CHEMISTRY (CODE - 043)

CHAPTER TEST - QUESTION PAPER

Class XI (2026-27) | Chapter 3: Classification of Elements and Periodicity in Properties

Time: 1 hour 30 minutes | Max. Marks: 35

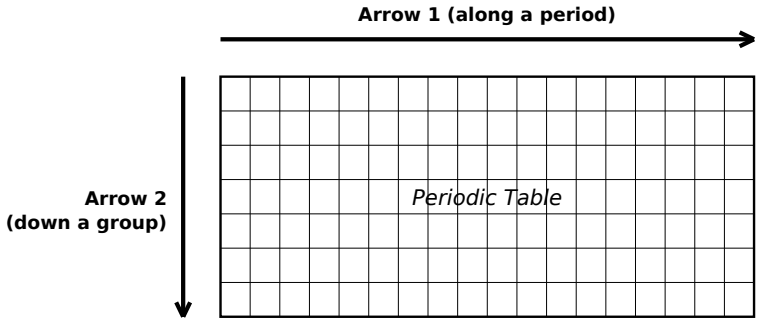
GENERAL INSTRUCTIONS:

1. Read the following instructions carefully.
2. There are 20 questions in this question paper with internal choice.
3. SECTION A consists of 12 questions carrying 1 mark each (Q. 1 to 9 are multiple-choice questions and Q. 10 to 12 are Assertion–Reason questions).
4. SECTION B consists of 4 very short answer questions carrying 2 marks each.
5. SECTION C consists of 2 short answer questions carrying 3 marks each.
6. SECTION D consists of 1 case-based question carrying 4 marks.
7. SECTION E consists of 1 long answer question carrying 5 marks.
8. All questions are compulsory. Internal choice is provided in Q. 16 (Section B) and Q. 20 (Section E).
9. Use of log tables and calculators is not allowed.
10. Avogadro constant $N_A = 6.022 \times 10^{23}$ mol^{-1}.

SECTION A

Questions 1 to 9 are multiple-choice questions. Only one of the choices is correct. Questions 10 to 12 are Assertion–Reason questions.

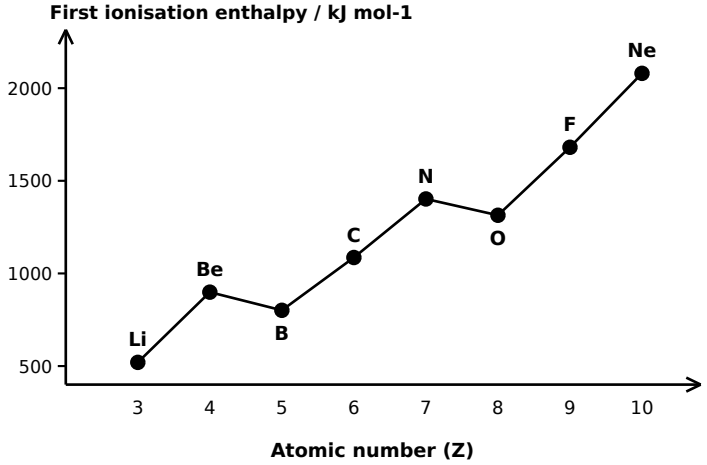
1	The element with atomic number 114 is located in the modern periodic table in: A. period 7, group 14 B. period 6, group 14 C. period 7, group 16 D. period 7, group 4	1
2	The figure shows a part of the periodic table. P, Q, R, S and T are not the actual symbols of the elements. *Group →* **1 2 13 14 15 16 17 18** **Period 2** ( ) ( ) ( ) ( ) ( ) ( ) **R** ( ) **Period 3** **P** **T** ( ) ( ) ( ) ( ) **Q** ( ) **Period 4** **S** ( ) ( ) ( ) ( ) ( ) ( ) ( ) The element with the largest atomic radius and the element with the highest electronegativity among them are, respectively: A. S and R B. P and R C. T and Q D. S and Q	1
3	The temporary IUPAC symbol of the element with atomic number 119 is: A. Uue B. Uun C. Ubn D. Uuu	1
4	Among the isoelectronic species F^-, Na^+, Mg^{2+} and Al^{3+}, the one with the largest ionic radius is: A. F^- B. Na^+ C. Mg^{2+} D. Al^{3+}	1

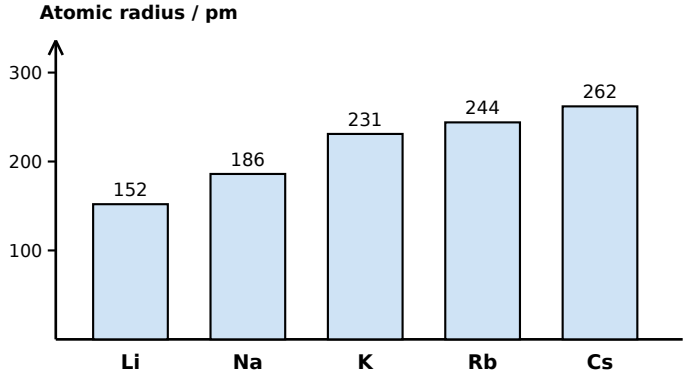
5	An element has the outer electronic configuration $(n-2)f^7\ (n-1)d^1\ ns^2$ with n = 6. It belongs to: A. period 6, f-block B. period 7, f-block C. period 6, d-block D. period 5, f-block	1
6	The outer electronic configurations of four elements P, Q, R and S are given below. <table><tr><th>Element</th><th>P</th><th>Q</th><th>R</th><th>S</th></tr><tr><td>Outer configuration</td><td>$3s^2 3p^4$</td><td>$3d^5 4s^2$</td><td>$3s^1$</td><td>$3s^2 3p^5$</td></tr></table>Which option correctly describes them? A. P – group 16; Q – d-block, group 7; R – group 1; S – group 17 B. P – group 14; Q – d-block, group 5; R – group 1; S – group 15 C. P – group 16; Q – p-block, group 7; R – group 2; S – group 17 D. P – group 6; Q – d-block, group 7; R – group 1; S – group 7	1
7	The arrows in the figure show the direction along a period (Arrow 1) and down a group (Arrow 2).  Which property **increases** along Arrow 1 and **decreases** along Arrow 2? A. Atomic radius B. Ionisation enthalpy C. Metallic character D. Ease of losing electrons	1
8	Which of the following is an amphoteric oxide? A. Na_2O B. Al_2O_3 C. Cl_2O_7 D. CO	1
9	Using the periodic table, the formula of the compound formed by aluminium and sulphur is: A. AlS B. Al_2S_3 C. Al_3S_2 D. AlS_3	1
10	Questions 10 to 12 are Assertion (A) and Reason (R) type questions. Select the correct option. **Assertion (A):** The first ionisation enthalpy of boron is lower than that of beryllium. **Reason (R):** The 2p electron of boron is better shielded and less penetrating than the 2s electron of beryllium. A. Both A and R are true, and R is the correct explanation of A. B. Both A and R are true, and R is not the correct explanation of A. C. A is true but R is false. D. A is false but R is true.	1

11	**Assertion (A):** Fluorine has a less negative electron gain enthalpy than chlorine. **Reason (R):** Fluorine is the most electronegative element. A. Both A and R are true, and R is the correct explanation of A. B. Both A and R are true, and R is not the correct explanation of A. C. A is true but R is false. D. A is false but R is true.	1
12	**Assertion (A):** Atomic radius increases from left to right across a period. **Reason (R):** The effective nuclear charge increases across a period. A. Both A and R are true, and R is the correct explanation of A. B. Both A and R are true, and R is not the correct explanation of A. C. A is true but R is false. D. A is false but R is true.	1

SECTION B

Questions 13 to 16 are very short answer questions carrying 2 marks each.

13	The graph shows the variation of the first ionisation enthalpy with atomic number for the elements of the second period.  Explain: (i) why boron has a lower first ionisation enthalpy than beryllium, although its nuclear charge is greater. [1] (ii) why oxygen has a lower first ionisation enthalpy than nitrogen. [1]	2
14	(i) What are isoelectronic species? Give one example. [1] (ii) Arrange N^{3-}, O^{2-}, F^{-}, Na^{+}, Mg^{2+} and Al^{3+} in the increasing order of their ionic radii. [1]	2
15	The electronegativity values (Pauling scale) of the elements of the third period are given below. **Element** | **Na** | **Mg** | **Al** | **Si** | **P** | **S** | **Cl** Electro-negativity | 0.9 | 1.2 | 1.5 | 1.8 | 2.1 | 2.5 | 3.0 (i) State the trend in electronegativity across the period and give a reason. [1] (ii) Which element in the table is the most metallic and which is the most non-metallic? Give a reason. [1]	2

16	The bar chart shows the atomic radii of the alkali metals.  (i) State the trend in atomic radius down the group and explain it. [1] (ii) Which of these metals would have the lowest first ionisation enthalpy? Give a reason. [1] **OR** What would be the IUPAC name and symbol of the element with atomic number 120? Name its block and group, and write its outer electronic configuration.	2

SECTION C

Questions 17 and 18 are short answer questions carrying 3 marks each.

17	Mendeleev left gaps in his periodic table and predicted the properties of the missing elements. Some predicted and observed properties are given below. **Property** / **Eka-aluminium (predicted)** / **Gallium (found)** / **Eka-silicon (predicted)** / **Germanium (found)** Atomic weight: 68 / 70 / 72 / 72.6 Density (g cm^{-3}): 5.9 / 5.94 / 5.5 / 5.36 Formula of oxide: E_2O_3 / Ga_2O_3 / EO_2 / GeO_2 Formula of chloride: ECl_3 / $GaCl_3$ / ECl_4 / $GeCl_4$ (i) State Mendeleev's periodic law. [1] (ii) What does the data show about Mendeleev's periodic table? [1] (iii) How does the Modern Periodic Law differ from Mendeleev's periodic law? [1]	3
18	(i) The energy of an electron in the ground state of the hydrogen atom is -2.18×10^{-18} J. Calculate the ionisation enthalpy of atomic hydrogen in kJ mol^{-1}. ($N_A = 6.022 \times 10^{23}$ mol^{-1}) [1] (ii) The first ionisation enthalpies (kJ mol^{-1}) of Na, Mg and Si are 496, 737 and 786. Predict whether the value for Al will be closer to 575 or 760. Justify. [1] (iii) Why is the first ionisation enthalpy of sodium lower than that of magnesium, but its second ionisation enthalpy higher? [1]	3

SECTION D

Question 19 is a case-based question carrying 4 marks.

19	**Ionisation and electron gain enthalpies** The first (Δ_iH_1) and the second (Δ_iH_2) ionisation enthalpies and the electron gain enthalpy ($\Delta_{eg}H$), all in kJ mol^{-1}, of six elements are given below. (I to VI are not the actual symbols of the elements.)	4

Element	Δ_iH_1	Δ_iH_2	$\Delta_{eg}H$
I	520	7300	−60
II	419	3051	−48
III	1681	3374	−328
IV	1008	1846	−295
V	2372	5251	+48
VI	738	1451	−40

Which of the above elements is likely to be:
(i) the least reactive element? [1]
(ii) the most reactive metal? [1]
(iii) the most reactive non-metal? [1]
(iv) the metal which can form a stable binary halide of the formula MX_2 (X = halogen)? [1]

SECTION E

Question 20 is a long answer question carrying 5 marks.

20	(i) The fifth period of the periodic table contains 18 elements. Justify using the order of energies of the orbitals being filled. [2] (ii) Write the general outer electronic configuration of s-, p-, d- and f-block elements. [2] (iii) Assign the period, group and block to the element whose outer configuration is $(n-1)d^2\,ns^2$ for n = 4. [1] **OR** Electron gain enthalpies (kJ mol^{-1}) of some halogens and chalcogens: F = −328, Cl = −349, O = −141, S = −200. (i) Define electron gain enthalpy. [1] (ii) Why are the values for F and O less negative than those for Cl and S respectively? [2] (iii) Why do noble gases have large positive electron gain enthalpies? [1] (iv) Which of the four elements has the most negative electron gain enthalpy? [1]	5

***** END OF QUESTION PAPER *****