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Chemistry Grade 9 — Chapter 3

Atomic Structure

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Practice MCQs extracted from the supplied Class 9 Chemistry chapter tests (Section A). Total: 30 questions.

A. Important / Main Topics

1. Who proposed the first scientific theory that atoms are indivisible particles?

(A) Dalton
(B) Rutherford
(C) Bohr
(D) Heisenberg

Correct Answer: A

Explanation: In 1803, John Dalton presented his atomic theory, stating that all elements are composed of tiny indivisible particles called atoms.

2. Which subatomic particle has a relative charge of -1 and a mass of approximately 1/1836 amu?

(A) Proton
(B) Electron
(C) Neutron
(D) Nucleon

Correct Answer: B

Explanation: Electron — this correctly answers the question.

3. The total number of protons and neutrons in an atom is known as its:

(A) Atomic number
(B) Valence number
(C) Mass number
(D) Isotopic number

Correct Answer: C

Explanation: The mass number (or nucleon number) is the total number of protons and neutrons in the nucleus.

4. What is the maximum number of electrons that can be accommodated in the **p sub-shell?**

(A) 2
(B) 10
(C) 14
(D) 6

Correct Answer: D

Explanation: The p sub-shell can accommodate a maximum of 6 electrons.

5. According to Bohr's atomic theory, the angular momentum of an electron is an integral multiple of:

(A) $h/2\pi$
(B) h
(C) $2\pi h$
(D) $h/4\pi$

Correct Answer: A

Explanation: Bohr postulated that the electron revolves only in those orbits where the angular momentum is an integral multiple of $h/2\pi$.

6. Which isotope is commonly used in the treatment of cancer by irradiating cancer cells?

(A) Iodine-131
(B) Cobalt-60
(C) Carbon-14

(D) Sodium-24

Correct Answer: B

Explanation: Cobalt-60 is commonly used to irradiate cancer cells in the hope of killing or shrinking the tumors.

7. The principal quantum number (n) for the M shell is:

(A) 1
(B) 2
(C) 3
(D) 4

Correct Answer: C

Explanation: The principal quantum number (n) for the M shell is 3.

8. Which of the following is the correct electronic configuration for a neutral sodium (Na) atom (Atomic No. 11)?

(A) \(1s^2 2s^2 2p^6\)
(B) \(1s^2 2s^2 2p^5 3s^2\)
(C) \(1s^2 2s^2 2p^3 3s^2 3p^3\)
(D) \(1s^2 2s^2 2p^6 3s^1\)

Correct Answer: D

Explanation: \(1s^2 2s^2 2p^6 3s^1\) — this correctly answers the question.

9. The isotopes of hydrogen are:

(A) Protium, Deuterium, Tritium
(B) Carbon-12, Carbon-13, Carbon-14
(C) Chlorine-35, Chlorine-37
(D) Uranium-234, Uranium-235, Uranium-238

Correct Answer: A

Explanation: The isotopes of hydrogen are Protium, Deuterium, Tritium.

10. Which principle states that it is impossible to simultaneously determine the exact location and future trajectory of an electron?

(A) Aufbau Principle
(B) Heisenberg Uncertainty Principle
(C) Pauli Exclusion Principle
(D) Hund's Rule

Correct Answer: B

Explanation: Formulated by Werner Heisenberg in 1927, this principle states that it is impossible to simultaneously determine the exact location and future trajectory of an electron.

11. Which observation from Rutherford's gold foil experiment led to the conclusion that the atom is mostly empty space?

(A) A few α-particles were deflected at small angles
(B) One in a million α-particles bounced back
(C) Most α-particles passed straight through the foil
(D) Some α-particles were absorbed by the gold foil

Correct Answer: C

Explanation: The fact that most α-particles passed through undeflected proved that most of the atom's volume is empty space.

12. Why did Rutherford's model fail to explain the stability of an atom?

(A) It did not include neutrons in the nucleus
(B) It could not explain the existence of isotopes
(C) It treated electrons as waves instead of particles
(D) It predicted that orbiting electrons would continuously emit energy and spiral into the nucleus

Correct Answer: D

Explanation: According to classical physics, a charged particle moving in a circular path emits energy continuously, which would cause the electron to lose energy and collapse into the nucleus.

13. According to Bohr's model, what happens when an electron jumps from a higher energy orbit to a lower energy orbit?

(A) It emits energy in the form of light
(B) It absorbs energy in the form of light
(C) It becomes a neutron
(D) It stops moving

Correct Answer: A

Explanation: Bohr postulated that light is emitted when an electron falls from a higher energy orbit to a lower energy orbit, with energy equal to the difference between the orbits.

14. Which of the following is the correct order of increasing energy of sub-shells?

(A) 1s < 2p < 2s < 3s < 3p
(B) 1s < 2s < 2p < 3s < 3p
(C) 2s < 1s < 2p < 3s < 3p
(D) 1s < 2s < 3s < 2p < 3p

Correct Answer: B

Explanation: The Aufbau principle states that electrons fill the lowest energy sub-shell first. The correct order is 1s < 2s < 2p < 3s < 3p.

15. The isotope Carbon-14 is used in carbon dating. Why is Carbon-14 suitable for this purpose?

(A) It is the most abundant isotope of carbon
(B) It is stable and does not decay
(C) It is radioactive and decays at a known rate
(D) It is produced only in living organisms

Correct Answer: C

Explanation: Carbon-14 is a radioactive isotope with a known half-life, making it useful for estimating the age of once-living things by measuring how much C-14 remains.

B. Less Important / Secondary Topics

16. Which of the following correctly represents the electronic configuration of a chloride ion (Cl□)? (Atomic number of Cl = 17)

(A) \(1s^2 2s^2 2p^6 3s^2 3p^6\)
(B) \(1s^2 2s^2 2p^6 3s^2 3p^4\)
(C) \(1s^2 2s^2 2p^6 3s^2 3p^5\)
(D) \(1s^2 2s^2 2p^6 3s^2 3p^6 4s^1\)

Correct Answer: A

Explanation: A neutral chlorine atom has 17 electrons. When it gains one electron to form Cl□, it has 18 electrons, giving the configuration \(1s^2 2s^2 2p^6 3s^2 3p^6\) (the same as argon).

17. Which subatomic particle is not found in the nucleus of an atom?

(A) Proton
(B) Electron
(C) Neutron
(D) Nucleon

Correct Answer: B

Explanation: Electrons orbit the nucleus in energy levels or shells. Protons and neutrons are found in the nucleus and are collectively called nucleons.

18. The symbol \(^{35}_{17}\text{Cl}\) represents a chlorine atom. How many neutrons are present in its nucleus?

(A) 17
(B) 35

(C) 18
(D) 52

Correct Answer: C

Explanation: The mass number (35) is the sum of protons and neutrons. Number of neutrons = mass number - atomic number = 35 - 17 = 18.

19. Why is the relative atomic mass of chlorine (35.5 amu) not a whole number?

(A) Chlorine atoms have half a proton
(B) It is the mass of the most abundant isotope
(C) Chlorine atoms lose mass during reactions
(D) It is the weighted average of the masses of its isotopes (Cl-35 and Cl-37)

Correct Answer: D

Explanation: Relative atomic mass is a weighted average of the isotopic masses based on their natural abundances. Chlorine is about 75% Cl-35 and 25% Cl-37, giving an average of 35.5 amu.

20. Which of the following is the correct number of neutrons for the isotope \(^{14}_{6}\text{C}\)?

(A) 8
(B) 6
(C) 14
(D) 20

Correct Answer: A

Explanation: 8 — this correctly answers the question.

21. An atom has an atomic number of 19 and a mass number of 39. Which of the following correctly describes its subatomic particles?

(A) 19 protons, 19 neutrons, 19 electrons
(B) 19 protons, 20 neutrons, 19 electrons
(C) 20 protons, 19 neutrons, 20 electrons
(D) 19 protons, 39 neutrons, 19 electrons

Correct Answer: B

Explanation: Atomic number = protons = 19. Mass number = protons + neutrons, so neutrons = 39 − 19 = 20. A neutral atom has electrons = protons = 19.

22. Which of the following electronic configurations represents an **excited state of a magnesium atom (Z = 12)?**

(A) \(1s^2 2s^2 2p^6 3s^2\)
(B) \(1s^2 2s^2 2p^6 3s^1\)
(C) \(1s^2 2s^2 2p^6 3p^2\)
(D) \(1s^2 2s^2 2p^5 3s^2\)

Correct Answer: C

Explanation: The ground state of Mg ends in \(3s^2\). An excited state has an electron promoted to a higher sub-shell (here, from 3s to 3p), while the total number of electrons remains 12.

23. An ion \(X^{2+}\) has the electronic configuration \(1s^2 2s^2 2p^6\). What is the atomic number of element X?

(A) 8
(B) 10
(C) 14
(D) 12

Correct Answer: D

Explanation: \(X^{2+}\) has 10 electrons. Since it lost 2 electrons, the neutral atom has 10 + 2 = 12 electrons, so its atomic number is 12 (magnesium).

24. The isotope \(^{14}_{6}\text{C}\) decays by emitting a beta particle. Which of the following best describes the change in the nucleus?

(A) The number of protons increases by 1 and the mass number stays the same

(B) The number of protons decreases by 1 and the mass number stays the same
(C) The number of protons decreases by 2 and the mass number decreases by 4
(D) The number of neutrons increases by 1 and the mass number increases by 1

Correct Answer: A

Explanation: In beta decay, a neutron changes into a proton, so the atomic number increases by 1 while the mass number remains constant. Carbon-14 becomes nitrogen-14.

25. An element has two isotopes with masses 63 amu and 65 amu. If the relative atomic mass is 63.5 amu, what is the approximate relative abundance of the heavier isotope?

(A) 50%
(B) 25%
(C) 63.5%
(D) 75%

Correct Answer: B

Explanation: 25% — this correctly answers the question.

26. Which of the following pairs of particles would be deflected in **opposite directions by an electric field?**

(A) Proton and neutron
(B) Electron and neutron
(C) Proton and electron
(D) Two neutrons

Correct Answer: C

Explanation: Protons are positive and are deflected toward the negative plate; electrons are negative and are deflected toward the positive plate. Neutrons are undeflected.

27. Which observation from the hydrogen emission spectrum **most directly supports the idea that energy levels in an atom are quantized?**

(A) The spectrum is continuous
(B) The spectrum appears white
(C) The spectrum changes with temperature
(D) The spectrum consists of discrete lines

Correct Answer: D

Explanation: The spectrum consists of discrete lines — this correctly answers the question.

28. An element's electronic configuration ends in \(3s^2 3p^4\). Which of the following is true about this element?

(A) It is a non-metal and will gain 2 electrons to form a 2− anion
(B) It is a metal and will lose electrons to form a cation
(C) It is a noble gas and will not react
(D) It is a metalloid with variable behaviour

Correct Answer: A

Explanation: Ending in \(3s^2 3p^4\) indicates Group 16, Period 3 — sulfur, a non-metal that gains 2 electrons to complete its octet and form S^{2}□.

29. A neutral atom has 17 protons. Which subatomic particles are present in the nucleus, and how many?

(A) 17 protons, 17 neutrons
(B) 17 protons, 18 neutrons (if mass number is 35)
(C) 17 electrons, 18 neutrons
(D) 17 protons, 17 electrons

Correct Answer: B

Explanation: Chlorine (Z = 17) has 17 protons. For chlorine-35, mass number = 35, so neutrons = 35 − 17 = 18. Electrons are not in the nucleus.

30. Which statement best explains why chlorine has a relative atomic mass of 35.5 amu, which is not a whole number?

(A) Chlorine atoms have half a proton
(B) It is the mass of the most common isotope
(C) It is a weighted average of the isotopes Cl-35 (≈75%) and Cl-37 (≈25%)
(D) Chlorine atoms lose mass during chemical reactions

Correct Answer: C

Explanation: Relative atomic mass = weighted average of isotopic masses; for Cl, about 75% Cl-35 and 25% Cl-37 gives ≈35.5 amu.