Ignite! Learning

# Energy

## Table of Contents

# UNIT CHALLENGE

**Purpose:** The unit challenges help students explore the big picture themes that tie together each unit of Ignite! content. These challenges are designed to complement the Ignite! Topic Lessons.

Each challenge presents students with an open-ended task with no single correct solution. Working in small groups, students prepare a short response, in either written or oral form, in which they use knowledge gained by studying the unit's multimedia movies to formulate and defend a particular position. These responses can be used to stimulate further class discussion and exploration of the issues.

> *NOTE: In order to use this activity with your class for a particular Ignite! unit, you should plan on having students study the Ignite! movies from most of the topics in that unit. Otherwise, students will not have enough information to complete the challenge activity.*

**Class time required:**

- 15 minutes at the start of unit to organize students into groups and review the challenge, and for the groups to discuss and record their initial thoughts and current knowledge of the issues.
- 20 minutes at the end of the unit for student groups to complete their responses to the challenge.
- *Optional*: 20-30 minutes for student groups to present their responses to the class.

**Teacher Instructions:**

At the Start of the Unit: Before studying any of the unit's topics or movies:

1. divide your class into teams of 3 to 4 students;
2. reproduce the unit challenge worksheet and distribute to students;
3. decide whether teams will give oral presentations and/or written statements in response to their challenge;
4. read the challenge(s) out loud and make sure that all terms and concepts are understood;
5. ask groups to complete Part One of their worksheets (Getting Started). They should discuss and write down their thoughts, based on their current knowledge for how they might respond to the selected challenge.

While the Class Studies the Unit's Topics: Over the next few days or weeks, as you are using the Ignite! Topic Lessons for this unit, occasionally remind students to record on their worksheets any information they have found in the Ignite! movies that might help them to develop or support their response to the challenge. They should record this information in Part Two of their worksheets (Taking Notes).

After Completing the Last Topic of the Unit: Give your students 20 minutes to discuss and write up their response to the challenge. They can use the space provided in Part Three of their worksheets (Preparing Your Response). You might consider allowing them to review some of the movies from the unit. Then, have students give brief presentations of their responses (2 to 3 minutes each) and/or submit their written responses.

# Energy

## Transforming Energy

Background: Energy is what you need to get stuff done, and it comes in many forms, including chemical, electrical, thermal, radiation, kinetic, potential, and nuclear. But energy can be changed from one form into another. For example, the chemical energy in the food you eat gets turned into kinetic energy when you run.

Challenge: Give five examples of how energy is changed from one form into another.

Tips:

- Think about the technology and machines that you use every day.
- Try to cover all of the energy forms listed above – each form should appear in at least one of your examples.

**PART ONE – Getting Started**

**Directions:** Based on what you already know, talk with the other members of your group about how you might respond to this challenge. Write your thoughts in the box below. You can change your mind later, after you have reviewed the Ignite! movies in this unit.

Notes:

**PART TWO – Taking Notes**
**Directions:** As you view and discuss the Ignite! movies in this unit be on the lookout for information that will help you develop a response to your challenge. Record that information in the box below. Use additional paper if necessary.

Notes:

**PART THREE – Preparing Your Response**
**Directions:** Depending on your teacher's instructions, work with your group to create a written or oral response to your challenge. Decide on what you want to communicate, and be sure to support your statements with evidence from the Ignite! movies. Use the space below for your response. Use additional paper if necessary.

Notes:

unit Energy

# Types of Energy

**Class:** _____ **Type Instruction:** Whole Class

**Learning Objective(s):** Students define matter and energy.

**Length of Time:** 10 Minutes

**Ignite! Movies:**

- Six Forms of Energy
- Defining Energy

**Teacher Instructions:** Play Ignite! movies with students and complete the following activity.
**Part One:** Students complete a vocabulary building activity.
**Part Two:** Students create a list individually and share with the class.

**Target Vocabulary/Key Terms:**

- *atom*
- *chemical energy*
- *electrical energy*
- *electron*
- *energy*
- *kinetic energy*
- *matter*
- *molecule*
- *nuclear fusion*
- *nucleus*
- *potential energy*
- *proton*
- *radiant energy*
- *thermal energy*

**Notes:**

Name: _____

## Energy Vocabulary

**Directions:** Match the term below with the correct definition.

| Term | Definition |
|---|---|
| 1. _____ **atom** | A. the capacity of a physical system to do work |
| 2. _____ **chemical energy** | B. energy that is carried through the electrons or protons of atoms |
| 3. _____ **electrical energy** | C. everything that has mass and occupies space |
| 4. _____ **electron** | D. the smallest complete unit of a compound; a combination of atoms joined by covalent bonds |
| 5. _____ **energy** | E. energy that an object has because of its motion |
| 6. _____ **kinetic energy** | F. energy that is released in a nuclear reaction either by fusion or fission |
| 7. _____ **matter** | G. a process in which stars give off light and heat; the joining of two nuclei together into one, which releases great amounts of energy in the form of heat and light |
| 8. _____ **molecule** | H. the smallest part of an element that has all of the chemical properties of that element |
| 9. _____ **nuclear energy** | I. energy that an object has because of its position |
| 10. _____ **nuclear fission** | J. a subatomic particle inside the nucleus of an atom; it has positive electric charge |
| 11. _____ **nuclear fusion** | K. the splitting of a nucleus of an atom nuclei of a heavy element, induced by the absorption of a neutron; it releases a large amount of energy |
| 12. _____ **nucleus** | L. energy that is transferred by rays, waves, or particles; its transfer between objects does not require a medium; also known as radiation |
| 13. _____ **potential energy** | M. a negatively-charged particle found in regions around an atomic nucleus |
| 14. _____ **proton** | N. energy associated with heat |
| 15. _____ **radiant energy** | O. energy stored in the chemical bonds of molecules |
| 16. _____ **thermal energy** | P. the positively charged and central part of an atom where most of its mass is concentrated |

## Examples of the Six Forms of Energy

**Directions:** Write a list of the six forms of energy and examples of each. Be prepared to share the examples with the class!

# unit Energy

## #2. Potential and Kinetic Energy

**Class:** _____ **Type Instruction:** Whole Class

**Learning Objective(s):** Students understand that energy is a property of many substances and is associated with mechanical motion.

**Length of Time:** 10 Minutes

**Ignite! Movies:**

- Life and Potential Energy
- Kinetic Energy & Earthquakes!

**Teacher Instructions:** Play Ignite! movies with students and complete the following activity.
**Part One:** Students complete a note-taking and application exercise.
**Part Two:** Earthquake Explanation is an individual writing assignment.

**Target Vocabulary/Key Terms:**

- *earthquake*
- *electricity*
- *fault*
- *hydroelectric dam*
- *mass*
- *speed*
- *turbine*
- *wave*

**Notes:**

## Potential Energy Transforming Into Kinetic Energy

**Directions:** List and describe five examples of potential energy transforming into kinetic energy. In each case, state the potential energy, the kinetic energy, and how it was transformed from one to the other.

1. _____

_____

2. _____

_____

3. _____

_____

4. _____

_____

5. _____

_____

## Earthquake Explanation

**Directions:** Write a paragraph explaining the stages of the catastrophic event of an earthquake. Explain how an earthquake is an example of the relationship between kinetic energy and potential energy. Be sure to use the following terms:

- earthquake
- fault
- kinetic energy
- potential energy
- wave



# #3. Conduction, Convection, and Radiation

**Class:** _____ **Type Instruction:** Whole Class

**Learning Objective(s):** Students understand that energy is a property of many substances and is associated with heat.

**Length of Time:** 10 Minutes

**Ignite! Movies:**

- Thermal Energy Transfer
- Three Types of Heat Transfer

**Teacher Instructions:** Play Ignite! movies with students and complete the following activity.
**Part One:** Students complete a note-taking and diagramming activity.
**Part Two:** Examples of Conduction, Convection, and Radiation is a class discussion.

**Target Vocabulary/Key Terms:**

- *conduction*
- *convection*
- *radiation*

**Notes:**

## Three Types of Heat Transfer

**Directions:** In the spaces below, describe and diagram examples of the three types of heat transfers.

| | Description | Diagram |
|---|---|---|
| **Conduction:** | | |
| **Convection:** | | |
| **Radiation:** | | |

## Examples of Conduction, Convection, and Radiation

**Directions:** As a class, discuss the following question: what are examples of conduction, convection, and radiation that we see in our everyday lives?

unit Energy

# 4. How Heat Is Transferred

**Class:** _____ **Type Instruction:** Whole Class

**Learning Objective(s):** Students understand that heat moves in predictable ways, flowing from warmer objects to cooler ones, until both reach the same temperature.

**Length of Time:** 10 Minutes

**Ignite! Movies:**

- The Flow of Heat
- Molecules in Motion

**Teacher Instructions:** Play Ignite! movies with students and complete the following activity.
**Part One:** Students create a caption for the illustrations.
**Part Two:** Students create a diagram showing The Process of Thermal Energy.

**Target Vocabulary/Key Terms:**

- *temperature*

**Notes:**

## The Behavior of Molecules

**Directions:** Describe how the behavior of the molecules changes in the three panels of the comic strip below.

## The Process of Thermal Energy

**Directions:** In the space below, draw the movement of particles during a transfer of thermal energy from a very hot substance to a cooler substance. Make it a sequential process. What will happen with the particles in each stage of the sequence? Do the particles speed up?

# unit Energy
# #5. Specific Heat

**Class:** _____ **Type Instruction:** Whole Class

**Learning Objective(s):** Students understand interactions between matter and energy, including specific heat.

**Length of Time:** 10 Minutes

**Ignite! Movies:**

- Looking at Temperature and Heat
- Specific Heat Capacity

**Teacher Instructions:** Play Ignite! movies with students and complete the following activity.
**Part One:** Students complete the statements.
**Part Two:** Knowing the Range of Specific Heat Capacities is a classroom sequencing activity.

**Target Vocabulary/Key Terms:**

- *calorie*
- *degree*
- *joule*
- *measure*
- *specific heat capacity*

**Notes:**

## Understanding Specific Heat

**Directions:** Fill in the blanks in the sentences below.

1. _____ is the amount of heat per gram required to change the temperature of water by one kelvin (or one degree Celsius).

2. A substance with a large specific heat capacity requires _____ energy and heats up more _____.

3. A substance with a small specific heat capacity requires _____ energy and heats up more _____.

## Knowing the Range of Specific Heat Capacities

**Directions:** As a class, rank three substances in order from smallest to largest specific heat capacity.

# unit Energy
# #6. Electricity

**Class:** _____ **Type Instruction:** Whole Class

**Learning Objective(s):** Students understand that energy is a property of many substances and is associated with electricity.

**Length of Time:** 10 Minutes

**Ignite! Movies:**

- We're So Electric
- Wind and Power

**Teacher Instructions:** Play Ignite! movies with students and complete the following activity.
**Part One:** Students complete a note-taking activity.
**Part Two:** Students work in pairs to create a diagram showing How Windmills Work.

**Target Vocabulary/Key Terms:**

- *magnet*

**Notes:**

Name: _____



## Electricity

**Directions:** Complete the sentence below.

Two factors that create electricity are the _____ of particles with opposite charges and the _____ of particles with the same charge.

## How Windmills Work

**Diagram:** With a partner, create and label a diagram sequentially showing how windmills transfer kinetic energy to electrical energy. Present your diagram to the class!

# unit Energy
# #7. Waves

**Class:** _____ **Type Instruction:** Whole Class

**Learning Objective(s):** Students understand and identify energy can be carried from one place to another by heat flow or by waves, including water, light and sound waves, or by moving objects.

**Length of Time:** 10 Minutes

**Ignite! Movies:**

- A Discussion of Waves
- What's a Wave?

**Teacher Instructions:** Play Ignite! movies with students and complete the following activity.
**Part One:** Students write the definitions.
**Part Two:** Students create and label a diagram of a transverse wave and a diagram of a longitudinal wave.

**Target Vocabulary/Key Terms:**

- *amplitude*
- *crest*
- *electromagnetic wave*
- *longitudinal wave*
- *mechanical wave*
- *speed*
- *transverse wave*
- *trough*
- *velocity*
- *wavelength*

**Notes:**

Name: _____

## The Vocabulary of Waves

**Directions:** Fill in the definitions for the following words.

1. **amplitude:** _____

_____

2. **crest:** _____

_____

3. **electromagnetic wave:** _____

_____

4. **mechanical wave:** _____

_____

5. **transverse wave:** _____

_____

6. **trough:** _____

_____

7. **wave:** _____

_____

8. **wavelength:** _____

_____

## Two Wave Diagrams

**Directions:** Create and label a diagram of a transverse wave and a diagram of a longitudinal wave. When you write your labels, be sure to use the following terms:

- compression
- crest
- expansion
- trough
- wave
- wavelength

unit Energy

# #8. Technology of Energy Transformation

**Class:** _____ **Type Instruction:** Whole Class

**Learning Objective(s):** Students identify and compare methods used for transforming energy in devices such as water heaters and cooling systems.

**Length of Time:** 10 Minutes

**Ignite! Movies:**

- Heating and Cooling Systems
- How Cooling Systems Work

**Teacher Instructions:** Play Ignite! movies with students and complete the following activity.
**Part One:** Students complete a compare and contrast activity.
**Part Two:** Students work in pairs to create a diagram and use their visual aid in a presentation to the class about how cooling systems work.

**Target Vocabulary/Key Terms:**

- *photosynthesis*
- *radiant energy*
- *system*

**Notes:**

## Understanding Water Heaters and Cooling Systems

**Directions:** Water heaters and cooling systems both use electrical energy to change the temperature of a substance (water or air), but how are they different? List five details that make water heaters and cooling systems different from each other.

1. _____

2. _____

3. _____

4. _____

5. _____

## Cooling System Diagram

**Diagram:** Work with a partner to create and label a diagram of a cooling system. Then, use the cooling system diagram as a visual aid in your presentation to the class about how cooling systems work. Be sure to explain the transfers of energy!

unit Energy

# #9. Two Methods of Energy Transformation

**Class:** _____ **Type Instruction:** Whole Class

**Learning Objective(s):** Students identify energy transformations occurring during the production of energy for human use.

**Length of Time:** 10 Minutes

**Ignite! Movies:**

- The Steam Engine
- Steam vs. Nuclear Power

**Teacher Instructions:** Play Ignite! movies with students and complete the following activity.
**Part One:** Students complete a sequencing and comprehension activity.
**Part Two:** Students create a Steam Engine Flowchart. This activity can be completed individually, in groups, or as a class. One (or more) student(s) can volunteer to draw the flowchart while the rest of the class instructs them.

**Target Vocabulary/Key Terms:**

*NA*

**Notes:**

## The Transformations of Energy in a Nuclear Power Plant

**Directions:** Using only three of the terms from the word bank below, sequence and describe all of the transformations of energy involved in a nuclear power plant. Follow the example below.

**A.** Ex. **Nuclear energy** is used to create **thermal energy** in the form of steam.

**B.** Then, the **thermal energy** --

**C.**

| Word Bank | | | |
|---|---|---|---|
| chemical energy | electrical energy | kinetic energy | nuclear energy |
| radiant energy | potential energy | thermal energy | |

## Steam Engine Flowchart

**Directions:** As a class, create and label a flowchart showing the transformations of energy in a steam engine. One student will make the chart based on the instructions of the others.

unit Energy

# #10. Efficiency of Energy Transformation

**Class:** _____ **Type Instruction:** Whole Class

**Learning Objective(s):** Students understand that the utility of energy sources is determined by factors that are involved in converting these sources to useful forms and the consequences of the conversion process.

**Length of Time:** 10 Minutes

**Ignite! Movies:**

- Efficiency
- Types of Power Plants

**Teacher Instructions:** Play Ignite! movies with students and complete the following activity.
**Part One:** Students complete the Pros and Cons comparison chart.
**Part Two:** Are You Efficient? is a class discussion.

**Target Vocabulary/Key Terms:**

- *biomass*

**Notes:**

## Pros and Cons of Power Plants

**Directions:** List the pros and cons of the following types of power plants.

| | Pros | Cons |
|---|---|---|
| **Hydroelectric Plant** | | |
| **Fossil Fuel Plant** | | |
| **Solar Energy Plant** | | |
| **Wind Power Plants** | | |

## Are You Efficient?

**Directions:** In physical science, efficiency is the percentage of useful energy produced by a conversion system out of the total energy supplied to it. Efficiency measures how much useful energy a power plant gives off compared to how much energy it is given. As a science student, how do you think you could become a more efficient student? Are there ways you can increase your efficiency? List them and share your ideas with the class!

unit **Energy**

# #11. Efficiency Comparisons

**Class:** _____ **Type Instruction:** Whole Class

**Learning Objective(s):** Students know energy types from their source to their use and determine if the type is renewable or non-renewable.

**Length of Time:** 10 Minutes

**Ignite! Movies:**

- Transforming Energies!
- Which Source Is Best?

**Teacher Instructions:** Play Ignite! movies with students and complete the following activity.
**Part One:** Students complete a note-taking activity.
**Part Two:** Students complete a creative thinking exercise and apply what they have learned to answer this question and share with the class.

**Target Vocabulary/Key Terms:**

- *acid rain*
- *greenhouse effect*

**Notes:**

## Renewable Energy and Nonrenewable Energy Examples

**Directions:** Describe and give three examples of renewable energy and nonrenewable energy.

| Energy Type | Description | Examples |
|---|---|---|
| renewable energy | | 1.<br>2.<br>3. |
| nonrenewable energy | | 1.<br>2.<br>3. |

## The World of Energy

**Directions:** Make a list of three ideal geographic locations to harvest different sources of renewable energy. Why is that particular location right for that energy source? Be prepared to share your list with the class!

Name: _____

# "Energy" Unit Test

1. Wind blowing leaves into the air is an example of _____ energy.

   A. kinetic
   B. electrical
   C. potential
   D. radiant

2. Energy is the --

   F. amount of matter contained in a system
   G. ability of a system to do work
   H. total friction within a system
   J. amount of heat contained in a system

3. Kinetic energy is the kind of energy a system has due to its --

   A. motion
   B. chemical bonds
   C. radiation
   D. molecules

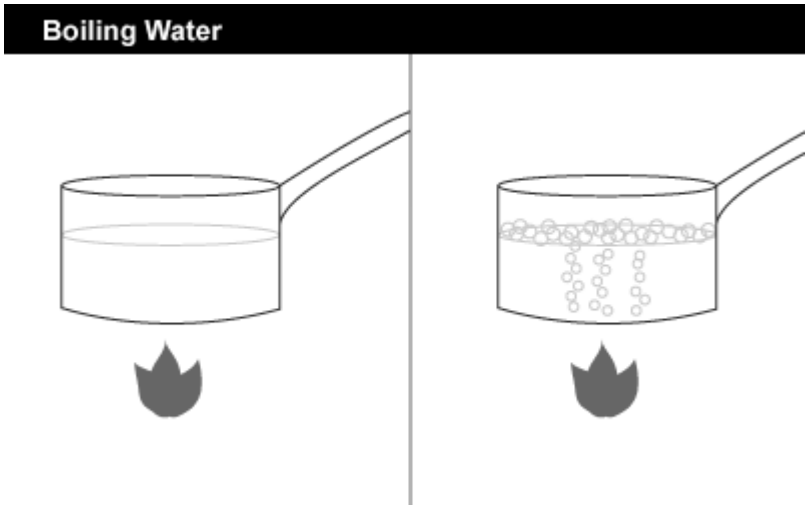
4. Earthquakes are an example of the transformation of _____ energy.

   F. kinetic to potential
   G. chemical to radiant
   H. potential to kinetic
   J. nuclear to chemical

5. The gravitational potential energy of an object depends on its mass and on its --

   A. chemical composition
   B. location
   C. temperature
   D. weight

6. Use the image below AND your science knowledge to answer the following question.




Heat is transferred from the stove to the water through the metal pot in a process called --

F. convection
G. conduction
H. radiation
J. emission

7. The only kind of transfer of thermal energy that does not require a medium or direct contact of objects is called --

A. conduction
B. convection
C. heat
D. radiation

8. Thunderstorms are generated by rapidly rising masses of warm air. This is an example of transfer of thermal energy by --

F. radiation
G. conduction
H. convection
J. emission

9. Heat always flows from _____ objects.

A. warmer to cooler
B. cooler to warmer
C. less massive to more massive
D. more massive to less massive

10. The measure of the average motion of atoms and molecules in a substance is called --

    F. temperature
    G. Fahrenheit
    H. thermal energy
    J. hertz

11. What happens to the molecules of a substance when they gain thermal energy?

    A. Their temperature decreases.
    B. They break into smaller units.
    C. Their sizes increase.
    D. Their kinetic energy increases.

12. Specific heat capacity is the --

    F. capacity of a substance to hold heat
    G. heat energy stored in a substance
    H. amount of heat required to change the temperature of a unit mass of a substance by one degree Kelvin
    J. amount of energy that a substance can transform from one form to another

13. Oil has a smaller specific heat capacity than water, which means that if the same amounts of oil and water absorb the same amount of energy, then the oil's temperature will be _____ that of water.

    A. lower than
    B. the same as
    C. higher than
    D. double

14. Electricity is produced when the _____ of a substance move from one region to another.

    F. atoms
    G. neutrons
    H. protons
    J. electrons

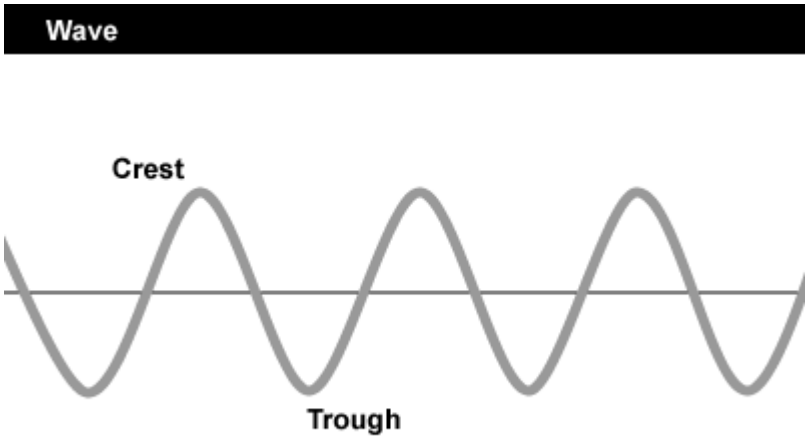
15. Windmills are sometimes used to convert wind energy into _____ energy.

    A. kinetic
    B. electrical
    C. radiant
    D. potential

16. In a transverse wave, particles move back and forth _____ to the direction of the wave's propagation.

F. perpendicular
G. parallel
H. opposite
J. identical

17. Use the image below AND your science knowledge to answer the following question.




The distance measured between two crests (or two troughs) in a wave is called its --

A. energy
B. frequency
C. amplitude
D. wavelength

18. Water waves are an example of --

F. electromagnetic waves
G. energy transfer
H. mass transfer
J. sound waves

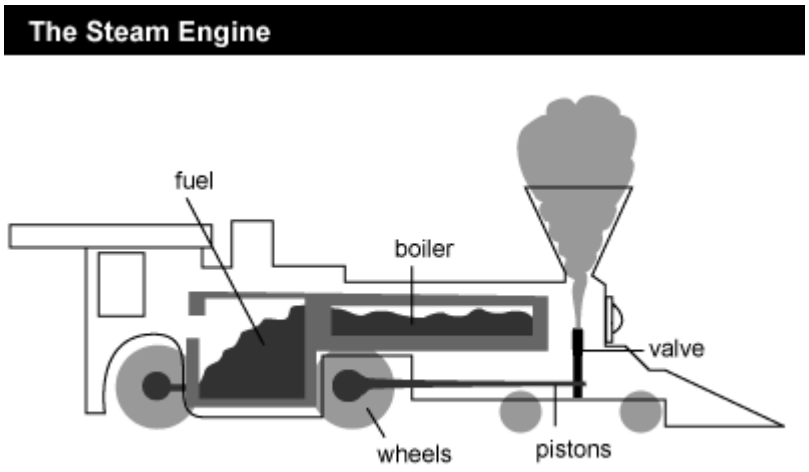
19. In an air-conditioned room, the air is cooled because it --

A. loses heat as it comes in contact with the cool coils filled with Freon gas
B. rises to the top of the room, creating a cooling convection current
C. is compressed inside the air conditioner
D. is made to blow at high speeds

20. The transfer of heat through the movement of a fluid (a liquid or a gas) is known as --

F. convection
G. conduction
H. temperature
J. thermal energy

21. Use the image below AND your science knowledge to answer the following question.




In a steam engine, the steam is capable of pushing or moving objects when it is released from a valve because the steam --

A. is very massive
B. occupies a very large volume
C. is under high pressure
D. has chemical energy

22. The phenomenon that occurs in both a steam engine and a nuclear power plant is --

F. energy destruction
G. energy transformation
H. mass destruction
J. mass generation

23. In the physical sciences, _____ measures the amount of useful energy produced when one kind of energy is transformed into another form.

A. usefulness
B. capacity
C. compatibility
D. efficiency

24. Currently, our most efficient power plants are --

F. wind
G. solar
H. chemical
J. hydroelectric

25. Nuclear plants are very efficient at converting nuclear energy into electricity. The main problems with nuclear plants is that they --

A. cause a lot of air pollution
B. are hard to operate
C. consume a lot of fuel
D. produce tons of radioactive waste

26. Converting some forms of energy into electricity can lead to an increase in _____, which contributes to the greenhouse effect.

F. radiation
G. acid rain
H. carbon dioxide
J. refraction

**Energy**

**Topic One:**

**Part One:**

The answers are 1. H (electrons) 2. O (radiant energy) 3. B (electrical energy) 4. M (electron) 5. A (energy) 6. E (kinetic energy) 7. C (matter) 8. D (molecule) 9. F (nuclear energy) 10. K (nuclear fission) 11. G (nuclear fission) 12. P (nucleus) 13. I (potential energy) 14. J (proton) 15. L (radiant energy) 16. N (thermal energy).

**Part Two:**

Examples of the six forms of energy will vary.
Sample answers:
kinetic energy: a person running
thermal energy: a warm oven
potential energy: a book on a high shelf
radiant energy: sunlight on its way to Earth
electrical energy: plugging in an appliance
chemical energy: the energy stored in an apple's sugars

**Topic Two:**

**Part One:**

Good responses of potential energy turning into kinetic energy will be clear instances of energy derived from position leading to motion, such as: an apple falling from a tree, a bike coasting downhill, or an avalanche of snow roaring down the side of a mountain.

**Part Two:**

Diagrams will vary but should demonstrate understanding of the sequence, as well as relevant terms.

**Topic Three:**

**Part One:**

Conduction is energy transferred from one material to another through direct contact, as in the heating of a cold metal spoon in a pot of hot soup.
Convection is the transfer of heat through the movement of a fluid, as in boiling soup carrying heat from the bottom to the top of the poet.
Radiation is energy transferred by rays, waves, or particles, and does not require direct contact. This is how sunlight warms us.

**Part Two:**

Examples will vary.

**Topic Four:**

**Part One:**

Heat begins to move from the hot water to the cold spoon.
The rapid motion of the water's molecules increase the vibrations in the spoon's atoms.
The spoon heats and the water cools until they reach the same temperature and thev flow of heat between them stops.

**Part Two:**

Students could use any number of examples, but should show the rapid motion of molecules in the hot substance, increase in heat as the cooler substance warms.

**Topic Five:**

**Part One:**

A calorie is the amount of heat per kilogram required to change the temperature of a substance by one kelvin (or one degree Celsius).
A substance with a large specific heat capacity requires more energy and heats up more slowly.
A substance with a small specific heat capacity requires less energy and heats up more quickly.

**Part Two:**

Answers will vary.

**Topic Six:**

**Part One:**

The two factors that create electricity are (1) the attraction of particles with opposite charges, or (2) the repulsion of particles with the same charge. Student phrasing should vary.

**Part Two:**

Diagrams should show the four-step process of the energy transfer.

**Topic Seven:**

**Part One:**

Student phrasing will vary, but should accurately paraphrase the given definitions.

**Part Two:**

Diagrams will vary, but should label specified parts and state if it is a mechanical wave or a transverse wave.

**Topic Eight:**

**Part One:**

Ways that water heaters and cooling systems are different include:
Cooling systems (1) go against the natural process that heat moves from warm objects to cold ones, (2) require Freon gas, (3) require a compressor, (4) require an expansion valve, and (5) do not use convection, as water heaters do.

**Part Two:**

Diagrams will vary.

**Topic Nine:**

**Part One:**

The thermal energy of the steam creates kinetic energy, turning coil of wire inside a magnet. That process creates electrical energy.

**Part Two:**

Good answers should show how the thermal energy of steam creates kinetic energy, and may, in some cases, also be used to create electrical energy.

**Topic Ten:**

**Part One:**

Pros and Cons of different types of power plants include:
Hydroelectric plants are very efficient, but can only be built in certain spots.
Fossil fuel plants are currently popular, but consume a nonrenewable resource and can have harmful effects on the environment.

Solar energy plants operate at an efficiency of only about 30%, but are using an inexhaustible resource.
Wind power plants are not very efficient, but do not have negative effects on the environment.

**Part Two:**

Answers will vary but should apply the principles of energy efficiency.

**Topic Eleven:**

**Part One:**

Renewable energy is created faster than humans consume it. Examples include the Sun, water, wind, and biomass.
Nonrenewable energy is consumed by humans faster than it can be created. Examples include fossil fuels such as oil, natural gas, and coal.

**Part Two:**

Samples of good answers include: a high spot on a powerful river for a hydroelectric dam, a very sunny area for solar panels, and an open area such as plains or desert, for windmills.

**Unit 9: Energy**

1. A
2. G
3. A
4. H
5. B
6. G
7. D
8. H
9. A
10. F
11. D
12. H
13. C
14. J
15. B
16. F
17. D
18. G
19. A
20. F
21. C
22. G
23. D
24. J
25. D
26. H