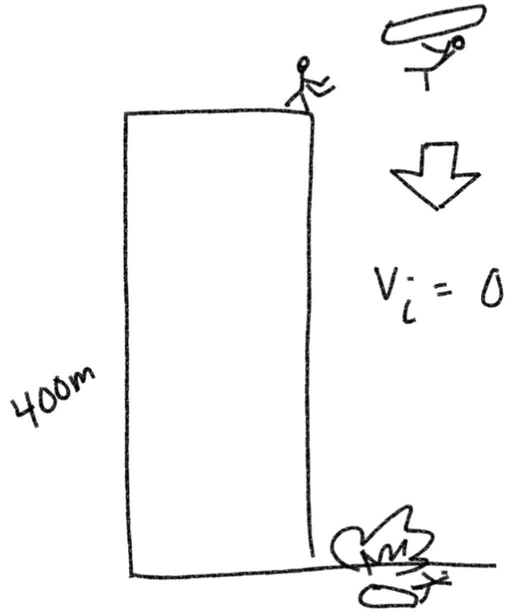
TH-GP General Physics Week 10 11/16



1.) Time to impact

2.) Velocity upon impact

Drop

$v_i = 0\,m/s \qquad y_f = y_0 + \cancel{v_i t}^{\,0} + \frac{1}{2}at^2$

$$0 = 400m + \frac{1}{2}(-9.80\,m/s^2)t^2$$

$$0 = 400m - 4.9\,m/s^2\,t^2$$

$$-400m \quad -400m$$

$$\frac{-400m}{-4.9} = \frac{-4.9\,m/s^2\,t^2}{-4.9}$$

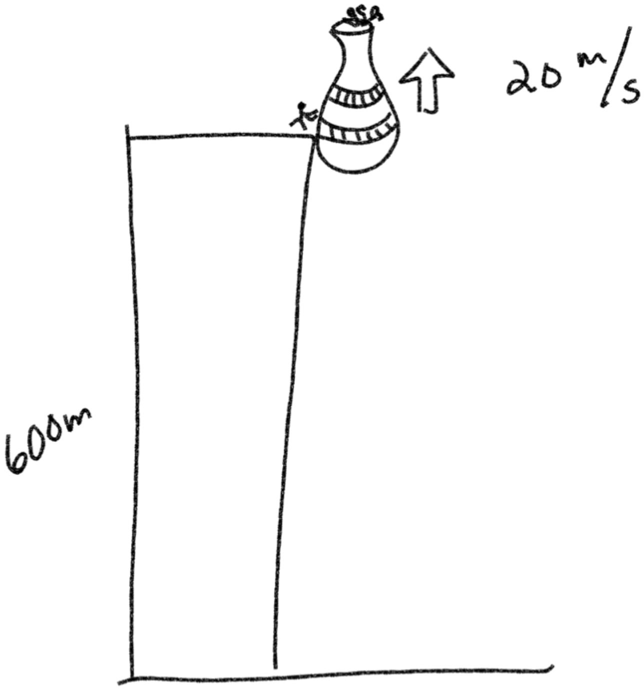
$$\sqrt{\frac{400}{4.9}} = \sqrt{t^2} \qquad t = \sqrt{\frac{400}{4.9}} = \boxed{9.03\,s}$$

Velocity upon impact

$$v_f = \cancel{v_i}^{\,0} + at$$

$$(-9.80\,m/s^{\cancel{2}})(9.03\,\cancel{s})$$

$$= \boxed{-88.5\,m/s^2}$$



1.) Time to max height

2.) Max height

3.) Time to impact [use Desmos]

4.) Velocity upon impact

$$y_f = y_0 + v_i t + \frac{1}{2}at^2$$

$$v_f = v_i + at$$

1 Time to max height $\qquad v_f = 0\,m/s$ @ max height

$$v_f = v_i + at$$

$$0 = 20 + (-9.8)t$$

$$-20 \quad -20$$

$$\frac{-20}{-9.8} = \frac{-9.8t}{-9.8}$$

$$\boxed{t = 2.04\,s}$$

2.) Find max height

$$y_f = y_0 + v_i t + \frac{1}{2}at^2$$

$$600 + 20(2.04) - 4.9(2.04)^2$$

$$\boxed{620.4\,m}$$

3.) Time to impact

Option #1: Use quadratic formula

option #2: Graph

$$y_f = y_0 + v_i t + \frac{1}{2} a t^2$$

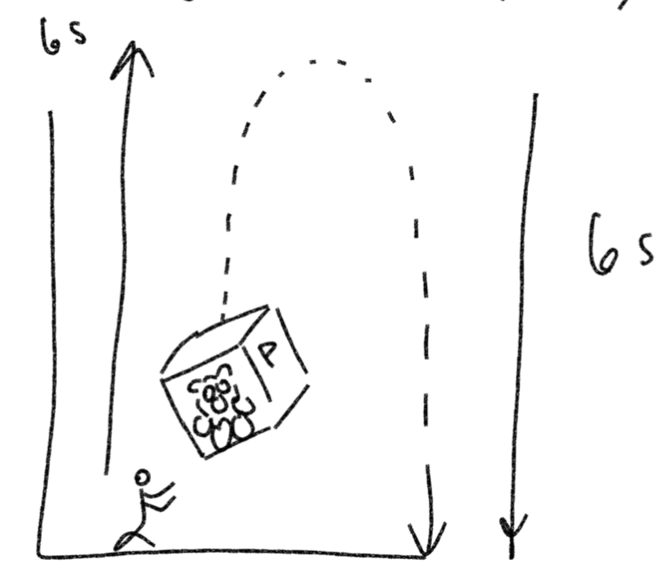
$$0 = 600 + \underline{\underline{20}}t - 4.9t^2 \qquad \boxed{13.3\,s}$$

4.) Velocity Upon Impact

$$v_f = v_i + at$$

max height

$$20 + (-9.8)(13.3s) = \boxed{-110\ m/s}$$



General Physics Chapter 1 & 2 Pre-Test

Please show work and **include units when available**. **Consider significant figures** when making your final answer. Please use a calculator.

1.) (3 pts total, 1 pt each) Provide the abbreviation and power of each prefix:

a) milli 10^{-3} m

b) kilo

c) centi

2.) (3 pts) What is the density of a metal with a mass of 98.2 g and a volume of 12.4 L?

$$D = \frac{M}{V} = \frac{98.2\,g}{12.4\,L} = \boxed{7.92\,g/L}$$

3.) (3 pts) How much of a compound do you have if it has a volume of 78.5 mL and a density of 14.1 g/mL?

4.) (3 pts) Use your knowledge of units to answer the following.

R represents the universal gas constant. Its units are $\frac{atm \cdot L}{mol \cdot K}$. If **P** corresponds to *atm*, **V** measured in *L*, **n** representing *mol*, and **T** corresponds to *K*. Each of these values are utilized within the ideal gas law. With this information, along with some algebra, Find what **P** is equivalent to.

$$R = \frac{atm \cdot L}{mol \cdot K} \qquad \frac{nT}{V}\left(R = \frac{P \cdot \cancel{V}}{\cancel{n} \cdot \cancel{T}}\right)\frac{\cancel{n}\,\cancel{T}}{\cancel{V}}$$

$$\boxed{P = \frac{RnT}{V}}$$

5.) (12 pts total, 3 pts each) Use your knowledge of dimensional analysis to answer the following.

a) Eric Dickerson holds the NFL record for rushing yards in a season with 2,105 yards. How many inches did he rush for?

b) In 2016, Mao Weidong of China set the world record for longest plank in history. He remained in the plank position for 8 hours and 1 minute. How many seconds to he remain in the plank position?

c) The deepest part of the ocean is called Challenger Deep, located near the end of the Mariana Trench in the Pacific Ocean. If it is 36,200 feet deep, how many centimeters is it to the bottom?

d) It is universally accepted that the Reese's Cup is the world's most perfect food. More specifically, the Reese's Peanut Butter Cup Pumpkin is… no words. Each pumpkin is 85 calories. If one pound of body weight is equivalent to 3500 calories, how much weight would you gain if you ate 25,000 peanut butter pumpkins?

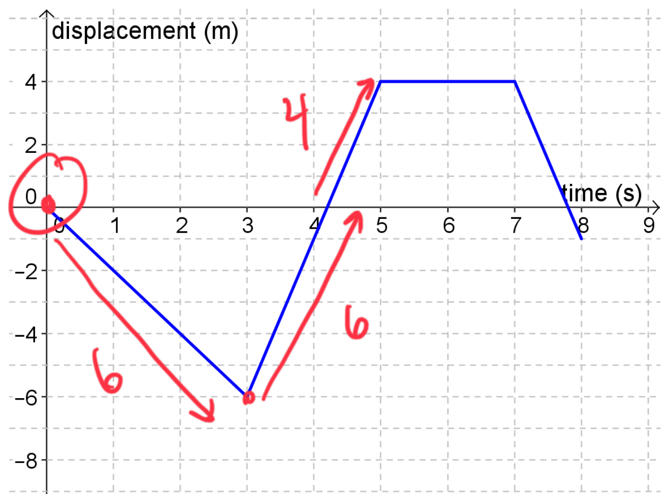
$$25{,}0\cancel{00}\text{ cups} * \frac{85\text{ cal}}{1\text{ cup}} * \frac{1\text{ lb}}{35\cancel{00}\text{ cal}} = \boxed{607\text{ lbs}}$$

6.) (3 pts) The Daytona 500 is a stock car race in which drivers complete 200 laps around a 2.5 mile oval track. What is the distance travelled by each stock car? What is the displacement? Explain your reasoning.

Distance: 2.5 mi (200) = $\boxed{\text{500 miles}}$

Displacement: $\boxed{\text{0 miles}}$

7.) (16 pts total, 2 pts each) Use the graph to answer the following. Assume three significant figures.



a) What is the displacement at time = 5.00 s?

$$\Delta X = X_f - X_i$$

$$4m - 0m = \boxed{4m}$$

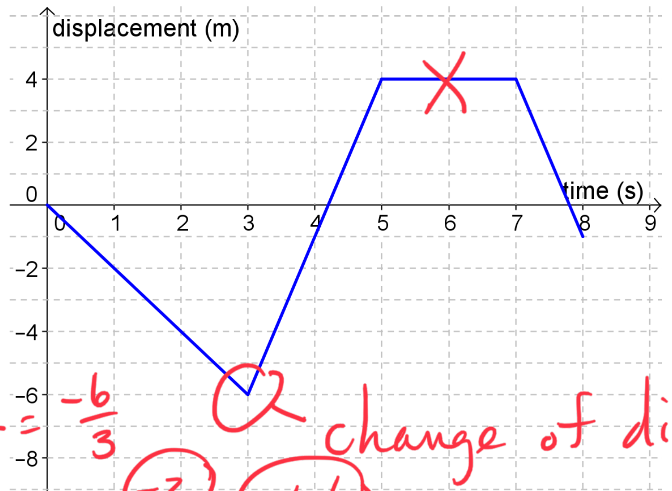
b) What is the distance at time = 5.00 s?

$$6m + 6m + 4m = \boxed{16m}$$

c) What is the average velocity at time = 6.00 s?

$$V = \frac{\Delta X}{\Delta t} = \frac{X_f - X_i}{t_f - t_i} = \frac{4m - 0m}{6s - 0s} = \frac{4}{6}\,\frac{m}{s}$$

$$\boxed{2/3 \text{ m/s}}$$



$V = \frac{\Delta x}{\Delta t} = \frac{x_f - x_i}{t_f - t_i}$

$\frac{-6-0}{3-0} = \frac{-6}{3}$

-2 $-2\ m/s$

change of direction

d) What is the average speed at time = 6.00 s?

$speed = \frac{distance}{time} = \frac{16\ m}{6\ s} = \boxed{\frac{8}{3}\ m/s}$

e) What is the instantaneous velocity at time = 6.00 s?

$\hookrightarrow$ slope $\boxed{0\ m/s}$

$\cap$ $\cup$

f) What occurred at time = 3.00 s?

change in direction

g) What is the average velocity at time = 3.00 s?

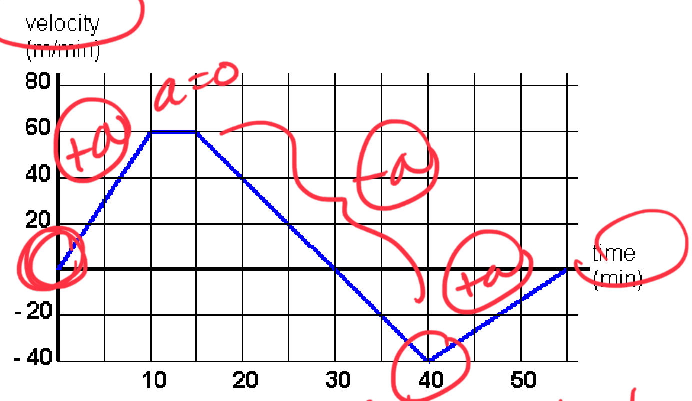
$\boxed{-2\ m/s}$

instant. velocity
$0\ m/s$

h) What is the instantaneous velocity at 2.00 s?

8.) (15 pts total, 3 pts each) Use the graph to answer each of the following. Assume 3 significant digits.

acceleration is the slope



0 m/min² instant acceleration

$\bar{v} = \frac{\Delta x}{\Delta t}$

a) Indicate on the graph where acceleration is positive, negative, and constant.

b) Find the average acceleration at t = 15 min.

$$\bar{a} = \frac{\Delta v}{\Delta t} = \frac{v_f - v_i}{t_f - t_i} = \frac{60\ m/min - 0\ m/min}{15\ min - 0\ min}$$

c) Find the instantaneous acceleration at t = 30 min.

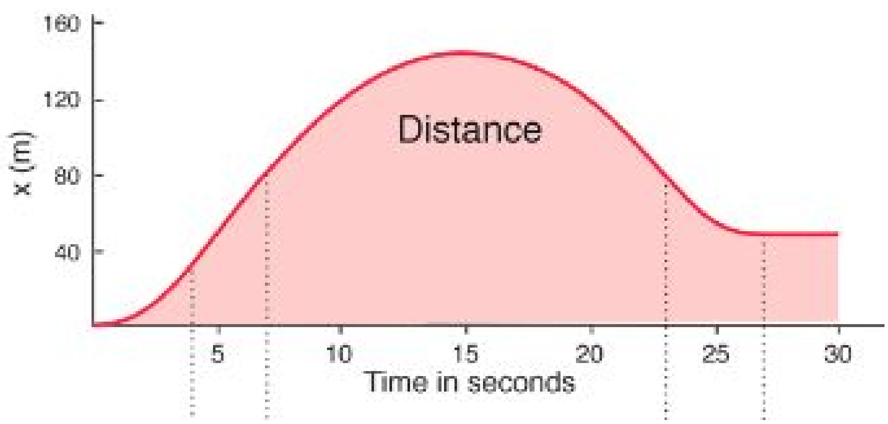
$$\frac{60}{15} = \boxed{4\ m/min^2}$$

d) Find the instantaneous acceleration at t = 40 min.

$$0\ m/min^2$$

e) Find the average acceleration at t = 25 min.

9.) (3 pts) Evaluate the graph. Label where velocity and acceleration are either positive or negative.



10.) (20 pts total, 4 pts each) Solve each. For each scenario, assume acceleration is constant. *Term breakdown will <u>not</u> appear on actual exam!*

a) An ambulance is 40.0 m from the hospital and heading away from it. If it starts at 3.50 m/s and accelerates at a rate of 2.80 m/s^2, how far away from the hospital will it be in 55.0 s?

$\boxed{x_i = 40.0\ m}$ $\boxed{v_i = 3.50\ m/s}$ $\boxed{a = 2.80\ m/s^2}$ $\boxed{t = 55.0\ s}$

x_i

v_i

a

t

$x_f = ?$

$x_f = x_i + v_i t + \frac{1}{2} a t^2$

With constant acceleration

$$v_{xf} = v_{xi} + a_x t$$

$$Av\ v_x = \frac{v_{xi} + v_{xf}}{2}$$

$$x_f = x_i + \tfrac{1}{2}(v_{xi} + v_{xf})t$$

$$x_f = x_i + v_{xi}t + \tfrac{1}{2}a_x t^2$$

$$v_{xf}^2 = v_{xi}^2 + 2a_x \underbrace{\boxed{(x_f - x_i)}}_{\Delta X} \qquad (V_f)^2 = (V_i)^2 + 2a\Delta X$$

Shhh....

1 inch = 2.54 ~~inches~~ cm