Name Answer Key Date: _____

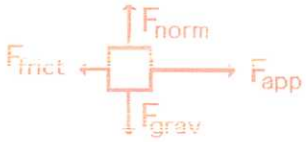
Honors Physics Forces WS #8H

Period _____ Mrs. Nadworny

Forces Review

Directions – Solve the following problems using the GUESS method and correct significant figures. Be sure to show ALL work! You may need to use a separate sheet of paper to show your work.

1. A rightward force of 339 newtons is applied to a 52.8 kg object to move it across a rough surface with a rightward acceleration of 2.89 m/s^2. Draw a free body diagram the situation. Calculate the net force. Calculate the force of friction. Calculate the normal force. Calculate the coefficient of friction. What two materials could this be?



$F_{net} = ma = 52.8kg(^{+}2.89\frac{m}{s^2}) = {}^{+}153N = 153N$ right

$M = 52.8\ kg$

$a = 2.89\ m/s^2$

$F_{net} = F_A - F_F$

$F_F = F_A - F_{net} = 339N - 153N = 186N$ left

$F_g = mg = 52.8kg(-9.81\frac{m}{s^2}) = 518N$ down

x: $F_{netx} = ma$

$F_A - F_F = ma$

$F_{net} = 0N$

$F_N - F_g = 0N$

y: $F_{nety} = 0N$

$F_N - F_g = 0N$

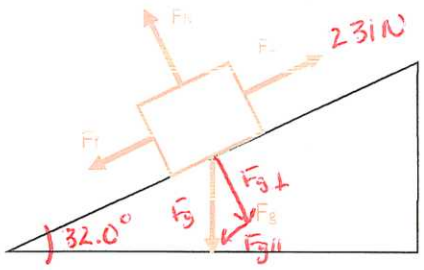
$F_N = F_g = 518N$ up

$F_N = F_g$

$\mu = \frac{F_F}{F_N} = \frac{186N}{518N} = 0.359 \cong 0.36$

This could be copper on steel.

2. A 39.4 kg wooden block is pushed up a wooden ramp inclined at 32.0° by applying a force of 231 newtons parallel to the incline. Draw a free body diagram of the situation. Calculate the weight. Calculate the normal force. Calculate the parallel component of the weight. Calculate the frictional force. Calculate the net force acting in the direction of motion. Calculate the acceleration.



$m = 39.4\,kg$

$\mu = .30$ (reference table)

$//$: $F_{net//} = ma$

$F_A - F_f - F_{g//} = ma$

$\perp$: $F_{net\perp} = 0N$

$F_N - F_{g\perp} = 0N$

$F_N = F_{g\perp}$

$F_g = mg = 39.4kg(-9.81\frac{m}{s^2}) = {}^{-}387N = 387N$ down

$F_{g//} = F_g \sin\theta = -387N \sin(32.0°) = {}^{-}205N = 205N$ downhill

$F_{g\perp} = F_g \cos\theta = (-387N)\cos(32.0°) = {}^{-}328N = 328N$ into hill

$F_{net\perp} = 0N$

$F_N - F_{g\perp} = 0N$

$F_N = F_{g\perp} = 328N$ out of hill

$F_f = \mu \cdot F_N = (0.30)(328N) = 98N$ downhill

$F_{net//} = F_A - F_f - F_{g//} = 231N - 98N - 205N = {}^{-}72N = 72N$ downhill

$$a = \frac{F_{net//}}{m} = \frac{-72N}{39.4kg} = -1.8\frac{m}{s^2} = 1.8\frac{m}{s^2} \text{ downhill}$$

3. A young boy is pulling a 12.7 kg wagon, with rubber wheels, that is full of teddy bears by exerting a force of 56.1 newtons at an angle of 29.0^0 with the dry concrete ground. Draw a free body diagram of the situation (it is NOT on a hill!). Calculate the weight. Calculate the components of the applied force. Calculate the normal force, using all of the vertical information. Calculate the force of friction. Calculate the horizontal net force. Calculate the acceleration.

The wagon is NOT on a hill! You do NOT calculate the parallel and perpendicular components of the weight!

$m = 12.7kg$

$\mu = .68$ (reference table)

X: $F_{net\,x} = ma$

$F_{Ax} - F_F = ma$

Y: $F_{net\,y} = 0N$

$F_N + F_{Ay} - F_g = 0N$

$F_g = mg = (12.7kg)(-9.81\frac{m}{s^2}) = -125N = 125N$ down

$F_{applied}\,x = F_x = F\cos\theta = (56.1N)(\cos 29.0°) = 49.1N$ right

$F_{applied}\,y = F_y = F\sin\theta = (56.1N)(\sin 29.0°) = 27.2N$ up

$F_{net\,y} = F_N + F_y - F_g = 0N$

$F_N = F_g - F_y = 125N - 27.2N = 98N$ up

$F_F = \mu_k F_N = (0.68)(98N) = 67N$ left

$F_{net\,x} = F_x - F_F = 49.1N - 67N = -18N = 18N$ left

$a = \frac{F_{net\,x}}{m} = \frac{-18N}{12.7kg} = -1.4\frac{m}{s^2} = 1.4\frac{m}{s^2}$ left

Answers in size order: 0.36, 1.4, 1.8, 18, 27.2, 49.1, 67, 72, 98, 98, 125, 153, 186, 205, 328, 387, 518