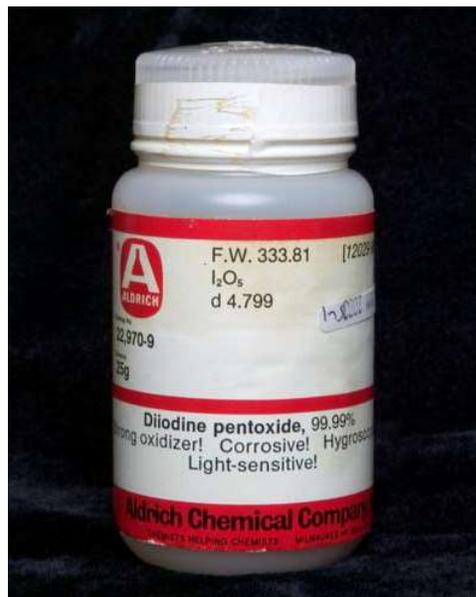## 2. This question is about diiodine pentoxide

Diiodine pentoxide, I_2O_5, is a white crystalline powder that has the useful property of reacting quantitatively with carbon monoxide to yield iodine and one other product.

(a) Suggest an equation for the reaction between I_2O_5 and carbon monoxide.

A 150 cm^3 sample of gas (at room temperature and pressure, r.t.p.) that was known to contain carbon monoxide was repeatedly passed over excess I_2O_5 at 170 °C. The I_2O_5 became coloured with iodine. The iodine generated required exactly 8.00 cm^3 of 0.100 mol dm^{-3} sodium thiosulfate solution to react with it. This reaction is:

$$I_{2\ (aq)} + 2\ Na_2S_2O_{3\ (aq)} \longrightarrow 2\ NaI_{\ (aq)} + Na_2S_4O_{6\ (aq)}$$
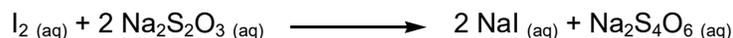
(b) Calculate the percentage by volume of carbon monoxide present in the sample of gas.
[Assume 1 mol of any gas occupies 24.0 dm^3 at r.t.p.]

Diiodine pentoxide readily absorbs water and is sometimes supplied in a hydrated form, $H_xI_yO_z$. If this is heated to 200 °C it loses 1.766% of its mass to form pure I_2O_5.

(c) Calculate the empirical formula of the impure form, and write the equation for its dehydration.

I_2O_5 is an acid anhydride and reacts with excess water to produce the parent acid. This is analogous to the reaction between ethanoic anhydride and water to form ethanoic acid.

(d) Suggest the formula for the simple parent acid of I_2O_5, and write the equation for its formation from I_2O_5. What is the oxidation state of the iodine in I_2O_5?

(e) Suggest a structure for the parent acid and hence a structure for I_2O_5.

(f) The parent acid of I_2O_5 may be formed by reacting iodine, chlorine and water.
Suggest an equation for this reaction.