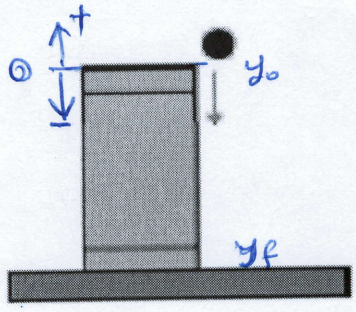
$= 600 - 500 = 100\ m$

Question 6

A stone falls off a tall building and hits the ground 5 seconds later. (Take g= - 10 m/s2)

a) How high is the building?

b) What is the velocity of the stone when it hits on the ground?



a) $v_0 = 0$ $\quad g = -10\frac{m}{s^2}$ $\quad t = 5s$

$\Delta y = y_f - y_0 = v_{y_0} t + \frac{1}{2}(-10)\cdot t^2$

$-y_0 = -5(5)^2 = -125$

$y_0 = 125$ from the ground

b) $v_{yf} = v_{y_0} + gt$

$v_{yf} = v_{y_0} + (-10)\cdot 5 \Rightarrow v_{yf} = -50\ \frac{m}{s}$