

# Unit 1: Car Crashes

Framework: Ch. 4 Pgs. 61-65

## Unit Big Ideas

- ❑ Transfer of energy: collisions
  - ❑ Motion
  - ❑ Collisions
  - ❑ Energy
  - ❑ Speed
  - ❑ Relationship of an object's speed and energy

## **Aligned STEMscopes**

- ❑ [Transfer of Energy in Collisions](#)
- ❑ [Energy and Collisions](#)
- ❑ [Energy and Speed](#)

## **Instructional Segments**

- ❑ **Explore** movement of materials such as toy cars, marbles, ramps, etc...
  - ❑ What happens when materials collide?
  - ❑ How can you make an object move faster?
  - ❑ SWBAT:
    - ❑ Test mental models of motion by exploring collisions using various materials
    - ❑ Ask questions, predict outcomes and record observations and results of different combinations of motion and collisions to be later described in terms of energy
- ❑ **Explain:** energy and transfer of energy
  - ❑ Energy: "ability to do work" or "ability to injure you"
  - ❑ Motion energy
  - ❑ Transformation of energy from one to another (also explored in unit 2)
    - ❑ For example: electricity to heat, motion to electricity, etc...
  - ❑ Transfer of energy (flow of energy in a system): energy gained by one object always comes at the loss of energy from somewhere else (put in context of their explorations observations)
    - ❑ Framework example:

- ❑ “People do not usually feel the effects losing energy when they push a small toy car, but pushing a real car would be exhausting. Clearly people must transfer more energy to a full size car to get it to move than pushing a toy car.”
- ❑ **(Elaborate)** Students plan and carry out investigations to explain the relationship between an object’s speed and its energy (4-PS3-3 Ask questions and predict outcomes about the changes in energy that occur when objects collide)
  - ❑ Must develop ways to measure speed (quantitatively) and energy (qualitatively)
    - ❑ Must develop an understanding of the effects of energy
    - ❑ More energy = larger effects
- ❑ **(Evaluate)** Forms of assessment might include the following:
  - ❑ Student write up of their investigations on the impact of speed of objects on the transfer of energy in a collision ( 4-PS3-1 Use evidence to construct an explanation relating the speed of an object to the energy of that object)
    - ❑ Write up should include accurate scientific reasoning based on evidence and scientific vocabulary
  - ❑ Student labeled, model (pictorial or video) of the transfer of energy in a collision
    - ❑ Should be accurate representation and include scientific vocabulary

# Unit 2: Renewable Energy

Framework: Ch. 4 Pgs. 65- 71

## Unit Big Ideas

- ❑ Forms of energy and transfer of energy
- ❑ and create devices that convert one form to another. They relate these abstract ideas about energy forms to the specific energy resources they rely on in everyday life.

## **Aligned STEMscopes**

- ❑ [Energy and Electric Currents](#)
- ❑ [Renewable and Non-Renewable Resources](#)
- ❑ [Natural Processes](#)

## **Instructional Segments**

- ❑ **Explore** a series of investigations (4-PS3-2. Make observations to provide evidence that energy can be transferred from place to place by sound, light, heat, and electric currents.) where they observe, model, and discuss situations where energy is: transferred from one object to another; transferred from place to place; or transformed from one form of energy to another. (*examples from framework*)
  - ❑ energy of motion to sound: one block collides into another block or a moving ball collides onto another ball;
  - ❑ elastic energy to motion: a rubber-band catapult or a trampoline;
  - ❑ light energy to heat: sunlight or a heat lamp on a surface;
  - ❑ chemical energy to heat and/or light: a hand warmer, a candle flame, a light stick;
  - ❑ light energy to electrical energy to sound: solar panel connected to a circuit that rings an electrically-operated doorbell;
  - ❑ wind energy to motion: blowing on a pinwheel; leaves moving on a tree;
  - ❑ motion into heat energy via friction: rubbing hands together, sliding object across surfaces such as sand paper and carpet;
  - ❑ mechanical energy to motion: wind-up devices such as wind-up toy chicks, chattering teeth, cars, or hand crank generators spinning a fan motor; and
  - ❑ motion to sound: vibrating tuning forks.
    - ❑ For each station they fill in a table with: (1) the forms of energy observed, (2) changes they observed in the interactions, (3) the

transfers of energy from one object to another or from one place to another, and (4) the transformations of energy (e.g., light to electrical energy).

- ❑ [Computer simulations](#) (PhET. n.d., Energy Forms and Changes: Energy Systems.)
- ❑ Explore media to obtain and combine information to describe that energy and fuels are derived from natural resources and their uses affect the environment. (4-ESS3-1)
  - ❑ *From the standards:* Examples of renewable energy resources could include wind energy, water behind dams, and sunlight; non-renewable energy resources are fossil fuels and fissile materials. Examples of environmental effects could include loss of habitat due to dams, loss of habitat due to surface mining, and air pollution from burning of fossil fuels.

## Explain

- ❑ Forms of energy
  - ❑ Heat
  - ❑ Electrical
  - ❑ Light
  - ❑ Sound
  - ❑ Chemical
  - ❑ Motion
  - ❑ Gravity
- ❑ Transfer of energy
- ❑ Renewable and nonrenewable energy and effects on the environment

## ❑ Elaborate

- ❑ Framework Engineering Connection: create a renewable energy resource (4-PS3-4. Apply scientific ideas to design, test, and refine a device that converts energy from one form to another)
  - ❑ *From the standards:* Examples of devices could include electric circuits that convert electrical energy into motion energy of a vehicle, light, or sound; and, a passive solar heater that converts light into heat. Examples of constraints could include the materials, cost, or time to design the device.] [Assessment Boundary: Devices should be limited to those that convert motion energy to electric energy or use stored energy to cause motion or produce light or sound.]

## ❑ Evaluate

- ❑ Draw or describe three examples of how energy is transferred from one object to another; transferred from place to place; or transformed from one form of energy to another.
  - ❑ Must include at least 4 different forms of energy
- ❑ Describe a nonrenewable energy, its impacts on the environment and an alternative renewable energy