Physics Blizzard Bag Assignment – Day 8

Mrs. Sauder

1. Visit the following website: http://www.sciencechannel.com/games-and-interactives/newtons-laws-of-motion-interactive.htm
    a. explore the links for Newton's 1st, 2nd, and 3rd laws.
    b. Click on "Newton's Bio" and read
    c. Click on "Quiz" to take the 10-question quiz

2. Read the information below, complete the activity, and answer the questions at the end.

LESSON 3: BEYOND THE BASICS

NAME:

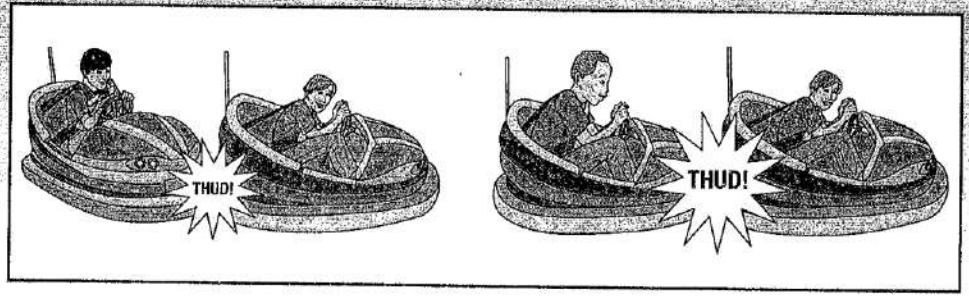
Day 3

KEY CONCEPTS

- force ✓
- motion ✓
- speed ✓
- velocity ✓
- acceleration ✓
- Newton's first law of motion ✓
- Newton's second law of motion
- Newton's third law of motion

THINK LIKE A SCIENTIST

You crash into cars. Cars crash into you. In the middle of all the crashing, you notice something. The faster a car is going when it hits you, the more sudden the crash and the faster you fly away. It seems to make sense, but you wonder why. Why, too, does the push seem harder when a bigger person is in the car that hits you? Why do these things make any difference?



Newton's Laws of Motion

You don't have to be in a bumper car to notice that a bigger push or pull makes things accelerate faster. About 300 years ago, Isaac Newton noticed the same thing. He noticed a lot of things about force and motion. By studying how they were related, he came up with the laws of motion. Newton's laws of motion are three scientific laws that describe how moving objects behave.

First Law of Motion

Newton's first law of motion states that an object at rest remains at rest. It also says that a moving object continues to move at a constant velocity unless an unbalanced force acts on it. You would observe this if your bumper car hit a wall and came to a sudden stop. Your body would keep moving forward. The only thing that would stop you is your safety harness. It would act on your body with an unbalanced force.

Second Law of Motion

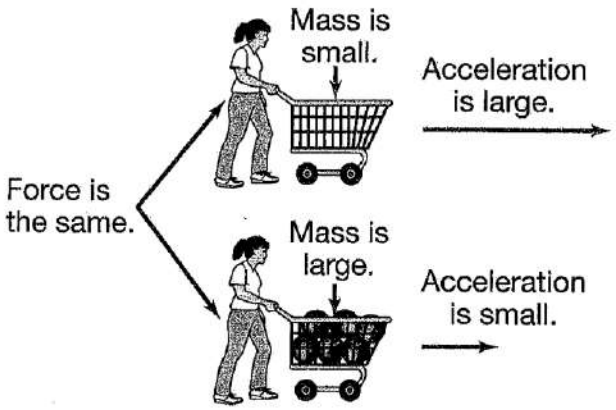
Newton's second law of motion states that an object's acceleration depends on its mass and the force acting on it. This can be written as the following equations:

$$acceleration = \frac{force}{mass}, \text{ or } a = \frac{F}{m}$$

$$force = mass \times acceleration, \text{ or } F = ma$$

It makes sense that a greater force can cause a greater acceleration. But how does mass figure into it?

Mass is a measure of the amount of matter in an object. A bumper car carrying a large person has more mass than one carrying a small person. If the same size force acted on each car, the car with less mass would have a greater acceleration. To put it another way, you could shove a light cart and start it accelerating. But shoving with the same force, could you do the same thing to a heavy cart loaded with bowling balls?



You can think of Newton's second law in another way, too. A greater acceleration results in a greater force, if the mass stays the same. This means that the faster your bumper car is moving, the harder you hit the wall or another car. So speed up before you try to crash into your friend's bumper car the next time!

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Third Law of Motion

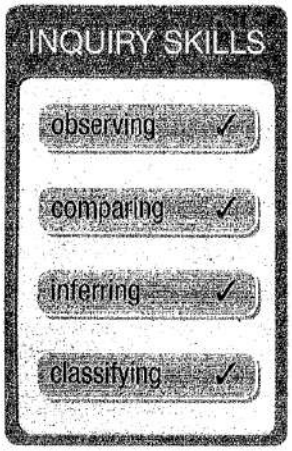
You may have already heard that for every action, there's an equal and opposite reaction. If so, you know another of Newton's laws. **Newton's third law of motion** states what happens when one object exerts a force on another object. The second object exerts an equal and opposite force on the first object. In other words, forces happen in pairs. The pair of forces is equal in size and opposite in direction.

For example, when your car crashes into a wall, it pushes on the wall. The wall pushes back. The two pushes are the same size but they act in opposite directions. You may wonder then, how does anything move? Wouldn't each pair of forces just cancel each other out?

Things move because each force in the pair of forces acts on a different object. For example, think again of pushing a cart. One pair of equal but opposite forces is you pushing the cart and the cart pushing back on you. To push the cart at all, however, you have to push against the ground. This brings in another force pair: you push the ground and the ground pushes you. If you look at the diagram below, you can see that the only force acting on the cart is you pushing on the cart. The cart has an unbalanced force acting on it. Therefore, it moves!

Now you know more about the force and motion of your bumper car. You know how to bump with more force and what happens when others bump you back. So pick up speed and crash into another bumper car before it crashes into you.

Using a rubber ball, follow each step in the left-hand column of the table. Then answer each question in the middle column. In the right-hand column, write which of Newton's laws explains what you observed.



Procedures	Questions/Answers	Newton's Law That Explains the Ball's Motion
Place the ball on a level surface, like the floor. Don't disturb the ball. Observe what happens.	What happens to the ball? Why?	
Roll the ball at a constant speed across the floor straight toward a wall. Observe what happens when the ball hits the wall.	How does the ball's motion change? Why?	
Tap the ball gently and observe how it moves. Then hit the ball harder and observe how it moves.	Which time did the ball move with greater acceleration? Why?	

NAME: _____

DAY 3

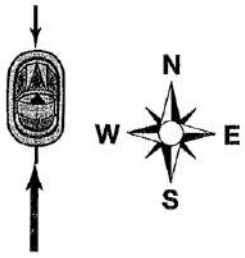
PUTTING IT ALL TOGETHER

You are now ready to show you understand the key concepts covered in this topic. Read each question. Circle the letter of the best answer.

1. Which of the following statements about force is NOT true?
   - **A.** A force is a push or pull.
   - **B.** A force has size and direction.
   - **C.** A force is a change in motion.
   - **D.** A force can be shown as an arrow.

2. Which of the following BEST describes motion?
   - **A.** a push or pull
   - **B.** a change in position
   - **C.** a law stated by Newton
   - **D.** a change in velocity

3. Two forces act on a bumper car as shown below. What will MOST LIKELY be the direction of the change in motion of the car?



   - **A.** north
   - **B.** east
   - **C.** south
   - **D.** west

4. If a bumper car has a constant velocity of 1.4 m/s east, you know that
   - **A.** the car is accelerating at a rate of 1.4 meters per second.
   - **B.** the car is not moving.
   - **C.** the car's speed is 1.4 meters per second and its direction is west.
   - **D.** the car's speed is 1.4 meters per second and its direction is east.

5. Which of the following is a unit of acceleration?
   - **A.** km/s
   - **B.** m/s^2
   - **C.** m/s
   - **D.** h/s/s

*NOTE:

Use lessons 1-3 to help answer these 10 questions. ☺

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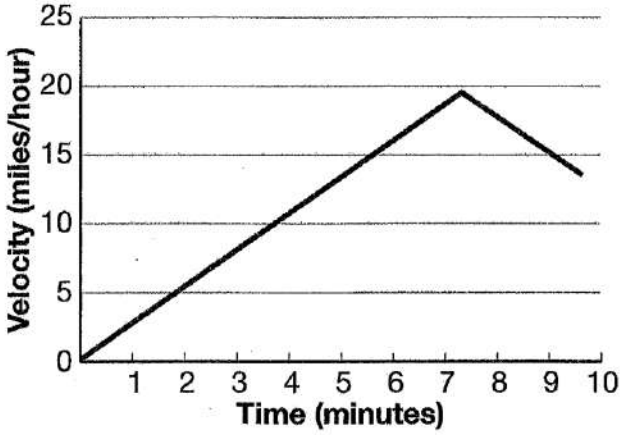
Use the graph below to answer questions 6 and 7.



6. The graph shows an object's

- **A.** speed.
- **B.** direction.
- **C.** changing acceleration.
- **D.** constant acceleration.

7. What happens to the object's motion between 8 and 10 minutes?

- **A.** It stops moving.
- **B.** It starts moving at a constant speed.
- **C.** It changes direction.
- **D.** Its velocity decreases.

8. Unbalanced forces acting on an object will MOST LIKELY cause the object to

- **A.** remain standing still.
- **B.** keep moving in the same direction.
- **C.** accelerate.
- **D.** keep moving at the same speed.

9. A moving object continues to move at a constant velocity unless an unbalanced force acts on it, according to Newton's

- **A.** first law of motion.
- **B.** second law of motion.
- **C.** third law of motion.
- **D.** law of unbalanced forces.

10. Why might ball A accelerate faster than ball B?

- **A.** Ball A has more mass than ball B.
- **B.** Ball A has the same mass as ball B.
- **C.** Ball A had a greater force applied to it.
- **D.** Ball B had a greater force applied to it.