**Chapter 13 Study Guide**

Lesson 1: How can you describe motion?

* Identify an object that has periodic motion. (pg. 407)
* What is velocity? (Pg. 409)
  + Find the velocity for a train traveling 150 miles north in 5 hours.

Lesson 2: What are forces?

* List examples of gravity’s force that can be seen. (pg. 410)
* What type of forces do electricity and magnetism apply to objects? (pg. 412)
* How is the motion of objects in space different than on Earth? (pg. 415 insert)
* What is power and the formula for it? (pg. 417)
  + Find the power for a machine that produces 48 joules of work in 4 seconds.
  + Find the power for a machine that produces 48 joules of work in 2 seconds.

Lesson 3: What are Newton’s laws of motion?

* Explain what net forces and how they affect an object. Give examples (pg. 418-419)
* What is inertia? (pg. 420)
* List examples of inertia in action. (pg. 420)
* How does net force affect an object? (pg. 422)
* Explain Newton’s Three Laws of Motion. (pg. 420-425)
  + Give an example of each law at work.

Lesson 4: What are simple machines?

* Identify two simple machines and how they make work easier. Give an example of each of them in use. (pg. 426-429)
* Define complex machine. (pg. 430-431)
  + Give an example of a complex machine that is mainly powered by human force.

**Chapter 13 Test will be Tuesday, December 16th.**

**Chapter 13 Study Guide: Answer Key**

Lesson 1: How can you describe motion?

* Identify an object that has periodic motion. (pg. 407)
  + *A pendulum*
* What is velocity? (pg. 409)
  + *Velocity is the speed and direction of an object’s motion.*
  + Find the velocity for a train traveling 150 miles north in 5 hours.
    - To find the velocity of the train, you would need to take 150 miles 5 hours to find the train’s velocity is 30 miles per hour north.

Lesson 2: What are forces?

* List examples of gravity’s force that can be seen. (pg. 410)
  + An apple falling from a tree, a satellite orbiting Earth, a pendulum swinging, etc.
* What type of forces do electricity and magnetism apply to objects? (pg. 412)
  + *Electricity and magnetism can either push or pull.*
* How is the motion of objects moving in space different than on Earth? (pg. 415 insert)
  + *On Earth, objects are slowed down by friction, where as in space, there is very little friction, so they continue to move at a relatively constant speed (see pg. 415 insert).*
* What is power and the formula for it? (pg. 417)
  + *Power is the rate at which work is done. To find power you take work (Joules) time (seconds) = Power (Watts)*
  + Find the power for a machine that produces 48 joules of work in 4 seconds.
    - 48 J 4 s = 12 W
  + Find the power for a machine that produces 48 joules of work in 2 seconds.
    - 48 J 2 s = 24 W

Lesson 3: What are Newton’s laws of motion?

* Explain what net forces are and how they affect an object. Give examples (pg. 418-419)
  + *Net forces are all of the forces acting on an object at the same time. They determine whether an object will start moving, stop moving or change direction.*
  + A box being pushed in one direction by more than one force will move in the direction being pushed with the sum of the forces being applied.
  + A box being pushed in opposite directions by equal forces will not move because the forces are in equilibrium and there is no net force.
  + A box being pushed in opposite directions by unequal forces will cause the box to move in the direction of the stronger force.
* What is inertia? (pg. 420)
  + *Inertia is the tendency of an object to resist any change in motion.*
* List examples of inertia in action. (pg. 420)
  + *Your body rising out of your seat at the top of a roller coaster, your body continuing forward in a car accident, etc.*
* How does net force affect an object? (pg. 422)
  + The greater the net force acting on an object, the more that object will accelerate.
* Explain Newton’s Three Laws of Motion. Give an example of each law at work. (pg. 420-425)
  + *Law 1: An object at rest stays at rest until a new force acts on it and an object moving at a constant speed will continue to move in a straight line and at a constant speed unless a net force acts on the object. (see pg. 420)*
    - *Inertia allows a satellite to travel in our solar system using very little fuel.*
    - *The forces acting on a football standing still are balanced, until a force, such as someone kicking it, causes the ball to move. The force will cause the football to move, but inertia will cause the football to continue to move through the air after the kick.*
    - *A full semi-truck has more inertia than an empty truck, so it will take more effort to either stop or start the truck.*
  + *Law 2: The relationship between acceleration, mass and net forces. (see pg. 422)*
    - *When moving a box, the net force acting on the box must be equal to the mass of the box multiplied by its acceleration. The greater the net force acting on the box the greater the acceleration of the box. The greater the mass of the box, the less acceleration there will be.*
    - *A train engine must exert enough force to pull the freight cars behind it. The more freight cars there are (greater the mass), the greater the force the engine needs to move the cars.*
    - *To slow down a race car, a force greater than the cars acceleration will need to be applied.*
  + *Law 3: When an object exerts a force on a second object, the second object exerts an equal and opposite force on the first object. (see pg. 424)*
    - *When a person pushes on a wall, the wall pushes on the person with an equal and opposite force.*
    - *When riding in a bumper car and you bump into another car, the cars exert an equal and opposite force on each other, cause the cars to bump apart in opposite directions.*
    - *When marbles collide, they exert a force on each other and cause each marble to change its velocity.*

Lesson 4: What are simple machines?

* Identify two simple machines and how they make work easier. Give an example of each them in use. (pg. 426-429)
  + *A pulley makes work easier by changing the direction of the force needed to do work. A flagpole uses a pulley to raise the flag.*
  + *A wheel and axle makes work easier by reducing the amount of force needed to do work. A steering wheel of a car uses a wheel and axle to reduce the amount of force needed to steer a car.*
  + *A lever makes work easier by changing the direction of force. A see-saw uses a bar and a fulcrum to change the direction of forces allowing a person to use less force to move an object.*
  + *An inclined plane makes work easier by allowing a person to use less force over a greater distance. A ramp is an example of an inclined plane.*
* Define complex machine. (pg. 430-431)
  + *A complex machine is a machine that uses two or more simple machines.*
  + Give an example of a complex machine that is mainly powered by human force.
    - *A bicycle*