



GRADE LEVEL: MIDDLE AND HIGH SCHOOL

Student Objectives

- Understand how concepts of energy and work are connected
- Identify seven different forms of energy as potential or kinetic
- Illustrate how NASCAR racing utilizes Newton's second law ($F=m*a$) to calculate energy
- Conduct experiments to measure energy

Materials List

- SPARK! Education Video: Energy in Action
- Previous SPARK lessons: [KaPow](#), [Chemistry in Action](#), [Engineered for Air](#) and [Tight and Loose](#)
- View NASCAR race from Darlington, South Carolina, on May 17, 2020
- Pencil
- Paper

Lesson Plan and Procedures

1. Review energy basics.
 - Define **potential energy**.
Suggested resources:
<https://flexbooks.ck12.org/cbook/ck-12-middle-school-physical-science-flexbook-2.0/section/14.3/primary/lesson/potential-energy-ms-ps>
<https://www.youtube.com/watch?v=ASZv3tIK56k>
 - Define **kinetic energy**.
Suggested resource: <https://examples.yourdictionary.com/kinetic-energy-examples.html>
 - What are the different types of potential energy? (list 2)
 - What are the different types of kinetic energy? (list 3)





2. Review the SPARK! Education energy video as well as the Darlington race footage. Identify the types of energy in the following locations associated with racing:
 - Race engine:
 - Race fuel:
 - Race car in a turn (banked part of track):
 - Pit stop:
 - Garage:
3. Review the SPARK! Education lessons for middle and high school listed above.
4. Select one of the lessons and conduct an experiment. You will be using the experiment to figure out the energy and work of the devices you create. You will need a scale for measurement and a tape measure.
5. Build the car(s) related to the lesson. Conduct the experiment as outlined in the lesson to ensure you have a functioning vehicle.
6. Using your vehicle, calculate one the following formulas to understand how work and energy can be measured by your vehicle.

Suggested online videos:

- <https://www.youtube.com/watch?v=ns1l8jS2BHg&t=93s>
- <https://www.youtube.com/watch?v=HEqY77RHnVO>
- <https://www.youtube.com/watch?v=Jyiw6KkedDY>

Formula abbreviations: m = mass (measure in kg); v = velocity; g = gravity; h = height; a = acceleration; w = work; d = displacement

- Newton's second law:
 $f = m \cdot a$
- Work formula:
 $w = f \cdot d$
- Potential energy formula:
 $P.E. = m \cdot g \cdot h$
- Kinetic energy formula:
 $K.E. = \frac{1}{2}mv^2$





7. Whew! STEM for energy is important. Without the math, science, engineering and technology facets coming together, the experiment wouldn't have been successful. Crew chiefs and engineers need to understand how energy and work will impact the race car.
8. If you want to do a fun experiment with your younger siblings, neighbors or friends, try the Energy in Action lesson and conduct a few game experiments with them.

