Module 2
Energy in Society

What this module is about

Physics is a physical science, focusing on matter and energy. In biology and chemistry, energy is also discussed but to a very limited extent. It is in physics that we get a detailed information about energy.

We should be aware of the important role of energy in our lives. Can you imagine what life would be like if there were no hydroelectric power plants and no geothermal power plants to generate electricity? Do you think we could reach distant places if crude oil was not introduced in the market? We learned how to harness energy for our benefit. What do you think are the benefits that we get from energy? While energy is very beneficial to us, we must not forget that it can also cause harm. What do you think are the bad effects of energy on the environment? How do you explain the idea that the total mass-energy in the universe is constant? Reading and doing the activities in Module 2 could answer all these queries.

Enjoy reading!

Module 2 includes the following lessons:

- **Lesson 1 - Energy: Its Role in the Development of Human Society**
- **Lesson 2 - Energy Conservation: An Answer to Energy Crisis**
- **Lesson 3 - Fossil Fuels and the Environment**
- **Lesson 4 - The Relationship between Matter and Energy**

What you are expected to learn

After going through this module, you are expected to:

1. explain the role of energy in human development;
2. discuss energy and its role in the following areas: home, transportation economy, information and communication technology, and environment;
3. discuss the different forms of energy and the law of conservation of energy as applied in transportation, economy, information and communication technology, and, environment and at home;
4. explain energy resources and their relation to energy crisis;

5. enumerate the environmental effects of the production and use of fossil fuels;
6. list the ways of conserving oil;
7. discuss the effects of energy in the environment; and
8. explain the meaning of $E= mc^2$.

How to learn from this module

Below are guidelines for you in going about the module:

1. Read and follow instructions very carefully.
2. Answer the pre-test to determine how much you already know about the lessons in this module.
3. Check your answers against the given answer key at the end of this module.
4. Read each lesson and do the activities that are provided for you.
5. Perform all the activities diligently to help you understand the topic.
6. Take the self-test after each lesson to determine how much you understand the topic.
7. Answer the posttest to measure how much you have gained from the lessons.

Good luck and have fun!

What to do before (Pretest)

Encircle the letter of the best answer.

1. All of the following are related to energy **EXCEPT**
   a. work
   b. joules
   c. heat
   d. time

2. Which of these refers to the capacity to do work?
   a. power
   b. energy
   c. velocity
   d. momentum

3. Which of the following situations shows that potential energy is stored?
   a. a bouncing ball
   b. a speeding car

c. exploding firecracker
d. a book on top of the cabinet

4. Which quantity has the greatest influence on the amount of kinetic energy that a large truck has while moving down the highway?
    a. mass
    b. weight
    c. velocity
    d. size

5. Which **does not** conserve energy?
    a. using firewood in cooking
    b. riding a bicycle to school
    c. riding a bus for long trips
    d. using several electric appliances at one time

6. Which of the following represents energy changes, which take place in a coal-fired power station?
    a. heat→ kinetic→ electrical
    b. heat→ light→ electrical
    c. heat→ chemical→ electrical
    d. kinetic→ electrical→ potential

7. What are the energy changes that take place in a hydroelectric power plant?
    a. electrical→ potential→ kinetic
    b. kinetic→ electrical→ potential
    c. potential→ kinetic→ electrical
    d. potential→ electrical→ kinetic

8. The vacuum in a thermos bottle reduces heat loss by
    a. radiation alone
    b. conduction alone
    c. convection alone
    d. conduction and radiation

9. Why are cooking pans usually made of metal while their handles are often made of plastic?
    a. Metals are good conductors and plastics are good insulators of heat.
    b. Metals are poor conductors and plastics are good insulators of heat.
    c. Metals and plastics are both good conductors of heat.
    d. Metals and plastics are good insulators.

10. Which of the following terms correctly describes the action of glass prism in splitting white light into the colors of the spectrum?
    a. deviation
    b. diffusion
    c. dispersion

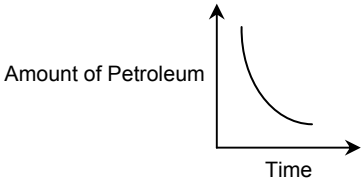
d. image formation

11. Which of the following is a radioactive substance?
    a. deuterium
    b. helium
    c. hydrogen
    d. uranium

12. Which of the following devices does NOT make use of electromagnetic waves in its operation?
    a. camera
    b. loudspeaker
    c. television set
    d. radio set

13. Which of the following graphs shows what will probably happen to the supply of petroleum in the years to come?

a.



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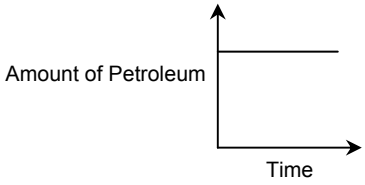

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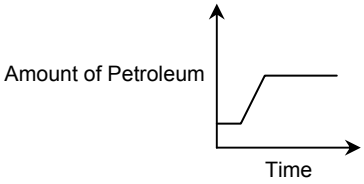
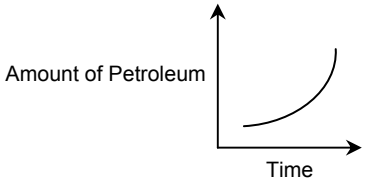


d.



14. What is true about a nuclear power plant and a geothermal power plant?
    a. They are renewable sources of energy.
    b. They use steam to turn turbines.
    c. They are easy to operate and maintain.
    d. They give off the same kind of pollutants.

15. Why does the greenhouse effect result to warmer temperature near the surface of earth?
    a. Clouds trap infrared radiation
    b. Ozone traps ultraviolet radiation
    c. Carbon dioxide traps infrared radiation
    d. Soil absorbs incoming radiation

16. Which statement is TRUE about fluorescent bulbs and incandescent bulbs?
    a. Fluorescent bulbs are more efficient than incandescent bulbs
    b. Incandescent bulbs are more efficient than fluorescent bulbs
    c. The bulbs are equally efficient
    d. The efficiency of the bulbs cannot be compared

17. A plug connected to a table lamp contains a 3 A fuse. Why is the fuse needed?
    a. to make it easier for the current to flow
    b. to increase the resistance of the circuit
    c. to prevent the lamp from getting too bright
    d. to protect the wiring from overheating

18. Which form of energy is common among the following objects: lighted bulb, hot soup, burning firewood and electric stove?
    a. heat
    b. light
    c. electric
    d. chemical

19. A tuning fork, a violin string, and a loudspeaker cone all produce sound. This is because they are all in a state of
    a. compression
    b. rarefaction
    c. vibration
    d. tension

20. What should be the speed of the object to convert mass to energy?

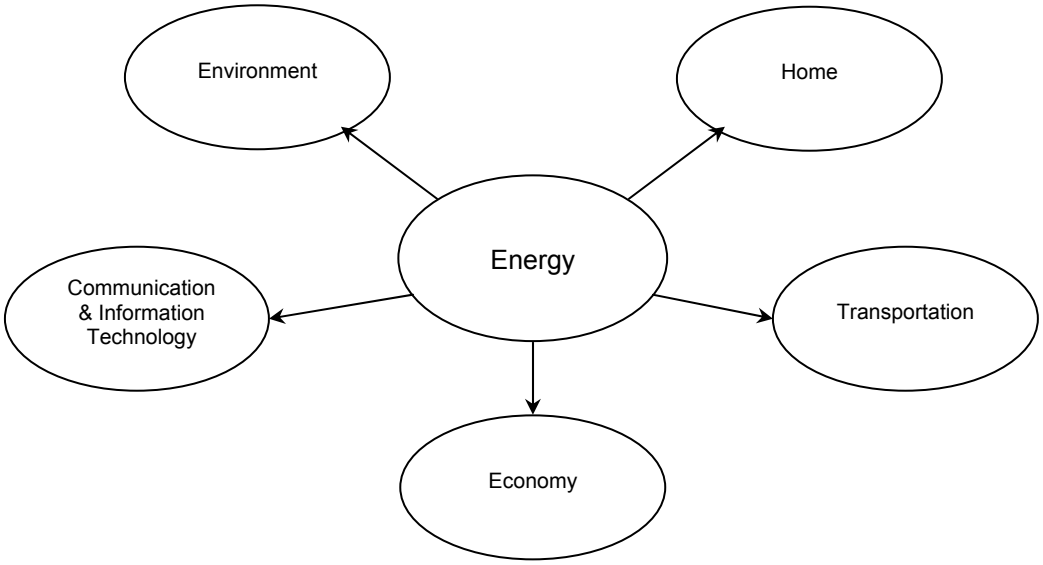
    a. increasing speed
    b. decreasing speed
    c. constant speed
    d. average speed

Key to answers on page 23

Lesson 1 Energy: Its Role in the Development of Human Society

What does a physicist mean by energy? *Energy* is the ability to do work. In addition, energy has different forms, each of which can be converted into any other form. The metric unit (SI) for energy is joule (J).

What is the role of energy in the development of human society? In answering this question consider the figure below.



It could be gleaned from the preceding figure that energy is greatly utilized in the following areas: environment, home, transportation, economy, and information and communications technology. The development of these areas greatly helps us to live comfortably.

To discuss the dependence of these fields on energy, topics on the different sources of energy and energy conversion will be considered. What do you think are the sources of energy and the different forms of energy that are used in these areas?

A. Energy: Its Role Environment

What helps you appreciate the beauty of your environment? Yes, you are right when you say its because of light reaching your eyes either directly or indirectly from some sources like the sun, light bulbs, fireflies, etc.

The colorful environment makes you appreciate your surroundings. It was Sir Isaac Newton who was the first to make a systematic study of color. With the use of a glass *prism,* the color of sunlight disperses into rainbow colors in the order of *red, orange, yellow, green, blue, and violet*. Newton called this spread of colors a *spectrum*.

The sun is the main source of light. Its radiation supplies heat to warm the earth and maintain human, animal and plant lives. Without light there will be darkness all over the earth. Our planet earth would rapidly cool off. Water and air would freeze.

Light can produce change. For example, a chemical change takes place when light strikes a photographic paper. When light strikes a certain metal, electric current is produced.

Another important form of energy is the nuclear energy. Nuclear energy can be formed by fission or fusion reactions. Fission is the splitting of heavy atoms, such as uranium, into lighter atoms. Fusion is the combining of lighter atoms like hydrogen and deuterium into heavier ones like helium. In both processes, tremendous amount of heat are released.

At present, nuclear power plants use fission reaction to generate electricity. Fusion is still currently being explored for electric power generation. It requires high temperature, which can now be obtained using laser beams.

A nuclear power plant uses uranium, a radioactive substance, as fuel. The major problems associated with nuclear power plants are the radioactive waste disposal and the risk of radioactive contaminant to our environment.

B. Energy: Its Role in the Home

Electricity is a form of energy and like all other forms of energy, it obeys the laws of energy conversion. When an electric current flows through a circuit, it may give rise to heating effects or chemical effects. We can make use of these effects to construct different kinds of electrical appliances.

There are different types of electrical appliances in your home. Each one changes electrical energy to some other forms.

Some of these electrical appliances are the electric iron, kettle, and electric stove. These appliances make use of the heating effect of an electric current. The element is

usually made of *nichrome* wire coiled round an insulating fireproof material, e.g., silica or mica.

The heat produced by an electric iron must be spread evenly over a large surface. A *metal base,* which conducts heat well, is used.

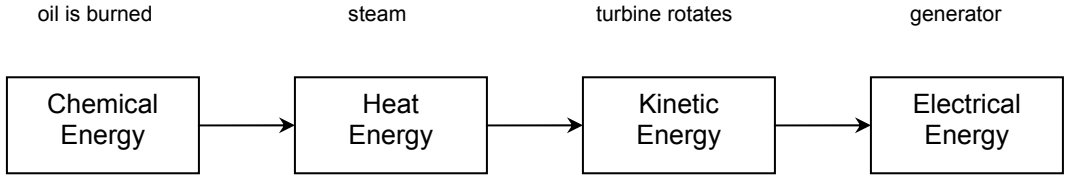
In the case of an electric kettle, the heating element is enclosed in a metal tube and electrically insulated from it. When a current flows through the heating element, the water around the element is heated first by *conduction.* Then the heat is spread through the water by *convection.*

Another very common example, which makes use of electricity for its operation is the electric fan. Electrical energy is converted into mechanical energy specifically *kinetic energy*, the energy in motion.

C. Energy: Its Role in Transportation

It is said that approximately 80% of our fossil fuels are used directly in transportation and industry. Petroleum and natural gas are formed from the remains of tiny plants and animals that lived millions of years ago. Coal, on the other hand, is formed from an accumulation of plant materials under special conditions millions of years ago. Thus petroleum, natural gas, and coal are called *fossil fuels.* These fuels contain energy store in the chemical bonds in their molecules. When they are burnt, the energy is released.

The illustration below shows the energy conversion from oil.



D. Energy: Its Role in Economy

Every month we pay our energy bills. We have a budget for the use of electricity, oil, and natural gas in our homes and for the gasoline used in our automobiles. There are indirect charges that we pay for the energy used in manufacturing processes and for the transportation of goods. Because our rate of using energy is increasing, it is becoming more expensive to generate sufficient energy to meet current demands. Thus, as we manufacture and sell more goods, add more technologies for our comfort and entertainment, and make more use of transportation facilities, we can look forward to larger and larger energy bills as well as to shortages of some of our fuels.

Modern society cannot exist without the production and utilization of energy. As long as we continue to use fuels, there will necessarily be undesirable side effects.

E. Energy: Its Role in Communication and Information Technology

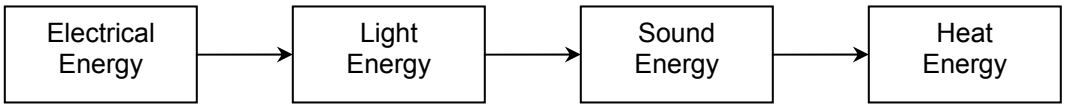
What do you think are the sources and forms of energy that are greatly involved in this field?

Moving water has been used as a source of energy for thousands of years. It is considered a renewable energy resource, inexhaustible as long as the rain falls. Hydroelectric power plants generate electricity. For the generation of hydroelectric power, dams are built across rivers high up in the hills to store water. The water behind the dam possesses potential energy. The potential energy (PE) of the water in the dam changes to kinetic energy (KE) when the water is allowed to run down the pipes. The KE of the water turns a turbine, which in turn drives a generator to produce electrical energy. The *electrical form of energy* is responsible for the operation of the different communication and information technologies. A computer, for example, is run by electricity. The convenience that this gadget gives to humans is tremendous. This is an example of technology that makes the world smaller. By just surfing the Internet we get to know the different events that are happening in the opposite side of the globe in a matter of seconds.

Radio and television sets are examples of communication technologies, which show how electrical energy is converted into sound energy and to some other form of energy, like heat energy.

Sound energy is best transmitted in solid, followed by liquid and the least is gas. In other words, there is a need for a medium for sound, which is produced by a vibrating body, to be transmitted.

Below is an illustration of energy conversion taking place in the operation of television to show the *law of conservation of energy*. The law of conservation of energy states that energy cannot be created or destroyed, but only changed from one form to another.



What you will do

Activity 1.1

Identify the energy conversions in each of the following technology/process:

Example: lighted candle: chemical energy→ light energy

1. dry cell
2. photosynthesis
3. burnt gasoline
4. charging of battery
5. loudspeaker

Key to answers on page 23

What you will do

Self-Test 1.1

Fill out the table below. Choose the form of energy from following: chemical energy, mechanical energy (PE or KE), heat energy, electrical energy, light energy, and sound energy. Choose the field/area from the following: transportation, industry, communication and technology, home, and economy.

Technology/ Process	Forms of energy	Field/Area
Ex. Car	chemical	Transportation
1. geothermal power plant		
2. radio		
3. guitar		
4. fluorescent bulb		
5. car battery		
6. refrigerator		

Key to answers on page 23

Lesson 2 Energy Conservation: An Answer to the Energy Crisis

In the early part of our discussion of energy, we have mentioned about energy's role in human development and the benefits that humans get in utilizing the different forms of energy. Majority of our activities require the use of energy. Hence, we should learn to conserve energy. But what is energy conservation? Why conserve energy? How can you conserve energy? As mentioned in Lesson 1 of this module, oil and coal are needed for electricity, transportation and industries. We depend so much on oil and its products like gasoline and cooking gas. But why save oil? It takes millions of years for plants and animals to decay and form oil. We burn oil faster than it is formed, hence we are experiencing energy crisis. Clearly, the supply is limited and the demand is high. The price of oil is fast increasing. Do you think the government is doing something to lessen the energy crisis the country is facing? Yes, the government is looking for alternative sources of energy.

Below are the alternative sources of energy:

1. *Energy of falling water*. Water is stored at high level in dams of rivers. Falling water turns turbines of generators producing electricity.

2. *Energy from the earth's interior*. Ground water in contact with hot rocks gets heated. Steam coming out through rock openings is used to produce steam, which turns turbines of generators producing electricity.

3. *Energy of the sun*. Heat from the sun is trapped and concentrated for cooking and heating.

4. *Energy of the wind*. Wind turns windmill blades to pump water or produce electricity.

5. *Energy from waste*. Waste is changed to methane gas, a substitute for cooking gas.

6. *Energy from alcohol*. Alcohol from sugar cane is used as a gasoline substitute.

7. *Energy from the atom*. Energy from splitting the nucleus of the atom can be used to produce steam. Steam turns turbines of electric generators.

Can you help the government conserve energy from oil? Do Activity 2.1 in answering this question.

What you will do

Activity 2.1

Below are ways by which you can help conserve energy. Put a check mark on those ways that you practice wherever you are, whether you are at home or in school.

___1. Turn off electric lights and electrical or gas appliances when these are not in use.
___2. Open ovens and refrigerators only when necessary.
___3. Turn off radios and televisions when not in use.
___4. Clean and oil machines regularly. Dust or dirt reduces efficiency of machines.
___5. Save on gasoline by using public rather than private vehicles.

Key to answers on page 24

What you will do

Self-Test 2.1

The passage below contains keywords on energy that have been jumbled up and italicized. Can you rearrange these words?

Energy cannot be *dactree* nor *reyossetdd*, but it can be changed from one form to another. The amount of energy during the change may be the same. The type or quality of energy is useful for living organisms but it is not so useful in mechanical processes. Too much heat produced by industrial production and operating equipment contributes to global *mwgrain.* At the same time, this means energy is lost and usable energy is reduced.

We get most of our energy from the sun. This is because billions of nuclear reactions occur at the core. The sun can be thought as a giant nuclear *rotacre*. The energy it emits will be gone one day, though that will not be for many millions of years at least. It has been estimated that the mass of the sun is being converted to energy at the rate of 4 million tons per second.

Key to answers on page 24

Lesson 3 Fossil Fuels and the Environment

We rely almost completely on fossil fuels such as oil, natural gas, and coal for our energy needs. However, these are nonrenewable resources, and their production and use have a variety of serious environmental impacts. Do you want to know the environmental issues linked to the production and use of these fuels? The succeeding discussion will give you information about this problem.

As mentioned in the early part of this module, fossil fuels are forms of stored solar energy. The main fossil fuels used today were created from incomplete biological decomposition of dead organic matter. The major fossil fuels- crude oil (petroleum), natural gas, and coal are our primary energy sources. On a worldwide basis, they provide approximately 90% of the energy consumed.

Oil in the 21st Century

Recent estimates of proven oil reserves suggest that, at present production rates, oil and natural gas will last only a few decades. The important question, however, is not how long oil is likely to last at present and future production rates, but when will we reach peak production? This is important because following peak production, less oil will be available, leading to shortages and price shocks. World oil production is likely to peak between the years 2020 and 2030, within the lifetime of many people living today. It is projected that world production of oil will be nearly exhausted by 2100

What do you think should be the appropriate response by people worldwide to the likelihood that production rate of oil will likely fall in the mid- 21st century?

1. We need an educational program early in the 21st century to inform people and governments of the potential depletion of crude oil and the consequences of shortages.

2. Planning and appropriate action are necessary to avoid military confrontation, food shortages, and social disruption.

Before significant shortages of oil occur, we need to develop alternative sources of energy such as solar energy and wind power and perhaps rely more on nuclear energy.

Environmental Effects of Oil and Natural Gas

Development of oil and gas fields involves drilling wells on land or beneath the sea floor. What are the possible environmental impacts on land?

- Use of land to construct pads for wells, pipelines, and storage tanks and to build a network of roads and other facilities.

- Pollution of surface waters and ground water from:

    1. leaks from broken pipes or tanks containing oil or other oil-field chemicals

    2. salty water (brine) that is brought to the surface in large volumes with the oil. The brine is toxic and may be disposed of by evaporation in lined pits, which may leak.

- Accidental release of air pollutants, such as hydrocarbons and hydrogen sulfide, a toxic gas.

- Land subsidence (sinking) as oil and gas are withdrawn.

- Loss or disruption and damage of fragile ecosystems, such as wetlands or other unique landscapes.

Environmental impacts associated with oil production in the marine environment include:

- Oil seepage into the sea from normal operations or large spills from accidents, such as blowouts or pipe ruptures

- Release of drilling mud containing heavy metals, such as barium, that may be toxic to marine life

- Aesthetic degradation from the presence of offshore oil-drilling platforms, which some people think is unsightly.

Refining

Refining crude oil and converting it to related products also create environmental impacts such as the following:

- Accidental spills and slow leaks of gasoline and other products from storage tanks and pipes.

- Over years of operation, large amounts of liquid hydrocarbons maybe released, polluting soil and groundwater resources below the site.

- Crude oil and its distilled products are used to make fine oil, a wide variety of plastics, and organic chemicals used by society in huge amounts. The industrial processes involved in the production of organic chemicals have the potential for releasing a variety of pollutants into the environment.

Delivery and Use

Some of the most extensive and significant environmental problems associated with oil and gas occur when the fuel is delivered and consumed.

- Crude oil is mostly transported on land in pipelines or across the ocean by tankers and both methods present the danger of oil spills.

- Air pollution is associated with the burning of oil. Combustion of gasoline in automobiles produces pollutants that contribute to urban smog.

Coal Mining and the Environment

Strip Mining

Coal mining is done by strip mining. This is a surface mining process in which the overlying layer of soil and rock is stripped off to reach the coal. Strip mining has the potential to pollute or damage water, land, and biological processes.

Underground Mining

Underground coal mining is a dangerous profession; there are always hazards of collapse, explosion, and fire. Miners are at risk of contracting respiratory illnesses, especially black lung disease, due to their exposure to coal dust. Black lung disease has killed or disabled many miners.

Some of the environmental problems associated with underground mining include the following:

- Acid mine drainage from the mines and waste piles has polluted thousands of kilometers of streams.

- Land subsidence can occur over mines

- Coal fires in underground mines maybe either naturally caused or deliberately set. The fires may belch smoke and hazardous fumes, causing people exposed to them to suffer from a variety of respiratory diseases.

What you will do

Activity 3.1

Fill out the table below regarding the environmental impacts related to the recovery of oil and gas up to its delivery and use by consumers.

Stages/Processes	Environmental Impacts
	Ex. Pollution of surface water
Recovery	1.
	2.
	3.
Refining	1.
	2.
	3.
Delivery and Use	1.
	2.
	3.

Key to answers on page 24

What you will do

Self-Test 3.1

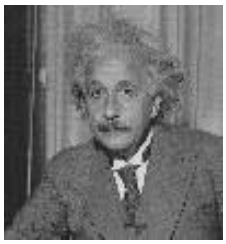
Answer the following questions:

1. Differentiate strip mining from underground mining.
2. What are the three major fossil fuels?

Key to answers on page 24

Lesson 4 The Relationship between Mass and Energy

In 1905 Albert Einstein published his theory of special relativity.


Albert Einstein
(1879-1955)

In it he concluded that mass and energy are interchangeable. The quantitative mass-energy relationship is given in his famous equation

$$E_0 = mc^2$$

where: E_0 is the amount of rest energy and c is the speed of light, which is 3×10^8 m/s. This equation gives the total energy content of a piece of stationary matter of mass m. The value of c^2 is a large number, and so a large amount of energy can be obtained from the conversion of a small amount of mass.

In nuclear reaction, when the nucleus of radium undergoes fission, the mass of the original radium nucleus is greater than the combined mass of the fission products. No protons and neutrons are destroyed during fission reaction. Before and after fission reaction, the total number of protons and neutrons are still the same. But the protons and neutrons are rearranged resulting to change in mass. The mass difference is converted to energy.

Sample Problem:

Calculate the amount of energy obtained from converting 1.0 g of mass into energy and compare it to the 3000 kcal of food used by a normal person in one day.

$$E = mc^2$$
$$= (1.0 \times 10^{-3}\ \text{kg})(3 \times 10^8\ \text{m/s})^2$$
$$= 9.0 \times 10^{13}\ \text{kg.m}^2/\text{s}^2$$
$$= 9.0 \times 10^{13}\ \text{N-m}$$
$$= 9.0 \times 10^{13}\ \text{J}$$

Compare this to 3000 kcal:

$$9.0 \times 10^{13}\ \text{J} \times 1\text{kcal}/4186\ \text{J} = 2.15 \times 10^{10}\ \text{kcal}$$

by taking the ratio

$$2.15 \times 10^{10}\ \text{kcal}/3000\ \text{kcal} = 7.2 \times 10^6$$

This is seven million times as much energy as the average person consumes in food in one day.

What you will do

Activity 4.1

Answer the following:

1. Calculate the amount of energy obtained from converting 1000 kg of mass.
2. What do you mean by *rest energy?*

Key to answers on page 24

What you will do

Self-Test 4.1

1. Who formulated the equation, $E_0 = mc^2$?
2. What is the value of c in the equation?
3. What does E_0 represent? How about m?

Key to answers on page 25

Let's summarize!

1. Energy is the capacity to do work. It is expressed in Joules (J).
2. Energy is utilized in the following areas: home, transportation, economy, communication and information technology and environment.
3. The different forms of energy are, namely: mechanical (PE and KE), chemical, electrical, sound, heat, light, and nuclear.
4. The law of conservation of energy states that energy cannot be created nor destroyed but it can be transformed from one form into another form.
5. We rely almost completely on fossil fuels (oil, natural gas, and coal) for our energy needs.
6. Fossil fuels are nonrenewable, so we have to develop other sources to meet our energy demands. These alternative sources of energy are: energy of falling water,

energy from the earth's interior, energy of the sun, energy of the wind, energy from wastes, energy from alcohol and energy from atom.

7. Environmental impacts related to oil and natural gas include those associated with exploration and development (damage to ecosystems, water pollution, air pollution, and waste disposal; those associated with refining and processing (soil, water, and air pollution) and those associated with burning oil and gas for energy to power automobiles, produce electricity, run industrial machinery, heat homes (air pollution).
8. Coal is a source of energy particularly damaging to the environment. Problems associated with mining include fires, subsidence, acid mine drainage, and difficulties related to land reclamation. Burning coal can release air pollutants, including sulfur dioxide and carbon dioxide.
9. Mass and energy are equivalent that is anything with mass also has energy. For an object at rest, its energy is its mass.

Posttest

Choose the letter of the best answer. Write the letter on your answer sheet

1. Which of the following is related to energy?
    a. time
    b. force
    c. heat
    d. speed

2. Which of the following refers to the capacity to do work?
    a. power
    b. energy
    c. velocity
    d. momentum

3. Which of the following situations possesses kinetic energy?
    a. a bouncing ball
    b. a car in a parking place
    c. a book on top on top of the table
    d. a hammer raised at a certain height

4. Which quantity has the greatest influence on the amount of kinetic energy that the car has while moving in a superhighway?
    a. mass
    b. weight
    c. velocity
    d. size

5. All of the following practices conserve energy **EXCEPT**
    a. using firewood in cooking
    b. riding a bicycle to school
    c. riding a bus for long trips
    d. using many electrical appliances at the same time

6. Which of the following energy changes take place in a hydroelectric power station?
    a. potential→ kinetic→ electrical
    b. kinetic→ potential→ electrical
    c. heat→ chemical→ electrical
    d. kinetic→ electrical→ potential

7. What are the energy changes that take place in a television?
    a. electrical→ potential→ kinetic
    b. kinetic→ electrical→ potential
    c. electrical→ light→ sound
    d. potential→ electrical→ kinetic

8. A photographer wants to determine the color of light he can use in the darkroom that will not expose the films he is processing. In one trial, he used blue incandescent bulb. Which bulb can he use for another trial?
    a. red incandescent bulb
    b. green incandescent bulb
    c. red fluorescent bulb
    d. blue fluorescent bulb

9. Why are cooking pans usually made of metal while their handles are often made of plastic?
    a. Metals are good conductors while plastics are good insulators of heat.
    b. Metals are poor conductors while plastics are good insulators of heat.
    c. Metals and plastics are both conductors of heat
    d. Metals and plastics are good insulators

10. Which of the following terms correctly describes the action of glass prism in splitting white light into the colors of the spectrum?
    a. deviation
    b. diffusion
    c. dispersion
    d. image formation

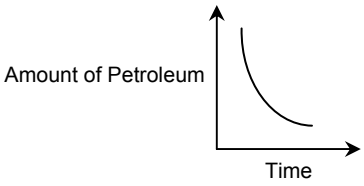
11. Purple light is a mixture of red and blue light. Orange paint reflects only red and yellow light. When purple light falls on orange paint, what color does the paint appear to be?
    a. purple
    b. red

c. yellow
d. orange

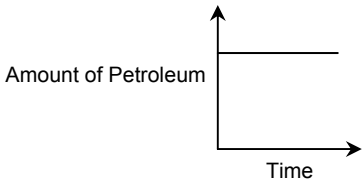
12. Which one of the following devices does NOT make use of electromagnetic waves in its operation?
    a. camera
    b. loudspeaker
    c. television set
    d. radio set

13. Which one of the following graphs shows what will probably happen to the supply of petroleum in the years to come?

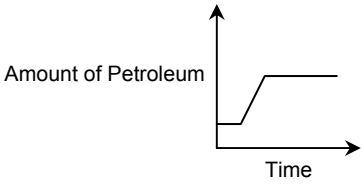
a.



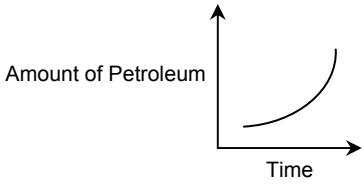
c.



b.



d.



14. All of the following are alternative sources of energy **EXCEPT**:
    a. wind energy
    b. natural gas
    c. solar energy
    d. energy from the earth's interior

15. Why does the greenhouse effect result to warmer temperature near the surface of earth?
    a. Clouds trap infrared radiation.
    b. Ozone traps ultraviolet radiation.
    c. Carbon dioxide traps infrared radiation.
    d. Soil absorbs incoming radiation.

16. Which of the following activities helps reduce water pollution?
    a. throwing liquid wastes
    b. using organic fertilizers in farms
    c. using soap instead of detergents
    d. treating wastewater before it is discharged

17. Atomic fission involves the splitting of atoms resulting in a tremendous release of energy. This is used to produce steam in electric power plants. Which of the following is the MOST accurate energy transformation?
    a. nuclear→chemical→mechanical→electrical
    b. nuclear→heat→mechanical→electrical
    c. chemical→mechanical→light→electrical
    d. chemical→nuclear→electrical-→light

18. Which process does NOT involve release of heat?
    a. explosion of bombs
    b. breakdown of food in the body
    c. melting of butter
    d. burning of gasoline

19. What form of energy does an object produce, which is set into vibration?
    a. compression
    b. rarefaction
    c. electrical
    d. sound

20. What should be the speed of the object to convert mass to energy?
    a. increasing speed
    b. decreasing speed
    c. constant speed
    d. average speed

Key to answers on page 25

Key to Answers

Pretest

1. d	11. a
2. b	12. b
3. d	13. a
4. c	14. b
5. d	15. c
6. a	16. a
7. c	17. d
8. d	18. a
9. a	19. c
10.c	20. b

Lesson 1

Activity 1.1

1. chemical → light
2. light → chemical
3. chemical → kinetic
4. electrical → chemical
5. electrical → chemical

Self-Test 1.1

Technology	Forms of Energy	Area/Field
1. geothermal power plant	1. heat	economy
2. radio	2. electrical	communication technology
3. guitar	3. sound	home
4. fluorescent bulb	4. light	home
5. car battery	5. chemical	economy
6. refrigerator	6. electrical	home/economy

Lesson 2

Activity 2.1

Note: Student's responses may vary because they may have different practices.

Self-Test 2.1

1. created
2. destroyed
3. warming
4. creator

Lesson 3

Activity 3.1

For recovery: They may choose only 3 out of 5 environmental impacts

1. accidental release of air pollutants
2. land subsidence
3. disruption and damage of fragile ecosystems
4. oil seepage into the sea
5. release of drilling mud
6. aesthetic degradation

For refining

1. accidental spills and slow leaks of gasoline
2. soil and water pollution
3. release of pollutants in the atmosphere

For delivery and use

1. oil spill
2. air pollution
3. effects of smog on vegetation

Lesson 4

Activity 4.1

1. 9×10^{19} J
2. Rest energy is the energy stored in matter which is at rest

Self-Test 4.1

1. Albert Einstein
2. $c = 3 \times 10^8$ m/s
3. E= energy
   m=mass

Posttest

1. a	11. b
2. b	12. b
3. a	13. a
4. c	14. b
5. d	15. c
6. a	16. d
7. c	17. b
8. d	18. c
9. a	19. d
10. c	20. a

-End of Module-

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