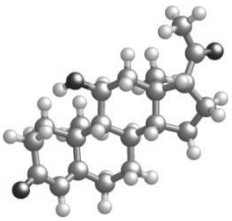


Chem!stry

Name: …… **( )**

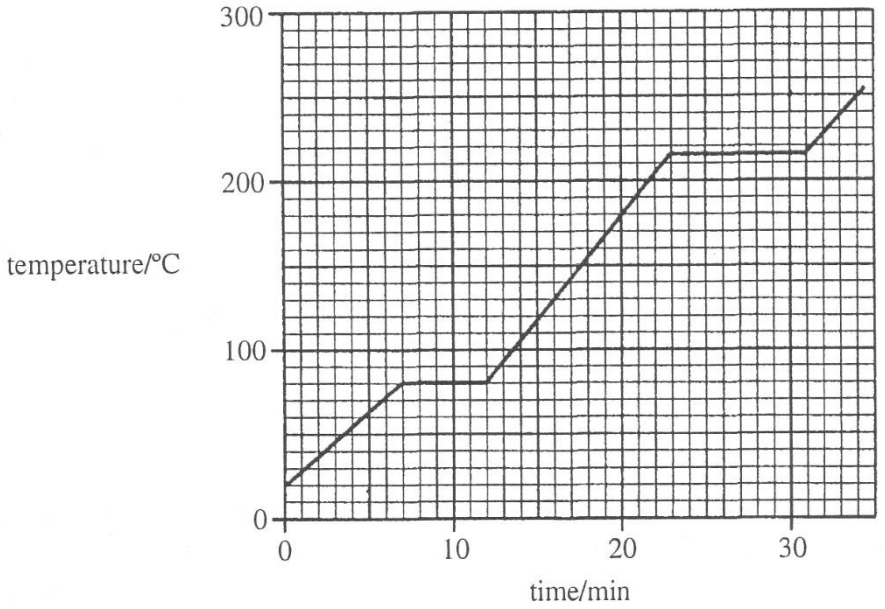
Class: ……

Date: …… **/** …… **/** ……

Revision Questions for the Secondary 3 Chemistry End-of-year Exam

Question 1.

The graph below shows the heating curve for a pure chemical **C**:



a) What information provided by the graph indicates that chemical **C** is pure?

……

[1 mark]

b) What is the boiling point of chemical **C**?

……

[1 mark]

c) Describe separation, arrangement and motion of the particles in chemical **C** at 60°C:

……

[1 mark]

d) Use appropriate terms from Kinetic Particle Theory to explain the shape of the graph as chemical **C** is heated from 150°C to 250°C:

……

……

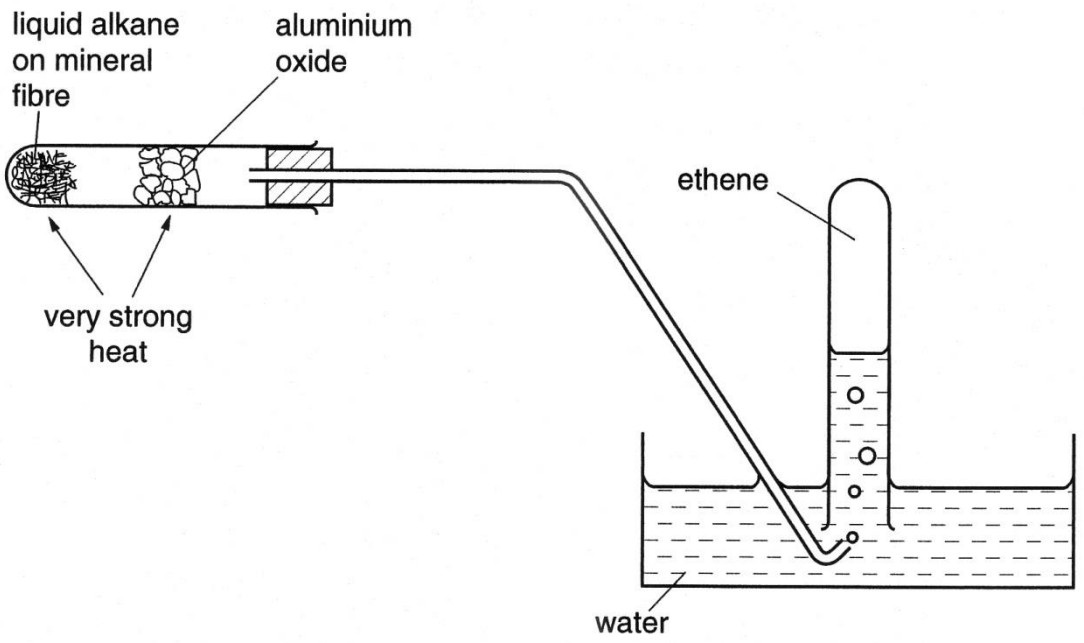
……

……

[3 marks]

Question 2.

The diagram below shows the apparatus used to prepare and collect a sample of ethene gas:



a) Name the method by which the ethene gas is being collected in the diagram above:

……..

[1 mark]

b) State one property of ethene gas that can be deduced from the information contained in the diagram above:

……..

[1 mark]

c) Why is it dangerous to stop heating <u>before</u> removing the delivery tube from the water?

……..

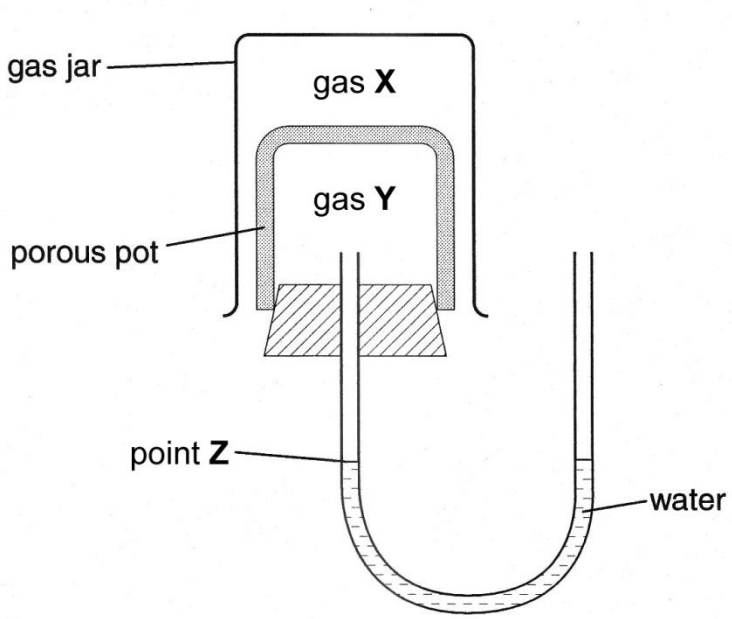
[1 mark]

d) Ethene has the formula C_2H_4. Use a dot (•) and cross (×) diagram to show the arrangement of the electrons, and hence the bonding, in ethene:

[2 marks]

Question 3.

The apparatus shown below is used to investigate the diffusion of gases:



State what will happen to the level of the liquid at point **Z** when the following pairs of gases are used in the apparatus shown above:

a) gas **X** = CO and gas **Y** = N_2

……

……

[2 marks]

b) gas **X** = CO_2 and gas **Y** = CH_4

……

……

[2 marks]

c) gas **X** = Ne and gas **Y** = SO_2

……

……

[2 marks]

Question 4.

Clearly and concisely, in four steps, explain how you would separate the following mixture of chemicals, thus obtaining a pure sample of each chemical:

copper(II) sulfate, sand, iron filings and naphthalene

Step 1: ……

……

Step 2: ……

……

Step 3: ……

……

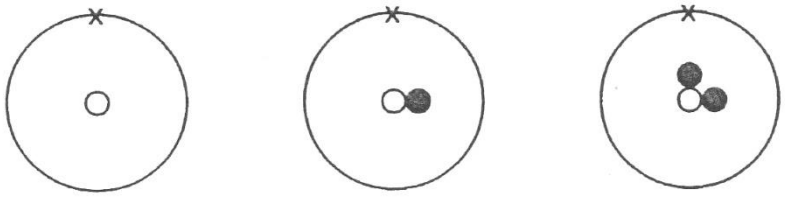
Step 4: ……

……

[4 marks]

Question 5.

Hydrogen (Symbol H) deuterium (symbol D) and tritium (symbol T) are isotopes of the same element. Their atomic structures are shown below:



a) Use the information in the diagram above to complete the following table:

Symbol:	Name of Particle:	Relative Charge on Particle:	Relative Mass of Particle:
○			
●			
×			

[3 marks]

b) Explain why the three atoms are isotopes of one another:

……

[1 mark]

c) What is the relative molecular mass of a molecule of tritium, formula T_2?

……

[1 mark]

d) Explain why the three isotopes have similar chemical properties:

……

[1 mark]

e) Even though they have similar chemical properties, explain why tritium may react more slowly than hydrogen:

……

[1 mark]

Question 6.

Four isotopes of iron are known to exist. Their mass numbers and percentage abundance are given in the table below:

Isotope	Percentage Abundance
^{54}Fe	5.80%
^{56}Fe	91.6%
^{57}Fe	2.20%
^{58}Fe	0.40%

Calculate the relative atomic mass of this sample of iron based on the data that is provided. Give your answer to three significant figures:

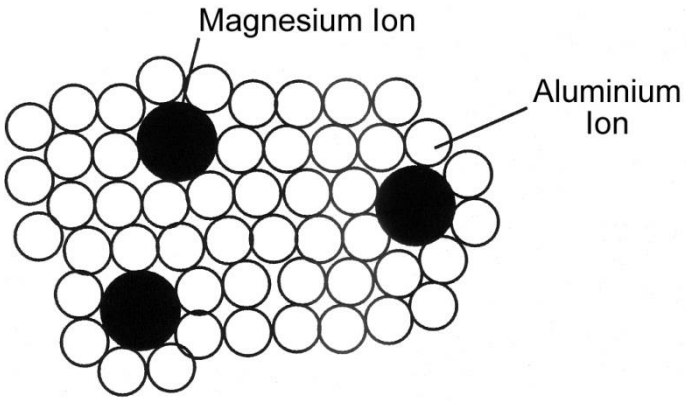
[2 marks]

Question 7.

a) Use a dot (•) and cross (×) diagram to show the arrangement of the electrons, and hence the bonding, in magnesium nitride (the compound formed when magnesium reacts with nitrogen):

[2 marks]

b) Aluminium is a strong metal with a relatively low density. Due to these properties, aluminium is frequently used to make aircraft parts. However, to increase its strength even further, magnesium is added to the aluminium to form an alloy. A diagram of this alloy is given below:



With reference to the diagram, explain why the addition of small quantities of magnesium to aluminium increases the strength of the aluminium:

……

……

[2 marks]

Question 8.

a) Clearly and concisely explain the following observations:

i) Both copper (Cu) and sodium chloride (Na*Cl*) conduct electricity when in the liquid (molten) state, but only metallic copper conducts electricity when in the solid state:

……

……

……

……

[4 marks]

ii) The boiling point of methane (CH_4) is –164°C while the boiling point of diamond (C) is +4827°C:

……

……

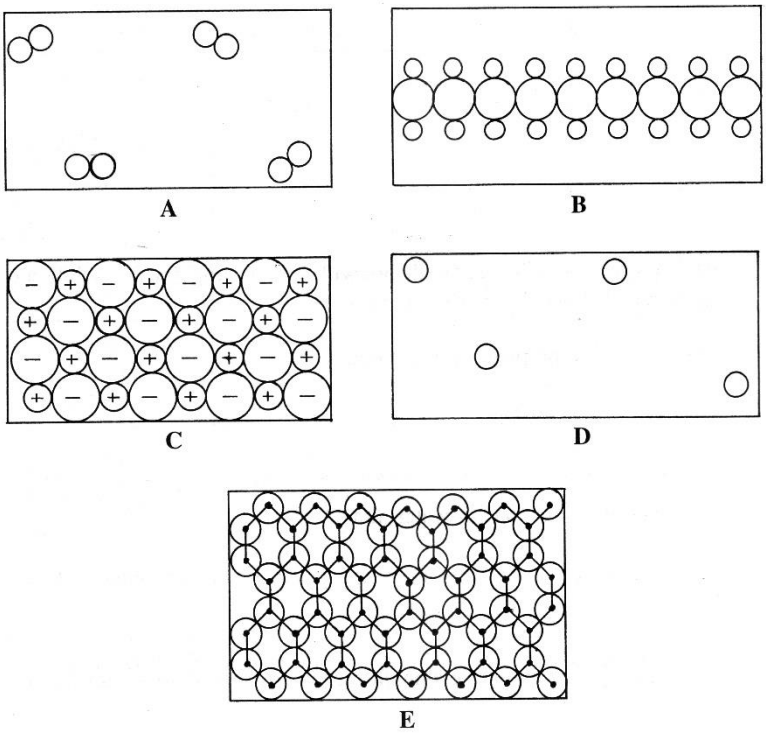
……

……

[4 marks]

b)

The diagrams on the right show the nature and arrangement of the particles in five different chemicals labelled **A** to **E**.



Choose which diagram; **A**, **B**, **C**, **D** or **E**, best represents the arrangement of the particles in:

i) Graphite: ……

ii) Oxygen: ……

iii) Xenon: ……

iv) Calcium oxide: ……

[4 marks]

Question 9.

a) Compound **A** (M_r = 242) contains 29.75% carbon, 4.13% hydrogen and 66.12% bromine by mass. Show that the molecular formula for **A** is $C_6H_{10}Br_2$:

[2 marks]

b) The compound hydrogen peroxide is rapidly decomposed into water and oxygen gas by the enzyme catalase according to the following balanced chemical equation:

hydrogen peroxide $\rightarrow$ water + oxygen

$$2H_2O_2(l) \rightarrow 2H_2O(l) + O_2(g)$$

If the enzyme were to decompose 238 g of hydrogen peroxide, then calculate:

i) The mass of water produced:

[3 marks]

ii) The volume of oxygen gas produced:

[2 marks]

Question 10:

A 50.0 cm^3 of a 1.0 mol/dm^3 solution of barium nitrate are added to 70.0 cm^3 of a 0.5 mol/dm^3 solution of sodium sulfate:

$$Ba(NO_3)_2(aq) + Na_2SO_4(aq) \rightarrow BaSO_4(s) + 2NaNO_3(aq)$$

a) Which of the two reagents is the limiting reagent for the reaction?

[2 marks]

b) Calculate the mass of barium sulfate that should be produced by this reaction to 3 significant figures:

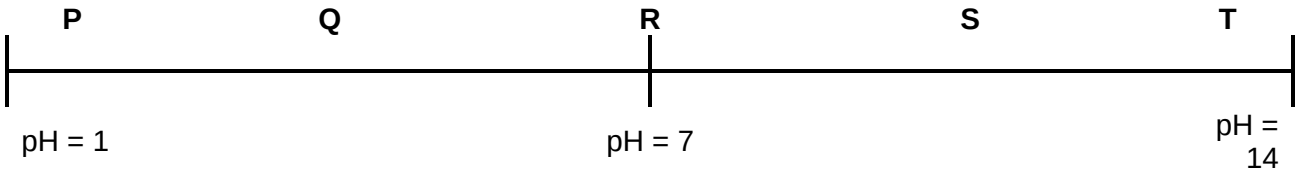
[2 marks]

c) Calculate the percentage yield for the reaction if only 5.80 g of barium sulfate are produced:

[1 mark]

Question 11:

The pH scale below shows the positions of five aqueous solutions, **P**, **Q**, **R**, **S** and **T**, of equal concentration:



a) Which of the aqueous solutions is:

i) A weak acid: …… Example: ……..

ii) A strong alkali: …… Example: ……..

iii) Neutral: …… Example: ……..

iv) A strong acid: …… Example: ……..

v) A weal alkali: …… Example: ……..

[5 marks]

b) Define the term *strong acid*:

……..

[1 mark]

c) Write a balanced chemical equation for the reaction between nitric acid and calcium hydroxide:

……..

[1 mark]

Question 12:

Using your knowledge of acids, bases and salts, answer the following questions:

a) Calcium hydroxide (slaked lime) is added into acidic soils containing sulfuric acid.
Explain, with a relevant chemical equation, why this is done by farmers.

Chemical equation: .....

Your explanation:

……..

……..

……..

[2 marks]

b) A student placed equal lengths of magnesium ribbon in equal volumes of 1 mol/dm^3 of ethanoic acid and 1 mol/dm^3 of dilute hydrochloric acid. After 1 minute, there was more gas collected from the reaction of magnesium with dilute hydrochloric acid. Explain the observation using the relevant chemical terms.

……

……

……

[2 marks]

c) The reading on an ammeter, which gives an indication of a solution's electrical conductivity, gradually drops to zero when silver sulfate is slowly added to 50 cm^3 of aqueous barium chloride. Explain the observation.

……

……

……

[2 marks]

Question 13.

Clearly describe how you would prepare a pure, dry sample of copper(II) nitrate in the laboratory.

a) Reagents used:

……

[1 mark]

b) Balanced chemical equation for the reaction:

……

[1 mark]

c) Step-by-step description of the procedure:

Step 1: ……...

……...

Step 2: ……...

……...

Step 3: ……...

……...

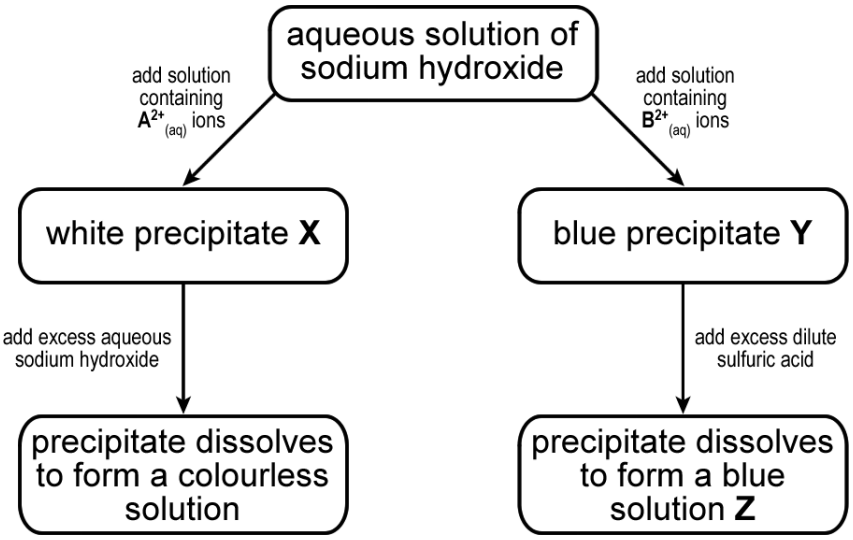
Step 4: ……...

……...

[4 marks]

Question 14.

The diagram below shows some of the properties and reactions of the ions $\mathbf{A^{2+}}$ and $\mathbf{B^{2+}}$, and substances **X**, **Y** and **Z**.



a) Suggest identities for the ions $\mathbf{A^{2+}}$ and $\mathbf{B^{2+}}$, and substances **X**, **Y** and **Z**.

$\mathbf{A^{2+}}$ ……

$\mathbf{B^{2+}}$ ……

X ……

Y ……

Z ……

[5 marks]

b) Write the ionic equation to show the formation of the blue precipitate **Y**.

……

[1 mark]

c) Explain how sodium hydroxide solution can be used to distinguish between a solution containing an iron(II) compound and a solution containing an iron(III) compound.

……

……

[1 mark]

Question 15.

Indigestion tablets reduce the symptoms of heartburn by neutralizing excess hydrochloric acid in the stomach. Indigestion tablets contain calcium carbonate, $CaCO_3$, as the active ingredient.

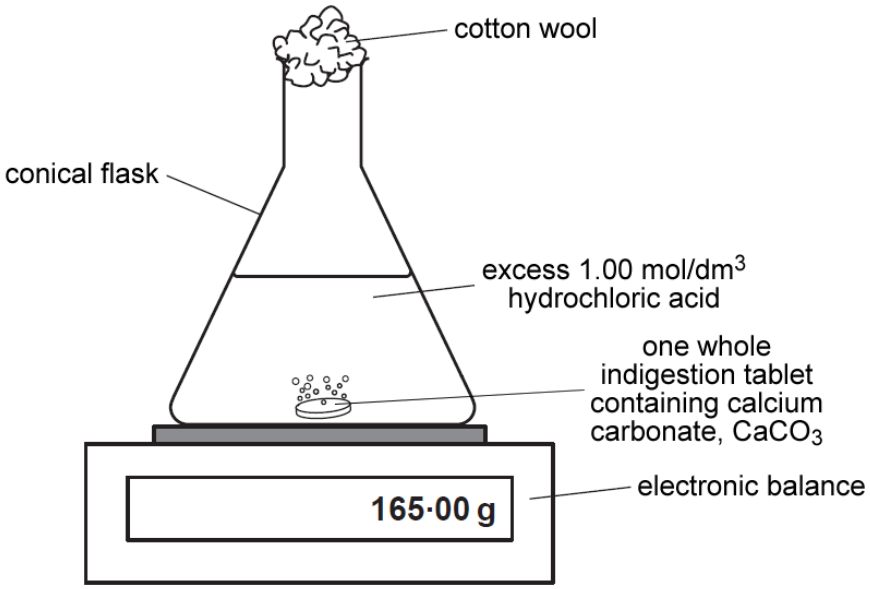
a) Write a balanced chemical equation for the reaction between calcium carbonate and dilute hydrochloric acid.

……

[1 mark]

One brand of indigestion tablet claimed to offer "*rapid relief from indigestion*". To investigate this claim, a student performed **two** different experiments to determine how fast one whole indigestion tablet reacted with an excess of 1.00 mol/dm^3 hydrochloric acid.

The apparatus and reagents that the student used for the **first** experiment are shown in the diagram below.



b) Explain the function of the cotton wool in the experiment shown above.

……

……

[1 mark]

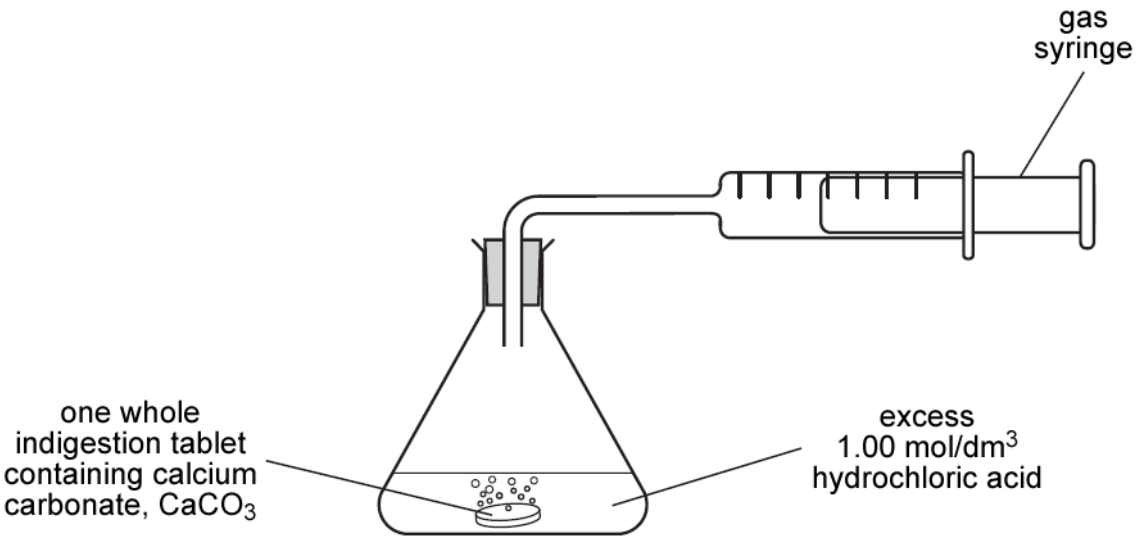
c) State how the mass reading on the electronic balance will change during the course of the reaction.

……

……

[1 mark]

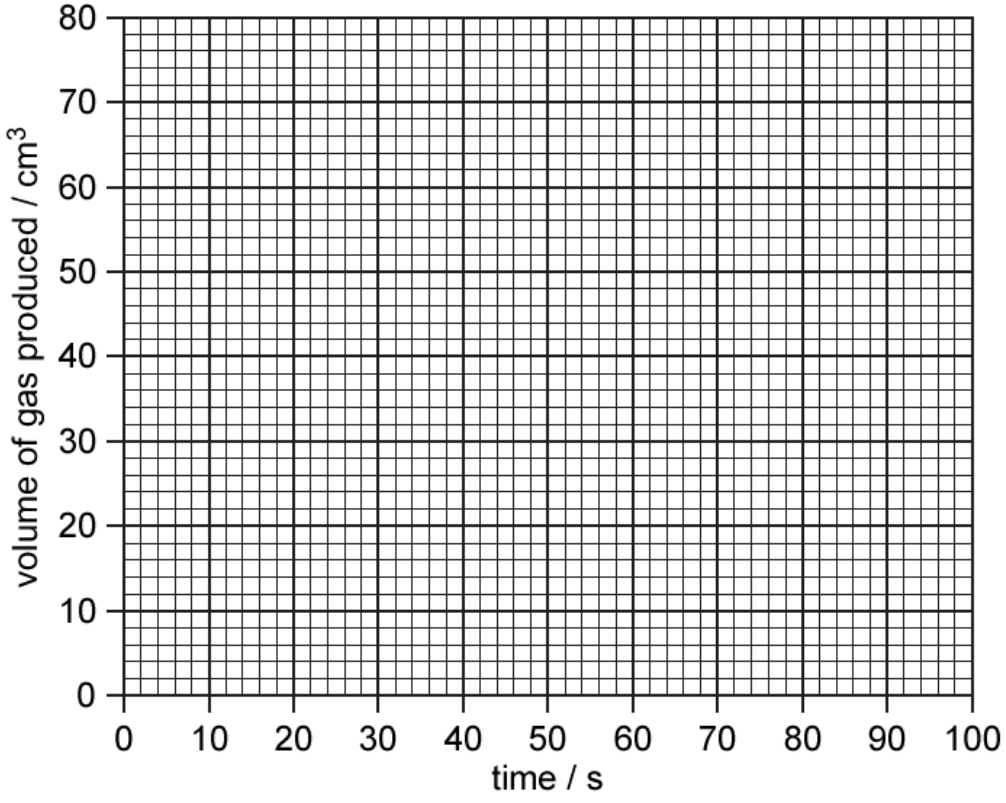
The apparatus and reagents that the student used for the **second** experiment are shown in the diagram below.



The student measured the volume of gas produced at ten second intervals. Her results are recorded in the table shown below.

Time / s	0	10	20	30	40	50	60	70
Volume of gas produced / cm^3	0	20	32	x	50	52	53	53

d) Plot the student's data on the graph paper provided below and draw a smooth curve through the data points.



[2 marks]

e) Using your graph, predict the volume of gas produced at 30 seconds.

……

[1 mark]

f) On the graph paper, **sketch** the graph of the results you expect the student to obtain if she repeated the experiment using:

i) Excess hydrochloric acid of concentration 0.500 mol/dm^3. Clearly label this line "**A**".

[1 mark]

ii) Half of one indigestion tablet that had been crushed into a powder. Clearly label this line "**B**".

[1 mark]

g) Using your knowledge of collision theory, explain why increasing the temperature of the reaction by 10 °C will double the rate of the reaction between the indigestion tablet and dilute hydrochloric acid.

……

……

……

……

[2 marks]

- Scan the QR code below for the answers to this assignment.

http://www.nygh.sg/miscellaneous/sec_3_chem/sec_3_chem_ans.pdf

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The Periodic Table of the Elements

Group I	Group II											Group III	Group IV	Group V	Group VI	Group VII	Group 0
							1 H hydrogen 1										4 He helium 2
7 Li lithium 3	9 Be beryllium 4											11 B boron 5	12 C carbon 6	14 N nitrogen 7	16 O oxygen 8	19 F fluorine 9	20 Ne neon 10
23 Na sodium 11	24 Mg magnesium 12											27 Al aluminium 13	28 Si silicon 14	31 P phosphorus 15	32 S sulfur 16	35.5 Cl chlorine 17	40 Ar argon 18
39 K potassium 19	40 Ca calcium 20	45 Sc scandium 21	48 Ti titanium 22	51 V vanadium 23	52 Cr chromium 24	55 Mn manganese 25	56 Fe iron 26	59 Co cobalt 27	59 Ni nickel 28	64 Cu copper 29	65 Zn zinc 30	70 Ga gallium 31	73 Ge germanium 32	75 As arsenic 33	79 Se selenium 34	80 Br bromine 35	84 Kr krypton 36
85 Rb rubidium 37	88 Sr strontium 38	89 Y yttrium 39	91 Zr zirconium 40	93 Nb niobium 41	96 Mo molybdenum 42	– Tc technetium 43	101 Ru ruthenium 44	103 Rh rhodium 45	106 Pd palladium 46	108 Ag silver 47	112 Cd cadmium 48	115 In indium 49	119 Sn tin 50	122 Sb antimony 51	128 Te tellurium 52	127 I iodine 53	131 Xe xenon 54
133 Cs caesium 55	137 Ba barium 56	139 La lanthanum 57 *	178 Hf hafnium 72	181 Ta tantalum 73	184 W tungsten 74	186 Re rhenium 75	190 Os osmium 76	192 Ir iridium 77	195 Pt platinum 78	197 Au gold 79	201 Hg mercury 80	204 Tl thallium 81	207 Pb lead 82	209 Bi bismuth 83	– Po polonium 84	– At astatine 85	– Rn radon 86
– Fr francium 87	– Ra radium 88	– Ac actinium 89 †															

*58-71 Lanthanoid series

†90-103 Actinoid series

140 Ce cerium 58	141 Pr praseodymium 59	144 Nd neodymium 60	– Pm promethium 61	150 Sm samarium 62	152 Eu europium 63	157 Gd gadolinium 64	159 Tb terbium 65	162 Dy dysprosium 66	165 Ho holmium 67	167 Er erbium 68	169 Tm thulium 69	173 Yb ytterbium 70	175 Lu lutetium 71
232 Th thorium 90	– Pa protactinium 91	238 U uranium 92	– Np neptunium 93	– Pu plutonium 94	– Am americium 95	– Cm curium 96	– Bk berkelium 97	– Cf californium 98	– Es einsteinium 99	– Fm fermium 100	– Md mendelevium 101	– No nobelium 102	– Lr lawrencium 103

Key: a = relative atomic mass; X = atomic symbol; b = proton (atomic) number