- 1 a Heading + unit 1m 2 readings +/- – 1m 2dp -1m Accuracy – 2m
 - **b** Ave 1m burette reading is 26.30cm³
 - No of mol NaOH = 25/1000X0.1 = 0.0025 mol No of mol HXO₃ = 0.0025 mol Concentration HXO₃ = 0.0025/26.3X1000 = 0.095057 = 0.0951 mol/dm³
 - d 1 dm³ solution contains = 3.5 x 2 = 7.5 g HXO₃ Mr of HXO₃ = mass / mole = 7.5 / 0.095057 = 78.9

Element	Relative atomic mass	Formula of its acid HXO₃	Relative molecular mass of its acid
Bromine (Br)	80	HBrO₃	1 + 80 + 48 = 129
Chlorine (Cl)	35.5	HCIO₃	1 + 35.5 + 48 = 84.5
Nitrogen (N)	14	HNO₃	1 + 14 + 48 = 63
Phosphorus (P)	31	HPO ₃	31 + 1 + 48 = 80

f X is phosphorus

е

2

- **a** The filtrate is a pale blue solution
 - **b i** Pungent, colourless gas turms most red litmus paper blue. Ammonia gas produced.
 - ii White ppt formed with aqueous silver nitrate Ppt dissolves in aqueous ammonia to form a colourless solution
 - c <u>Filtrate is a blue solution</u>
 - i <u>Light blue ppt,</u> Ppt is soluble in excess to form a deep blue solution
 - ii Cream ppt in a brown solution / filtrate is a brown/orange solution
 - iii Blue ppt formed. Black ppt on warming
 - **d** The metal is copper and the impurity is ammonium chloride
 - e i Cu^{2+} (aq) + 2 OH⁻ (aq) \rightarrow Cu(OH)₂ (s)
 - ii $Cu(OH)_2(s) \rightarrow CuO(s) + H_2O(l)$
 - **f** KI is a reducing agent, the iodide ion is oxidised to form brown iodine solution. Iodide ions lose electrons to form iodine.
 - **g** All nitrate salts produced from nitric acid are soluble in water. The solutions are suitable for precipitation in the test reactions. However, a few salts of sulfate and chloride are not soluble and could not be used in precipitation.

i

Independent variable: types of catalyst (X and MnO₂) Dependent variable: volume of oxygen gas at 1 min Controlled variables: mass of catalyst; particle size of catalyst; concentration and volume of hydrogen peroxide; temperature

- 1 Set up the apparatus as shown in the diagram.
- 2 Measure 50cm³ of hydrogen peroxide using a measuring cylinder and transfer into the conical flask attached to a gas syringe.
- 3 Weigh 1.00g of X into a small test tube and secure it with a thread to the stopper of the conical flask as shown in the diagram. Release the thread and shake the conical flask for the hydrogen peroxide to react with the catalyst.
- 4 Measure the time taken to collect 50 cm³ of gas.
- 5 Repeat step 1 to 4 using 1.00g of manganese(IV) oxide Instead of X.
- 6 The results are tabulated.

Results and conclusions:

catalyst	Time taken to collect 50	
-	cm³ of gas / s	
Х	T ₁	
MnO ₂	Τ2	



Method 1 Variable 1 Apparatus 1 Procedure 1

T₁ is longer than T₂. MnO₂ is a better catalyst than X.

- **3 c** As the concentration of the dilute 00sulfuric acid increases, the time taken for the magnesium to dissolve decreases and hence the reaction is faster.
 - **d** concentration of the acid = 0.0210/30X1000 = 0.7 mol/dm³ from the graph, time taken is 120s
 - Measure the mass of magnesium instead of using the length of 4 cm.
 Use burette or pipette to measure the fixed volume of acid.
 Dry the breaker after washing and rinsing.