Classification of Elements and Periodicity in Properties

Class 11 Chemistry · 24 NEET MCQs with answers & explanations

Classification of Elements and Periodicity covers the modern periodic table, periodic trends (atomic radius, ionisation enthalpy, electron gain enthalpy, electronegativity) and anomalous properties. NEET tests trend comparisons across periods and groups, exceptions to trends, and diagonal relationships.

Periodic Trends

Property	Trend
Atomic radius	Decreases across period (↑ Zeff); increases down group (new shell)
Ionisation enthalpy	Increases across period; decreases down group; exceptions at half-filled/fully-filled
Electron gain enthalpy	Becomes more negative across period (halogens most); Cl > F (anomaly: small size of F)
Electronegativity	Increases across period; decreases down group; F is most electronegative
Metallic character	Decreases across period; increases down group
Diagonal relationship	Li~Mg, Be~Al, B~Si — similar charge/radius ratio gives similar properties

Questions

Q1. Which order of first ionisation enthalpies for Na, Mg, Al and Si is correct?

(A) Na > Mg > Al > Si
(B) Na < Mg < Al < Si
(C) Na < Al < Mg < Si
(D) Si < Al < Mg < Na

Q2. Which of the following correctly explains why ionization enthalpy generally increases across a period?

(A) Atomic size increases across a period
(B) Effective nuclear charge increases across a period
(C) Shielding effect increases across a period
(D) Number of electron shells increases

Q3. Which statement regarding the modern periodic law is correct?

(A) Properties are periodic functions of atomic mass
(B) Properties are periodic functions of atomic number
(C) Chemical properties depend only on atomic volume
(D) Properties depend only on neutron count

Q4. Element with configuration [Ne]$3s^2 3p^5$ — which combination is correct?

(A) Period 3, Group 15, p-block
(B) Period 2, Group 17, p-block
(C) Period 3, Group 17, p-block
(D) Period 3, Group 7, d-block

Q5. Which quantum number directly corresponds to the period number of an element in the modern periodic table?

(A) Azimuthal quantum number (l)
(B) Principal quantum number (n)
(C) Magnetic quantum number (m_l)
(D) Spin quantum number (m_s)

Q6. Which of the following is the correct basis of modern periodic classification?

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

Q7. Which of the following correctly explains why electron gain enthalpy becomes less negative going down a group?

(A) Atomic size increases reducing nuclear attraction
(B) Nuclear charge decreases down the group
(C) Electron repulsion increases down the group
(D) Shielding decreases going down the group

Q8. Which type of radius is defined as half the distance between nuclei of two bonded atoms of the same element?

(A) Metallic radius
(B) Covalent radius
(C) van der Waals radius
(D) Ionic radius

Q9. Which of the following species is largest in size?

(A) F
(B) F^-
(C) Cl
(D) Cl^-

Q10. Which of the following correctly explains why diagonal elements resemble each other despite being in different groups and periods?

(A) Same number of valence electrons
(B) Same period and same group
(C) Similar charge-to-size ratio balances opposing trends
(D) Same electronic configuration

Q11. Which of the following elements has the highest electronegativity on the Pauling scale?

(A) Oxygen, due to small atomic size
(B) Fluorine, due to smallest size and highest nuclear charge
(C) Nitrogen, due to half-filled stability
(D) Chlorine, due to highest electron gain enthalpy

Q12. Which of the following correctly explains why metallic character decreases across a period?

(A) Atomic radius increases across a period
(B) Effective nuclear charge increases making electron loss harder
(C) Shielding effect increases across a period
(D) Electron-electron repulsion increases across period

Q13. Which of the following best explains why the first element of a group behaves anomalously compared to the rest?

(A) Highest atomic mass in the group
(B) Smallest size and highest electronegativity
(C) Lowest ionisation enthalpy
(D) Maximum number of valence electrons

Q14. Which root represents the digit 0 in the IUPAC systematic nomenclature?

(A) un
(B) nil
(C) bi
(D) tri

Q15. Which of the following correctly explains why properties of elements are periodic functions of atomic number?

(A) Atomic number equals number of neutrons in nucleus
(B) Atomic number determines electronic configuration, which governs chemical properties
(C) Atomic mass increases uniformly with atomic number
(D) Neutron number repeats after fixed intervals

Q16. Which statement is INCORRECT regarding the modern periodic law?

(A) It resolved anomalies in Mendeleev's table
(B) It is based on atomic number
(C) It arranges elements by strictly increasing atomic mass
(D) It reflects periodicity in chemical properties

Q17. Which of the following pairs of elements were incorrectly placed in Mendeleev's table but correctly placed in the modern periodic table?

(A) Argon and Potassium
(B) Sodium and Chlorine
(C) Carbon and Silicon
(D) Oxygen and Sulfur

Q18. Which scientist's X-ray experiments established atomic number as the fundamental property for periodic classification?

(A) Henry Moseley
(B) Mendeleev
(C) Dobereiner
(D) Newlands

Q19. Which of the following correctly explains why atomic mass does NOT always increase with atomic number in the modern periodic table?

(A) Proton number is variable for the same element
(B) Electrons contribute significantly to atomic mass
(C) Existence of isotopes causes atomic mass to be fractional or inverted
(D) Neutrons are absent in lighter elements

Q20. The total number of periods in the modern periodic table is:

(A) 6
(B) 7
(C) 8
(D) 9

Q21. Which period in the modern periodic table contains the maximum number of elements?

(A) 2nd period
(B) 3rd period
(C) 6th period
(D) 4th period

Q22. Which block of elements is characterized by the progressive filling of p-orbitals?

(A) s-block
(B) d-block
(C) f-block
(D) p-block

Q23. Hydrogen is placed separately or with Group 1 in the periodic table because it:

(A) Can lose one electron like alkali metals but also resembles halogens
(B) Has the same electronegativity as sodium
(C) Is a metal with one valence electron
(D) Forms ionic compounds exclusively

Q24. Helium ($1s^2$) is placed in Group 18 despite being an s-block element. Which of the following BEST justifies this placement?

(A) Helium has the highest atomic mass among period 1 elements
(B) Its completely filled valence shell makes it chemically inert like other noble gases
(C) It has the same electronic configuration as neon
(D) It forms compounds with fluorine under extreme conditions

Answer key

1-C	**2-B**	**3-B**	**4-C**	**5-B**	**6-B**	**7-A**	**8-B**
9-D	**10-C**	**11-B**	**12-B**	**13-B**	**14-B**	**15-B**	**16-C**
17-A	**18-A**	**19-C**	**20-B**	**21-C**	**22-D**	**23-A**	**24-B**

Answers with explanations

Q1 — Answer: (C) Na < Al < Mg < Si
Across Period 3, first ionisation enthalpy generally increases, but Al ($3p^1$) is lower than Mg ($3s^2$) because Mg has a stable filled $3s^2$ subshell. The correct order is Na < Al < Mg < Si.

Q2 — Answer: (B) Effective nuclear charge increases across a period
Across a period, electrons are added to the same shell while nuclear charge increases, raising Zeff and strengthening the hold on valence electrons. Option C is incorrect — shielding stays nearly constant across a period.

Q3 — Answer: (B) Properties are periodic functions of atomic number
The modern periodic law states that physical and chemical properties of elements are periodic functions of their atomic numbers. Atomic number determines electronic configuration, which governs all periodic behaviour.

Q4 — Answer: (C) Period 3, Group 17, p-block
The highest principal quantum number is 3, giving Period 3. The valence configuration ns^2np^5 identifies Group 17 and p-block. This is chlorine. Group 15 and d-block placements are incorrect.

Q5 — Answer: (B) Principal quantum number (n)
Period number equals the principal quantum number (n) of the outermost (valence) shell. Azimuthal quantum number l determines subshell type (s/p/d/f), not the period.

Q6 — Answer: (B) Atomic number
Modern Periodic Law (Moseley) states that properties are periodic functions of atomic number, not atomic mass. Mass number and neutron number are distractors — neither governs periodicity.

Q7 — Answer: (A) Atomic size increases reducing nuclear attraction
As atomic size increases down a group, the incoming electron is farther from the nucleus and experiences weaker attraction, so less energy is released and EGE becomes less negative. Nuclear charge actually increases down a group (B), so that factor alone would predict more negative EGE — size and shielding override it. Option D is factually wrong — shielding increases down a group.

Q8 — Answer: (B) Covalent radius
Covalent radius is defined as half the internuclear distance between two identical bonded atoms. van der Waals radius applies to non-bonded atoms; metallic radius to atoms in crystal lattice.

Q9 — Answer: (D) Cl^-
An anion is larger than its parent atom: the added electron increases electron–electron repulsion while the nuclear charge stays the same, so the electron cloud expands. Size also increases down a group as a new shell is added. Hence Cl^- (181 pm) > F^- (133 pm) and Cl^- > Cl (99 pm) > F (64 pm).

Q10 — Answer: (C) Similar charge-to-size ratio balances opposing trends
Moving down a group increases atomic size; moving across a period decreases it. These two opposing trends nearly cancel for diagonal elements, resulting in similar ionic radii and charge density. It is this charge/size similarity — not group membership or configuration — that drives the diagonal relationship.

Q11 — Answer: (B) Fluorine, due to smallest size and highest nuclear charge
Fluorine has the highest electronegativity (4.0 on Pauling scale) due to its smallest atomic size and high effective nuclear charge, which together create the strongest pull on bonding electrons. Oxygen (A) is second highest (3.5) — a common confusion point. Cl (D) has the highest EGE but not the highest EN — this distinction is a frequent NEET trap.

Q12 — Answer: (B) Effective nuclear charge increases making electron loss harder
As effective nuclear charge increases across a period, the outermost electrons are held more tightly by the nucleus, making electron loss progressively harder and reducing metallic character. Atomic radius decreases (not increases) across a period. Shielding remains nearly constant across a period — it increases down a group.

Q13 — Answer: (B) Smallest size and highest electronegativity
First elements have the smallest atomic radius and highest electronegativity in their group, giving them uniquely high charge density and polarising power. This causes covalent character, distinct bond types, and diagonal relationships not seen in heavier congeners. Size and electronegativity together — not any single factor — drive the anomaly.

Q14 — Answer: (B) nil
The digit 0 is represented by "nil" in the IUPAC system. The 10 roots are: 0=nil, 1=un, 2=bi, 3=tri, 4=quad, 5=pent, 6=hex, 7=sept, 8=oct, 9=enn.

Q15 — Answer: (B) Atomic number determines electronic configuration, which governs chemical properties
Electronic configuration repeats periodically as atomic number increases — elements with similar configurations show similar properties. Atomic mass (option C) does not increase uniformly due to isotopes, and neutrons (option D) show no periodic pattern.

Q16 — Answer: (C) It arranges elements by strictly increasing atomic mass
Modern periodic table is based on atomic number, not atomic mass. Mendeleev used atomic mass, which caused anomalies (Ar/K, Co/Ni). Option A is correct — modern law did resolve these.

Q17 — Answer: (A) Argon and Potassium
Ar (atomic mass 39.9) was placed before K (39.1) by Mendeleev based on mass — this was an anomaly. The modern table based on atomic number (Ar=18, K=19) resolves it correctly. Na/Cl, C/Si, O/S had no such anomaly.

Q18 — Answer: (A) Henry Moseley
Moseley's X-ray spectroscopy experiments showed atomic number is the fundamental property, replacing atomic mass as the basis of classification. Mendeleev used atomic mass; Dobereiner and Newlands made earlier incomplete attempts.

Q19 — Answer: (C) Existence of isotopes causes atomic mass to be fractional or inverted
Isotopes of elements cause average atomic mass to deviate from a strict increasing order, as seen in pairs like Ar(39.9)–K(39.1) and Co(58.9)–Ni(58.7). Electrons (option B) contribute negligible mass.

Q20 — Answer: (B) 7
The modern long form of the periodic table has exactly 7 periods, corresponding to the 7 energy levels (n=1 to n=7). Period 8 does not exist in the current table.

Q21 — Answer: (C) 6th period
The 6th period contains 32 elements (Cs to Rn), including 10 d-block and 14 f-block (lanthanoid) elements. The 4th period (18 elements) is the next largest.

Q22 — Answer: (D) p-block
p-block elements (Groups 13–18) have their last electron entering p-orbitals. s-block fills s-orbitals, d-block fills d-orbitals, and f-block fills f-orbitals.

Q23 — Answer: (A) Can lose one electron like alkali metals but also resembles halogens
Hydrogen resembles alkali metals (loses $1e^-$, forms H^+) and halogens (gains $1e^-$, forms H^-, exists as diatomic H_2). This dual character makes its placement anomalous — no other element belongs to two groups.

Q24 — Answer: (B) Its completely filled valence shell makes it chemically inert like other noble gases
He ($1s^2$) has a completely filled shell, giving it noble gas character identical to p-block Group 18 elements. Its placement is based on chemical behavior, not orbital type. Neon's configuration ($2s^2 2p^6$) is different from He's.

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