Topical Past Paper Questions Workbook

Edexcel IGCSE Chemistry (4CH1) 1C & 1CR

Exam Series: Jan 2017 – Jan 2022

Format Type A:
Answers to all questions are provided as an appendix

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Introduction

Each topical past paper questions workbook consists of hundreds of questions and their answer schemes, in the form of worksheets. Questions are assigned to each chapter according to their corresponding topic. Topics, in turn, are based on the items of the latest Edexcel IGCSE or AS/A level syllabus content. This book's specifications are as follows:

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Contents

Chapter 1

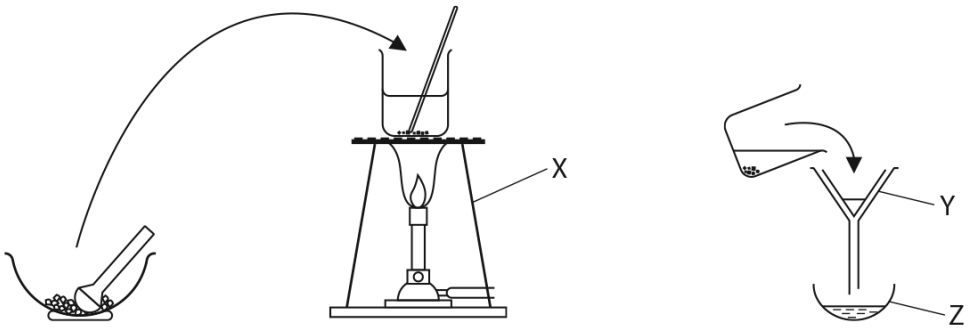
Assessing Investigative / Experimental Skills

1.1 Assessing Investigative / Experimental Skills

1. 4CH0_1C_que_20190110 Q: 2

Rock salt is a mixture of the soluble salt, sodium chloride, and some insoluble impurities.

The diagram shows the first three stages of a method used to obtain pure sodium chloride from rock salt.



Stage 1
rock salt crushed

Stage 2
crushed rock salt added to water

Stage 3

(a) Name the pieces of apparatus labelled X, Y and Z

(3)

X .....

Y .....

Z .....

(b) (i) State why the mixture of rock salt and water is warmed and stirred in stage 2.

(2)

.....

.....

.....

.....

(ii) What is water in stage 2?

(1)

☒ **A** a residue

☒ **B** a solute

☒ **C** a solution

☒ **D** a solvent

(c) (i) Explain what happens to the impurities in stage 3.

(2)

.....

.....

.....

.....

(ii) What is the liquid collected at the end of stage 3?

(1)

☒ **A** a residue

☒ **B** a solute

☒ **C** a solution

☒ **D** a solvent

(Total for Question 2 = 9 marks)

2. 4CH0_1C_que_20180110 Q: 4

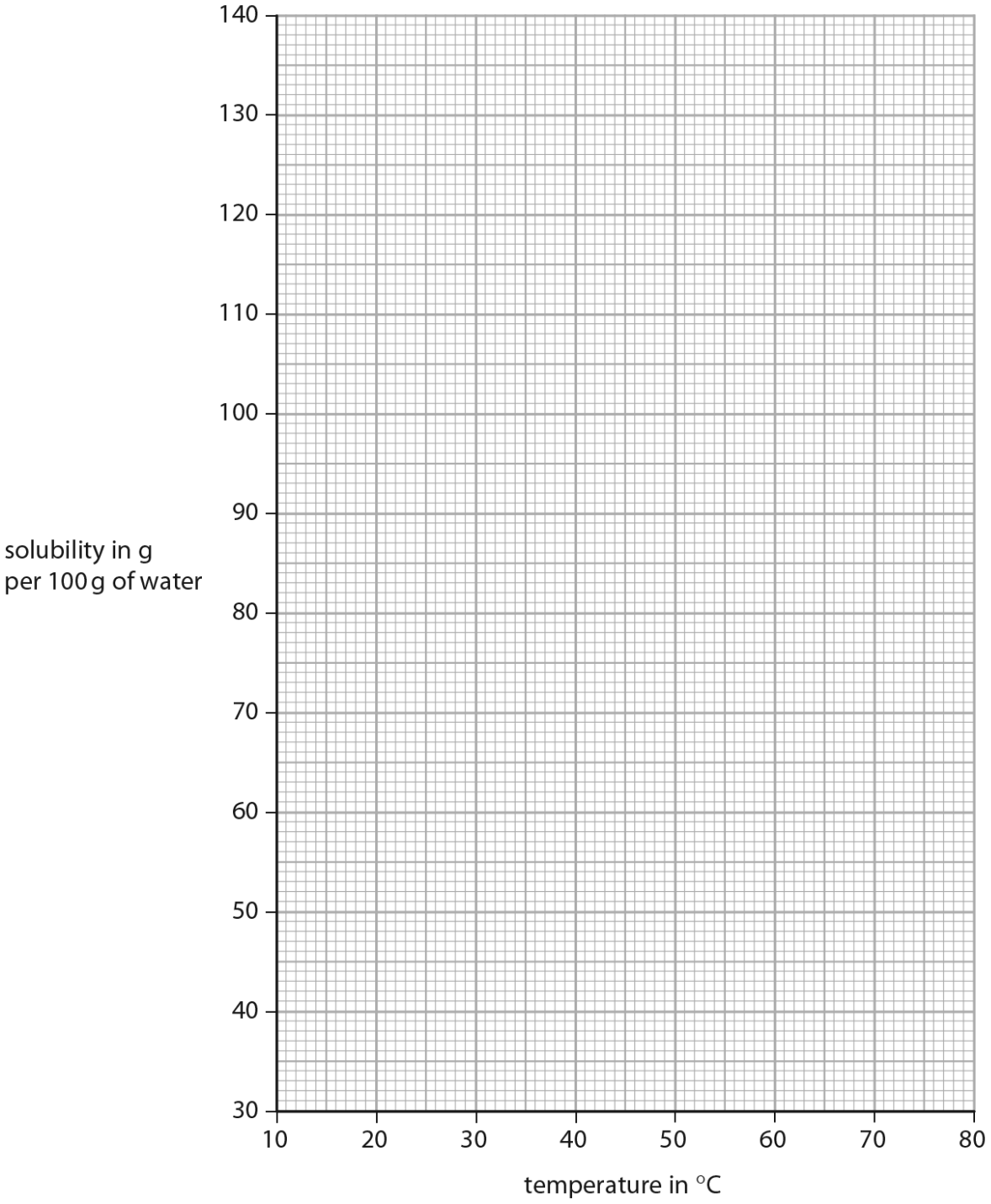
The maximum mass of a solid that dissolves in 100 g of water at a given temperature is called its solubility.

The table gives the solubility of potassium nitrate at six different temperatures.

Temperature in °C	20	30	40	50	60	70
Solubility in g per 100 g of water	41	52	65	83	106	135

(a) Plot the points on the grid and draw a curve of best fit.

(3)



(b) Extend your curve to find the solubility of potassium nitrate at 10 °C.

(2)

solubility = ... g per 100 g of water

(c) Use your graph to find the maximum mass of potassium nitrate that could dissolve in 50 g of water at 35 °C.

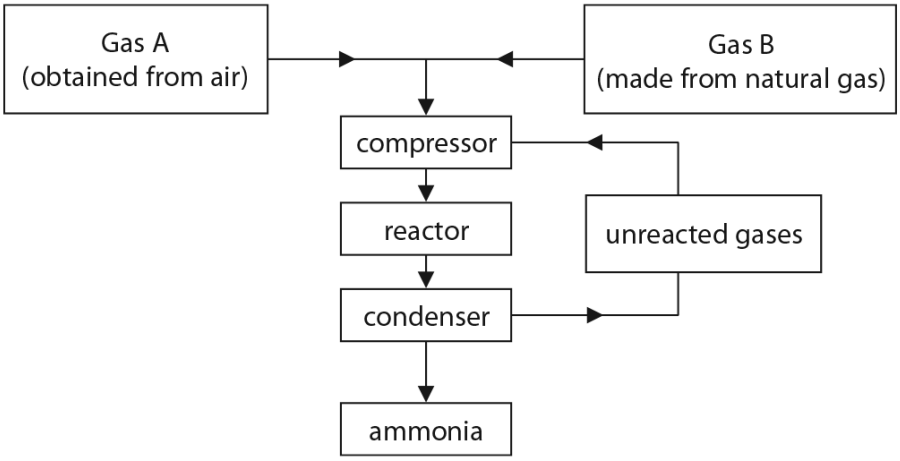
(2)

maximum mass = ... g

(Total for Question 4 = 7 marks)

3. 4CH0_1C_que_20180110 Q: 15

The flow diagram shows the main stages in an industrial process to manufacture ammonia.



(a) Give the name of this industrial process.

(1)

.....

(b) Identify gases A and B.

(2)

gas A.....

gas B.....

(c) State the purpose of the condenser.

(1)

.....

.....

(d) Name the catalyst that is used in the reactor.

(1)

.....

(e) Suggest two reasons why the unreacted gases are recycled.

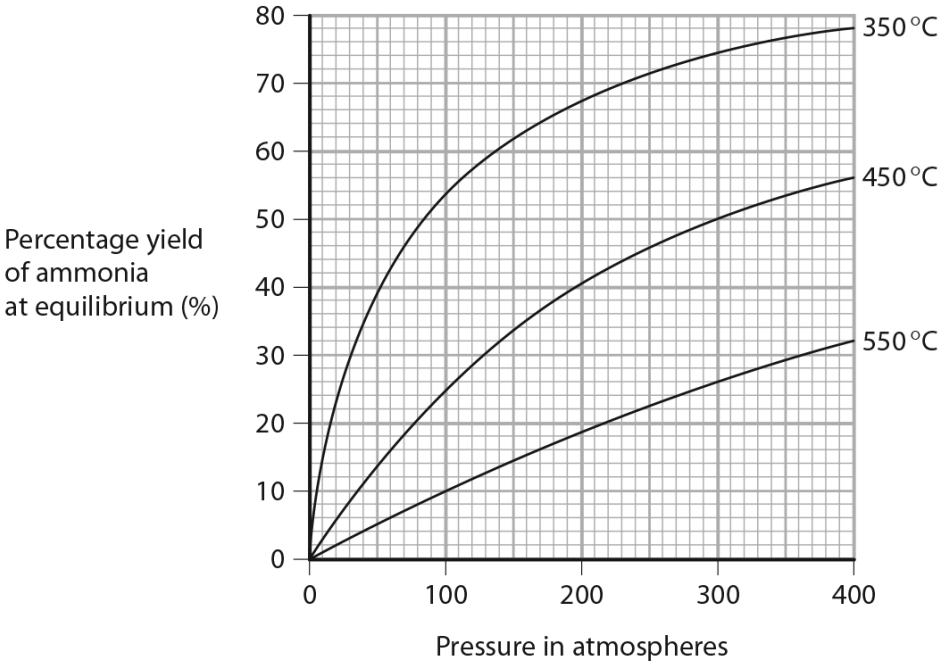
(2)

1.....

2.....

(f) The reaction to make ammonia is reversible and can reach a position of equilibrium.

The graph shows the percentage yield of ammonia at equilibrium, and at different temperatures and pressures.



(i) State the conditions of temperature and pressure that would produce the largest percentage yield of ammonia.

(2)

.....

.....

(ii) Find the percentage yield of ammonia at equilibrium, at a pressure of 200 atmospheres and a temperature of 450 °C.

(1)

.....

(iii) Suggest why, in the industrial process, the percentage yield of ammonia at 200 atmospheres and 450 °C is only 15%.

(1)

.....

.....

(Total for Question 15 = 11 marks)

4. 4CH0_1C_que_20180517 Q: 11

Malachite is an ore of copper containing copper(II) carbonate and several other compounds that are insoluble in water.

You are supplied with several pieces of malachite, these chemicals and items of apparatus.

Chemicals: dilute sulfuric acid magnesium powder

Apparatus: beakers filter funnel and paper pestle and mortar

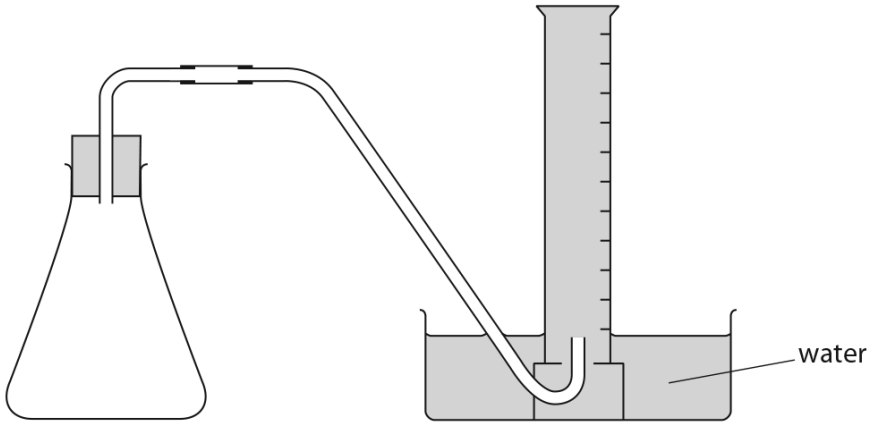
Describe how you would use the chemicals and the apparatus to obtain a sample of copper from the malachite.

(6)

(Total for Question 11 = 6 marks)

5. 4CH0_1CR_que_20170518 Q: 5

A student uses this apparatus to investigate the rate of reaction between an excess of magnesium and two different dilute acids, X and Y.



This is the method given to the student.

- place 0.5 g of magnesium ribbon into the conical flask
- use a measuring cylinder to add 50 cm^3 of dilute acid X and then replace the bung
- record the total volume of gas collected every 20 seconds for two minutes
- repeat the method using 50 cm^3 of dilute acid Y instead of dilute acid X
- in each experiment, keep the temperature the same and the magnesium in excess

(a) The student decides to use a burette, rather than a measuring cylinder, to add the acid to the conical flask.

(i) Using a burette would be an improvement only if another change is made to the method.

State the other change needed to the method.

(1)

.....

.....

(ii) State the advantage of using a burette.

(1)

.....

.....

(b) The table shows the student's results.

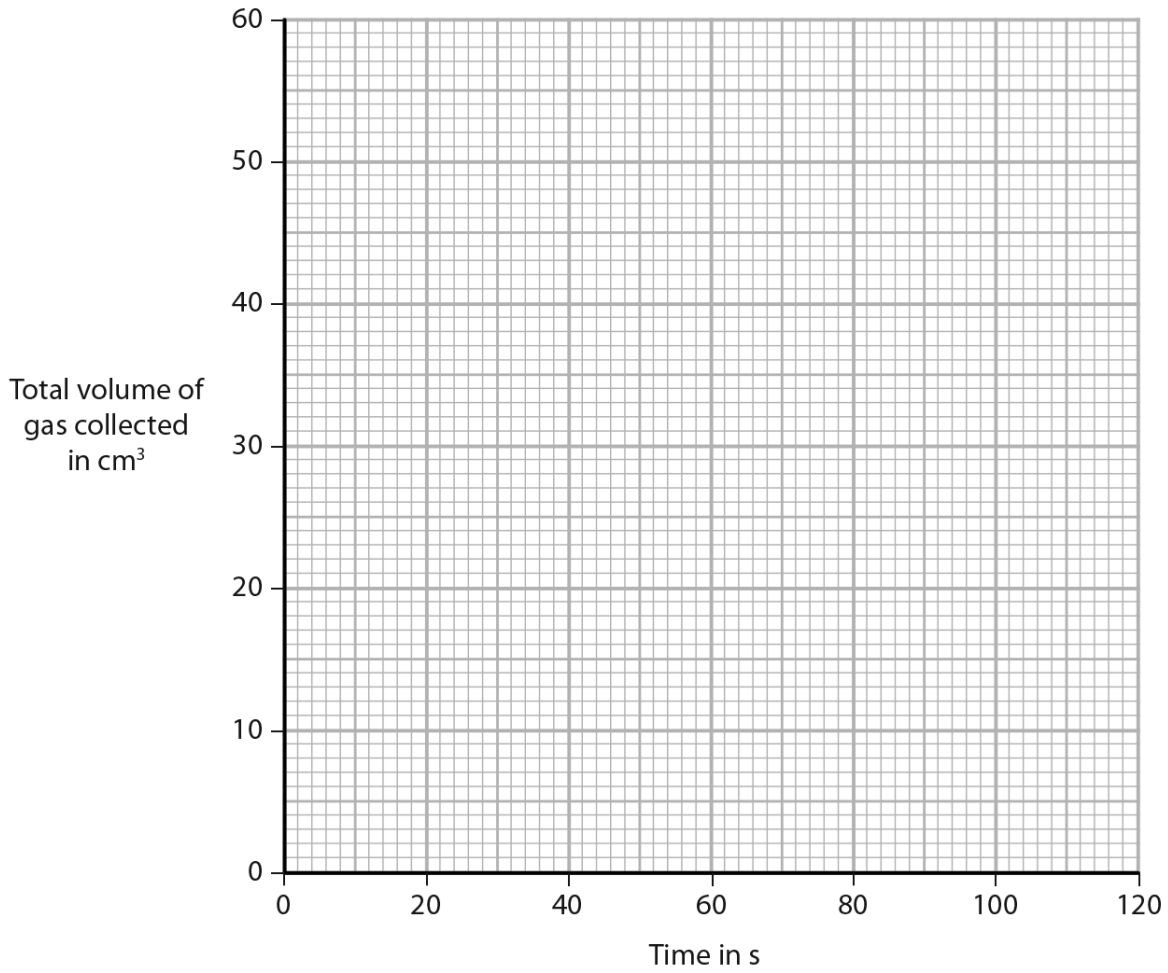
	Time in s	0	20	40	60	80	100	120
Acid X	**Total volume of gas collected in cm^3**	0	6	11	15	18	20	21
Acid Y	**Total volume of gas collected in cm^3**	0	12	22	30	37	43	48

Plot the results for each acid on the grid.

Draw a curve of best fit for each set of points.

Label each curve as acid X or acid Y.

(4)



(c) Explain how the curves show which acid has the greater concentration.

(2)

.....

.....

.....

.....

.....

.....

(d) Use the graph to find the total volume of gas collected at 70 s for acid X.

Show on the graph how you obtained your answer.

(2)

volume of gas = ... cm^3

(e) The average (mean) rate of the reaction for acid Y can be calculated using the expression

$$\text{average rate} = \frac{\text{total volume of gas collected}}{\text{time to collect the gas}}$$

Calculate the average rate, in cm^3/s, for the first 30 s for acid Y.

(2)

average rate = ... cm^3/s

(Total for Question 5 = 12 marks)

Chapter 2

Principles of chemistry

2.1 States of matter

6. 4CH1_1CR_que_20220108 Q: 2

(a) (i) State the meaning of the term **solute**.

(1)

(ii) State the meaning of the term **solvent**.

(1)

(b) Explain what is meant by a saturated solution.

(2)

(c) A dark purple liquid is diluted by adding water.

The diluted liquid becomes a pale purple colour.

Explain the process that causes this change.

Refer to particles in your answer.

(2)

(Total for Question 2 = 6 marks)

7. 4CH1_1C_que_20210304 Q: 1

This question is about states of matter.

(a) Use the words solid, liquid or gas to give the initial and final state of matter for each of the changes listed in the table.

The first one has been done for you.

(3)

Change	Initial state	Final state
melting	solid	liquid
sublimation		
condensing		
evaporation		

(b) Particles in a solid are closely packed, arranged in a regular pattern and vibrate about fixed positions.

Describe the arrangement and movement of the particles in a gas.

(3)

.....

.....

.....

.....

.....

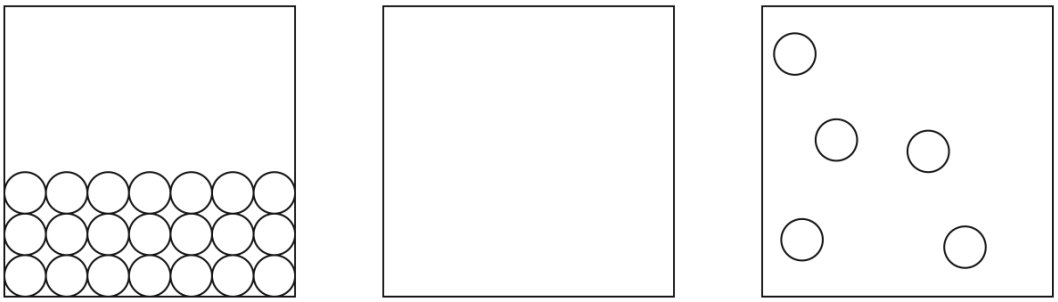
.....

(Total for Question 1 = 6 marks)

8. 4CH1_1CR_que_20200305 Q: 2

This question is about states of matter.

(a) The diagram shows how the particles of a substance are arranged in two different states.



solid liquid gas

(i) Complete the diagram to show how particles are arranged in the liquid state.

(1)

(ii) Identify the state of matter in which the particles have the most energy.

(1)

(b) The state symbols (s), (l), (g) and (aq) are often used in chemistry.

The table shows some physical changes.

Complete the table by giving the state symbol before and after each change.

(3)

	State symbol	
Physical change	**before change**	**after change**
water evaporates		
crystals of iodine sublime		
ice melts		

(c) Explain why hot water evaporates more quickly than cold water.

(2)

.....

.....

.....

.....

(Total for Question 2 = 7 marks)

9. 4CH0_1C_que_20190110 Q: 1

The three states of matter are solid, liquid and gas.

(a) Substances can be changed from one state to another.

The box lists some words relating to changes of state.

condensing	cooling	evaporation
heating	melting	sublimation

Complete the table by giving the correct word from the box for each change of state.

Each word may be used once, more than once, or not at all.

(3)

Change of state	Name of change
from solid to liquid	
from liquid to gas	
from solid to gas	

(b) The particles in a solid are closely packed, arranged in a regular pattern and vibrate about a fixed position.

Describe the arrangement and movement of the particles in a gas.

(3)

.....

.....

.....

.....

.....

.....

(Total for Question 1 = 6 marks)

10. 4CH1_1CR_que_20190517 Q: 1

This question is about the three states of matter, solid, liquid and gas.

(a) Solids, liquids and gases can be changed from one state to another.

The box gives the names of some changes of state.

condensing	evaporation	melting	sublimation

Use words from the box to complete the sentences.

Each word may be used once, more than once or not at all.

(i) The change from solid to liquid is called .....

(1)

(ii) The change from liquid to gas is called .....

(1)

(iii) The change from solid to gas is called .....

(1)

(b) Describe the arrangement and the movement of particles in a solid.

(3)

.....

.....

.....

.....

.....

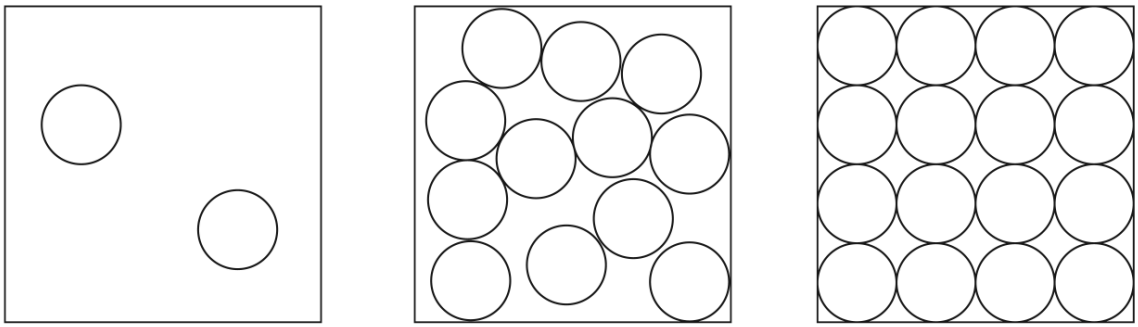
.....

(Total for Question 1 = 6 marks)

11. 4CH0_1C_que_20180110 Q: 2

The diagram shows the arrangement of particles in the three states of matter.

Each circle represents a particle.



X Y Z

(a) Use the letters X, Y and Z to give the starting and finishing states of matter for each of the changes in the table.

The first one has been done for you.

(3)

Change	Starting state	Finishing state
ice to water	Z	Y
solid iodine to iodine gas		
molten iron to solid iron		
ethene to poly(ethene)		

(b) Which of these changes takes place when solid iodine is heated to form iodine gas?

(1)

☒ **A** crystallisation

☒ **B** evaporation

☒ **C** melting

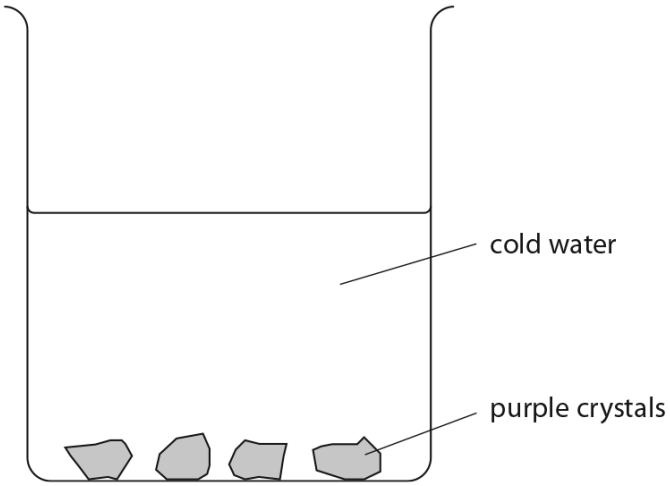
☒ **D** sublimation

(Total for Question 2 = 4 marks)

12. 4CH0_1C_que_20180110 Q: 3

A student places a few purple crystals at the bottom of a beaker containing some cold water.

The crystals start to dissolve.



(a) State how the appearance of the crystals and the water change as the crystals dissolve.

(2)

crystals.....

.....

water.....

.....

(b) Which process occurs as the crystals dissolve to form a solution?

(1)

☒ **A** condensation

☒ **B** crystallisation

☒ **C** diffusion

☒ **D** melting

Appendix A

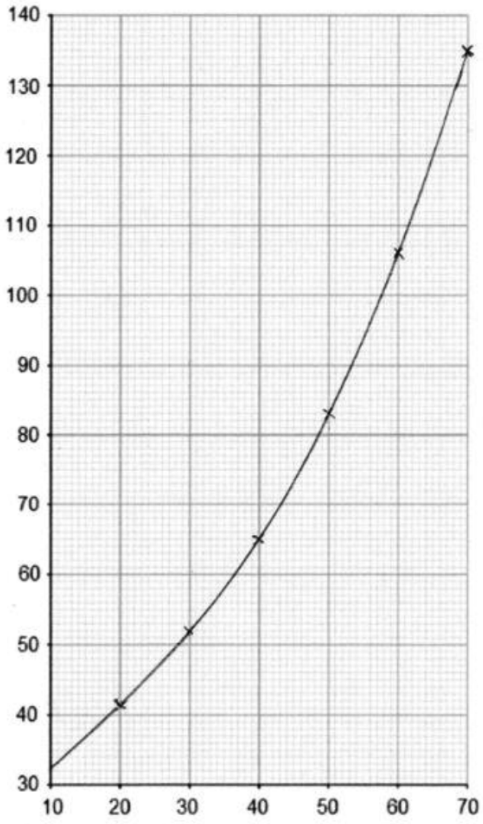
Answers

1. 4CH0_1C_rms_20190110 Q: 2

Question number	Answer	Notes	Marks
(a)	M1 tripod M2 Y (filter) funnel M3 Z evaporating basin/dish	ACCEPT correct labelling on diagram if answers not on answer lines ALLOW evaporating bowl	3
(b)(i)	M1 so the sodium chloride/salt dissolves M2 (more) quickly	REJECT so the rock salt dissolves IGNORE references to increased rate of reaction M2 dep on mention of dissolving in M1	2
(ii)	**D** a solvent		1
(c)(i)	M1 impurities remain in filter paper/funnel M2 because they are insoluble / do not dissolve	ALLOW impurities are filtered out/off /are the residue ACCEPT because the particles are too large to pass through (filter paper)	2
(ii)	**C** a solution		1

Total for Question 2 = 9 marks

2. 4CH0_1C_rms_20180110 Q: 4

Question number	Answer	Notes	Marks
(a)		**M1** and **M2** all points plotted correctly to nearest gridline Penalise 1 mark for each point plotted incorrectly **M3** suitable curve of best fit drawn for points plotted Do not consider any extrapolation of curve for M3	3
(b)	**M1** curve correctly extrapolated to cut y axis (at 10 °C) **M2** correct reading to nearest gridline from curve drawn	typical answer in range 32-33	2
(c)	**M1** correct reading to nearest gridline at 35 °C from curve drawn **M2** value from **M1** divided by 2 and correctly evaluated	typical answer = 58	2

Total 7 marks

3. 4CH0_1C_rms_20180110 Q: 15

Question number	Answer	Notes	Marks
(a)	Haber (process)		1
(b)	**M1** (gas A) - nitrogen/N_2	If name and formula given both must be correct	1
	M2 (gas B) - hydrogen/H_2	If both answers correct but in wrong order award 1 mark	1
(c)	to liquefy the ammonia	IGNORE to condense the ammonia ALLOW to separate the ammonia from the unreacted gases/nitrogen and hydrogen	1
(d)	iron		1
(e)	Any two from:		
	M1 saves raw materials/resources	ALLOW stops raw materials/resources being wasted	2
	M2 uses less energy	ACCEPT saves energy	
	M3 to produce more ammonia / to improve yield (of ammonia)	ALLOW so recycled gases/nitrogen and hydrogen/they can be reacted again IGNORE references to saves money	
(f) (i)	**M1** 350 (°C)	ACCEPT low temperature	1
	M2 400 (atm)	ACCEPT high pressure If numerical answers given units or indication of which is temp/pressure required	1
(ii)	40 (%)	ACCEPT range 40-41 (%)	1
(iii)	the reaction does not reach equilibrium		1

Total 11 marks

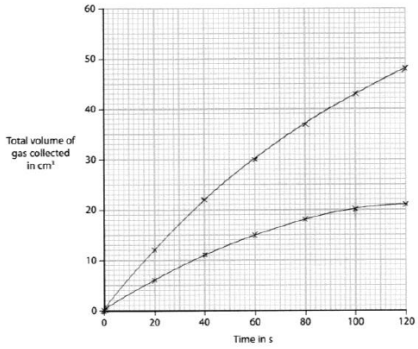
4. 4CH0_1C_rms_20180517 Q: 11

Question number	Answer	Notes	Marks
	M1 powder/crush the malachite (using the pestle and mortar) **M2** add the malachite/powder to dilute sulfuric acid (in a beaker) **OR** add dilute sulfuric acid to the malachite (in a beaker) **M3** filter (using filter funnel and paper) **M4** add magnesium powder to the filtrate/solution/copper sulfate **M5** method to collect/obtain/ remove the residue/copper (using filter funnel and paper) **M6** reference to appropriate use of at least two pieces of apparatus	**ALLOW** powder/crush the ore **ACCEPT** mix the powder with dilute sulfuric acid (in a beaker) **ALLOW** decant **IGNORE** any later steps e.g. washing / evaporation	6

Q	Answer	Notes	Mark
	OR <u>If malachite and magnesium are both added to the acid at the same time, then:</u> **M1** powder/crush the malachite (using the pestle and mortar) **M2** add the malachite/powder to dilute sulfuric acid and add the magnesium (in a beaker) **M3** filter and collect/obtain the residue/copper (using filter funnel and paper) **M4** reference to appropriate use of at least two pieces of apparatus	**IGNORE** any later steps e.g. washing / evaporation	

Total for Question 11 = 6 marks

5. 4CH0_1CR_rms_20170518 Q: 5

Question number	Answer	Notes	Marks
(a) (i)	add acid before magnesium	ORA	1
(ii)	a burette has a better resolution (than a measuring cylinder)	**ALLOW** greater accuracy (of data) **ALLOW** greater precision (of data)	1
(b)	 **M1** and **M2** all points plotted correctly to the nearest gridline for both experiments **M3** suitable curve of best fit drawn for acid X **M4** suitable curve of best fit drawn for acid Y	Deduct one mark for each incorrectly plotted point Missing (0,0) loses 1 mark only	4

Q	Answer	Notes	Mark
(c)	**M1 Y** (has the greater concentration) **M2** (because) the curve (for acid Y) has a steeper slope/greater gradient (showing that the reaction is faster) **OR** (because) it produces the larger volume of gas/more gas in the same time	 **M1** DEP **M2** OWTTE Mark CSQ on candidate's labelling of their curves If no labelling assume steeper curve is acid Y	2
(d)	**M1** vertical line drawn to touch curve at t = 70 s **OR** horizontal line drawn to touch curve at t = 70 s **M2** value read correctly from candidate's graph to nearest gridline	 Expected value in range 16-17 (cm^3)	2
(e)	**M1** 17 (cm^3) **M2** (17 ÷30) = 0.57 (cm^3/s)	**ACCEPT** value read correctly from candidate's graph to nearest gridline **ACCEPT** any number of sig figs e.g. 0.6, 0.567, 0.56 recurring Mark **M2** CSQ on **M1**	2
		Total	**12**

6. 4CH1_1CR_rms_20220108 Q: 2

Question number	Answer	Notes	Marks
(a) (i)	(solute is) the substance/solid that dissolves (in a solvent) OWTTE		1
(ii)	(solvent is) the substance/liquid the solute/solid/substance dissolves in OWTTE		1
(b)	**M1** (saturated solution) contains as much dissolved solute/solid/substance as possible OWTTE **M2** at a particular temperature		2
(c)	**M1** process called diffusion **M2** particles spread out (evenly throughout water/solution/liquid)	 **ALLOW** particles move from area of high concentration to area of low concentration	2
		Total for Question 2 = 6 marks	

7. 4CH1_1C_rms_20210304 Q: 1

<table>
<tr><th>Question number</th><th>Answer</th><th>Notes</th><th>Marks</th></tr>
<tr><td>(a)</td><td><table><tr><th>Start</th><th>End</th></tr><tr><td>solid</td><td>liquid</td></tr><tr><td>solid</td><td>gas</td></tr><tr><td>gas</td><td>liquid</td></tr><tr><td>liquid</td><td>gas</td></tr></table></td><td>Award 1 mark for each correct row

ALLOW gas to solid for sublimation</td><td>3</td></tr>
<tr><td>(b)</td><td>A description that refers to any three of the following points

M1 irregular /random arrangement (of particles)

M2 large gaps between them /far apart /widely spaced

M3 random movement / move freely

M4 move (very) quickly</td><td>

ALLOW spread out

IGNORE references to kinetic energy</td><td>3</td></tr>
<tr><td colspan="3"></td><td>6 marks</td></tr>
</table>

8. 4CH1_1CR_rms_20200305 Q: 2

Question number	Answer	Notes	Marks
(a) (i)	Particles should be close together and should fill from the bottom of the box, some particles should touch	**ALLOW** particles filling the whole box **IGNORE** the size of the particles **REJECT** a regular arrangement	1
(ii)	Gas	**ALLOW** gaseous	1
(b)	**M1** (water evaporates) l to g **M2** (crystals of iodine sublime) s to g **M3** (ice melts) s to l	**ALLOW** words for M1, M2 and M3	3
(c)	**M1** (particles / molecules have) more energy **M2** to overcome / break the forces (between water molecules)	**ALLOW** water has more energy **ALLOW** (particles / molecules have) move faster **IGNORE** vibrate more **ALLOW** to overcome / break the bonds (between water molecules) **OR** to break away from one another **OR** so escape more easily **IGNORE** references to collisions or activation energy	2

9. 4CH0_1C_rms_20190110 Q: 1

Question number	Answer	Notes	Marks
(a)	M1 melting M2 evaporation M3 sublimation		3
(b)	Any three from M1 (Arrangement of particles) irregular M2 large gaps between them /far apart /widely spaced M3 random movement / move freely M4 move (very) quickly	 ALLOW spread out IGNORE references to kinetic energy	3

Total for Question 1 = 6 marks

10. 4CH1_1CR_rms_20190517 Q: 1

Question number	Answer	Notes	Marks
a (i)	melting		1
(ii)	evaporation		1
(iii)	sublimation		1
b	A description that refers to three of the following points **M1** (particles) close together **M2** (particles) regularly arranged **M3** (particles) do not move around **M4** (particles) vibrate (about a fixed position)	 **ALLOW** tightly packed/ touching **ALLOW** arranged in a lattice **M1** and **M2** can be scored from a diagram **ALLOW** do not move freely **IGNORE** references to fixed shape and volume	3 **Total 6**

11. 4CH0_1C_rms_20180110 Q: 2

<table>
<tr><th>Question number</th><th>Answer</th><th>Notes</th><th>Marks</th></tr>
<tr><td>(a)</td><td>
<table>
<tr><th>Change</th><th>Starting state</th><th>Finishing state</th></tr>
<tr><td>ice to water</td><td></td><td></td></tr>
<tr><td>solid iodine to iodine vapour</td><td>Z</td><td>X</td></tr>
<tr><td>molten iron to solid iron</td><td>Y</td><td>Z</td></tr>
<tr><td>ethene to (poly)ethene</td><td>X</td><td>Z</td></tr>
</table>
</td><td>1 mark for each correct row</td><td>3</td></tr>
<tr><td>(b)</td><td>D (sublimation)</td><td></td><td>1</td></tr>
</table>

Total 4 marks

12. 4CH0_1C_rms_20180110 Q: 3

Question number	Answer	Notes	Marks
(a)	**M1** (crystals) - get smaller **M2** (water) - turns (from colourless to) purple	ACCEPT disappear IGNORE dissolve IGNORE reference to (incorrect) colours/loses colour IGNORE mass decreases ALLOW pink IGNORE goes cloudy ALLOW (water) turns to colour of crystals REJECT other incorrect observations, e.g. fizzing, crystals change colour, only once in (a)	2
(b)	**C** diffusion		1
(c)(i)	(water would change colour/go purple) more quickly	ALLOW change (in appearance) /it happens more quickly ALLOW (dissolves) more quickly IGNORE cloudy/incorrect colour ALLOW references to darker purple/colour with hot water ALLOW references to faster reaction IGNORE references to collisions	1
(c)(ii)	**M1** particles/molecules/ions/they have more (kinetic) energy/are moving faster (in hot water) **M2** particles/molecules/ions/they diffuse/spread more quickly	ALLOW reverse argument in cold water If change is slower in (i) then ALLOW particles/molecules/ions have less (kinetic) energy/are moving slower ALLOW particles/molecules/ions/they dissolve more quickly ALLOW more particles dissolve ALLOW references to more frequent collisions between water molecules and crystals	2

Total 6 marks

13. 4CH0_1C_rms_20170111 Q: 2

Question number	Answer	Notes	Marks
(a)	diagram showing solid state	Accept minimum of two complete rows	1
(b)	C (regular vibrating)		1
(c)	C (freezing)		1
(d)	sublimation		1
(e)	M1 water vapour M2 steam	Accept in either order	2
		(Total for Question 2 = 6 marks)	

14. 4CH1_1CR_rms_20220108 Q: 3

Question number	Answer	Notes	Marks
(a)	**M1** (same) solvent **M2** (same type of chromatography) paper	**ALLOW** (same) named solvent eg water **IGNORE** reference to size/length **of paper** **ALLOW** reference to use of pencil (for start line)/spots must start on horizontal line /solvent must start below line or spots **ALLOW** same distance travelled by solvent **IGNORE** distance of line from bottom of paper **IGNORE** amount/volume/concentration of solvent /references to size/volume of dyes or spots /references to temperature/time	2
(b) (i)	C is insoluble (in the solvent)		1
(ii)	**M1** Student 2 and dye D/(R_f value) 1.20 **M2** because R_f value must be less than 1 / cannot be greater than 1	 ALLOW spot cannot move further than solvent front OWTTE	2

Question number	Answer	Notes	Marks
(c)	**M1** (R_f =) $\frac{9.7}{12}$ **M2** = 0.808(33..) **M3** = 0.81 (to 2 SF)	 0.808(33..) with no working scores **M1** and **M2** **ALLOW M2** ECF if used 10.7 or 13 and $R_f < 1$ **ALLOW** 1 mark for $\frac{12}{9.7}$ = 1.2(37..) **ALLOW M3** ECF **M2** (must be correct to 2 SF) 0.81 with no working scores 3	3
		Total for Question 3 = 8 marks	

15. 4CH1_1C_rms_20210304 Q: 5

Question number	Answer	Notes	Marks
(a)	**Method** filtration simple distillation **or** fractional distillation fractional distillation crystallisation	**ALLOW** filtering **ALLOW** distillation **REJECT** simple distillation or distillation	4
(b) (i)	M1 A and B M2 because they are the same height /moved the same distance up the paper / have the same R_f values as the spots in the purple ink	 M2 dep on M1 correct or missing	2
(ii)	M1 D M2 because the spot is closest to the start line /travelled the least distance (from the start line) / has the lowest R_f value	 M2 dep on M1 correct or missing	2
(c)	Example calculation M1 120 × 0.72 M2 86 / 86.4 (mm)	Correct answer of 86 or 86.4 (mm) with or without working scores 2	2
			10 marks

16. 4CH1_1C_rms_20210428 Q: 4

Question number	Answer	Notes	Marks
(a) (i)	A description including any three of the following **M1** pour some solvent into a beaker /chromatography tank **M2** place the paper in the solvent so that the food colourings are above the level of the solvent **M3** leave the paper until the solvent reaches the level shown in the diagram/ has moved to near the top of the paper OWTTE **M4** take the paper out and leave to dry	**M1** and **M2** can be scored from a labelled diagram **ALLOW** any named solvent	3
(ii)	one/1		1
(iii)	(F/it is) insoluble (in the solvent)/ does not dissolve (in the solvent)		1
(iv)	**M1** E and H **M2** they contain a dye that moved the furthest (distance up the paper)/ is closest to the solvent front / has the greatest R_f value	 **M2** dep on **M1**	2
(b)	**M1** distance moved by solvent = 59-61mm **and** distance moved by the dye = 37-41mm **M2** distance moved by the dye ÷ distance moved by the solvent ≈ 0.67 **M3 (**the dye in food colouring) G	**ALLOW** distances in cm e.g. 6cm and 4cm If paper has been printed on A4 distances will be 51-53mm and 33-37mm **ALLOW** alternative methods	3 **Total 10**