

# August 26, 2014

**12** Scientists theorize that the Atlantic Ocean is slowly increasing in width. Which is the best approximation of the rate at which lithospheric plates beneath the Atlantic Ocean are moving?

- F** 2 millimeters per year
- G** 2 centimeters per year
- H** 2 meters per year
- J** 2 kilometers per year

**You must explain why your answer is correct.**

**Please write the page number in your book that supports your explanation.**

**Use the index of your book to help you.**

# Chapter 13 Day 12

## Lesson 3 Part 2

I can identify how Newton's laws of motion relate to the movement of objects.

GLE: 0707.11.4 Investigate how Newton's laws of motion explain an object's movement

# Presentations

# CHAPTER 13 LESSON 3

Isaac Newton

Newton's Laws of Motion

Molly Con/pd. 9/Science

For more videos about the laws of motion, click here.

Click on my face for a video about the three laws of motion!!

Newton's First Law (The Law of Inertia)  
An object at rest remains at rest, and an object in motion remains in motion at constant speed and direction.

Newton's Second Law (The Law of Force)  
The acceleration of an object depends on the mass of the object and the size of the net force applied.

Newton's Third Law (The Law of Action and Reaction)  
When a force is applied to an object, the object exerts an equal and opposite force.

What are the Laws of Motion?  
Before the 1600s, people thought that objects slowed down and stopped by themselves. It wasn't until 1686 that Isaac Newton discovered the laws of motion.

Who is Isaac Newton?  
Isaac Newton is remembered for developing the calculus, his law of gravitation and his laws of motion.

Newton's Laws of Motion

I can identify how Newton's laws of motion relate to the movement of objects.

# What You Will Learn

- How net force, mass, and acceleration are related
- What Newton's second law says
- What Newton's second law looks like in real life

# What Mastery Looks Like

As the wheels of a train push down on a track, the track pushes back against the wheels. Which of Newton's laws is used to explain these forces?

- A** An object at rest tends to stay at rest unless acted upon by an unbalanced force.
- B** The net force of an object is equal to its mass times its acceleration.
- C** For every action, there is an equal and opposite reaction.
- D** Any two objects exert a gravitational force of attraction on each other.

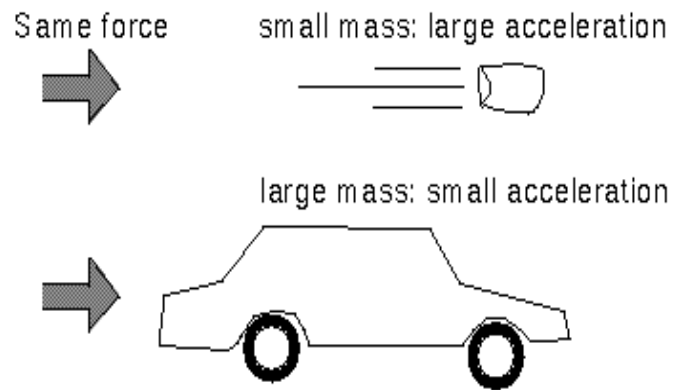
# III. The Second Law of Motion

- 2<sup>nd</sup> Law of motion states that acceleration of an object depends on the net force acting on the object and the object's mass.
- Equation:  $F=ma$



# A. Acceleration and Mass

- Why is it harder to throw a basketball than it is a baseball?
  - The mass of the basketball is larger than the mass of the baseball.
- If the net force is the same, the acceleration of an object's decreases as the mass of the object increases.
  - Example: The same **net force** causes the baseball's acceleration to be greater than basketball.
  - Or, An empty backpack speeds up more quickly than one that's full using same force.



$$\text{Force} = \text{mass} \times \text{acceleration}$$



## B. Acceleration and Direction of the Net Force

- Acceleration is in the same direction as the force.
  - When you pull a wagon, it starts moving in the same direction as your pull. (your force)
  - When a tennis player throws a ball in the air, the ball changes direction after it is hit by a racket.
- When an object slows down the direction of its acceleration is opposite to its direction of motion.



**What other force is acting on the ball while it is in the air?**



# C. Acceleration and Net Force

- Lifting a backpack – its speed depends on its mass and the **force** you exert.
  - Pulling upward quickly (using force), the speed of backpack changes quickly
  - Acceleration increases when the net force increases.
  - What happens if you pick up your backpack thinking it's heavy, but it's actually light?



# Newton's 2<sup>nd</sup> Law—Apply the Knowledge

- **What force is needed to accelerate a 10 kg shopping cart 3 m/s<sup>2</sup>?**
- What do you know?
- What do you want to find out?
- Write the formula:
- Substitute into the formula:
- Calculate & Simplify:
- Check that your units agree
- Answer:  $F=30\text{ N}$

# CFU

- **If a force of 35N is added to a box and it accelerates to a rate of 7 m/s<sup>2</sup>, what is the mass of the box?**
- What do you know?
- What do you want to find out?
- Write the formula:
- Substitute into the formula:
- Calculate & Simplify:
- Check that your units agree
- Answer: mass=5 kg

# Independent Practice $F=ma$

1. What net force is required to accelerate a car at a rate of  $2 \text{ m/s}^2$  if the car has a mass of  $3,000 \text{ kg}$ ?
2. A  $10 \text{ kg}$  bowling ball would require what force to accelerate down an alleyway at a rate of  $3 \text{ m/s}^2$ ?
3. Victor has a car that accelerates at  $5 \text{ m/s}^2$ . If the car has a mass of  $1000 \text{ kg}$ , how much force does the car produce?

# Exit Ticket

How are acceleration and net force related?

HW – Complete second section of Newton's Laws Worksheet.