Unit Topic: Energy

Essential Question: How does energy relate to forces?

Concept 1:
Nature of Energy

Objectives:
Discern if an object has kinetic or potential energy, based on a description.

Vocabulary:
Energy
Kinetic energy
Potential energy
Gravitational potential energy

Practice:
1. Explain the differences between the 3 types of potential energy.
2. What is the energy of a 4 kg apple that is sitting on a 2 m high tree branch?
3. What is the energy of a baby who weighs 20 N sitting in a high chair 1.5 m high?
4. What is the kinetic energy of a bike with a mass of 16 kg traveling at 4 m/s?
5. How high is a 0.5 kg squirrel sitting if it has 36 J of energy?

Concept 2:
Conservation of Energy

Objectives:
Given a picture or a description, explain the energy conversion occurring in an object.

Vocabulary:
Law of Conservation of Energy
Electromagnetic energy
Mechanical energy

Practice:
6. Give an example of where you would find each of the following types of energy: radiant, thermal, electrical, sound, nuclear, and electromagnetic.
7. What is the relationship between kinetic and potential energy of a falling object?
8. Determine the energy conversion for the following:
   a. Light bulb
   b. Firework
   c. Flute
   d. Leaf
9. Draw a picture of a pendulum or someone hitting a golf ball, showing how GPE, KE, and ME change throughout the object's motion. Make your labels very clear.

Concept 3:
Thermal Energy

Objectives:
Identify materials as conductors or insulators.

Given a picture or a scenario, explain how thermal energy is being transferred.

Vocabulary:
Thermal energy
Temperature
Heat
Insulator
Conductor
Specific heat

Practice:
10. Explain the relationship between temperature and kinetic energy.
11. Explain why there is no such thing as "cold".
12. Describe how thermal energy flows when a person is sitting in a chair at their desk.
13. Explain the difference between the 3 types of thermal energy transfer. Include an example of each.
14. List examples of materials that would classify as conductors vs. insulators.
15. How much heat is needed to warm 0.072 kg of gold from 20°C to 90°C if the specific heat of gold is 136 J/kg/°C?

Concept 4:
Work and Power

Objectives:
Use Newton's 2nd Law to complete work and power calculations.

Vocabulary:
Work
Power

Practice:
16. A force of 85 N is used to push a box along the floor a distance of 15 m. How much work was done?
17. 150 J of work was done to lift a crate with a force of 20 N. How far was the crate lifted?
18. How much power is used if a force of 90 N is used to push a box a distance of 30 m in 10 s?
19. A go-cart and rider have a mass of 100 kg. If the cart accelerates at 5 m/s^2 during a 25 m sprint, how much work did the cart do?
20. A 10 kg rock falls from a height of 18 m and lands on a guy about 3 s later. How much power did it hit him with?