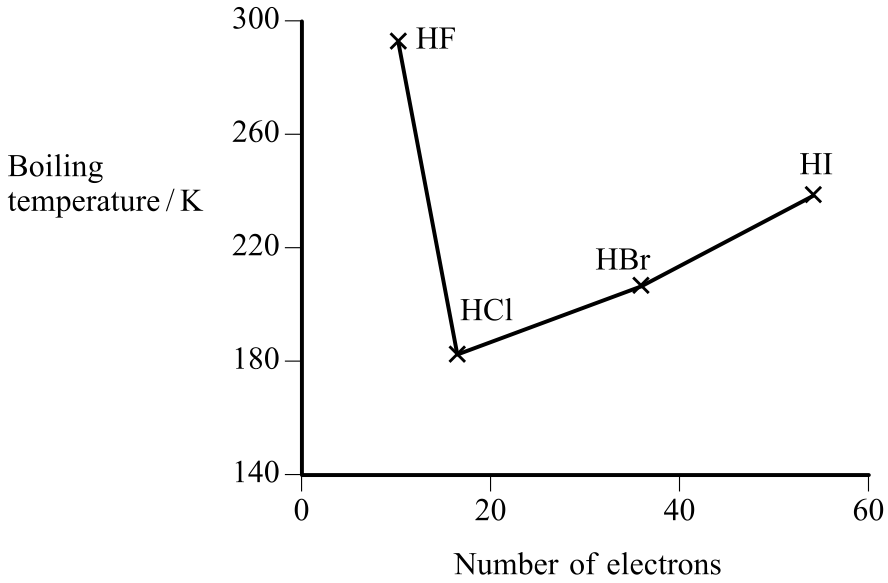
1 The graph below shows the boiling temperatures of the hydrides of Group 7.

Boiling temperatures of Group 7 hydrides



(a) (i) Identify the type of intermolecular force that gives rise to the unusually high boiling temperature of hydrogen fluoride.

(1)

(ii) State and explain whether the electronegativity of fluorine is greater than, similar to or less than, that of bromine.

Hence explain why hydrogen fluoride can form the type of intermolecular force named in (a)(i) but hydrogen bromide cannot.

(3)

(iii) Use the graph to predict what the boiling temperature of hydrogen fluoride would be without the presence of the type of intermolecular force named in (a)(i).

(1)

(b) Propanone, CH_3COCH_3, is a useful solvent for cleaning glassware in laboratories.

(i) Why is propanone able to dissolve a wide range of substances?

(1)

(ii) Propanone can be used to remove both water and octane from glassware.

For each of these substances, identify the strongest intermolecular force formed with propanone and the feature of the propanone molecule involved.

(2)

Water

Octane

(Total for Question = 8 marks)

2 The boiling temperatures of some hydrides are given below.

Compound	Boiling temperature / K
HF	293
HCl	188
HBr	206
HI	238
H_2O	373

*(a) Explain, by comparing the forces involved, why HI has a higher boiling temperature than HBr.

(3)

*(b) Explain, by comparing the types of forces involved, why HF has a higher boiling temperature than HCl.

(3)

(c) Suggest why H_2O has a higher boiling temperature than HF.

(1)

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(Total for Question 7 marks)

3 This question is about iodine and its compounds.

(a) (i) The element iodine can be obtained from seaweed. One step in the procedure is to extract the iodine from aqueous solution by shaking with a hydrocarbon solvent in a separating funnel.

Draw a diagram of a separating funnel containing the separated layers. Label the hydrocarbon layer, and state its colour.

[Density of hydrocarbon layer 0.660 g cm ^{3}]

(3)

Diagram

Colour of hydrocarbon layer .....

(ii) Iodine is also formed when an aqueous solution containing iodide ions reacts with an aqueous solution of iron(III) ions.

Write the ionic equation for this reaction. State symbols are **not** required.

(1)

(b) Hydrogen iodide gas is usually prepared by adding phosphoric(V) acid to solid potassium iodide.

(i) Suggest why phosphoric(V) acid is used in this preparation rather than concentrated sulfuric acid.

(1)

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(ii) Describe what you would see if a test tube of hydrogen iodide gas was inverted in a beaker of water.

(1)

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(iii) When hydrogen iodide gas reacts with ammonia, dense white fumes form. Write the equation for this reaction, including state symbols.

(2)

(c) 1-iodobutane can be made by reacting butan-1-ol with phosphorus(III) iodide, PI_3, formed by reacting moist red phosphorus with iodine.

(i) Complete the following equation for the formation of 1-iodobutane.

(1)

PI_3 + ... $C_4H_9OH \rightarrow$

(ii) Identify the intermolecular forces present between molecules of 1-iodobutane.

(1)

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(iii) 1-iodobutane reacts with hot aqueous silver nitrate solution. Describe what you would see when this reaction takes place.

(1)

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(iv) Give the structural formula for the organic product of the reaction between 1-iodobutane and ammonia.

(1)

(Total for Question 12 marks)