IGCSE Edexcel Chemistry Revision

Revision Guide Section 1: Particles and Mixtures

Paper 1 [All Pathways]

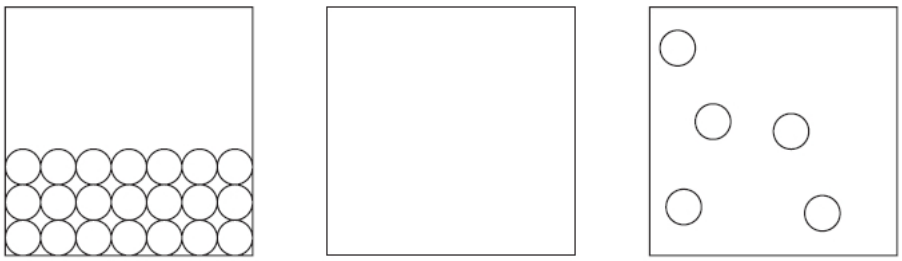
Please note, these questions may have parts related to **other** topics within the GCSE Chemistry course. However, all questions are related at least in part to Particles and Mixtures

Questions taken from 2019 and 2020 January and June Papers (C and CR)

10 questions
78 marks
Recommended time: 85 minutes

1. 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)

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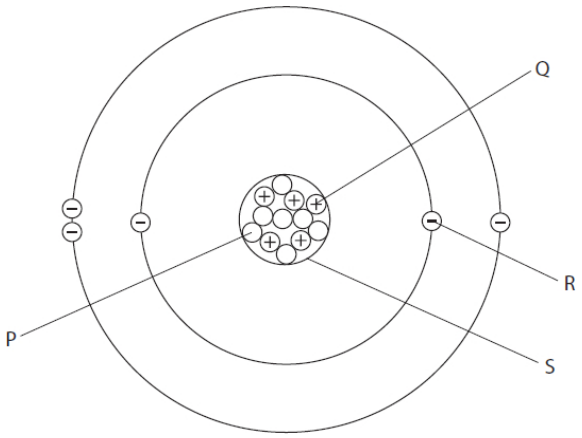
(Total for question = 7 marks)

2. The diagram shows the particles in an atom of an element.



(a) Name the particles labelled P, Q and R. (3)

P .....

Q .....

R .....

(b) Name the part of the atom labelled S. (1)

.....

(c) (i) What is the atomic number of this atom? (1)

- ☐ A 5
- ☐ B 7
- ☐ C 12
- ☐ D 17

(ii) What is the mass number of this atom? (1)

- ☐ A 5
- ☐ B 7
- ☐ C 12
- ☐ D 17

(iii) Identify this element. (1)

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(Total for question = 7 marks)

3. This question is about ammonium chloride.

(a) Give the formula of the ammonium ion. (1)

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(b) Describe a test to show that ammonium chloride contains ammonium ions. (3)

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(c) The equation shows the thermal decomposition of ammonium chloride.

$$NH_4Cl(s) \rightleftharpoons NH_3(g) + HCl(g)$$

State what the $\rightleftharpoons$ symbol indicates about this reaction. (1)

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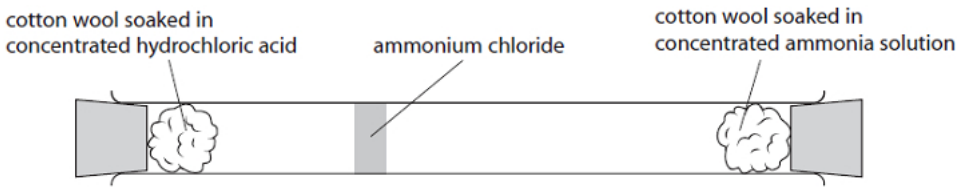
.....

(d) The diagram shows the formation of ammonium chloride in a glass tube.



(i) Explain how the mean speed of ammonia molecules compares with the mean speed of hydrogen chloride molecules. (2)

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(ii) Gas particles travel very quickly.
Give two reasons why it takes several minutes for the ammonium chloride to form. (2)

1 .....

.....

2 .....

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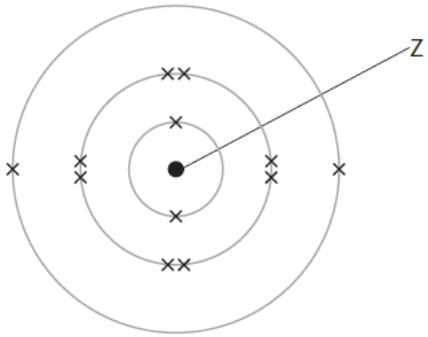
(Total for question = 9 marks)

4. The diagram shows the electronic configuration of an atom of an element.



(a) Complete the table by giving the missing information about this atom. (5)

name of the part of this atom labelled Z	
number of protons in this atom	
number of the group that contains this element	
number of the period that contains this element	
the charge on the ion formed from this atom	

(b) This element has three isotopes.
The table shows the mass number and percentage abundance of each isotope in a sample of this element.

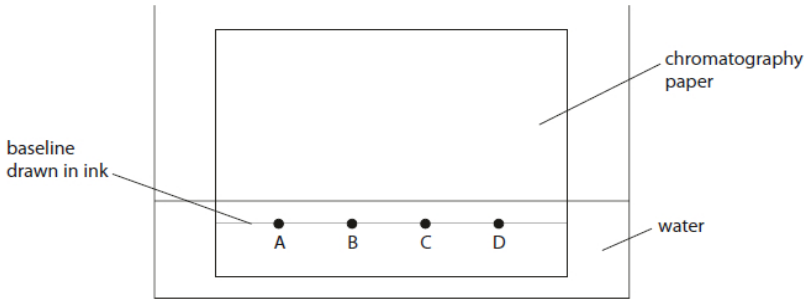
Mass number	Percentage abundance (%)
24	79.2
25	10.0
26	10.8

Calculate the relative atomic mass (A_r) of this element.
Give your answer to one decimal place. (3)

relative atomic mass = ...

(Total for question = 8 marks)

5. A student uses this apparatus to investigate the colours in four different inks, A, B, C and D.



(a) Explain two mistakes the student made when setting up his experiment. (4)

1 .....

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2 .....

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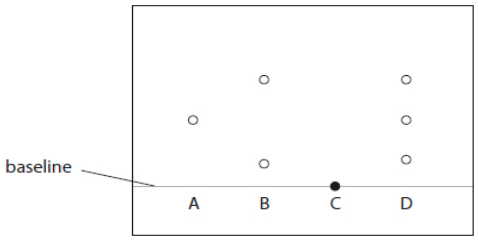
(b) Another student does the experiment but does not make any mistakes. The diagram shows her results.



(i) State how many colours ink D contains. (1)

.....

(ii) State which of the inks tested could be mixed together to make ink D. (1)

.....

(iii) Explain which of the inks tested is insoluble in water. (2)

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(Total for question = 8 marks)

6. A student uses paper chromatography to investigate the dyes in five different inks, V, W, X, Y and Z.
   This is what she uses.
   - a beaker
   - a piece of chromatography paper with a pencil line drawn near the bottom of the paper
   - a solvent
   - inks V, W, X, Y and Z

(a) Describe how the student should set up and carry out her experiment.
You may draw a diagram to help with your answer. (4)

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(b) Explain why the line on the paper is drawn in pencil rather than in ink. (2)

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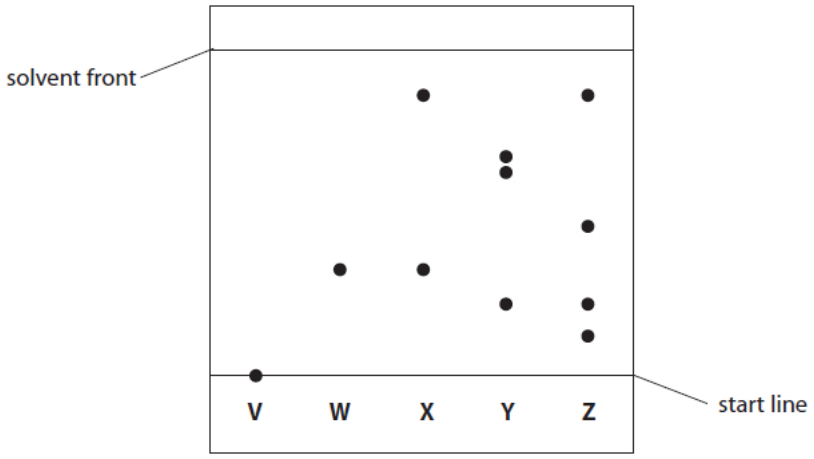
(c) The chromatogram shows the results for inks V, W, X, Y and Z.



(i) Explain which ink contains a dye that is insoluble in the solvent. (2)

.....

.....

(ii) Explain which two inks contain the dye that is likely to be the most soluble in the solvent. (2)

.....

.....

(iii) Explain which two inks may contain only one dye. (2)

.....

.....

(d) One dye in ink Y moves 4.3 cm when the solvent front moves 6.5 cm.
Calculate the value for this dye.
Give your answer to 2 significant figures. (3)

R_f = ...

(Total for question = 15 marks)

7. Answer the question with a cross in the box you think is correct ☒. If you change your mind about an answer, put a line through the box ☒ and then mark your new answer with a cross ☒.
Iron reacts with dilute sulfuric acid to form a salt called iron(II) sulfate.
The formula of iron(II) sulfate is $FeSO_4$

(a) (i) How many different elements are there in iron(II) sulfate? (1)

- ☐ A 2
- ☐ B 3
- ☐ C 4
- ☐ D 6

(ii) Use information from the Periodic Table to calculate the relative formula mass of iron(II) sulfate. (2)

relative formula mass = ...

(b) Some iron filings are added to dilute sulfuric acid. The mixture is warmed and hydrogen gas is given off.

(i) State why the mixture is warmed. (1)

.....

.....

(ii) State the observation that shows a gas is being given off. (1)

.....

(iii) Give the test for hydrogen gas. (1)

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(c) When the reaction stops, some iron filings remain.

(i) State why the reaction stops. (1)

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(ii) Give a chemical equation for the reaction between iron and sulfuric acid.(1)

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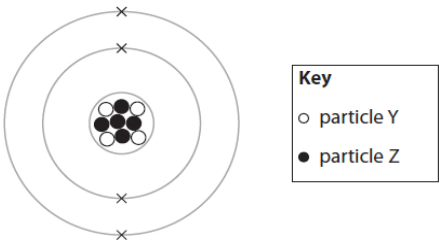
(Total for question = 8 marks)

8. The diagram shows the particles in the atom of an element.



(a) Particle Y is a proton.
What is particle Z? (1)

- ☐ A an electron
- ☐ B a molecule
- ☐ C a neutron
- ☐ D a nucleus

(b) Which of these has the smallest mass? (1)

- ☐ A an electron
- ☐ B a neutron
- ☐ C a nucleus
- ☐ D a proton

(c) What is the mass number of this atom? (1)

- ☐ A 4
- ☐ B 5
- ☐ C 9
- ☐ D 13

(d) What is the atomic number of this atom? (1)

- ☐ A 4
- ☐ B 5
- ☐ C 9
- ☐ D 13

(e) (i) Identify the element that contains this atom. (1)

.....

(ii) State what is formed when this atom loses its outer shell electrons. (1)

.....

(Total for question = 6 marks)

9. 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)

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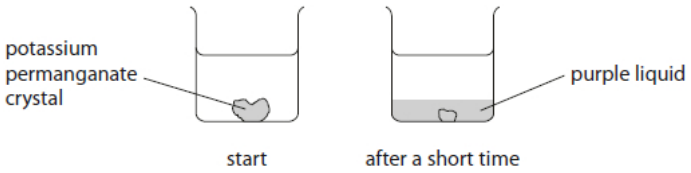
(Total for question = 6 marks)

10. Potassium permanganate is a purple solid that is soluble in water.
A crystal of potassium permanganate is placed in a beaker containing water.



(a) After a short time, the crystal becomes smaller and the liquid at the bottom of the beaker becomes purple.
Which statement explains this observation? (1)

- ☐ A the crystal condenses in the water
- ☐ B the crystal dissolves in the water
- ☐ C the crystal evaporates in the water
- ☐ D the crystal melts in the water

(b) The beaker is left until there is no further change in the appearance of the liquid.
(i) Which statement describes the final appearance of the liquid? (1)

- ☐ A all of the liquid is purple
- ☐ B none of the liquid is purple
- ☐ C only the bottom half of the liquid is purple
- ☐ D only the top half of the liquid is purple

(ii) Which process causes this change in appearance? (1)

- ☐ A condensation
- ☐ B crystallisation
- ☐ C diffusion
- ☐ D evaporation

(c) The formula of potassium permanganate is $KMnO_4$
How many different elements are there in potassium permanganate? (1)

- ☐ A 3
- ☐ B 4
- ☐ C 6
- ☐ D 7

(Total for question = 4 marks)

Mark Scheme

Q1.

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

(**Q02 4CH1/1CR, Jan 2020**)

Q2.

Question number	Answer	Additional guidance	Marks
(a) (i)	**M1** P – neutron(s) **M2** Q – proton(s) **M3** R- electron(s)		3
(b)	nucleus	**ALLOW** nuclei	1

(c) (i)	**A** (5) **B** is incorrect as 7 is the number of neutrons not the atomic number **C** is incorrect as 12 is the mass number not the atomic number **D** is incorrect as 17 is the total number of protons, neutrons and electrons, not the atomic number		1
(ii)	**C** (12) **A** is incorrect as 5 is the atomic number not the mass number **B** is incorrect as 7 is the number of neutrons not the mass number **D** is incorrect as 17 is the total number of protons, neutrons and electrons, not the mass number		1
(iii)	Boron / B		1
		Total	**7**

(**Q01 4SS0/1C, June 2019**)

Q3.

Question number	Answer	Notes	Marks
(a)	NH_4^+	**ALLOW** NH_4^{+1} and NH_4^{1+}	1
(b)	**M1** add sodium hydroxide solution (and warm) **M2** (test the gas with damp) red litmus **M3** turns blue **OR** **M2** expose the gas to concentrated hydrochloric acid **M3** white smoke produced	 **ALLOW** (test the gas with damp) universal indicator If universal indicator is used allow blue / purple for **M3** **M3** dep on litmus or universal indicator in **M2** If sodium hydroxide solution is not added **max = 1**	3
(c)	(the reaction is) reversible	**ACCEPT** reaction that goes both ways / both forwards and backwards reactions occur **IGNORE** references to equilibrium	1

(d)(i)	**M1** (molecules / particles of) ammonia move / diffuse faster **M2** because the ammonium chloride forms near(er) to the HCl **OR** because the ammonia has travelled further (in the same time)	 **IGNORE** references to the masses / sizes of the particles	2
(d)(ii)	Any **two** from: **M1** (gas particles) move in random directions / don't travel in straight lines OWTTE **M2** (gas particles) collide with air / other particles **M3** (gas particles) collide with the walls / sides (of the tube) OWTTE	 **ALLOW** air / other particles slow them down **IGNORE** any references to rate of reaction / collisions	2

(**Q04 4CH1/1CR, Jan 2020**)

Q4.

Question number	Answer	Notes	Marks
(a)	name of the part of the atom labelled Z: nucleus number of protons in this atom: 12 number of the group that contains this element: 2 number of the period that contains this element: 3 charge on the ion formed from this atom: 2+	**ACCEPT** +2 / Mg^{2+}	5
(b)	• calculate sum of mass numbers multiplied by percentage abundances • divide answer by 100 • give answer to one decimal place Example calculation **M1** (24 x 79.2) + (25 x 10.0) + (26 x 10.8) **OR** 2431.6 **M2** 2431.6 ÷ 100 **OR** 24.316 **M3** 24.3	**REJECT** if correct working given but incorrectly evaluated **ALLOW** ECF from M1 (24 x 0.792) + (25 x 0.100) + (26 x 0.108) **OR** 24.316 with or without working scores **M1** and **M2** **ALLOW** ECF from M2 if calculated answer is to 1dp	3 **Total 8**

(**Q02 4CH1/1C, Jan 2020**)

Q5.

Question number	Answer	Notes	Marks
a	Explanations that link together the following two pairs of points: **M1** baseline has been drawn in ink **M2** and therefore it will interfere with /contaminate the results **M3** the water level is above the ink spots **M4** and therefore the inks will mix with the water	 **ACCEPT** not drawn in pencil **ACCEPT** will produce other colours/will move up the paper/will get mixed up with the ink samples **ALLOW** pencil will not interfere with the results/ pencil will not dissolve **ACCEPT** too high/above the baseline **ACCEPT** the spots are under water **ACCEPT** the inks will dissolve in the water / the inks will wash off the paper	**4**

b (i)	3		**1**
(ii)	A **AND** B		**1**
(iii)	An explanation that links together the following two points: **M1** C **M2** because the spot/ink did not move (up)	 **ACCEPT** did not spread/stayed on the baseline **M2** DEP on **M1**	**2**

(**Q04 4CH1/1C, June 2019**)

Q6.

Question number	Answer	Notes	Marks
a	A description/diagram which makes reference to the following points **M1** put (separate) spots of each of the inks on the (pencil) line. OWTTE **M2** pour some solvent into the bottom of the beaker OWTTE **M3** place the paper in the beaker so that the spots are (just) above the level of the solvent OWTTE **M4** leave until the solvent has risen up the paper (to the top/near the top and then take paper out) OWTTE	**ALLOW** water for solvent throughout If diagram shows solvent above pencil line only **M1 and M2** can be scored **DO NOT ALLOW M3** if words and diagram contradict each other **ALLOW** leave until inks stopped separating OWTTE **ALLOW** leave until spots/dyes stopped moving OWTTE **IGNORE** references to leaving for a specified length of time	4

Question number	Answer	Notes	Marks
b	An explanation which links the following two points **M1** ink would/might dissolve in the solvent **OR** pencil would not dissolve in the solvent **M2** ink would interfere with/contaminate the results OWTTE **OR** pencil would not interfere with/contaminate the results OWTTE	**ALLOW** water for solvent **ALLOW** would produce spots/other colours/get mixed up with inks/move up the paper OWTTE **IGNORE** smudge/run **ALLOW** pencil would not produce spots/not produce other colours/not get mixed up with the inks/not move up the paper OWTTE	2

Question number	Answer	Notes	Marks
c (i)	For all parts of 3c an explanation which links each of the two points **M1** V **M2** as it stayed on the start line/did not move	**ALLOW** blob/dot/mark OWTTE for spot **ACCEPT** did not produce spots/did not separate **ALLOW** has R_f value of 0 **M2 DEP on M1**	2
(ii)	**M1** X and Z **M2** as they both have a dye/spot that travelled the furthest (up the paper)	**ALLOW** both have spot closest to solvent front **ALLOW** have highest R_f value(s) **M2 DEP on M1**	2
(iii)	**M1** V and W **M2** as they both only form one spot (on the paper)	**ACCEPT** as W only has one spot and cannot tell about V (as it does not move/is insoluble) **ACCEPT** reference to the other inks/X, Y, Z form more than one spot **M2 DEP on M1**	2

Question number	Answer	Notes	Marks
d	• Working or equation for R_f value • Calculating the R_f value • Giving the answer to 2 significant figures **M1** $\frac{4.3}{6.5}$ **M2** 0.6615 **M3** 0.66	 Award one mark if correct equation for finding R_f value seen **ACCEPT** any number of sig fig must be 2 sig fig 0.66 with no working scores 3 correct answer given to 3 or more sig fig with no working scores 2 **M3 subsumes M2** can score **M2 and M3** **ECF** provided use 4.3 and 6.5 and do a division	3

(Q03 4CH1/1CR, June 2019)

Q7.

Question number	Answer	Additional guidance	Marks
(a) (i)	**B** 3 **A** is incorrect as there are not only 2 different elements **C** is incorrect as there are not 4 different elements **D** is incorrect as 6 is the total number of atoms in the formula, not the number of different elements		1
(ii)	**M1** 56 **and** 32 **and** 16 used in calculation **M2** 152	152 without working scores both marks 104 without working scores 1	2

(b) (i)	to increase the rate of reaction / to speed up the reaction	**ALLOW** make the reaction quicker/faster **ALLOW** reference to more particles having the necessary activation energy **IGNORE** reference to dissolving	1
(ii)	bubbles / fizzing / effervescence		1
(iii)	(squeaky) pop with burning /lit/lighted splint	**IGNORE** squeaky pop test without mention of burning/lit splint **ALLOW** burns with a pop	1
(c) (i)	all of the (sulfuric) acid has reacted / the (sulfuric) acid has been used up / the acid is the limiting reagent	**REJECT** any reference to reactants used up or iron (filings) used up	1
(ii)	$Fe + H_2SO_4 \rightarrow FeSO_4 + H_2$	**ACCEPT** multiples and fractions **IGNORE** state symbols, even if incorrect	1
		Total	**8**

(**Q02 4SS0/1C, June 2019**)

Q8.

Question number	Answer	Notes	Marks
(a)	C Neutron The only correct answer is C because the nucleus contains protons and neutrons. Protons are identified as the white dots A is not correct because electrons occur in the shells B is not correct because a molecule is not a particle found in the nucleus D is not correct because the nucleus contains protons **and** neutrons		1
(b)	A Electron The only correct answer is A because electrons have a relative mass of 1/1836 compared to a proton or a neutron B is not correct because a neutron has a relative mass of 1 C in not correct because the nucleus contains 4 protons and 5 neutrons D is not correct because a proton has a relative mass of 1		1
(c)	C 9 The only correct answer is C because the mass number is the sum of the protons and neutrons A is not correct because the atomic number is 4 B is not correct because 5 is the number of neutrons D is not correct because 13 is the total number of protons, neutrons and electrons		1
(d)	A 4 The only correct answer is A because the atomic number is equal to the number of protons which is 4 B is not correct because 5 is the number of neutrons C is not correct because 9 is the total number of particles in the nucleus D is not correct because 13 is the total number of protons, neutrons and electrons		1
(e) (i)	beryllium/Be		1
(ii)	(positive) ion	**ALLOW** ecf from the element given in (e)(i) **ACCEPT** any positive beryllium ion (or other ecf ion) **REJECT** any negative ion	1

(**Q01 4CH1/1CR, Jan 2020**)

Q9.

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**

(**Q01 4CH1/1CR, June 2019**)

Q10.

Question number	Answer	Notes	Marks
(a)	**B** (the crystal dissolves in water) A is not correct as the crystal does not condense C is not correct as the crystal does not evaporate D is not correct as the crystal does not melt		**1**
(b) (i)	**A** (all of the liquid is purple) B is not correct as the crystal will remain dissolved C is not correct as the particles will have diffused throughout the whole of the liquid D is not correct as the particles will have diffused throughout the whole of the liquid		**1**
(ii)	**C** (diffusion) A is not correct as condensation describes the process of a gas changing into a liquid B is not correct as crystallisation describes the process of a soluble solid forming from a solution C is not correct as evaporation describes the process of a liquid changing into a gas		**1**
(c)	**A** (3) B is not correct as there are only 3 elements present not 4 C is not correct as there are only 3 elements present not 6 D is not correct as there are only 3 elements present not 7		**1**

(**Q01 4CH1/1C, June 2019**)