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Chemistry Grade 9 — Chapter 4

Periodic Table and Periodicity of Properties

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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. The periodic table is arranged in order of increasing:

(A) Atomic number
(B) Atomic mass
(C) Number of neutrons
(D) Density

Correct Answer: A

Explanation: The periodic table is arranged based on increasing atomic number (number of protons), following Moseley's 1913 discovery.

2. The horizontal rows in the periodic table are called:

(A) Groups
(B) Periods
(C) Blocks
(D) Families

Correct Answer: B

Explanation: The horizontal rows in the periodic table are called Periods.

3. Which of the following elements belongs to the s-block?

(A) Carbon (C)
(B) Chlorine (Cl)
(C) Sodium (Na)
(D) Neon (Ne)

Correct Answer: C

Explanation: Sodium (Z = 11) has the configuration \(1s^2 2s^2 2p^6 3s^1\). Its valence electron is in the s sub-shell, so it is an s-block element.

4. The general electronic configuration of Group VIIIA (noble gases) is:

(A) \(ns^1\)
(B) \(ns^2 np^5\)
(C) \(ns^2 np^3\)
(D) \(ns^2 np^6\)

Correct Answer: D

Explanation: Noble gases (except He) have a complete octet with the configuration \(ns^2 np^6\).

5. Which of the following is the correct trend for atomic radius across a period (left to right)?

(A) Decreases
(B) Increases
(C) Remains constant
(D) Increases then decreases

Correct Answer: A

Explanation: Decreases — this correctly answers the question.

6. Which factor is primarily responsible for the shielding effect?

(A) Electrons in the valence shell
(B) Electrons in the inner shells
(C) Protons in the nucleus

(D) Neutrons in the nucleus

Correct Answer: B

Explanation: Shielding effect is the reduction in attraction between the nucleus and valence electrons caused by electrons in the inner shells.

7. Which of the following elements has the **highest electronegativity?**

(A) Chlorine (Cl)
(B) Oxygen (O)
(C) Fluorine (F)
(D) Nitrogen (N)

Correct Answer: C

Explanation: Fluorine (F) — this correctly answers the question.

8. Which of the following is **not a characteristic of transition elements?**

(A) High density
(B) Variable oxidation states
(C) Coloured compounds
(D) Very low melting points

Correct Answer: D

*Explanation: Transition elements generally have **high** melting points due to strong metallic bonding from partially filled d sub-shells.*

9. The correct order of **decreasing oxidizing power for halogens is:**

(A) \(F_2 > Cl_2 > Br_2 > I_2\)
(B) \(I_2 > Br_2 > Cl_2 > F_2\)
(C) \(Cl_2 > F_2 > Br_2 > I_2\)
(D) \(Br_2 > Cl_2 > F_2 > I_2\)

Correct Answer: A

Explanation: Fluorine is the strongest oxidizing agent and iodine is the weakest; the order is \(F_2 > Cl_2 > Br_2 > I_2\).

10. Which of the following statements about **metals and **non-metals** is correct?**

(A) Non-metals are good conductors of electricity
(B) Metals are malleable and ductile
(C) Metals are brittle and non-malleable
(D) Non-metals have high melting points

Correct Answer: B

Explanation: Metals are malleable (can be hammered into sheets) and ductile (can be drawn into wires), while non-metals are generally brittle.

11. Why does the shielding effect increase down a group in the periodic table?

(A) The number of valence electrons increases
(B) The nuclear charge decreases
(C) The number of inner electron shells increases
(D) The atomic radius decreases

Correct Answer: C

Explanation: Down a group, additional electron shells are added. The electrons in these inner shells shield the valence electrons from the nucleus, increasing the shielding effect.

12. Which of the following explains why atomic radius decreases across a period from left to right?

(A) The number of shells increases
(B) The shielding effect increases
(C) The number of protons decreases
(D) The effective nuclear charge increases

Correct Answer: D

Explanation: The effective nuclear charge increases — this correctly answers the question.

13. A neutral atom has the electronic configuration \(1s^2 2s^2 2p^6 3s^2 3p^5\). Which block, group, and period does this element belong to?

(A) p-block, Group 17, Period 3
(B) s-block, Group 1, Period 3
(C) p-block, Group 7, Period 3
(D) d-block, Group 17, Period 3

Correct Answer: A

Explanation: The valence electron is in the 3p sub-shell → p-block. Highest n = 3 → Period 3. Valence electrons = 2 + 5 = 7; for p-block, group = 7 + 10 = 17.

14. Which of the following statements correctly describes the trend in ionization energy across a period?

(A) It decreases because atomic size increases
(B) It increases because nuclear charge increases while shielding remains constant
(C) It decreases because shielding increases
(D) It remains constant across the period

Correct Answer: B

Explanation: Across a period, the nucleus becomes more positive while inner shielding stays the same; valence electrons are more tightly held, so ionization energy increases.

15. Which of the following elements would have the **lowest ionization energy?**

(A) Fluorine (F)
(B) Oxygen (O)
(C) Lithium (Li)
(D) Neon (Ne)

Correct Answer: C

Explanation: Lithium is the furthest left in Period 2 and has the largest radius and lowest effective nuclear charge among these; its single valence electron is easiest to remove, giving the lowest ionization energy.

B. Less Important / Secondary Topics

16. Which pair of elements would you expect to have the **most similar chemical properties?**

(A) Na and K
(B) Na and Mg
(C) Na and Cl
(D) Na and Ne

Correct Answer: A

Explanation: Na and K are both in Group 1 (alkali metals). They have the same valence electron configuration (\(ns^1\)) and therefore similar chemical properties.

17. The oxidation state of chromium in potassium dichromate, K□Cr□O□, is:

(A) +3
(B) +6
(C) +7
(D) +2

Correct Answer: B

Explanation: K = +1 (×2 = +2); O = −2 (×7 = −14). Sum must be zero: +2 + 2x − 14 = 0 → 2x = 12 → x = +6.

18. Which of the following is **not a correct comparison between metals and non-metals?**

(A) Metals are malleable; non-metals are brittle
(B) Metals conduct electricity; non-metals (except graphite) do not
(C) Metals have low melting points; non-metals have high melting points
(D) Metals have free electrons; non-metals generally lack free electrons

Correct Answer: C

*Explanation: This is the reverse of the actual trend. Metals generally have **high** melting points; non-metals generally have **low** melting points.*

19. Bromine is a liquid at room temperature, whereas fluorine and chlorine are gases. What does this indicate about the trend in the halogens?

(A) Intermolecular forces become weaker down the group
(B) Atomic size decreases down the group
(C) Electronegativity increases down the group
(D) Intermolecular forces become stronger down the group

Correct Answer: D

Explanation: As the size and mass of halogen molecules increase down the group, van der Waals forces between molecules strengthen; hence Br□ is a liquid and I□ is a solid while F□ and Cl□ are gases.

20. What is the main reason why transition elements exhibit variable oxidation states?

(A) Their d sub-shell electrons can participate in bonding along with s electrons
(B) They have only one valence electron
(C) They are all radioactive
(D) They have very small atomic radii

Correct Answer: A

Explanation: Because the energies of the 4s and 3d (or corresponding) sub-shells are close, both can lose electrons to different extents, giving multiple oxidation states.

21. Element X has the electronic configuration \(1s^2 2s^2 2p^6 3s^2 3p^6 4s^2\). Which of the following statements correctly identifies its position in the periodic table?

(A) p-block, Group 12, Period 4
(B) s-block, Group 2, Period 4
(C) s-block, Group 12, Period 4
(D) d-block, Group 2, Period 4

Correct Answer: B

Explanation: The last electron enters the 4s sub-shell → s-block. The highest n is 4 → Period 4. Valence electrons = 2 (in 4s), so group = 2.

22. Which of the following elements would have the **largest atomic radius?**

(A) Li
(B) Na
(C) Rb
(D) K

Correct Answer: C

Explanation: Atomic radius increases down a group. Rb is the lowest element among the options in Group 1, so it has the largest radius.

23. An element is placed in Group 17 and Period 3. Which of the following is its correct identity and electronic configuration?

(A) Fluorine, \(1s^2 2s^2 2p^5\)
(B) Bromine, \(1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 3d^{10} 4p^5\)
(C) Sulfur, \(1s^2 2s^2 2p^6 3s^2 3p^4\)
(D) Chlorine, \(1s^2 2s^2 2p^6 3s^2 3p^5\)

Correct Answer: D

Explanation: Group 17 means 7 valence electrons, Period 3 means highest n = 3. Chlorine has 17 electrons, ending in \(3s^2 3p^5\).

24. Which of the following explains why the first ionization energy of sodium is lower than that of magnesium?

(A) Sodium has a larger atomic radius and lower effective nuclear charge
(B) Magnesium has more inner shells
(C) Sodium has a full outer shell

(D) Magnesium has a lower nuclear charge

Correct Answer: A

Explanation: Na and Mg are in the same period. Na is to the left, with a larger radius and lower effective nuclear charge; its valence electron is easier to remove.

25. A transition element is used as a catalyst in the Haber process for the synthesis of ammonia. Which element is this, and why is it effective?

(A) Platinum, because it is very dense
(B) Iron, because it provides a surface for the reaction and has variable oxidation states
(C) Nickel, because it is malleable
(D) Copper, because it is a good conductor

Correct Answer: B

Explanation: The Haber process uses iron (Fe) as a catalyst. Transition metals are effective catalysts due to their partially filled d sub-shells and variable oxidation states.

26. Which of the following correctly describes the trend in metallic character across a period and down a group?

(A) Increases across a period; decreases down a group
(B) Remains constant across a period; increases down a group
(C) Decreases across a period; increases down a group
(D) Increases both across a period and down a group

Correct Answer: C

Explanation: Metallic character decreases from left to right across a period (harder to lose electrons) and increases down a group (easier to lose electrons).

27. The isotope \(^{37}_{17}\text{Cl}\) has a different atomic mass from \(^{35}_{17}\text{Cl}\). Which of the following correctly describes the difference between these two isotopes?

(A) They have a different number of protons
(B) They have a different number of electrons in a neutral atom
(C) They belong to different groups of the periodic table
(D) They have a different number of neutrons

Correct Answer: D

Explanation: They have a different number of neutrons — this correctly answers the question.

28. Which of the following combinations would produce an **ionic compound?**

(A) A metal from Group 1 and a non-metal from Group 17
(B) Two non-metals from Group 16
(C) Two metals from Group 2
(D) Two non-metals from Group 17

Correct Answer: A

Explanation: A metal from Group 1 and a non-metal from Group 17 — this correctly answers the question.

29. Which statement correctly explains why **noble gases are unreactive?**

(A) They have one valence electron and lose it easily
(B) They have a complete valence shell and do not tend to gain or lose electrons
(C) They are the most electronegative elements
(D) They are the largest atoms in their periods

Correct Answer: B

Explanation: Noble gases have a stable octet configuration (\(ns^2np^6\)), so they have no tendency to lose or gain electrons, making them chemically inert.

30. A student predicts that a halogen X will displace another halogen Y from its salt solution. Which condition must be true for this displacement to occur?

(A) X must be less reactive than Y
(B) X and Y must be in different groups
(C) X must be more reactive than Y

(D) X must be a metal

Correct Answer: C

Explanation: In halogen displacement reactions, a more reactive halogen displaces a less reactive one from its salt solution. For example, Cl□ displaces Br□ from bromide solutions.