Practice Question Set For A-Level
Subject : Chemistry
Paper-1 Topic: Physical 1

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Name of the Student:_____
Max. Marks : 25 Marks **Time : 25 Minutes**

Q1.

This question is about iron and its ions.

(a) Discuss the role of iron as a heterogeneous catalyst in the Haber process.

$$3\ H_2 + N_2 \rightleftharpoons 2\ NH_3$$

Your answer should include:

- the meaning of the term heterogeneous catalyst
- how iron acts as a heterogeneous catalyst
- the factors that affect the efficiency and lifetime of the catalyst.

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(6)

(b) Fe^{2+} ions catalyse the reaction between peroxodisulfate(VI) ions and iodide ions in aqueous solution.

$$S_2O_8^{2-}(aq) + 2\ I^-(aq) \rightarrow 2\ SO_4^{2-}(aq) + I_2(aq)$$

Explain why this reaction is slow before the catalyst is added.
Give **two** equations to show how Fe^{2+} ions catalyse this reaction.

Why reaction is slow before catalyst added _____

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Equation 1

_____

Equation 2

_____

(4)

(c) Give a reason why Zn^{2+} ions do **not** catalyse the reaction in part (b).

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(1)

(d) Iron reacts with dilute hydrochloric acid to form iron(II) chloride and hydrogen.

$$Fe(s) + 2\ HCl(aq) \rightarrow FeCl_2(aq) + H_2(g)$$

A 0.998 g sample of pure iron is added to 30.0 cm^3 of 1.00 mol dm^{-3} hydrochloric acid.

One of these reagents is in excess and the other reagent limits the amount of hydrogen produced in the reaction.

Calculate the maximum volume, in m^3, of hydrogen gas produced at 30 ^oC and 100 kPa.

Give your answer to 3 significant figures.

In your answer you should identify the limiting reagent in the reaction.

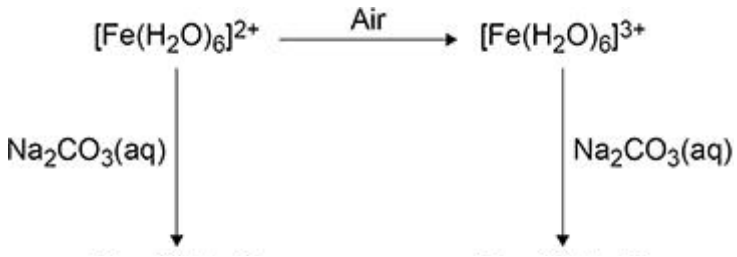
The gas constant, R = 8.31 J K^{-1} mol^{-1}

Volume of hydrogen _____ m^3

(6)

The figure below shows some reactions of iron ions in aqueous solution.

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(e) Identify **A** and state its colour.

Identity _____

Colour _____

(2)

(f) Give the formula of **B** and state its colour.

Give an ionic equation for the reaction of $[Fe(H_2O)_6]^{3+}$ with aqueous Na_2CO_3 to form **B**.

Formula _____

Colour _____

Ionic equation

_____

(3)

(g) Explain why an aqueous solution containing $[Fe(H_2O)_6]^{3+}$ ions has a lower pH than an aqueous solution containing $[Fe(H_2O)_6]^{2+}$ ions.

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(3)

(Total 25 marks)

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