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AMC/AFNS/NUMS Chemistry-1 Test Preparation

Atomic Structure & Periodic Table

1. The smallest particle of an element that retains its chemical properties is called:

- A. Molecule
- B. Atom
- C. Ion
- D. Electron

Correct Answer: B. Atom

Explanation: An atom is the smallest unit of an element that shows the chemical properties of that element. It consists of protons, neutrons, and electrons. Molecules are formed when two or more atoms combine chemically, while ions are charged particles formed by loss or gain of electrons.

2. The nucleus of an atom contains:

- A. Electrons only
- B. Protons and electrons
- C. Protons and neutrons
- D. Neutrons and electrons

Correct Answer: C. Protons and neutrons

Explanation: The nucleus is the central dense part of an atom. It contains positively charged protons and neutral neutrons. Electrons revolve around the nucleus in shells or energy levels. Most of the atomic mass is concentrated in the nucleus.

3. The charge on a proton is:

- A. Negative
- B. Positive
- C. Neutral
- D. Variable

Correct Answer: B. Positive

Explanation: A proton carries one unit positive charge. The number of protons in the nucleus determines the atomic number and identity of an element. For example, all carbon atoms contain six protons.

4. The particle with negligible mass and negative charge is:

- A. Proton
- B. Neutron
- C. Electron
- D. Nucleus

Correct Answer: C. Electron

Explanation: Electrons are negatively charged subatomic particles present outside the nucleus.

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Their mass is very small compared with protons and neutrons. Chemical bonding and chemical reactions mainly involve electrons, especially valence electrons.

5. Atomic number is equal to the number of:

- A. Neutrons only
- B. Protons only
- C. Protons + neutrons
- D. Electrons + neutrons

Correct Answer: B. Protons only

Explanation: Atomic number is the number of protons present in the nucleus of an atom. In a neutral atom, the number of electrons is also equal to the number of protons, but atomic number is specifically defined by protons.

6. Mass number is equal to:

- A. Protons + electrons
- B. Electrons + neutrons
- C. Protons + neutrons
- D. Protons only

Correct Answer: C. Protons + neutrons

Explanation: Mass number represents the total number of nucleons in the nucleus. Nucleons include protons and neutrons. Electrons are not included because their mass is negligible compared with protons and neutrons.

7. Isotopes are atoms of the same element having:

- A. Same mass number but different atomic number
- B. Same atomic number but different mass number
- C. Different number of protons
- D. Same number of neutrons only

Correct Answer: B. Same atomic number but different mass number

Explanation: Isotopes have the same number of protons, so they belong to the same element. However, they have different numbers of neutrons, which gives them different mass numbers. For example, carbon-12 and carbon-14 are isotopes of carbon.

8. Which of the following are isotopes of hydrogen?

- A. Protium, deuterium, tritium
- B. Alpha, beta, gamma
- C. Sodium, potassium, lithium
- D. Chlorine-35 and chlorine-37

Correct Answer: A. Protium, deuterium, tritium

Explanation: Hydrogen has three common isotopes: protium, deuterium, and tritium. Protium has no neutron, deuterium has one neutron, and tritium has two neutrons. All have one proton, so their atomic number remains the same.

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9. Rutherford's atomic model was based on the scattering of:

- A. Beta particles
- B. Alpha particles
- C. Gamma rays
- D. X-rays

Correct Answer: B. Alpha particles

Explanation: Rutherford performed the gold foil experiment using alpha particles. Most alpha particles passed straight through the foil, but some were deflected, and a few bounced back. This showed that the atom has a small, dense, positively charged nucleus.

10. Rutherford's model failed to explain:

- A. Existence of nucleus
- B. Positive charge of nucleus
- C. Stability of atom
- D. Deflection of alpha particles

Correct Answer: C. Stability of atom

Explanation: According to classical physics, electrons revolving around the nucleus should continuously lose energy and fall into the nucleus. Rutherford's model could not explain why atoms are stable and why electrons do not collapse into the nucleus.

11. Bohr's atomic model successfully explained the spectrum of:

- A. Sodium atom
- B. Hydrogen atom
- C. Chlorine atom
- D. Uranium atom

Correct Answer: B. Hydrogen atom

Explanation: Bohr's model explained the line spectrum of hydrogen atom by suggesting that electrons revolve in fixed energy levels. When an electron jumps between energy levels, energy is absorbed or emitted as radiation. However, Bohr's model was not fully successful for multi-electron atoms.

12. According to Bohr's model, electrons revolve around nucleus in:

- A. Random paths
- B. Fixed energy levels
- C. Straight lines
- D. Inside the nucleus

Correct Answer: B. Fixed energy levels

Explanation: Bohr proposed that electrons move in specific circular orbits called shells or energy levels. Electrons do not radiate energy while moving in these allowed orbits. Energy is emitted or absorbed only when electrons jump from one orbit to another.

13. The maximum number of electrons in the first shell is:

- A. 2

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- B. 8
- C. 18
- D. 32

Correct Answer: A. 2

Explanation: The maximum number of electrons in a shell is calculated by the formula $2n^2$, where n is the shell number. For the first shell, $n = 1$, so maximum electrons = $2(1)^2 = 2$.

14. The maximum number of electrons in the second shell is:

- A. 2
- B. 8
- C. 18
- D. 32

Correct Answer: B. 8

Explanation: For the second shell, $n = 2$. By using the formula $2n^2$, maximum electrons = $2(2)^2 = 8$. This shell can contain up to eight electrons.

15. The electronic configuration of sodium, atomic number 11, is:

- A. 2, 8, 1
- B. 2, 7, 2
- C. 2, 6, 3
- D. 2, 8, 8

Correct Answer: A. 2, 8, 1

Explanation: Sodium has 11 electrons in a neutral atom. The first shell contains 2 electrons, the second shell contains 8 electrons, and the remaining 1 electron goes into the third shell. Therefore, its electronic configuration is 2, 8, 1.

16. Valence electrons are present in the:

- A. Nucleus
- B. Innermost shell
- C. Outermost shell
- D. Neutron shell

Correct Answer: C. Outermost shell

Explanation: Valence electrons are the electrons present in the outermost shell of an atom. They determine the chemical properties and reactivity of an element. Elements with similar valence electrons usually show similar chemical behavior.

17. Elements in the same group of the periodic table have same:

- A. Atomic mass
- B. Number of shells
- C. Number of valence electrons
- D. Number of neutrons

Correct Answer: C. Number of valence electrons

Explanation: Elements in the same group have the same number of valence electrons. This is

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why they show similar chemical properties. For example, lithium, sodium, and potassium are in group 1 and all have one valence electron.

18. Elements in the same period of the periodic table have same:

- A. Number of valence electrons
- B. Number of shells
- C. Atomic mass
- D. Chemical properties

Correct Answer: B. Number of shells

Explanation: A period represents the number of occupied electron shells in an atom. Elements in the same period have the same number of shells, but their valence electrons increase from left to right.

19. The modern periodic table is arranged according to increasing:

- A. Atomic mass
- B. Atomic number
- C. Neutron number
- D. Mass number

Correct Answer: B. Atomic number

Explanation: The modern periodic law states that properties of elements are periodic functions of their atomic numbers. Atomic number is more fundamental than atomic mass because it determines the number of protons and the electronic configuration of an element.

20. Mendeleev arranged elements mainly according to increasing:

- A. Atomic number
- B. Atomic mass
- C. Number of electrons
- D. Density

Correct Answer: B. Atomic mass

Explanation: Mendeleev arranged elements in order of increasing atomic masses and grouped elements with similar properties together. His table successfully predicted some undiscovered elements, but it had problems with isotopes and some element positions.

21. Across a period from left to right, atomic radius generally:

- A. Increases
- B. Decreases
- C. Remains same
- D. Becomes zero

Correct Answer: B. Decreases

Explanation: Across a period, nuclear charge increases because the number of protons increases. Electrons are added to the same shell, so shielding does not increase much. Stronger nuclear attraction pulls electrons closer, causing atomic radius to decrease.

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22. Down a group, atomic radius generally:

- A. Decreases
- B. Increases
- C. Remains same
- D. First decreases then becomes zero

Correct Answer: B. Increases

Explanation: Down a group, new electron shells are added. Although nuclear charge increases, the added shells and shielding effect reduce the attraction between nucleus and valence electrons. Therefore, atomic radius increases down the group.

23. Across a period from left to right, ionization energy generally:

- A. Decreases
- B. Increases
- C. Becomes zero
- D. Remains exactly same

Correct Answer: B. Increases

Explanation: Ionization energy is the energy required to remove an electron from a gaseous atom. Across a period, atomic size decreases and nuclear attraction increases, so more energy is required to remove an electron.

24. Down a group, ionization energy generally:

- A. Increases
- B. Decreases
- C. Remains same
- D. Becomes infinite

Correct Answer: B. Decreases

Explanation: Down a group, atomic size and shielding effect increase. The valence electron becomes farther from the nucleus and is held less strongly. Therefore, less energy is required to remove it, so ionization energy decreases.

25. The most electronegative element is:

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

Correct Answer: C. Fluorine

Explanation: Fluorine is the most electronegative element because it has a small atomic size and strong nuclear attraction for bonding electrons. It attracts shared electrons more strongly than any other element.

26. Metallic character across a period from left to right:

- A. Increases
- B. Decreases

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- C. Remains same
- D. Becomes maximum at noble gases

Correct Answer: B. Decreases

Explanation: Metallic character is the tendency of an atom to lose electrons. Across a period, nuclear charge increases and atomic size decreases, so atoms hold electrons more strongly. Therefore, metallic character decreases from left to right.

27. Metallic character down a group:

- A. Decreases
- B. Increases
- C. Remains same
- D. Disappears completely

Correct Answer: B. Increases

Explanation: Down a group, atomic size increases and valence electrons become farther from the nucleus. As a result, atoms lose electrons more easily. Therefore, metallic character increases down the group.

28. Noble gases are chemically inert because they have:

- A. Half-filled shells
- B. Completely filled outermost shells
- C. No protons
- D. No electrons

Correct Answer: B. Completely filled outermost shells

Explanation: Noble gases have stable electronic configurations with complete valence shells. Because of this stability, they have very little tendency to gain, lose, or share electrons. This makes them chemically unreactive under normal conditions.

29. Halogens belong to which group of the periodic table?

- A. Group 1
- B. Group 2
- C. Group 17
- D. Group 18

Correct Answer: C. Group 17

Explanation: Halogens are group 17 elements. They have seven valence electrons and need one more electron to complete their octet. Fluorine, chlorine, bromine, iodine, and astatine are examples of halogens.

30. Alkali metals belong to:

- A. Group 1
- B. Group 2
- C. Group 17
- D. Group 18

Correct Answer: A. Group 1

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Explanation: Alkali metals are group 1 elements, such as lithium, sodium, and potassium. They have one valence electron and are highly reactive because they can easily lose this electron to form positive ions.

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