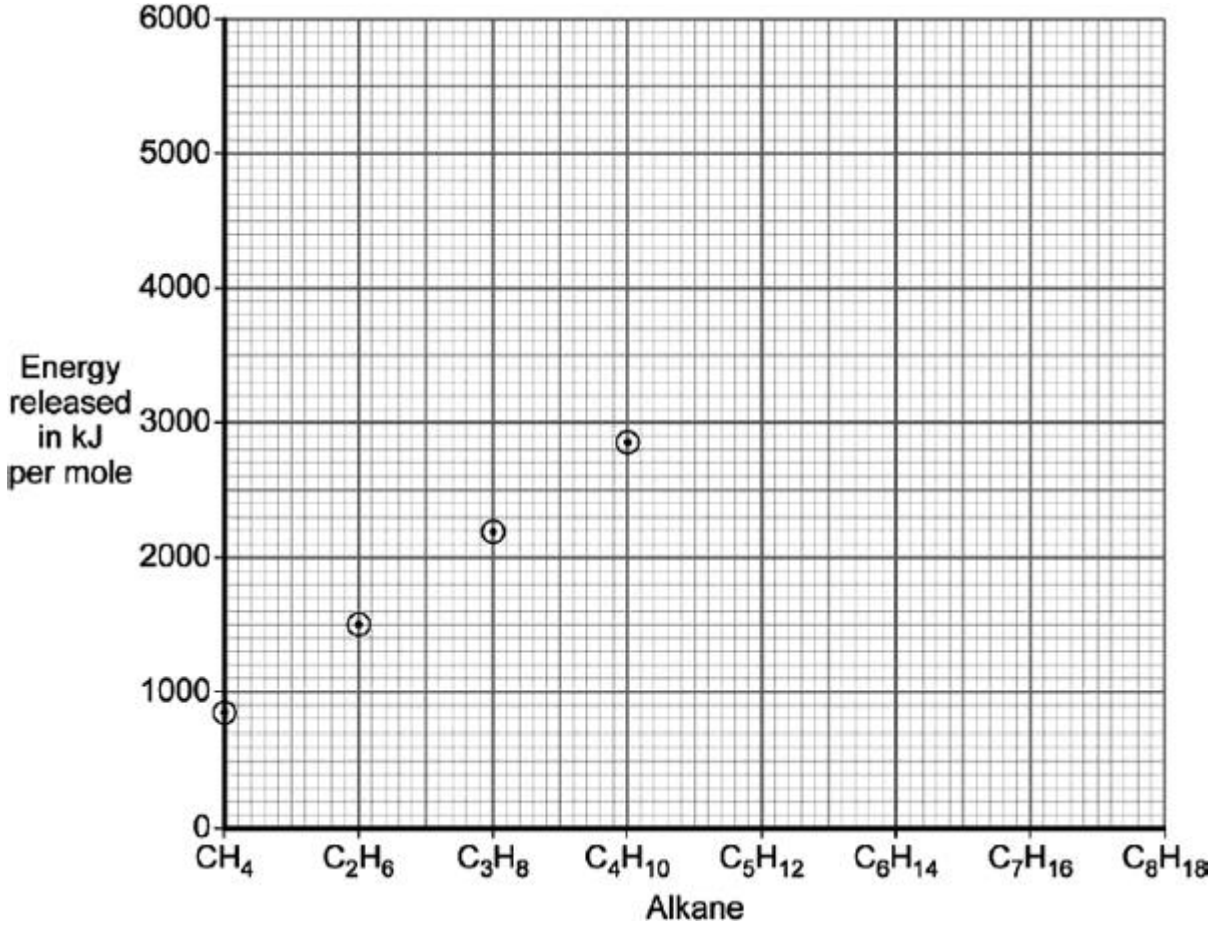
Quantitative chemistry part 2

Q1.

(a) Alkanes are important hydrocarbon fuels. They have the general formula C_nH_{2n+2}

The points on the graph show the amount of energy released when 1 mole of methane (CH_4), ethane (C_2H_6), propane (C_3H_8) and butane (C_4H_{10}) are burned separately.



(i) Draw a line through the points and extend your line to the right-hand edge of the graph.

(1)

(ii) Use the graph to estimate the amount of energy released when 1 mole of octane (C_8H_{18}) is burned.

Energy released = _____ kJ

(1)

(iii) Suggest why we can make a good estimate for the energy released by 1 mole of pentane (C_5H_{12}).

_____

_____

(1)

(iv) A student noticed that octane (C_8H_{18}) has twice as many carbon atoms as

butane (C_4H_{10}), and made the following prediction:

"When burned, 1 mole of octane releases twice as much energy as 1 mole of butane."

Use the graph to decide if the student's prediction is correct. You **must** show your working to gain credit.

_____

_____

_____

_____

(2)

(b) Some information about four fuels is given in the table.

			Combustion products			
Fuel	**Type**	**Heat released in kJ per g**	**CO_2**	**SO_2**	**H_2O**	**Type of flame**
Bio-ethanol	Renewable	29	✓		✓	Not smoky
Coal	Non-renewable	31	✓	✓	✓	Smoky
Hydrogen	Renewable	142			✓	Not smoky
Natural gas	Non-renewable	56	✓		✓	Not smoky

From this information a student made two conclusions.

For each conclusion, state if it is correct **and** explain your answer.

(i) "Renewable fuels release more heat per gram than non-renewable fuels."

_____

_____

_____

_____

(2)

(ii) "Non-renewable fuels are better for the environment than renewable fuels."

_____

_____

_____

_____

_____

_____

_____

(2)

(Total 9 marks)

Q2.

Chemical tests can be used to detect and identify elements and compounds.

Two jars of chemicals from 1870 are shown.

(a) One jar contains copperas. Copperas was a name used for iron(II) sulfate, $FeSO_4$ It does not contain any copper!

Describe and give the result of a chemical test to show that a solution of copperas contains:

(i) iron(II) ions, Fe^{2+}

Test _____

_____

Result _____

(2)

(ii) sulfate ions, SO_4^{2-}

Test _____

_____

Result _____

(2)

(b) The other jar contained a mixture of common salt (sodium chloride, NaCl) and washing soda (sodium carbonate, Na_2CO_3).

To show that the mixture contains chloride ions, silver nitrate solution ($AgNO_3$) and nitric acid (HNO_3) are added. A white precipitate is produced.

$AgNO_3(aq) + NaCl(aq) \rightarrow AgCl(s) + NaNO_3(aq)$

(i) The carbonate ions in the mixture will affect the test for chloride ions.

Use the equations to explain why carbonate ions affect the test for chloride ions **and** how nitric acid overcomes this problem.

$AgCl$ (s)	+	HNO_3 (aq)	→	no reaction				
$2AgNo_3$ (aq)	+	Na_2CO_3 (aq)	→	Ag_2CO_3 (s) white	+	$2NaNO_3$ (aq)		
Ag_2CO_3 (s)	+	$2HNO_3$ (aq)	→	$2AgNO_3$ (aq)	+	H_2O (l)	+	CO_2 (g)

_____

_____

_____

_____

_____

_____

(2)

(ii) Hydrochloric acid (HCl) should **not** be used instead of nitric acid when testing for chloride ions with silver nitrate solution.

Suggest why.

_____

_____

(1)

(Total 7 marks)

Q3.

Iron is an essential part of the human diet. Iron(II) sulfate is sometimes added to white bread flour to provide some of the iron in a person's diet.

(a) The formula of iron(II) sulfate is $FeSO_4$

Calculate the relative formula mass (M_r) of $FeSO_4$

Relative atomic masses: O = 16; S = 32; Fe = 56.

_____

_____

The relative formula mass (M_r) = _____

(2)

(b) What is the mass of one mole of iron(II) sulfate? Remember to give the unit.

_____

(1)

(c) What mass of iron(II) sulfate would be needed to provide 28 grams of iron?

Remember to give the unit.

_____

(1)

(Total 4 marks)

Q4.

Aspirin tablets have important medical uses.

A student carried out an experiment to make aspirin. The method is given below.

1. Weigh 2.00 g of salicylic acid.
2. Add 4 cm^3 of ethanoic anhydride (an excess).
3. Add 5 drops of concentrated sulfuric acid.
4. Warm the mixture for 15 minutes.
5. Add ice cold water to remove the excess ethanoic anhydride.
6. Cool the mixture until a precipitate of aspirin is formed.
7. Collect the precipitate and wash it with cold water.
8. The precipitate of aspirin is dried and weighed.

(a) The equation for this reaction is shown below.

$C_7H_6O_3$ + $C_4H_6O_3$ → $C_9H_8O_4$ + CH_3COOH

salicylic acid — aspirin

Calculate the maximum mass of aspirin that could be made from 2.00 g of salicylic acid.

The relative formula mass (M_r) of salicylic acid, $C_7H_6O_3$, is 138

The relative formula mass (M_r) of aspirin, $C_9H_8O_4$, is 180

Maximum mass of aspirin = _____ g

(2)

(b) The student made 1.10 g of aspirin from 2.00 g of salicylic acid.

Calculate the percentage yield of aspirin for this experiment.

(If you did not answer part (a), assume that the maximum mass of aspirin that can be made from 2.00 g of salicylic acid is 2.50 g. This is **not** the correct answer to part (a).)

Percentage yield of aspirin = _____ %

(2)

(c) Suggest **one** possible reason why this method does **not** give the maximum amount of aspirin.

(1)

(d) Concentrated sulfuric acid is a catalyst in this reaction.

Suggest how the use of a catalyst might reduce costs in the industrial production of aspirin.

(1)

(Total 6 marks)

Q5.

This question is about methods of treating water.

(a) Chlorine is used to kill microorganisms in water. When chlorine is added to water a chemical reaction takes place. The equation for this reaction is shown below.

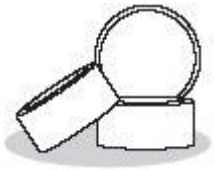
$$Cl_2(g) + H_2O(l) \rightleftharpoons 2H^+(aq) + OCl^-(aq) + Cl^-(aq)$$

An acidic solution is produced when chlorine reacts with water.

Which ion, shown in the equation, makes the solution acidic? _____

(1)

(b) Calcium hypochlorite tablets are added to water in some swimming pools to kill microorganisms.



The formula of calcium hypochlorite is $CaCl_2O_2$

(i) Calculate the relative formula mass (M_r) of calcium hypochlorite.

Relative atomic masses: O = 16; Cl = 35.5; Ca = 40.

_____

_____

Relative formula mass (M_r) of calcium hypochlorite = _____

(2)

(ii) Calculate the percentage by mass of chlorine in calcium hypochlorite.

_____

_____

Percentage by mass of chlorine in calcium hypochlorite = _____ %

(2)

(iii) Calculate the mass of chlorine in a 20 g tablet of calcium hypochlorite.

_____

_____

Mass of chlorine = _____ g

(1)

(c) Waste water from some industrial processes sometimes contains harmful metal ions, such as chromium ions. These ions must be removed from the water before it can be returned to a river.

A method of removing chromium ions (Cr^{3+}) from water is represented by this equation.

$$Cr^{3+}(aq) + 3OH^-(aq) \rightarrow Cr(OH)_3(s)$$

(i) What type of substance would be added to the water to provide the OH^- ions?

_____

_____

(1)

(ii) A *precipitate* is formed in this reaction.

What is a *precipitate*?

_____

_____

(1)

(iii) What method could be used to separate the precipitate from the solution?

_____

_____

(1)

(Total 9 marks)

Q6.

(a) A chemist was asked to identify a nitrogen compound. The chemist carried out an experiment to find the relative formula mass (M_r) of the compound.

The M_r of the compound was **44**.

Relative atomic masses: N = 14, O = 16

Draw a ring around the formula of the compound.

NO **NO_2** **N_2O_4** **N_2O**

(1)

(b) Potassium nitrate is another nitrogen compound. It is used in fertilisers. It has the formula **KNO_3**.

The **M_r** of potassium nitrate is **101**.

Calculate the percentage of **nitrogen** by mass in potassium nitrate.

Relative atomic mass: N = 14.

_____

_____

Percentage of nitrogen = _____ %

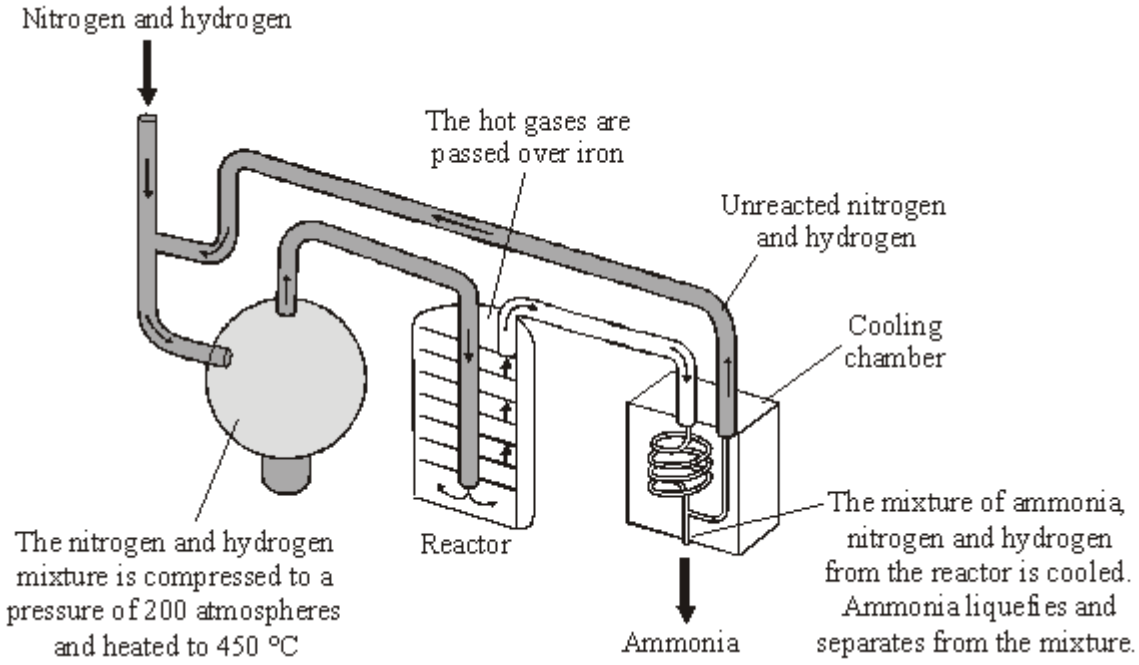
(2)

(Total 3 marks)

Q7.

The Haber process is named after the German chemist, Fritz Haber.

The diagram shows the main stages in the Haber process.



An exothermic reaction takes place when nitrogen reacts with hydrogen to make ammonia.

The reaction can be represented by this equation.

$$N_2\,(g) + 3H_2\,(g) \rightleftharpoons 2NH_3\,(g)$$

(a) Calculate the maximum mass of ammonia that could be made from 1000 g of nitrogen.

Relative atomic masses: H = 1; N = 14

Mass _____g

(3)

(b) At a temperature of 450 °C and 200 atmospheres the actual mass of ammonia produced when 1000 g of nitrogen is passed through the reactor is 304 g.

Calculate the percentage yield of ammonia produced in the reactor.

(If you did not answer part (a), then assume that the maximum mass of ammonia that can be made from 1000 g of nitrogen is 1100 g. This is **not** the correct answer to part (a).)

Percentage yield of ammonia = _____ %

(2)

(c) State **and** explain:

(i) how a **decrease** in temperature would affect the yield of ammonia

(2)

(ii) how an **increase** in pressure would affect the yield of ammonia.

(2)

(d) Factories that make ammonia are often near to large towns.

Discuss the economic, safety and environmental factors to be considered when there is an ammonia factory near a town.

(3)

(Total 12 marks)

Q8.

In 1916, during the First World War, a German U-boat sank a Swedish ship which was carrying a cargo of champagne. The wreck was discovered in 1997 and the champagne was brought to the surface and analysed.

(a) 25.0 cm^3 of the champagne were placed in a conical flask.

Describe how the volume of sodium hydroxide solution needed to react completely with the weak acids in 25.0 cm^3 of this champagne can be found by titration, using phenolphthalein indicator.

Name any other apparatus used.

_____

_____

_____

_____

_____

_____

_____

_____

(4)

(b) The acid in 25.0 cm^3 of the champagne reacted completely with 13.5 cm^3 of sodium hydroxide of concentration 0.10 moles per cubic decimetre.

Calculate the concentration in moles per cubic decimetre of acid in the champagne.

Assume that 1 mole of sodium hydroxide reacts completely with 1 mole of acid.

_____

_____

_____

_____

Concentration = _____ moles per cubic decimetre

(2)

(c) Is analysis by titration enough to decide whether this champagne is safe to drink?

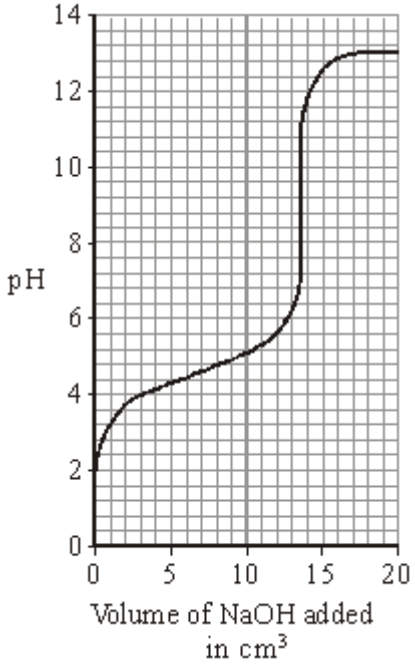
Explain your answer.

_____

_____

(1)

(d) The graph shows how the pH of the solution changes during this titration.



Phenolphthalein is the indicator used in this titration. It changes colour between pH 8.2 and pH 10.0.

Methyl orange is another indicator. It changes colour between pH 3.2 and pH 4.4.

Suggest why methyl orange is **not** a suitable indicator for this titration.

_____

_____

_____

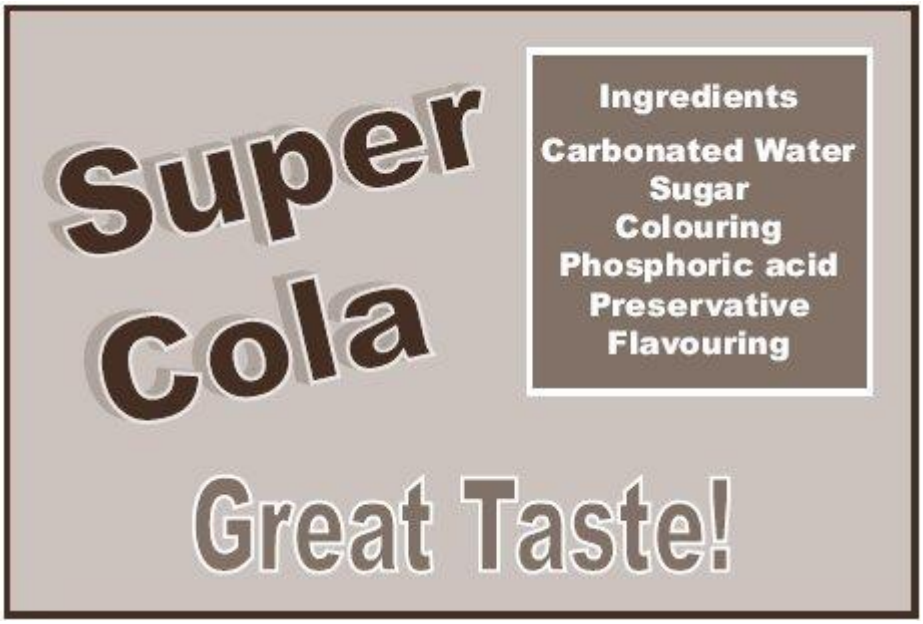
_____

(2)

(Total 9 marks)

Q9.

This label was taken from a cola drink.



The pH of this drink is 2.5.

(a) (i) Which **one** of the ingredients in the cola drink causes the low pH?

_____

(1)

(ii) Draw a ring around the name of the ion that gives the cola drink its low pH.

chloride **hydrogen** **hydroxide** **sodium**

(1)

(b) The preservative used in the cola drink is sodium benzoate.
Sodium benzoate is made using two chemical reactions.

Reaction 1
Methylbenzene is reacted with oxygen, with the help of a catalyst, to form benzoic acid.

Reaction 2
Benzoic acid is neutralised by sodium hydroxide solution to form sodium benzoate and water.

(i) How does the catalyst help **reaction 1**?

_____

_____

(1)

(ii) **Reaction 1** has a high atom economy.

The table lists several statements. Put a tick (✓) next to the **one** statement which best describes a high atom economy.

Statement	(✓)
All the atoms used are cheap.	

Most of the starting materials end up as useful products.	
Only a small number of atoms are used in the reaction.	

(1)

(iii) **Reaction 2** is a neutralisation reaction.

Complete the equation by writing the formula of the product.

$H^+ \quad + \quad OH^- \quad \rightarrow \quad$ _____

(1)

(Total 5 marks)

Q10.

Toothpastes often contain fluoride ions to help protect teeth from attack by bacteria.

Some toothpastes contain tin(II) fluoride.

This compound has the formula SnF_2 .

(a) Calculate the relative formula mass (M_r) of SnF_2.

Relative atomic masses: F = 19; Sn = 119

_____

_____

_____

_____

Relative formula mass (M_r) = _____

(2)

(b) Calculate the percentage by mass of fluorine in SnF_2.

_____

_____

_____

_____

Percentage by mass of fluorine = _____ %

(2)

(c) A tube of toothpaste contains 1.2 g of SnF_2.

Calculate the mass of fluorine in this tube of toothpaste.

_____

_____

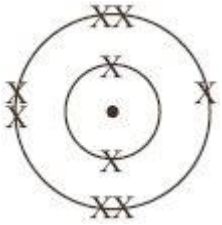
_____

_____

Mass of fluorine = _____ g

(1)

(d) The diagram represents the electron arrangement of a fluorine atom.



Explain how a fluorine atom can change into a fluoride ion, F^-.

_____

_____

_____

_____

(2)

(Total 7 marks)

Q11.

Chemical tests are used to identify compounds.

(a) What colour is produced by sodium compounds in flame tests?

_____

(1)

(b) Chemical tests are carried out on these substances.

ammonium	**copper bromide**	**magnesium sulphate**
potassium nitrate	**copper nitrate**	**zinc carbonate**

Complete each sentence by choosing the correct substance from the box. You may use each substance once or not at all.

The substance which

(i) reacts with dilute hydrochloric acid to produce carbon dioxide gas is

_____

(1)

(ii) in solution reacts with sodium hydroxide solution to form a blue precipitate is

_____

(1)

(iii) in solution reacts with barium chloride solution, in the presence of dilute hydrochloric acid, to form a white precipitate is

_____

(1)

(c) State what you **see** when sodium chloride solution reacts with silver nitrate solution in the presence of dilute nitric acid.

_____

(1)

(Total 5 marks)

Q12.

Iron ore contains iron oxide.

(i) Calculate the relative formula mass of iron oxide, Fe_2O_3.

Relative atomic masses: O = 16; Fe = 56.

_____

_____

Answer = _____

(2)

(ii) Calculate the percentage by mass of iron in iron oxide.

_____

Percentage of iron = _____ %

(2)

(iii) Calculate the mass of iron that could be extracted from 1000 kg of iron oxide.

Use your answer to part (c) (ii) to help you with this calculation.

_____

Mass of iron = _____ kg

(1)

(Total 5 marks)

Q13.

This cake recipe is taken from a cookery book.

Soda Cake

- Mix the flour and butter and add the sugar, currants and flavouring.
- Then add the beaten egg.
- Add a little milk with a teaspoonful of **baking soda (sodium hydrogencarbonate)** and mix it in well.
- Bake in a moderate oven for about 30 minutes.

When sodium hydrogencarbonate is heated in an oven, it forms carbon dioxide gas.

$$2\ NaHCO_3 \xrightarrow{Heat} Na_2CO_3 + H_2O + CO_2$$

A teaspoonful of baking soda contains a mass of 11 g of sodium hydrogencarbonate. Calculate the mass of carbon dioxide that could be made from 11 g of sodium hydrogencarbonate. Show clearly how you work out your final answer.

Relative atomic masses: H = 1; C = 12; O = 16; Na = 23.

_____

_____

_____

_____

Mass of carbon dioxide = _____ g

(Total 3 marks)

Q14.

Four labels have come off four bottles.

Aluminium sulphate solution $Al_2(SO_4)_3$ (aq)	Ammonium sulphate solution $(NH_4)_2SO_4$ (aq)
Magnesium sulphate solution $MgSO_4$ (aq)	Sodium sulphate solution Na_2SO_4 (aq)

Describe and give the results of the **chemical** tests that you would do to identify which bottle contained which substance.

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

(Total 5 marks)

Q15.

(a) This label has been taken from a bottle of vinegar.

Vinegar is used for seasoning foods. It is a solution of ethanoic acid in water.

In an experiment, it was found that the ethanoic acid present in a 15.000 cm^3 sample of vinegar was neutralised by 45.000 cm^3 of sodium hydroxide solution, of concentration 0.20 moles per cubic decimetre (moles per litre).

The equation which represents this reaction is

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

Calculate the concentration of the ethanoic acid in this vinegar:

(i) in moles per cubic decimetre (moles per litre);

_____

_____

_____

Concentration =_____ moles per cubic decimetre

(2)

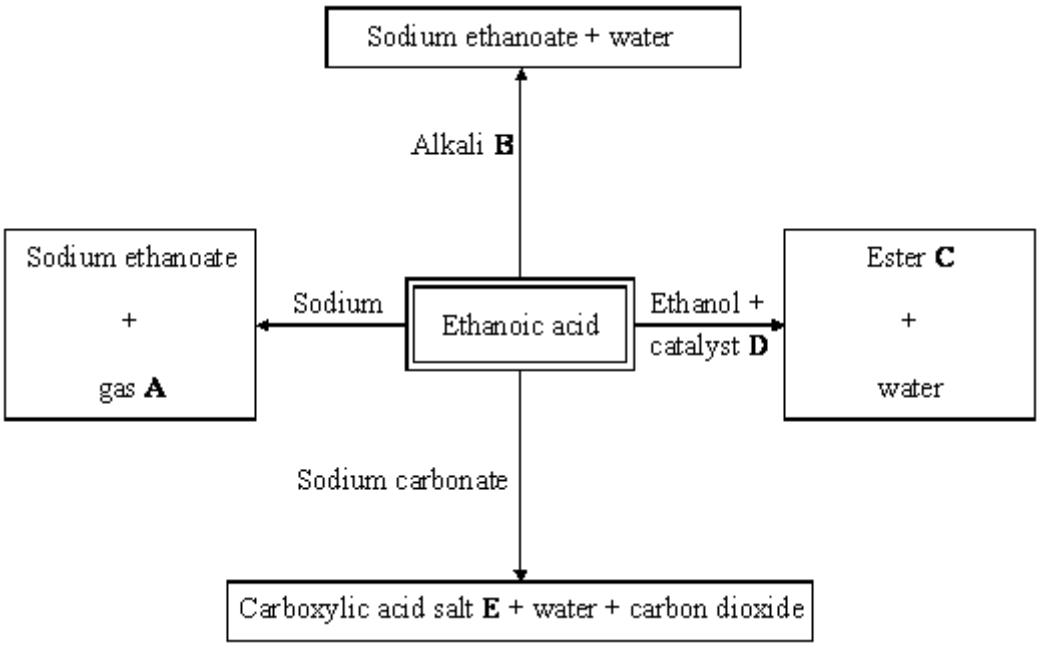
(ii) in grams per cubic decimetre (grams per litre).

Relative atomic masses: H = 1; C = 12; O = 16.

Concentration = _____ grams per cubic decimetre

(2)

(b) The flow diagram shows some reactions of ethanoic acid.



Give the name of:

(i) gas **A**,

(1)

(ii) alkali **B**,

(1)

(iii) ester **C**,

(1)

(iv) catalyst **D**,

_____

(1)

(v) carboxylic acid salt **E**.

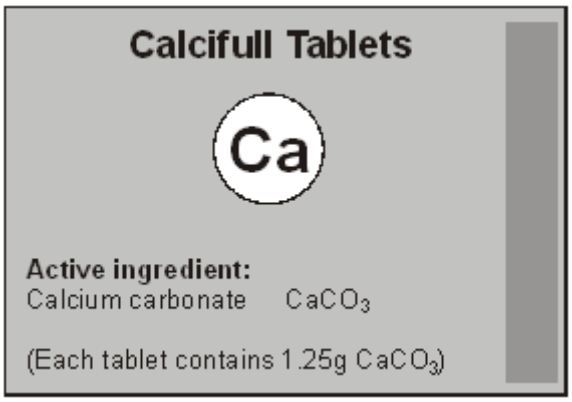
_____

(1)

(Total 9 marks)

Q16.

Calcium carbonate tablets are used to treat people with calcium deficiency.



(a) Calculate the relative formula mass (M_r) of calcium carbonate.

Relative atomic masses: C = 12; O = 16; Ca = 40.

_____

_____

Relative formula mass = _____

(2)

(b) Calculate the percentage of calcium in calcium carbonate, $CaCO_3$.

_____

_____

Percentage of calcium = _____ %

(2)

(c) Calculate the mass of calcium in each tablet.

_____

_____

Mass of calcium = _____ g

(2)

(d) An unwanted side effect of this medicine is that it can cause the patient to have 'wind' (too much gas in the intestine).

The equation below represents the reaction between calcium carbonate and

hydrochloric acid (the acid present in the stomach).

$$CaCO_3\ (s) + 2HCl\ (aq) \rightarrow CaCl_2\ (aq) + H_2O\ (l) + CO_2\ (g)$$

Suggest why the patient may suffer from 'wind'.

_____

_____

(1)

(Total 7 marks)

Q17.

Silicon is an important element used in the electronics industry.

(a) Silicon can be made by heating a mixture of sand (silicon dioxide) with magnesium powder.

The equation for this reaction is shown below.

$$SiO_2\ (s) + 2Mg\ (s) \rightarrow 2MgO\ (s) + Si\ (s)$$

Calculate the mass of silicon dioxide needed to make 1 g of silicon.

Relative atomic masses: O = 16; Si = 28

_____

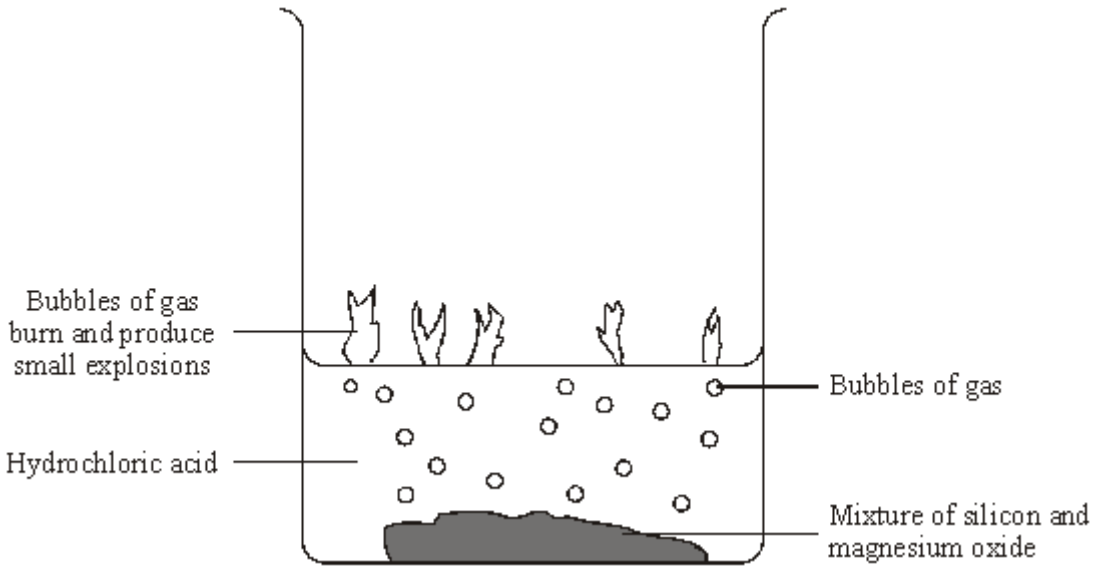
_____

_____

Mass = _____g

(3)

(b) The resulting mixture of magnesium oxide and silicon is added to a beaker containing hydrochloric acid. The silicon is then filtered from the solution.



(i) The magnesium oxide reacts with the hydrochloric acid and forms magnesium

chloride ($MgCl_2$) solution and water.

magnesium oxide + hydrochloric acid → magnesium chloride solution + water

Write a balanced symbol equation for this reaction, including state symbols.

(2)

(ii) The gases produced are a mixture of several silicon hydrides.

One of the gases produced in the reaction is the silicon hydride with the formula SiH_4. The structure of this molecule is similar to methane, CH_4.

Draw a diagram to show the bonding in a molecule of SiH_4. Represent the electrons as dots and crosses and only show the outer shell (energy level) electrons.

(1)

(iii) A sample of a different silicon hydride was found to contain 1.4 g of silicon and 0.15 g of hydrogen.

Calculate the formula of this silicon hydride. You must show all your working to gain full marks.

Relative atomic masses: H = 1; Si = 28

(4)

(iv) The silicon hydrides react immediately they come into contact with oxygen in the air. They burst into flames with a small explosion and give out energy.

Which letter, **A** to **H**, best describes this reaction?

Energy involved in breaking and forming bonds	Activation energy	Rate of reaction	Letter
The energy released from forming new bonds is greater than the energy needed to break existing bonds	high	fast	**A**
		slow	**B**
	low	fast	**C**
		slow	**D**
The energy needed to break existing bonds is greater than the energy released from forming new bonds	high	fast	**E**
		slow	**F**
	low	fast	**G**
		slow	**H**

Letter _____

(1)

(c) The structure of silicon is similar to the structure of diamond.

Describe the structure of silicon and explain why it has a high melting point. You may draw a diagram if this helps.

_____

_____

_____

_____

_____

_____

_____

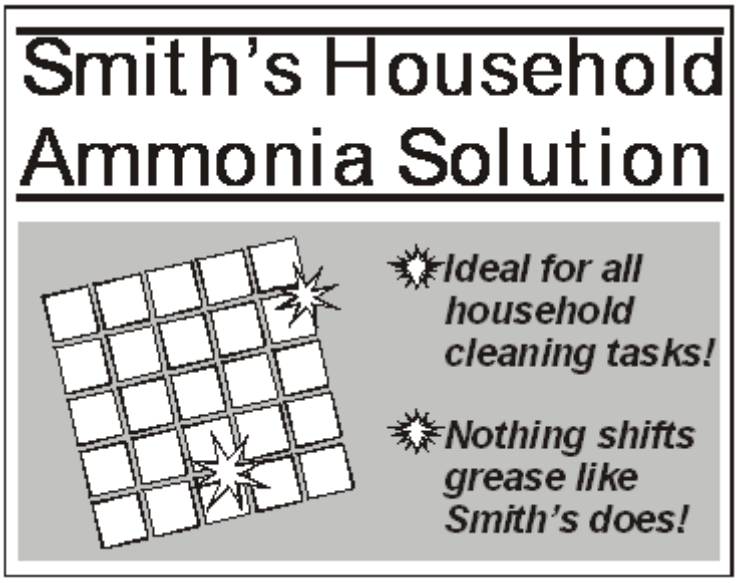
_____

(4)

(Total 15 marks)

Q18.

This label has been taken from a bottle of household ammonia solution.



Household ammonia is a dilute solution of ammonia in water. It is commonly used to remove grease from ovens and windows.

(a) The amount of ammonia in household ammonia can be found by titration.

25.0 cm^3 of household ammonia is placed in a conical flask. Describe how the volume of dilute nitric acid required to neutralise this amount of household ammonia can be found accurately by titration. Name any other apparatus and materials used.

To gain full marks you should write down your ideas in good English. Put them into a sensible order and use correct scientific words.

(4)

(b) In an experiment, it was found that 25.0 cm^3 of household ammonia was neutralised by 20.0 cm^3 of dilute nitric acid with a concentration of 0.25 moles per cubic decimetre.

The balanced symbol equation which represents this reaction is

$$NH_3(aq) + HNO_3(aq) \rightarrow NH_4NO_3(aq)$$

Calculate the concentration of the ammonia in this household ammonia in moles per cubic decimetre.

_____

_____

_____

_____

Concentration = _____ moles per cubic decimetre

(2)

(c) The salt, ammonium nitrate, is formed in this reaction.

Describe, and give the result of, a chemical test which shows that ammonium nitrate contains ammonium ions.

_____

_____

_____

_____

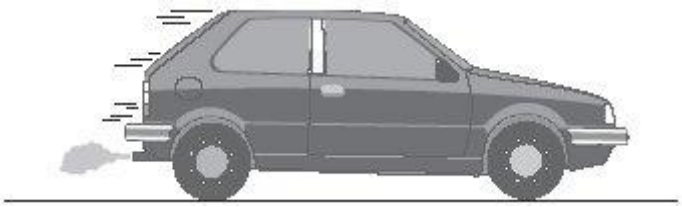
(2)

(Total 8 marks)

Q19.

Petrol is a mixture of hydrocarbons such as octane, C_8H_{18}

When petrol is burned in a car engine, a large amount of carbon dioxide is produced.



This car uses 114 g of petrol to travel one mile.

Calculate the mass of carbon dioxide produced when this car travels one mile.

Assume that petrol is octane and that combustion is complete.

(Relative atomic masses: H = 1; C = 12; O = 16)

The combustion of octane can be represented by this equation.

$$C_8H_{18} + 12\tfrac{1}{2}\ O_2 \rightarrow 8CO_2 + 9H_2O$$

_____

_____

_____

_____

Mass of carbon dioxide = _____ g

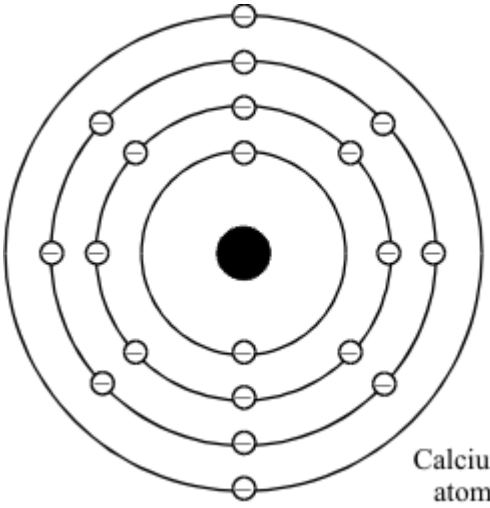
(Total 3 marks)

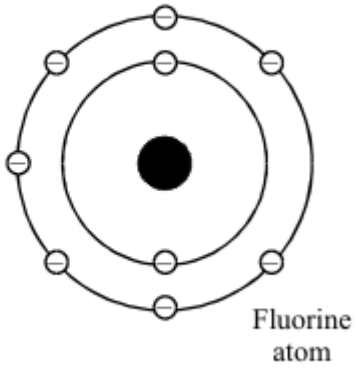
Q20.

Uranium metal can be produced by reacting uranium hexafluoride with calcium.

$UF_6 + 3Ca \rightarrow 3CaF_2 + U$

(a) Describe how calcium and fluorine bond together to form calcium fluoride. The electron arrangement of each atom is shown.





(5)

(b) Uranium has two main isotopes, $^{235}_{92}U$ and $^{238}_{92}U$. Use these as examples to explain what is meant by the word isotope.

(4)

(c) At the start of a reaction there was 174.5 g of uranium hexafluoride, UF_6.

Relative atomic masses: F 19; U 235

(i) Calculate the relative formula mass of uranium hexafluoride, UF_6.

Relative formula mass UF_6 = _____ g

(1)

(ii) Calculate the mass of uranium that would be produced from 134.5 g of uranium hexafluoride.

Mass of uranium = _____ g

(2)

(Total 12 marks)

Q21.

A student carried out a titration to find the concentration of a solution of sulphuric acid. 25.0 cm^3 of the sulphuric acid solution was neutralised exactly by 34.0 cm^3 of a potassium hydroxide solution of concentration 2.0 mol/dm^3. The equation for the reaction is:

$2KOH(aq) + H_2SO_4(aq) \rightarrow K_2SO_4(aq) + 2H_2O(l)$

(a) Describe the experimental procedure for the titration carried out by the student.

(4)

(b) Calculate the number of moles of potassium hydroxide used.

Number of moles = _____

(2)

(c) Calculate the concentration of the sulphuric acid in mol/dm^3.

_____

_____

_____

_____

Concentration = _____ mol/dm^3

(3)

(Total 9 marks)

Q22.

As the world population increases there is a greater demand for fertilisers.

(a) Explain what fertilisers are used for.

_____

_____

_____

_____

(2)

(b) The amount of nitrogen in a fertiliser is important.

(i) How many nitrogen atoms are there in the formula, NH_4NO_3?

_____

(1)

(ii) Work out the relative formula mass of ammonium nitrate, NH_4NO_3.

Relative atomic masses: H 1; N 14; O 16.

_____

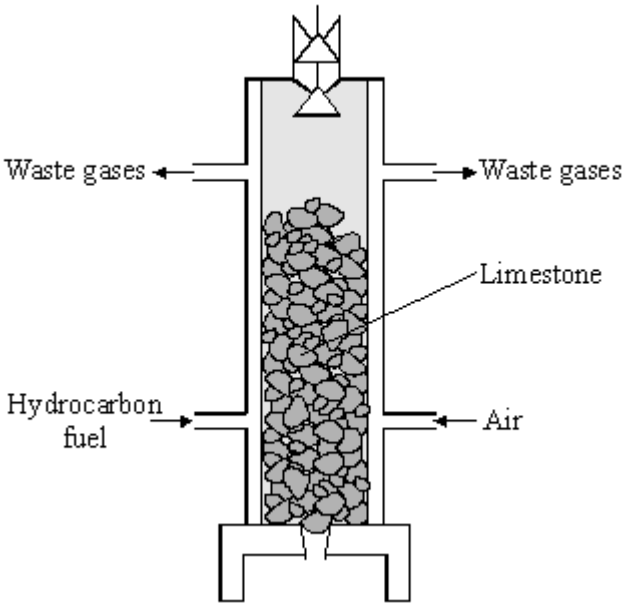
Relative formula mass of ammonium nitrate = _____

(1)

(Total 4 marks)

Q23.

Limestone is a useful mineral. Every day, large amounts of limestone are heated in limekilns to produce lime. Lime is used in the manufacture of iron, cement and glass and for neutralising acidic soils.



$$CaCO_3 \rightleftharpoons CaO + CO_2$$

(i) The decomposition of limestone is a *reversible* reaction. Explain what this means.

_____

_____

_____

_____

(2)

(ii) Calculate the mass of lime, CaO, that would be produced from 250 tonnes of limestone, $CaCO_3$.

Relative atomic masses: C 12; O 16; Ca 40.

_____

_____

_____

_____

_____

Mass of lime = _____ tonnes

(3)

(Total 5 marks)

Q24.

An oven cleaner solution contained sodium hydroxide. A 25.0 cm^3 sample of the oven cleaner solution was placed in a flask. The sample was titrated with hydrochloric acid containing
73 g/dm^3 of hydrogen chloride, HCl.

(a) Describe how this titration is carried out.

_____

_____

_____

_____

_____

(3)

(b) Calculate the concentration of the hydrochloric acid in mol/dm^3.

Relative atomic masses: H 1; Cl 35.5

_____

Answer = _____ mol/dm^3

(2)

(c) 10.0 cm^3 of hydrochloric acid were required to neutralise the 25.0 cm^3 of oven cleaner solution.

(i) Calculate the number of moles of hydrochloric acid reacting.

_____

Answer = _____ mol

(2)

(ii) Calculate the concentration of sodium hydroxide in the oven cleaner solution in mol/dm^3.

_____

Answer = _____ mol/dm^3

(2)

(Total 9 marks)

Q25.

Follow the steps to find the percentage of iron in iron oxide.

Relative atomic masses: O 16; Fe 56.

(i) Step 1

Calculate the relative formula mass of iron oxide, Fe_2O_3.

_____

_____

(1)

(ii) Step 2

Calculate the total relative mass of just the iron atoms in the formula, Fe_2O_3.

_____

(1)

(iii) Step 3

Calculate the percentage (%) of iron in the iron oxide, Fe_2O_3.

_____

_____

Percentage of iron _____ %

(1)

(Total 3 marks)

Q26.

Titanium is a transition metal used as pins and plates to support badly broken bones. Titanium is extracted from an ore that contains the mineral titanium oxide. This oxide is converted into titanium chloride. Titanium chloride is heated with sodium to form titanium metal. This reaction takes place in an atmosphere of a noble gas, such as argon.

$$4Na(s) + TiCl_4(l) \rightarrow Ti(s) + 4NaCl(s)$$

Calculate the mass of titanium that can be extracted from 570 kg of titanium chloride.

Relative atomic masses: Cl 35.5; Ti 48.

_____

_____

_____

_____

Mass of titanium = _____ kg

(Total 3 marks)

Q27.

A student carried out a titration to find the concentration of a solution of hydrochloric acid. The following paragraph was taken from the student's notebook.

> I filled a burette with hydrochloric acid. 25.0 cm^3 of 0.40 mol/dm^3 potassium hydroxide was added to a flask. 5 drops of indicator were added. I added the acid to the flask until the indicator changed colour. The volume of acid used was 35.0 cm^3.

(a) What piece of apparatus would be used to measure 25.0 cm^3 of the potassium hydroxide solution?

_____

(1)

(b) Name a suitable indicator that could be used.

_____

(1)

(c) Calculate the number of moles of potassium hydroxide used.

_____

_____

Moles of potassium hydroxide = _____ mol

(2)

(d) Calculate the concentration of the hydrochloric acid. The equation for the reaction is:

$KOH + HCl \rightarrow KCl + H_2O$

_____

_____

_____

Concentration of hydrochloric acid = _____ mol/dm^3

(2)

(Total 6 marks)

Q28.

Limestone ($CaCO_3$) is a raw material. On strong heating it is converted to calcium oxide which is a very useful substance.

$$CaCO_3 \xrightarrow{\text{heat}} CaO + CO_2$$

(a) Calculate the formula mass (M_r) of calcium carbonate.

_____

M_r of calcium carbonate = _____

(2)

(b) About 60 million tonnes of calcium oxide is made in Britain each year.
Calculate the mass of calcium carbonate needed to make this amount of calcium oxide.

_____

_____

_____

_____

_____

_____

Mass of calcium carbonate needed = _____ million tonnes

(4)

(c) Water is added to some of the calcium oxide produced in a process known as 'slaking'. The product of this reaction is used to make plaster.

$CaO_{(s)} + H_2O_{(1)} \rightarrow Ca(OH)_{2(s)}$

(i) Give the chemical name of $Ca(OH)_2$.

_____

(1)

(ii) What is the physical state of the $Ca(OH)_2$ formed in the reaction?

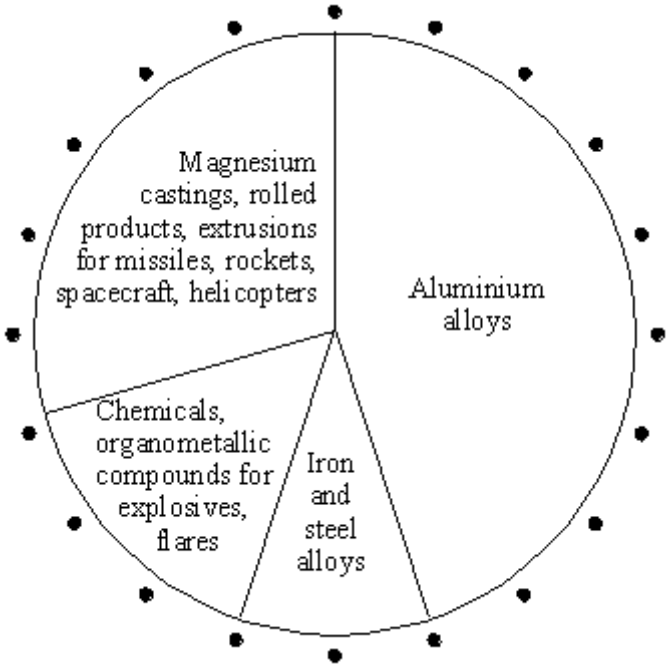
_____

(1)

(Total 8 marks)

Q29.

280 000 tonnes of magnesium are produced in the world each year. The pie chart below shows the ways in which magnesium is used.



(a) (i) Use the pie chart to calculate the percentage of magnesium used to make aluminium alloys.

_____ %

(1)

(ii) How many tonnes of magnesium are used to make aluminium alloys each

year?

_____ tonnes

(1)

(b) Magnesium is produced by the electrolysis of molten magnesium chloride. The reactions which take place at the electrodes are represented by the equations below.

$Mg^{2+} + 2e^- \rightarrow Mg$

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

(i) Calculate the mass of chlorine produced when one kilogram of magnesium is made.
(Relative atomic masses: Mg = 24, Cl = 35.5)

_____

_____

_____

_____

(3)

(ii) Give a use for chlorine.

_____

(1)

(Total 6 marks)

Q30.

Ammonium nitrate is an important fertiliser. It is made by reacting nitric acid with the alkali ammonia.

(i) State the type of reaction taking place.

_____

(1)

(ii) The equation for this reaction is:

$NH_3 + HNO_3 \rightarrow NH_4NO_3$

Calculate the number of tonnes of ammonium nitrate that can be made from 68 tonnes of ammonia.

(Relative atomic masses: H = 1, N = 14, O = 16)

_____

_____

_____

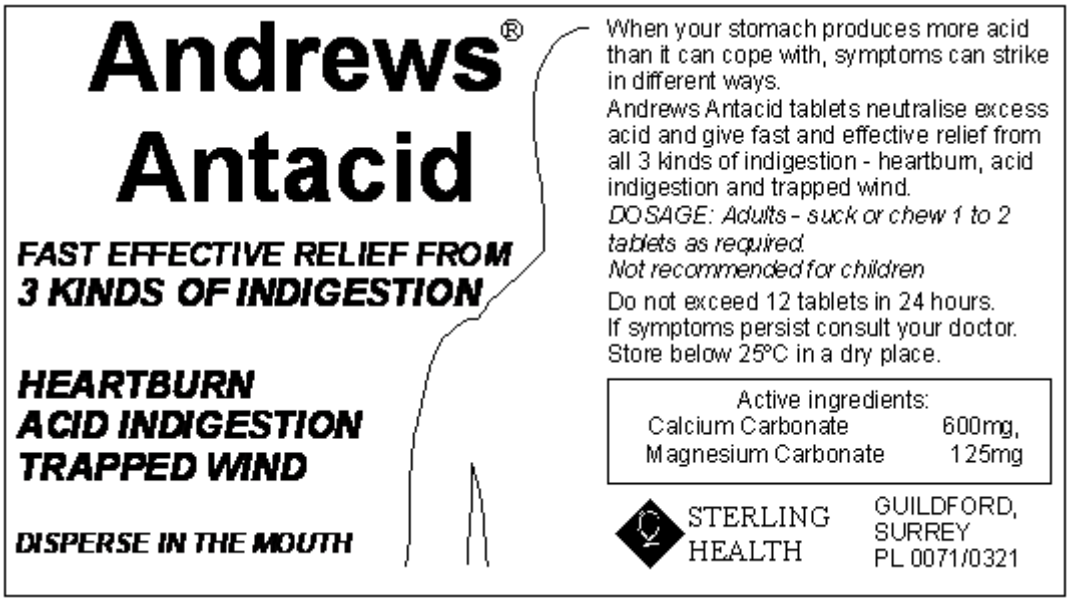
_____

(3)

(Total 4 marks)

Q31.

(a) This label has been taken from a packet of *Andrews Antacid*.



(i) Write the simplest ionic equation which represents a neutralisation reaction.

_____

(1)

(ii) Chewing the tablet cures indigestion faster than swallowing the tablet whole. Explain why.

_____

_____

_____

_____

(1)

(b) The active ingredients in the *Antacid* react with hydrochloric acid in the stomach to give salts, water and carbon dioxide.

A student investigated how quickly the tablets react with **excess** hydrochloric acid.

40 cm^3 of dilute hydrochloric acid were placed in a conical flask. The flask was placed on a direct reading balance. Two *Antacid* tablets were quickly added to the flask. The apparatus was weighed immediately. At the same time, a stop clock was started. The mass was recorded every half minute for 5 minutes.

The results are shown in the table below.

Mass of flask + contents (g)	92.0	90.0	89.0	88.3	87.8	87.5	87.3	87.1	87.0	87.0	87.0
Time (minutes)	0	0.5	1.0	1.5	2.0	2.5	3.0	3.5	4.0	4.5	5.0

The main active ingredient in *Andrews Antacid* is calcium carbonate.

(i) Balance the equation which represents the reaction between calcium carbonate and hydrochloric acid.

$CaCO_{3(s)}$ + _____ $HCl_{(aq)}$ → $CaCl_{2(aq)}$ + $H_2O_{(l)}$ + $CO_{2(g)}$

(1)

(ii) State the meaning of the symbol "(aq)".

_____

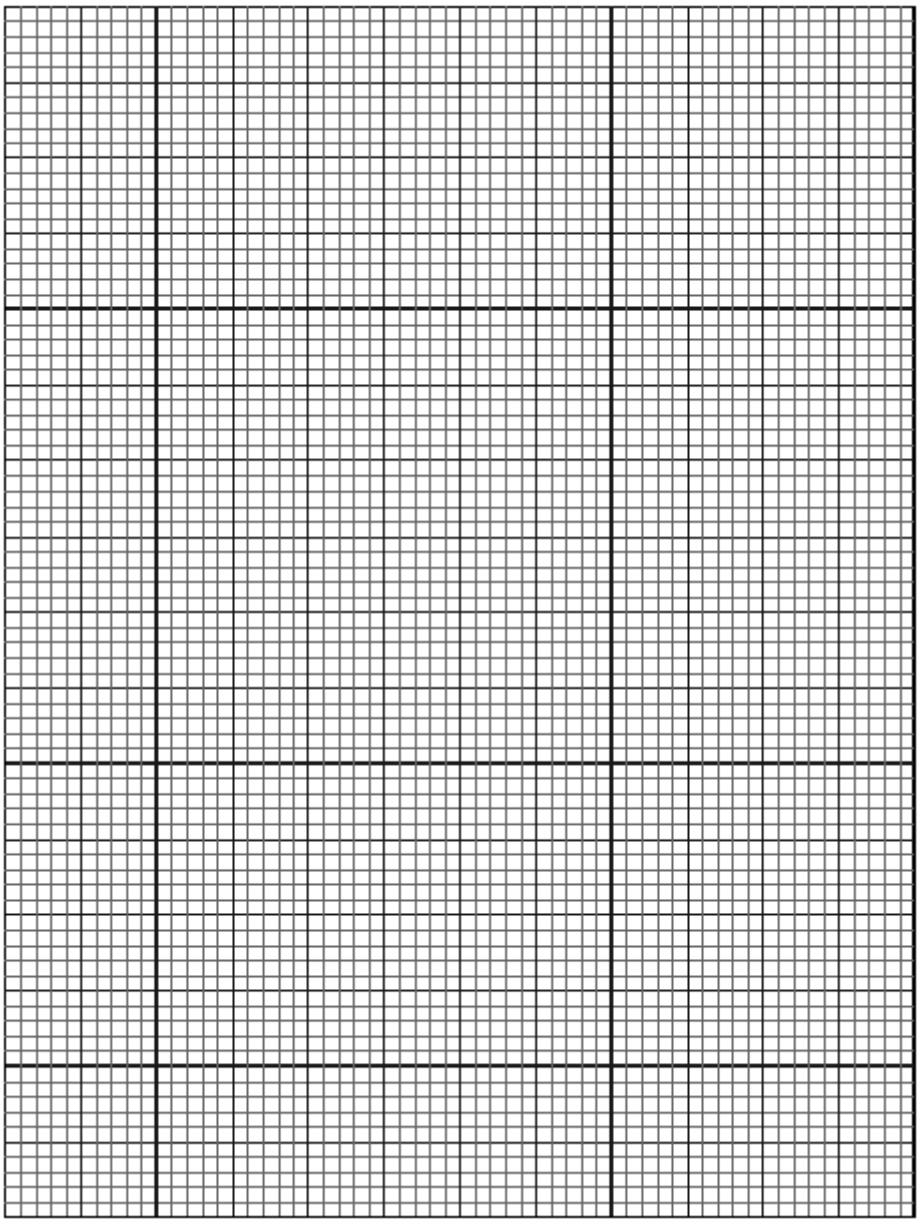
(1)

(iii) Why does the mass of the flask and contents decrease?

_____

(1)

(c) (i) Plot the results on the graph below and draw a smooth curve to show how the mass of the flask and its contents changes with time. Label this curve "A".



(3)

(ii) One of the results does not appear to fit the pattern. Circle this result on the graph.

(1)

(d) The student did a second experiment. The only change was that the acid was twice as concentrated.

On the graph, sketch a second curve to show a possible result for this experiment. Label this curve "B".

(2)

(Total 12 marks)

Q32.

Calcium oxide (quicklime) is made by heating calcium carbonate (limestone).

calcium carbonate	→	calcium oxide	+	carbon dioxide
100 g		?		44 g

(a) 44 grams of carbon dioxide is produced when 100 grams of calcium carbonate is heated.

Calculate the mass of calcium oxide produced when 100 grams of calcium carbonate is heated.

_____

mass _____ g

(1)

(b) What mass of carbon dioxide could be made from 100 tonnes of calcium carbonate?

mass _____ tonnes

(1)

(Total 2 marks)

Q33.

The following passage was taken from a chemistry textbook.

Germanium is a white, shiny, brittle element. It is used in the electronics industry because it is able to conduct a small amount of electricity.

It is made from germanium oxide obtained from flue dusts of zinc and lead smelters. The impure germanium oxide from the flue dusts is changed into germanium by the process outlined below.

STEP 1 The germanium oxide is reacted with hydrochloric acid to make germanium tetrachloride. This is a volatile liquid in which the germanium and chlorine atoms are joined by covalent bonds.

STEP 2 The germanium tetrachloride is distilled off from the mixture.

STEP 3 The germanium tetrachloride is added to an excess of water to produce germanium oxide and hydrochloric acid.

STEPS 1 to 3 are repeated several times.

STEP 4 The pure germanium oxide is reduced by hydrogen to form germanium.

(a) Balance the equation below which represents the reaction in step 1.

GeO_2 + _____ HCl → $GeCl_4$ + _____ H_2O

(1)

(b) Write a word equation for the reaction in step 3.

_____

(1)

(c) Suggest why steps 1 to 3 are repeated several times.

_____

_____

(1)

(d) The equation which represents the reaction in step 4 is shown below.

GeO_2 + $2H_2$ → Ge + $2H_2O$

(i) Explain what is meant by the term 'reduced'.

_____

_____

(1)

(ii) Calculate the mass of germanium which could be made from 525 g of germanium oxide. (Relative atomic masses: Ge = 73; O = 16).

_____

_____

_____

_____

Mass _____ g

(3)

(e) Germanium is difficult to classify as either a metal or a non-metal.

(i) Give as much evidence as you can from the information in this question to support the view that germanium is a metal. Explain your answer as fully as you can.

_____

_____

_____

_____

_____

(3)

(ii) Give as much evidence as you can from the information in this question to support the view that germanium is a non-metal. Explain your answer as fully as you can.

_____

_____

_____

_____

(3)

(Total 13 marks)

Q34.

Use these relative atomic masses: H = 1; O = 16; Ca = 40
to calculate the relative formula mass *(M_r)* of

quicklime CaO _____

slaked lime $Ca(OH)_2$ _____

(Total 2 marks)

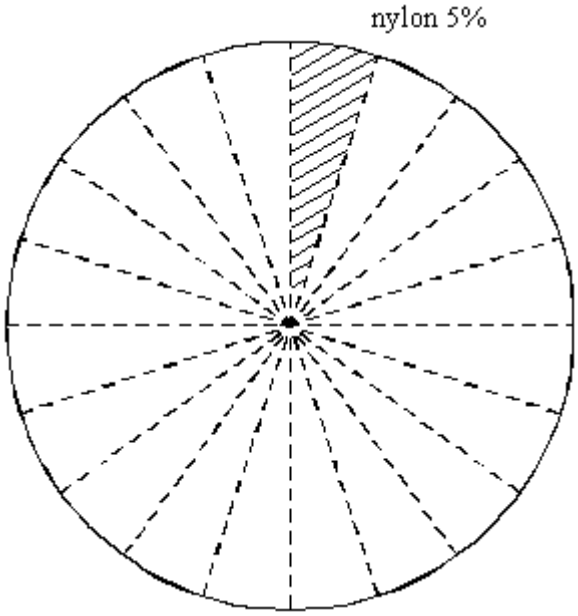
Q35.

Ammonia is a very important chemical.

(a) The table shows the percentage of ammonia used to make different substances.

SUBSTANCES MADE FROM AMMONIA	PERCENTAGE (%) OF AMMONIA USED
fertilisers	75
nitric acid	10
nylon	5
others	10

Shade on the pie chart the percentage of ammonia used to make nitric acid.



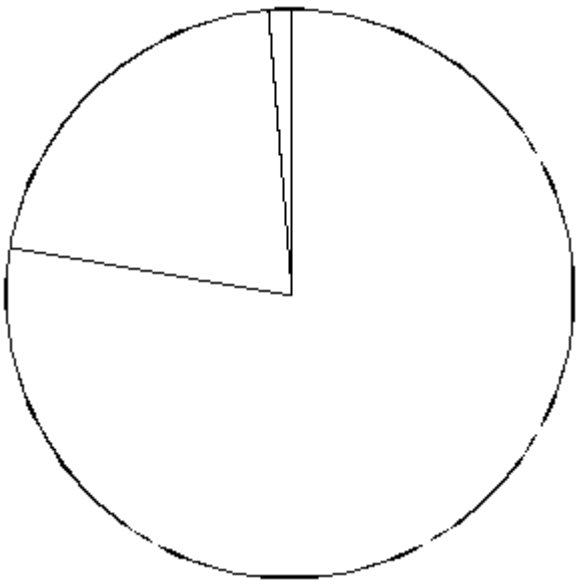
(1)

(b) Ammonia gas is made by the reaction between nitrogen gas and hydrogen gas.
Write a word equation to represent this reaction.

_____ + _____ ⇌ _____

(1)

(c) Nitrogen is one of the raw materials used to make ammonia.
Nitrogen is obtained from air.
This pie chart shows the proportion of nitrogen, oxygen and other gases in air.
Label the area which represents the proportion of nitrogen in air.



(1)

(d) An artificial fertiliser contains compounds with the formulae:

NH_4NO_3 and **KCl**

(i) Use the Data Sheet to help you answer this question.
Name the elements in the compound NH_4NO_3.

1. _____

2. _____

3. _____

(2)

(ii) Use the Data Sheet to help you answer this question.
Name the compound KCl.

_____

(1)

(e) (i) Ammonium nitrate is one type of artificial fertiliser.
Calculate the relative formula mass of ammonium nitrate NH_4NO_3.
(Relative atomic masses: H = 1, N = 14, O = 16.)

_____

_____

(1)

(ii) Use your answer to part (f)(i) to help you calculate the percentage by mass of nitrogen present in ammonium nitrate NH_4NO_3.

_____

_____

_____

(2)

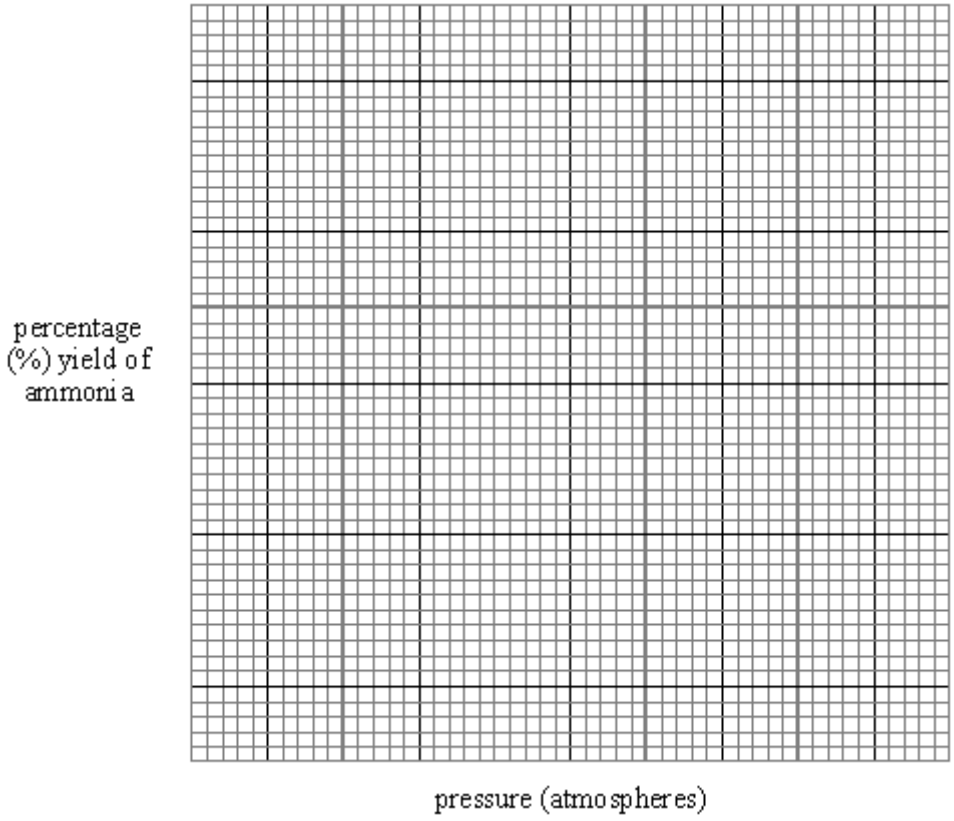
(Total 9 marks)

Q36.

The Haber process is used to make ammonia NH_3.
The table shows the percentage yield of ammonia at different temperatures and pressures.

PRESSURE (ATMOSPHERES)	PERCENTAGE (%) YIELD OF AMMONIA AT 350°C	PERCENTAGE (%) YIELD OF AMMONIA AT 500°C
50	25	5
100	37	9
200	52	15
300	63	20
400	70	23
500	74	25

(a) (i) Use the data in the table to draw two graphs on the grid below. Draw one graph for a temperature of 350°C and the second graph for a temperature of 500°C.
Label each graph with its temperature.



(4)

(ii) Use your graphs to find the conditions needed to give a yield of 30% ammonia.

_____ °C and _____ atmospheres

(1)

(iii) On the grid sketch the graph you would expect for a temperature of 450°C.

(1)

(b) (i) This equation represents the reaction in which ammonia is formed.

$N_{2(g)} + 3H_{2(g)} \rightleftharpoons 2NH_{3(g)} +$ heat

What does the symbol $\rightleftharpoons$ in this equation tell you about the reaction?

_____

(1)

(ii) Use your graphs and your knowledge of the Haber process to explain why a temperature of 450°C and a pressure of 200 atmospheres are used in industry.

_____

_____

_____

_____

_____

_____

(5)

(c) (i) Ammonium nitrate is one type of artificial fertiliser.
Calculate the relative formula mass of ammonium nitrate NH_4NO_3.
(Relative atomic masses: H = 1, N = 14, O = 16.)

_____

_____

(1)

(ii) Use your answer to part (c)(i) to help you calculate the percentage by mass of nitrogen present in ammonium nitrate NH_4NO_3.

_____

_____

(2)

(Total 15 marks)

Q37.

Bromine can be made from sea water. In 1000 g of sea water there is 0.065 g of bromine.
What mass of sea water would be needed to make 1000 g of bromine?

_____

_____

(Total 2 marks)

Q38.

Nitrates, such as ammonium nitrate, are added to soil to help plant growth.

(a) When rain falls nitrates dissolve and can end up in drinking water.
Nitrates in drinking water can stop respiration in babies. This only happens if there is a lot of nitrate in the drinking water.

Plants use nitrates for growth. Humans need plants. Should large amounts of nitrates be added to soil?
Give **two** reasons for your answer.

Answer _____

Reason 1 _____

_____

Reason 2 _____

_____

(2)

(b) The amount of nitrogen in a nitrate compound is important.

(i) How many nitrogen atoms are there in the formula of ammonium nitrate, NH_4NO_3

_____

(1)

(ii) Calculate the percentage of nitrogen in ammonium nitrate, NH_4NO_3.

(Relative atomic masses: H = 1; N = 14; O = 16)

_____

_____

_____

Percentage of nitrogen in ammonium nitrate = _____ %

(3)

(Total 6 marks)

Q39.

Iron is the most commonly used metal. Iron is extracted in a blast furnace from iron oxide using carbon monoxide.

$$Fe_2O_3 + 3CO \rightarrow Fe + 3CO_2$$

(a) A sample of the ore haematite contains 70% iron oxide.

Calculate the amount of iron oxide in 2000 tonnes of haematite.

_____

_____

Amount of iron oxide = _____ tonnes

(1)

(b) Calculate the amount of iron that can be extracted from 2000 tonnes of haematite.
(Relative atomic masses: O = 16; Fe = 56)

_____

_____

_____

_____

_____

_____

Amount of iron = _____ tonnes

(4)

(Total 5 marks)

Q40.

Calculate the percentage of iron in iron sulphate ($FeSO_4$).

(Relative atomic masses: Fe = 56, O = 16, S = 32)

_____

_____

_____

_____

Percentage of iron in iron sulphate = _____%

(Total 3 marks)

Q41.

'Iron tablets' usually contain iron sulphate ($FeSO_4$).

(a) This salt can be made by reacting iron with sulphuric acid.

$$Fe + H_2SO_4 \rightarrow FeSO_4 + H_2$$

Calculate the mass of iron sulphate that could be obtained from 4 g of iron.

(Relative atomic masses: Fe = 56, H = 1, O = 16, S = 32)

_____

_____

_____

_____

_____

_____

Mass of iron sulphate = _____ g

(3)

(b) Under different conditions, another type of iron sulphate may form.
Balance the symbol equation for this reaction.

$$Fe + H_2SO_4 \rightarrow Fe_2(SO_4)_3 + H_2$$

(1)

(Total 4 marks)

Q42.

Ammonium chloride, NH_4Cl, is made up of nitrogen, hydrogen and chlorine atoms.

(i) Complete the table to show the number of atoms of each element present in NH_4Cl.

Element	Number of atoms in NH_4Cl
nitrogen	1
hydrogen	
chlorine	

(1)

(ii) Calculate the relative formula mass of ammonium chloride, NH_4Cl.

(Relative atomic masses: H = 1, N = 14, Cl = 35.5)

_____

_____

_____

_____

Relative formula mass = _____

(2)

(Total 3 marks)

Q43.

The balanced symbol equation for the reaction is

$$H_2(g) + Cl_2(g) \rightarrow 2HCl(g)$$

Starting with 2 g of hydrogen, what mass of hydrogen chloride would be produced?
(Relative atomic masses: H = 1; Cl = 35.5)

_____

_____

_____

_____

Mass of hydrogen chloride = _____ g

(Total 3 marks)

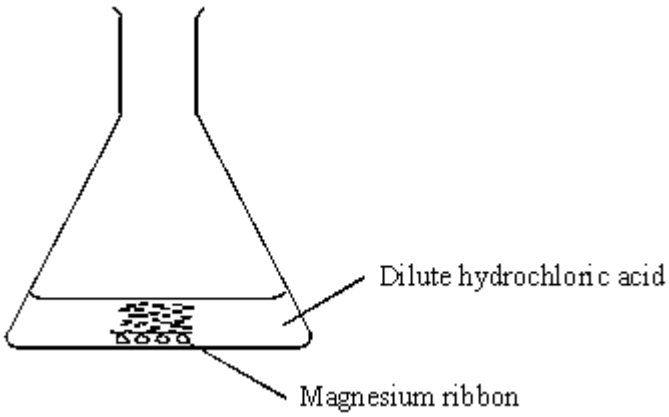
Q44.

In this question you will need to use the following information:

Relative atomic masses: H 1; O 16; Mg 24.

The volume of one mole of any gas is 24 $dm^{>3}$ at room temperature and atmospheric pressure.

The diagram shows a chemical reaction taking place in a conical flask.



The balanced equation for this reaction is:

$Mg(s) + 2HCl(aq) \rightarrow MgCl_2(aq) + H_2(g)$

(a) Write a balanced ionic equation for this reaction.

_____

(2)

(b) Calculate the mass of magnesium required to produce 0.50 g of hydrogen. Show clearly how you work out your final answer and give the unit.

_____

_____

Mass = _____

(2)

(c) (i) Draw a diagram to show how the electrons are arranged in a hydrogen molecule.

(1)

(ii) What is the name of the type of chemical bond between the hydrogen atoms in a hydrogen molecule?

_____

(1)

(d) The chemical formula for hydrogen peroxide is H_2O_2.

Calculate, to the nearest whole number, the percentage, by mass, of hydrogen in hydrogen peroxide. Show clearly how you work out your answer.

_____

_____

Percentage = _____ %

(2)

(Total 8 marks)

Q45.

(a) Ammonia is manufactured from nitrogen and hydrogen. The equation for the reaction between them is:

$$N_2(g) + 3H_2(g) \rightleftharpoons 2NH_3(g)$$

(i) What is the source of the nitrogen?

_____

(1)

(ii) Why does increasing the pressure increase the chance of molecules of hydrogen reacting with molecules of nitrogen?

_____

_____

(1)

(iii) The percentage yield of ammonia is the percentage, by mass, of the nitrogen and hydrogen which has been converted to ammonia. Calculate the mass, in tonnes, of ammonia which can be produced from 90 tonnes of hydrogen when the percentage yield is 50%. The relative atomic masses are: H 1; N 14.

Show clearly how you get to your answer.

_____

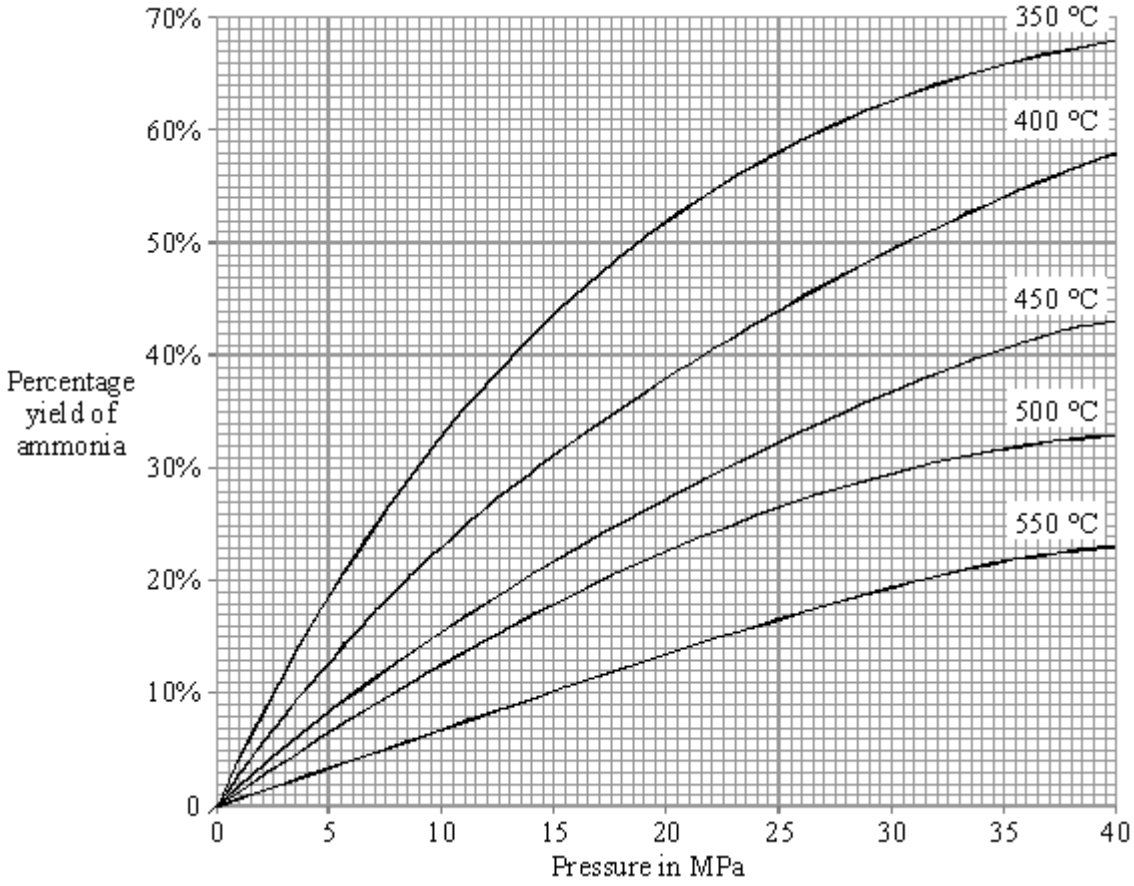
_____

_____

Mass = _____ tonnes

(2)

(b) The percentage yield of ammonia depends on the temperature and pressure inside the reaction vessel. The set of graphs show this.



(i) MPa is the symbol for which unit?

_____

(1)

(ii) What is the percentage yield of ammonia produced at a temperature of 450 °C and a pressure of 20 MPa?

_____

(1)

(iii) Suggest what changes the chemical engineers should make to both the temperature and the pressure to **increase** the percentage yield of ammonia.

Temperature _____

Pressure _____

(1)

(iv) How can the rate of ammonia production be increased without changing the temperature or pressure or the mass of hydrogen and nitrogen?

_____

_____

(1)

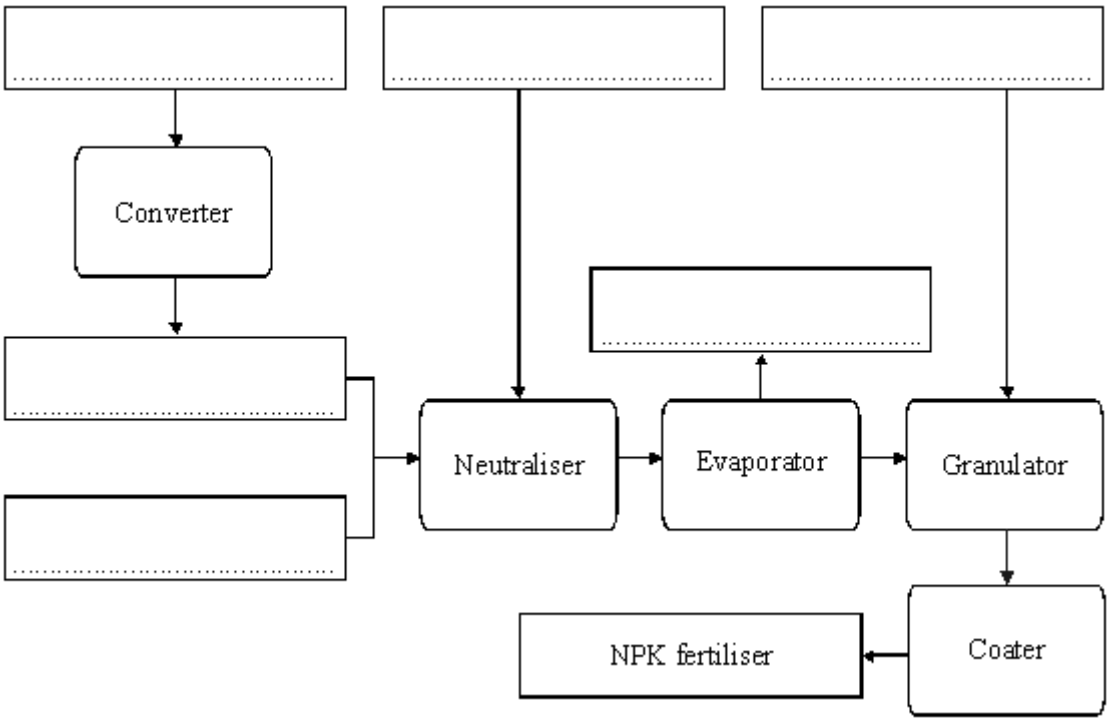
(c) About four-fifths of ammonia production is used to produce fertilisers. One of them is known as NPK. It is made in the following way.

- Some ammonia is converted to nitric acid which is then mixed with phosphoric

acid.

- The mixture is neutralised with more ammonia and the solution is partly evaporated.
- Potassium chloride is added to form granules.
- The granules are coated to make the fertiliser free-flowing.

Complete the flow-chart for the production of NPK by writing in the names of the correct chemicals in the **six** boxes.



(2)

(Total 10 marks)

Q46.

(a) Ammonium sulphate is made by the reaction:

$$2NH_3(aq) + H_2SO_4(aq) \rightarrow (NH_4)_2SO_4(aq)$$

(i) Complete the **three** answers in the table.

Question	Answer
How many hydrogens are there in the formula of ammonium sulphate?	_____
What is the name of the substance with the formula NH_3?	_____
What is the name of the substance with the formula H_2SO_4?	_____

(3)

(ii) What is the main use for ammonium sulphate?

_____

(1)

(iii) A similar reaction is used to make ammonium nitrate. What is the name of the acid which must be used?

_____

(1)

(b) NH_3 is made by the reversible reaction:

$N_2(g) + 3H_2(g) \rightleftharpoons 2NH_3(g)$

(i) Explain what the term *reversible reaction* means.

_____

_____

_____

(2)

(ii) What is the name of the raw material which is the source of nitrogen (N_2)?

_____

(1)

(iii) Nitrogen is an element. Explain what the term *element* means.

_____

_____

_____

(2)

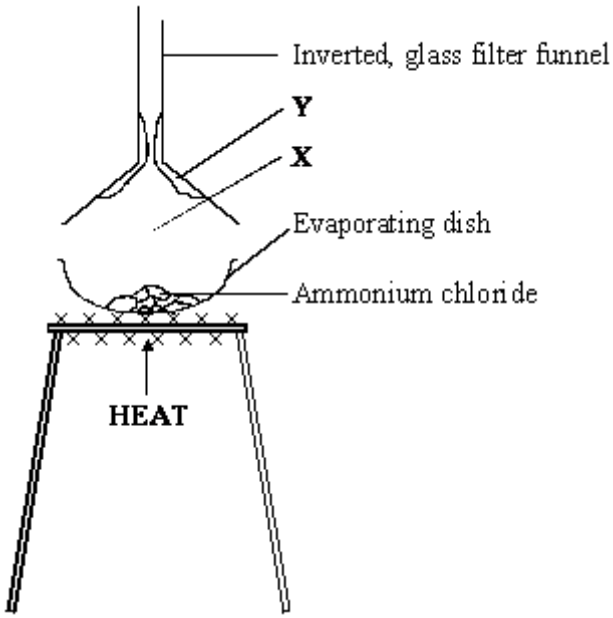
(Total 10 marks)

Q47.

(a) The equation for the reaction that takes place when ammonium chloride is heated is:

$NH_4Cl(s)$	$\rightleftharpoons$	$NH_3(g)$	+	HCl (g)
ammonium chloride		ammonia		hydrogen chloride

The diagram shows how a teacher demonstrated this reaction. The demonstration was carried out in a fume cupboard.



(i) Apart from the gases normally in the atmosphere, which two gases would be at **X**?

_____ and _____

(1)

(ii) Name the white solid that has formed at **Y**.

_____

(1)

(iii) Why was the demonstration carried out in a fume cupboard?

_____

_____

(1)

(iv) Complete the **four** spaces in the passage.

The chemical formula of ammonia is NH_3. This shows that there is one atom of _____ and three atoms of _____ in each _____ of ammonia. These atoms are joined by bonds that are formed by sharing pairs of electrons. This type of bond is called a _____ bond.

(4)

(b) Electrons, neutrons and protons are sub-atomic particles.

(i) Complete the **three** spaces in the table.

Name of sub-atomic particle	Relative mass	Relative charge

_____	1	+1
_____	1	0
_____	$\frac{1}{1840}$	–1

(2)

(ii) Which **two** sub-atomic particles are in the nucleus of an atom?

_____ and _____

(1)

(Total 10 marks)

Q48.

(a) Iron powder is used in the manufacture of ammonia. Why is it used?

_____

_____

(1)

(b) Ammonia is manufactured from nitrogen and hydrogen. The equation for the reaction between them is:

$N_2(g) + 3H_2(g) \rightleftharpoons 2NH_3(g)$

(i) Which **two** raw materials are used to make the hydrogen?

_____ and _____

(1)

(ii) Why does increasing the pressure increase the chance of molecules of nitrogen reacting with molecules of hydrogen?

_____

_____

(1)

(iii) Calculate the mass, in tonnes, of ammonia which could be produced from 560 tonnes of nitrogen.

The relative atomic masses are: H 1; N 14.

Show clearly how you get to your answer.

_____

_____

_____

Mass of ammonia = _____ tonnes

(3)

(Total 6 marks)

Q49.

(a) The formula for ammonia is NH_3. What does the formula tell you about each molecule of ammonia?

(3)

(b) Ammonia is used to make nitric acid (HNO_3). Calculate the formula mass (Mr) for nitric acid. (Show your working).

(3)

(Total 6 marks)

Q50.

The information on the Data Sheet will be helpful in answering this question.

(a) Calculate the formula mass (M_r) of the compound iron (III) oxide, Fe_2O_3.

(Show your working.)

(3)

(b) Calculate the mass of iron produced when 32g of iron (III) oxide is completely reduced by aluminium.

The reaction is shown in the symbol equation:

$$Fe_2O_3 + 2Al \rightarrow 2Fe + Al_2O_3$$

(Show your working.)

Answer = _____ grams

(3)

(Total 6 marks)

Q51.

Calculate the formula mass (Mr), of the compound

calcium hydroxide, $Ca(OH)_2$.

(Show your working)

(Total 3 marks)

Q52.

The formula for the chemical compound magnesium sulphate is $MgSO_4$.

Calculate the relative formula mass (M_r) of this compound. (Show your working.)

(Total 2 marks)

Q53.

(a) The formula for the chemical compound magnesium sulphate is $MgSO_4$.

Calculate the relative formula mass (M_r)of this compound. (Show your working.)

(2)

(b) Magnesium sulphate can be made from magnesium and dilute sulphuric acid.

This is the equation for the reaction.

$$Mg + H_2SO_4 \rightarrow MgSO_4 + H_2$$

Calculate the mass of magnesium sulphate that would be obtained from 4g of magnesium.
(Show your working.)

Answer _____ g

(2)

(Total 4 marks)