

Name of the Student: _____

Max. Marks : 20 Marks

Time : 20 Minutes

Q1.

For many years, swimming pool water has been treated with chlorine gas. The chlorine is added to kill any harmful bacteria unintentionally introduced by swimmers. Pool managers are required to check that the chlorine concentration is high enough to kill the bacteria without being a health hazard to the swimmers.

When chlorine reacts with water in the absence of sunlight, the chlorine is both oxidised and reduced and an equilibrium is established.

(a) Write an equation for this equilibrium.

For each chlorine-containing species in the equation, write the oxidation state of chlorine below the species.

(2)

(b) The pool manager maintains the water at a pH slightly greater than 7.0

Explain how this affects the equilibrium established when chlorine is added to water.

(2)

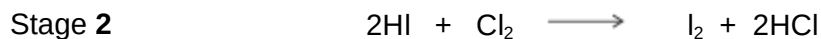
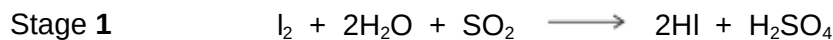
(c) Explain why chlorine is used to kill bacteria in swimming pools, even though chlorine is toxic.

(2)
(Total 6 marks)

Q2.

This question is about Group 7 chemistry.

- (a) Sea water is a major source of iodine.
The iodine extracted from sea water is impure. It is purified in a two-stage process.



- (i) State the initial oxidation state and the final oxidation state of sulfur in Stage 1.

Oxidation state of S in SO_2 _____

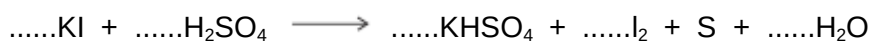
Oxidation state of S in H_2SO_4 _____

(2)

- (ii) State, in terms of electrons, what has happened to chlorine in Stage 2.

(1)

- (b) When concentrated sulfuric acid is added to potassium iodide, iodine is formed in the following redox equations.



- (i) Balance the equation for the reaction that forms sulfur.

(1)

- (ii) Deduce the half-equation for the formation of iodine from iodide ions.

(1)

- (iii) Deduce the half-equation for the formation of hydrogen sulfide from concentrated sulfuric acid.

(1)

- (c) A yellow precipitate is formed when silver nitrate solution, acidified with dilute nitric acid, is added to an aqueous solution containing iodide ions.

- (i) Write the **simplest ionic** equation for the formation of the yellow precipitate.

(1)

- (ii) State what is observed when concentrated ammonia solution is added to this yellow precipitate.

(1)

- (iii) State why the silver nitrate solution is acidified when testing for iodide ions.

(1)

- (iv) Explain why dilute hydrochloric acid is **not** used to acidify the silver nitrate solution in this test for iodide ions.

(1)

- (d) Chlorine is toxic to humans. This toxicity does not prevent the large-scale use of chlorine in water treatment.

- (i) Give **one** reason why water is treated with chlorine.

(1)

- (ii) Explain why the toxicity of chlorine does **not** prevent this use.

(1)

- (iii) Write an equation for the reaction of chlorine with cold water.

(1)

- (e) Give the formulas of the **two** different chlorine-containing compounds that are formed when chlorine reacts with cold, dilute, aqueous sodium hydroxide.

Formula 1 _____

Formula 2 _____

(1)

(Total 14 marks)