Pearson Edexcel

International GCSE

Chemistry (9–1) (Modular)

Sample Assessment Materials

Pearson Edexcel International GCSE in Chemistry (Modular) (4XCH1)

First teaching September 2024
First examination June 2025
First certification August 2025

Issue 1

Please check the examination details below before entering your candidate information

Candidate surname	Other names

Centre Number | Candidate Number

Pearson Edexcel International GCSE (9–1)

Sample assessment material for first teaching 2024

Time: 1 hour 40 minutes

Paper reference **4WCH1/1C**

Chemistry (Modular)
UNIT 1

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.*

Information

- The total mark for this unit is 90.
- 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.
- Try to answer every question.
- Check your answers if you have time at the end.

Turn over ▶

S81545A

S 8 1 5 4 5 A 0 1 2 8

Pearson

The Periodic Table of the Elements

1	2											3	4	5	6	7	0
							1 H hydrogen 1										4 He helium 2
7 Li lithium 3	9 Be beryllium 4											11 B boron 5	12 C carbon 6	14 N nitrogen 7	16 O oxygen 8	19 F fluorine 9	20 Ne neon 10
23 Na sodium 11	24 Mg magnesium 12											27 Al aluminium 13	28 Si silicon 14	31 P phosphorus 15	32 S sulfur 16	35.5 Cl chlorine 17	40 Ar argon 18
39 K potassium 19	40 Ca calcium 20	45 Sc scandium 21	48 Ti titanium 22	51 V vanadium 23	52 Cr chromium 24	55 Mn manganese 25	56 Fe iron 26	59 Co cobalt 27	59 Ni nickel 28	63.5 Cu copper 29	65 Zn zinc 30	70 Ga gallium 31	73 Ge germanium 32	75 As arsenic 33	79 Se selenium 34	80 Br bromine 35	84 Kr krypton 36
85 Rb rubidium 37	88 Sr strontium 38	89 Y yttrium 39	91 Zr zirconium 40	93 Nb niobium 41	96 Mo molybdenum 42	[98] Tc technetium 43	101 Ru ruthenium 44	103 Rh rhodium 45	106 Pd palladium 46	108 Ag silver 47	112 Cd cadmium 48	115 In indium 49	119 Sn tin 50	122 Sb antimony 51	128 Te tellurium 52	127 I iodine 53	131 Xe xenon 54
133 Cs caesium 55	137 Ba barium 56	139 La* lanthanum 57	178 Hf hafnium 72	181 Ta tantalum 73	184 W tungsten 74	186 Re rhenium 75	190 Os osmium 76	192 Ir iridium 77	195 Pt platinum 78	197 Au gold 79	201 Hg mercury 80	204 Tl thallium 81	207 Pb lead 82	209 Bi bismuth 83	[209] Po polonium 84	[210] At astatine 85	[222] Rn radon 86
[223] Fr francium 87	[226] Ra radium 88	[227] Ac* actinium 89	[261] Rf rutherfordium 104	[262] Db dubnium 105	[266] Sg seaborgium 106	[264] Bh bohrium 107	[277] Hs hassium 108	[268] Mt meitnerium 109	[271] Ds darmstadtium 110	[272] Rg roentgenium 111	Elements with atomic numbers 112–116 have been reported but not fully authenticated						

Key

relative atomic mass
atomic symbol
name
atomic (proton) number

**** The lanthanoids (atomic numbers 58–71) and the actinoids (atomic numbers 90–103) have been omitted.***

The relative atomic masses of copper and chlorine have not been rounded to the nearest whole number.

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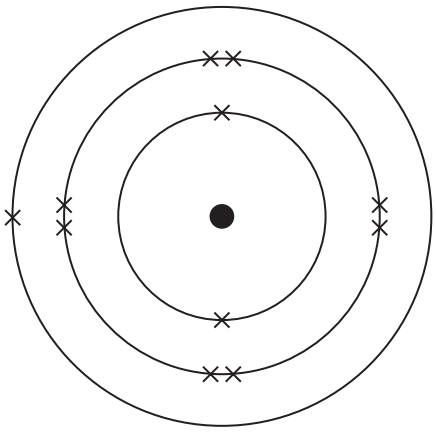
Answer ALL questions.

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 ☒.

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



(a) Name the part of the atom that contains the protons and neutrons.

(1)

.....

(b) Give the number of protons in this atom.

(1)

.....

(c) Give the number of the group that contains this element.

(1)

.....

(d) Give the number of the period that contains this element.

(1)

.....

(Total for Question 1 = 4 marks)

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2 The diagram shows the positions of some elements in part of the Periodic Table.

Na												Al			S	Cl	
K																	Xe
												In					

(a) (i) Give the symbol of a metal from the diagram.

(1)

.....

(ii) Give the symbol of an element from the diagram that forms an acidic oxide.

(1)

.....

(b) Give a similarity in the electron configurations of Al and In.

(1)

.....

.....

(c) Explain which element in the diagram is unreactive.

(2)

.....

.....

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.....

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(d) One of the isotopes of Cl can be shown as ^{35}Cl

Determine the number of each sub-atomic particle in this isotope.

(3)

number of protons

.....

number of neutrons

.....

number of electrons

.....

(Total for Question 2 = 8 marks)

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3 This question is about changes of state and separation of mixtures.

(a) The box shows some changes of state.

boiling	condensation	evaporation
freezing	melting	sublimation

The table lists some physical changes.

Complete the table using words from the box to show the change of state for each physical change.

(4)

Physical change	Change of state
water to ice	
steam to water	
solid wax to liquid wax	
iodine crystals to iodine vapour	

(b) A student plans to obtain salt solution from a mixture of salt and sand.

The student adds pure water to the mixture to dissolve the salt.

State two things the student could do to make the salt dissolve quickly.

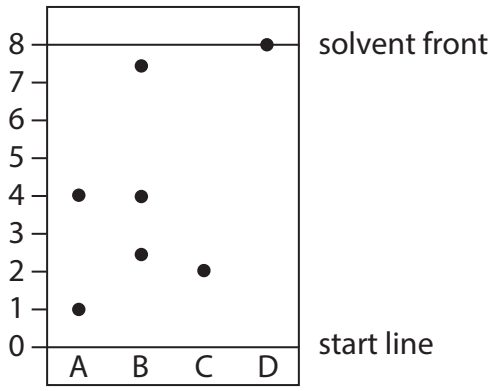
(2)

1 .....

2 .....

(c) Some mixtures can be separated using paper chromatography.

The diagram shows a chromatogram of the food dyes in four different food colourings, A, B, C and D.



(i) Give the letter of the food colouring that contains three different food dyes.

(1)

.....

(ii) Give the letters of the two food colourings that contain the same dye.

(1)

.....

(iii) Using the scale on the diagram, determine the R_f value of the dye in food colouring C.

(2)

R_f = ...

(iv) Give a reason why the dye in food colouring D moves the furthest from the start line.

(1)

.....

.....

(Total for Question 3 = 11 marks)

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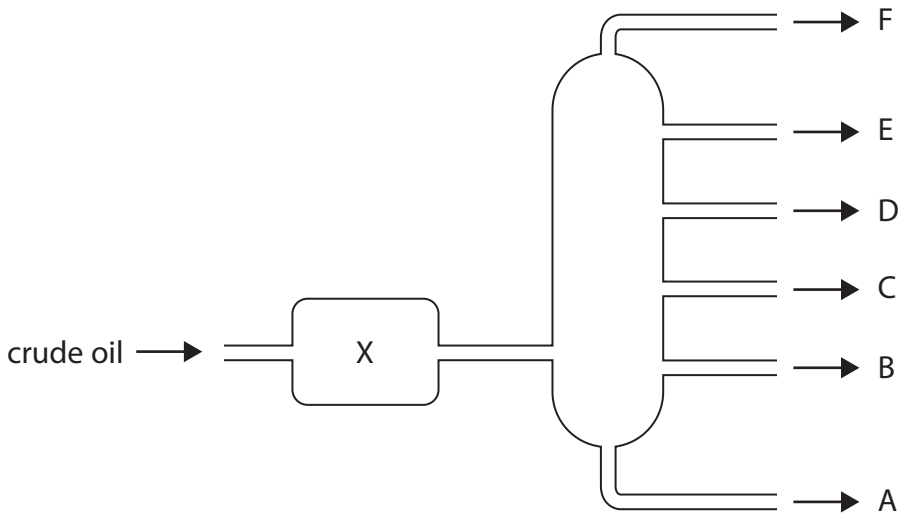
4 Crude oil is an important source of organic compounds.

(a) The diagram shows how crude oil can be separated into fractions by fractional distillation.



(i) State what happens to the crude oil when it is in X.

(1)

.....

(ii) Give the name of fraction E.

(1)

.....

(iii) Give a use for fraction A.

(1)

.....

(b) One of the compounds in fraction D is tridecane ($C_{13}H_{28}$) which can be cracked to form shorter-chain hydrocarbons.

(i) State the catalyst and temperature used in this cracking reaction.

(2)

catalyst

.....

.....

temperature

.....

.....

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(ii) The equation shows an example of a catalytic cracking reaction.

$$C_{13}H_{28} \rightarrow C_8H_{18} + C_2H_4 + C_3H_6$$

Give **two** reasons why this reaction is important.

(2)

1 .....

.....

2 .....

.....

(c) Sulfur is an impurity in crude oil.

Explain why this is a problem for the environment.

(3)

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(Total for Question 4 = 10 marks)

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5 The reactions of metals with water and with dilute sulfuric acid can be used to determine the order of reactivity of the metals.

The table shows the reactions of four metals, W, X, Y and Z, with water and with dilute sulfuric acid.

Metal	Reaction with water	Reaction with dilute sulfuric acid
W	no reaction	no reaction
X	very slow reaction	reacts quickly
Y	no reaction	reacts slowly
Z	reacts quickly	reacts violently

(a) What is the order of reactivity of these metals?

(1)

Most reactive ⟶ least reactive

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

(b) (i) State which metal, W, X, Y or Z, could be copper.

(1)

.....

(ii) State which metal, W, X, Y, or Z, could be magnesium.

(1)

.....

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(c) A displacement reaction can also be used to decide the order of reactivity of two metals.

State two observations made when an excess of magnesium powder is added to an aqueous solution of copper(II) sulfate.

(2)

1 .....

.....

2 .....

.....

(Total for Question 5 = 5 marks)

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6 A salt can be made by reacting an acid with an insoluble base.

A student has a sample of copper(II) oxide.

The student uses this method.

Stage 1 pour 50 cm^3 of dilute sulfuric acid into a beaker

Stage 2 warm the acid using a Bunsen burner

Stage 3 add a small amount of copper(II) oxide to the warm acid and stir the mixture

Stage 4 add further amounts of copper(II) oxide until copper(II) oxide is in excess

Stage 5 filter the mixture

Stage 6 obtain crystals from the filtrate

(a) State why the acid is warmed in stage 2.

(1)

.....

.....

(b) State how the student would know that the copper(II) oxide is in excess in stage 4.

(1)

.....

.....

(c) State why the mixture is filtered in stage 5.

(1)

.....

.....

(d) State the colour of the filtrate obtained in stage 5.

(1)

.....

.....

(e) Describe how the student could obtain a pure, dry sample of hydrated copper(II) sulfate crystals from the filtrate in stage 6.

(5)

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(f) The overall equation for the formation of hydrated copper(II) sulfate crystals from copper(II) oxide is

$$CuO(s) + H_2SO_4(aq) + 4H_2O(l) \rightarrow CuSO_4.5H_2O(s)$$

(i) In an experiment, a student completely reacts 9.54 g copper(II) oxide.

Show that the maximum possible mass of $CuSO_4.5H_2O$ crystals that can be obtained is about 30 g.

[M_r of CuO = 79.5 M_r of $CuSO_4.5H_2O$ = 249.5]

Give your answer to an appropriate number of significant figures.

(3)

mass = ... g

(ii) In this experiment, the actual yield of $CuSO_4.5H_2O$ crystals is 23.92 g.

Calculate the percentage yield of $CuSO_4.5H_2O$

(2)

percentage yield = ... %

(Total for Question 6 = 14 marks)

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7 Titanium is an important metal in industry. Titanium metal is extracted from its ore.

The first stage in this extraction is the conversion of titanium dioxide to titanium(IV) chloride.

(a) This is the equation for the reaction.

$$TiO_2 + 2Cl_2 + C \rightarrow TiCl_4 + CO_2$$

Calculate the volume, in dm^3, of chlorine gas at rtp needed to react completely with 20 tonnes of titanium dioxide.

Give your answer in standard form.

[1 tonne = 10^6 g M_r of TiO_2 = 80]

[molar volume of chlorine gas at rtp = 24 dm^3]

(4)

volume of chlorine gas = ... dm^3

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(b) Aeroplanes are made of an alloy containing aluminium and titanium.

Explain why the alloy is stronger than pure titanium metal.

You may include diagrams in your answer.

(3)

(Total for Question 7 = 7 marks)

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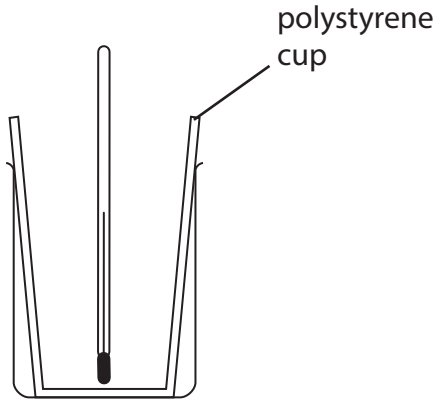
8 A student uses this apparatus to investigate the temperature change that occurs when ammonium nitrate is dissolved in water.



The student uses this method.

- put 100 cm^3 of water into the polystyrene cup and measure the initial temperature of the water
- add 8.00 g of ammonium nitrate and stir
- record the lowest temperature reached by the solution

The table shows her results.

Initial temperature of water in °C	20.0
Lowest temperature of solution in °C	14.2

(a) Use the results of the experiment to explain what type of reaction is taking place when ammonium nitrate is added to water.

(2)

.....

.....

.....

.....

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(b) Show that the heat energy change, Q, is about 2400 J.

[mass of 1.00 cm^3 of solution = 1.00 g]

[for the solution, c = 4.18 J/g/°C]

(3)

Q = ... J

(c) Use your answer to part (b) to calculate the enthalpy change, ΔH, in kilojoules per mole of ammonium nitrate.

[M_r of ammonium nitrate = 80.0]

Include a sign in your answer.

(4)

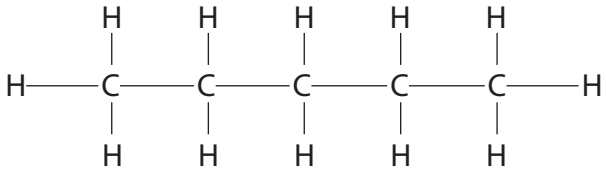
ΔH = ... kJ / mol

(Total for Question 8 = 9 marks)

9 (a) There are three isomers with the molecular formula C_5H_{12}

One of these isomers is pentane.

The displayed formula for pentane is



(i) State what is meant by the term **isomers**.

(2)

.....

.....

.....

.....

(ii) Draw the displayed formula for another isomer of C_5H_{12}

(2)

(b) Pentane reacts with bromine in the presence of ultraviolet radiation.

(i) Complete the equation for this reaction.

(2)

$C_5H_{12} + Br_2 \rightarrow$ ..... + ...

(ii) Give the name of this type of reaction.

(1)

.....

(Total for Question 9 = 7 marks)

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10 When a bottle of wine is left open for several days, some of the ethanol in the wine turns to ethanoic acid, CH_3COOH

(a) A scientist uses a titration method to investigate how much ethanoic acid is formed if a bottle of white wine is left open for one week.

The scientist uses this method.

- fill a burette with the white wine and record the reading
- add 25.0 cm^3 of sodium hydroxide solution to a conical flask
- add a few drops of phenolphthalein indicator to the flask
- swirl the flask continuously while adding wine from the burette
- add the wine drop by drop near the end point
- record the reading at the end point

(i) Name the piece of apparatus that would be most suitable for measuring the 25.0 cm^3 of sodium hydroxide solution.

(1)

.....

.....

(ii) Suggest why red wine would not be suitable to use for this investigation.

(1)

.....

.....

.....

(iii) State why the scientist swirls the flask continuously.

(1)

.....

.....

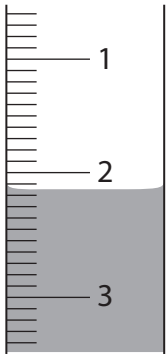
(iv) State why the scientist adds the wine drop by drop near the end point.

(1)

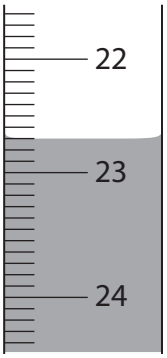
.....

.....

(b) The diagram shows the burette readings at the start and end of one of the titrations.



start



end

Use the readings to complete the table.

Give your values to the nearest 0.05 cm^3.

(3)

Burette reading at end	
Burette reading at start	
Volume of wine added in cm^3	

(c) The scientist repeats the titration four more times.

The table shows the results for these four titrations.

Titration number	1	2	3	4
Volume Volume of wine added in cm^3	20.40	20.10	20.35	20.45
Concordant results dant results				

Concordant results are those within 0.20 cm^3 of each other.

(i) Add ticks (✓) to the table to show the concordant results.

(1)

(ii) Use your ticked results to calculate the mean (average) volume of wine added.

(2)

mean volume of wine added = ... cm^3

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(d) Another scientist repeats the titration with a different bottle of white wine that has been left open for a week.

The equation for the reaction that occurs in this titration is

$$CH_3COOH + NaOH \rightarrow CH_3COONa + H_2O$$

The mean volume of wine added is 19.50 cm^3.

(i) The concentration of the sodium hydroxide solution is 0.0500 mol / dm^3.

Calculate the amount, in moles, of NaOH in 25.0 cm^3 of sodium hydroxide solution.

(2)

amount of NaOH = ... mol

(ii) Deduce the amount, in moles, of CH_3COOH in 19.50 cm^3 of the wine.

(1)

amount of CH_3COOH = ... mol

(iii) Calculate the concentration, in mol / dm^3, of CH_3COOH in wine.

(2)

concentration of CH_3COOH = ... mol/dm^3

(Total for Question 10 = 15 marks)

TOTAL FOR UNIT = 90 MARKS

Chemistry Unit 1 (Modular)
Mark Scheme

Question Number	Answer	Notes	Mark
1(a)	nucleus	**ACCEPT** nuclei	**1**

Question Number	Answer	Mark
1(b)	11 / eleven	**1**

Question Number	Answer	Mark
1(c)	1 / one / group 1	**1**

Question Number	Answer	Mark
1(d)	3 / three / period 3	**1**

Question Number	Answer	Notes	Mark
2(a)(i)	Any one from: Na K Al In	ALLOW names of elements Apply list principle	**1**

Question Number	Answer	Notes	Mark
2(a)(ii)	Any one from: S Cl	ALLOW names of elements	**1**

Question Number	Answer	Notes	Mark
2(b)	same number / three electrons in the outer shell	ALLOW valence shell	**1**

Question Number	Answer	Notes	Mark
2(c)	M1 Xe or xenon M2 as it has a full outer shell (of electrons)	 ALLOW has eight electrons in outer shell ACCEPT does not (easily) gain/lose/share electrons M2 dep on M1	**2**

Question Number	Answer	Mark
2(d)	M1 (number of protons) 17 M2 (number of neutrons) 18 M3 (number of electrons) 17	**3**

Question Number	Answer	Notes	Mark
3(a)	<table><tr><th>Change</th><th>Change of state</th></tr><tr><td>water to ice</td><td>freezing</td></tr><tr><td>steam to water</td><td>condensation</td></tr><tr><td>solid wax to liquid wax</td><td>melting</td></tr><tr><td>iodine crystals to iodine vapour</td><td>sublimation</td></tr></table>	ALLOW condensing ALLOW subliming	**4**

Question Number	Answer	Notes	Mark
3(b)	M1 heat M2 stir / mix	ALLOW use hot water IGNORE add more water ALLOW grind / crush the solid / mixture	**2**

Question Number	Answer	Mark
3(c)(i)	B	**1**

Question Number	Answer	Mark
3(c)(ii)	A and B	**1**

Question Number	Answer	Notes	Mark
3(c)(iii)	M1 2 and 8 M2 0.25	0.25 without working scores 2 ALLOW M1 for 1.8-2.2 and 8 and ALLOW M2 ECF as long as correctly evaluated to at least 2 SF (Special case if used ruler and then) 1.4-1.7 and 5.9-6.2 used no M1 but ALLOW M2 ECF as long as correctly evaluated to at least 2 SF	**2**

Question Number	Answer	Mark
3(c)(iv)	the dye is the most soluble (in the solvent/water)	**1**

Question Number	Answer	Notes	Mark
4(a)(i)	(crude oil/it is) heated / vapourised	ALLOW evaporated / boiled REJECT melted	**1**

Question Number	Answer	Notes	Mark
4(a)(ii)	gasoline	ALLOW petrol	**1**

Question Number	Answer	Mark
4(a)(iii)	road (surfacing) / roofs / tarmac	**1**

Question Number	Answer	Notes	Mark
4(b)(i)	M1 silica / alumina (catalyst) M2 600 to 700 ^{o}C	ACCEPT SiO_2/Al_2O_3 / silicon dioxide / aluminium oxide /aluminosilicates / zeolites	**2**

Question Number	Answer	Notes	Mark
4(b)(ii)	Any two from: M1 shorter-chain alkanes are in high(er) demand / more useful / used for petrol / more flammable M2 alkenes are needed / used to make polymers	 ALLOW $\underline{C_8H_{18}}$ is in high(er) demand (than $C_{13}H_{28}$) / more useful / used for petrol / more flammable IGNORE shorter-chain alkanes are used as fuels ALLOW C_2H_4 / C_3H_6 are needed / used to make polymers / plastics shorter chain hydrocarbons / the products are in high(er) demand / more useful / more flammable scores 1 if no other mark awarded to create shorter alkanes and alkenes scores 1 if no other mark awarded	**2**

Question Number	Answer	Notes	Mark
4(c)	An explanation that links the following three points: M1 sulfur dioxide produced when fuel is burned M2 (sulfur dioxide) dissolves in / reacts with rain / water M3 (causing) acid rain	 ALLOW sulfur / fuel reacts with oxygen / oxidises forming sulfur dioxide IGNORE sulfur trioxide and sulfur oxide ACCEPT (sulfur oxide / sulfur trioxide) dissolves in / reacts with rain / water IGNORE mixes	**3**

Question Number	Answer	Mark
5(a)	The only correct answer is **B** (Z X Y W) *A is not correct as Z is the most reactive metal* *C is not correct as Z is the most reactive metal* *D is not correct as X is more reactive than Y*	**1**

Question Number	Answer	Mark
5(b)(i)	W	**1**

Question Number	Answer	Mark
5(b)(ii)	X	**1**

Question Number	Answer	Notes	Mark
5(c)	M1 brown/pink/pink-brown solid forms M2 solution turns colourless	ALLOW red-brown /orange-brown IGNORE red or orange alone ALLOW precipitate for solid ALLOW solution becomes paler IGNORE clear IGNORE incorrect initial colour of solution IGNORE references to magnesium disappearing IGNORE references to heat	**2**

Question Number	Answer	Notes	Mark
6(a)	to increase the rate of reaction	ACCEPT to make the reaction faster/ to speed up the reaction REJECT any reference to increasing the solubility of copper(II) oxide	**1**

Question Number	Answer	Notes	Mark
6(b)	(the copper(II) oxide/it) stops disappearing OR mixture turns cloudy (black) OR (black) solid settles (at the bottom of the beaker)	ALLOW stops dissolving REJECT any other colour REJECT any other colour ALLOW copper(II) oxide/ it settles (at the bottom of the beaker) IGNORE precipitate	**1**

Question Number	Answer	Notes	Mark
6(c)	to remove excess/unreacted copper(II) oxide/solid/base (from the mixture)	ACCEPT to separate the copper(II) sulfate solution (from the copper(II) oxide/unreacted solid/excess solid)	**1**

Question Number	Answer	Mark
6(d)	blue	**1**

Question Number	Answer	Notes	Mark
6(e)	M1 heat/boil the filtrate M2 until crystals form in a cooled sample/ on a glass rod M3 leave the solution to cool/crystallise M4 filter (to remove the crystals) M5 dry the crystals on filter paper/on paper towel/in a warm oven /in a desiccator /leave to dry	NOTE: If the solution is heated to remove all the water then only M1 can be awarded NOTE If the solution is left to evaporate all the water without heating only 1 mark can be awarded ACCEPT to crystallisation point /to form a saturated solution /until crystals start to form /to remove some of the water M2 dep on M1 NOTE: If the solution is left to completely evaporate after heating then award MAX 3 ACCEPT decant the (excess) solution IGNORE references to washing the crystals REJECT hot oven or any method of direct heating e.g. Bunsen burner No M5 if crystals washed after drying	**5**

Question Number	Answer	Notes	Mark
6(f)(i)	• calculate the moles of CuO • calculate the mass of $CuSO_4.5H_2O$ • give the answer to an appropriate number of significant figures Example calculation M1 *n*[CuO] = 9.54 ÷ 79.5 OR 0.120 (mol) M2 mass of $CuSO_4.5H_2O$ = 0.120 × 249.5 OR 29.94 (g) M3 = 29.9 OR M1 249.5 ÷ 79.5 M2 9.54 (g) x (249.5 ÷ 79.5) (g) OR 29.94 (g) M3 = 29.9	Final answer must be to 3 sig figures 29.94 with no working scores 2 29.9 with no working score 3	**3**

Question Number	Answer	Notes	Mark
6(f)(ii)	M1 (23.92 ÷ 29.9) × 100 OR (23.92 ÷ M3 from (i)) × 100 M2 = 80(%)	ALLOW use of M2 from (i) 29.94 gives 79.89% ALLOW any number of sig figs ACCEPT answer of 79.7(3)% using 30g Correct answer without working scores 2	**2**

Question Number	Answer	Notes	Mark
7(a)	M1 (moles of TiO_2 =) $\frac{20 \times 10^6}{80}$ OR 2.5×10^5 (mol) M2 (moles of Cl_2 =) $2.5 \times 10^5 \times 2$ OR 5.0×10^5 (mol) M3 (vol of Cl_2 =) $5.0 \times 10^5 \times 24$ OR 12 000 000 (dm^3) M4 1.2×10^7 (dm^3)	correct answer with or without working scores 4 ACCEPT 250 000 (mol) ACCEPT 500 000 (mol) ALLOW ecf on M2 and M3 6×10^6 scores 3 3×10^6 scores 3 6 000 000 scores 2 3 000 000 scores 2 2.083×10^4 scores 3	**4**

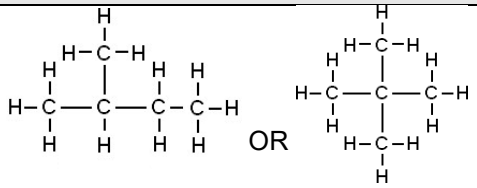
Question Number	Answer	Notes	Mark
7(b)	An explanation that links the following three points M1 in pure titanium all atoms are the same size OR layers/atoms can slide over each other (making it soft /malleable) M2 the alloy has atoms of different sizes M3 (which disrupts the structure so that) atoms/layers do not/harder to slide over each other (making it stronger) OWTTE	all marks can be awarded from labelled diagrams ALLOW cations/ions /particles in place of atoms throughout REJECT mention of molecules once only	**3**

Question Number	Answer	Notes	Mark
8(a)	An explanation that links together M1 the reaction is endothermic and either of the following points: M2 it takes in thermal energy/heat (from the surroundings) OR M3 as shown by the decrease in temperature (of the reaction mixture)	REJECT exothermic for both marks ALLOW references to cooling No M2 or M3 if the statements contradict each other	**2**

Question Number	Answer	Notes	Mark
8(b)	• calculation of temperature change • substitution into $Q = mc\Delta T$ • evaluation Example calculation M1 14.2 – 20.0 = (-)5.8 M2 $Q = 100 \times 4.18 \times (-)5.8$ M3 = (–)2420 (J)	100 x 4.18 x (20 – 14.2) scores M1 and M2 ACCEPT any number of sig figs greater than 2 Calculator answer is 2424.4 and M3 (= 2618) 2400 alone scores 0 ALLOW use of 4.2 for all 3 marks (= 2436)	**3**

Question Number	Answer	Notes	Mark
8(c)	• calculation of moles (n) of ammonium nitrate • division of Q by n • conversion of J to kJ • answer given with + sign Example calculation M1 $n[NH_4NO_3]$ = 8.00 ÷ 80 OR 0.1(00) (mol) M2 $\frac{Q}{n}$ OR $\frac{2420}{0.1(00)}$ OR $\frac{\text{answer to b}}{\text{answer to M1}}$ M3 ΔH = (+)24.2 (kJ/mol) M4 positive sign included	ACCEPT any number of sig figs in the numerator except 1 ACCEPT any number of sig figs except 1 ALLOW ecf from M2 correct answer with no working and no sign or incorrect sign scores 3 correct answer with no working and correct sign scores 4	**4**

Question Number	Answer	Notes	Mark
9(a)(i)	M1 (compounds/molecules) with the same molecular formula M2 but with different structural/displayed formula	ACCEPT same number and same type of atoms REJECT elements for compounds/molecules once only ACCEPT different structures ACCEPT atoms arranged differently REJECT contradicting statements, e.g. same displayed formula but different structures scores 0 out of 2	**2**

Question Number	Answer	Notes	Mark
9(a)(ii)	 OR M1 correct carbon skeleton M2 all hydrogen atoms and all bonds shown	M2 dep on M1	**2**

Question Number	Answer	Notes	Mark
9(b)(i)	$(C_5H_{12} + Br_2) \rightarrow C_5H_{11}Br + HBr$ M1 correct formula of organic product M2 HBr as a product and correctly balanced	deduct 1 mark if cases or subscripts incorrect ACCEPT multiple substitutions of bromine $C_5H_{10}Br_2 + H_2$ scores M1	**2**

Question Number	Answer	Notes	Mark
9(b)(ii)	substitution		**1**

Question Number	Answer	Mark
10(a)(i)	pipette	**1**

Question Number	Answer	Notes	Mark
10(a)(ii)	red wine would mask the colour of the indicator / difficult to see colour change (at end point)	ACCEPT indicator and red wine are a similar colour OWTTE	**1**

Question Number	Answer	Notes	Mark
10(a)(iii)	to mix the contents (of the flask so that they can react) OWTTE	ACCEPT to ensure the colour change is permanent OWTTE ALLOW to speed up the reaction/ to ensure complete reaction	**1**

Question Number	Answer	Notes	Mark
10(a)(iv)	so as not to add more wine than is needed (for complete reaction)/ so as not to overshoot the end point OWTTE	ACCEPT to find the actual/precise point of neutralisation IGNORE to obtain an accurate reading	**1**

Question Number	Answer	Notes	Mark
10(b)	M1 final burette reading in cm^3 22.70 M2 initial burette reading in cm^3 2.15 M3 volume of wine added in cm^3 20.55	MAX 2 if final and initial burette readings are reversed. MAX 2 if readings not given to 2 decimal places. ALLOW ECF for M3 on correct subtraction of M1 – M2	**3**

Question Number	Answer	Mark
10(c)(i)	Ticks in boxes 1, 3 and 4	**1**

Question Number	Answer	Notes	Mark
10(c)(ii)	• setting out of calculation • answer M1 $\frac{20.40 + 20.35 + 20.45}{3}$ M2 20.40	20.40 without working scores 2 20.4 with or without working scores 1 If no results ticked then only use of 2 or 3 concordant titres can score both marks in (ii) If only one result ticked then M2 can be scored for averaging two or more titre values correctly M1 CQ on results ticked M2 CQ on correct calculation from M1 Answer to M2 must be correct to 2dp	**2**

Question Number	Answer	Notes	Mark
10(d)(i)	• setting out of calculation • final answer M1 $\frac{25.0 \times 0.05(00)}{1000}$ M2 0.00125	If no division by 1000 giving an answer of 1.25 award 1 mark Correct answer without working scores 2	**2**

Question Number	Answer	Mark
10(d)(ii)	0.00125 OR answer to (i)	**1**

Question Number	Answer	Notes	Mark
10(d)(iii)	• setting out of calculation • final answer M1 $\frac{0.00125 \times 1000}{19.50}$ OR $\frac{\text{answer to (ii)} \times 1000}{19.5}$ M2 0.0641 OR answer to M1	ACCEPT any number of sig fig cept 1 Correct answer without working scores 2 $\frac{\text{answer to (ii)}}{19.5}$ correctly evaluated to 2 or more sig figs. scores 1 Do not penalise not multiplying by 1000 in (iii) if they have not divided by 1000 in (i)	**2**