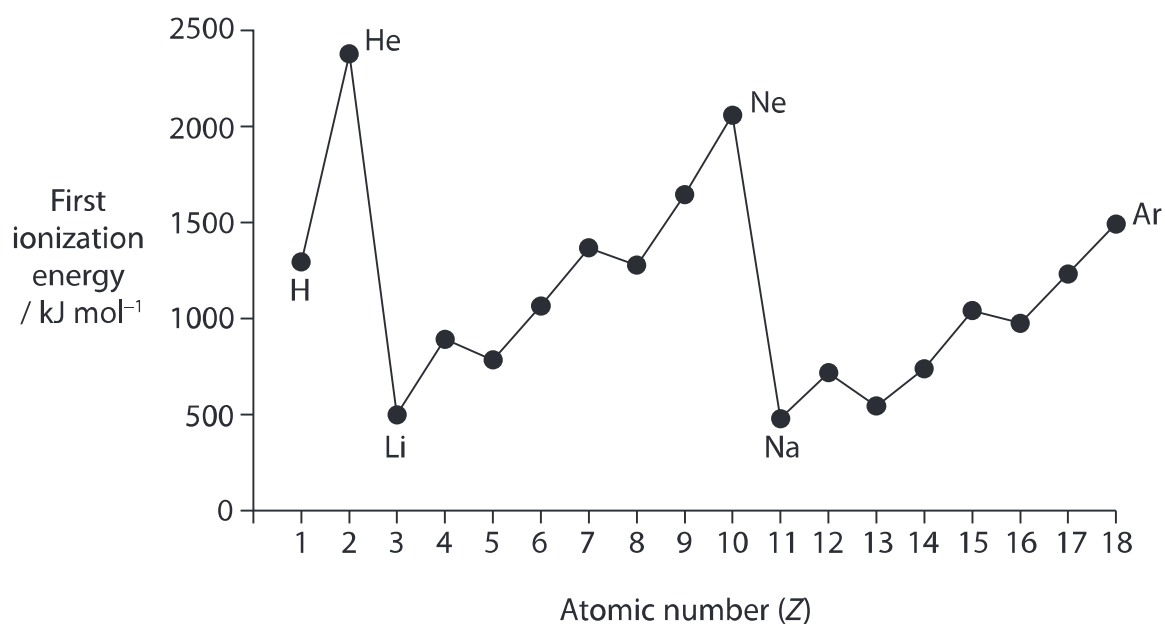


24 The diagram below shows the pattern in the first ionization energies of the first 18 elements.



(a) Give the equation, including state symbols, for the first ionization energy of fluorine.

(2)

*(b) Explain why there is a **general** increase in the first ionization energies from sodium to argon.

(3)

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(c) *(i) Explain why the first ionization energy of aluminium ($Z = 13$) is less than that of magnesium ($Z = 12$).

(2)

*(ii) Explain why the first ionization energy of sulfur ($Z = 16$) is less than that of phosphorus ($Z = 15$).

(2)

(d) The table below, which is incomplete, refers to the elements sodium to sulfur.

Element	Na	Mg	Al	Si	P	S
Melting temperature	low	high				
Structure		giant				
Electrical conductivity		high				

(i) Complete the **melting temperature** row by using only the words 'high' or 'low'.

(2)

(ii) Complete the **structure** row by using only the words 'giant' or 'molecular'.

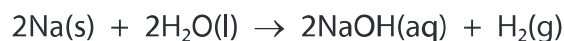
(2)

(iii) Complete the **electrical conductivity** row by using only the words 'high' or 'low'.

(1)



- (e) In an experiment, 2.76 g of sodium completely reacted with water to form 500 cm³ of aqueous sodium hydroxide.



- (i) Calculate the number of moles of sodium that reacted.

(1)

- (ii) Calculate the maximum volume, in dm³, of hydrogen that can be formed at room temperature and pressure.

[1 mol of any gas occupies 24 dm³ at room temperature and pressure.]

(2)

- (iii) Calculate the concentration, in mol dm⁻³, of the sodium hydroxide solution, NaOH(aq), formed in the experiment.

(2)

(Total for Question 24 = 19 marks)

TOTAL FOR SECTION B = 60 MARKS
TOTAL FOR PAPER = 80 MARKS

