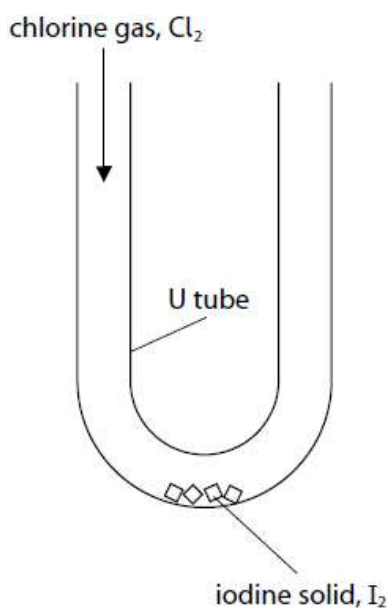


Redox Chemistry - Questions by Topic

Q1.

Iodine monochloride, ICl, is a covalent compound produced by the reaction of iodine with chlorine. Iodine monochloride is a dark brown liquid at room temperature.

The equipment shown can be used to pass chlorine over solid iodine to produce iodine monochloride.



When excess chlorine is passed through the U tube, the iodine monochloride reacts to produce iodine trichloride in an equilibrium reaction.

(a) Write a chemical equation for the reaction of iodine with chlorine to produce iodine monochloride. Include state symbols.

(2)

(b) The iodine monochloride molecule has a permanent dipole. Complete the following table using the electronegativity data from your Data Booklet and hence show the dipole on the diagram of the iodine monochloride molecule.

(1)

Element	Electronegativity
Cl	
I	



(c) Iodine monochloride reacts with propene to form two isomeric products. This is an addition reaction that is similar to the reaction of propene with hydrogen halides.

(i) Draw the skeletal formulae of both isomers.

(2)

(ii) Explain which of these isomers is the major product.

(3)

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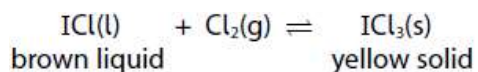
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(d) The equation for the reaction between iodine monochloride and chlorine is:



(i) State and justify **one** precaution that must be taken when preparing iodine trichloride.

(2)

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(ii) Give the oxidation number of iodine in both iodine-containing compounds in the equilibrium.

(1)

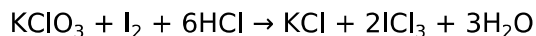
I in ICl

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I in ICl₃

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(iii) Iodine trichloride can also be made by reacting potassium chlorate(V) with iodine in hydrochloric acid. The equation for the reaction is



By considering oxidation numbers for chlorine, explain whether or not this reaction is a disproportionation.

(2)

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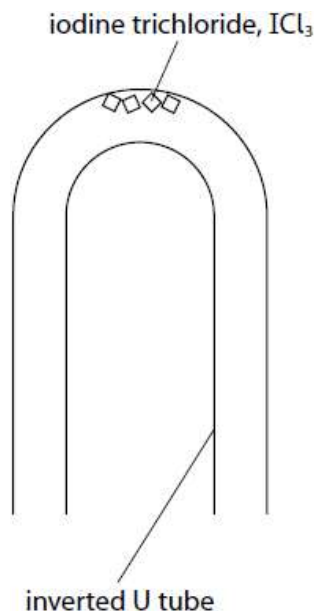
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(e) Chlorine gas has a molar volume of $24\,000\text{ cm}^3\text{ mol}^{-1}$ under the conditions used in this reaction.

(i) Show that the density of chlorine gas is approximately 3 g dm^{-3} .

(2)

(ii) Air has an average density of 1.25 g dm^{-3} . If the U-tube used in part (d) is inverted, as shown in the diagram, the solid yellow iodine trichloride produced in the equilibrium reaction turns to a brown liquid.



Explain this observation.

(3)

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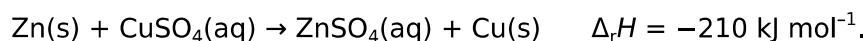
(f) A mass of 0.64 g of iodine reacted with fluorine to form 1.31 g of a fluoride of iodine. Calculate the empirical formula of this compound of iodine and fluorine.

(2)

(Total for question = 20 marks)

Q2.

Zinc metal reacts with copper(II) sulfate solution. The equation for the reaction is:



(a) What is the temperature rise, in °C, when excess zinc powder is added to 50 cm³ of copper(II) sulfate solution containing 0.0025 mol of copper(II) ions?

[Assume the specific heat capacity of the solution is 4.2 J g⁻¹ °C⁻¹].

(1)

- A 2.5
- B 10.5
- C 25.0
- D 44.1

(b) The reaction of zinc with copper(II) sulfate is best classified as:

(1)

- A disproportionation
- B neutralisation
- C redox
- D thermal decomposition

(Total for question = 2 marks)