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EDEXCEL COMBINED SCIENCE CHEMISTRY: QUESTIONS BY TOPIC

States of Matter and Mixtures (2)

Combined Science Chemistry (Foundation) Topic 2

9 questions · 78 marks · Mark schemes included

Pearson Edexcel Combined Science (9-1) Chemistry 1SC0, Foundation Tier, June 2018 - June 2025

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HOW TO USE THIS BOOKLET

Questions run from the lowest mark tariff to the highest, so similar questions sit together.

Click any row below to jump straight to that question.

On every question page, click ANSWER in the top-right corner to jump to its mark scheme.

Diagrams, graphs, tables and data are printed exactly as they appeared in the original papers.

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QUESTIONS

9 questions · 78 marks · lowest tariff first



6-MARK QUESTIONS

2 questions in this booklet



- 1 Figure 1 shows a metal spoon and two test tubes being heated in a water bath. One test tube contains a piece of chocolate, the other some liquid egg white.

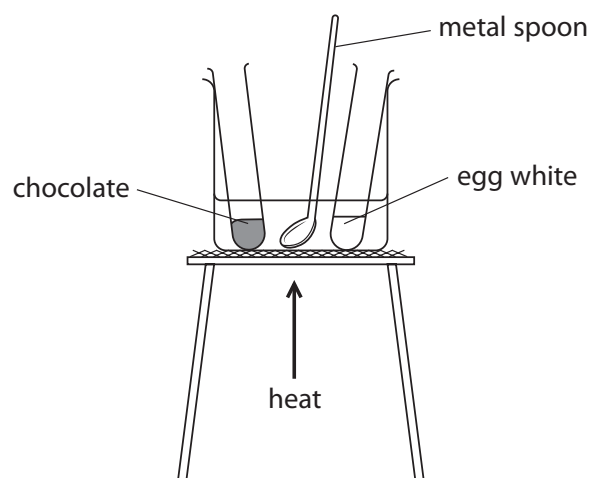


Figure 1

After heating, the spoon, the chocolate and the egg white are allowed to cool to room temperature.

Figure 2 shows the state of the three different substances before heating, when hot and after cooling.

substance	before heating	when hot	after cooling
metal spoon	solid	solid	solid
chocolate	solid	liquid	solid
egg white	liquid	solid	solid

Figure 2

- (a) Describe the differences in the arrangement and movement of the particles in a solid and in a liquid.

(2)

difference in arrangement of particles

difference in movement of particles

- (b) What name is given to the process when the chocolate changes from a solid to a liquid?

(1)

- ☐ A condensing
- ☐ B evaporating
- ☐ C freezing
- ☐ D melting

- (c) Give a reason why the metal spoon has not changed state during the experiment.

(1)

- (d) Explain how we know the change to the egg white is a chemical change rather than a physical change.

(2)

(Total for Question 1 = 6 marks)



- 1 Figure 1 shows a test tube being heated in a beaker of water.

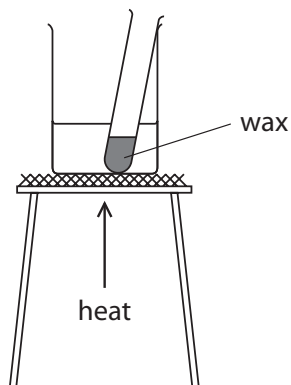


Figure 1

The test tube contains solid wax.

As the test tube was heated, the solid wax changed to liquid wax.

After heating, the wax was allowed to cool to room temperature.

- (a) Figure 2 shows the arrangement of particles in liquid wax.

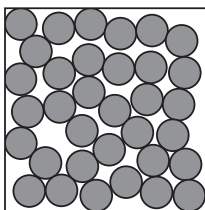


Figure 2

Draw the arrangement of particles in solid wax in the box in Figure 3.

(1)



Figure 3

(b) When the wax cools, it changes from a liquid back to a solid.
This change is a **physical change**.

(i) What name is given to the change of a liquid to a solid?

(1)

- ☐ A condensing
- ☐ B evaporating
- ☐ C freezing
- ☐ D melting

(ii) Explain why the change from a liquid to a solid is a physical change rather than a chemical change.

(2)

.....

.....

.....

.....

(c) Another physical change is when a liquid changes into a gas.

(i) Which row shows the movement and arrangement of the particles in a gas?

(1)

	movement of particles	arrangement of particles
☐ A	slow	regular
☐ B	slow	random
☐ C	fast	regular
☐ D	fast	random

(ii) Suggest why the wax did **not** change into a gas when the test tube was heated in the beaker of water.

(1)

.....

.....

(Total for Question 1 = 6 marks)



8-MARK QUESTIONS

1 question in this booklet



1 In an experiment, paper chromatography was used to separate the coloured dyes in four different inks, **W**, **X**, **Y** and **Z**.

(a) Figure 1 shows the chromatogram at the end of the experiment.

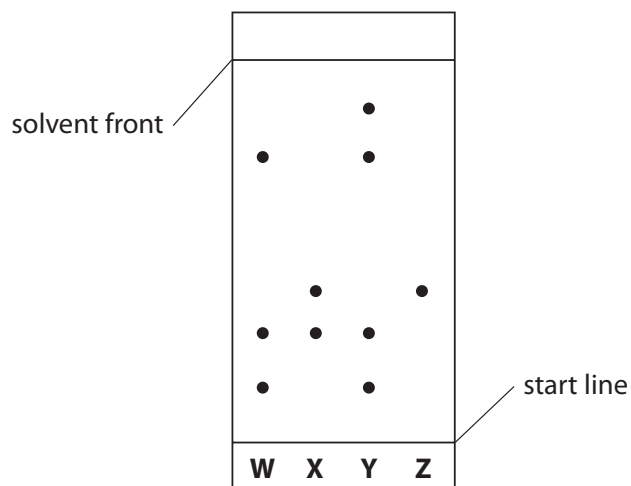


Figure 1

(i) The chromatogram shows that only one of the inks contains a single dye.

Which ink contains a single dye?

(1)

- ☐ **A** **W**
- ☐ **B** **X**
- ☐ **C** **Y**
- ☐ **D** **Z**

(ii) Which ink contains the greatest number of dyes?

(1)

- ☐ **A** **W**
- ☐ **B** **X**
- ☐ **C** **Y**
- ☐ **D** **Z**

(iii) The R_f value of a dye can be calculated using the equation

$$R_f = \frac{\text{distance moved by the dye}}{\text{distance moved by solvent front}}$$

At the end of the chromatography one dye had moved 3.60 cm and the solvent front had moved 9.20 cm.

Calculate the R_f value for this dye.

Give your answer to 2 decimal places.

(2)

.....

.....

.....

$R_f =$



- (b) The substance used as the solvent in the chromatography was heated for 8 minutes.

Figure 2 shows how the temperature of the substance changed with time.

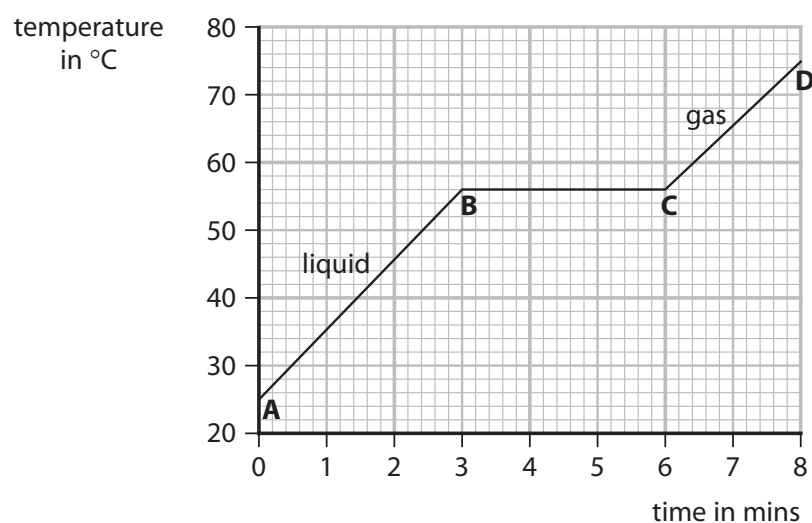


Figure 2

From **A** to **B** the substance was a liquid.

From **C** to **D** the substance was a gas.

- (i) Give the name of the change when a liquid becomes a gas.

(1)

- (ii) Use Figure 2 to give the temperature of the substance at 4 minutes.

(1)

..... °C

- (iii) Use Figure 2 to give the time when the substance has completely changed into a gas.

(1)

..... minutes

- (iv) The temperature of the substance at **A** was 25 °C.

Calculate the temperature rise of the substance from **A** to **D**.

(1)

..... °C

(Total for Question 1 = 8 marks)



9-MARK QUESTIONS

5 questions in this booklet



4 An ink is a mixture of coloured substances dissolved in water.

(a) Which method is used to separate the coloured substances in the ink?

(1)

- ☐ A chromatography
- ☐ B crystallisation
- ☐ C filtration
- ☐ D fractional distillation

(b) The apparatus shown in Figure 6 can be used to separate water from ink.

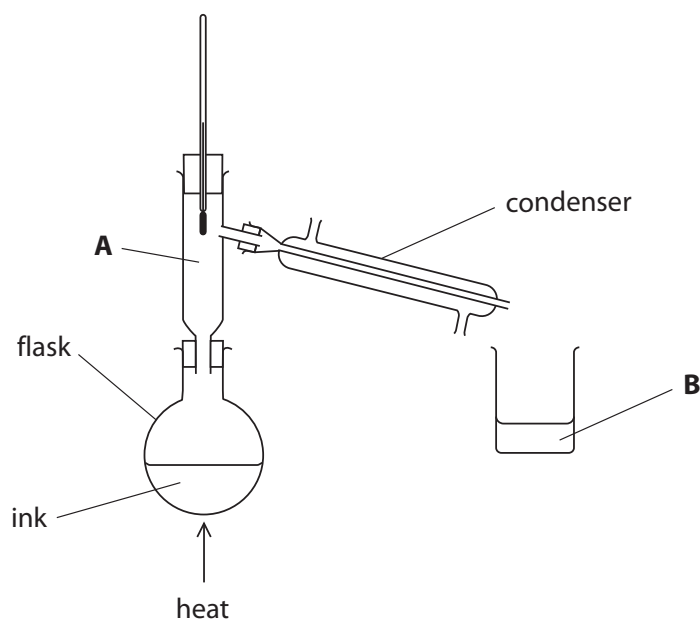


Figure 6

(i) Cold water flows through the condenser.

On Figure 6 use arrows to show where the water should flow in and where it should flow out.

(1)

(ii) Explain why a condenser is used.

(2)

(iii) The flask was heated with a Bunsen burner.

Give the name of an alternative piece of apparatus that could be used to heat the flask.

(1)

(c) The particles in the ink in the flask can be shown as in Figure 7.

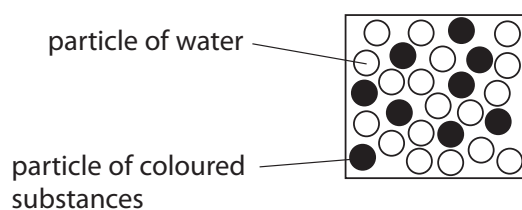


Figure 7

In the boxes below, draw the arrangement of particles that would be expected at **A** and **B** shown in Figure 6.

(2)



particles at **A**



particles at **B**

(d) Changes of state between the three states of matter are shown in Figure 8.



Figure 8

The changes shown are physical changes.

Explain why these changes are called physical changes rather than chemical changes.

(2)

.....

.....

.....

.....

(Total for Question 4 = 9 marks)



1 If liquid water is cooled below 0°C it turns into the solid, ice.

(a) (i) Give the name for the change of state from liquid to solid.

(1)

(ii) Here are five statements about ice and water.

Place ticks in boxes by the **two** statements that are correct.

(2)

the molecules move faster in water than in ice	☐
the molecules are more randomly arranged in ice than in water	☐
the molecules start moving when water becomes ice	☐
the molecules are arranged regularly in ice but not in water	☐
the molecules have more energy in ice than in water	☐



(b) Figure 1 shows a label from a bottle of drinking water.

Pure drinking water	
Mass of dissolved solids in mg per 1000 cm ³	
calcium ions	60
sodium ions	2
hydrogencarbonate ions	200
pH of water	
pH	7

Figure 1

(i) Explain why this drinking water should not be described as pure water.

(2)

.....

.....

(ii) State the information from Figure 1 that shows that the drinking water is neutral.

(1)

.....

(iii) Calculate the mass of calcium ions in 250 cm³ of this drinking water.

(2)

.....

.....

mass = ... mg

(c) State how you know that calcium is a metal from its position in the periodic table.

(1)

.....

.....

(Total for Question 1 = 9 marks)



2 Potable water is water that is suitable for drinking.

(a) River water can be treated to make it potable.

Chlorination, filtration and sedimentation are three of the processes involved in making the river water potable.

(i) Which row of the table shows these three processes in the order in which they are carried out?

(1)

	first	second	third
☐ A	chlorination	sedimentation	filtration
☐ B	chlorination	filtration	sedimentation
☐ C	sedimentation	filtration	chlorination
☐ D	sedimentation	chlorination	filtration

(ii) State the reason why chlorine is added during the water treatment.

(1)

.....

.....

(iii) Describe how sedimentation is carried out.

(2)

.....

.....

.....

.....

(iv) Figure 3 shows the results of an analysis of a sample of potable water.

ion	concentration in mg dm^{-3}
chloride	60.70
fluoride	0.24
nitrate	24.90
sulfate	71.40
copper	0.05
magnesium	9.10

Figure 3

Using this information, explain why this sample of potable water is not the same as pure water.

(2)

.....

.....

.....

.....



- (b) A student wanted to distil a sample of potable water.
Figure 4 shows apparatus the student used.

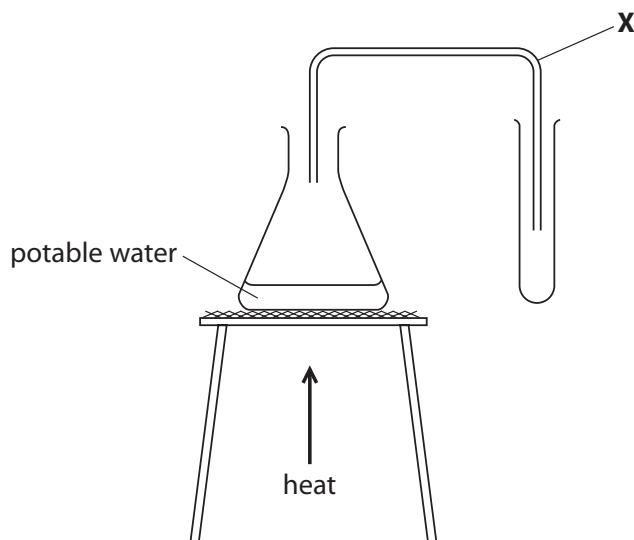


Figure 4

- (i) Name the piece of equipment labelled **X** in Figure 4.

(1)

- (ii) The student made an error when setting up the equipment in Figure 4.
This error meant no water could be collected in the test tube.

Explain what the student needs to do so water can be collected.

(2)

(Total for Question 2 = 9 marks)

2 Water treatment is needed to make most sources of water suitable for drinking.

- (a) Water treatment includes the processes of **chlorination**, **filtration** and **sedimentation**.

Place these processes in the order that they take place during water treatment.

(2)

first		last

- (b) Some tap water contains chloride ions.

- (i) Explain, in terms of electrons, how a chlorine atom, Cl, forms a chloride ion, Cl⁻.

(2)

.....

.....

.....

.....

- (ii) Why is chlorine added to water during water treatment?

(1)

- ☐ **A** to clean the water
- ☐ **B** to dissolve insoluble substances in the water
- ☐ **C** to increase the pH of the water to 11
- ☐ **D** to kill any bacteria in the water

- (iii) State why tap water is not suitable for use in chemical analysis.

(1)

.....

.....



- (c) A student was asked to distil a sample of tap water.
Figure 4 shows the apparatus the student used.

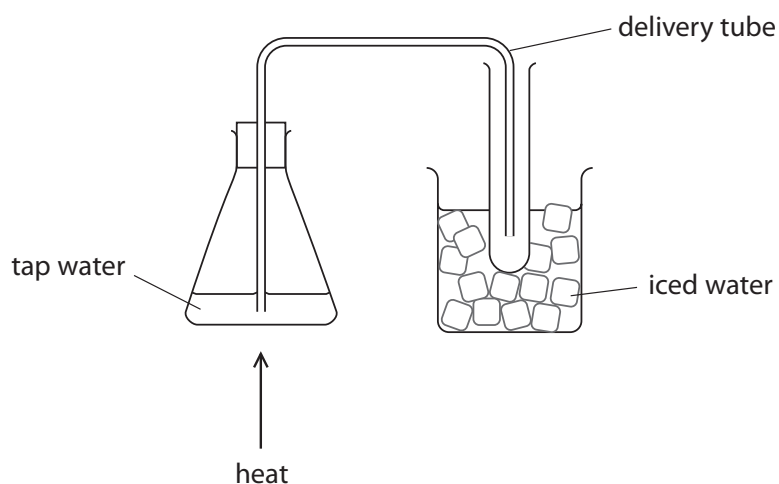


Figure 4

- (i) The student made an error when setting up the apparatus in Figure 4.

This error meant that pure water could **not** be collected in the test tube.

Explain what the student needs to change so that pure water can be collected in the test tube.

(2)

.....

.....

.....

.....

.....

- (ii) State what the student should use to heat the water.

(1)

.....

(Total for Question 2 = 9 marks)

- 2 (a) Figure 3 shows the changes of state between ice, water and steam.

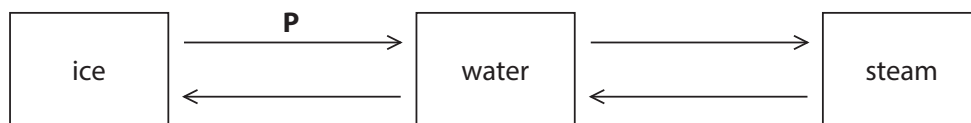


Figure 3

- (i) What is the name of the change of state labelled **P** in Figure 3?

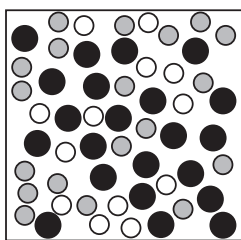
(1)

- ☐ **A** evaporating
- ☐ **B** freezing
- ☐ **C** melting
- ☐ **D** subliming

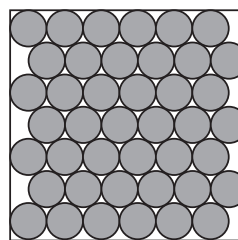
- (ii) Which of the following shows the arrangement of particles in ice?

(1)

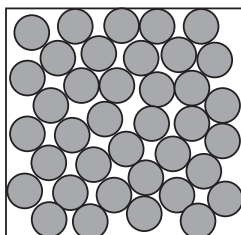
☐ **A**



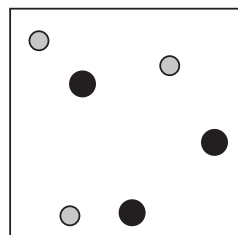
☐ **B**



☐ **C**



☐ **D**



- (b) Figure 4 shows the apparatus that can be used to separate a mixture of ethanol and water by fractional distillation.

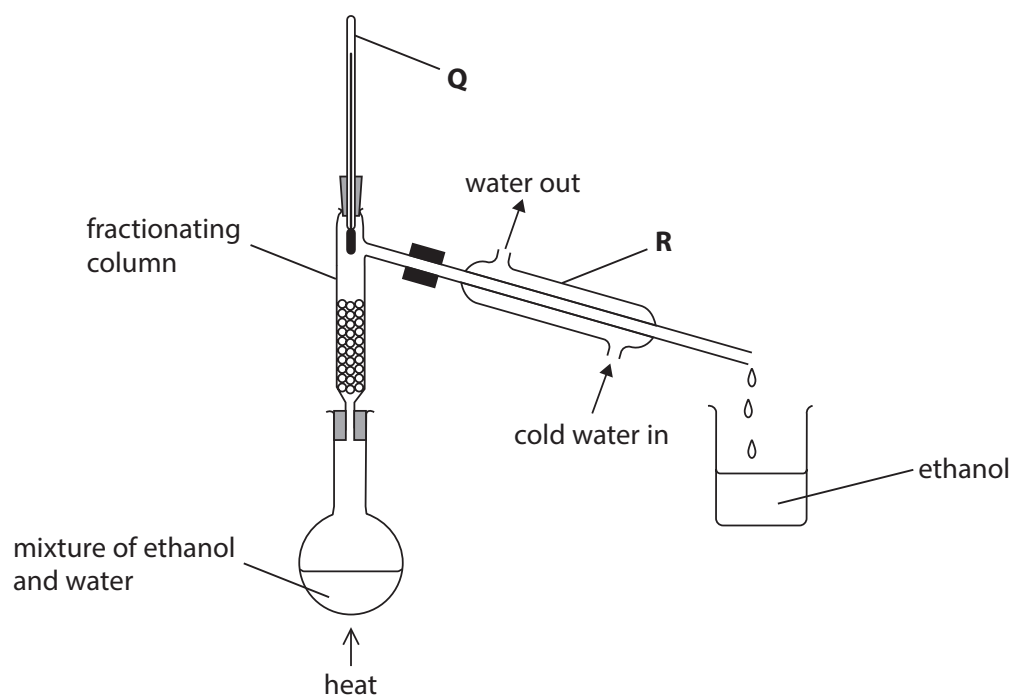


Figure 4

- (i) Name the piece of apparatus labelled **R** in Figure 4.

(1)

.....

- (ii) Explain the purpose of the piece of apparatus labelled **Q** in Figure 4.

(2)

.....
.....
.....
.....

- (c) A student investigates the food dyes used to make the colours **W**, **X**, **Y** and **Z** in four different sweets.

Figure 5 shows the chromatogram produced.

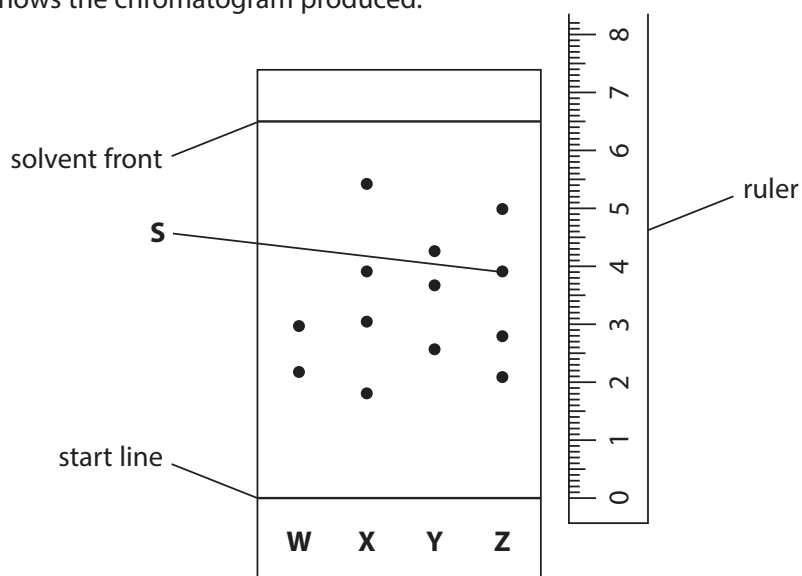


Figure 5

The solvent front shows how far the solvent moves during the investigation.

- (i) Using the information in Figure 5, state which colour is made of only two food dyes.

(1)

- (ii) The R_f value of a spot on the chromatogram can be calculated using the equation

$$R_f = \frac{\text{distance moved by the food dye}}{\text{distance moved by solvent front}}$$

Using the information in Figure 5, calculate the R_f value of the food dye labelled **S**.

Give your answer to 2 decimal places.

(3)

R_f value of food dye **S** = ...

(Total for Question 2 = 9 marks)

13-MARK QUESTIONS

1 question in this booklet



6 (a) A sample of potable water contains impurities.

Why is this sample of water potable even though it contains impurities?

(1)

- ☐ **A** the impurities have no smell
- ☐ **B** the impurities are colourless
- ☐ **C** the impurities are harmless
- ☐ **D** the impurities are soluble

(b) Waste water can be used to produce drinking water.

The processes used include sedimentation, filtration and chlorination.

(i) What is sedimentation?

(1)

- ☐ **A** the waste water is heated so the impurities evaporate
- ☐ **B** the waste water has an acid added to remove impurities
- ☐ **C** the impurities in the waste water settle to the bottom of their container
- ☐ **D** the impurities in the waste water are bleached

(ii) State why the waste water is filtered.

(1)

.....

.....

(iii) State the reason for chlorination.

(1)

.....

.....

.....

- (c) Some salts can be added to waste water to remove impurities. In an experiment, different masses of salt **A** were added to 1000 cm^3 samples of waste water. The experiment was repeated with salt **B**. The percentages of impurities removed from the waste water are shown in Figure 7.

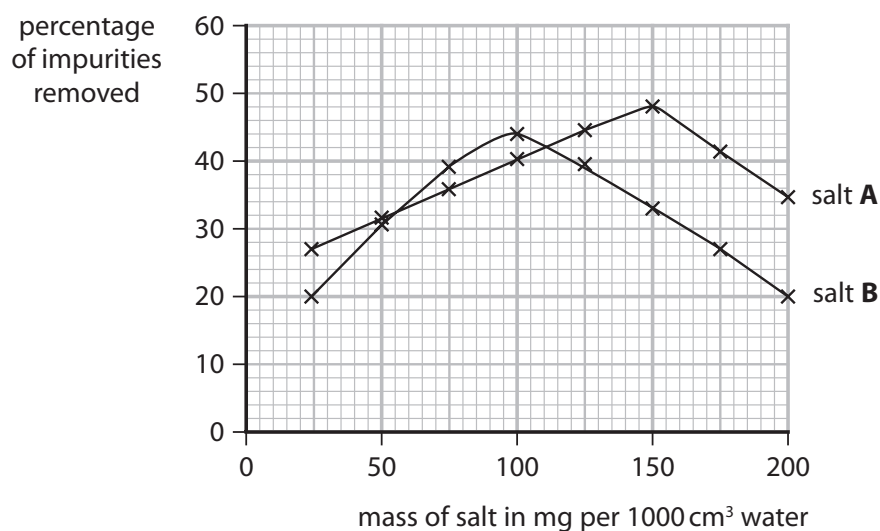


Figure 7

It was concluded that the best way to purify 1000 cm^3 of the waste water is to add 100 mg of salt **B**.

Use the information about salt **A** and salt **B** in Figure 7 to evaluate this conclusion.

(3)

.....

.....

.....

.....

(Total for Question 6 = 13 marks)



MARK SCHEMES

official Pearson Edexcel mark schemes



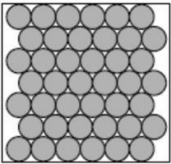
Question number	Answer	Additional guidance	Mark
1(a)	<u>Arrangement – 1 mark max</u> in a solid (particles are): - regularly arranged/ close(r) / in lattice / fixed (position) (1) OR in a liquid (particles are): - randomly arranged / further apart (1) <u>Movement – 1 mark max</u> in a solid (particles): - vibrate / do not move (around) (1) OR In a liquid (particles): - move (1)	answer for one state will be taken to imply opposite for other; but if both given, both must be correct OR one correct and one an ignore allow uniformly arranged / in a fixed shape / (tightly) packed together / in lines / in layers / in rows / ordered / organised ignore compact(ed) / attached / bonded / particles touching allow spread out / space between particles reject do not move much “They” is assumed to mean particles allow suitable diagrams allow answers in either space	(2) AO1-1

Question number	Answer	Mark
1(b)	D melting is the only correct answer A is not correct as condensing is gas to liquid B is not correct as evaporating is liquid to gas C is not correct as freezing is liquid to solid	(1) AO1-1

Question number	Answer	Additional guidance	Mark
1(c)	melting point (too) high / (temperature) below melting point / metals have high melting point / (water is) not hot enough	allow melting point higher (than chocolate) allow not enough {heat/ energy} / takes a lot of {heat / energy} allow metallic bonds are strong / no bonds have been broken (at temperature of water) ignore any statements referring to boiling point ignore 'hard to melt'	(1) AO3-2b

Question number	Answer	Additional guidance	Mark
1(d)	An explanation linking: (when heated) changes to a solid (1) (when cooled) stays solid / doesn't change back / change is permanent / change is irreversible (1)	allow it does not {boil / form gas}/ colour change (must be goes white if specified) / new substance forms ignore 'changes state' / (chemical) reaction occurs allow doesn't go back to liquid / cannot change back	(2) AO2-1



Question number	Answer	Additional guidance	Mark
1(a)		all particles should be arranged regularly allow overlapping circles should be at least 3 rows/columns, each row can be directly over the one below	(1) AO1-1

Question number	Answer	Mark
1(b)(i)	C freezing is the only correct answer A is incorrect as condensing is gas to liquid B is incorrect as evaporating is liquid to gas D is incorrect as melting is solid to liquid	(1) AO1-1

Question number	Answer	Additional guidance	Mark
1(b)(ii)	An explanation linking: - it is reversible (1) - no new substance is made (1)	allow a description of reversible / not a permanent change allow the {substance / compound} does not change / it is only a change of state / not a chemical <u>reaction</u> / it is the same product ignore no {bonds/intermolecular forces} are broken	(2) AO2-1

Question number	Answer	Mark
1(c)(i)	D fast random is the only correct answer A is incorrect as particles move fast and are random in a gas B is incorrect as particles move fast in a gas C is incorrect as particles are random in a gas	(1) AO1-1

Question number	Answer	Additional guidance	Mark
1(c)(ii)	the boiling point of wax is higher than the boiling point of water / the boiling water is not hot enough	comparison needed allow (water) not {heated/hot} enough / temperature not hot enough	(1) AO2-1

Total for Question 1 = 6 marks



Question number	Answer	Mark
1(a)(i)	D Z is the only correct answer. A , B and C are incorrect because they have more than one spot	A01-1 (1)

Question number	Answer	Mark
1(a)(ii)	C Y is the only correct answer. A , B and D are incorrect because those inks have fewer spots	A03-1 (1)

Question number	Answer	Additional guidance	Mark
1(a)(iii)	0.39 scores 2 marks with or without working $\frac{3.60}{9.20} = 0.39(1304\dots)$ (1) = 0.39 (1) (rounded to 2dp)	fraction $\frac{9}{23}$ scores 1 mark 1 mark for correct substitution and evaluation $\frac{3.60}{9.20} = 0.4$ scores only 1 for correct evaluation to 1dp 9.20 Note: 0.4 alone without working scores 0 1 mark for correct rounding (has to use the numbers 3.60 and 9.20 in the calculation) $\frac{9.20}{3.60} = 2.56$ scores 1 (for 2dp) Note: by default $3.60 \times 9.20 = 33.12$ has an answer to 2dp, so 2 nd mark is given	A02-1 (2)

Question number	Answer	Additional guidance	Mark
1(b)(i)	evaporation / evaporating	allow boiling / vaporisation do not allow boiling <u>point</u> / bpt	A01-1 (1)

Question number	Answer	Additional guidance	Mark
1(b)(ii)	56 (°C)		A03-1 (1)

Question number	Answer	Additional guidance	Mark
1(b)(iii)	6 (minutes)		A03-1 (1)

Question number	Answer	Additional guidance	Mark
1(b)(iv)	answers between 49 and 51 score 1 mark with or without working. 75 – 25 = 50 (1)	allow readings between 74 and 76	A03-1 (1)

Total for Question 1 = 8 marks



Question Number	Answer	Mark
4(a)	A chromatography The only correct answer is A <i>B is not correct this would not separate colours</i> <i>C is not correct because this would not separate colours</i> <i>D is not correct because this would not separate colours in best way</i>	(1) AO 1 1

Question Number	Answer	Additional guidance	Mark
4(b)(i)	arrows drawn to show water going in the condenser in the bottom and out the condenser at the top	reject arrows drawn coming out of the middle of the condenser	(1) AO 1 2

Question Number	Answer	Additional guidance	Mark
4(b)(ii)	An explanation linking - to cool (1) - so (water) {vapour/gas} turns to liquid (1)	allow water for liquid allow steam for vapour if cooling the ink max 1 for first marking point only	(2) AO 1 2

Question Number	Answer	Additional guidance	Mark
4(b)(iii)	electric heater / heating mantle	allow spirit burner allow hot plate/heated plate allow blow torch ignore heater alone ignore Bunsen burner ignore hot water bath	(1) AO 2 2

Question Number	Answer	Additional guidance	Mark
4(c)	particles at A: white circles only, none touching (1) particles at B: white circles only, randomly arranged, more circles than in A (1)	reject 'strings' of particles if black circles are present in both boxes allow 1 mark if arrangement of particles in both boxes is otherwise correct.	(2) AO 2 1

Question Number	Answer	Additional guidance	Mark
4(d)	An explanation linking - physical changes do not result in formation of a new substance / chemical change results in formation of a new substance (1) - physical change is easily reversed / chemical change is not easily reversed (1)	allow no chemical reaction has taken place ignore you can see the change	(2) AO 1 1

(Total for question 4 = 9 marks)

Question number	Answer	Additional guidance	Mark
1(a)(i)	freezing / solidifying / solidification	ignore frozen	(1) AO1

Question number	Answer	Mark										
1(a)(ii)	<table><tr><td>the molecules move faster in water than in ice</td><td>✓ (1)</td></tr><tr><td>the molecules are more randomly arranged in ice than in water</td><td></td></tr><tr><td>the molecules start moving when water becomes ice</td><td></td></tr><tr><td>the molecules are arranged regularly in ice but not in water</td><td>✓ (1)</td></tr><tr><td>the molecules have more energy in ice than in water</td><td></td></tr></table>	the molecules move faster in water than in ice	✓ (1)	the molecules are more randomly arranged in ice than in water		the molecules start moving when water becomes ice		the molecules are arranged regularly in ice but not in water	✓ (1)	the molecules have more energy in ice than in water		(2) AO1
	the molecules move faster in water than in ice	✓ (1)										
	the molecules are more randomly arranged in ice than in water											
	the molecules start moving when water becomes ice											
	the molecules are arranged regularly in ice but not in water	✓ (1)										
	the molecules have more energy in ice than in water											
Allow any marks in the boxes.												
If three boxes are ticked, give one mark only if both correct boxes are ticked												
If four or five boxes ticked, no marks awarded												

Question number	Answer	Additional guidance	Mark
1(b)(i)	An explanation linking - pure water contains {only water (molecules)/ only one substance} / impure water contains more than one substances (1) - identification <u>from label</u> of impurity: dissolved solids/ calcium (ions) / sodium (ions) / hydrogencarbonate (ion) / ions	ignore all references to pH	(2) AO3

Question number	Answer	Mark
1(b)(ii)	pH (=7)	(1) AO2

Question number	Answer	Mark
1(b)(iii)	15 mg with or without working scores 2 250/1000 (1) (=0.250) 60 x 250/1000 (1) (=15) OR 1000/250 (1) = 4 60/4 (1) (=15)	(2) AO2

Question number	Answer	Mark
1(c)	It is on left / in group 2 / column 2	(1) AO2



Question number	Answer	Mark
2(a)(i)	C sedimentation filtration chlorination is the only correct answer A and B are incorrect as sedimentation is the first step D is incorrect as chlorination is the last step	(1) AO1-1

Question number	Answer	Additional guidance	Mark
2(a)(ii)	to kill {bacteria / microorganisms / microbes / pathogens}	ignore germs / diseases allow viruses allow 'remove' / 'get rid of' / eliminate for kill allow to sterilise / disinfect (the water) ignore to clean / purify / bleach / make water clear	(1) AO1-1

Question number	Answer	Additional guidance	Mark
2(a)(iii)	A description including: (put waste) water in tank / left to (stand / settle) (1) {particles / dirt / impurities / sediment / solid} <u>fall</u> to bottom (1)	allow any put in suitable large or small container e.g. container / beaker allow for MP1 add a substance that causes clumping / aluminium sulfate must have idea that particles sink reject large(r) pieces e.g- sand / rocks / branches etc - that would be filtered ignore any references to filtration before or after sedimentation	(2) AO1-1



Question number	Answer	Additional guidance	Mark
2(a)(iv)	an explanation linking: (the water) contains {chloride / fluoride, nitrate / sulfate / copper / magnesium / ions / salts } (1) (therefore) <u>more than</u> just water (molecules) / it does not contain <u>just</u> water / which are impurities / pure substances contain <u>only</u> one substance / pure water does not contain ions (1)	allow chemicals / minerals / substances ignore particles / metals / elements / molecules / things allow pure water is just H₂O / contains hydrogen and oxygen only reject pure substances contain only one element allow pure water does not contain any of {ions in the table / these ions / specifically named ions from table} for 2 marks	(2) A03- 2a – 1 2b – 1
Question number	Answer	Additional guidance	Mark
2(b)(i)	(delivery) tube	allow {glass / rubber / plastic} tube	(1) A02-1

Question number	Answer	Additional guidance	Mark
2(b)(ii)	an explanation linking: add bung / cork (to top of flask) (1) (so) {water / vapour / gas / steam} cannot escape (from top of flask) / will go into {(delivery) tube/ X} (1)	ignore seal / block / lid / cover etc allow stopper allow incorrect naming of flask ignore 'so water is collected' allow incorrect naming of delivery tube mark independently for max 1 allow replacement of X with a (Liebig) condenser / cooling of delivery tube / ice bath around test tube (1)	(2) A03-3b

Question number	Answer		Mark
2(a)	sedimentation → filtration → chlorination (2) first or last step correct (1)		(2) A01-1

Question number	Answer	Additional guidance	Mark
2(b)(i)	An explanation linking - gain of electron(s) (1) - one electron (1)	MP2 depends on MP1 gains an electron (2)	(2) A01-1

Question number	Answer	Mark
2(b)(ii)	D to kill any bacteria in the water is the only correct answer A, B, C are not reasons why chlorine is added	(1) A01-1

Question number	Answer	Additional guidance	Mark
2(b)(iii)	any one from - ions {present / make test invalid} - the water is impure - tap water would interfere with analysis	allow named substances that could be present in tap water eg calcium ions / chlorine / chloride ions / magnesium ions / minerals allow (water) is not pure ignore 'sterile' / 'contains chemicals' / 'not clean' / 'contains bacteria' ignore any substances not found in tap water	(1) A01-1

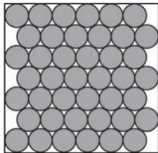


Question number	Answer	Additional guidance	Mark
2(c)(i)	An explanation linking either - remove (delivery) tube from below water line (1) - so that {gas / water vapour / steam} can move through (delivery) tube / to prevent water being pushed up the delivery tube (1) or (delivery) tube is too low (1) {gas / water vapour / steam} not being able to get into the tube (1)	allow alternative description of delivery tube allow error circle on Figure 4 allow move delivery tube higher in conical flask ignore change the delivery tube (alone) MP2 depends on MP1 allow error circle on Figure 4 MP4 depends on MP3	(2) A03-3
Question number	Answer	Additional guidance	Mark
2(c)(ii)	Bunsen (burner) / spirit burner	allow electric heater ignore other forms of heat and equipment	(1) A02-2

Total for Question 2 = 9 marks



Question number	Answer	Mark
2(a)(i)	C melting is the only correct answer A , C and D are not correct because they are names for other changes of state	(1) AO1-1

Question number	Answer	Additional guidance	Mark
2(a)(ii)	B  is the only correct answer A , C and D are not the arrangement of particles in the solid state of a pure substance		(1) AO1-1

Question number	Answer	Additional guidance	Mark
2(b)(i)	(Liebig) condenser	allow water condenser, condenser tube reject condensation tube	(1) AO2-1

Question number	Answer	Additional guidance	Mark
2(b)(ii)	An explanation linking any two from: - thermometer (1) - to show temperature (1) - so it identifies the {fraction / substance / gas} (being condensed) (1)	allow record, find etc allow to show boiling point / 78°C / 100°C reject 'measure heat' allow so that only {one gas / ethanol} goes to condenser / both gases do not enter condenser	(2) AO2-1



Question number	Answer	Additional guidance	Mark
2(c)(i)	W	reject answers with any additional letter	(1) AO1-2

Question number	Answer	Additional guidance	Mark
2(c)(ii)	distance moved by dye S = 3.8 to 4.0 AND distance moved by solvent front = 6.5 (1) $R_f = \frac{3.8 \text{ to } 4.0}{6.5} (1)$ = fraction evaluated and correctly rounded to 2 dp (1)	if no working 0.58 / 0.60 / 0.62 scores 3 if no working 1.63 / 1.67 / 1.71 scores 2 allow $R_f = \frac{2.8 \text{ to } 5}{6 \text{ to } 7}$ for MP2 MP3 only scores from allowed range for MP2 or inverse 3.8 gives 0.58, 3.9 gives 0.60, 4.0 gives 0.62 ignore recurring dots if fraction inverted, can score MP1 and MP3 (3.8 gives 1.71, 3.9 gives 1.67, 4.0 gives 1.63)	(3) AO3-1

Total for Question 2 = 9 marks



Question number	Answer	Mark
6(a)	C the impurities are harmless C is the only correct answer. A, B and D are incorrect as the properties are not relevant	(1) AO2

Question number	Answer	Mark
6(b)(i)	C the impurities in the waste water settle to the bottom of their container C is the only correct answer. A, B and D are incorrect because no sediment is formed	(1) AO1

Question number	Answer	Additional guidance	Mark
6(b)(ii)	to remove {insoluble substances / solids}	allow named solid substances eg sand ignore materials removed by initial screening eg twigs, debris etc ignore to produce clean/pure water reject remove bacteria	(1) AO1

Question number	Answer	Additional guidance	Mark
6(b)(iii)	to kill {bacteria / microorganisms}	ignore to cleanse, purify, clean, make safe allow to remove bacteria / germs	(1) AO1

Question number	Answer	Additional guidance	Mark
6(c)	An answer including • best amount of A is 150 (mg) (1) • 150 mg A removes more than 100 (mg) B (1) • so it is better to use salt A than salt B (1) OR • because (at peak activity) B removes a higher percentage per gram than A (1) • so less salt would be needed / more efficient (1) • so it is better to use salt B than salt A (1)	ignore incorrect units of mass • allow so salt B is more	(3) AO3



	OR 150 mg of A removes 48% impurities 100 mg of B removes 44% impurities - so salt A is better (than salt B) as more impurities are removed (1) OR 100 mg of A removes 40% impurities 100 mg of B removes 44% impurities - so salt B is better (than salt A) as more impurities are removed for same mass of salt (1)	effective in smaller quantities	
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Question number	Indicative content	Mark
* 6(d)	Answers will be credited according to candidate's deployment of knowledge and understanding of the material in relation to the qualities and skills outlines in the generic mark scheme. The indicative content below is not prescriptive and candidates are not required to include all the material which is indicated as relevant. Additional content included in the response must be scientific and relevant. SEPARATION - distillation - solution in flask - heat - water evaporates - water vapour into condenser - cooling water jacket - water vapour condensed back to liquid - water collected in beaker - solid remains in flask - boiling point = 100 °C TEST - take distilled water in a test tube - add a few drops of neutral litmus/Universal Indicator - correct neutral colour OR - pH probe - pH = 7	(6) AO1 AO3

Level	Mark	Descriptor	Additional Guidance
	0	No rewardable material.	Read whole answer and ignore all incorrect material/ discard any contradictory material then:
Level 1	1–2	<u>Additional Guidance</u>	Gives simple parts of the plan or describes the test to show the water is neutral. e.g. heat the solution (1) use the Bunsen burner to heat the solution (2) use universal indicator to test the water, it should turn green (2)
Level 2	3–4	<u>Additional Guidance</u>	Gives a more detailed plan or a simple part of the plan with the test to show the water is neutral. e.g. heat the solution with a Bunsen burner, the water evaporates at 100°C (3) Heat the solution in a flask, the water will evaporate and move into the condenser where it turns back to a liquid (4) Heat the solution to evaporate the water and then use the condenser, use universal indicator to test the water which should turn green. (4)
Level 3	5–6	<u>Additional Guidance</u>	Gives a more detailed plan and the test to show the water is neutral. e.g. heat the solution, the water will evaporate and move to the condenser where it will cool and turn back to a liquid. Test the water neutral litmus paper (5) Use distillation, heat the solution in a flask, the water vapour moves to the condenser where it cools and turns back to a liquid. The water can be tested with a pH meter the reading should be pH 7 (6)