Chemistry 30

Unit 1: Energy Changes in Chemical Reactions 22 max

Assignment 1: Sections 1-1 to 1-6

Value

1. Define "potential energy" and "kinetic energy". Give some specific examples of each form of energy.

2

Potential energy – stored energy. Chemical bond energy, nuclear energy are examples.

Kinetic energy – energy of motion. Heat, light, electrical energy are all examples.

2. What is the SI unit for energy?

1

The joule, J.
(In chemistry we will typically refer to kilojoules, kJ 1 kJ = 1,000 J)

3. State the Law of Conservation of Energy. What is another name for this Law?

2

Also known as the First Law of Thermodynamics, the Law of Conservation of Energy tells us that energy can be converted from one form to another, but cannot be created or destroyed during chemical reactions.

4. What is the relationship between the amount of kinetic energy a particle has and how fast it is moving? Pick one of the following:

1

A. Slower moving particles have more kinetic energy than faster particles.

⇒ ***B. Faster moving particles have more kinetic energy than slower particles.***

C. Speed of motion and kinetic energy are not related.

2 5. A. Convert the following to Kelvin temperatures: 10°C , -20°C

10°C = 283 K **-20°C = 253 K**

B. Convert the following to Celsius temperatures: 25 K, 300 K

2

25 K = -248°C **300 K = 27°C**

6. Identify each of the following as either endothermic or exothermic:

2

A. $Cu(s) + Cl_2(g) \rightarrow CuCl_2(s) + 220.1\ kJ$ **Exothermic**

B. $6\ CO_2(g) + 6\ H_2O(l) + 2802\ kJ \rightarrow C_6H_{12}O_6(s) + 6\ O_2(g)$ **Endothermic**

7. If you were holding reaction 6A in your hand, would your hand feel warmer or colder? Explain.

2

Your hand would feel warmer. Exothermic reactions release heat to the surroundings.

8. When potassium nitrate dissolves in water, the beaker containing the solution gets cooler. Is dissolving this salt an exothermic or endothermic process? Explain.

2

The water temperature drops because the reaction is endothermic and is absorbing heat from the water.

9. What is calorimetry?

1

The measurement of the amount of heat released or absorbed during a chemical reaction.

10. How much heat would have to be absorbed by 2000 grams of water to change its temperature from 20°C to 50°C? Use the value 4.2 J/(g°C) for the specific heat of water.

Hint: You will need to use the formula: Q = mc∆T. Solve for Q

Be sure to show work.

2

Q = mc∆T

$$Q = (2000g)\left(\frac{4.2J}{g\cdot^{\circ}C}\right)(30^{\circ}C) = 252{,}000J = 252kJ$$

(or 300 kJ to the correct number of sig figs (no deduction for an answer of 252 kJ)

You may leave your answer in J or convert to kJ, but marks (-½) are deducted if units are not included with your answer.

11. If 500 grams of water at 25°C loses 1.05×10^4 joules of heat, what will be the final temperature of the water? Show your work.

Hint: You will use the formula Q = mc∆T. Solve for ∆T, then find the final water temperature.

Rearrange the equation to solve for ∆T: $\Delta T = \frac{Q}{mc}$

3

$$\Delta T = \frac{Q}{mc} = \frac{1.05\times10^4}{(500)(4.2)} = 5$$

The *change* in temperature is 5°C; the question wants to find the *final* temperature.

Since the reaction lost heat, the final temperature will be 20°C:

25°C - 5°C = 20°C