

**OXFORD CAMBRIDGE AND RSA EXAMINATIONS
GCSE (9–1)
J250/03**

**COMBINED SCIENCE
(CHEMISTRY) A (GATEWAY SCIENCE)
Paper 3, C1–C3 and CS7 (PAGs C1–C5)
(Foundation Tier)**

**THURSDAY 17 MAY 2018: Morning
TIME ALLOWED: 1 hour 10 minutes
plus your additional time allowance
MODIFIED ENLARGED 24pt**

First name		Last name	
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Centre number						Candidate number				
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YOU MUST HAVE:

a ruler (cm/mm)

**the Data Sheet (for GCSE Combined
Science A (Chemistry))**

YOU MAY USE:

**a scientific or graphical calculator
an HB pencil**

READ INSTRUCTIONS OVERLEAF



INSTRUCTIONS

The Data Sheet will be found with this document.

Use black ink. You may use an HB pencil for graphs and diagrams.

Complete the boxes on the front page with your name, centre number and candidate number.

Answer ALL the questions.

Write your answer to each question in the space provided. If additional space is required, use the lined page(s) at the end of this booklet. The question number(s) must be clearly shown.

INFORMATION

The total mark for this paper is 60.

The marks for each question are shown in brackets [].

Quality of extended responses will be assessed in questions marked with an asterisk (*).

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SECTION A

Answer ALL the questions.

You should spend a maximum of 20 minutes on this section.

- 1 A student wants to make solid ammonium sulfate from the solution of ammonium sulfate.**

What should the student do first? [1]

- A Distil the solution.**
- B Evaporate the solution.**
- C Filter the solution.**
- D Use chromatography.**

Your answer

2 A metal carbonate reacts with an acid.

What products are made? [1]

A Salt and carbon dioxide

B Salt and water

C Salt, carbon dioxide and water

D Salt, hydrogen and carbon dioxide

Your answer

☐

3 Ethanoic acid is a WEAK acid.

What is the pH of ethanoic acid? [1]

A 1

B 5

C 7

D 12

Your answer

☐

4 A student wants to re-crystallise a solute from a solution.

What type of apparatus should she use? [1]

- A An evaporating dish, wire gauze, tripod and Bunsen burner**
- B A filter funnel, filter paper and conical flask**
- C A round-bottomed flask connected to a condenser**
- D A separating funnel**

Your answer

5 What is the chemical formula for sodium chloride? [1]

A Na_2Cl

B NaCl

C NaCl_2

D Na_2Cl_3

Your answer

6 In 1808 John Dalton published his theory about matter.

Which of Dalton's ideas is now known to be INCORRECT? [1]

- A A chemical reaction is a rearrangement of atoms.**
- B All matter consists of atoms.**
- C Atoms cannot be subdivided.**
- D When elements react, their atoms combine in simple, whole-number ratios.**

Your answer

☐

7 An element has a RELATIVE ATOMIC MASS of 19.0.

Find this element on the Periodic Table.

How many protons does this element contain? [1]

A 9

B 10

C 19

D 28

Your answer

8 An atom is the smallest particle of an element.

What is the approximate size of a single atom? [1]

A $0.0001 \times 10^{-6} \text{ m}$

B $0.0001 \times 10^{-10} \text{ m}$

C $0.01 \times 10^{-10} \text{ m}$

D $0.1 \times 10^{-12} \text{ m}$

Your answer

9 Graphite is used in pencils.

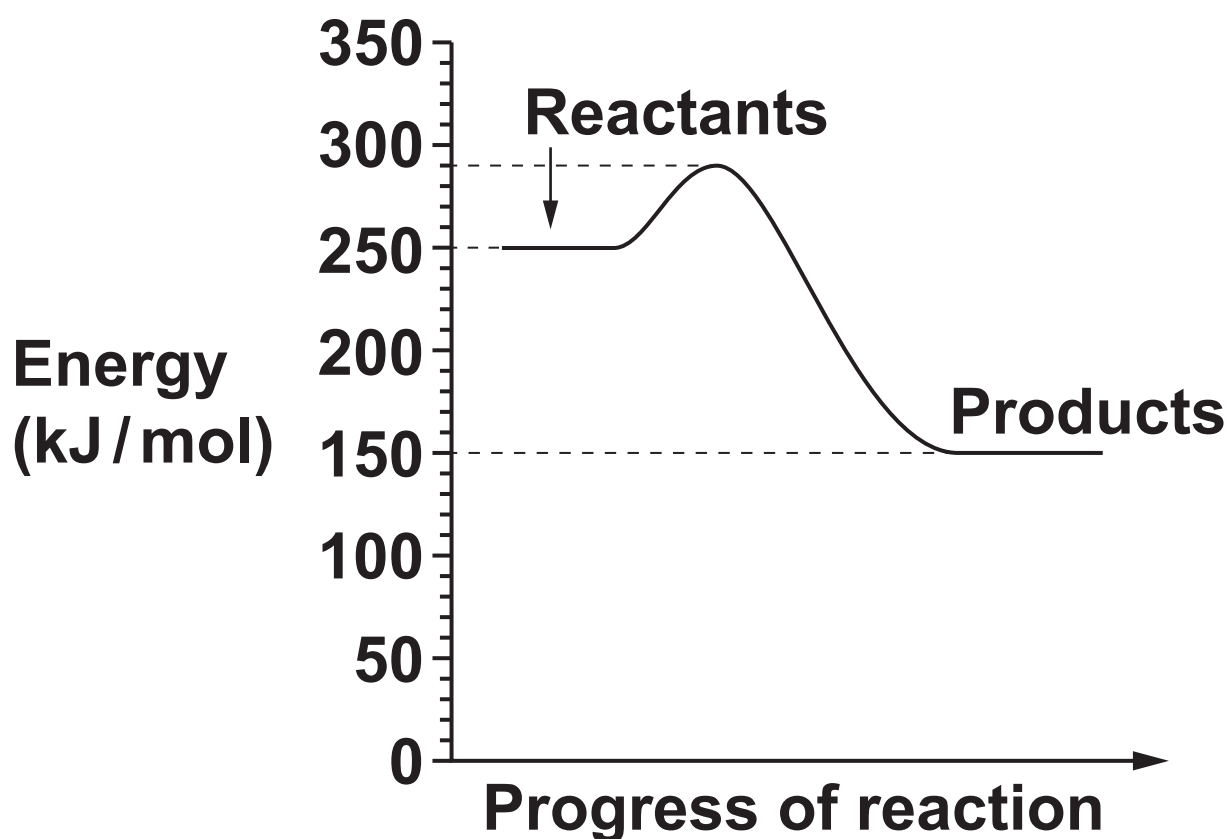
Why can graphite make marks on paper? [1]

- A All the bonds in graphite are weak.**
- B Atoms in graphite are in layers.**
- C Forces between layers in graphite are strong.**
- D Every atom in graphite is strongly bonded to four others.**

Your answer

☐

10 The diagram shows a reaction profile.



What is the energy change of the reaction? [1]

- A +40 kJ/mol
- B -100 kJ/mol
- C +140 kJ/mol
- D -140 kJ/mol

Your answer

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SECTION B

Answer ALL the questions.

11 Look at the pictures of some common laboratory equipment.

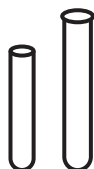
Crucible



Tripod



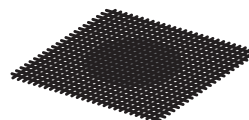
Test tube



Funnel



Gauze



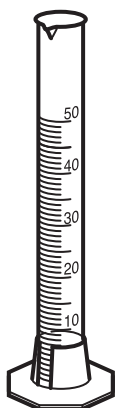
Spatula



Thermometer



Measuring cylinder



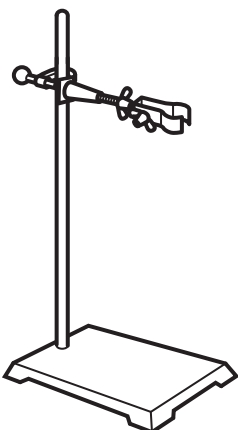
Conical flask



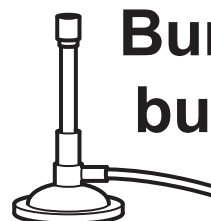
Stop watch



Clamp stand



Bunsen burner



Beaker



Tongs



Pestle and mortar



(a) A student wants to ACCURATELY measure the melting point of ice.

Describe an experiment that she could do.

You may draw a LABELLED diagram to help your answer.

Use some of the equipment from the pictures on page 14.

[2]

(b) Suggest ONE thing the student could do to improve the experiment.

[1]

12 (a) This question is about atomic structure.

(i) What is meant by RELATIVE ATOMIC MASS?

_____ **[1]**

(ii) What TWO things can you work out from the ATOMIC NUMBER of an element?

1 _____

2 _____

[2]

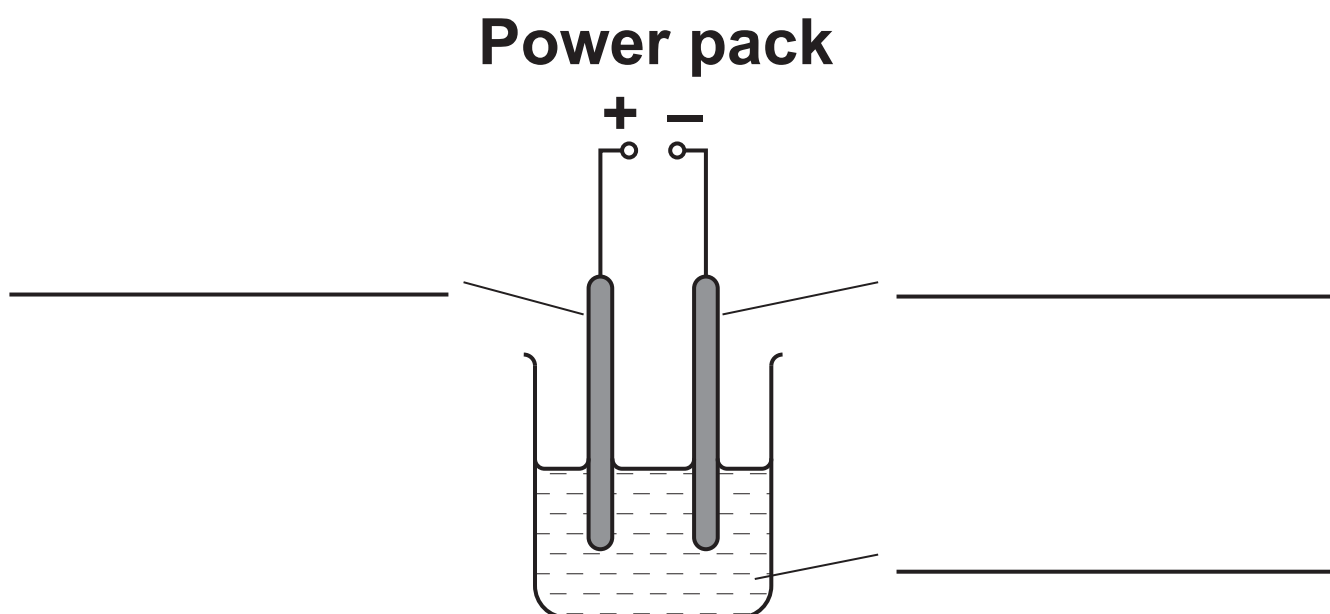
(b) Look at the table about the particles in an atom.

Particle	Relative Charge	Relative Mass
Proton	+1	
Neutron		1
Electron		Almost 0

Complete the table. [3]

13 (a) Look at the diagram of an electrolysis experiment.

(i) Complete the labels on the diagram. [2]



(ii) Sodium chloride is an IONIC compound.

Sodium chloride

Will NOT conduct electricity when it is solid

Will conduct electricity when it is dissolved in water.

Explain why.

[2]

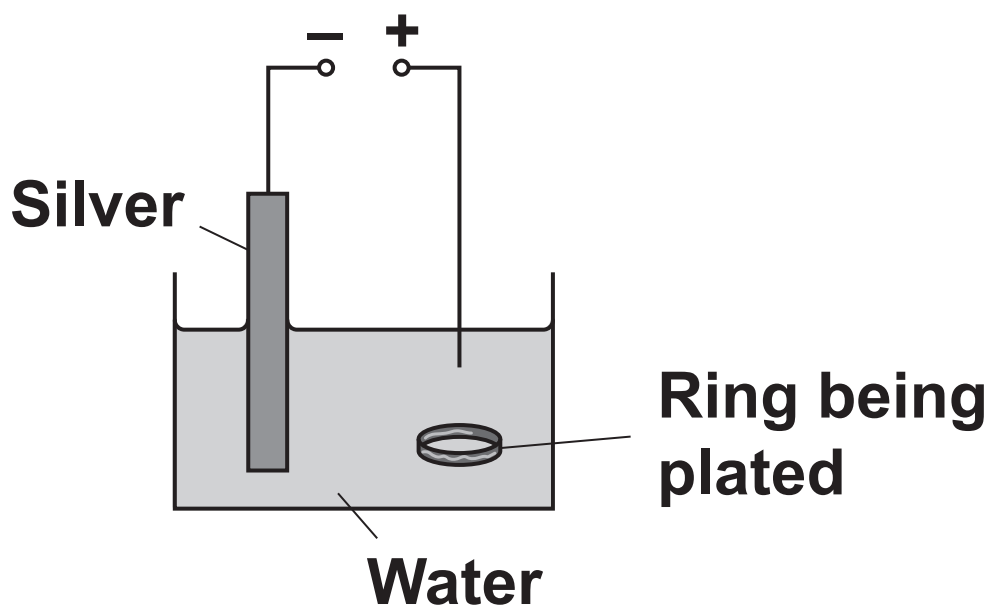
(b) A scientist electrolyses three different compounds.

Complete the table below to show what products will be formed. [3]

Compound	Product formed at negative electrode	Product formed at positive electrode
Molten PbBr_2	Lead	
A solution of KBr	Hydrogen	
A solution of CuCl_2	Copper	

(c) Electrolysis can also be used to **ELECTROPLATE** one metal onto another.

Look at the diagram of this experiment.

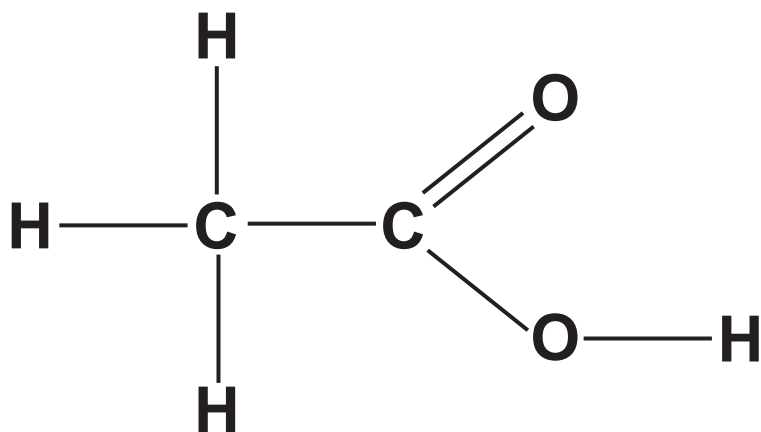


The experiment shown in this diagram will **NOT** work.

Suggest **TWO** things that must be changed to make the experiment work.

[2]

14 Look at the molecule below:



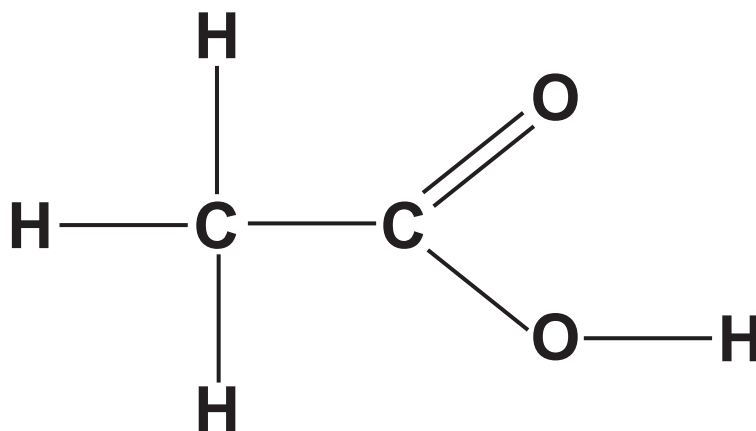
(a) Write down the **EMPIRICAL FORMULA** for this molecule.

_____ [1]

(b) Calculate the **RELATIVE FORMULA MASS**, M_r , for this molecule.

Answer = _____ [1]

- (c) The displayed formula for the molecule does not show the exact length of the bonds.



Write down TWO other limitations of the displayed formula.

[2]

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15 This question is about electronic structure and bonding.

(a) The electronic structure of phosphorus is 2.8.5.

Use these THREE NUMBERS to explain the POSITION of phosphorus in the Periodic Table.

[2]

(b) Phosphorus bonds with hydrogen to form the toxic gas phosphine, PH_3 .

Draw a 'dot and cross' diagram to show the COVALENT bonding in PH_3 . Use the space below. [2]

16 Sodium hydroxide reacts with hydrochloric acid.

Sodium chloride and water are made.

(a) Write a WORD equation for this reaction.

_____ **[1]**

(b) A student adds 5 cm^3 of hydrochloric acid (HCl) to 55 cm^3 of sodium hydroxide (NaOH).

He measures the highest temperature reached during the reaction.

He also measures the pH at the end of the reaction.

He repeats this experiment three times and works out the mean temperature.

He then repeats the experiment with different volumes of hydrochloric acid and sodium hydroxide.

Look at his results on the next page.

Experiment	Volume of HCl (cm ³)	Volume of NaOH (cm ³)	Highest temperature reached during reaction (°C)				pH at the end of the reaction
			1	2	3	Mean	
A	10	50	29.3	30.6	30.7	30.2	12.0
B	20	40	34.5	35.3	35.2	35.0	7.8
C	30	30	37.3	37.6	36.7	37.2	7.0
D	40	20	34.3	35.5	34.6		6.3

- (i) Calculate the mean temperature for experiment D.**

Answer = _____ °C [1]

- (ii) Describe the pattern of the highest temperature reached for experiments A to C.**

_____ [1]

- (iii) Describe the pattern of pH at the end of the reaction for experiments A to D.**

_____ [1]

(iv) How could the student measure the pH?

[1]

(c) What conclusion can you draw from the student's experiments?

[1]

17* A student wants to find out which pigments are in a plant.

She does a chromatography experiment on a sample from the plant.

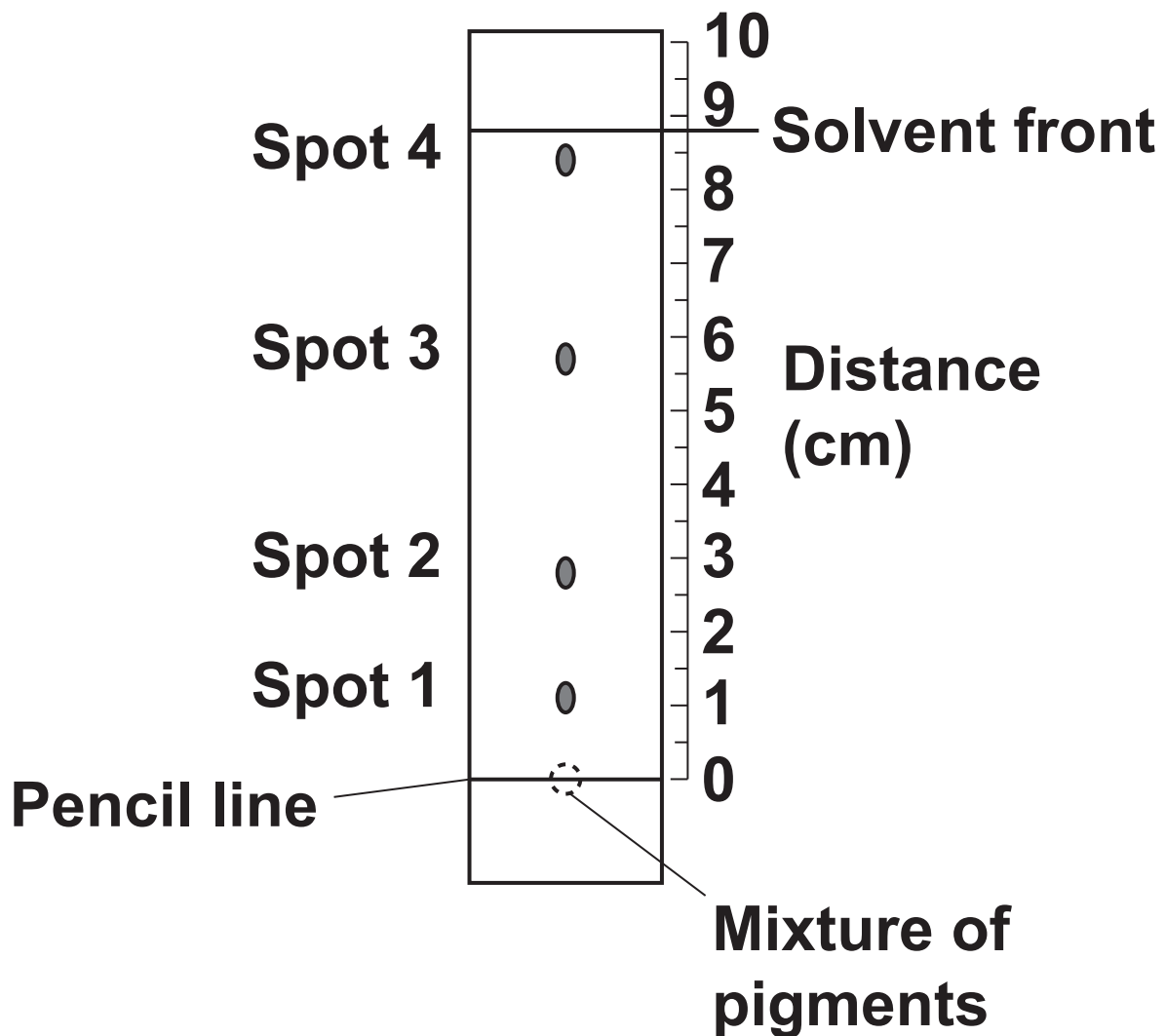
Look at her results on the next page.

Distance to spot 1 = 1.1 cm

Distance to spot 2 = 2.8 cm

Distance to spot 3 = 5.7 cm

Distance to spot 4 = 8.4 cm



The R_f values for some pigments are shown in the table.

Pigment	A	B	C	D	E
R_f value	0.95	0.45	0.32	0.25	0.15

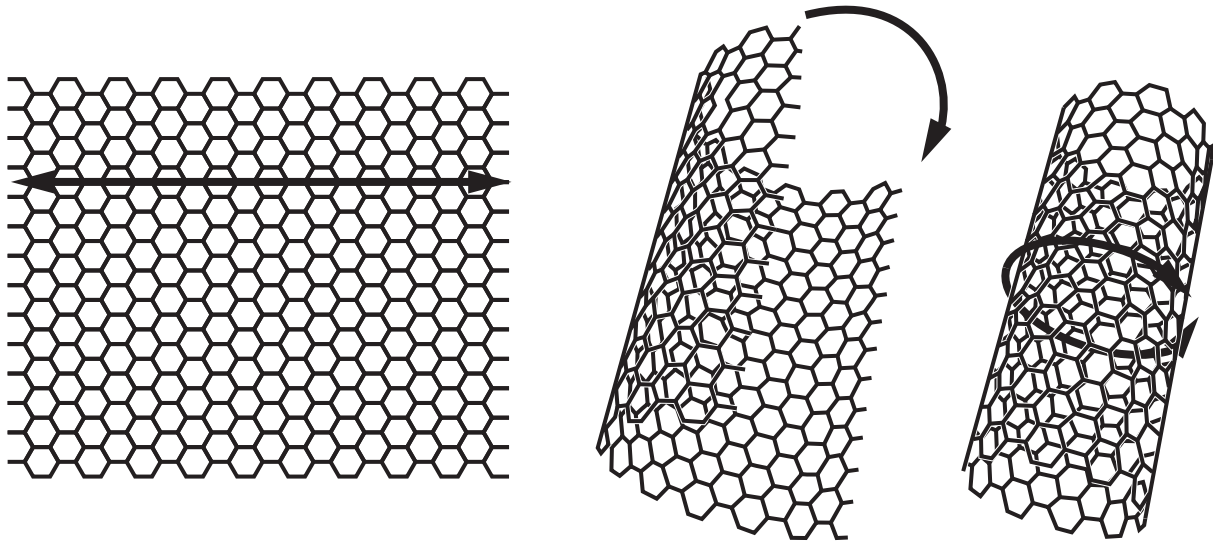
Calculate the R_f value for each spot.

Describe and explain which pigments are in the sample from the plant and suggest why further analysis of the plant pigments is needed. [6]

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18 Carbon nanotubes are a new material.

The diagrams show how a graphene sheet can form a nanotube.



(a) Nanotubes are more than 100 times stronger than iron.

Explain why nanotubes are so strong. Use ideas about bonding.

[2]

(b) Carbon is a non-metal.

Carbon nanotubes conduct electricity.

Explain why carbon nanotubes conduct electricity.

[2]

- (c) Carbon nanotubes and iron have very similar electrical conductivities.**

Look at some other properties of carbon nanotubes and iron.

Material	Density (g/cm³)	Melting point (°C)
Carbon nanotubes	1.6	3500
Iron	7.9	1538

- (i) Calculate how many times more dense iron is than carbon nanotubes.**

Answer = _____ [2]

(ii) Explain why iron is more dense than carbon nanotubes.

[1]

(iii) Suggest a reason why carbon nanotubes have a higher melting point than iron.

[1]

19 The table shows some common ions.

Negative ions		Positive ions	
Nitrate	NO_3^-	Aluminium	Al^{3+}
Oxide	O^{2-}	Magnesium	Mg^{2+}

(a) Write the formula for ALUMINIUM OXIDE.

_____ [1]

(b) A teacher wrote the formula for magnesium nitrate as:



A student says that the formula is incorrect.

Who is right? Explain your answer.

_____ [1]

(c) Aluminium sulfide reacts with dilute hydrochloric acid.

(i) Balance the equation for this reaction. [1]



(ii) The table shows the melting point and boiling point of H_2S .

Melting point	-85.5°C
Boiling point	-60.7°C

What state does H_2S exist in at room temperature?

_____ [1]

END OF QUESTION PAPER

ADDITIONAL ANSWER SPACE

If additional space is required, you should use the following lined page(s). The question number(s) must be clearly shown in the margin(s).

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[illegible]

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