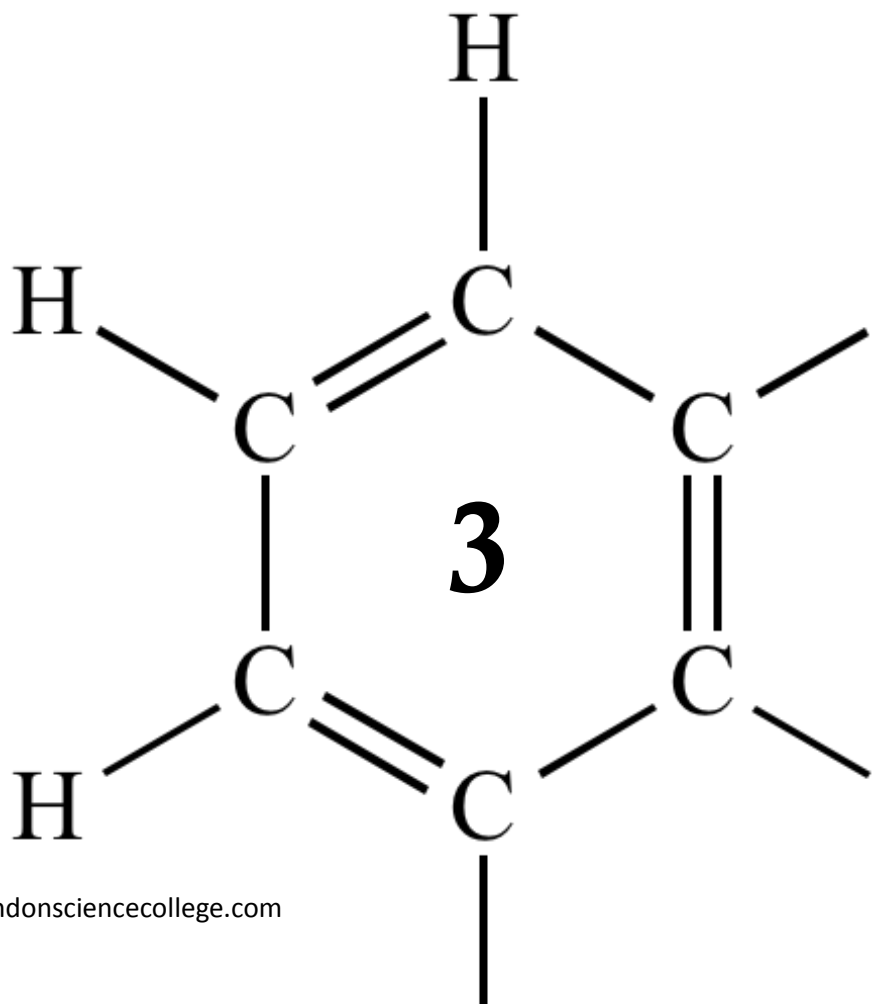


AQA AS CHEMISTRY

# PERIODICITY



1

(a) Complete the electronic configuration for the sodium ion, Na<sup>+</sup>

1s<sup>2</sup> .....

(1)

(b) (i) Write an equation, including state symbols, to represent the process for which the energy change is the second ionisation energy of sodium.

.....

(2)

(ii) Explain why the second ionisation energy of sodium is greater than the second ionisation energy of magnesium.

.....

.....

.....

.....

(3)

(iii) An element X in Period 3 of the Periodic Table has the following successive ionisation energies.

	First	Second	Third	Fourth
Ionisation energies / kJ mol <sup>-1</sup>	577	1820	2740	11600

Deduce the identity of element X.

.....

(1)

(c) State and explain the trend in atomic radius of the Period 3 elements from sodium to chlorine.

Trend .....

Explanation .....

.....

.....

(3)

(d) Explain why sodium has a lower melting point than magnesium.

.....  
.....  
.....  
.....

(3)

(e) Sodium reacts with ammonia to form the compound  $\text{NaNH}_2$  which contains the  $\text{NH}_2^-$  ion.  
Draw the shape of the  $\text{NH}_2^-$  ion, including any lone pairs of electrons.  
Name the shape made by the three atoms in the  $\text{NH}_2^-$  ion.

Shape of  $\text{NH}_2^-$

Name of shape .....

(2)

(f) In terms of its electronic configuration, give **one** reason why neon does not form compounds with sodium.

.....

(1)

(Total 16 marks)

2

This question is about the elements in Period 3 from Na to P

(a) (i) Explain the meaning of the term *first ionisation energy*.

.....  
.....  
.....

(2)

(ii) State and explain the general trend in first ionisation energies for the elements Na to P

Trend .....

Explanation .....

.....

.....

**(3)**

(iii) State which one of the elements from Na to P deviates from this general trend and explain why this occurs.

Trend .....

Explanation .....

.....

.....

**(3)**

(b) State which one of the elements from Na to P has the highest melting point and explain your answer.

Element .....

Explanation .....

.....

.....

**(3)**

**(Total 11 marks)**

**3**

The elements phosphorus, sulfur, chlorine and argon are in the p block of the Periodic Table.

(a) State why these elements are classified as p block elements.

.....

**(1)**

(b) State the trend in atomic radius from phosphorus to chlorine and explain the trend.

*Trend* .....

*Explanation* .....

.....

.....

**(3)**

(c) In terms of structure and bonding, explain why sulfur has a higher melting point than phosphorus.

.....

.....

.....

.....

**(3)**

(d) In terms of atomic structure, explain why the van der Waals' forces in liquid argon are very weak.

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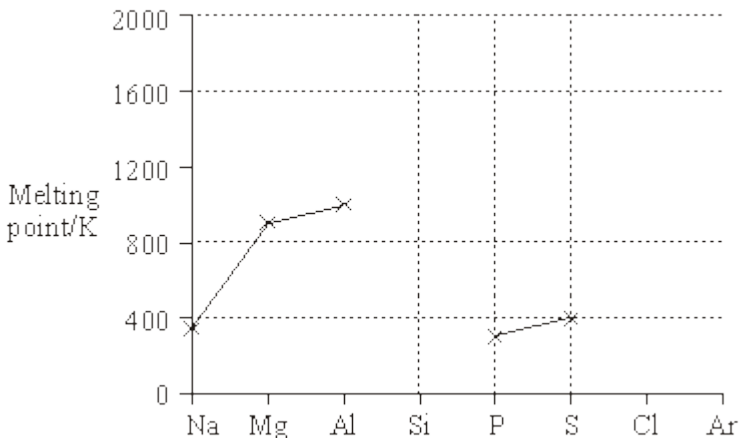
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**(2)**

**(Total 9 marks)**

4

(a) The diagram below shows the melting points of some of the elements in Period 3.



- (i) On the diagram, use crosses to mark the approximate positions of the melting points for the elements silicon, chlorine and argon. Complete the diagram by joining the crosses.
- (ii) By referring to its structure and bonding, explain your choice of position for the melting point of silicon.

.....  
.....  
.....

- (iii) Explain why the melting point of sulphur, S<sub>8</sub>, is higher than that of phosphorus, P<sub>4</sub>

.....  
.....

(8)

(b) State and explain the trend in melting point of the Group II elements Ca–Ba.

*Trend* .....

*Explanation* .....

.....  
.....

(3)

(Total 11 marks)

5

(a) State the meaning of the term *first ionisation energy* of an atom.

.....  
.....

(2)

(b) Complete the electron arrangement for the  $Mg^{2+}$  ion.

$1s^2$  .....

(1)

(c) Identify the block in the Periodic Table to which magnesium belongs.

.....

(1)

(d) Write an equation to illustrate the process occurring when the **second** ionisation energy of magnesium is measured.

.....

(1)

(e) The Ne atom and the  $Mg^{2+}$  ion have the same number of electrons. Give **two** reasons why the first ionisation energy of neon is lower than the third ionisation energy of magnesium.

*Reason 1* .....

*Reason 2* .....

(2)

(f) There is a general trend in the first ionisation energies of the Period 3 elements, Na – Ar

(i) State and explain this general trend.

*Trend* .....

*Explanation* .....

.....

.....

- (ii) Explain why the first ionisation energy of sulphur is lower than would be predicted from the general trend.

.....  
.....  
.....

(5)  
(Total 12 marks)

6

- (a) When aluminium is added to an aqueous solution of copper(II) chloride,  $\text{CuCl}_2$ , copper metal and aluminium chloride,  $\text{AlCl}_3$ , are formed. Write an equation to represent this reaction.

.....

(1)

- (b) (i) State the general trend in the first ionisation energy of the Period 3 elements from Na to Ar.

.....

- (ii) State how, and explain why, the first ionisation energy of aluminium does not follow this general trend.

.....  
.....  
.....  
.....

(4)

- (c) Give the equation, including state symbols, for the process which represents the second ionisation energy of aluminium.

.....

(1)



(d) State and explain the trend in the melting points of the Period 3 metals Na, Mg and Al.

*Trend* .....

*Explanation* .....

.....

.....

**(3)**  
**(Total 9 marks)**