Problem Set #4 2019-2020

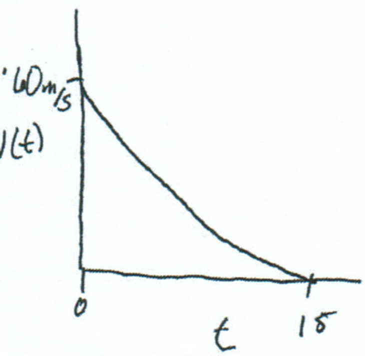
1. Average velocity is equal to the total displacement of the object from its starting point divided by the time it took the object to get there. It only accounts for when and where the object started its movement and where and when the object stopped its movement. It does not look at anything that happened in between the start and finish. Anything could have happened in the middle, including stopping.

   The instantaneous velocity is the velocity at a specific point in time. Therefore it could be zero and the average velocity could be non-zero.

1. $V_0 = 60.0\,m/s$ at $t_0 = 0s$, $V_f = 0\,m/s$ at $t_f = 15s$

2.

a.



b. $a = \dfrac{V_f - V_0}{t_f - t_0} = \dfrac{0 - 60}{15 - 0} = \dfrac{-60}{15} = \boxed{-4\,m/s^2}$

c. Negative sign means that the spaceship is slowing down in the positive direction.

1. 3.

3. 13.0 km in 2.00 hrs, 6.5 km/hr

2. stops for 15 minutes, 0 km/hr, 0 km, ↳ 0.25hr

1. 35.0 minutes, 85 km/hr, 49.58 km

a. $\Delta X_{tot} = X_1 + X_2 + X_3 = 49.58 + 0 + 65$
$= \boxed{114.58\ km}$

b. $V_{avg} = \dfrac{\Delta X_{tot}}{\Delta t_{tot}} = \dfrac{114.58\,km}{2.833\,hr} = \boxed{40.44\,km/hr}$

$\Delta t_{tot} = 0.583\,hr + 0.25\,hr + 2.00\,hr$
$= 2.833\ hr$

1. Need to change time to hours

$t = \dfrac{35\,min.}{} \Big| \dfrac{1\,hour}{60\,minutes} = 0.583\ hrs$

displacement equals velocity x time

$X = V \cdot t = 85\,km/hr \cdot 0.583\,hrs$
$= 49.58\ km$

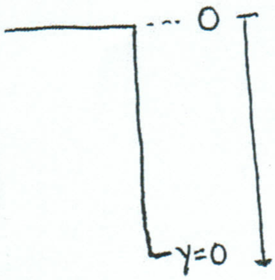
2. change time to hours

$t = \dfrac{15\,min}{} \Big| \dfrac{1\,hour}{60\,min.} = 0.25\,hr$

3. velocity = displacement / time

$V = \dfrac{13\,km}{2.00\,hr} = 6.5\,km/hr$

4



time

$y(t) = y_0 + V_0 t + \frac{1}{2}at^2$

$\underset{\text{where we end up}}{0} = \underset{\text{where we start}}{20} + 0 \cdot t + \frac{1}{2}(-9.8)t^2$

$0 = 20 - 4.9t^2$

$\frac{-20}{-4.9} = \frac{-4.9t^2}{-4.9}$

$\sqrt{4.08} = \sqrt{t^2}$

$\boxed{2.02s = t}$

Final Velocity

$V_f = V_0 + at$

$V_f = 0 + (-9.8)(2.02)$

$\boxed{V_f = -19.8 \text{ m/s}}$

5.

$V_0 = 20 \text{ m/s}$ $\longrightarrow$ $a = 2 \text{m/s}^2$ $\cdots\cdots\rightarrow$ $V_f = 60 \text{ m/s}$

$V_f^2 = V_0^2 + 2a\Delta S$

$(60)^2 = (20)^2 + 2 \cdot 2 \cdot \Delta S$

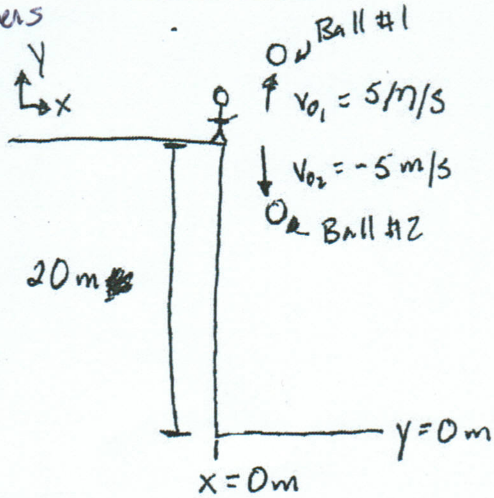
$3{,}600 = 400 + 4\Delta S$

$-400 \quad -400$

$\frac{3{,}200}{4} = \frac{4\Delta S}{4}$

$800m = \Delta S$

6. CHrens



Ball #1: Need to find how high the ball goes before it comes down. It comes down after reaching its peak. To find how high it goes first we need to find the time the ball reaches its peak...

at max/peak height $V=0$

$$V(t_{max}) = V_0 + a t_{max} \qquad a = -9.8\ m/s^2$$

$$0 = 5 + (-9.8)\, t_{max}$$

$$-5 = -9.8\, t_{max}$$

$$0.51 = t_{max}$$

put t_{max} in displacement eqn along with other initial conditions

$$Y(t) = Y_0 + V_0 t + \tfrac{1}{2} a t^2$$

$$Y(t=0.51) = 20 + 5 \cdot 0.51 + \tfrac{1}{2}(-9.8)(0.51)^2$$

$$Y_{max} = 21.28\ m$$ total height of Ball

<u>Ball #2 Final Velocity</u>

$$V_f^2 = V_0^2 + 2ax \qquad x = (Y_f - Y_0) = (0 - 20) = -20$$

$$V_f^2 = (5)^2 + 2 \cdot (-9.8)(-20)$$

$$V_f^2 = 25 + 392$$

$$\sqrt{V_f^2} = \sqrt{417}$$

$$\boxed{V_f = -20.42\ m/s}$$

Final Velocity for Ball #2 on next Page

<u>Ball #1 final velocity</u>

$$V_f^2 = V_0^2 + 2ax \qquad (Y_f - Y_0) = (0 - 21.28) = -21.28\ m$$

$V_0 = 0$, because we start falling down from the Y_{max} /peak

$$V_f^2 = (0)^2 + 2(-9.8)(-21.28)$$

$$V_f^2 = 0 + 417$$

$$\sqrt{V_f^2} = \sqrt{417} \rightarrow \boxed{V_f = -20.42\ m/s}$$