Newton's 2nd Law Review

Concepts:

1. Identify the following using the following terms: *weight, friction force, system, net force, normal force, applied force, mass, Newton's Second Law, Newton's First Law.*

   a. _____ The "leftover" or "unbalanced" force that is acting on an object.

   b. _____ Two objects that are connected and have the same acceleration.

   b. _____ $F_{net} = ma$

   c. _____ For example, the force from the floor or a table that holds up objects.

   d. _____ The force of gravity acting on an object.

   e. _____ Objects will maintain a constant velocity if and ony if all the forces on the object are balanced and therefore cancel out.

   f. _____ The force that prevents objects from slipping.

   g. _____ Some random force that is trying to move an object.

   h. _____ This is always measured in kg.

2. What are the units of

   a. force? _____ b. mass? _____ c. weight? _____ d. acceleration? _____

3. Acceleration is always in the direction of the
   a. friction force. b. net force. c. weight. d. normal force. e. applied force.

4. If you are traveling to the right, and speeding up, what is the direction of your
   acceleration? net force?

5. If you are moving the right and slowing down, what is the direction of your
   acceleration? net force?

6. If you are moving to the right with a constant speed, what is the direction of your
   acceleration? net force?

7. How can you tell the direction of the force of friction if something is moving?

8. How can you tell the direction of the force of friction if something is at rest?

9. Draw and label a force diagram that would show all the forces acting on an object for the following:
   a. A block at rest on a lab table.

   b. A block being pushed at constant speed on a level surface.

   d. A block being pushed across a rough table and speeding up.

10. If an object has zero acceleration, can you conclude that no forces are acting on the object? Explain.

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11. A backpack with a mass of 12 kg is just sitting on the floor. What is the:
    a. weight of the backpack?
    b. normal force on the backpack?
    c. net force on the backpack?
    d. applied force on the backpack?
    e. force of friction on the backpack?

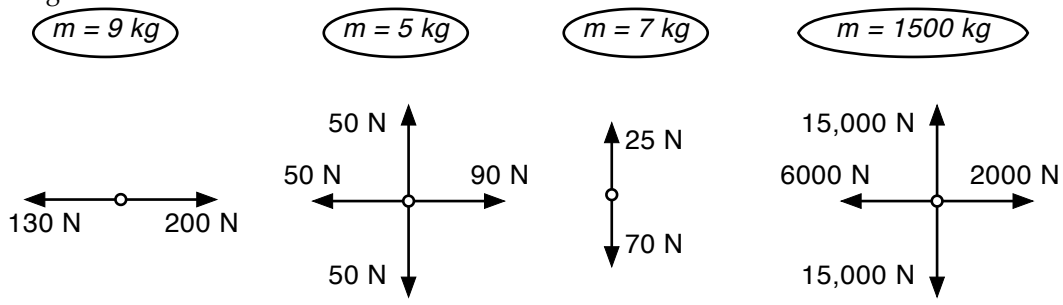
12. A car is driving down the road at a constant speed. The car weighs 25,000 N and there is an applied force of 1200 N pushing the car forward. What are
    a. normal force acting on the car?
    b. the mass of the car?
    c. the net force on the car?
    d. the force of friction on the car?

13. What net force is needed to accelerate a 1500 kg car at 3 m/s^2?

14. What net force is needed to accelerate a 12,000 N car at 2 m/s^2? Careful!

15. What is the mass of an object if a net force of 100 N causes it to accelerate at 4 m/s^2?

16. For each of the following free-body diagrams, what is the acceleration of the mass? Give both the magnitude and the direction.



17. For each of the following free-body diagrams, what is/are the missing force(s) if the acceleration and mass are as shown?

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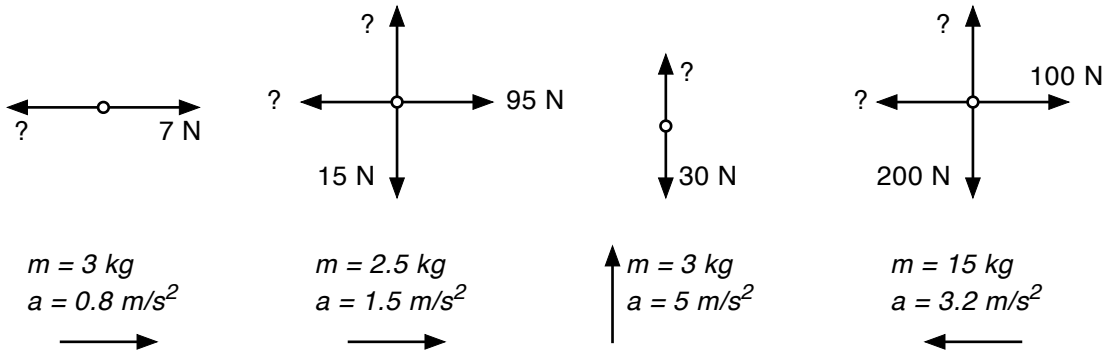

Problems:

18. Imagine there is a 50 kg object with a force of 400 N trying to push it to the right and at the same time there is another force of 150 N trying to pull it to the left. What is the acceleration of the object?

19. A 2500 kg car was traveling at 30 m/s when it skids to a stop in a distance of 120 meters.
    a. What was the net force on the car? (*Find acceleration first.)*

    b. During this skid, there were three individual forces acting on the car. What were they?

20. Imagine you are pulling a heavy box across the floor with a force of 200 N. The box has a mass of 35 kg. The box started at rest, and sped up to 7.5 m/s in only 2.5 seconds. What was the force of friction acting on the box? (*Find acceleration first.)*

21. A small plane of mass 20,000 kg speeds up from 10 m/s to 50 m/s. It travels a distance of 240 meters during this acceleration. If the force of friction on the plane during this was 50,000 N, how much force was generated by the engines? (*Find acceleration first.)*

22. A 0.75 kg mass is hanging from a string that is connected by a pulley to a mass of 2.5 kg that is on a horizontal table.
    a. If the table is frictionless, what is the acceleration of the system? (*Find applied force first*.)

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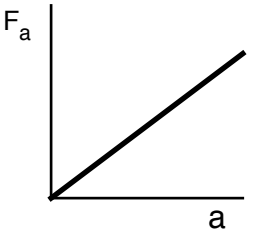
b. If the table was not frictionless, and there was 5 N of friction, what would be the acceleration? (*Find net force first*.)

c. What would the force of friction have to be so that the masses do <u>not</u> accelerate?

23. Some students do a lab in which they have masses on a frictionless cart attached to a hanger. There are a lot of masses on the cart. They move masses from the cart to the hanger, measuring the acceleration of the cart/hanger each time.
    a. For one of their trials, there was 0.15 kg total on the hanger and the cart was 1.75 kg total. Calculate the following:

Applied Force: _____ Mass Accelerated: _____ Acceleration: _____

b. They made a graph of Applied Force vs. Acceleration and got the graph shown to the right. Based on this graph, what would happen to the acceleration of the cart if they doubled the applied force on the car?



24. Imagine you are pulling <u>up</u> on a book with a force of 20 N. The mass of the book is 1.2 kg. What is the acceleration of the book?