NAME: ……

SCHOOL:……

WINCHESTER
COLLEGE

WINCHESTER ENTRANCE

Chemistry Examination

MAY 2 2024

Time Allowed: 30 minutes

Total Marks: 30

The mark for each question is given in brackets [ ].

Calculators may be used.

Write your answers in this booklet. If you need additional space, please write on sheets of A4 paper and attach them to this booklet.

You should show all your working so that credit may be given for partly correct answers.

Candidates will be penalized for giving answers to too many significant figures.

Question C4 involves graph plotting: a spare grid has been added at the end of the question paper in case candidates need to make a second attempt at plotting the required data.

Do not be discouraged if you do not finish.

Diagrams are not drawn to scale and are reproduced from CAIE's 0971/61 Summer 2022 exam paper.

C1 Circle the correct answer for each of the following:

(a) Hydrochloric acid and copper carbonate are reacted together. State the gas produced.

hydrogen	nitrogen	carbon dioxide	chlorine

(b) A mixture of dyes is separated into individual components based on the solubility of each dye. State the technique being used.

distillation	chromatography	filtration	evaporation

(c) A glowing splint is put into a test tube containing a gas. The glowing splint does not relight. State which gas is **not** present in the test tube.

nitrogen	oxygen	hydrogen	carbon dioxide

(d) State the name used for the result when a solid dissolves in a water.

solution	solute	insoluble	solvent

(e) Select the chemical name and symbol formula pair which does not match correctly.

calcium carbonate, $CaCO_3$	iron, Fe
sodium, So	copper sulphate, $CuSO_4$

[5]

C2 Draw lines between the left and right-hand columns to match each piece of **apparatus** with its **function**.

Apparatus	**Function**
funnel	used to turn a gas into a liquid
condenser	used to measure temperatures
thermometer	used to measure volume of solutions
measuring cylinder	used to separate liquids from solids

[3]

C3 The well-known pH indicators *litmus* and *universal indicator* are just two of a very large number of indicators used by Chemists. Details of four other indicators are given in the table below.

indicator	**colour 1**	**pH**	**colour 2**	**pH**
bromophenol blue	yellow	3.0	blue	4.5
phenolphthalein	colourless	8.0	pink	10.0
methyl orange	red	3.0	yellow	4.5
thymol blue	yellow	6.0	blue	7.5

Typically:

hydrochloric acid solution has a pH of 1.0 ammonia solution has a pH of 10.0

ethanoic acid solution has a pH of 5.0 sodium hydroxide has a pH of 12.5

(a) Complete the table below to show colours of the indicators in the solutions.

indicator	**solution**	**colour**
litmus	ammonia solution	
litmus	hydrochloric acid	
universal indicator	sodium hydroxide	
universal indicator	distilled water	
universal indicator	ethanoic acid	
bromophenol blue	hydrochloric acid	
phenolphthalein	ethanoic acid	
methyl orange	ammonia solution	
thymol blue	sodium hydroxide	

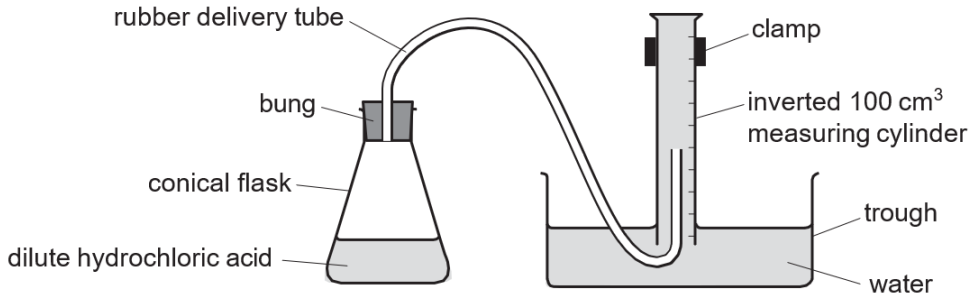
[5]

(b) Name an indicator which fails to differentiate ethanoic acid and sodium hydroxide.

.....

[1]

C4 A student investigated the rate at which hydrogen gas is evolved when two equivalent samples of magnesium metal were reacted with two different solutions of dilute hydrochloric acid, **C** and **D**, of different concentrations. The dilute hydrochloric acid was in excess in both experiments. Two experiments were done using the apparatus shown.



Experiment 1

- A measuring cylinder was used to pour 60 cm^3 of solution **C** into a conical flask.
- The bung was removed from the conical flask and a coiled 5 cm length of magnesium ribbon was added to the flask. The bung was replaced immediately, and a timer started.
- The volume of gas collected was recorded every 20 seconds for 160 seconds.

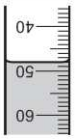
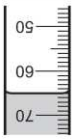
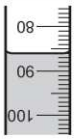
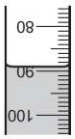
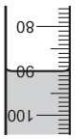
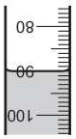
Experiment 2

- Experiment 1 was repeated using 60 cm^3 of solution **D** instead of solution **C**

Using an inverted measuring cylinder means that **the measuring cylinder is full of water at the start, i.e. a reading of 0 cm^3**, but as gas replaces the water the reading on the measuring cylinder increases.

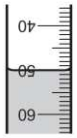
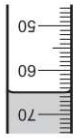
(a) Use the inverted measuring cylinder diagrams to complete the data tables for the **two experiments**.

Results from Experiment 1

time / s	20	40	60	80	100	120	140	160
diagrams of inverted measuring cylinder								
volume of gas collected / cm^3								

[2]

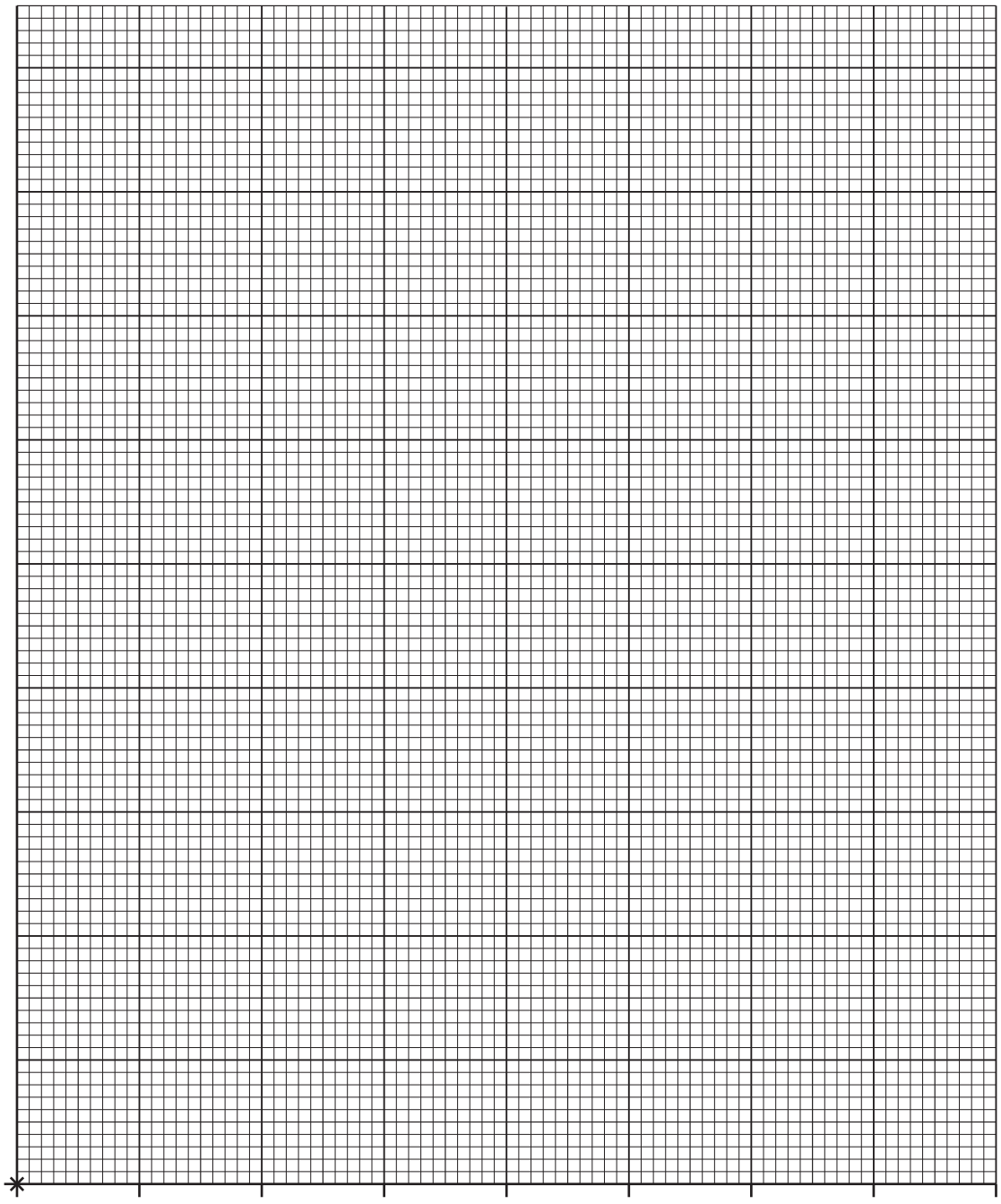
Results from Experiment 2

time / s	20	40	60	80	100	120	140	160
diagrams of inverted measuring cylinder								
volume of gas collected / cm^3								

[2]

(b) Plot the results from Experiments 1 and 2 on the grid. Use the same set of axes to draw **two labelled** smooth line graphs.

[8]



Time/s

(c) **From your graph**, deduce the volume of gas that was collected after 50 seconds in experiment 2. Show clearly **on the grid** how you worked out your answer.

.....

..... [2]

Concentration is defined as a measure of particle density within a solution.

(d) State which concentration, **C** or **D**, is the more concentrated acid. Justify your answer by reference to your graph.

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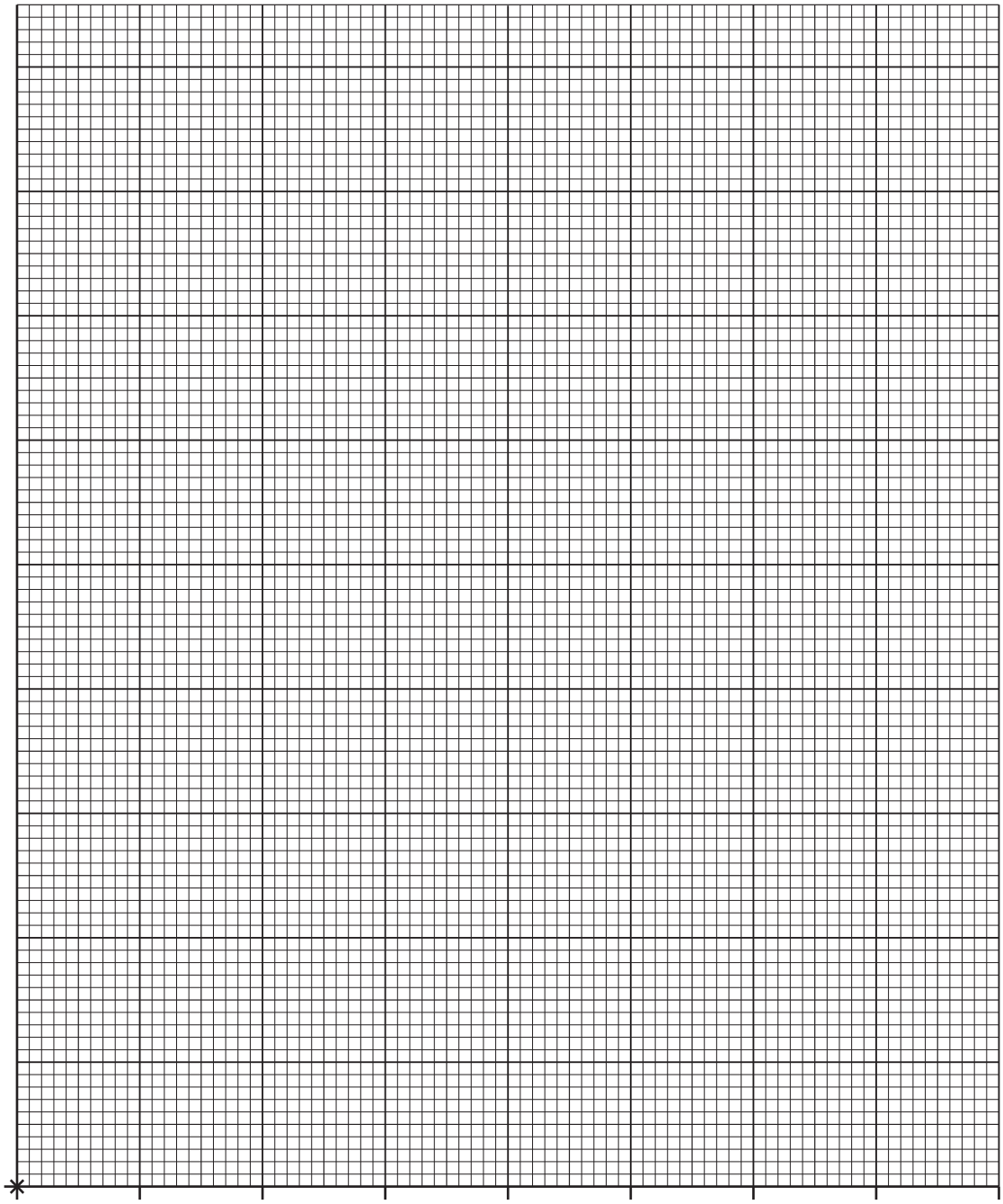
..... [2]

Total: 30 marks

End of this paper

If you need a fresh piece of graph paper to work on for question **C4(b)**, use the grid below



Time/s