Name Key
Period __ Date _____

PHYSICS - Unit V Review

1. Use Newton's 2nd Law to qualitatively describe the relationship between **m** and **a**, **F** and **a**, **m** and **F**.
   a. What two conclusions did you draw from the lab at the beginning of the unit?

   Acceleration is proportional to the Net Force

   Acceleration " " " 1/mass.

   b. Complete the table to demonstrate your understanding of Newton's 2nd law. State in the results by what factor each quantity will change, i.e. double, triple, ½, etc.

$a = F \frac{1}{m}$

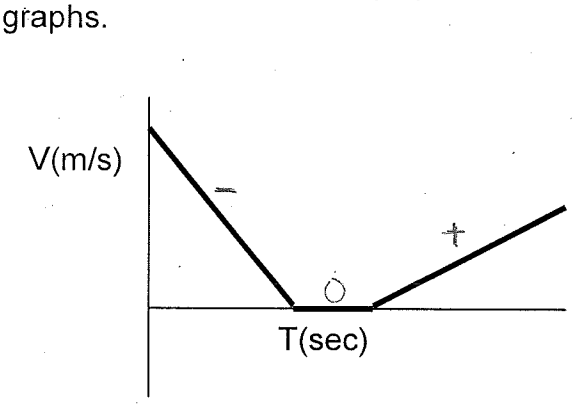
Held constant	Condition	Results	
Net Force	You reduce the mass in half.	The acceleration will...	↑ by 2x
Net Force	You triple the mass.	The acceleration will...	↓ 1/3
Mass	You reduce the net force to a third of its original value.	The acceleration will...	↓ by 1/3
Mass	You double the net force.	The acceleration will...	↑ by 2x
Acceleration	You double the mass.	The net force must be...	↑ by 2x
Acceleration	You reduce the net force to ¼ of its original value.	The mass must be...	↓ by 1/4

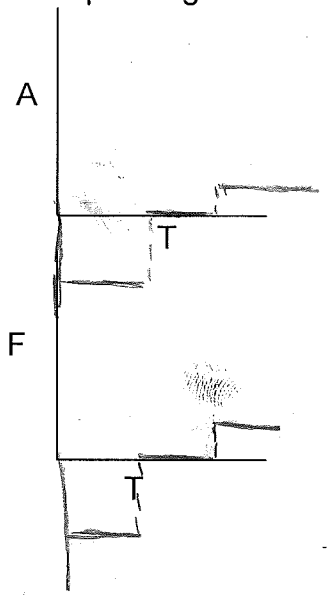
2. Use Newton's 2nd Law to qualitatively describe and explain the collision between a large truck and a small car by comparing:
   a. Force on each vehicle $F_T \rightarrow = \leftarrow F_c$ (3rd Law pairs)
   b. Acceleration of each vehicle

$F_T = Ma = F_c = mA$

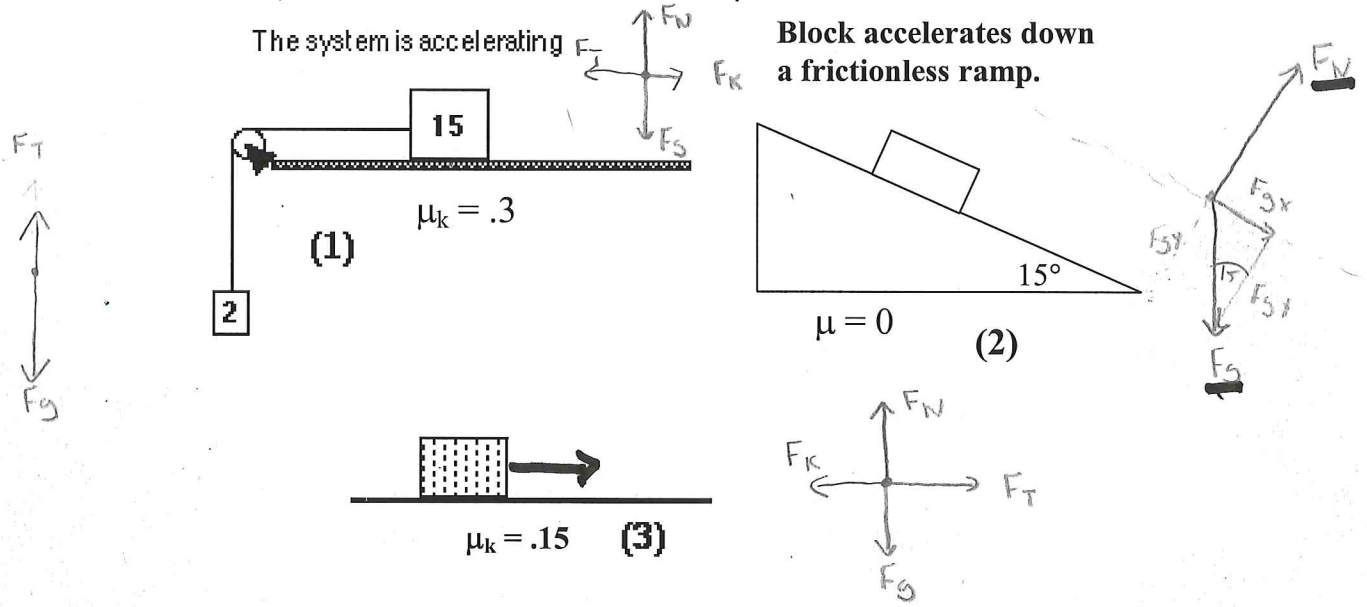
The car has a greater acceleration due to its smaller mass.

3. Given the following **v** vs **t** graph, draw the corresponding **a** vs **t** and **F** vs **t** graphs.





4. **From dynamics information** - If you are given forces, or the physical description of the system and surroundings, draw a force diagram. Ask yourself: "Can I tell if the system is accelerating?" If yes, then the forces do NOT add up to zero, then $\Sigma F = ma$. If the system is moving at constant velocity or is motionless, then the forces cancel out and $\Sigma F = 0$.



a) Next to each object sketch a force diagram for each of the objects above.

b) i. Write the equation for the sum of the forces in the x-direction(along the incline) in (2). $\Sigma F_x = {}^{+}F_{gx} = m \times a$

ii. Solve for the acceleration of a 10 kg object down the ramp.

① $\sin\theta = \frac{F_{gx}}{F_g}$ 15 * $(F_g = 9.8\ m/s^2 \times 10\ kg = -98\ N)$

$\sin 15 = \frac{{}^{+}F_{gx}}{-98N} = 25.4N$ ② $F_{gx} = m \times a$ $a = 2.54\ m/s^2$

$25.4N = 10kg \times a$

c) i. Write the equation for the sum of the forces in the x-direction in (3).

$\Sigma F_{Net} = F_T + -F_K = m \times a$

ii. What is the frictional force F_k acting on the block if its mass is 20 kg?

1) $F_g = 20kg \times -9.8 = -196N$ 2) $F_K = \mu_K F_N$

$\therefore F_N = 196N$ $= .15 \cdot 196N = \boxed{-29.4\ N}$

iii. If the force of tension is 40 N, what is the acceleration of the block?

$F_T + -F_K = m \times a$

$40N + -29.4N = 20kg \times a$

$.53\ m/s^2$

a) A 12, 000 kg bus slows from 30 m/s to 10 m/s in 10 s. What is the net force acting on the bus?

mass = 12,000 kg
V_0 = 30 m/s
V_f = 10 m/s
t = 10 s
a = ? f_{Net} = ?

1) $V = V_0 + at$

$10\,m/s = 30\,m/s + a(10s)$

$\frac{-20\,m/s}{10s} = \frac{a(10s)}{10s}$

$a = -2\,m/s^2$

2) $F_{Net} = m \times a$

$F_{Net} = 12{,}000\,kg \times -2\,m/s^2$

$F_{Net} = -24{,}000\,N$

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b) What does a scale (F_N) read for a 75 kg man in an elevator that goes from - 6.0 m/s to zero in 10 m?

$\Delta x = -10\,m$
$V_0 = -6.0\,m/s$
$V = 0\,m/s$
a =

① $V^2 = V_0^2 + 2ax$

$(0\,m/s)^2 = (-6\,m/s)^2 + 2a(-10m)$

$\frac{-36\,m^2/s^2}{-20m} = \frac{2a(-10m)}{-20m}$

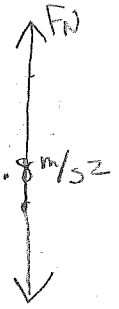
$a = +1.8\,m/s^2$

② $\Sigma F_y = F_g + F_N = m \times a$

$= -735N + F_N = 75kg \times 1.8\,m/s^2$

$= -735N + F_N = +135N$

$F_N = 870N$



$(9.8\,N/kg \times 75kg)F_g$
$= -735N$

Unit V: Constant Force Particle Model Explained
What you should know when all is said and done

By the time you finish all labs, worksheets and related activities, you should be able to:

1. Use Newton's 2nd Law to qualitatively describe the relationship between **m** and **a**, **F** and **a**, **m** and **F**. (e.g., if you double the mass, the acceleration will...)

2. Given a **v** vs **t** graph, draw the corresponding **a** vs **t** and **F** vs **t** graphs.

3. Determine the net force acting on an object by:
   a. drawing a force diagram for an object given a written description of the forces acting on it.
   b. resolving forces into **x** and **y** components, then finding the vector sum of the forces.
   c. analysis of the kinematic behavior of the object.

4. Solve quantitative problems involving forces, mass and acceleration using Newton's 2nd Law.
   a. Having determined the net force (as in #3), and given the mass, find the acceleration.
   b. Continue to use the kinematical models from unit III to determine the velocity or displacement of the object, once the acceleration is known.

5. Solve quantitative problems involving friction as a force.