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AMC/AFNS/NUMS Chemistry-3 Test Preparation

Thermochemistry and Energetics

1. Thermochemistry is the branch of chemistry that deals with:

- A. Structure of atoms
- B. Heat changes during chemical reactions
- C. Classification of elements
- D. Radioactivity only

Correct Answer: B. Heat changes during chemical reactions

Explanation: Thermochemistry is the study of heat energy absorbed or released during chemical and physical processes. It helps explain energy changes accompanying reactions, phase changes, and bond formation or breaking.

2. The study of energy transformations in chemical reactions is called:

- A. Electrochemistry
- B. Thermochemistry
- C. Photochemistry
- D. Biochemistry

Correct Answer: B. Thermochemistry

Explanation: Thermochemistry focuses on the relationship between chemical reactions and energy changes. It measures how much heat is absorbed or released when substances react.

3. Energy is defined as the:

- A. Ability to do work
- B. Rate of doing work
- C. Force per unit area
- D. Mass of a substance

Correct Answer: A. Ability to do work

Explanation: Energy is the capacity to perform work. In chemical systems, energy is stored in chemical bonds and may be released or absorbed during reactions.

4. The SI unit of energy is:

- A. Watt
- B. Newton
- C. Joule
- D. Pascal

Correct Answer: C. Joule

Explanation: The SI unit of energy is the joule (J). One joule is the amount of work done when a force of one newton moves an object through one meter.

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5. Heat is a form of:

- A. Matter
- B. Energy
- C. Element
- D. Compound

Correct Answer: B. Energy

Explanation: Heat is a form of energy that transfers from a hotter object to a colder object due to a temperature difference. It is measured in joules or calories.

6. A reaction that releases heat is called:

- A. Endothermic
- B. Exothermic
- C. Reversible
- D. Neutral

Correct Answer: B. Exothermic

Explanation: Exothermic reactions release heat energy into the surroundings. As a result, the temperature of the surroundings usually increases. Examples include combustion and respiration.

7. A reaction that absorbs heat is called:

- A. Exothermic
- B. Endothermic
- C. Catalytic
- D. Nuclear

Correct Answer: B. Endothermic

Explanation: Endothermic reactions absorb heat energy from the surroundings. These reactions often cause the surroundings to become cooler. Photosynthesis is a common example.

8. Which of the following is an exothermic process?

- A. Melting of ice
- B. Boiling of water
- C. Combustion of methane
- D. Sublimation of iodine

Correct Answer: C. Combustion of methane

Explanation: Combustion reactions release large amounts of heat energy and are therefore exothermic. Burning fuels such as methane, coal, and gasoline are common exothermic processes.

9. Which of the following is an endothermic process?

- A. Freezing of water
- B. Condensation of steam
- C. Photosynthesis
- D. Respiration

Correct Answer: C. Photosynthesis

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Explanation: Photosynthesis requires energy from sunlight to convert carbon dioxide and water into glucose. Therefore, it is an endothermic process.

10. The total heat content of a system is called:

- A. Entropy
- B. Enthalpy
- C. Pressure
- D. Density

Correct Answer: B. Enthalpy

Explanation: Enthalpy (H) represents the total heat content of a system at constant pressure. Changes in enthalpy indicate whether heat is absorbed or released during a reaction.

11. The symbol used for enthalpy change is:

- A. ΔH
- B. ΔS
- C. ΔG
- D. ΔT

Correct Answer: A. ΔH

Explanation: The symbol ΔH represents the change in enthalpy during a reaction. A negative ΔH indicates an exothermic reaction, while a positive ΔH indicates an endothermic reaction.

12. In an exothermic reaction, ΔH is:

- A. Positive
- B. Negative
- C. Zero
- D. Infinite

Correct Answer: B. Negative

Explanation: In exothermic reactions, products have lower enthalpy than reactants. Therefore, heat is released and ΔH has a negative value.

13. In an endothermic reaction, ΔH is:

- A. Negative
- B. Positive
- C. Zero
- D. Constant

Correct Answer: B. Positive

Explanation: Endothermic reactions absorb heat from the surroundings. Products contain more energy than reactants, resulting in a positive value of ΔH .

14. The heat required to raise the temperature of 1 g of water by 1°C is called:

- A. Joule
- B. Calorie
- C. Watt

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D. Mole

Correct Answer: B. Calorie

Explanation: One calorie is the amount of heat required to increase the temperature of one gram of water by one degree Celsius. It is a traditional unit of heat energy.

15. One calorie is equal to approximately:

- A. 4.184 J
- B. 0.184 J
- C. 10 J
- D. 100 J

Correct Answer: A. 4.184 J

Explanation: The relationship between calories and joules is $1 \text{ cal} = 4.184 \text{ J}$. This conversion is frequently used in thermochemical calculations.

16. The heat absorbed or released at constant pressure is equal to:

- A. ΔT
- B. ΔH
- C. ΔS
- D. ΔV

Correct Answer: B. ΔH

Explanation: At constant pressure, the heat exchanged by a system is equal to the change in enthalpy, represented by ΔH .

17. The standard enthalpy of formation refers to the enthalpy change when:

- A. One mole of a compound is formed from its elements
- B. One mole of a compound is decomposed
- C. One mole of water is boiled
- D. One mole of gas is compressed

Correct Answer: A. One mole of a compound is formed from its elements

Explanation: Standard enthalpy of formation is the enthalpy change when one mole of a compound is formed from its constituent elements in their standard states.

18. The standard enthalpy of combustion is the heat released when:

- A. One mole of substance burns completely
- B. One mole dissolves in water
- C. One mole freezes
- D. One mole evaporates

Correct Answer: A. One mole of substance burns completely

Explanation: Standard enthalpy of combustion is the energy released when one mole of a substance burns completely in excess oxygen under standard conditions.

19. Combustion reactions are generally:

- A. Endothermic

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- B. Exothermic
- C. Reversible
- D. Neutral

Correct Answer: B. Exothermic

Explanation: Combustion reactions release large amounts of heat and light energy because strong bonds are formed in the products such as CO_2 and H_2O .

20. The standard enthalpy of neutralization refers to heat change when:

- A. Acid reacts with base
- B. Salt dissolves
- C. Water freezes
- D. Metal melts

Correct Answer: A. Acid reacts with base

Explanation: Neutralization occurs when an acid reacts with a base to produce water and salt. This process usually releases heat and is therefore exothermic.

21. Hess's Law states that enthalpy change depends only on:

- A. Reaction pathway
- B. Initial and final states
- C. Temperature only
- D. Catalyst only

Correct Answer: B. Initial and final states

Explanation: Hess's Law states that the total enthalpy change of a reaction is independent of the route taken. It depends only on the initial reactants and final products.

22. The law of conservation of energy states that energy:

- A. Can be created
- B. Can be destroyed
- C. Can neither be created nor destroyed
- D. Exists only as heat

Correct Answer: C. Can neither be created nor destroyed

Explanation: Energy can only be transformed from one form to another. The total energy of an isolated system remains constant.

23. The SI unit of heat capacity is:

- A. J K^{-1}
- B. kg mol^{-1}
- C. N m^{-1}
- D. Pa

Correct Answer: A. J K^{-1}

Explanation: Heat capacity is the amount of heat required to raise the temperature of a substance by one kelvin. Its SI unit is joule per kelvin.

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24. Specific heat capacity is the amount of heat required to raise the temperature of:

- A. 1 mole by 1°C
- B. 1 g by 1°C
- C. 100 g by 10°C
- D. 1 kg by 100°C

Correct Answer: B. 1 g by 1°C

Explanation: Specific heat capacity is defined as the heat required to raise the temperature of one gram of a substance by one degree Celsius or one kelvin.

25. Water has a high specific heat capacity because of:

- A. Ionic bonds
- B. Metallic bonds
- C. Hydrogen bonding
- D. Nuclear forces

Correct Answer: C. Hydrogen bonding

Explanation: Hydrogen bonds between water molecules require significant energy to break. Therefore, water can absorb large amounts of heat without a large temperature increase.

26. During melting, the temperature remains constant because heat is used for:

- A. Increasing mass
- B. Breaking intermolecular forces
- C. Increasing pressure
- D. Creating atoms

Correct Answer: B. Breaking intermolecular forces

Explanation: During melting, the supplied heat is used to overcome attractive forces between particles rather than increasing kinetic energy. Therefore, temperature remains constant until melting is complete.

27. The heat required to convert a solid into liquid at its melting point is called:

- A. Heat of fusion
- B. Heat of vaporization
- C. Heat capacity
- D. Heat of reaction

Correct Answer: A. Heat of fusion

Explanation: Heat of fusion is the energy required to convert a solid into a liquid without changing temperature. Ice melting into water is a common example.

28. The heat required to convert a liquid into gas at its boiling point is called:

- A. Heat of combustion
- B. Heat of vaporization
- C. Heat of formation
- D. Heat of neutralization

Correct Answer: B. Heat of vaporization

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Explanation: Heat of vaporization is the energy needed to change a liquid into gas without temperature change. It is generally greater than heat of fusion.

29. Respiration in living organisms is an example of:

- A. Endothermic reaction
- B. Exothermic reaction
- C. Photochemical reaction
- D. Reversible reaction

Correct Answer: B. Exothermic reaction

Explanation: During respiration, glucose reacts with oxygen and releases energy. This energy is used for biological activities, making respiration an exothermic process.

30. Photosynthesis is classified as:

- A. Exothermic process
- B. Endothermic process
- C. Neutral process
- D. Catalytic process

Correct Answer: B. Endothermic process

Explanation: Photosynthesis absorbs energy from sunlight to convert carbon dioxide and water into glucose. Since energy is absorbed, photosynthesis is an endothermic process.

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