**Force 2**

1. Four masses are connected by ropes.

A. Since they are not on the table, which force cannot be acting on m3 and m4?

B. Below are the force diagrams for the masses. Label them as m1, m2, m3 or m4. Include a brief explanation for each.

 

2. A man pushes on a 12 kg object for 10 seconds. It moves 8 m to the right while he is pushing it.

A. Calculate the acceleration of the mass.

B. Now, use F = ma to calculate the magnitude of the man’s force.

C. If the surface is frictionless, how does v3 compare to v2? Why?

D. If the surface has friction, how does v3 compare to v2? Why?

*There are two major categories of forces: contact forces (when objects are actually touching) and field forces (forces that act at a distance and don’t need to be touching).*

3. **C**ontact or **F**ield force?

A. \_\_\_\_ Tension

B. \_\_\_\_ Normal force

C. \_\_\_\_ Can cause accelerations

D. \_\_\_\_ Gravity

E. \_\_\_\_ \* Electrostatic force

(like a balloon rubbed on hair)

*Why this matters: Newton’s Third Law: “For every force there is an equal and opposite force.” But this opposite force must be of the same type: contact forces oppose contact forces; field forces oppose field forces.*

4. A box is sitting on a table.

A. What force opposes the normal force pushing up on the box? Why?

B. What force opposes the force of weight pulling down on the box? Why?

5. Two very small people are pulling a box. Identify the four shown forces as Ff (friction); T; Fg; FN. The “Σ” symbol is sigma and means to add up all of the forces.

A. \_\_\_\_\_ F1— the two men pulling WITH A ROPE.

B. \_\_\_\_\_ F2— the force pushing up by the floor.

C. \_\_\_\_\_ F3— the force pulling down on the mass.

D. \_\_\_\_\_ F4— the force trying to stop the mass from moving.

E. \_\_\_\_\_ Which force is in the negative x-direction?

F. \_\_\_\_\_ Which force is in the positive y-direction?

G. \_\_\_\_\_ Which force is in the positive x-direction?

H. \_\_\_\_\_ Which force is in the negative y-direction?

I. Which forces would be used in this equation: ΣFy = may?

J. Which forces would be used in this equation: ΣFx = max?

6. Two masses are attached by a rope that is threaded around a pulley, as shown. Identify the four shown forces as Ff (friction); T; Fg; FN.



A. \_\_\_\_ F1 (the force pulling down on the 2 kg mass).

B. \_\_\_\_ F2  (the force of the rope pulling up on the 2 kg mass).

C. \_\_\_\_ F3 (the force pulling up on the 8 kg mass).

D. \_\_\_\_ F4 (the force pulling down on the 8 kg mass).

E. Which two forces are equal? Why?

F. Calculate F1.

G. Calculate F4.

H. Which forces are y-direction forces?

I. Which forces are x-direction forces?

J. Which way will the system accelerate? Why?

K. Which force is bigger, F2or F1? Why?

L. Which force is bigger, F3or F4? Why?

M. Find the acceleration of the system.

7. A small child (m=40 kg) is standing on a scale in an elevator. Answer the following questions about the forces acting on the boy for each situation.

a. The elevator is moving at a constant velocity of 14 m/s. How does the normal force compare to the weight? Why?

b. The elevator is accelerating upward at 5 m/s2. How does the normal force compare to the weight? Why?

c. The elevator is accelerating down at 5 m/s2. How does the normal force compare to the weight? Why? Calculate the normal force.

d. The elevator is accelerating down at 10 m/s2 (equal to the acceleration due to gravity). What is the normal force? Why?

8. What is the acceleration of the following system? What is the tension in the string?

10 kg

20 kg

9. What is the acceleration of the following system? What is the tension in each string?

12 kg

5 kg

20 kg