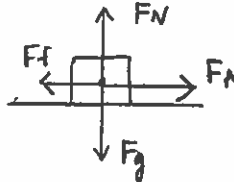


Key

## Newton's Laws mini-LTA

A 4.5 kg Teflon pan sits on a futuristic Teflon countertop. A horizontal force of 8 Newtons acts on the pan to the right.

- a) Draw a Free-Body diagram showing all forces (horizontal and vertical) acting on the body. *Be sure label and indicate the direction of each force vector.*



- b) Calculate the weight ( $F_g$ ) of the pan.

$$F_g = mg = (4.5 \text{ kg})(9.81 \frac{\text{m}}{\text{s}^2}) = \boxed{44.145 \text{ N}}$$

- c) Determine the magnitude of the normal force ( $F_N$ ) acting on the pan.

$$F_N \text{ is same as } F_g \quad \boxed{44.145 \text{ N}}$$

- d) Using the table of "Approximate Coefficients of Friction" found on your reference table, calculate the *kinetic* force of friction.

$$F_{f_k} = \mu_k mg = (.04)(4.5 \text{ kg})(9.81 \frac{\text{m}}{\text{s}^2}) = \boxed{1.7658 \text{ N}}$$

- e) Determine the *net horizontal force* acting on the pan.

$$F_{\text{net}} = 8 \text{ N} - 1.7658 \text{ N} = \boxed{6.2342 \text{ N}}$$

- f) Calculate the horizontal *acceleration* of the pan.

$$a = \frac{F_{\text{net}}}{m} = \frac{6.2342 \text{ N}}{4.5 \text{ kg}} = \boxed{1.385 \frac{\text{m}}{\text{s}^2}}$$

Define equilibrium. Describe how one can easily identify an object in equilibrium by observing its motion.

If the net force on an object is zero Newtons, it is in equilibrium.

The object will be traveling at a constant speed or at rest.  
(No acceleration)

What is the *physical significance* of the slope of an  $F_{\text{net}}$  versus acceleration graph?

mass

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

What is the *physical significance* of the slope of an  $F_{\text{net}}$  versus mass graph?

acceleration

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

What is the *physical significance* of the slope of a weight versus mass graph?

"g" acceleration due to gravity.

$$\frac{w}{m} = g$$

Describe how a swimmer can accelerate using only the water in the pool. Please use Newton's Third Law in your explanation.

push water backwards, water pushes swimmer forward. Action/Reaction

Briefly describe the difference between the coefficient of friction and the force of friction.

The coefficient of friction is a number that helps you calculate the force of friction. The c.o.f. describes how easy it is to slide the surfaces across each other

A 92 kg student stands in an elevator car.

- a) Calculate the weight of the student.

$$F_g = mg = (92 \text{ kg})(9.81 \frac{\text{m}}{\text{s}^2}) = 902.52 \text{ N}$$

- b) If the scale reads 1000. N at a given moment, what type of motion must be occurring. Explain.

accel up since  $F_N > F_g$  (1000. N > 902.52 N)

- c) Calculate the acceleration of the elevator in part b.

$$F_N - mg = ma$$

$$a = \frac{F_N - mg}{m} = \frac{1000 \text{ N} - 902.52 \text{ N}}{92 \text{ kg}} = 1.06 \frac{\text{m}}{\text{s}^2}$$