

MASTERING CONCEPTS

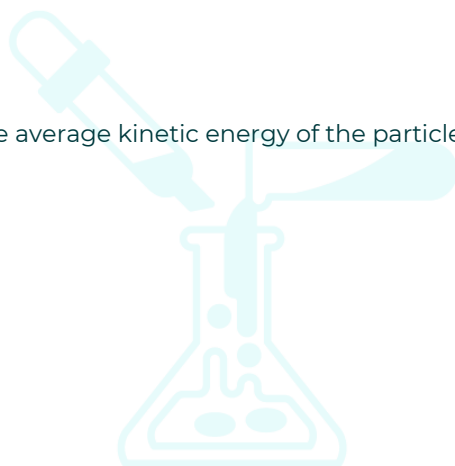
1. _____ is the ability to do work or produce heat.
 - a) Heat
 - b) Energy**
 - c) Calorie
 - d) Joule

2. _____ is a form of energy that flows from a warmer object to a cooler object.
 - a) Heat**
 - b) Calorie
 - c) Energy
 - d) Joule

3. _____ is a measure of the average kinetic energy of the particles in a sample of matter.
 - a) Calorie
 - b) Heat
 - c) Temperature**
 - d) Joule

4. How does the chemical potential energy of a system change during an endothermic reaction?
 - a) increases**
 - b) decreases
 - c) does not change
 - d) depends on the system

5. During an avalanche, the _____ energy of snow at a higher altitude is converted to _____ energy as the snow cascades down a mountain.
 - a) kinetic - potential
 - b) chemical - kinetic
 - c) potential - electrical
 - d) potential - kinetic**



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6. How is the energy in gasoline converted and released when it burns in an automobile engine?
- a) Much is converted to work to move pistons in the engine; some is released as heat.
 - b) Much is converted to heat to move pistons in the engine; some is released as work.
 - c) Some is converted to heat to move pistons in the engine; much is released as work.
 - d) Some is converted to work to move pistons in the engine; much is released as heat.**
7. How does the nutritional Calorie compare with the calorie?
- a) One nutritional Calorie equals 1 calorie.
 - b) One nutritional Calorie equals 1000 calories.**
 - c) One nutritional Calorie equals 10 calories.
 - d) One nutritional Calorie equals 0.001 calories.
8. What is the relationship between the Calorie and a kilocalorie?
- a) One nutritional Calorie equals 10 kilocalorie.
 - b) One nutritional Calorie equals 1000 kilocalorie.
 - c) One nutritional Calorie equals 0.1 kilocalorie.
 - d) One nutritional Calorie equals 1 kilocalorie.**
9. What quantity has the units $\text{J}/(\text{g} \cdot ^\circ\text{C})$?
- a) Heat
 - b) Specific heat**
 - c) Energy
 - d) Temperature
10. $1 \text{ cal} = \underline{\hspace{1cm}} \text{ J}$.
- a) 1
 - b) 0.84
 - c) 4.184**
 - d) 1000

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1 J = 0.2390 cal	1 cal = 4.184 J	1 Calorie = 1 kcal
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1. A food item contains 124 nutritional Calories. How many calories does the food item contain?

$$124 \text{ Calories} \times \frac{1000 \text{ calories}}{1 \text{ Calorie}} = 124,000 \text{ calories} \quad (62)$$

2. How many joules are absorbed in a process that absorbs 0.5720 kcal?

$$0.5720 \text{ kcal} \times \frac{1000 \text{ cal}}{1 \text{ kcal}} \times \frac{4.184 \text{ J}}{\text{cal}} = 2,393 \text{ J} \quad (63)$$

3. Ethanol is being used as an additive to gasoline. The combustion of 1 mol of ethanol releases 1367 kJ of energy. How many Calories are released?

$$1367 \text{ kJ} \times \frac{1000 \text{ J}}{1 \text{ kJ}} \times \frac{1 \text{ cal}}{4.184 \text{ J}} \times \frac{1 \text{ Calorie}}{1000 \text{ cal}} = 327 \text{ Calories} \quad (64)$$

4. To vaporize 2.00 g of ammonia, 656 calories are required. How many kilojoules are required to vaporize the same mass of ammonia?

$$656 \text{ cal} \times \frac{4.184 \text{ J}}{1 \text{ cal}} \times \frac{1 \text{ kJ}}{1000 \text{ J}} = 2.74 \text{ kJ} \quad (65)$$

5. One mole of ethanol releases 326.7 Calories of energy during combustion. How many kilojoules are released?

$$326.7 \text{ Cal} \times \frac{1000 \text{ cal}}{1 \text{ Cal}} \times \frac{4.184 \text{ J}}{1 \text{ cal}} \times \frac{1 \text{ kJ}}{1000 \text{ J}} = 1367 \text{ kJ} \quad (66)$$

6. A 25.0-g bolt made of an alloy absorbed 250 J of heat as its temperature changed from 25.0°C to 78.0°C. What is the specific heat of the alloy?

$$\Delta T = 78.0^\circ\text{C} - 25.0^\circ\text{C} = 53.0^\circ\text{C} \quad (67)$$

$$c = \frac{q}{m \times \Delta T} = \frac{250 \text{ J}}{25.0 \text{ g} \times 53.0^\circ\text{C}}$$

$$c = 0.189 \text{ J/g}\cdot^\circ\text{C}$$

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7. A breakfast of cereal, orange juice, and milk might contain 230 nutritional Calories. Express this energy in joules.

$$9.6 \times 10^5 \text{ J}$$

(Example 1)

8. An exothermic reaction releases 86.5 kJ. How many kilocalories of energy are released?

$$86.5 \text{ kJ} \times \frac{1 \text{ kcal}}{4.184 \text{ kJ}} = 20.7 \text{ kcal}$$

(Applications - 2)

9. The temperature of a sample of iron with a mass of 10.0 g changed from 50.4°C to 25.0°C with the release of 114 J. What is the specific heat of iron?

$$c = 0.449 \text{ J/(g} \cdot ^\circ\text{C)}$$

(Example 2)

10. If the temperature of 34.4 g of ethanol increases from 25.0°C to 78.8°C, how much heat has been absorbed by the ethanol? Refer to **Table 2**.

$$q = c \times m \times \Delta T$$

(Applications - 4)

$$q = 2.44 \text{ J/(g} \cdot ^\circ\text{C)} \times 34.4 \text{ g} \times 53.8^\circ\text{C} = 4.52 \times 10^3 \text{ J}$$

11. A 155 g sample of an unknown substance was heated from 25.0°C to 40.0°C. In the process, the substance absorbed 5696 J of energy. What is the specific heat of the substance? Identify the substance among those listed in Table 2.

$$q = c \times m \times \Delta T$$

(Applications - 5)

$$c = \frac{q}{m\Delta T} = \frac{(5696 \text{ J})}{(155 \text{ g})(40.0 - 25.0^\circ\text{C})} = 2.45 \text{ J/(g} \cdot ^\circ\text{C)}$$

The specific heat is very close to the value for ethanol.

12. A 4.50 g nugget of pure gold absorbed 276 J of heat. The initial temperature was 25.0°C. What was the final temperature?

$$q = c \times m \times \Delta T$$

(Applications - 6)

$$\Delta T = \frac{q}{cm} = \frac{(276 \text{ J})}{(0.129 \text{ J/g} \cdot ^\circ\text{C})(4.50 \text{ g})} = 475^\circ\text{C}$$

$$\Delta T = T_f - T_i = T_f - 25.0^\circ\text{C} = 475^\circ\text{C}$$

$$T_f = 500^\circ\text{C}$$

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13. Calculate the amount of heat absorbed when 5.50 g of aluminum is heated from 25.0°C to 95.0°C. The specific heat of aluminum is 0.897 J/(g·°C).

$$q = cm\Delta T$$

(Review - 10)

$$q = (0.897 \text{ J/(g}\cdot\text{°C)})(5.50 \text{ g})(95.0^\circ\text{C} - 25.0^\circ\text{C})$$

$$q = 345 \text{ J}$$

