Lesson S2a

NEWTON'S LAWS: ENERGY ON THE JOB

SCIENCE TEKS OBJECTIVES	
§112.18	9. Force, motion, and energy. The student knows that the Law of Conservation of Energy states that energy can neither be created nor destroyed, it just changes form. The student is expected to: (C) demonstrate energy transformations such as energy in a flashlight battery changes from chemical energy to electrical energy to light energy.
§112.19.	7. Force, motion, and energy. The student knows that there is a relationship among force, motion, and energy. The student is expected to: (B) illustrate the transformation of energy within an organism such as the transfer from chemical energy to heat and thermal energy in digestion

CAREER EXPLORATION AND PORTALS TEKS OBJECTIVES	
§127.3 c	4. The student evaluates skills for personal success. The student is expected to: (B) use interpersonal skills to facilitate effective teamwork; (C) use a problem-solving model and critical-thinking skills to make informed decisions; and (D) use effective time-management and goal-setting strategies. 7. The student develops skills for professional success. The student is expected to: (A) demonstrate effective verbal, nonverbal, written, and electronic communication skills, (C) model characteristics of effective leadership, teamwork, and conflict management; (E) explore and model characteristics necessary for professional success such as work ethics, integrity, dedication, perseverance, and the ability to interact with a diverse population; and (F) complete activities using project- and time-management techniques. 8. The student identifies and explores technical skills essential to careers in multiple occupations, including those that are high skill, high wage, or high demand. The student is expected to: (A) complete actual or virtual labs to simulate the technical skills required in various occupations.

Instructional Directions

This activity is designed to take 15–30 minutes for brainstorming; 10–45 minutes for skits depending on class size.

1. Students have acquired background knowledge and comprehension of energy transformation that take place around us and the Law of Conservation of Matter (Energy).
2. Students are given a scenario from a particular job. (**Blackline Masters S2.1–S2.7**)
3. Students brainstorm energy transformations that take place in that scenario.
4. In the blank space on their worksheet, students draw out transformations using arrows to show direction of transfer.
5. Students create a pantomime (silent) skit of the transformations.
6. Students perform their skit for their classmates. Classmates try to guess which job is being shown.
7. Class discusses energy transformations shown in group's skit.

Learning Outcome(s)

The students will demonstrate knowledge and application of energy transformations in an activity by a given job.

Related Industries/Occupations

Scientist, Nurse, Doctor, Accountant, HVAC Specialist, Geoscientist, Licensed Vocational Nurse (LVN)

Deliverables

Acting out a pantomime demonstrating the scene given. A list of energy transformations found in the scene.

Resources Needed

Blackline Masters S2.1–S2.7 (This is where students will list their energy transformations.)

Vocabulary or Concepts (New and/or Challenging)

- Pantomime
- Energy
- Law of Conservation of Energy
- Energy transformations

MODIFICATIONS & EXTENSIONS

Video clips could be shown of a job in action. Students could describe or even draw energy transformations shown.

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Date _____

Group Member Names _____ _____

_____ _____

ENERGY TRANSFORMATION SKITS

As a group, read your situation and think about the energy transformations that may take place in the situation. One person in the group needs to draw the energy transformations with the actions your group will pantomime. Hand this paper to your teacher when time to practice is up. It must have the names of all your group members.

Group 1: Astronauts replace a "window" on the international space station that allows sunlight to enter the lab where the **scientists** are experimenting on growth plants in space.

When your group is called on, act out your situation. The audience will record on a piece of notebook paper what they think your situation is and the energy transformations that they saw. Your grade is based on:

- The energy transformations shown below on this page (with arrows correct)
- Appropriate participation in your group
- Showing a minimum of three energy transformations in your pantomime
- Making your situation obvious to your audience in your acting
- Your active participation in observing other groups

Date _____

Group Member Names _____ _____

_____ _____

ENERGY TRANSFORMATION SKITS

As a group, read your situation and think about the energy transformations that may take place in the situation. One person in the group needs to draw the energy transformations with the actions your group will pantomime. Hand this paper to your teacher when time to practice is up. It must have the names of all your group members.

Group 2: A **college nursing instructor** is showing students how to give an immunization shot. A student attempts to give another student a shot and is too rough. The student receiving the shot screams in pain.

When your group is called on, act out your situation. The audience will record on a piece of notebook paper what they think your situation is and the energy transformations that they saw. Your grade is based on:

- The energy transformations shown below on this page (with arrows correct)
- Appropriate participation in your group
- Showing a minimum of three energy transformations in your pantomime
- Making your situation obvious to your audience in your acting
- Your active participation in observing other groups

Date _____

Group Member Names _____ _____

_____ _____

ENERGY TRANSFORMATION SKITS

As a group, read your situation and think about the energy transformations that may take place in the situation. One person in the group needs to draw the energy transformations with the actions your group will pantomime. Hand this paper to your teacher when time to practice is up. It must have the names of all your group members.

Group 3: You eat a bad hamburger, become ill, go to see a **doctor**. He/She writes a prescription after examining you.

When your group is called on, act out your situation. The audience will record on a piece of notebook paper what they think your situation is and the energy transformations that they saw. Your grade is based on:

- The energy transformations shown below on this page (with arrows correct)
- Appropriate participation in your group
- Showing a minimum of three energy transformations in your pantomime
- Making your situation obvious to your audience in your acting
- Your active participation in observing other groups

Date _____

Group Member Names _____ _____

_____ _____

ENERGY TRANSFORMATION SKITS

As a group, read your situation and think about the energy transformations that may take place in the situation. One person in the group needs to draw the energy transformations with the actions your group will pantomime. Hand this paper to your teacher when time to practice is up. It must have the names of all your group members.

Group 4: An **accountant** is trying to calculate the end-of-month expenses but her phone keeps ringing and no one is on the other end. Finally, her boss comes in and informs her that he has been trying to call her. They realize his phone is not working. He throws it out the window.

When your group is called on, act out your situation. The audience will record on a piece of notebook paper what they think your situation is and the energy transformations that they saw. Your grade is based on:

- The energy transformations shown below on this page (with arrows correct)
- Appropriate participation in your group
- Showing a minimum of three energy transformations in your pantomime
- Making your situation obvious to your audience in your acting
- Your active participation in observing other groups

Date _____

Group Member Names _____ _____

_____ _____

ENERGY TRANSFORMATION SKITS

As a group, read your situation and think about the energy transformations that may take place in the situation. One person in the group needs to draw the energy transformations with the actions your group will pantomime. Hand this paper to your teacher when time to practice is up. It must have the names of all your group members.

Group 5: Your home's air-conditioning has gone out! UGH! You call an **HVAC** (home ventilation & air conditioning) **specialist** to come out and fix the problem. He finds that a huge weed has grown and become intertwined in the unit outside. He cuts it back and restores AC to your home! Thank goodness!

When your group is called on, act out your situation. The audience will record on a piece of notebook paper what they think your situation is and the energy transformations that they saw. Your grade is based on:

- The energy transformations shown below on this page (with arrows correct)
- Appropriate participation in your group
- Showing a minimum of three energy transformations in your pantomime
- Making your situation obvious to your audience in your acting
- Your active participation in observing other groups

Date _____

Group Member Names _____ _____

_____ _____

ENERGY TRANSFORMATION SKITS

As a group, read your situation and think about the energy transformations that may take place in the situation. One person in the group needs to draw the energy transformations with the actions your group will pantomime. Hand this paper to your teacher when time to practice is up. It must have the names of all your group members.

Group 6: **Geoscientists** take seismic readings to determine what kind of rock is under the ground. They use computers to interpret that info and then show the petroleum technician where to drill on a map.

When your group is called on, act out your situation. The audience will record on a piece of notebook paper what they think your situation is and the energy transformations that they saw. Your grade is based on:

- The energy transformations shown below on this page (with arrows correct)
- Appropriate participation in your group
- Showing a minimum of three energy transformations in your pantomime
- Making your situation obvious to your audience in your acting
- Your active participation in observing other groups

Date _____

Group Member Names _____ _____

_____ _____

ENERGY TRANSFORMATION SKITS

As a group, read your situation and think about the energy transformations that may take place in the situation. One person in the group needs to draw the energy transformations with the actions your group will pantomime. Hand this paper to your teacher when time to practice is up. It must have the names of all your group members.

Group 7: It's your grandpa's birthday. He lives in a nursing home. His **LVN** (Licensed Vocational Nurse) wheels him in the room. You get to light the candles on the cake and then help him blow them out before you all eat it.

When your group is called on, act out your situation. The audience will record on a piece of notebook paper what they think your situation is and the energy transformations that they saw. Your grade is based on:

- The energy transformations shown below on this page (with arrows correct)
- Appropriate participation in your group
- Showing a minimum of three energy transformations in your pantomime
- Making your situation obvious to your audience in your acting
- Your active participation in observing other groups

Lesson S2b

NEWTON'S LAWS: A LESSON IN FORCE

SCIENCE TEKS OBJECTIVES	
§112.19.	7. Force, motion, and energy. The student knows that there is a relationship among force, motion, and energy. The student is expected to: (A) contrast situations where work is done with different amounts of force to situations where no work is done such as moving a box with a ramp and without a ramp, or standing still;
§112.20.	6. Force, motion, and energy. The student knows that there is a relationship between force, motion, and energy. The student is expected to: (A) demonstrate and calculate how unbalanced forces change the speed or direction of an object's motion; (B) differentiate between speed, velocity, and acceleration; and (C) investigate and describe applications of Newton's law of inertia, law of force and acceleration, and law of action-reaction such as in vehicle restraints, sports activities, amusement park rides, Earth's tectonic activities, and rocket launches.

CAREER EXPLORATION AND PORTALS TEKS OBJECTIVES	
§127.3 c	1. The student explores personal interests and aptitudes as they relate to education and career planning. The student is expected to: (B) explore the career clusters as defined by the U.S. Department of Education. 2. The student analyzes personal interests and aptitudes regarding education and career planning. The student is expected to: (C) develop and analyze tables, charts, and graphs related to career interests. 4. The student evaluates skills for personal success. The student is expected to: (C) use a problem-solving model and critical-thinking skills to make informed decisions; and (E) effectively use information and communication technology tools 7. The student develops skills for professional success. The student is expected to: (A) demonstrate effective verbal, nonverbal, written, and electronic communication skills. 8. The student identifies and explores technical skills essential to careers in multiple occupations, including those that are high skill, high wage, or high demand. The student is expected to: (A) complete actual or virtual labs to simulate the technical skills required in various occupations.
§127.4 c	2. The student explores pathways of interest within one or more career clusters. The student is expected to: (B) explore careers of personal interest; and (E) describe the technical-skill requirements for careers of personal interest. 6. The student explores labor market information. The student is expected to: (A) analyze national, state, regional, and local labor market information; and (B) cite evidence of high-skill, high-wage, or high-demand occupations based on analysis of labor market information.

Instructional Directions **This activity is designed to take 45 – 60 minutes as presented below.**

1. Students discover background information of the types of high-skill, high-demand jobs found in the Gulf Coast region (**http://tinyurl.com/menzpp9**)
2. Students can also review background information on Newton's Second Law through discussion of previous lessons or watching a video such as **http://tinyurl.com/kv2osp2**
3. Students will be given instructions to think of a contrasting situation related to one of the jobs on the video to show/illustrate Newton's Second Law: Force = Mass x Acceleration. Students select one. All groups can be given the same jobs or each group can have a different job/scenario. Students must then illustrate the contrasting scenarios.
   * Example: The same nurse has to move two different patients from their beds to a gurney to get x-rays taken. The first patient is an elderly lady that weighs 90 lbs. (lesser mass). The second is a former Houston Texans player who weighs 295 lbs. (greater mass). To accelerate (move the same direction at the same speed), the nurse will have to use more force with the second patient – the one with the greater mass. Students could draw or find computer images to portray this contrasting scene that illustrates Newton's Second Law of Motion.

   (NOTE: Ask students to avoid situations that involve gravity as most don't fully grasp the concept of gravity as a force yet.)

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NEWTON'S LAWS: A LESSON IN FORCE

4. Illustrations can be computer-generated or hand-drawn.
5. Students will write a paragraph explaining how their illustration portrays Newton's Second Law.
6. Share final examples with the class. Discuss the accuracy of the concepts portrayed by the students.

Learning Outcome(s)

Students will review the concept of Newton's Second Law. Students will also review the types of high-skill, high-growth jobs found in the Gulf Coast region. The students apply their comprehension of the law by creating an illustration of Newton's Second Law at work in a particular job related task. Each student will do his/her own illustration.

Related Industries/Occupations

Any of those found in Workforce Solutions' High-Skill/High-Growth Jobs List

Deliverables

Short essay illustrating example of Newton's Second Law.
Contributions can be individual or group assignments.

Resources Needed

IDEAL

- U.S. Department of Labor videos
- Focus On profiles (wrksolutions.com/jobs/focuson.html)
- High-Skill/High-Growth Jobs List (wrksolutions.com/jobs/doc/WFS-HSHG.pdf)
- Computers, Internet access for images, drawing paper, markers, map pencils

LIMITED RESOURCES

- Teacher provides paper-based information on pre-selected jobs from the High-Skill/ High Growth Jobs List (wrksolutions.com/jobs/doc/WFS-HSHG.pdf)
- Students hand-draw illustrations on their essay page

Vocabulary or Concepts (New and/or Challenging)

- Force
- Motion
- Acceleration
- Mass
- Net force
- Direction of force
- Sir Isaac Newton
- Newton's Second Law of Motion
- Portray
- Illustrate
- Effect
- Affect

MODIFICATIONS & EXTENSIONS

As students are watching the Department of Labor videos, teacher could pause to ask about forces found in each of the scenarios. Analysis questions:

- If more mass was added to _____ how would that affect the acceleration of _____?
- What would happen if more force was applied to _____?
- Students with higher math abilities can use the formula to make up word problems with realistic values to apply to their illustrated scenes. Word problems could be teacher created as well.
- **Simplify:** Students would not create their own illustrations. Examples could be teacher-generated showing:
  a. the same force acting on different masses producing different acceleration rates.
  – OR –
  b. different forces on the same mass producing different acceleration rates.
- **Simplify:** Students could write the paragraph of the application of Newton's Second Law to "On the Job" illustrations that could be provided.

Adapted from: Newton's Second Law Illustrations developed by N. Stewart

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