Electron Configurations Worksheet Answer Key PDF

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Part 1: Foundational Knowledge

What is the maximum number of electrons that can occupy a single orbital?

undefined. 1

undefined. 2 ✓

undefined. 4

undefined. 6

The maximum number of electrons that can occupy a single orbital is 2.

Which of the following principles are used to determine electron configurations?

undefined. Aufbau Principle ✓

undefined. Pauli Exclusion Principle ✓

undefined. Hund's Rule ✓

undefined. Heisenberg Uncertainty Principle

The principles used to determine electron configurations include the Aufbau Principle, Pauli Exclusion Principle, and Hund's Rule.

Explain the significance of electron configurations in determining the chemical properties of an element.

Electron configurations are significant because they determine how an element interacts with others, influencing its reactivity and the types of bonds it can form.

List the subshells in order of increasing energy for the first four principal energy levels.

1. 1st energy level

1s

2. 2nd energy level

2s, 2 p

3. 3rd energy level

3s, 3 p, 3 d

4. 4th energy level

4s, 4 p

The order of subshells in increasing energy for the first four principal energy levels is: 1s, 2s, 2 p, 3s, 3 p, 4s, 3 d, 4 p.

Part 2: Understanding and Interpretation

Which element has the electron configuration $1s^2\ 2s^2\ 2\ p^6\ 3s^2\ 3\ p^4$?

undefined. Oxygen

undefined. Sulfur ✓

undefined. Phosphorus

undefined. Chlorine

The element with the electron configuration $1s^2\ 2s^2\ 2\ p^6\ 3s^2\ 3\ p^4$ is sulfur.

Identify the correct statements about the periodic table and electron configurations:

undefined. Elements in the same group have similar valence electron configurations. ✓

undefined. Elements in the same period have the same number of electron shells. ✓

undefined. Transition metals have a completely filled d subshell.

undefined. Noble gases have a full outer electron shell. ✓

Correct statements include that elements in the same group have similar valence electron configurations and elements in the same period have the same number of electron shells.

Describe how Hund's Rule affects the arrangement of electrons in the p subshell.

Hund's Rule states that electrons will fill degenerate orbitals singly before pairing up, which affects the stability and arrangement of electrons in the p subshell.

Part 3: Applying Knowledge and Analyzing Relationships

Which of the following electron configurations represents an ion of sodium (Na^+)?

undefined. $1s^2\ 2s^2\ 2\ p^6\ 3s^1$

undefined. $1s^2\ 2s^2\ 2\ p^6$ ✓

undefined. $1s^2\ 2s^2\ 2\ p^5$

undefined. $1s^2\ 2s^2\ 2\ p^6\ 3s^2$

The electron configuration that represents an ion of sodium (Na^+) is $1s^2\ 2s^2\ 2\ p^6$.

Predict the electron configuration for the ion formed by chlorine (Cl^-):

undefined. $1s^2\ 2s^2\ 2\ p^5\ 3s^2$

undefined. $1s^2\ 2s^2\ 2\ p^6\ 3s^2\ 3\ p^6$ ✓

undefined. $1s^2\ 2s^2\ 2\ p^6\ 3s^2\ 3\ p^4$

undefined. $1s^2\ 2s^2\ 2\ p^6\ 3s^2\ 3\ p^3$

The electron configuration for the ion formed by chlorine (Cl^-) is $1s^2\ 2s^2\ 2\ p^6\ 3s^2\ 3\ p^6$.

Apply the principles of electron configuration to explain why copper (Cu) has an electron configuration of [Ar] 3 d^{10} 4 s^1 instead of [Ar] 3 d^9 4 s^2.

Copper has an electron configuration of [Ar] 3 d^{10} 4 s^1 because this arrangement provides greater stability due to the fully filled d subshell.

Which of the following elements would you expect to have the most unpaired electrons in its ground state?

undefined. Carbon

undefined. Nitrogen ✓

undefined. Oxygen

undefined. Fluorine

The element with the most unpaired electrons in its ground state is nitrogen.

Analyze the following electron configurations and identify which are exceptions to the Aufbau Principle:

undefined. [Ar] 3 d^{10} 4 s^1 (Copper) ✓

undefined. [Ar] 3 d^5 4 s^1 (Chromium) ✓
undefined. [Ne] 3 s^2 3 p^6 4 s^2 3 d^{10} 4 p^6 (Krypton)
undefined. [Kr] 4 d^{10} 5 s^2 5 p^6 (Xenon)

The exceptions to the Aufbau Principle include [Ar] 3 d^{10} 4 s^1 (Copper) and [Ar] 3 d^5 4 s^1 (Chromium).

Part 4: Synthesis and Reflection

Which of the following configurations would you expect to be the most stable and why?

undefined. [Ne] 3 s^2 3 p^6
undefined. [Ar] 3 d^{10} 4 s^2
undefined. [Kr] 4 d^{10} 5 s^2 5 p^6 ✓
undefined. [Xe] 4 f^{14} 5 d^{10} 6 s^2 6 p^6

The most stable configuration is [Kr] 4 d^{10} 5 s^2 5 p^6 because it has a full outer shell.

Evaluate the following statements and select those that correctly describe the role of electron configurations in chemical bonding:

undefined. Elements with similar electron configurations tend to form similar types of bonds. ✓
undefined. Electron configurations determine the number of bonds an atom can form. ✓
undefined. Atoms with full outer shells tend to be highly reactive.
undefined. Transition metals can form multiple bonds due to their d orbitals. ✓

Correct statements include that elements with similar electron configurations tend to form similar types of bonds and that electron configurations determine the number of bonds an atom can form.

Create a hypothetical element with a unique electron configuration. Describe its position on the periodic table and predict its chemical properties based on its configuration.

A hypothetical element could have a unique electron configuration that places it in a specific group and period, influencing its reactivity and bonding behavior.