Name: _____ Class: _____ Date: _____

Energy and energy efficiency

PAGES 70 TO 72

CONCEPT REVIEW 9
Complete this concept review handout and keep it as a record of what you have learned.

Definitions

- Energy is *the ability to do work or effect change.*

Unit of measurement: *joule* Symbol: *J*

1 J = *1 N × 1 m*

- The law of conservation of energy states *that energy can neither be created nor destroyed; it can only be transferred or transformed. The total amount of energy in an isolated system always remains constant.*

- Energy efficiency is *the percentage of energy consumed by a machine or system that was transformed into useful energy.*

Mathematical formula for calculating energy efficiency

$$\text{Energy efficiency} = \frac{\text{Amount of useful energy}}{\text{Amount of energy consumed}} \times 100$$

Some forms of energy, with possible sources

Form of energy	Description	Examples of sources
Radiation	*Energy contained in and transported by electromagnetic waves.*	• *Microwave oven* • *Sun* • *Cellphone* • *Light bulb* • *Radiographic equipment* • *Fire* • *Radio* • *Television*
Chemical energy	*Energy stored in molecular bonds.*	• *Apple* • *Candle wax* • *Fossil fuels*
Wind energy	*Energy resulting from the movement of the air.*	• *Wind*

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INTEGRATION QUESTIONS

Energy and energy efficiency

1. In the examples below, does energy perform work (W) or provoke change (C)?

a) A man runs a marathon. W

b) Clothing dries in the sun. C

c) A woman lifts weights. W

d) A house burns. C

2. Name a form of energy that could be associated with the following objects.

a) A wind turbine. *Wind energy, electrical energy.*

b) Food. *Chemical energy, solar energy, mechanical energy, thermal energy.*

c) An MP3 player. *Radiation, sound energy, electrical energy.*

3. In each of the situations below, specify whether there is a transfer or a transformation of energy.

a) A baseball player hits a ball. *Energy transfer.*

b) Pasta provides the human body with energy. *Energy transformation.*

c) Gas makes a car run. *Energy transformation.*

d) A distribution substation supplies a village with electricity. *Energy transfer.*

e) An electric baseboard produces heat. *Energy transformation.*

4. A machine has an energy efficiency of 35 percent. What amount of energy must this machine consume to provide 68 kWh of useful energy?

$$\text{Amount of energy consumed} = \frac{\text{Amount of useful energy}}{\text{Energy efficiency}} \times 100$$
$$= \frac{68\ \text{kWh}}{35} \times 100$$
$$= 194\ \text{kWh}$$

The machine must consume 194 kWh of energy.

5. The amount of energy contained in a litre of gas is 3.6×10^7 joules. If only 12 percent of this energy is actually used to make a car move, what is the amount of useful energy per litre of gas?

$$\text{Amount of useful energy} = \frac{\text{Energy efficiency} \times \text{Amount of energy consumed}}{100}$$
$$= \frac{12 \times 3.6 \times 10^7\ \text{J/L}}{100}$$
$$= 4.32 \times 10^6\ \text{J/L}$$

The amount of useful energy is 4.32×10^6 J/L of gas.

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Thermal energy

PAGES 73 TO 75

CONCEPT REVIEW 10
Complete this concept review handout and keep it as a record of what you have learned.

Definitions

- Thermal energy is *the energy contained in a substance, determined by the number of particles in it and their temperature.*
- Heat is *the transfer of thermal energy between two environments with different temperatures. Heat always passes from the warmer to the cooler environment.*
- Temperature is *a measure of the degree of agitation of the particles of a substance.*
- The specific heat capacity corresponds *to the amount of thermal energy required to raise the temperature of one gram of a substance by one degree Celsius.*

Factors affecting the thermal energy of a substance

Factor	Factor variation	Result
Number of particles	*Increases.*	*Increases.*
	Decreases.	*Decreases.*
Temperature	*Increases.*	*Increases.*
	Decreases.	*Decreases.*

Mathematical formulas and units of measurement

Formula for indicating the relationship between heat and thermal energy:

$Q = \Delta E_t$

where
- Q *is heat (in J).*
- ΔE_t *is the variation in thermal energy (in J).*

Formula for calculating heat absorbed or released:

$Q = mc\Delta T$

where
- Q *is the heat—in other words, the variation in thermal energy (in J).*
- m *is the mass (in g).*
- c *is the specific heat capacity (in J/g°C).*
- ΔT *is the temperature variation (in °C).*

$\Delta T = T_f - T_i$

where
- T_f *is the final temperature (in °C).*
- T_i *is the initial temperature (in °C).*

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