Name of the Student:_____
Max. Marks : 17 Marks **Time : 17 Minutes**

Q1.

This question is about hydrogen peroxide, H_2O_2

The half-equation for the oxidation of hydrogen peroxide is

$$H_2O_2 \longrightarrow O_2 + 2\,H^+ + 2e^-$$

Hair bleach solution contains hydrogen peroxide.

A sample of hair bleach solution is diluted with water.
The concentration of hydrogen peroxide in the diluted solution is 5.00% of that in the original solution.
A 25.0 cm^3 sample of the diluted hair bleach solution is acidified with dilute sulfuric acid.
This acidified sample is titrated with 0.0200 mol dm^{-3} potassium manganate(VII) solution.
The reaction is complete when 35.85 cm^3 of the potassium manganate(VII) solution are added.

(a) Give an ionic equation for the reaction between potassium manganate(VII) and acidified hydrogen peroxide.

Calculate the concentration, in mol dm^{-3}, of hydrogen peroxide in the original hair bleach solution.

(If you were unable to write an equation for the reaction you may assume that the mole ratio of potassium manganate(VII) to hydrogen peroxide is 3:4
This is **not** the correct mole ratio.)

Concentration _____ mol dm^{-3}

(5)

(b) State why an indicator is **not** added in this titration.

_____

_____

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(1)

(c) Give the oxidation state of oxygen in hydrogen peroxide.

_____

(1)

(d) Hydrogen peroxide decomposes to form water and oxygen.

Give an equation for this reaction.

Calculate the amount, in moles, of hydrogen peroxide that would be needed to produce 185 cm^3 of oxygen gas at 100 kPa and 298 K

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

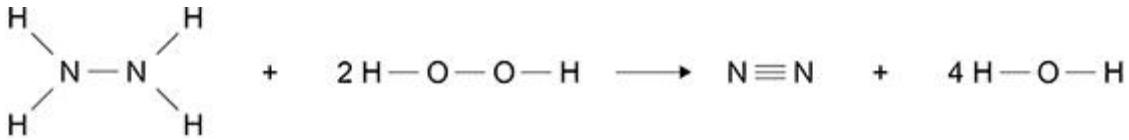
Equation

_____

Amount _____ mol

(5)

(e) Hydrazine (N_2H_4) is used as a rocket fuel that is oxidised by hydrogen peroxide. The equation for this reaction in the gas phase is



The enthalpy change for this reaction, ΔH = –789 kJ mol^{-1}

The table below shows some mean bond enthalpy values.

	N–H	**N–N**	**N≡N**	**O–H**
Mean bond enthalpy / kJ mol^{-1}	388	163	944	463

Define the term mean bond enthalpy.

Use the equation and the data in the table above to calculate a value for the O–O bond enthalpy in hydrogen peroxide.

Definition _____

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Bond enthalpy _____ kJ mol^{-1}

(5)

(Total 17 marks)

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