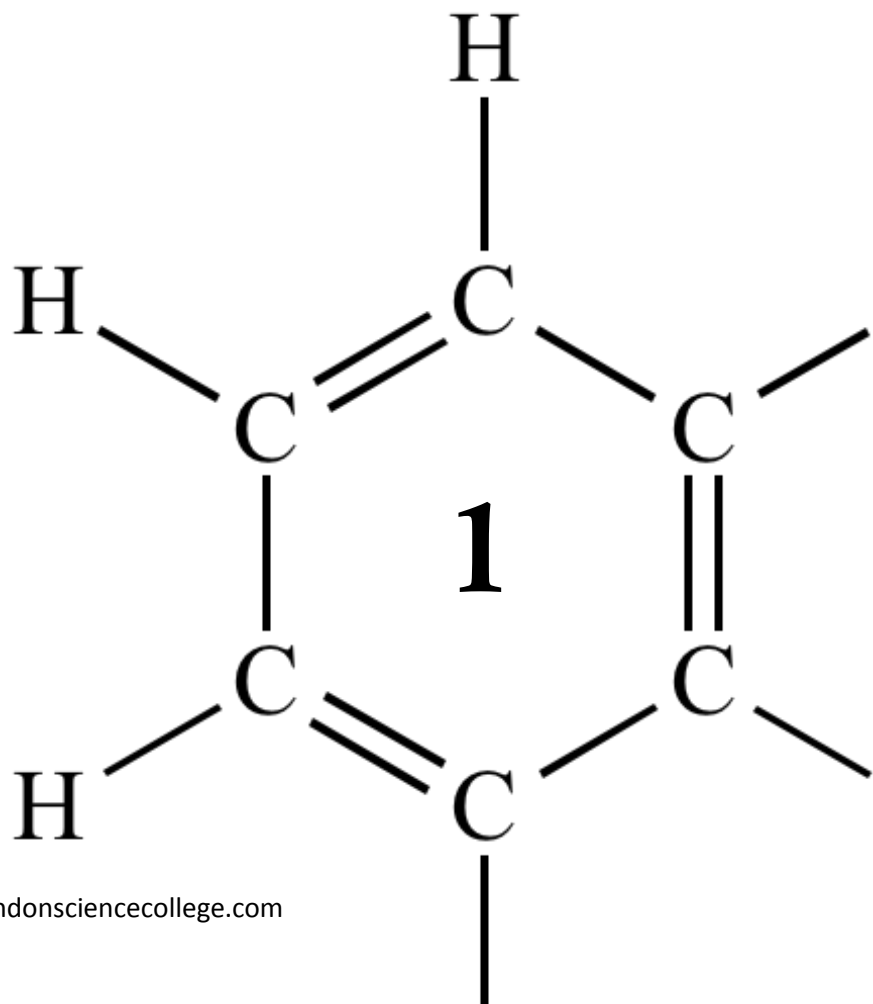


AQA AS CHEMISTRY
PERIODICITY



1

This question is about Period 3 of the Periodic Table.

- (a) Deduce which of Na^+ and Mg^{2+} is the smaller ion.
Explain your answer.

Smaller ion

Explanation

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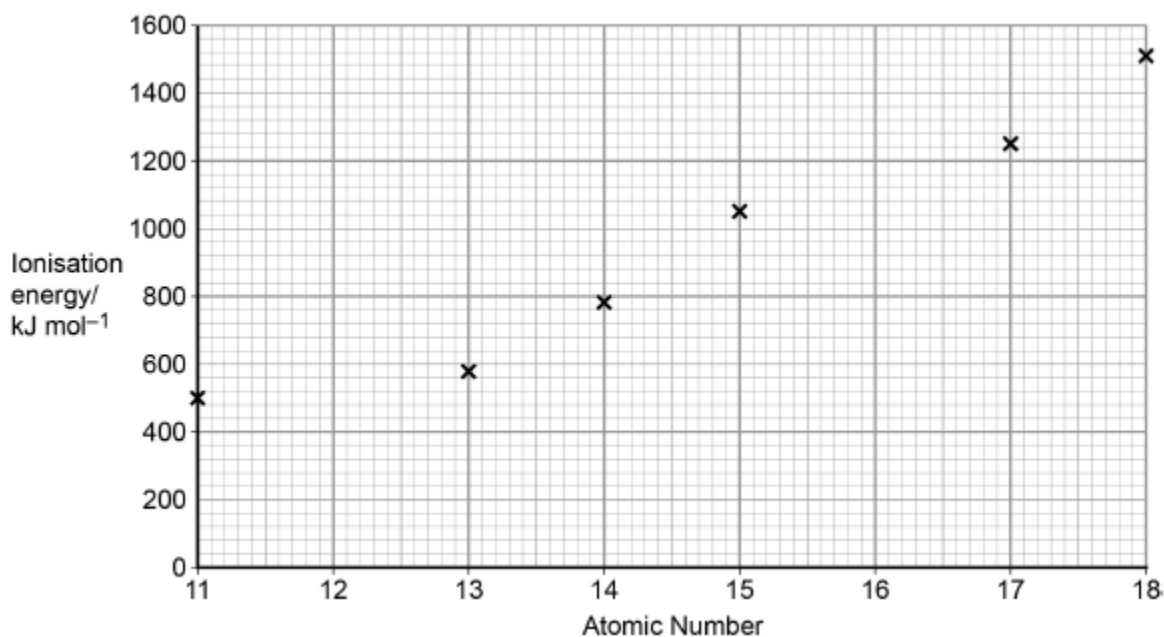
(2)

- (b) Write an equation to represent the process that occurs when the first ionisation energy for sodium is measured.

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(1)

(c) The first ionisation energies of some Period 3 elements are shown in the following graph.



Complete the graph by plotting the approximate first ionisation energy values for magnesium and sulfur.

Explain why the first ionisation energy of sulfur is different from that of phosphorus.

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(4)
(Total 7 marks)

2 Which element is in the d-block of the Periodic Table?

A Selenium

B Antimony

C Tantalum

D Lead

(Total 1 mark)

3 This question is about the periodicity of the Period 3 elements.

(a) State and explain the general trend in first ionisation energy across Period 3.

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(4)

- (b) Give one example of an element which deviates from the general trend in first ionisation energy across Period 3.

Explain why this deviation occurs.

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(3)

- (c) The table shows successive ionisation energies of an element **Y** in Period 3.

Ionisation number	1	2	3	4	5	6	7	8
Ionisation energy / kJ mol^{-1}	1000	2260	3390	4540	6990	8490	27 100	31 700

Identify element **Y**.

Explain your answer using data from the table.

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(2)

(d) Identify the Period 3 element that has the highest melting point.

Explain your answer by reference to structure and bonding.

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(4)
(Total 13 marks)

4

Which of these elements has the highest second ionisation energy?

A Na

B Mg

C Ne

D Ar

(Total 1 mark)

5

(a) Explain why the atomic radii of the elements decrease across Period 3 from sodium to chlorine.

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(2)

(b) Explain why the melting point of sulfur (S_8) is greater than that of phosphorus (P_4).

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(2)

(c) Explain why sodium oxide forms an alkaline solution when it reacts with water.

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(2)

(d) Write an ionic equation for the reaction of phosphorus(V) oxide with an excess of sodium hydroxide solution.

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(1)

(Total 7 marks)

6

This question is about the elements in Period 3 of the Periodic Table.

(a) State the element in Period 3 that has the highest melting point.
Explain your answer.

Element

Explanation

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(3)

- (b) State the element in Period 3 that has the highest first ionisation energy.
Explain your answer.

Element

Explanation

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(3)

- (c) Suggest the element in Period 3 that has the highest electronegativity value.

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(1)

- (d) Chlorine is a Period 3 element.
Chlorine forms the molecules ClF_3 and CCl_2

- (i) Use your understanding of electron pair repulsion to draw the shape of ClF_3 and the shape of CCl_2
Include any lone pairs of electrons that influence the shape.

Shape of ClF_3

Shape of CCl_2

(2)

- (ii) Name the shape of CCl_2

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(1)

- (iii) Write an equation to show the formation of one mole of ClF_3 from its elements.

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(1)

(Total 11 marks)

7

- (a) Nickel is a metal with a high melting point.

- (i) State the block in the Periodic Table that contains nickel.

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(1)

(ii) Explain, in terms of its structure and bonding, why nickel has a high melting point.

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(2)

(iii) Draw a labelled diagram to show the arrangement of particles in a crystal of nickel. In your answer, include at least six particles of each type.

(2)

(iv) Explain why nickel is ductile (can be stretched into wires).

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(1)

(b) Nickel forms the compound nickel(II) chloride (NiCl₂).

(i) Give the full electron configuration of the Ni²⁺ ion.

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(1)

(ii) Balance the following equation to show how anhydrous nickel(II) chloride can be obtained from the hydrated salt using SOCl₂. Identify **one** substance that could react with both gaseous products.



Substance

(2)

(Total 9 marks)

8

The elements in Period 2 show periodic trends.

- (a) Identify the Period 2 element, from carbon to fluorine, that has the largest atomic radius. Explain your answer.

Element

Explanation

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(3)

- (b) State the general trend in first ionisation energies from carbon to neon. Deduce the element that deviates from this trend and explain why this element deviates from the trend.

Trend

Element that deviates

Explanation

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(4)

- (c) Write an equation, including state symbols, for the reaction that occurs when the first ionisation energy of carbon is measured.

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(1)

- (d) Explain why the second ionisation energy of carbon is higher than the first ionisation energy of carbon.

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(1)

- (e) Deduce the element in Period 2, from lithium to neon, that has the highest second ionisation energy.

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(1)
(Total 10 marks)