# 3.2 Oxides, Group 1 & Group 17

## Question Paper

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| Course | DP IB Chemistry |
| Section | 3. Periodicity |
| Topic | 3.2 Oxides, Group 1 & Group 17 |
| Difficulty | Medium |

**Time allowed:** 60

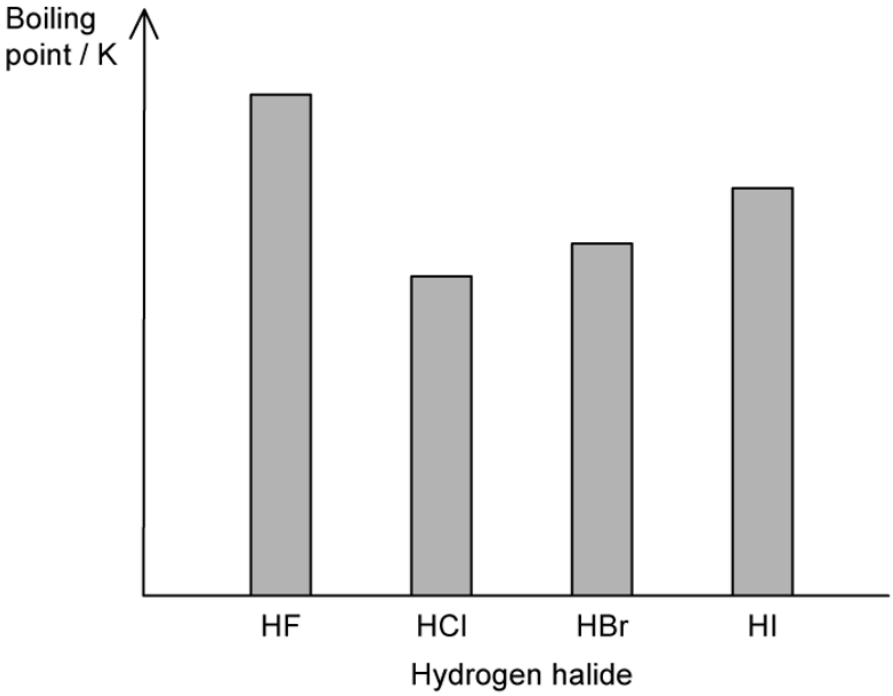
**Score:** /48

**Percentage:** /100

## Question 1a

a) The hydrogen halides do not show perfect periodicity. A bar chart of boiling points, as seen in Figure 1, shows that the boiling point of hydrogen fluoride, HF, is much higher than periodic trends would indicate.

**Figure 1**




Explain why the boiling point of HF is much higher than the boiling point of the other hydrogen halides.

**[2 marks]**

## Question 1b

b) There is an increase in boiling point moving from HC*l* to HI.
Explain this trend in boiling points of the hydrogen halides.

[2 marks]

## Question 1c

c) A student adds a solution containing silver ions to two test tubes containing chloride and bromide ions. The student observes that both solutions turn cloudy.

Explain the observation the student made upon carrying out the experiment.

[2 marks]

## Question 1d

d) Write equations for the reactions happening in the two test tubes.

[2 marks]

## Question 2a

a) A student dissolves the oxides of potassium and selenium in water and tests the resulting solutions with litmus paper.

Explain what the student would expect to observe.

[3 marks]

## Question 2b

b) Magnesium and silicon(V) oxides melt at high temperatures, unlike phosphorus(V) oxide and sulfur trioxide, which do so at lower temperatures.

State whether each of the four oxides would conduct electricity in their molten state.

**[2 marks]**

## Question 2c

c) For the solutions formed by dissolving the oxides in water in part (b), identify each as acidic, alkaline, or neutral.

**[2 marks]**

## Question 2d

d) Write equations for each of the reactions when the oxides of magnesium, phosphorus, and sulfur in part b) are dissolved in water.

**[3 marks]**

## Question 3a

a) Sodium oxide and silicon dioxide are two compounds of period 3 elements that react with water. Write equations for their separate reactions with water.

**[2 marks]**

## Question 3b

b) Suggest the pH of the resulting solutions when both sodium oxide and phosphorus(V) oxide react with water.

**[2 marks]**

## Question 3c

c) Aluminium oxide can react as both an acid and as a base.

(i) State the name given to this type of oxide.

(ii) Write an equation for the reaction of aluminium oxide with hydrochloric acid.

(iii) State whether aluminium oxide is behaving as an acid or base in this reaction.

**[3 marks]**

## Question 3d

d) Outline the acid-base nature of the oxides of the elements in period 3 from sodium to chlorine

**[3 marks]**

## Question 4a

a) Potassium is an element found in group 1 of the periodic table.
State how potassium reacts with water and write a balanced equation for the reaction including state symbols.

**[2 marks]**

## Question 4b

b) A student has a sample of lithium and sodium which he drops into a beaker of distilled water.
Compare the reactivity of lithium and sodium with water and state what the student would see in each reaction.

**[3 marks]**

## Question 4c

c) The student continues to react various group 1 metals with water and observes a change in reactivity as they move down the group.
Explain the trend in reactivity that would be observed.

**[3 marks]**

## Question 4d

d) From only the first three elements in each of group 1 and group 17, state which group 1 element and group 17 element would show the most vigorous reaction when they react together.
Write a balanced equation for the reaction.

**[2 marks]**

## Question 5a

a) Chlorine is a greenish-yellow gas, bromine is a dark red liquid, and iodine is a dark grey solid.
State and explain the property which most directly causes these differences in volatility.

**[3 marks]**

## Question 5b

b) Explain why $Cl_2$ rather than $Br_2$ would react more vigorously with a solution of $I^-$.

**[2 marks]**

## Question 5c

c) Describe what happens when aqueous bromine solution is added to separate solutions of sodium chloride and sodium iodide.
Include balanced equations for any reactions that occur.

**[3 marks]**

## Question 5d

d) Astatine, At, is the rarest naturally occurring element in the Earth's crust. Before it was discovered in 1940 scientists could only predict its existence and properties.

Suggest the basis for these predictions.

**[2 marks]**