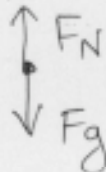


15. If a box is being pushed so that it moves to the right, in what direction does friction act?

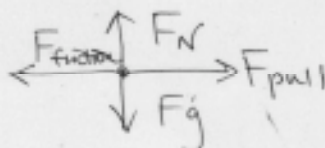
Left!

16. Draw free-body (force) diagrams for the following:

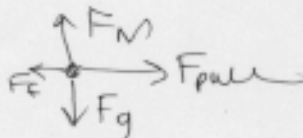
a) a box sitting on a table



b) a box being pulled horizontally across the floor at a constant speed



c) a box being pulled at an accelerating rate across the floor



17. True or false: If an object is in equilibrium, the object must be at rest. Explain.

False!

18. True or false: If an object has a net force on it, the object must be accelerating. Explain.

True!

19. If you increase the force on a moving mass, what happens to the mass's acceleration? Explain.

Increase!

20. Newton's 2<sup>nd</sup> Law is often written in equation form, which has three variables. Write the equation in its three forms (solved for each variable: force, mass, acceleration)

$$F = m \cdot a$$

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

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

21. A 2 kg mass has an acceleration of 4 m/s<sup>2</sup>. What net force must be acting on it? **SHOW YOUR WORK!**

$$m = 2 \text{ kg}$$

$$a = 4 \text{ m/s}^2$$

$$F_{\text{net}} = ?$$

$$F = m a$$

$$F_{\text{net}} = 2(4)$$

$$F_{\text{net}} = \boxed{8 \text{ N}}$$

22. A 2 kg mass has a net force of 10 N acting on it. What is its acceleration? **SHOW YOUR WORK!**

$$m = 2 \text{ kg}$$

$$F_{\text{net}} = 10 \text{ N}$$

$$a = ?$$

$$F_{\text{net}} = m a$$

$$10 \text{ N} = 2 \text{ kg } a$$

$$\boxed{a = 5 \text{ m/s}^2}$$

23. A net force of 5 N causes an object to have an acceleration of 1 m/s<sup>2</sup>. What is the mass of the object? **SHOW YOUR WORK!**

$$F_{\text{net}} = 5 \text{ N}$$

$$a = 1 \text{ m/s}^2$$

$$m = ?$$

$$F_{\text{net}} = m a$$

$$5 \text{ N} = m \cdot 1 \text{ m/s}^2$$

$$\boxed{m = 5 \text{ kg}}$$

24. If a feather and a rock are dropped at the same time in the absence of air resistance, which one hits the ground first? Explain.

Same!

25. State Newton's Third Law in your own words.

Action / Reaction Pair!



26. Can a force exist by itself? Explain.

No!

27. A 70 kg person on ice skates pushes against the wall of the ice rink with a force of 35 N and recoils.

A. What is the magnitude of the force on the wall? 35 N

B. What is the magnitude of the force on the person? 30 35 N

C. What acceleration does that person experience (include direction)?

0.5 m/s<sup>2</sup> back

SHOW YOUR WORK!

$$\begin{aligned} F_{\text{net}} &= 35 \text{ N} \\ m &= 70 \text{ kg} \\ a &= ? \end{aligned}$$

$$\begin{aligned} F &= ma \\ -35 &= 70 \cdot a \\ a &= -2 \text{ m/s}^2 \end{aligned}$$

28. Newton's third law tells us that for every action, there is an equal and opposite reaction. Identify the action and reaction forces for a falling book (the book is falling because the earth is pulling on it). If a force is exerted on the earth, why don't we see it move? Explain.

Action = Earth pulls the rock  
Reaction = Rock pulls the earth

$$F = ma$$

→ rock has small mass... so it accelerates very quickly.