3.2 Oxides, Group 1 & Group 17

Question Paper

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

Time allowed: 30

Score: /25

Percentage: /100

Question 1a

a)
An acid base reaction occurs for the reaction between solid potassium bromide and concentrated sulfuric acid. The equation for this is:

$2H_2SO_4(aq) + 2KBr(s) \rightarrow K_2SO_4(aq) + SO_2(g) + Br_2(g) + 2H_2O(l)$

In this reaction redox products are also formed. List all of the **redox** products produced from the reaction between solid potassium bromide and concentrated sulfuric acid **and** give observations for any products.

[2]

[2 marks]

Question 1b

b)
Explain why the reaction between solid potassium iodide and concentrated sulfuric acid produces hydrogen sulfide whereas the reaction between solid potassium bromide, and concentrated sulfuric acid does not.

[4]

[4 marks]

Question 1c

c)
Hydrogen halides, H-X, are formed from the reaction of hydrogen and a halogen, X_2. In solution hydrogen fluoride is classed as a weak acid, whereas HCl is classed as a strong acid. Explain this difference.

[2]

[2 marks]

Question 2a

a)
Describe the trends in first ionisation energy and atomic radius as you move up Group 1.

[1]

[1 mark]

Question 2b

b)
Explain the connection between first ionisation energy and atomic radius seen in the alkali metals.

[2]

[2 marks]

Question 2c

c)
Potassium reacts with water to form hydrogen gas. Using sections 1 and 2 of the data booklet, determine the volume, in cm^3, of hydrogen gas that could theoretically be produced at 273 K and 1.01105 Pa when 0.0587 g of potassium reacts with excess water.

[3]

[3 marks]

Question 3a

a)
Write equations for the separate reactions of lithium oxide and carbon dioxide with excess water and differentiate between the solutions formed.

Lithium oxide.....

Carbon dioxide.....

Differentiation.....

[3]

[3 marks]

Question 3b

b)
Suggest why it is surprising that dinitrogen monoxide dissolves in water to give a neutral solution.

[1]

[1 mark]

Question 3c

c)
Calcium carbide reacts with water to form ethyne, C_2H_2, and one other product.

Estimate the pH of the resultant solution.

[1]

[1 mark]

Question 4a

a)
Impurities cause phosphine to ignite spontaneously in the air to form an oxide of phosphorus and water.

The oxide formed in the reaction with air contains 56.3 % phosphorus by mass. Determine the empirical formula of the oxide, showing your method.

[3]

[3 marks]

Question 4b

b)
The molar mass of the oxide is approximately 220 g mol^{-1}. Determine the molecular formula of the oxide.

[1]

[1 mark]

Question 4c

c)
State the equation for the reaction of this oxide of phosphorus with water.

[1 mark]

Question 4d

d)
Predict how dissolving an oxide of phosphorus would affect the electrical conductivity of water.

[1]

[1 mark]