

Chemistry Questions

1. Why is aluminium positioned in group 3 of the periodic table?
It has three electrons in its outer energy level/outer shell.
2. A student carries out an experiment to determine the melting point of a waxy solid. She heats a sample until it melts, then measures and records its temperature as it cools down. Explain how the student could use her results to decide whether the waxy solid is a pure substance or a mixture.
 - a. *Plot a graph of temperature against time. [1 mark]*
 - b. *Temperature remains constant at the melting point. [1 mark]*
 - c. *A pure substance gives a sharp melting point (line should be horizontal). [1 mark]*
 - d. *A mixture melts over a range of temperatures (line will not be horizontal). [1 mark]*
3. Use data from **table 1** to explain why ethanol and water can be separated using fractional distillation. **[3 marks]**

Table 1

Substance	Boiling point
Ethanol	78°C
Water	100°C

- a. *Ethanol has a lower boiling point than water. [1 mark]*
 - b. *On heating, ethanol vapour leaves the mixture of liquids first. [1 mark]*
 - c. *The ethanol vapour can be cooled and condensed separately. [1 mark]*
4. Use data from **table 2** to choose two atoms that are different isotopes of the same element. Explain your choice. **[2 marks]**

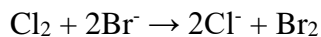
Table 2

Atom	No of protons	No of neutrons	No of electrons
V	6	6	6
W	17	18	18
X	17	18	17
Y	8	8	8
Z	6	8	6

V and Z [1 mark]

The two atoms have the same number of protons but different numbers of neutrons. [1 mark]

5. Chlorine displaces bromine from bromide ions.



What happens in this reaction? Tick **one** box. [1 mark]

- A Chlorine loses electrons and is reduced
B Chlorine gains electrons and is oxidised
C *Bromide ions lose electrons and are oxidised*
D Bromide ions lose electrons and are reduced
6. Magnesium exists naturally as three isotopes.

Table 1 shows the relative abundance of each isotope.

Table 1

Relative mass of isotope	Percentage abundance of isotope
24	79
25	10
26	11

Calculate the relative atomic mass, A_r , of magnesium. Give your answer to two decimal places. [2 marks]

$$A_r = \frac{(79 \times 24) + (10 \times 25) + (11 \times 26)}{100}$$

$$= 24.32 \text{ [1 mark]}$$

7. Rock salt is a mixture of sand and salt. Salt dissolves in water. Sand does not dissolve in water. Some students separated rock salt. This is the method used:
- place the rock salt in a beaker
 - add 100 cm³ of water
 - allow sand to settle to the bottom of the beaker
 - heat the contents of the evaporating dish with a Bunsen burner until salt crystals start to form

Suggest one improvement to step 2 to make sure all the salt is dissolved in the water. [1 mark]

Heat or stir the water. [1 mark]

8. Two elements in group 1 of the periodic table are lithium and sodium. Very small pieces of lithium and sodium were reacted separately with water. Describe the similarities and differences in what is seen and in the products of the reactions. [6 marks]
- a. Similarities - both:*
- float/on the surface*
 - move around*
 - effervescence/bubble/fizz*
 - decrease in size/disappear/dissolve*
 - produce hydrogen/H₂*
 - produce (metal) hydroxide/LiOH and NaOH*
 - produce alkaline solution/solution with pH greater than 7/add named indicator to the solution and correct colour change*
 - correct products shown in equations*
- b. Differences:*
- sodium more vigorous/more effervescence/moves faster*
 - melts*
 - forms ball/sphere*
 - produces a flame/catches fire/sparks*
9. Which of the following does NOT depend on the attraction of the bonding pair towards the nucleus?
- The repulsion by the electrons in the same valence shell*
 - The amount of shielding by inner shell electrons
 - The distance from the nucleus
 - The number of protons in the nucleus
10. Which of the following statements accurately describes the different classifications of elements?
- The noble metals like gold, silver, and platinum are resistant to corrosion due to their fully-filled dddd-bands.*
 - The alkali earth metals react with water to form hydrogen gas as well as the metal oxides in aqueous solution.
 - The alkali metals have distinctive flame colors because of their easily excited dddd electrons.
 - All the halogens react with hydrogen to form hydrogen halides, which when mixed with water form strong acids.
11. Which of the following statements most accurately describes the characteristics of the transition metals?
- The transition metals have little variability in their ionization energies and electronegativities due to their similar valence electron shells.*
 - Transition metals are characterized by the formation of many diamagnetic compounds due to the presence of unpaired dddd electrons.
 - One difference between transition metals and main group metals is the latter's ability to form coordination complexes.

- d. Transition metals are characterized by many oxidation states due to the high reactivity of the unpaired dddd electrons.
12. Which of the following statements describes a correct step in the formation of an ionic bond between sodium and chlorine?
- a. Removing an electron from sodium (ionization energy) will provide energy for ionic bond formation.
 - b. Adding an electron to chlorine (electron affinity) will require energy for ionic bond formation.
 - c. *The Coulombic potential between the ions (lattice energy) will release energy.***
 - d. Overcoming the Pauli repulsion from the overlap of wavefunctions of core electrons will release energy.
13. Which of the following statements does NOT accurately describe the atomic trends?
- a. Moving up, electronegativity increases due to the shortening distance between the nucleus and valence electron shell.
 - b. Moving down, effective nuclear charge decreases due to increasing electron shells.
 - c. Moving across from left to right, ionic radius decreases, increases, then decreases due to the switch from cationic to anionic species.
 - d. *Moving across from left to right, second ionization energy increases due to increasing nuclear charge.***