



EXAM PAPERS PRACTICE

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2002

XVIII

1583

Time allowed
69 Minutes

Score

/58

Percentage

%

CHEMISTRY

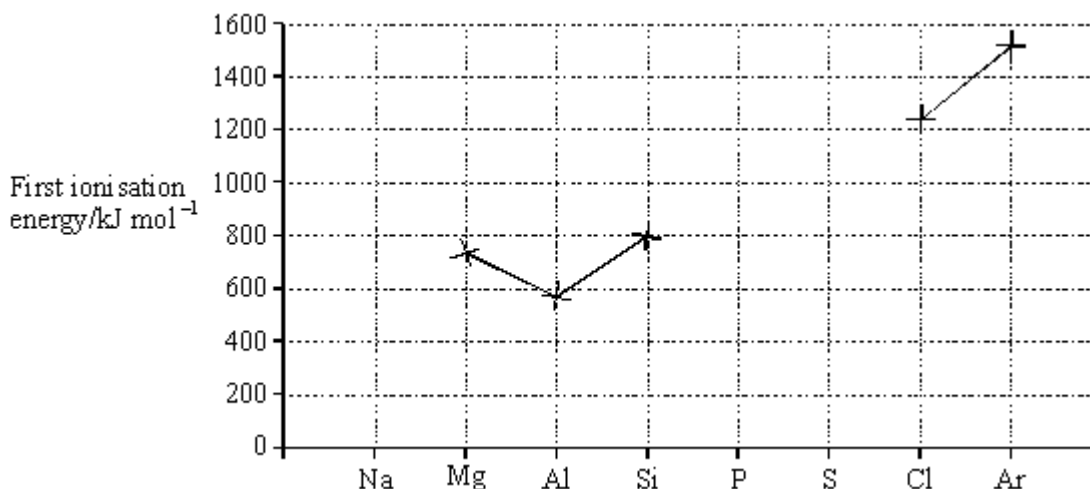
AQA
AS & A LEVEL

Topic Questions

3.1 Physical chemistry

1.

The diagram below shows the values of the first ionisation energies of some of the elements in Period 3.



- (a) On the above diagram, use crosses to mark the approximate positions of the values of the first ionisation energies for the elements Na, P and S. Complete the diagram by joining the crosses. (3)

- (b) Explain the general increase in the values of the first ionisation energies of the elements Na–Ar.

.....

(3)

- (c) In terms of the electron sub-levels involved, explain the position of aluminium and the position of sulphur in the diagram.

Explanation for aluminium

.....

.....

Explanation for sulphur

.....

.....

(4)
(Total 10 marks)

2

- (a) One isotope of sodium has a relative mass of 23.
- (i) Define, in terms of the fundamental particles present, the meaning of the term *isotopes*.
-
-
- (ii) Explain why isotopes of the same element have the same chemical properties.
-
-
- (iii) Calculate the mass, in grams, of a single atom of this isotope of sodium.
(The Avogadro constant, L , is $6.023 \times 10^{23} \text{ mol}^{-1}$)
-
-
-
- (5)
- (b) Give the electronic configuration, showing all sub-levels, for a sodium atom.
-
- (1)
- (c) Explain why chromium is placed in the d block in the Periodic Table.
-
-
- (1)
- (d) An atom has half as many protons as an atom of ^{28}Si and also has six fewer neutrons than an atom of ^{28}Si . Give the symbol, including the mass number and the atomic number, of this atom.
-
- (2)
- (Total 9 marks)

3 There is a general trend in the values of the first ionisation energies of the elements Na to Ar. The first ionisation energies of the elements Al and S deviate from this trend.

- (a) Write an equation, including state symbols, to represent the process for which the energy change is the first ionisation energy of Na.

.....

(2)

- (b) State and explain the general trend in the values of the first ionisation energies of the elements Na to Ar.

Trend

Explanation

.....

.....

(3)

- (c) State how, and explain why, the values of the first ionisation energies of the elements Al and S deviate from the general trend.

How the values deviate from the trend

Explanation for Al

.....

Explanation for S

.....

(5)

(Total 10 marks)

4 Which one of the following is the electronic configuration of the strongest reducing agent?

A $1s^2 2s^2 2p^5$

B $1s^2 2s^2 2p^6 3s^2$

C $1s^2 2s^2 2p^6 3s^2 3p^5$

D $1s^2 2s^2 2p^6 3s^2 3p^6 4s^2$

(Total 1 mark)

5

- (a) State the meaning of the term *electronegativity*.

.....

(2)

- (b) State and explain the trend in electronegativity values across Period 3 from sodium to chlorine.

Trend

Explanation

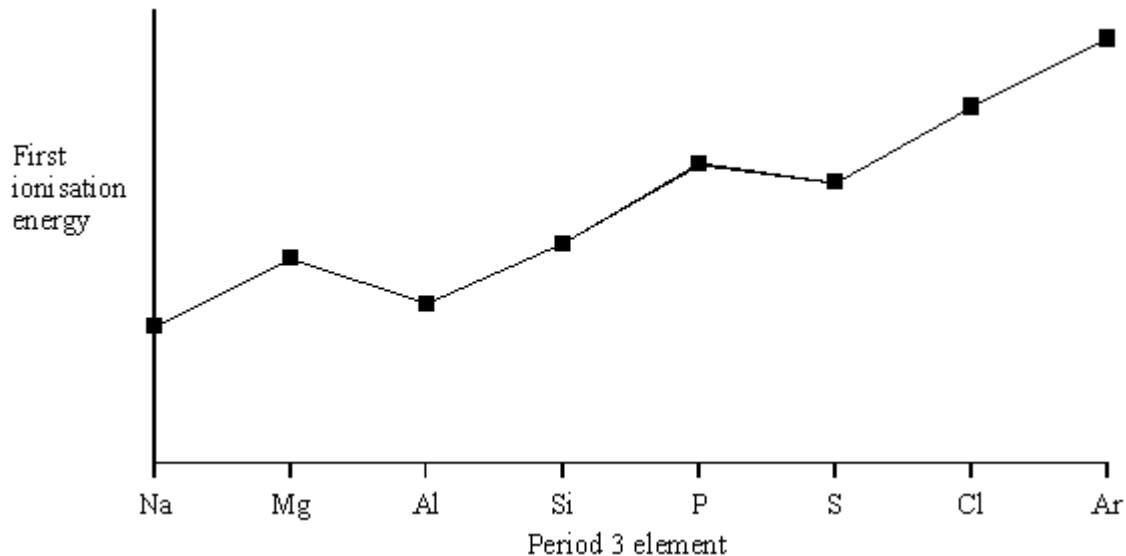
(3)

- (c) What is meant by the term *first ionisation energy*?

.....

(2)

- (d) The diagram below shows the variation in first ionisation energy across Period 3.



- (i) What is the maximum number of electrons that can be accommodated in an s sub-level?

- (ii) What evidence from the diagram supports your answer to part (d)(i)?

.....

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- (iii) What evidence from the diagram supports the fact that the 3p sub-level is higher in energy than the 3s?

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- (iv) What evidence from the diagram supports the fact that no more than three unpaired electrons can be accommodated in the 3p sub-level?

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(5)
(Total 12 marks)

6

Lithium hydride, LiH, is an ionic compound containing the hydride ion, H⁻. The reaction between LiH and aluminium chloride, AlCl₃, produces the ionic compound LiAlH₄.

- (a) Balance the equation below which represents the reaction between LiH and AlCl₃.



(1)

- (b) Give the electronic configuration of the hydride ion, H⁻.

.....

(1)

- (c) Predict the shape of the AlH_4^- ion. Explain why it has this shape.

Shape

Explanation

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(3)

- (d) A bond in AlH_4^- can be represented by $\text{H} \rightarrow \text{Al}$

Name this type of bond and explain how it is formed.

Type of bond

Explanation

.....

.....

(3)

(Total 8 marks)

7

The values of the first ionisation energies of neon, sodium and magnesium are 2080, 494 and 736 kJ mol⁻¹, respectively.

- (a) Explain the meaning of the term *first ionisation* of an atom.

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(2)

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

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(2)

- (c) Explain why the value of the first ionisation energy of magnesium is higher than that of sodium.

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(2)

- (d) Explain why the value of the first ionisation energy of neon is higher than that of sodium.

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(2)

(Total 8 marks)