Periodic Table & Subshell Electronic Configuration

TEACHER ANSWER KEY & DERIVATIONS

Q1. What is the maximum number of electrons that can be accommodated in the d-subshell? [1 Mark]

(A) 2

(B) 6

(C) 10 ✓ Correct

(D) 14

STEP-BY-STEP DERIVATION & EXPLANATION:
Subshells hold maximum electrons: s = 2, p = 6, d = 10, f = 14.

Q2. Which block in the periodic table contains elements with valence electrons entering the s-subshell? [1 Mark]

(A) s-block ✓ Correct

(B) p-block

(C) d-block

(D) f-block

STEP-BY-STEP DERIVATION & EXPLANATION:
Groups 1 and 2 belong to the s-block as their outermost electrons enter the s-subshell.

Q3. What is the subshell electronic configuration of Sodium (Na, Atomic Number 11)? [1 Mark]

(A) 1s^2 2s^2 2p^6 3s^1 ✓ Correct

(B) 1s^2 2s^2 2p^5 3s^2

(C) 1s^2 2s^2 2p^7

(D) 1s^2 2s^4 2p^5

STEP-BY-STEP DERIVATION & EXPLANATION:
Sodium (Z = 11) subshell electronic configuration: 1s^2 2s^2 2p^6 3s^1.

Q4. How is the period number of an element determined from its subshell configuration? [1 Mark]

(A) Number of valence electrons

(B) Highest principal quantum number (shell number) ✓ Correct

(C) Total number of subshells

(D) Atomic mass

STEP-BY-STEP DERIVATION & EXPLANATION:
The highest shell number in configuration indicates the period of the element.

Q5. What is the group number of an element with outer configuration 3s^2 3p^4? [1 Mark]

(A) Group 4

(B) Group 6

(C) Group 14

(D) Group 16 ✓ Correct

STEP-BY-STEP DERIVATION & EXPLANATION:
For p-block elements: Group number = 12 + valence p-electrons = 12 + 4 = Group 16.

Q6. Which block of elements generally exhibit variable oxidation states? [1 Mark]

(A) s-block

(B) p-block

(C) d-block ✓ Correct

(D) Noble gases

STEP-BY-STEP DERIVATION & EXPLANATION:
Transition metals (d-block) exhibit variable oxidation states due to small energy difference between (n-1)d and ns subshells.

Q7. What is the oxidation state of Fe in FeCl3? [1 Mark]

(A) +1

(B) +2

(C) +3 ✓ Correct

(D) -3

STEP-BY-STEP DERIVATION & EXPLANATION:
Chlorine has -1 oxidation state. $Fe + 3(-1) = 0 \Rightarrow Fe = +3$.

Q8. Which subshell has lower energy and is filled before 3d? [1 Mark]

(A) 3p

(B) 4s ✓ Correct

(C) 4p

(D) 3s

STEP-BY-STEP DERIVATION & EXPLANATION:
According to Aufbau principle, 4s ($n+l = 4+0=4$) fills before 3d ($n+l = 3+2=5$).

Q9. Elements in Group 18 of the periodic table are known as: [1 Mark]

(A) Alkali Metals

(B) Halogens

(C) Noble / Inert Gases ✓ Correct

(D) Lanthanides

STEP-BY-STEP DERIVATION & EXPLANATION:
Group 18 elements have complete octet configuration (ns^2 np^6) and are unreactive noble gases.

Q10. What is the noble gas shorthand configuration for Chlorine (Cl, Atomic Number 17)? [1 Mark]

(A) [Ne] 3s^2 3p^5 ✓ Correct

(B) [Ar] 4s^1

(C) [He] 2s^2 2p^6

(D) [Ne] 3s^1 3p^6

STEP-BY-STEP DERIVATION & EXPLANATION:
Neon core is 10 electrons. $17 - 10 = 7 \Rightarrow [Ne]\ 3s^2\ 3p^5$.