Chem 167 Quiz 3 Answer Key PDF Answer Key PDF

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Which of the following are types of chemical reactions?

A. Synthesis ✓
B. Decomposition ✓
C. Single Replacement ✓
D. Combust ion ✓

Which factors can affect the rate of a chemical reaction?

A. Temperature ✓
B. Catalyst presence ✓
C. Concentration of reactants ✓
D. Surface area of reactants ✓

Which of the following statements about acids and bases are true?

A. Acids donate protons according to Brønst ed-Lowry theory. ✓
B. Bases accept electrons according to Lewis theory. ✓
C. Strong acids completely dissociate in water. ✓
D. Bases increase the concentration of OH- ions in solution. ✓

Which properties are periodic trends in the periodic table?

A. Electronegativity ✓
B. Atomic radius ✓
C. Ionization energy ✓
D. Electron affinity ✓

Which of the following are characteristics of exothermic reactions?

A. Release of heat ✓
B. Negative ΔH ✓
C. Products have lower energy than reactants ✓
D. Absorption of heat

What is the correct balanced equation for the combustion of methane (CH_4)?

A. $CH_4 + O_2 \rightarrow CO_2 + H_2O$
B. $CH_4 + 2O_2 \rightarrow CO_2 + 2H_2O$ ✓
C. $CH_4 + 3O_2 \rightarrow 2CO_2 + 2H_2O$
D. $CH_4 + 2O_2 \rightarrow 2CO_2 + H_2O$

Which of the following is a strong acid?

A. Acetic acid
B. Hydrochloric acid ✓
C. Ammonia
D. Sodium hydroxide

What is the molecular geometry of water (H_2O) according to VSEPR theory?

A. Linear
B. Trigonal planar
C. Bent ✓
D. Tet rahedral

Which element has the highest electronegativity?

A. Oxygen
B. Fluorine ✓
C. Chlorine
D. Nitrogen

What is the main product of the reaction between an acid and a base?

A. Salt and water ✓
B. Carbon dioxide and water

C. Hydrogen gas
D. Oxygen gas

Explain how Le Chatelier's principle can be used to predict the effect of changing conditions on a chemical equilibrium. Provide an example to illustrate your explanation.

Le Chatelier's principle can be used to predict that if the concentration of reactants is increased in a chemical equilibrium, the system will shift to the right, favorably producing more products. For instance, in the reaction A + B ⇌ C + D, adding more A will shift the equilibrium towards C and D.

Describe the process of calculating the enthalpy change (ΔH) for a reaction using Hess's Law. Include a step-by-step approach with a hypothetical reaction.

To calculate the enthalpy change (ΔH) for a reaction using Hess's Law, follow these steps: 1. Identify the target reaction for which you want to find ΔH. 2. Find known reactions with their enthalpy changes that can be combined to yield the target reaction. 3. If necessary, reverse any reactions and change the sign of their ΔH values. 4. Adjust the coefficients of the reactions to match the stoichiometry of the target reaction, multiplying the ΔH by the same factor. 5. Sum the ΔH values of the adjusted reactions to obtain the total ΔH for the target reaction.

Discuss the differences between ionic and covalent bonds. Include examples of each and explain how these differences affect the properties of the compounds formed.

Ionic bonds are formed through the transfer of electrons, resulting in the formation of positively and negatively charged ions, as seen in sodium chloride (NaCl). In contrast, covalent bonds involve the sharing of electrons between atoms, exemplified by water (H2O). The differences in bonding lead to ionic compounds having high melting points and electrical conductivity in solution, while covalent compounds often have lower melting points and variable solubility.

Analyze the impact of temperature on the solubility of gases in liquids. How does this relate to real-world phenomena such as carbonated beverages?

As temperature increases, the solubility of gases in liquids decreases, which is why carbonated beverages lose their fizz when warmed.

Evaluate the role of catalysts in chemical reactions. How do they affect the activation energy and the rate of reaction? Provide examples of industrial applications.

Catalysts lower the activation energy of chemical reactions, allowing them to proceed more quickly without being consumed in the process. For example, in the Haber process, iron catalysts facilitate the synthesis of ammonia from nitrogen and hydrogen, significantly increasing the reaction rate.

Which of the following are examples of intermolecular forces?

A. Hydrogen bonding ✓
B. Ionic bonding
C. Dipole-dipole interactions ✓
D. London dispersion forces ✓

Which of the following are characteristics of a dynamic equilibrium?

A. The forward and reverse reactions occur at the same rate. ✓
B. The concentrations of reactants and products remain constant. ✓
C. The system is static and unchanging.
D. The equilibrium can be shifted by changing conditions. ✓

Which statements about the pH scale are correct?

A. A pH of 7 is neutral. ✓
B. A pH less than 7 is acidic. ✓
C. A pH greater than 7 is basic. ✓
D. A pH of 0 is the strongest base.

What is the primary reason for the increase in atomic size down a group in the periodic table?

A. Increase in nuclear charge
B. Addition of electron shells ✓
C. Increase in electronegativity
D. Decrease in ionization energy

Which of the following elements is a noble gas?

A. Oxygen
B. Nitrogen
C. Argon ✓

D. Chlorine

What is the main characteristic of a covalent bond?

A. Transfer of electrons

B. Sharing of electrons ✓

C. Formation of ions

D. Attraction between oppositely charged ions

Discuss the significance of stoichiometry in chemical reactions. How does it help in predicting the amounts of reactants and products involved?

Stoichiometry helps in predicting the amounts of reactants and products involved in chemical reactions by using balanced chemical equations to relate the ratios of substances, enabling accurate calculations for laboratory and industrial processes.

Explain the concept of activation energy and its importance in chemical kinetics. How can it be altered in a reaction?

Activation energy (Ea) is the energy barrier that must be overcome for reactants to be transformed into products in a chemical reaction. It is important in chemical kinetics because it influences the rate at which reactions occur; higher activation energy typically results in slower reactions. Activation energy can be altered by increasing the temperature, which provides more energy to the reactants, or by using catalysts, which lower the activation energy required for the reaction to proceed.

Describe the process of determining the empirical formula of a compound from its percent composition. Provide a detailed example.

1. Convert the percent composition to grams (assuming 100g total). For example, 40g C, 6.67g H, and 53.33g O. 2. Convert grams to moles by dividing by the atomic mass (C: 12.01 g/mol, H: 1.008 g/mol, O: 16.00 g/mol). This gives approximately 3.33 moles C, 6.67 moles H, and 3.33 moles O. 3. Divide each mole value by the smallest number of moles (3.33) to get the simplest ratio: C: 1, H: 2, O: 1. 4. The empirical formula is CH2O.

Analyze the environmental impact of combustion reactions. What are some strategies to mitigate their negative effects?

The environmental impact of combustion reactions includes the release of carbon dioxide, nitrogen oxides, sulfur dioxide, and particulate matter, which contribute to global warming and air quality degradation. To mitigate these negative effects, strategies such as adopting renewable energy

sources (like solar and wind), enhancing energy efficiency in industrial processes, and utilizing carbon capture and storage technologies can be implemented.

Evaluate the use of the periodic table as a tool for predicting chemical behavior. How do periodic trends assist in this prediction?

The periodic table allows for the prediction of chemical behavior by revealing periodic trends that indicate how elements will interact, such as their reactivity, bonding patterns, and the types of compounds they will form.