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Surname	Other names
Pearson Edexcel	Centre Number
International GCSE	Candidate Number
<h1>Chemistry</h1> <p>Unit: 4CH0 Science (Double Award) 4SC0 Paper: 1C</p>	
Wednesday 10 January 2018 – Morning	Paper Reference
Time: 2 hours	4CH0/1C 4SC0/1C
You must have: Calculator, ruler	Total Marks

Instructions

- Use **black** ink or ball-point pen.
- **Fill in the boxes** at the top of this page with your name, centre number and candidate number.
- Answer **all** questions.
- Answer the questions in the spaces provided
– *there may be more space than you need.*
- Show all the steps in any calculations and state the units.
- Some questions must be answered with a cross in a box ☒. If you change your mind about an answer, put a line through the box ☒ and then mark your new answer with a cross ☒.

Information

- The total mark for this paper is 120.
- The marks for **each** question are shown in brackets
– *use this as a guide as to how much time to spend on each question.*

Advice

- Read each question carefully before you start to answer it.
- Write your answers neatly and in good English.
- Try to answer every question.
- Check your answers if you have time at the end.

Turn over ►

P53275A

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THE PERIODIC TABLE

Period 1 2 3 4 5 6 7 0

Group

Period

1



7 Li Lithium 3	9 Be Beryllium 4
23 Na Sodium 11	24 Mg Magnesium 12
39 K Potassium 19	40 Ca Calcium 20
86 Rb Rubidium 37	88 Sr Strontium 38
133 Cs Caesium 55	137 Ba Barium 56
223 Fr Francium 87	226 Ra Radium 88

45 Sc Scandium 21	89 Y Yttrium 39	139 La Lanthanum 57	227 Ac Actinium 89
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48 Ti Titanium 22	91 Zr Zirconium 40	179 Hf Hafnium 72
51 V Vanadium 23	93 Nb Niobium 41	181 Ta Tantalum 73
52 Cr Chromium 24	96 Mo Molybdenum 42	184 W Tungsten 74
55 Mn Manganese 25	99 Tc Technetium 43	186 Re Rhenium 75
56 Fe Iron 26	101 Ru Ruthenium 44	190 Os Osmium 76
59 Co Cobalt 27	103 Rh Rhodium 45	192 Ir Iridium 77
59 Ni Nickel 28	106 Pd Palladium 46	195 Pt Platinum 78
63.5 Cu Copper 29	108 Ag Silver 47	197 Au Gold 79
65 Zn Zinc 30	112 Cd Cadmium 48	201 Hg Mercury 80
70 Ga Gallium 31	115 In Indium 49	204 Tl Thallium 81
73 Ge Germanium 32	119 Sn Tin 50	207 Pb Lead 82
75 As Arsenic 33	122 Sb Antimony 51	209 Bi Bismuth 83
79 Se Selenium 34	128 Te Tellurium 52	210 Po Polonium 84
80 Br Bromine 35	127 I Iodine 53	210 At Astatine 85
84 Kr Krypton 36	131 Xe Xenon 54	222 Rn Radon 86

56 Fe Iron 26	59 Co Cobalt 27	59 Ni Nickel 28	63.5 Cu Copper 29	65 Zn Zinc 30
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Key

Relative atomic mass
Symbol
Name
Atomic number

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P 5 3 2 7 5 A 0 2 3 2

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Answer ALL questions.**1** Use the Periodic Table on page 2 to help you answer this question.

(a) Give the symbol of the element that has an atomic number of 14.

(1)

Si

1.18

(b) Give the symbol of the element that has a relative atomic mass of 14.

(1)

N

1.18

(c) Give the number of the group that contains the noble gases.

(1)

0

1.18

(d) Identify the group whose atoms form ions with a charge of +1.

(1)

☒ **A** 1☐ **B** 2☐ **C** 6☐ **D** 7

1.18

(e) Identify the group whose atoms form ions with a charge of -1.

(1)

☐ **A** 1☐ **B** 2☐ **C** 6☒ **D** 7

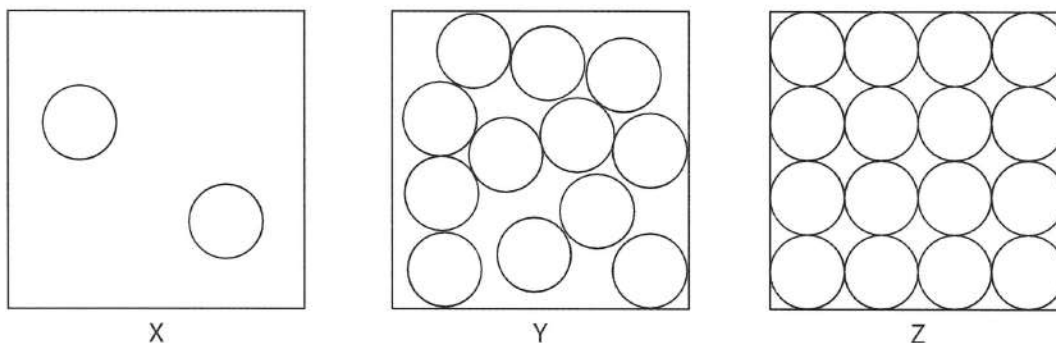
1.18

(Total for Question 1 = 5 marks)

P 5 3 2 7 5 A 0 3 3 2

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

Each circle represents a particle.



- (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	Z	X
molten iron to solid iron	Y	Z
ethene to poly(ethene)	X	Z

- (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)



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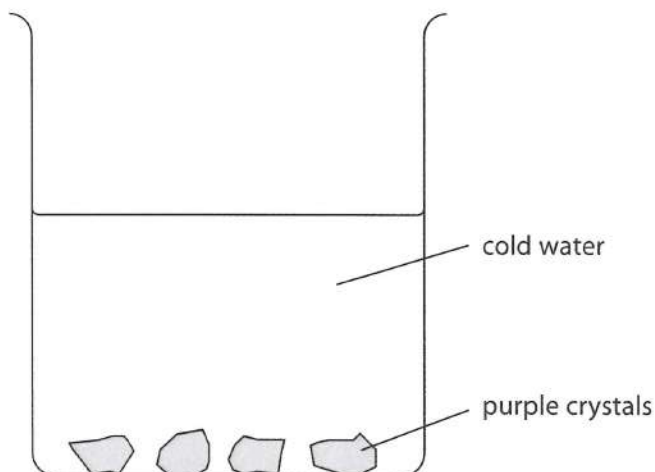
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- 3 A student places a few purple crystals at the bottom of a beaker containing some cold water. The crystals start to dissolve.



- (a) State how the appearance of the crystals and the water change as the crystals dissolve. (2)

crystals Get smaller

water colourless to purple

- (b) Which process occurs as the crystals dissolve to form a solution? (1)

- ☐ A condensation
☐ B crystallisation
☒ C diffusion
☐ D melting



(c) The student repeats the experiment using hot water instead of cold water.

- (i) State how the change in the appearance of the water differs when hot water is used instead of cold water.

(1)

Water changes colour more quickly

3.09

- (ii) Explain, in terms of particles, why the change differs when hot water is used instead of cold water.

(2)

• Particles have more energy, move faster
∴ diffuse more quickly

3.10

(Total for Question 3 = 6 marks)



P 5 3 2 7 5 A 0 7 3 2

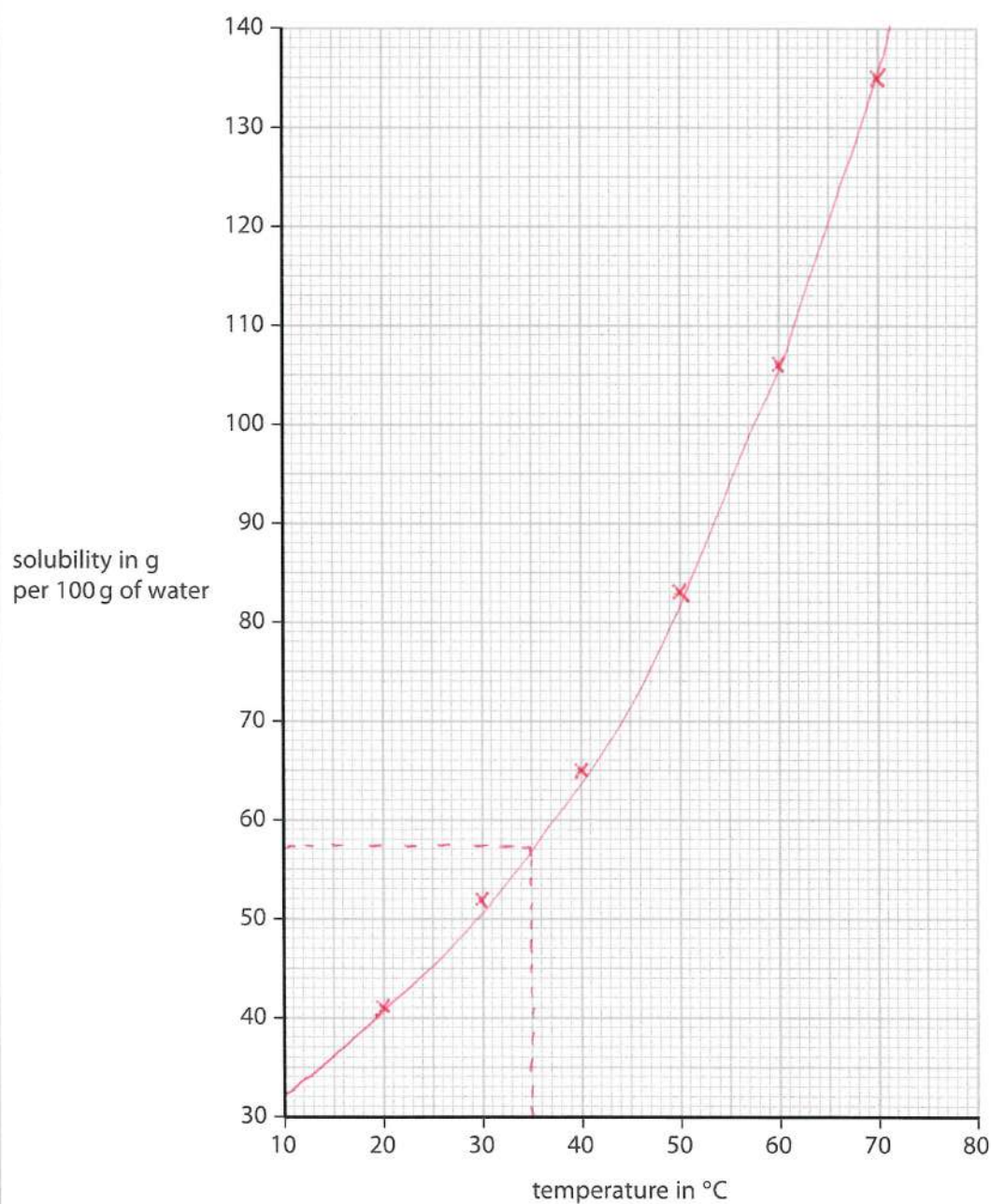
- 4 The maximum mass of a solid that dissolves in 100 g of water at a given temperature is called its solubility.

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.

(32-33)

(2)

solubility = 32 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)

At 35 °C, 57g dissolves in 100g water ✓

$$\frac{57}{2} = 28.5$$

maximum mass = 28.5 g

(Total for Question 4 = 7 marks)

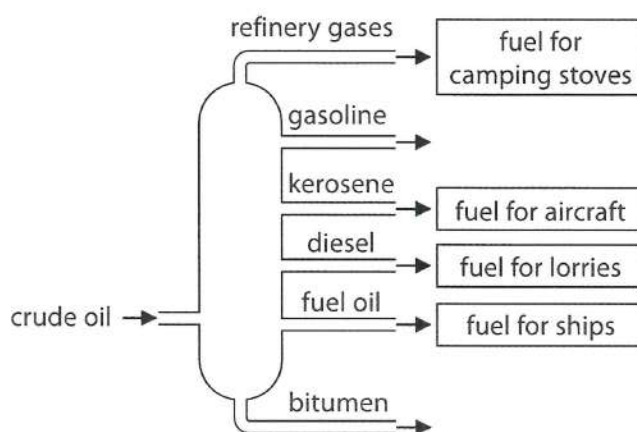


P 5 3 2 7 5 A 0 9 3 2

5 Crude oil is a liquid that contains a mixture of many hydrocarbons.

The diagram shows a fractionating column used in the distillation of crude oil.

The six fractions obtained are shown. One use for each of four of the fractions is also shown.



(a) Describe what is done to the crude oil before it enters the fractionating column.

(2)

4.08

Heated until vapourised

(b) State how the temperature changes from the top of the column to the bottom.

(1)

4.08

Increases

(c) Give a use for gasoline and a use for bitumen.

(2)

4.09

gasoline..... Fuel for cars

bitumen..... Making roads

(d) Name the fraction that contains the largest molecules.

(1)

4.10

Bitumen

(e) State the physical property that allows the different fractions to be collected at different heights in the column.

(1)

4.10

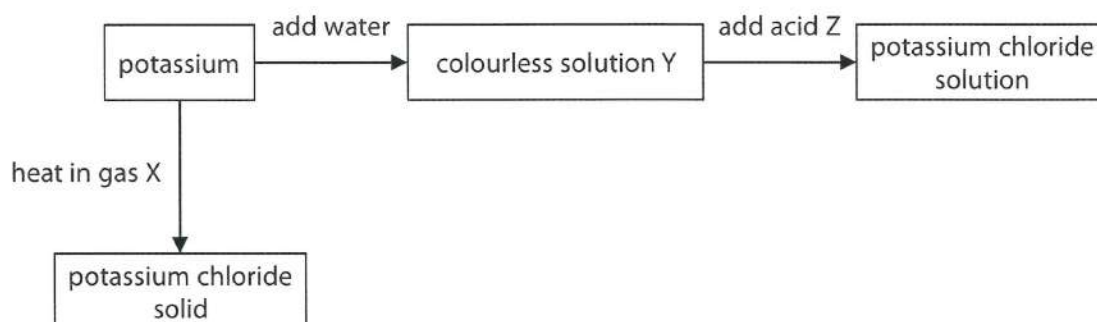
Boiling point

(Total for Question 5 = 7 marks)



6 This question is about elements in Groups 1 and 7 of the Periodic Table.

(a) The diagram shows two ways in which potassium can be converted into potassium chloride.



Give the names of gas X, colourless solution Y and acid Z.

(3)

gas X chlorine

colourless solution Y Potassium Hydroxide

acid Z Hydrochloric

(b) When sodium is burned in iodine gas, sodium iodide is formed.

(i) Write a chemical equation for the reaction between sodium and iodine.

(1)



(ii) Give a test to show that an aqueous solution of sodium iodide contains iodide ions.

(3)

test for iodide ions • Add nitric acid

• Add silver nitrate

observation Yellow ppt

(Total for Question 6 = 7 marks)



P 5 3 2 7 5 A 0 1 1 3 2

7 Copper pyrites is an ore of copper that contains copper, iron and sulfur.

(a) The percentage composition by mass of copper pyrites is

Cu 34.60% Fe 30.52% S 34.88%

Show, by calculation, that the empirical formula of copper pyrites is CuFeS_2

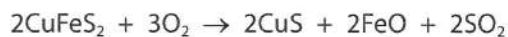
(3)

	Cu	Fe	S
	$\frac{34.60}{63.5}$	$\frac{30.52}{56}$	$\frac{34.88}{32}$
Mol	0.545	0.545	1.09
Smallest No.	$\frac{0.545}{0.545}$	$\frac{0.545}{0.545}$	$\frac{1.09}{0.545}$
Ratio	1	1	2

\therefore Empirical formula : CuFeS_2

(b) Copper is obtained from copper pyrites in a two-stage process.

Stage 1 Copper pyrites is heated in air.



Stage 2 The copper(II) sulfide is separated and then heated in air. It reacts with oxygen to form copper and sulfur dioxide.

(i) State why the sulfur in the reaction in stage 1 is described as being oxidised.

(1)

Gained oxygen

(ii) Write a chemical equation for the reaction that occurs in stage 2.

(1)



(c) Sulfur dioxide dissolves in water to form an acidic solution.

(i) Identify the ion that causes this solution to be acidic.

(1)

H^+

2.31

(ii) State how litmus paper can be used to show that the solution is acidic.

(1)

Litmus paper turns red

2.28

(iii) Give two observations that are made when a piece of magnesium ribbon is added to the acidic solution.

(2)

0.00

1

Effervesence

2

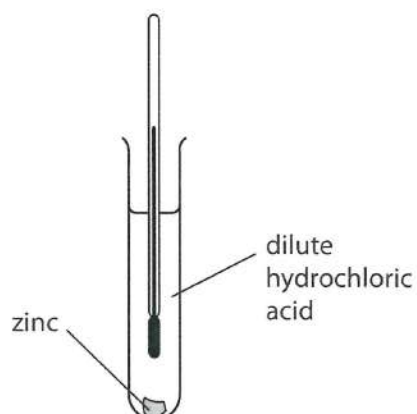
Magnesium disappears

(Total for Question 7 = 9 marks)



P 5 3 2 7 5 A 0 1 3 3 2

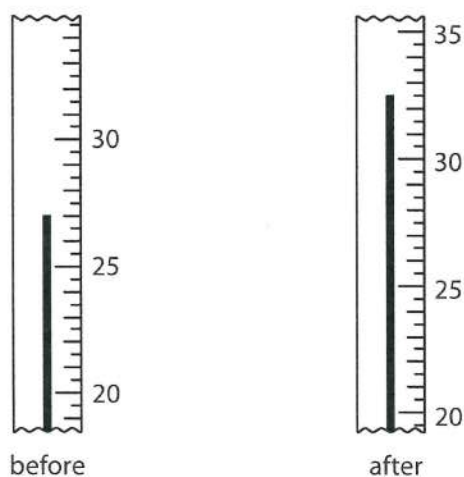
- 8 In an experiment, a student adds a piece of zinc to some dilute hydrochloric acid in a test tube.



The student measures the temperature before adding the zinc.

After adding the zinc, he stirs the mixture and measures the highest temperature reached.

The diagram shows his results.



- (a) Use the readings to complete the table, giving all values to the nearest 0.5 °C.

Temperature in °C after adding the zinc	32.5
Temperature in °C before adding the zinc	27.0
Change in temperature in °C	5.5



- (b) The student wants to find out if there is a relationship between the reactivity of a metal and the temperature rise.

He repeats the experiment four times, using a different metal each time.

The table shows his results.

Metal added	Temperature rise in °C
magnesium	7.5
gold	0.0
iron	3.0
calcium	10.5

- (i) State three factors that the student should keep constant in each experiment.

(3)

1. Size of metal OR Amount of moles (M1)
2. Concentration of acid (M2) • volume of acid (M3)
3. Rate of stirring (M4)

- (ii) Using information from the table, state the relationship between the reactivity of a metal and the temperature rise.

(1)

More reactive the metal the greater the temp rise

- (iii) State why there is no temperature rise when gold is added to the acid.

(1)

No reaction

(Total for Question 8 = 7 marks)



P 5 3 2 7 5 A 0 1 5 3 2

9 The ions present in ionic compounds can be identified using simple tests.

- some cations (positive ions) can be identified using a flame test
- some anions (negative ions) can be identified by observing reactions in solutions of the compounds

Table 1 shows the flame test colours for four cations.

Cation	Flame test colour
caesium	blue
rubidium	violet
strontium	red
tantalum	blue

Table 1

Table 2 shows the results of three tests used to identify anions in solution.

Anion	Test and Result		
	Hydrochloric acid added	Magnesium chloride solution added	Methyl orange added
carbonate	effervescence	white precipitate forms	yellow
chloride	no change	no change	orange
hydrogencarbonate	effervescence	no change	yellow
hydrogensulfate	no change	no change	red
hydroxide	no change	white precipitate forms	yellow

Table 2

Use the information in the tables to answer these questions.

- (a) In the tests, compound X gives a red flame and produces effervescence when hydrochloric acid is added.

Suggest two possible identities for compound X.

(2)

1. Strontium carbonate
2. Strontium hydrogencarbonate



- (b) (i) In the tests, compound Y gives a blue flame and produces a yellow colour when methyl orange is added.

A student concludes that compound Y is tantalum hydroxide.

Give two reasons why this conclusion may not be correct.

ANY 2

(2)

1

• Caesium also gives blue flame

2

• Carbonate turns yellow with methyl orange

• Hydrogen carbonate turns yellow with methyl orange

- (ii) Which additional test from Table 2 would show that the only anion in compound Y is the hydroxide ion?

(1)

Add hydrochloric acid

- (c) An aqueous solution contains either carbonate ions or hydrogencarbonate ions.

Using only information from the tables, explain how you could decide if the solution contains carbonate or hydrogencarbonate ions.

(3)

• Add magnesium chloride

• Carbonate ions, white ppt

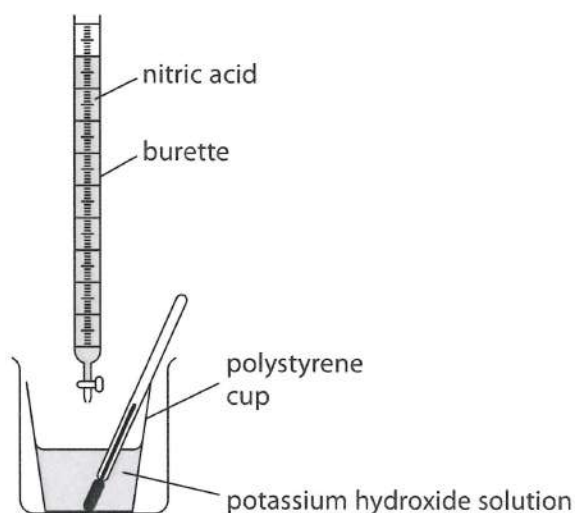
• Hydrogen carbonate ions, no change

(Total for Question 9 = 8 marks)



P 5 3 2 7 5 A 0 1 7 3 2

- 10 A student uses this apparatus to investigate the heat energy released when nitric acid is added to potassium hydroxide solution.



She uses this method.

- put 25.0 cm^3 of potassium hydroxide solution into the polystyrene cup
- measure the temperature of the potassium hydroxide solution
- add 5.00 cm^3 of nitric acid from the burette
- stir the mixture and measure the highest temperature reached
- add further 5.00 cm^3 samples of nitric acid, stir and measure the highest temperature reached after each addition

- (a) Name the piece of apparatus that should be used to measure the 25.0 cm^3 of potassium hydroxide solution.

(1)

Pipette

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

Total volume of acid added in cm^3	0.00	5.00	10.00	15.00	20.00	25.00	30.00
Highest temperature reached in $^{\circ}\text{C}$	18.0	22.0	25.0	29.0	31.0	37.0	40.00



(i) The result for 20.00 cm³ of acid is anomalous.

Suggest two possible mistakes, other than misreading the thermometer, that the student might have made to produce the anomalous result.

ANY 2

(2)

1

• Did not stir mixture

2

• Added less than 5 cm³ of acid

• Did not wait until highest temp reached

(ii) Suggest a true value for the temperature when 20.00 cm³ of acid is added.

(1)

33°C (32 - 34)

(c) In another experiment, the student records these results.

volume of potassium hydroxide solution	25.0 cm ³
starting temperature of potassium hydroxide solution	16.0 °C
total volume of acid added	25.00 cm ³
highest temperature reached by the mixture	35.0 °C

Calculate the heat energy released using the equation

$$Q = m \times 4.18 \times \Delta T$$

Q = the heat energy released in J

m = mass of the mixture in g

ΔT = change in temperature in °C

[assume mass of 1.00 cm³ of the mixture is 1.00 g]

(3)

$$\Delta T = 35 - 16 \\ = 19.0^\circ\text{C}$$

$$Q = 50.0 \times 4.18 \times 19.0 \\ = 3970 \text{ J}$$

$$m = 25.0 + 25.0 \\ = 50.0 \text{ g}$$

heat energy released = 3970 J

(Total for Question 10 = 7 marks)

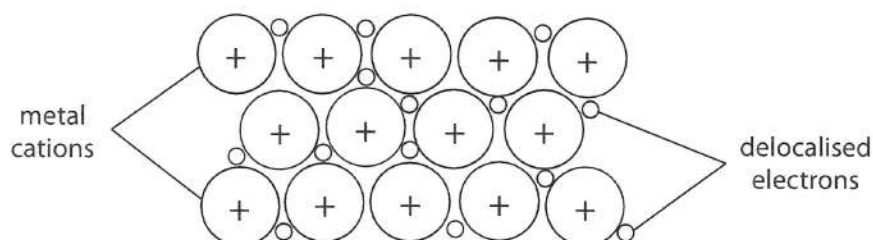


P 5 3 2 7 5 A 0 1 9 3 2

11 This question is about titanium and its compounds.

(a) Titanium is a metal.

The diagram shows the arrangement of the particles in titanium.



(i) State why metals such as titanium are good conductors of electricity.

(1)

delocalised electrons can flow

(ii) Explain why metals such as titanium are malleable.

(2)

1.54C

• Layers of cations can slide over one another

(b) Titanium(IV) chloride, TiCl_4 , and titanium(IV) oxide, TiO_2 , are both covalent compounds.

TiCl_4 is a liquid at room temperature. TiO_2 is a solid with a high melting point.

Explain these properties in terms of the structures of the two compounds.

(5)

TiCl_4

- Simple molecular (M1)
- Weak intermolecular forces (M2)

1.47
+
1.49

TiO_2

- Giant covalent (M3)
- Strong covalent bonds (M4)

\therefore Less energy required to overcome forces in TiCl_4 AND more energy required to break the covalent bonds in TiO_2 (M5)

(c) (i) A mixture of titanium(IV) oxide and carbon reacts with chlorine to form titanium(IV) chloride and carbon dioxide.

Write a chemical equation for this reaction.

(2)



1.25

(ii) Titanium(IV) chloride reacts with magnesium to form titanium and magnesium chloride, MgCl_2

Write a chemical equation for this reaction.

(1)



1.25

(Total for Question 11 = 11 marks)



P 5 3 2 7 5 A 0 2 1 3 2

12 A mixture of carbon monoxide, carbon dioxide and hydrogen is known in industry as synthesis gas.

Synthesis gas is converted to methanol, CH_3OH , by passing it over a heated solid catalyst.

The equations for the two reactions are



(a) Assume that both reactions reach a position of equilibrium.

- (i) For reaction 1, predict whether using a high or a low temperature would produce the higher yield of methanol.

Give a reason for your choice.

(1)

prediction

Low

reason

Forward reaction exothermic

- (ii) For reaction 2, predict whether using a high or a low pressure would produce the higher yield of methanol.

Give a reason for your choice.

(1)

prediction

High

reason

Fewer molecules on RHS

(b) The catalyst increases the rate of both the forward reaction and the backward reaction.

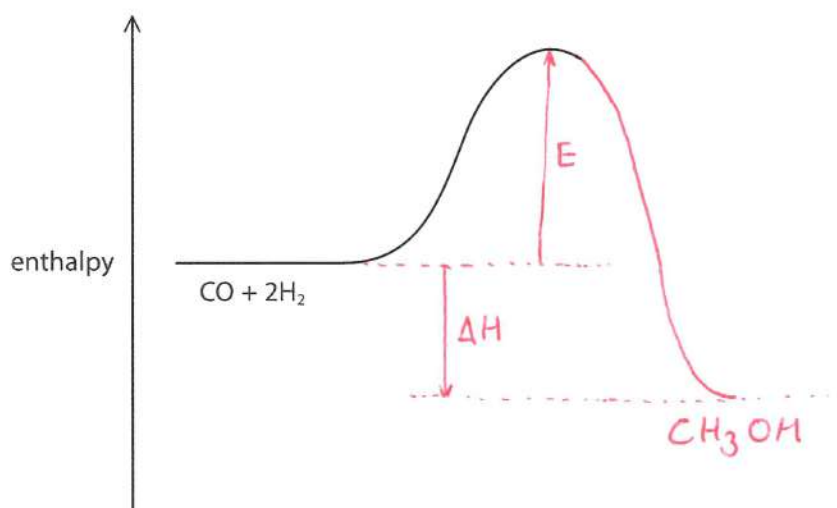
Suggest why the catalyst has no effect on the position of equilibrium.

(1)

Increases both rates equally



(c) Reaction 1 can be represented by a reaction profile diagram.



- (i) Complete the profile by showing the products of the reaction and the enthalpy change, ΔH , for the reaction.

(2)

3.14C

- (ii) Draw an arrow on the profile to represent the activation energy for the forward reaction.

Label this arrow E.

(1)

3.14C

- (iii) State the effect, if any, of the catalyst on the enthalpy change for the reaction.

(1)

No effect

3.21C

(Total for Question 12 = 7 marks)



P 5 3 2 7 5 A 0 2 3 3 2

13 Calcium carbonate decomposes when heated. The equation for the reaction is



- (a) Calculate the maximum mass of CaO that could be obtained when 20 tonnes of CaCO_3 is decomposed.

Give the unit.

[M_r of CaO = 56; M_r of CaCO_3 = 100; 1 tonne = 10^6 g]

$$n(\text{CaCO}_3) = \frac{20 \times 10^6}{100} \\ = 2 \times 10^5 \text{ mol}$$

(3)

$$m(\text{CaO}) = 2 \times 10^5 \times 56 \\ = 11.2 \text{ tonnes}$$

mass of CaO = 11.2 unit tonnes

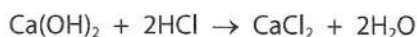
- (b) Slaked lime, Ca(OH)_2 , forms when water is added to calcium oxide.
Give the chemical name of slaked lime.

(1)

calcium hydroxide

- (c) Slaked lime is often added to soil to raise the pH of the soil.

A chemist neutralises 25.0 cm^3 of 0.500 mol/dm^3 hydrochloric acid with slaked lime.



- (i) Calculate the amount, in moles, of HCl that is neutralised.

(2)

$$n(\text{HCl}) = \frac{25}{1000} \times 0.5 \\ = 0.0125 \text{ mol}$$

amount of HCl = 0.0125 mol

- (ii) Calculate the minimum mass, in grams, of Ca(OH)_2 required to neutralise the HCl.

[M_r of Ca(OH)_2 = 74]

$$n[\text{Ca(OH)}_2] = \frac{0.0125}{2} \\ = 0.00625 \text{ mol}$$

(2)

$$m[\text{Ca(OH)}_2] = 0.00625 \times 74 \\ = 0.463 \text{ g}$$

minimum mass of Ca(OH)_2 = 0.463 g



(d) A clear solution of slaked lime is made by dissolving Ca(OH)_2 in an excess of water.

This solution is left exposed to air. The solution slowly goes milky as a faint white precipitate forms.

Explain why a faint white precipitate forms.

(2)

• Ca(OH)_2 reacts with CO_2 to form
 CaCO_3 (white ppt)

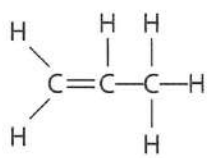
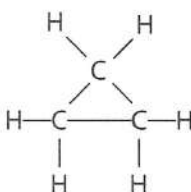
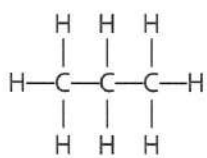
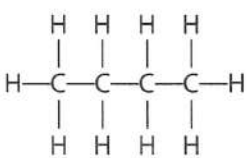
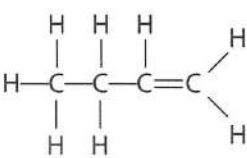
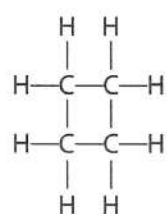
(Total for Question 13 = 10 marks)

2.44



P 5 3 2 7 5 A 0 2 5 3 2

14 The table shows the displayed formulae of six hydrocarbons, Q, R, S, T, U and V.

<p>Q</p> 	<p>R</p> 	<p>S</p> 
<p>T</p> 	<p>U</p> 	<p>V</p> 

(a) Which two hydrocarbons will instantly decolourise bromine water?

(1)

- ☐ A R and V
- ☒ B Q and U
- ☐ C S and T
- ☐ D Q and T

(b) Which two hydrocarbons have the general formula C_nH_{2n+2} ?

(1)

- ☐ A R and V
- ☐ B Q and U
- ☒ C S and T
- ☐ D Q and T

(c) Which hydrocarbon is an isomer of U?

(1)

- ☐ A Q
- ☐ B R
- ☐ C T
- ☒ D V



(d) Which two hydrocarbons have the empirical formula CH_2 ?

(1)

- ☒ **A** R and V
☐ **B** Q and S
☐ **C** R and S
☐ **D** T and U

(e) The substitution reaction between hydrocarbon T and bromine is similar to the reaction between methane and bromine.

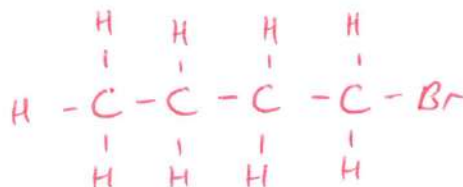
- (i) State a condition, other than temperature, that is required for this reaction to take place.

(1)

UV

- (ii) Suggest a displayed formula for a possible organic product of the reaction between hydrocarbon T and bromine.

(1)

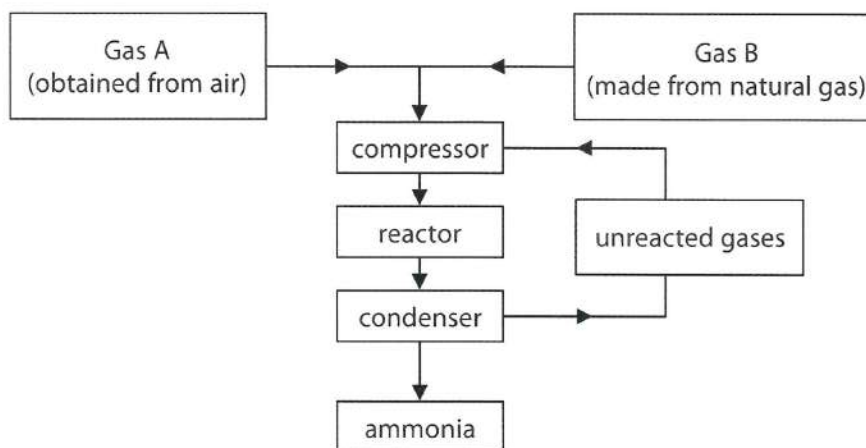


(Total for Question 14 = 6 marks)



P 5 3 2 7 5 A 0 2 7 3 2

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



(a) Give the name of this industrial process.

(1)

Haber

(b) Identify gases A and B.

(2)

gas A

N₂

gas B

H₂

(c) State the purpose of the condenser.

(1)

Liquefy the ammonia

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

(1)

Iron

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

(2)

ANY 2

1

• Saves raw materials

2

• Uses less energy

• Improve yield of ammonia



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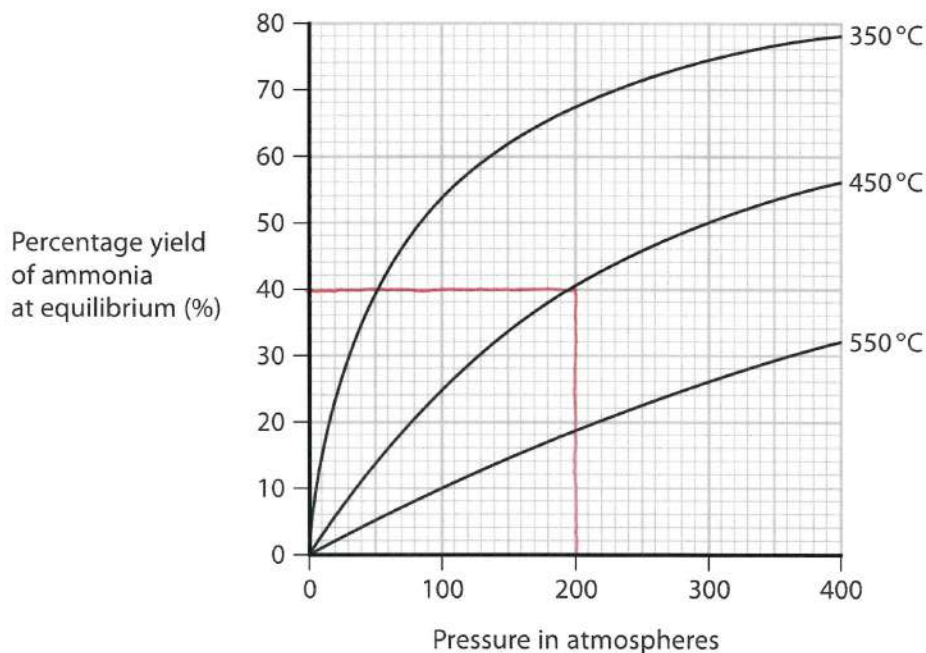
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- (f) The reaction to make ammonia is reversible and can reach a position of equilibrium.

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)

0.00

350°C

400 atm

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

(1)

0.00

40%

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

(1)

0.00

Reaction does not reach equilibrium

(Total for Question 15 = 11 marks)

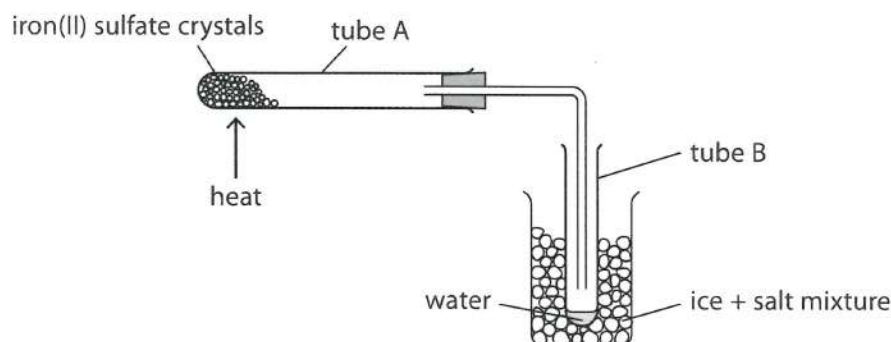


P 5 3 2 7 5 A 0 2 9 3 2

16 The mineral rozenite contains crystals of hydrated iron(II) sulfate, $\text{FeSO}_4 \cdot x\text{H}_2\text{O}$

A student wants to find the value of x .

She uses this apparatus to remove and collect the water of crystallisation from a sample of iron(II) sulfate crystals.

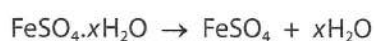


She uses this method.

- weigh empty tube A to find its mass
- place a sample of hydrated iron(II) sulfate crystals into tube A and reweigh
- heat tube A
- allow tube A to cool and reweigh
- repeat the process until the mass no longer changes

Heating until the mass no longer changes is known as heating to constant mass.

When iron(II) sulfate crystals are heated gently, they decompose according to this equation.



These are the student's results.

mass of tube A	11.96 g
mass of tube A and $\text{FeSO}_4 \cdot x\text{H}_2\text{O}$	17.56 g
mass of tube A and contents after heating to constant mass	15.76 g

(a) State why it is necessary to heat the crystals to constant mass.

(1)

Make sure all of the water has
been removed



- (b) (i) Calculate the mass of FeSO_4 formed after heating to constant mass.

$$m(\text{FeSO}_4) = 15.76 - 11.96 \\ = 3.80\text{g}$$

(1)

mass of FeSO_4 formed = 3.80 g

1.29

- (ii) Calculate the mass of water collected in tube B after heating to constant mass.

$$m(\text{H}_2\text{O}) = 17.56 - 15.76 \\ = 1.80\text{g}$$

(1)

mass of water collected = 1.80 g

1.29

- (iii) Calculate the value for x in the formula $\text{FeSO}_4 \cdot x\text{H}_2\text{O}$

Give your answer to the nearest whole number.

$[M_r \text{ of } \text{FeSO}_4 = 152; M_r \text{ of } \text{H}_2\text{O} = 18]$

(3)

$$n(\text{FeSO}_4) = \frac{3.80}{152} \\ = 0.025 \text{ mol}$$

$$x = \frac{0.1}{0.025} \\ = 4$$

$$n(\text{H}_2\text{O}) = \frac{1.8}{18} \\ = 0.1 \text{ mol}$$

$x = 4$

1.31

- (c) When the student adds the water from tube B to anhydrous copper(II) sulfate, she observes that the mixture gets hot and that there is a colour change from white to blue.

Explain these observations.

(2)

- Reaction is exothermic
- Hydrated copper(II) sulfate formed

3.01

+
2.49

(Total for Question 16 = 8 marks)

TOTAL FOR PAPER = 120 MARKS



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