Disclaimer: these are only predictions and educated guesses! Make sure you are prepared for any question to come up, not only the topics included in this pack!

2025 Chemistry Prediction Paper 2

The questions in this pack cover the **major** topics that are **predicted** to come up in Chemistry Paper 2. These questions are all from Edexcel International GCSE papers, though questions are included from the old specification. The content has been checked to ensure it is still relevant.

Please bear in mind that your actual Paper 2 will also include easier content as well as the challenging questions included here.

Total marks available: 155

Recommended time: 180 minutes

Important: these questions do NOT cover everything that could be included in Paper 2! The checklist shows all content that can be included in Paper 2.

If you print these questions out double sided and double staple them on the left, they format will be exactly like an exam paper ☺

Qu	Content	Score
1	Chromatography	/ 7
2	Oxidation reactions, properties of ionic compounds	/ 7
3	Reactions of Alkali Metals	/ 6
4	Equilibrium	/ 8
5	Titrations methods and calculations	/ 15
6	Solubility	/ 7
7	Metals and alloys	/ 7
8	Polymerisation	/ 6
9	Reactions of carboxylic acids Esters	/ 11
10	Ethanol	/ 12
11	Electrolysis of aqueous solutions	/ 9
12	Making insoluble salts	/ 18
13	Properties of ionic compounds	/ 8
14	Calculating enthalpy, bond energies, energy level diagrams	/ 10
15	Empirical formulae, metal extraction	/ 9
16	Thermal decomposition	/ 9
17	Reacting masses, gas calculations	/ 6

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.

1. Chromatography can be used to separate the substances in a mixture.

(a) Diagram 1 shows the apparatus used to separate the different dyes in a food colouring.

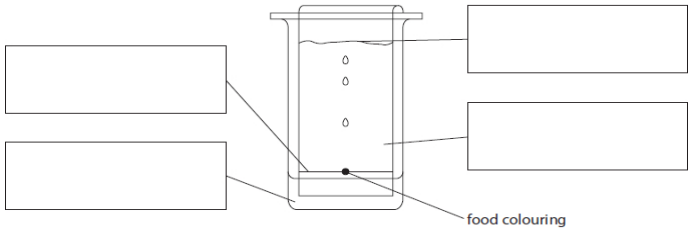


Diagram 1

The box lists some terms used in chromatography.

baseline	chromatography paper
solvent	solvent front

Use the terms from the box to label diagram 1. (3)

(b) Diagram 2 shows a chromatogram produced using four different food colourings, P, Q, R and S.

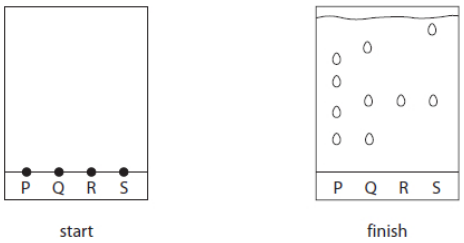


Diagram 2

(i) Which food colouring contains only one dye? (1)

- ☐ A P
- ☐ B Q
- ☐ C R
- ☐ D S

(ii) Which food colourings have one dye in common? (1)

- ☐ A P, Q and R
- ☐ B P, R and S
- ☐ C Q, R and S
- ☐ D P, Q, R and S

(iii) Explain which food colouring contains the largest number of dyes. (2)

.....

.....

.....

(Total for question = 7 marks)

2. Antimony, Sb, is an element in Group 5 of the Periodic Table.
The mineral, stibnite, contains antimony sulfide, Sb_2S_3
Antimony can be obtained from stibnite in a two-stage process.

Stage 1 stibnite is roasted in air

$Sb_2S_3 + 5O_2 \rightarrow Sb_2O_4 + 3SO_2$

Stage 2 the oxide produced is heated with carbon to form antimony and carbon dioxide

(a) (i) State why the sulfur in stage 1 is said to be oxidised. (1)

.....

.....

(ii) Complete the equation for the reaction in stage 2. (1)

$Sb_2O_4 +$ ..... $C \rightarrow$ ..... $Sb +$ ..... CO_2

(b) Bismuth is another element in Group 5 of the Periodic Table.
Bismuth forms an oxide, Bi_2O_3, which has a giant ionic structure.
(i) Give the formula of the bismuth ion in bismuth oxide. (1)

.....

(ii) Explain why bismuth oxide has a high melting point. (2)

.....

.....

.....

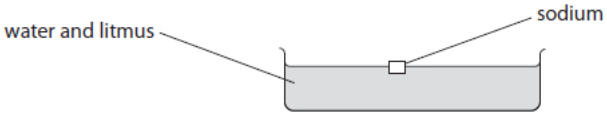
.....

(iii) Bismuth oxide reacts with dilute hydrochloric acid to form bismuth chloride.
Write a chemical equation for this reaction. (2)

.....

(Total for question = 7 marks)

3. A teacher investigates the reaction between sodium and water.
The teacher fills a trough with water.
She adds a few drops of litmus solution to the water, and then adds a piece of sodium.



(a) The sodium floats on the water. It reacts with the water and produces bubbles of hydrogen gas.

(i) State two other observations that are made during the reaction. (2)

1 .....

.....

2 .....

.....

(ii) Balance the equation for the reaction between sodium and water.
Include the state symbols. (2)

..... Na(.....) + ... H_2O(.....) → ..... NaOH(.....) + ... H_2(.....)

(b) Lithium and potassium react in a similar way to sodium when added to water.

(i) State why they have a similar reaction in terms of the electronic configurations of their atoms. (1)

.....

.....

(ii) Place the elements lithium, potassium and sodium in order of reactivity. (1)

most reactive .....

.....

least reactive .....

(Total for question = 6 marks)

4. Dinitrogen tetraoxide, N_2O_4, is a colourless gas.
Nitrogen dioxide, NO_2, is a brown gas.
The two gases can exist together in dynamic equilibrium according to the equation

$$N_2O_4(g) \rightleftharpoons 2NO_2(g)$$

(a) Explain what is meant by the term dynamic equilibrium. (2)

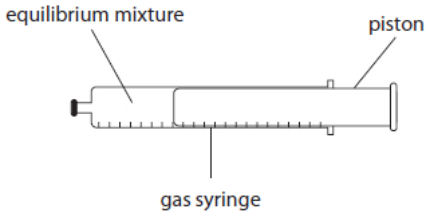
.....

.....

.....

.....

(b) Some N_2O_4 and some NO_2 are put into a sealed gas syringe and allowed to form an equilibrium mixture.



This equilibrium mixture is brown.

(i) The pressure of the gas in the syringe is increased by pushing in the piston. The mixture is then allowed to reach a new equilibrium at the same temperature as before.
Explain why the new equilibrium mixture contains less NO_2 than the original equilibrium mixture. (2)

.....

.....

.....

.....

.....

.....

(ii) A student suggests that the new equilibrium mixture would be lighter in colour than the original equilibrium mixture, as there is now less NO_2 present. Suggest why the new equilibrium mixture is actually darker than the original. (1)

.....

.....

.....

(c) Carbon monoxide, CO, and oxides of nitrogen are produced in a car engine when petrol is burned.
These oxides can be partly removed by using a catalytic converter fitted to the car's exhaust system.
(i) State how oxides of nitrogen are produced in the car engine. (1)

.....

.....

(ii) Give a disadvantage of allowing oxides of nitrogen to escape into the atmosphere. (1)

.....

.....

(iii) Write a chemical equation for the reaction between nitrogen monoxide, NO, and carbon monoxide to form carbon dioxide and nitrogen. (1)

.....

(Total for question = 8 marks)

5. 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.
She 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 she swirls the flask continuously. (1)

.....

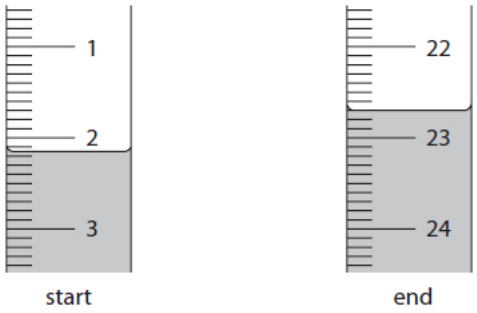
.....

(iv) State why she 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.



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 her results for these four titrations.

titration number	1	2	3	4
volume of wine added in cm^3	20.40	20.10	20.35	20.45
concordant 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

(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 the wine. (2)

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

(Total for question = 15 marks)

BLANK PAGE

6. This is a method used to measure the solubility of a solid in water:

- add an excess of solid to some water in a boiling tube and stir
- measure the temperature of the saturated solution formed
- weigh an empty evaporating basin
- pour some of the saturated solution into the evaporating basin
- weigh the basin and contents
- heat the evaporating basin to remove all of the water
- weigh the evaporating basin and remaining solid.

(a) The table shows the results of an experiment using this method.

mass of evaporating basin / g	89.6
mass of evaporating basin + saturated solution / g	115.8
mass of evaporating basin + solid / g	94.9

Calculate the mass of solid obtained and the mass of water removed. (2)

mass of solid = ... g

mass of water = ... g

(b) In another experiment, at a different temperature, the mass of solid obtained is 10.5 g and the mass of water removed is 16.8 g.
Calculate the solubility of the solid, in g per 100 g of water, at this temperature. (2)

solubility = ... g per 100 g of water

(c) If the evaporating basin is heated too strongly some of the solid decomposes to form a gas.
Explain how this strong heating would affect the value of the calculated solubility of the solid. (3)

.....

.....

.....

.....

.....

.....

(Total for question = 7 marks)

7. This question is about metals.

(a) Which statement describes metallic bonding? (1)

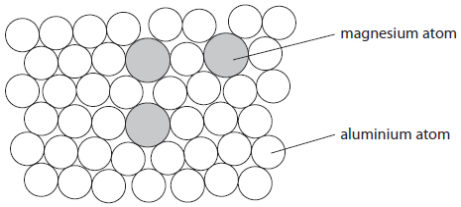
- ☒ A electrostatic attraction between oppositely charged ions
- ☒ B electrostatic attraction between the nuclei of two atoms and a pair of electrons shared between them
- ☒ C electrostatic attraction between positively charged particles and delocalised electrons
- ☒ D electrostatic attraction between atoms

(b) Aluminium is malleable and can be easily shaped to make saucepans used for cooking food.
State two other properties of aluminium that make it suitable for saucepans used for cooking food. (2)

1 .....

2 .....

(c) Magnalium is an alloy of aluminium and magnesium.
The diagram shows how the atoms are arranged in this alloy.



(i) State what is meant by the term alloy. (1)

.....

.....

(ii) Explain why magnalium is harder than aluminium. (3)

.....

.....

.....

.....

.....

(Total for question = 7 marks)

8. Polymers can be classified as addition polymers or condensation polymers.

(a) An addition polymer can be formed from the monomer $CH_2 = CHCl$

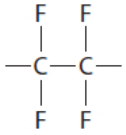
(i) Name this monomer. (1)

.....

(ii) Name the addition polymer formed from this monomer. (1)

.....

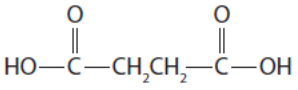
(b) The diagram shows the repeat unit of a different addition polymer.

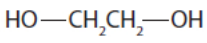


Draw the displayed formula of the monomer used to make this polymer. (1)

(c) Polyesters are condensation polymers.

The structures of two monomers that are used to make a polyester are:





(i) Draw the structure of the repeat unit of the polyester formed from these two monomers. (2)

(ii) Identify the small molecule formed when these two monomers form the polyester. (1)

.....

(Total for question = 6 marks)

9. This question is about the reactions of carboxylic acids.

(a) Carboxylic acids react with solutions of metal carbonates.

(i) Complete the chemical equation for the reaction of ethanoic acid, CH_3COOH, with potassium carbonate solution. (2)

$2CH_3COOH + K_2CO_3 \rightarrow$ ..... + ... + ...

(ii) State what you would see in this reaction. (1)

.....

(b) The ester, ethyl ethanoate, can be prepared by reacting ethanol with ethanoic acid.
This is the method for the preparation.

- mix equal amounts of ethanoic acid and ethanol in a boiling tube
- add a few drops of concentrated sulfuric acid
- place the boiling tube in a hot water bath for several minutes

(i) State the role of concentrated sulfuric acid in this reaction. (1)

.....

.....

(ii) Suggest why the mixture is heated in a water bath rather than directly with a Bunsen burner flame. (1)

.....

.....

(iii) State how you would know that ethyl ethanoate has formed. (1)

.....

.....

(c) Another ester, methyl propanoate, can be prepared by reacting methanol with propanoic acid.

(i) Draw the displayed formulae of methanol, propanoic acid and the ester, methyl propanoate. (3)

methanol	propanoic acid

methyl propanoate

(ii) Give the name of the other product of this reaction. (1)

.....

(d) Give one use of esters. (1)

….....

(Total for question = 11 marks)

10. Ethanol can be manufactured by fermentation or by the direct hydration of ethene.

(a) In Brazil, the main source of sugar for fermentation is sugar cane.

- sugar cane is added to water
- sugar cane contains sucrose ($C_{12}H_{22}O_{11}$) that dissolves in the water
- during the fermentation process the sucrose is broken down into glucose ($C_6H_{12}O_6$)
- this glucose is then converted into ethanol (C_2H_5OH) and carbon dioxide

(i) Name the substance that is added to the sucrose solution to allow fermentation to take place. (1)

.....

(ii) Complete the equation for the conversion of sucrose into glucose. (1)

$C_{12}H_{22}O_{11} + H_2O \rightarrow$ .....

(iii) Write a chemical equation for the conversion of glucose into ethanol and carbon dioxide. (1)

.....

(iv) Fermentation produces a solution that is a mixture of ethanol and water. Which of these is the most effective method of obtaining ethanol from this mixture? (1)

- ☒ A crystallisation
- ☒ B filtration
- ☒ C fractional distillation
- ☒ D simple distillation

(b) In the direct hydration method, ethene reacts with steam.
The equation for the reaction is

$$C_2H_4 + H_2O \rightarrow C_2H_5OH$$

(i) Name the catalyst used in this reaction. (1)

.....

(ii) State the temperature and pressure used in this reaction. (2)

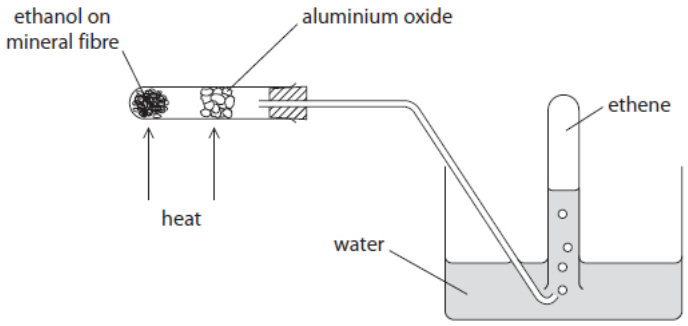
temperature

.....

pressure

.....

(c) This apparatus is used to convert ethanol into ethene.



(i) Name the type of reaction taking place. (1)

.....

(ii) State the function of the aluminium oxide in this reaction. (1)

.....

(d) Ethene belongs to a homologous series of unsaturated hydrocarbons called alkenes.

(i) State what is meant by the term unsaturated (1)

.....

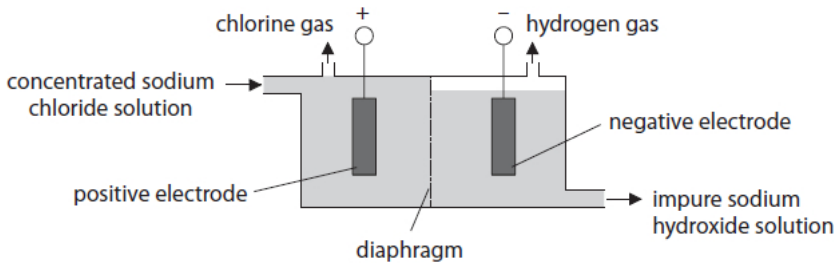
.....

(ii) State the colour change that is observed when bromine water is shaken with ethene in a test tube. (2)

from ..... to .....

(Total for question = 12 marks)

11. The diagram shows the electrolysis of concentrated sodium chloride solution in a diaphragm cell.



(a) (i) The ionic half-equation for the reaction at the positive electrode is

$$2Cl^- \rightarrow Cl_2 + 2e^-$$

Use this equation to explain why oxidation occurs at the positive electrode. (2)

.....

.....

.....

.....

(ii) At the negative electrode, water molecules gain electrons to form hydroxide ions and hydrogen gas.
Complete the ionic half-equation for this reaction. (2)

$2H_2O$ + ... → ..... + ...

(b) Chlorine reacts with sodium hydroxide to produce a mixture of water, sodium chloride and sodium chlorate(I), NaOCl.
Write a chemical equation for this reaction. (1)

.....

(c) Chlorine is used in the manufacture of the addition polymer poly(chloroethene).

(i) Explain how an addition polymer is formed from its monomers. (2)

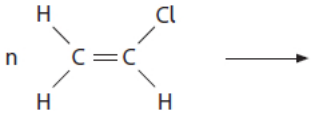
.....

.....

.....

.....

(ii) Complete this equation by drawing the displayed formula of poly(chloroethene). (2)



(Total for question = 9 marks)

12. A student investigates the reaction between lead(II) nitrate solution and potassium chromate solution.

(a) Lead(II) nitrate solution and potassium chromate solution react to form a yellow precipitate of lead(II) chromate and potassium nitrate solution.

(i) Complete the equation by adding the state symbols. (1)

$Pb(NO_3)_2$ (…….) + K_2CrO_4 (…....) → $PbCrO_4$ (…….) + $2KNO_2$ (…….)

(ii) Use information from the equation to determine the charge on the chromate ion. (1)

.....

(b) The student uses this method for her investigation.

- place 5.0 cm^3 potassium chromate solution in a test tube standing in a test tube rack
- add 1.0 cm^3 lead(II) nitrate solution to the test tube
  allow the precipitate to settle and measure its height
- repeat the method using separate 5.0 cm^3 samples of potassium chromate and adding different volumes of lead(II) nitrate solution

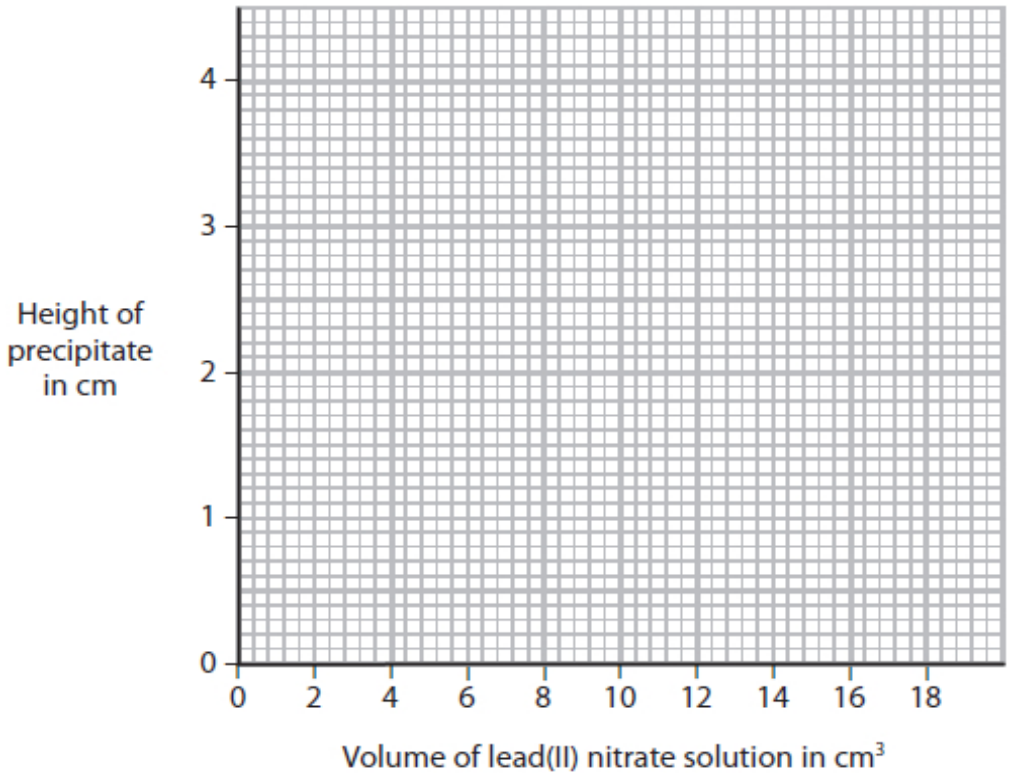
These are the student's results.

Volume of lead(II) nitrate solution in cm^3	Height of precipitate in cm
1.0	0.3
2.0	0.6
4.0	1.2
6.0	1.8
8.0	2.4
9.0	2.7
11.0	3.0
12.0	3.0
14.0	2.1
16.0	3.0
18.0	3.0

(i) Plot the student's results on the grid. (2)

(ii) Circle the anomalous result on the grid. (1)

(iii) Ignoring the anomalous result, draw a straight line of best fit through the first six points, and another straight line of best fit through the last five points. Make sure that the two lines cross. (2)



(iv) Use your graph to find the volume of lead(II) nitrate solution that reacts exactly with the 5.0 cm^3 (1)

volume of lead(II) nitrate solution = ... cm^3

(v) Suggest two possible reasons for the anomalous result. (2)

1 .....

.....

2 .....

.....

(c) (i) Describe how to obtain a pure, dry sample of solid lead(II) chromate from the test tube at the end of the investigation. (3)

.....

.....

.....

.....

.....

.....

(ii) Give a test to show that the potassium nitrate solution in the test tube contains potassium ions. (2)

.....

.....

.....

.....

(d) The student does a similar experiment to produce a precipitate of lead iodide, PbI2, using the following reaction.

$$Pb(NO_3)_2 + 2KI \rightarrow PbI_2 + 2KNO_3$$

He finds that 5.0 cm^3 of 0.90 mol/dm^3 KI solution reacts with 8.0 cm^3 of $Pb(NO_3)_2$ solution.
Calculate the concentration, in mol/dm^3, of the $Pb(NO_3)_2$ solution. (3)

concentration of $Pb(NO_3)_2$ solution = ... mol/dm^3

(Total for question = 18 marks)

13. Lithium fluoride, LiF, and magnesium oxide, MgO, are ionic compounds.

(a) (i) Calculate the relative formula mass (M_r) of MgO. (1)

M_r = ...

(ii) Give the formulae of the two ions in LiF. (1)

..... and .....

(b) Explain why

- ionic compounds have high melting points
- the melting point of magnesium oxide is much higher than the melting point of lithium fluoride (4)

.....

.....

.....

.....

.....

.....

(c) Explain why ionic compounds do not conduct electricity when solid, but do conduct electricity when molten or in aqueous solution. (2)

.....

.....

.....

.....

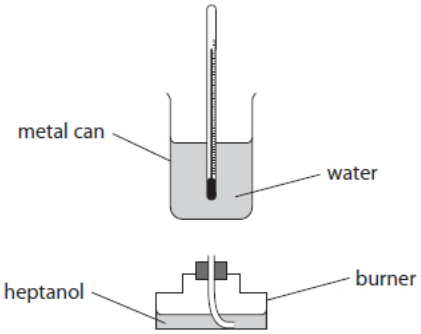
.....

.....

(Total for question = 8 marks)

14. Heptanol and hydrogen are both used as fuels.

(a) A student uses this apparatus to find the heat energy released from the combustion of heptanol.



He uses this formula

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

[Q = heat energy released, m = mass of water in g, ΔT = change in temperature of water]

1.00 cm^3 water has a mass of 1.00 g.

(i) State the measurements that the student needs to record to find a value for the heat energy released. (2)

.....

.....

.....

.....

(ii) The student burns 0.75 g of heptanol and calculates Q to be 19 kJ.
Use this information to calculate the molar enthalpy change, in kJ/mol, for the combustion of heptanol.
[M_r of heptanol = 114] (3)

molar enthalpy change = ... kJ/mol

(b) The equation for the combustion of hydrogen is

$$2H_2 + O_2 \rightarrow 2H_2O$$

(i) This equation shows the reaction, including the covalent bonds in the molecules.

$$2H{-}H + O{=}O \rightarrow 2H{-}O{-}H$$

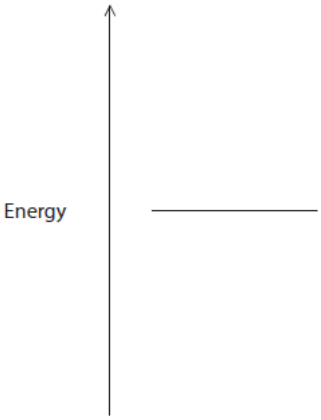
The table gives the average (mean) bond energies.

Bond	Average bond energy in kJ/mol
H—H	436
O=O	498
H—O	464

Use the values in the table to calculate the enthalpy change, Δ*H*, for the reaction.
Include the sign in your answer. (3)

Δ*H* = ... kJ

(ii) Complete the energy level diagram for the reaction between hydrogen and oxygen by showing the reactants and products.
Label the enthalpy change, Δ*H*, for the reaction. (2)



(Total for question = 10 marks)

15. 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)

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

Stage 1
Copper pyrites is heated in air.

$$2CuFeS_2 + 3O_2 \rightarrow 2CuS + 2FeO + 2SO_2$$

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)

.....

.....

(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)

.....

(ii) State how litmus paper can be used to show that the solution is acidic. (1)

.....

.....

(iii) Give two observations that are made when a piece of magnesium ribbon is added to the acidic solution. (2)

1 .....

.....

2 .....

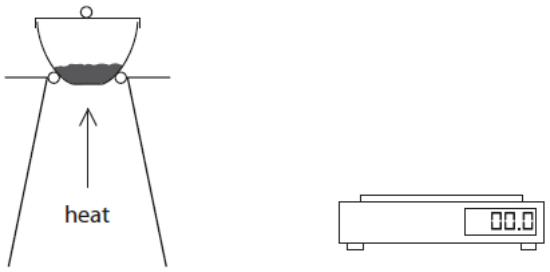
.....

(Total for question = 9 marks)

16. The equation for the thermal decomposition of copper(II) carbonate is

$$CuCO_3(s) \rightarrow CuO(s) + CO_2(g)$$

A student investigates the decomposition of copper(II) carbonate using this apparatus.



She uses this method.

- weigh the crucible, lid and copper(II) carbonate
- heat the crucible, lid and contents for 2 minutes
- allow to cool and then reweigh
- heat for a second period of 2 minutes
- allow to cool and then reweig
- heat for a third period of 2 minutes
- allow to cool and then reweigh

The table shows the student's results.

	Mass of crucible, lid and contents in grams			
Experiment	before heating	after heating for 2 minutes	after heating for 4 minutes	after heating for 6 minutes
1	26.3	23.0	21.9	21.4
2	25.8	22.7	21.5	21.5
3	26.0	23.0	21.2	21.2
4	26.1	23.2	21.8	21.8

(a) Why does the mass decrease during heating? (1)

.....

.....

(b) State the colours of the solids in the reaction. (2)

$CuCO_3(s)$.....

CuO(s).....

(c) (i) In which experiment might the decomposition not be complete? (1)

.....

(ii) Give a reason for your choice. (1)

.....

.....

(iii) Which statement could explain why the decomposition might not be complete? (1)

- ☒ A The student used a higher temperature than in the other experiments.
- ☒ B The student used less copper(II) carbonate than in the other experiments.
- ☒ C The student heated the crucible without a lid on.
- ☒ D The student used a spirit burner instead of a Bunsen burner.

(d) In another experiment, the student calculates that she should obtain a mass of 3.7 g of CuO(s) after completely decomposing a sample of $CuCO_3$(s).
She actually obtains a mass of 3.4 g of CuO(s).
Calculate the percentage yield in her experiment. (2)

percentage yield = ... %

(Total for question = 8 marks)

17. Sulfuric acid can be manufactured from sulfur in a four–stage process.

stage 1 sulfur is burned in air to form sulfur dioxide

$$S + O_2 \rightarrow SO_2$$

stage 2 the sulfur dioxide is reacted with more oxygen to form sulfur trioxide

$$SO_2 + ½\ O_2 \rightarrow SO_3$$

stage 3 the sulfur trioxide is absorbed in concentrated sulfuric acid to make oleum

$$SO_3 + H_2SO_4 \rightarrow H_2S_2O_7$$

stage 4 the oleum is carefully diluted with water to form sulfuric acid

(a) Write a chemical equation for the formation of sulfuric acid from oleum. (1)

.....

(b) A mass of 80 tonnes of sulfur is reacted with oxygen in stage 1.
Calculate the maximum mass, in tonnes, of sulfur trioxide that can be produced in stage 2.
[1 tonne = 1.0×10^6g] (3)

maximum mass = ... tonnes

(c) Calculate the minimum volume at rtp, in cubic decimetres (dm^3), of oxygen required to completely react with 64 tonnes of sulfur dioxide.
[1 mol of oxygen at rtp has a volume of 24 dm^3] (2)

volume of oxygen = ... dm^3

(Total for question = 6 marks)

END OF QUESTIONS