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# CHEMISTRY

## INORGANIC CHEMISTRY

Level & Board	AQA (A-LEVEL)
TOPIC:	PERIODICITY
PAPER TYPE:	SOLUTION - 3
TOTAL QUESTIONS	10
TOTAL MARKS	33

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## Periodicity - 3

1. *Periodicity is defined as the repeating trends in physical and chemical properties of elements as you move across periods. These trends include properties like atomic radius, ionization energy, and electronegativity, which show consistent patterns. For instance, atomic size tends to decrease across a period, while ionization energy and electronegativity generally increase.* (2)
2. **D** (1)
3. *The atomic radius decreases across the period 3 from sodium to argon. This trend is due to the increase in the number of protons in the nucleus as you move across the period. The greater number of protons results in a higher nuclear charge, exerting a stronger attractive force on the electrons in the same shell. With a more significant attraction for electrons in the same shell, the outer electrons are pulled closer to the nucleus, leading to a reduction in atomic radius. So, the decrease in atomic radius is a consequence of the increasing nuclear charge and the intensified attraction for electrons in the same energy level.* (5)
4. **B** (1)
5. *The electronegativity increases across the Period 3 from sodium to argon. This trend is due to the increase in the number of protons or nuclear charge as moving from sodium to argon. The greater nuclear charge results in a stronger attraction for electrons in the same shell. Additionally, the decrease in atomic radius (so the electrons being in the same shell with constant shielding) further increases the attraction for bonding or shared electrons.* (4)
6. **B** (1)
7. **(a)**

The element in Period 3 with the highest melting point is silicon (Si).

**Explanation:**

Silicon has a covalent bonding structure. The high melting point is due to the strong and more covalent bonds present in its giant covalent structure. So, breaking these covalent bonds requires a lot of amount of energy.

(3)

(b)

The element in Period 3 with the highest first ionization energy is argon (Ar).

**Explanation:**

Argon has the largest number of protons or the largest nuclear charge among the elements in Period 3. The effective nuclear charge experienced by the outermost electrons in argon is higher due to the larger number of protons, making it more difficult to remove an electron. Argon, along with the other noble gases in Period 3, has the same number of electron shells (energy levels) and similar shielding, contributing to the high first ionization energy.

So, argon (Ar) has the highest first ionization energy i.e 1,521 kJ/mol.

(3)

(c)

Chlorine Cl is the element in Period 3 that has the highest electronegativity value i.e. 3.16

(1)

8.

(a)

The Period 2 element from carbon to fluorine with the largest atomic radius is carbon (C).

**Explanation:**

**Fewest Protons:** Carbon has the fewest protons (smallest nuclear charge) among the elements from carbon to fluorine. The shielding effect in carbon is similar to that in fluorine. This results in the least attraction between the protons in the nucleus and the electrons in the outermost shell, leading to weaker nuclear attraction to electrons.

(3)

(b)

The general trend in first ionization energies from carbon to neon in Period 2 is an increase.

Oxygen (O) deviates from this trend.

**Explanation of Deviation:**

**Paired Electrons in a (2)p Orbital:** Oxygen has paired electrons in a 2p orbital. When two electrons occupy the same orbital, there is electron-electron repulsion, making it easier to remove one of the paired electrons. As a result, oxygen has a lower first ionization energy compared to nitrogen and fluorine, which precede and follow it in Period 2.

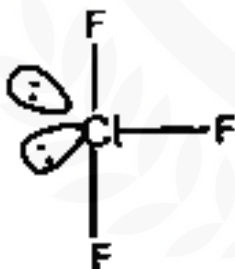
So, the deviation from the increasing trend in first ionization energies in Period 2 occurs with oxygen due to the presence of paired electrons in a 2p orbital, leading to increased electron-electron repulsion and a lower first ionization energy.

(4)

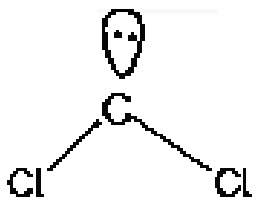
9.

(a)

Shape of  $\text{ClF}_3$



Shape of  $\text{CCl}_2$



I am Sorry !!!!!

(b) (2)  
The shape of  $\text{CCl}_2$  (dichloromethane) is Bent / v shape.

(c) (1)  
Formation of one mole of  $\text{ClF}_3$  from its elements.  
$$\frac{1}{2} \text{Cl}_2 + \frac{3}{2} \text{F}_2 \rightarrow \text{ClF}_3$$

10. D (1)



I am Sorry !!!!!



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- Founder & CEO of Chemistry Online Tuition Ltd.
- Completed Medicine (M.B.B.S) in 2007
- Tutoring students in UK and worldwide since 2008
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