



Attempt all questions before checking the answer key. Explain trends using effective nuclear charge, shell number, shielding and electronic configuration.

A. Very short answers - 1 mark each

1. State the modern periodic law.
2. What determines the period of an element from its electronic configuration?
3. Define first ionisation enthalpy.
4. Distinguish electron gain enthalpy from electronegativity.
5. What are isoelectronic species?

B. Short answers / practice - 2 marks each

6. Locate the period, group and block of an element with configuration $[\text{Ne}]3s^23p^3$.
7. Arrange Na, Mg, Al and Si in increasing atomic radius, with a reason.
8. Arrange O^{2-} , F^- , Na^+ and Mg^{2+} in increasing ionic radius.
9. Why is the first ionisation enthalpy of Be greater than that of B?
10. Why is chlorine's electron gain enthalpy more negative than fluorine's?
11. Locate period and group of $[\text{Ne}]3s^2$.
12. Is Na^+ smaller than Na? Explain.
13. Which is larger, K or Na?
14. Why does electronegativity generally increase across a period?
15. Arrange Li, Na, K in increasing first ionisation enthalpy.
16. Can an anion be larger than its parent atom?
17. Which block contains elements whose differentiating electron enters a p orbital?
18. Identify the period of $[\text{Ar}]4s^1$.
19. Why are alkali metals readily oxidised?
20. Compare the acid-base nature of Na_2O and SO_3 .

C. Short answers - 3 marks each

21. Explain why the first ionisation enthalpy of N exceeds that of O despite the general trend across the period.

22. An element has successive ionisation enthalpies with a large jump after the second removal. Infer its likely valence-electron count and typical ion, explaining the reasoning.

23. Compare cation, atom and anion sizes for the same element where such species exist. Explain the role of electron repulsion and nuclear attraction.

24. Classify Na_2O , MgO , Al_2O_3 and SO_3 by acid-base character. Explain the trend across the period.

25. Explain why noble gases have very high ionisation enthalpies and generally unfavourable electron gain enthalpies.

D. Long answers - 5 marks each

26. Trace atomic radius, ionisation enthalpy, electronegativity and metallic character across a period and down a group. Explain the major causes and two important ionisation-enthalpy exceptions.

27. For elements with $Z = 11, 12, 17$ and 18 , write configurations and identify period, group and block. Compare likely ions, metallic character and relative atomic sizes.

28. Explain the rationale of s-, p-, d- and f-block classification. Relate the position of an element to its differentiating electron and describe where transition and inner-transition elements occur.

29. Explain Mendeleev's achievements and limitations and how atomic-number ordering resolves key difficulties. Include isotopes, anomalous mass order and prediction of undiscovered elements.

30. Explain systematic IUPAC nomenclature for elements with atomic numbers above 100. Obtain temporary names and symbols for $Z = 119$ and 120 , and distinguish temporary systematic names from approved permanent names.

ANSWER KEY - Numerical / short answers

6) Period 3, group 15, p-block. 7) $\text{Si} < \text{Al} < \text{Mg} < \text{Na}$. 8) $\text{Mg}^{2+} < \text{Na}^+ < \text{F}^- < \text{O}^{2-}$. 11) Period 3, group 2. 12) Yes; loss of the outer shell and stronger attraction per electron. 13) K. 15) $\text{K} < \text{Na} < \text{Li}$. 16) Yes; extra electron repulsion often expands it. 17) p-block. 18) Period 4. 20) Na_2O basic; SO_3 acidic. 22) Two valence electrons; typically M^{2+} . 27) Na: $[\text{Ne}]3s^1, 3/1/s$; Mg: $[\text{Ne}]3s^2, 3/2/s$; Cl: $[\text{Ne}]3s^23p^5, 3/17/p$; Ar: $[\text{Ne}]3s^23p^6, 3/18/p$. 30) 119: ununennium (Uue); 120: unbinilium (Ubn), temporary systematic names.