Physics Sem 1 Review Packet

Name KEY Date _____ Pd ____

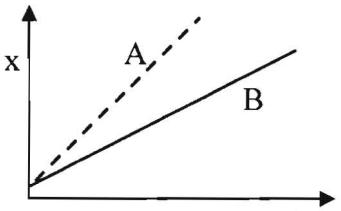
Vocabulary to know: (write down definitions, symbols used, units, formulas, etc.)

- position
- distance
- displacement
- speed
- velocity
- average velocity
- acceleration
- mass
- force
- "Total Force" (same as "Net Force"or "Resultant Force", ΣF)
- Force Normal
- Force Friction
- Force Tension
- Force Gravity
- Force Push/Pull
- Coefficient of Friction
- Vector
- Free fall
- Fundamental forces
  - Gravity
  - Electromagnetic
  - Strong Nuclear
- Specific Equation

see your packets and/or physicsclassroom.com

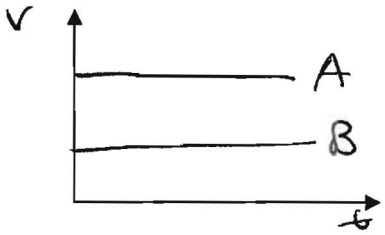
If the total force on an object is zero (balanced), then the object will not speed up, slow down, or change direction. In other words, its velocity will be constant and its acceleration will be zero. This is also known as Newton's 1st Law of Motion.

If the total force on a system is doubled, but the system's mass remains constant, then the acceleration that the system experiences will double. If the system's mass doubles, but the total force on the system remains constant, then the system's acceleration will be half as much. The more general form of this relationship is known as Newton's 2nd Law of Motion: **a** = F/m, or stated another way, **ΣF** = $m \cdot a$



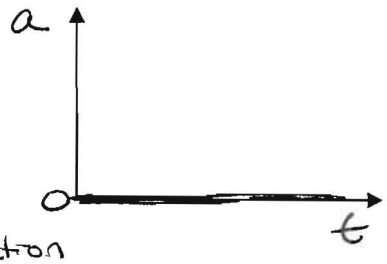
What does the **slope** represent?
velocity

Draw a **v** vs. **t** graph for A & B.



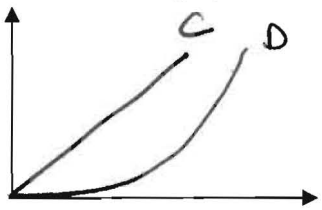
What does the **slope** represent? acceleration
What does the **area** represent? displacement

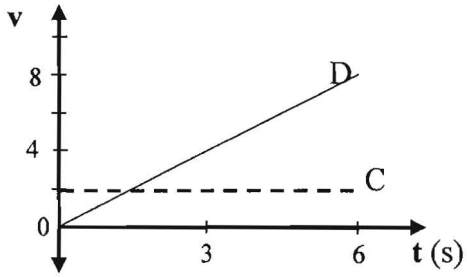
Draw an **a** vs. **t** graph for A & B.



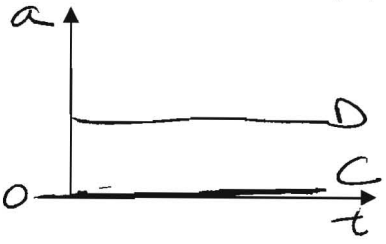
- Is the total force, ΣF, on A positive, negative, or zero? ...object B? How do you know?
  both — constant velocity
- Compare the accelerations (+, -, 0) of objects A and B.
  both are zero
- Do the objects ever have the same velocity? If so, when?
  no
- Are the objects ever at the same position at the same time? If so, when?
  Both are at position zero at t=0
- Which object is ahead of the other? Does this ever change? If so, when?
  A is always ahead of B

Draw the **x** vs. **t** graph.





Draw the **a** vs. **t** graph

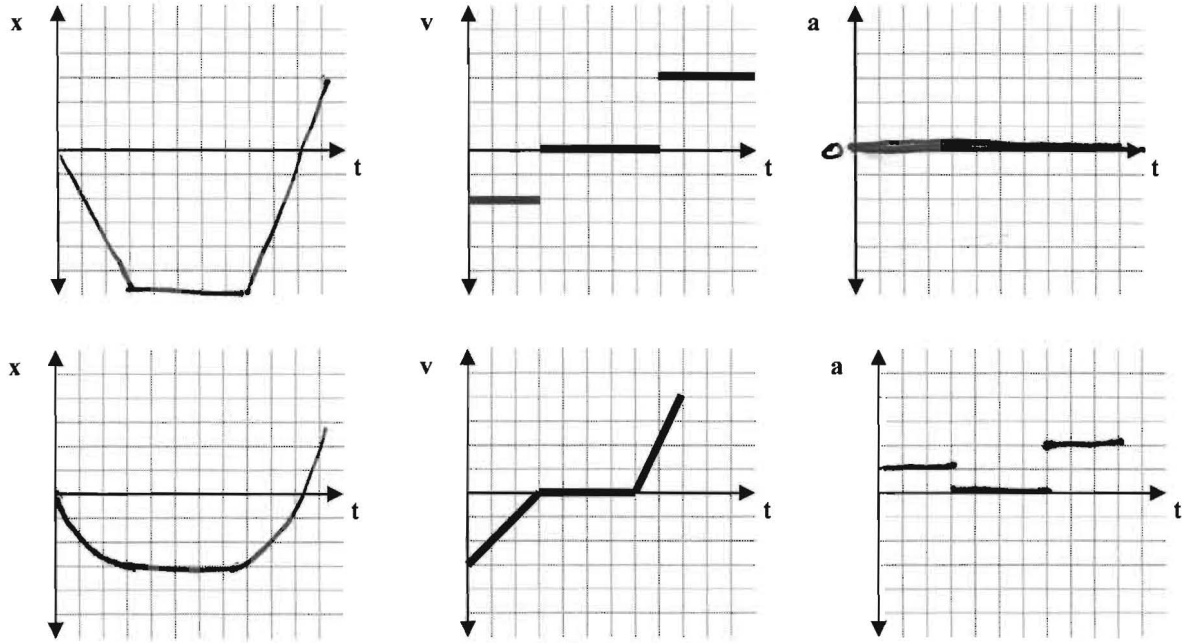


- Is the total force, ΣF, on C positive, negative, or zero? ...object D? How do you know?
  positive — C is constant velocity, D is accelerating
- Compare the accelerations (+, -, 0) of objects C and D.
  C = 0 D = constant and positive
- Do the objects ever have the same velocity? If so, when?
  Yes, at approximately 1.5s
- What is the displacement for object C at 6s?
  Δx = area of v vs t graph = b·h = (6)(2) = 12 m
- What is the displacement for object D at 6s?
  ½(6)(8) = 24m
- Based upon the velocity vs. time graph above, which object has the larger velocity at t = 4 s? D
- Based upon the velocity vs. time graph, which object has the larger acceleration? D
- What is the specific equation for object D in the v vs t graph above?
  $v = (1.33\ m/s^2)t$

Two objects are in contact with each other. How does the force of the larger object on the smaller object compare to the force of the smaller object on the larger object? Equal

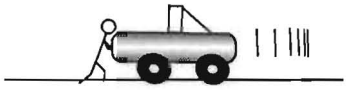
An object can't push on another object without receiving an equal push back, in the opposite direction. This is known as Newton's 3rd Law of Motion: For every force, there is an equal but opposite force.

Complete the x vs t and a vs t graphs below:

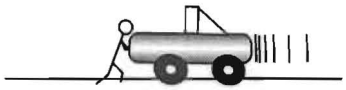


Complete the comparison for each of the following with >, <, or =.

$F_{person\text{-}truck}$ = $F_{truck\text{-}person}$



$F_{person\text{-}truck}$ = $F_{truck\text{-}person}$



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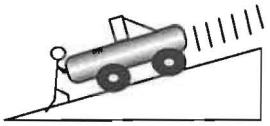

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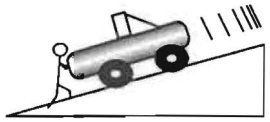
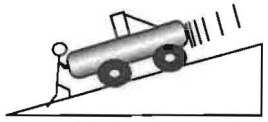


$F_{person\text{-}truck}$ = $F_{truck\text{-}person}$



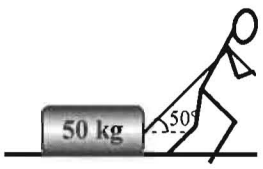
$F_{person\text{-}truck}$ = $F_{truck\text{-}person}$

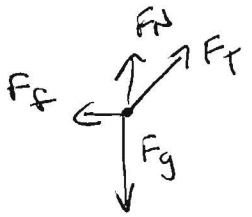
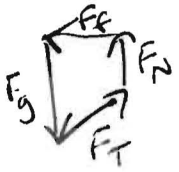
When a car hits a mosquito, which object experiences a greater force? ...a greater acceleration?

both equal / mosquito

Do you pull harder on the Earth or does the Earth pull harder on you? same for both

When hit, which experiences the greater force, the baseball or the bat? same for both



Force Diagram	Force Vector Addition Diagram
	

Since $\Delta v = 0$ & $a =$ 0, therefore $\Sigma F =$ 0.

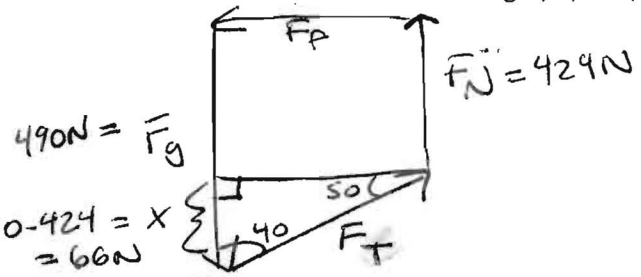
If the object (in the above) has a mass of 50 kg, the normal force is 424 N, and the angle at which the person is pulling is 50°, how hard must the person be pulling and what is the coefficient of friction? Which is larger, F_T or F_f?

$F_g = 50kg \cdot 9.8 N/kg = 490N$

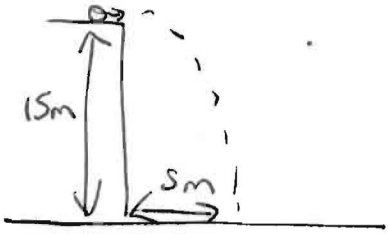
$\frac{66N}{\sin 50} = \frac{F_T}{\sin 90}$ $\quad F_T = 86.2N$

$\frac{66N}{\sin 50} = \frac{F_f}{\sin 40}$ $\quad F_f = 55.4N$

$F_f = \mu \cdot F_N$ $\quad \mu = F_f / F_N = 0.64$



A marble rolls off of the ledge that of a building that is 15 m above the ground. How fast would the marble need to be rolling in order to land 5 m from the base of the building?



horizontal

$\Delta x = 5m$

$\Delta t = 1.75s$

$a = 0$

$v_i =$

$5m = 0 + v_i(1.75s)$

$v_i = 2.86 m/s$

vertical

$\Delta y = -15m$

$\Delta t = 1.75s$

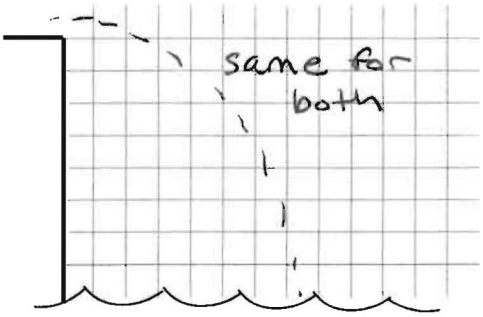
$a_x = -9.8 m/s^2$

$v_i = 0 m/s$

$-15m = \frac{1}{2}(-9.8 \frac{m}{s^2}) t^2 + 0$

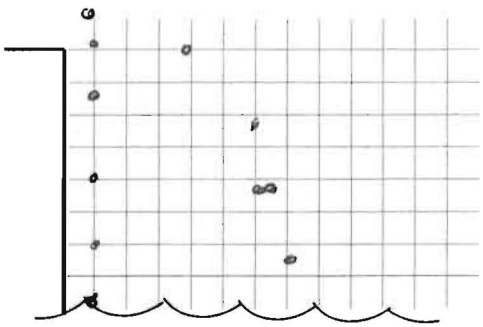
$t^2 = 3.06 s^2 \Rightarrow t = 1.75s$

You and a friend throw rocks horizontally off a cliff into a lake. Your **friend throws a rock with twice the mass**, but both rocks leave with the same velocity. Draw their trajectories and compare (>, <, =) the:



- Time to hit the water — Big Rock = Small Rock
- Final velocity — Big Rock = Small Rock
- Horizontal distance traveled — Big Rock = Small Rock
- Total force while in the air — Big Rock > Small Rock
- Mass — Big Rock > Small Rock
- Acceleration while in the air — Big Rock = Small Rock

You pick up two more rocks. Again, you throw your rock horizontally off the cliff. Your friend, however, just drops his rock over the edge as you throw your rock. Draw their trajectories and compare the:



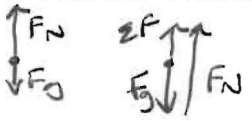
- Time to hit the water — Thrown = Dropped
- Vertical velocity when hit water — Thrown = Dropped
- Horizontal distance traveled — Thrown > Dropped
- Acceleration while in air — Thrown = Dropped

From a stoplight, a 50kg person accelerates at 7 m/s^2 in their Chevy Corvette. The total force, ΣF, on the person is:

$\Sigma F = m \cdot a = 50kg \cdot 7 m/s^2 = 350N$

A 70kg person is riding in an elevator. The elevator accelerates upward at 1.0 m/s^2.

a) Draw a labeled force diagram and vector addition diagram for this situation:



$F_g = 70kg \cdot 9.8 N/kg = 686N$

$\Sigma F = 70kg \cdot 1.0 m/s^2 = 70N$

$F_N = F_g + \Sigma F$

$= 756N$

b) What is the force due to gravity on the person? 686N

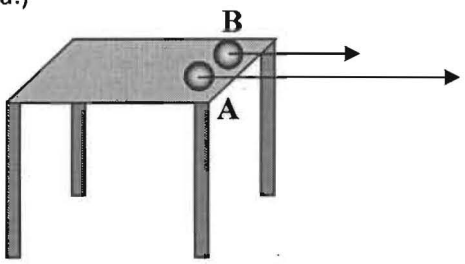
c) What is the force normal, F_N, on the ~~donkey?~~ person 756N

You are shooting to the top of power tower while increasing speed. Draw the force diagram and describe if you would feel your usual weight, heavier than normal, or lighter than normal for this situation.

feel heavier (force normal is bigger than usual)

Examine the following diagrams and answer the questions for each.

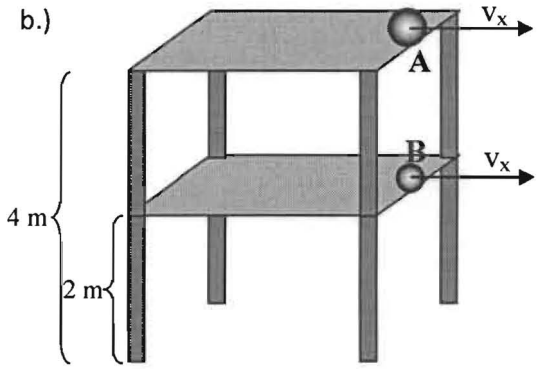
a.)



Two marbles of equal mass, A and B, are launched off a table.
Marble A has twice the horizontal velocity.

Which marble will hit the floor first? Neither—same time
Which marble will travel farther? A
Why?
A has faster velocity - can travel farther in same amount of time

b.)



Marble A has twice the mass of Marble B.
Marble A is launched from twice the height as Marble B.
They are launched at the same horizontal velocity.

Which marble will hit the floor first? B
Which marble will travel farther? A
Why? A spends more time in the air so it will travel farther.