PEARSON EDEXCEL GCSE CHEMISTRY · 1CH0

CHEMISTRY



EXAM QUESTION PACK

TOPIC 5: SEPARATE CHEMISTRY 1 (PACK 3)

SCORE	PERCENTAGE
/142	%

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Q1.

Ships made of steel have blocks containing magnesium fixed to their hulls, as shown in Figure 3.

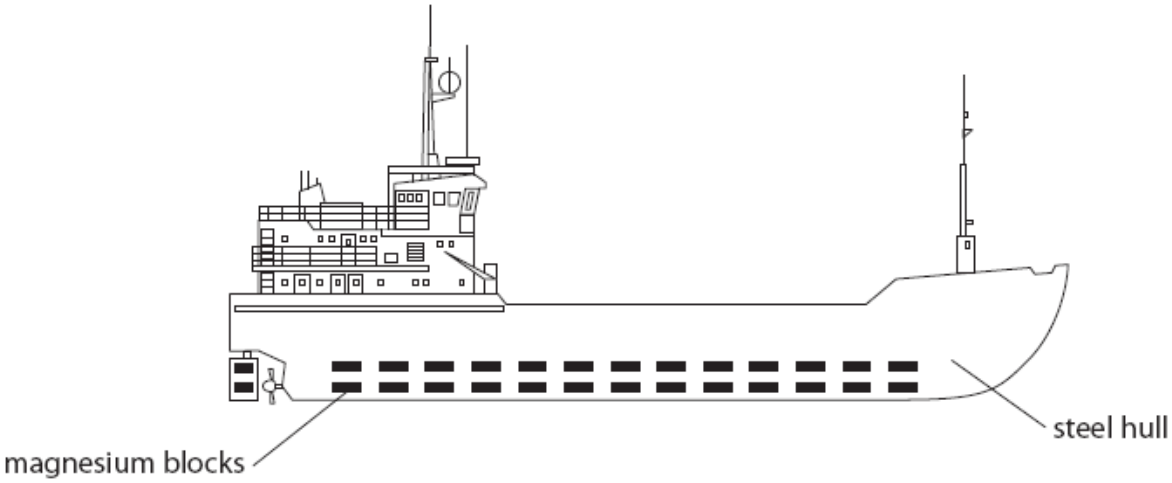


Figure 3

The magnesium prevents the steel hulls from rusting.

Explain how the magnesium prevents the steel from rusting.

(2)

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(Total for question = 2 marks)

Q2.

Transition metals and group 1 metals have many properties in common because they are all metals.

However some properties of transition metals are different from properties of group 1 metals.

Which is a property of transition metals but not of group 1 metals?

(1)

☒ **A** good conductor of electricity

☒ **B** high melting point

☒ **C** malleable

☒ **D** shiny when cut or polished

(Total for question = 1 mark)

Q3.

Answer the questions with a cross in the boxes you think are correct ☒. If you change your mind about an answer, put a line through the box ☒ and then mark your new answer with a cross ☒.

Ammonia is manufactured by the Haber process.

The equation for the reaction is

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

The reaction is reversible and can reach equilibrium.

(i) An iron catalyst can be used in the reaction.

Which row of the table shows how adding the iron catalyst affects the rate of attainment of equilibrium and the equilibrium yield of ammonia?

(1)

	rate of attainment of equilibrium	equilibrium yield of ammonia
☒ **A**	increases	increases
☒ **B**	decreases	does not change
☒ **C**	decreases	increases
☒ **D**	increases	does not change

(ii) Which of the following statements is correct when the reaction reaches equilibrium?

(1)

☒ **A** the reverse reaction starts to take place

☒ **B** the amounts of nitrogen, hydrogen and ammonia are equal

☒ **C** the amounts of nitrogen, hydrogen and ammonia become constant

☒ **D** the reaction stops

(iii) The reaction is carried out at a pressure of 200 atmospheres.

Explain what effect a pressure higher than 200 atmospheres would have on the rate of attainment of equilibrium and on the equilibrium yield of ammonia.

(4)

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(Total for question = 6 marks)

Q4.

Ammonium nitrate is produced from ammonia and nitric acid on a large scale in industry.

Ammonium nitrate can also be made in the laboratory by titrating ammonia solution with dilute nitric acid.

$$NH_3 + HNO_3 \rightarrow NH_4NO_3$$

Ammonium nitrate crystals can then be obtained by evaporating off some of the water from the solution.

Give **two** reasons why this laboratory method is not suitable for use on a large scale in industry.

(2)

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(Total for question = 2 marks)

Q5.

Objects made from transition metals are sometimes coated with a thin layer of another transition metal to improve their appearance and to protect against corrosion.

Figure 10 shows equipment that can be used to electroplate an iron spoon with silver.

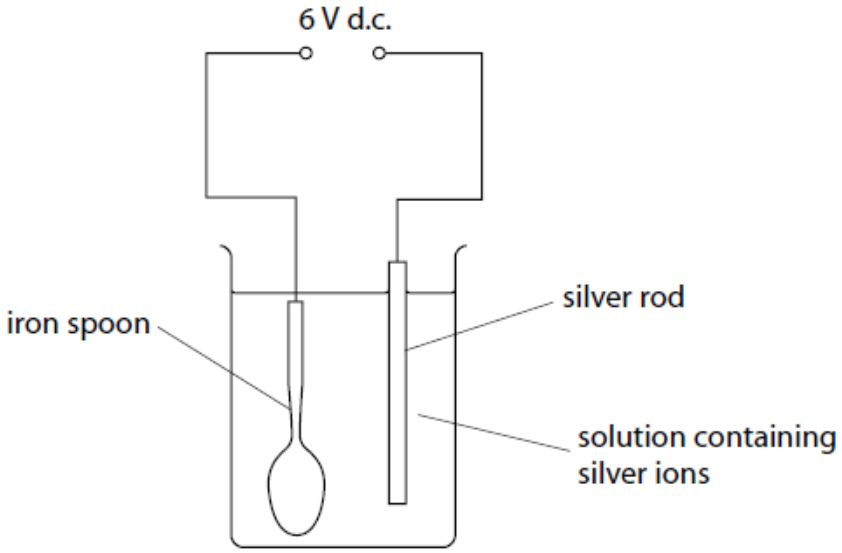


Figure 10

(i) Which row of the table correctly shows the charge on the silver rod electrode and the type of reaction occurring at this electrode?

(1)

	charge	type of reaction
☒ **A**	negative	oxidation
☒ **B**	negative	reduction
☒ **C**	positive	oxidation
☒ **D**	positive	reduction

(ii) Silver metal is deposited on the spoon.

Which half-equation represents this reaction?

(1)

☒ **A** $Ag + e \rightarrow Ag^+$

☒ **B** $Ag \rightarrow Ag^+ + e^-$

☒ **C** $Ag^+ + e \rightarrow Ag$

☒ **D** $Ag^+ \rightarrow Ag + e^-$

(Total for question = 2 marks)

Q6.

Transition metals have many uses.

Figure 7 shows five statements about iron.

Put ticks (✓) in the boxes in Figure 7 to show which statements are true and which statements are false.
The first one has been done for you.

(3)

	true	false
iron is a poor conductor of heat		✓
iron can act as a catalyst		
iron forms compounds that are coloured		
iron has a low density		
iron has a very high melting point		

Figure 7

(Total for question = 3 marks)

Q7.

(a) Substance **X** is an ammonium salt.

(i) Complete the sentence by putting a cross (☒) in the box next to your answer.

A test was carried out to find which anion is present in substance **X**.
Dilute hydrochloric acid was added to a sample of substance **X**.
There was effervescence and the gas given off turned limewater milky.

The anion present in substance **X**is

(1)

☒ **A** carbonate ion, CO_3^{2-}

☒ **B** chloride ion, Cl^-

☒ **C** nitrate ion, NO_3^-

☒ **D** sulfate ion, SO_4^{2-}

(ii) Describe how sodium hydroxide solution can be used to show that ammonium ions are present in substance **X**.

(2)

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(b) Aluminium ions, Al^{3+}, react with hydroxide ions in solution to give a white precipitate of aluminium hydroxide.

Write the ionic equation for this reaction.

(3)

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*(c) A technician found some colourless crystals of a substance left, unlabelled, in a beaker in a laboratory.

She knew the substance was one of potassium sulfate, potassium iodide, sodium sulfate or sodium iodide.

Explain how, using chemical tests, the technician could find out if the substance left in the beaker was potassium sulfate, potassium iodide, sodium sulfate or sodium iodide.

You may include equations in your answer.

(6)

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(Total for Question = 12 marks)

Q8.

The method used to make lead sulfate is:

- pour 100 cm^3 lead nitrate solution into a beaker
- add drops of sodium sulfate solution until a precipitate is seen
- allow the precipitate to settle to the bottom of the beaker
- pour off the liquid
- use a spatula to transfer the solid lead sulfate onto a filter paper

Explain **two** ways of improving this experimental method to increase the amount and quality of lead sulfate obtained from the same volume of lead nitrate solution.

(4)

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(Total for question = 4 marks)

Q9.

The table shows information about iron and two alloy steels.

metallic substance	density / kg m^{-3}	relative cost per tonne	relative strength	resistance to rusting
iron	7850	low	low	low
high speed steel	7850	high	very high	high
stainless steel	7480 – 8000	high	very high	high

Use the information from the table to suggest reasons why iron is converted to these alloy steels.

(2)

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Q10.

When iron rusts it forms hydrated iron oxide, $Fe_2O_3.H_2O$.

$$4Fe + 3O_2 + 2H_2O \rightarrow 2Fe_2O_3.H_2O$$

(1)

In this reaction iron is

☒ **A** decomposed

☒ **B** neutralised

☒ **C** oxidised

☒ **D** reduced

(Total for question = 1 mark)

Q11.

Complete the sentence by putting a cross (☒) in the box next to your answer.

When iron nails are left exposed to air and water, the iron reacts to form rust.

In this reaction, iron is

(1)

☒ **A** oxidised

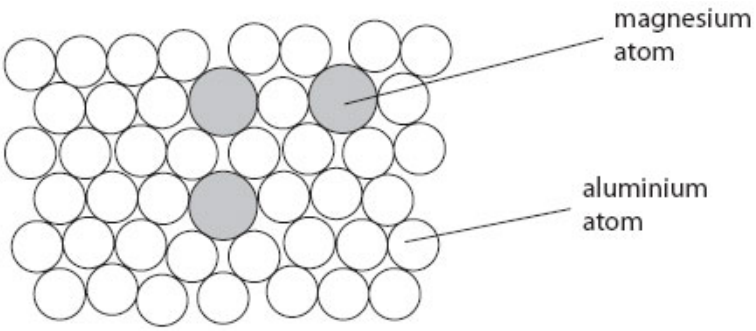
☒ **B** crystallised

☒ **C** neutralised

☒ **D** reduced

Q12.

Magnalium is an alloy of aluminium and magnesium.
The diagram shows the structure of this alloy.



(i) Explain what you understand by the term **alloy.**

(2)

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(ii) Explain, in terms of their structures, why magnalium is stronger than pure aluminium.

(3)

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Q13.

In industry sodium carbonate is made from sodium chloride solution and calcium carbonate in the Solvay Process.

(a) Describe the test to show that calcium carbonate contains carbonate ions.

(3)

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(b) Another product of the Solvay Process is calcium chloride.

Calculate the relative formula mass of calcium chloride, $CaCl_2$.
(Relative atomic masses: Ca = 40; Cl = 35.5)

(1)

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relative formula mass = ...

(c) The overall equation for the Solvay Process is

$$2NaCl + CaCO_3 \rightarrow Na_2CO_3 + CaC_2$$

Calculate the maximum mass of sodium carbonate that could be formed by reacting 40 kg of calcium carbonate with an excess of sodium chloride solution.
(Relative formula masses: $CaCO_3$ = 100; Na_2CO_3 = 106)

(2)

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mass of sodium carbonate = ... kg

(d) Sodium carbonate was made in a laboratory experiment.
The theoretical yield of the experiment was 15.0 g.
The actual yield of the experiment was 10.4 g.

(i) Calculate the percentage yield of sodium carbonate in this experiment.

(2)

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percentage yield = ...

(ii) Suggest **two** reasons why the actual yield was less than the theoretical yield.

(2)

reason 1 .....

.....

reason 2 .....

.....

(Total for Question = 10 marks)

Q14.

Making sodium chloride

To make pure sodium chloride from sodium hydroxide solution and dilute hydrochloric acid, a titration has to be used.

(a) Ethanol is produced by fermentation of carbohydrates.

The equation for the reaction is

$$HCl(aq) + NaOH(aq) \rightarrow NaCl(.....) + H_2O(.....)$$

(a) Which state symbols follow NaCl and H_2O to complete the equation?

Put a cross (☒) in the box next to your answer.

(1)

		NaCl	H_2O
☒	**A**	s	l
☒	**B**	aq	aq
☒	**C**	s	aq
☒	**D**	aq	l

(b) The reaction above is a neutralisation reaction.

Write the ionic equation for the reaction.

(2)

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(c) When sodium hydroxide solution is titrated with dilute hydrochloric acid, an acid-base

indicator is used.
The hydrochloric acid is added from a burette to the sodium hydroxide solution in a conical flask. At the end point the indicator changes colour.

(i) Give the name of a suitable indicator to use in this titration.

(1)

.....

(ii) State the colour change for this indicator at the end point.

(1)

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

(d) A sodium hydroxide solution was made up by dissolving 20.0 g of sodium hydroxide in water and making the volume of the solution up to 1.00 dm^3. Calculate the concentration of sodium hydroxide, NaOH, in this solution in mol dm^{-3}.

(relative atomic masses: H = 1.00, O = 16.0, Na = 23.0)

(2)

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.....

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concentration = ... mol dm^{-3}

(e) In another experiment, a titration was carried out.
25.0 cm^3 of 1.50 mol dm^{-3} sodium hydroxide solution, NaOH, was titrated with hydrochloric acid. The volume of the hydrochloric acid required to neutralise the sodium hydroxide solution was 30.0 cm^3.

Calculate the concentration of the hydrochloric acid, HCl, in mol dm^{-3}.

$$HCl + NaOH \rightarrow NaCl + H_2O$$

(3)

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concentration = ... mol dm^{-3}

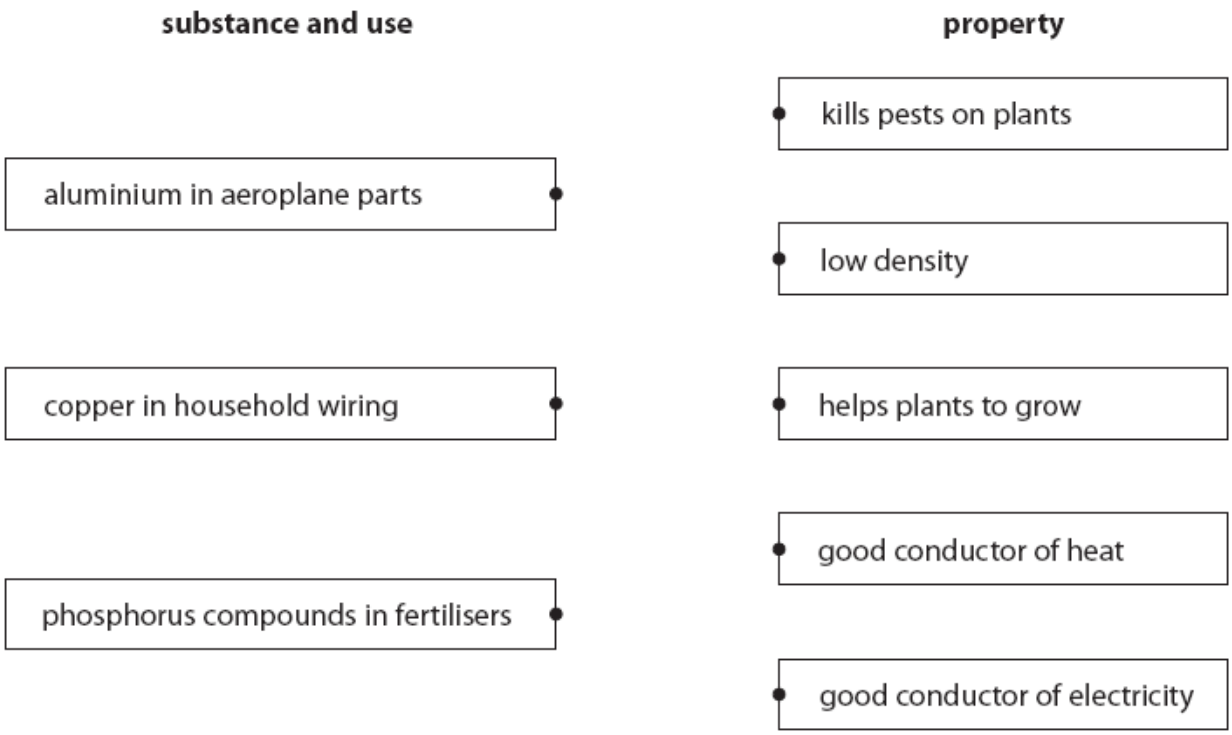
(Total for question = 10 marks)

Q15.

Many elements are useful in everyday life.

Draw **one** straight line from each substance and its use to the property that makes it suitable for the use given.

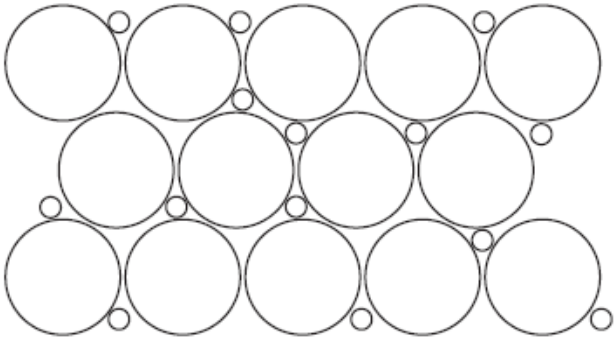
(3)



(Total for question = 3 marks)

Q16.

* The diagram shows the structure of a metal.



Use the diagram to describe the structure of a metal and to explain why metals are malleable and conduct electricity.

(6)

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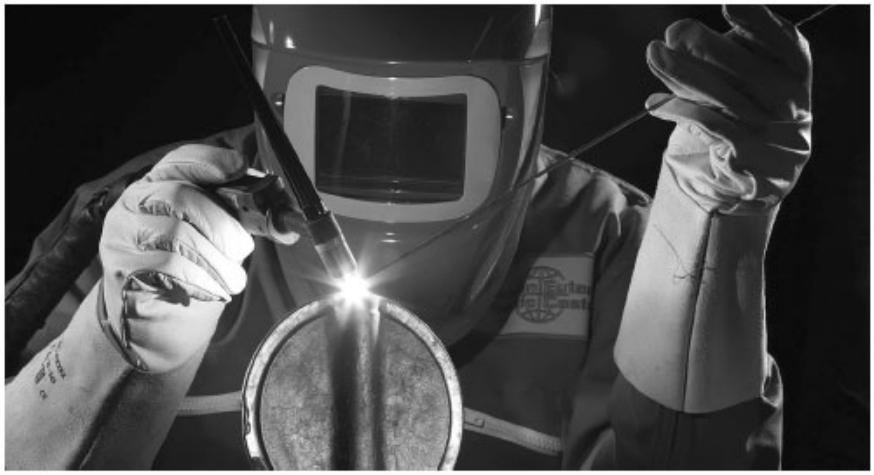
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Q17.

(a) Two pieces of metal can be joined by welding them together.



(i) Complete the sentence by putting a cross (☒) in the box next to your answer.

The structure of a metal is a lattice of

(1)

☒ **A** anions

☒ **B** anions and cations

☒ **C** cations in a sea of electrons

☒ **D** molecules in a sea of electrons

(ii) To join two pieces of metal by welding, they must be melted together.

State why a high temperature has to be used.

(1)

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.....

(iii) The pieces of metal are welded together in an atmosphere of argon.

Explain why an atmosphere of argon is used.

(2)

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(b) Some metals react with halogens.

Iron reacts with bromine, Br_2, to form iron(III) bromide, $FeBr_3$.

Write the balanced equation for this reaction.

(2)

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(c) Complete the sentence by putting a cross (☒) in the box next to your answer.

At room temperature, iodine is a

(1)

☒ **A** brown gas

☒ **B** brown liquid

☒ **C** grey solid

☒ **D** purple gas

(d) When a halogen is added to a solution containing halide ions a displacement reaction may occur

In the table

✓ shows a displacement reaction occurs

× shows a displacement reaction does not occur

halogen added	halide ion in solution		
	chloride ion	bromide ion	iodide ion
chlorine		✓	✓
bromine	×		✓
iodine	×	×	

Use the information in the table to explain the order of reactivity of the three halogens.

(2)

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(Total for Question = 9 marks)

Q18.

Metals

(a) In the extraction of tin from tin oxide, tin oxide is heated with carbon.

$$SnO_2 + C \rightarrow Sn + CO_2$$

Complete the sentence by putting a cross (☒) in the box next to your answer.

When the tin oxide reacts with carbon to form the products

(1)

☒ **A** tin is oxidised

☒ **B** tin oxide is reduced

☒ **C** carbon is reduced

☒ **D** carbon dioxide is oxidised

(b) Pure gold is too soft to be used for some jewellery.

(i) Gold alloys contain other metals such as copper and silver.

In terms of the arrangement of metal atoms, explain why gold alloys are stronger than pure gold.

(2)

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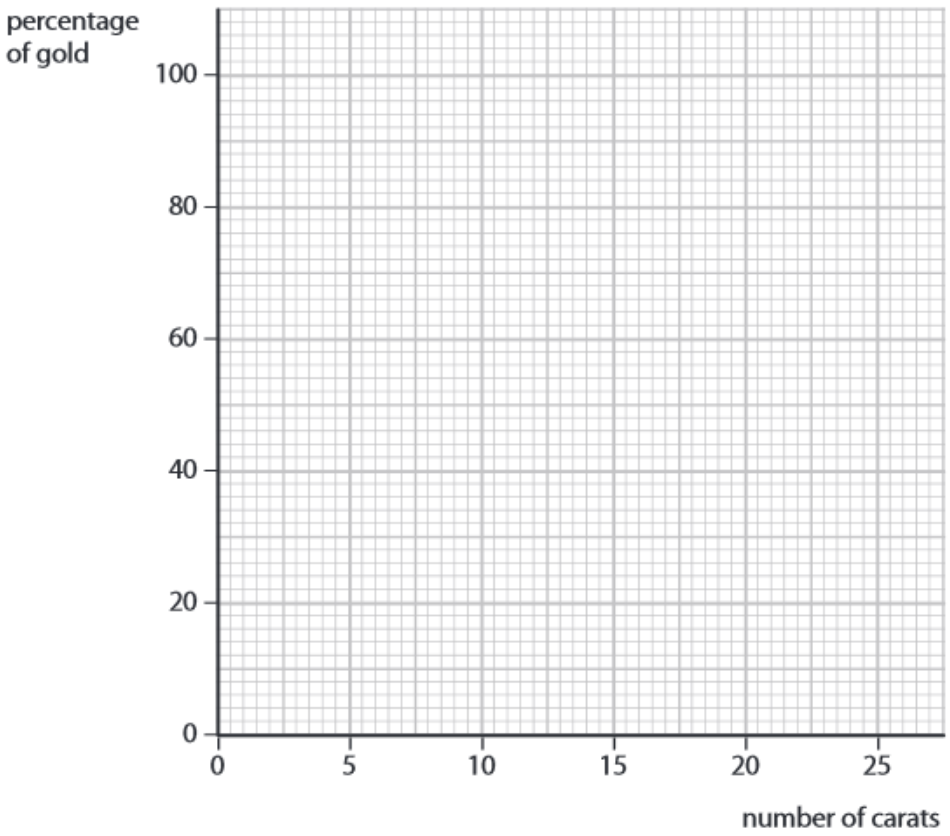
(ii) The purity of gold is often measured in carats.

The data shows how the number of carats is related to the percentage of gold.

number of carats	percentage of gold
24	100
22	92
18	75
9	38

On the grid provided, draw a graph of the percentage of gold against the number of carats.

(2)



(iii) A gold ring is 14 carat gold.

Use the graph to determine the percentage of gold in the ring.

(1)

.....

(*c) Metals are obtained from the Earth's crust by different methods.

Some metals are found uncombined but others have to be extracted from their ores by electrolysis or by heating the ore with carbon.

Explain, using aluminum, gold and iron as examples, how the method used to obtain the metal is related to its position in the reactivity series and to the cost of the extraction process.

(6)

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(Total for question = 12 marks)

Q19.

(a) Use words from the box to complete the sentences.

electricity	copper	carbon	methane	water

(2)

(i) Iron is extracted from its ore by heating the ore with ..... .

(ii) It is difficult to reduce aluminium ore to aluminium metal. Therefore,

to produce aluminium from its ore, it is necessary to use ..... .

(b) Lead oxide can be converted into lead by heating it with carbon.

The word equation for the reaction is

lead oxide + carbon → lead + carbon dioxide

Explain how this equation shows that lead oxide is reduced and carbon is oxidised.

(2)

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.....

(c) The table shows some information about the metals copper and aluminium

metal	ability to conduct electricity	density / g cm^{-3}
copper	good	8.9
aluminium	good	2.7

Overhead power cables, supported by pylons, are used to carry electricity around the country.

Use the information from the table to explain why aluminium, rather than copper, is used for overhead power cables.

(2)

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(d) Complete the sentence by putting a cross (☒) in the box next to your answer.

Stainless steel is an alloy containing iron and chromium.
Stainless steel is used instead of pure iron because it is

(1)

☒ **A** more reactive

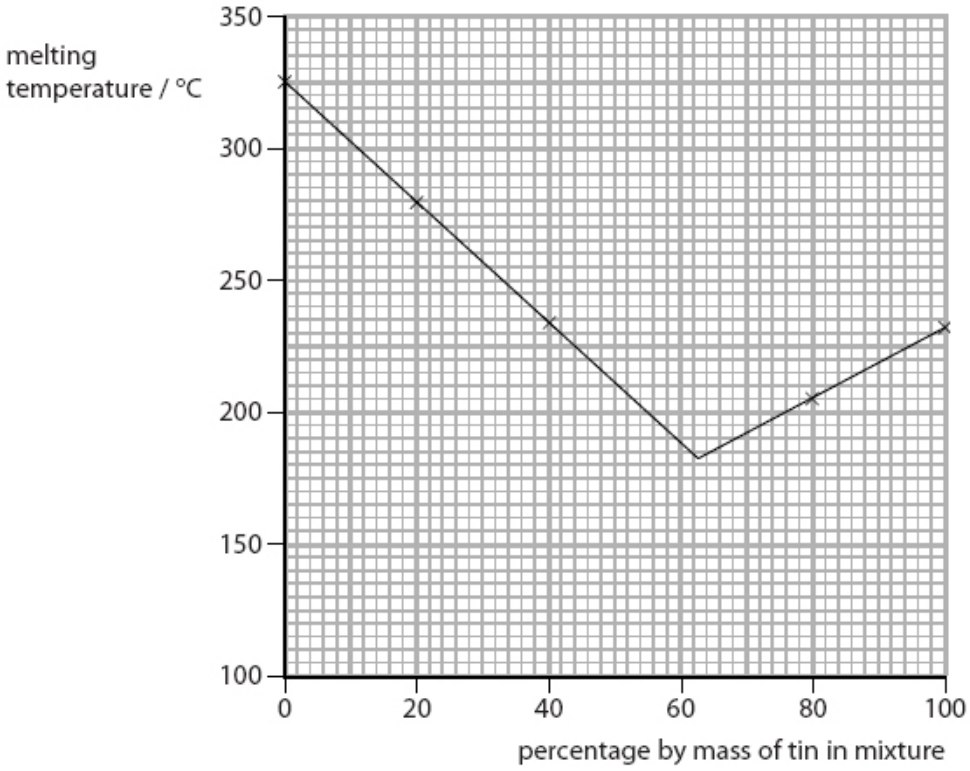
☒ **B** weaker

☒ **C** more flexible

☒ **D** more resistant to corrosion

(e) Alloys are made by melting mixtures of metals and then leaving them to solidify.
Tin and lead form an alloy called solder.
Samples of solder containing different amounts of tin and lead were prepared.
The temperature at which each sample started to melt was recorded as the melting temperature.

The results are shown on the graph.



(i) Use the graph to find the percentage of tin in the mixture that has the lowest melting temperature.

(1)

.....%

(ii) Describe how the melting temperature changes as the percentage by mass of tin in the mixture increases from 0% to 100%.

(2)

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.....

(Total for Question = 10 marks)

Q20.

Answer the question with a cross in the box you think is correct ☒. If you change your mind about an answer, put a line through the box ☒ and then mark your new answer with a cross ☒.

In industry, ammonia is manufactured by reacting nitrogen with hydrogen.

Most of the ammonia manufactured in industry is used to produce fertilisers.

(i) A fertiliser is made by reacting ammonia with nitric acid.

What is the name of this fertiliser?

(1)

☒ **A** ammonia nitrate

☒ **B** ammonia nitric

☒ **C** ammonium nitrate

☒ **D** ammonium nitric

(ii) Explain the importance of fertilisers in farming.

(2)

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(Total for question = 3 marks)

Q21.

The table shows some information about the metals copper and aluminium

metal	ability to conduct electricity	density / g cm^{-3}
copper	good	8.9
aluminium	good	2.7

Overhead power cables, supported by pylons, are used to carry electricity around the country.

Use the information from the table to explain why aluminium, rather than copper, is used for overhead power cables.

(2)

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Q22.

(i) In an experiment to produce lead, 7.67 g of lead are obtained.

The theoretical yield of lead for the experiment is 11.80 g.

Calculate the percentage yield of lead in this experiment.

(2)

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percentage yield = ...

(ii) In most reactions, the percentage yield of any product is less than 100%.

Give **two** reasons why the percentage yield is less than 100%.

(2)

reason 1

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.....

reason 2

.....

.....

(Total for question = 4 marks)

Q23.

(i) In an experiment to produce lead, 7.67 g of lead are obtained.

The theoretical yield of lead for the experiment is 11.80 g.

Calculate the percentage yield of lead in this experiment.

(2)

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percentage yield = ...

(ii) In most reactions, the percentage yield of any product is less than 100%.

Give **two** reasons why the percentage yield is less than 100%.

(2)

reason 1

.....

.....

reason 2

.....

.....

(Total for question = 4 marks)

Q24.

Universal indicator solution is not a suitable indicator for an acid-alkali titration.

(i) Give the name of an indicator that is suitable for use in the titration of sodium hydroxide

solution with hydrochloric acid.

(1)

.....

(ii) Universal indicator goes through a series of gradual colour changes as the pH changes in a solution.

Give a reason why universal indicator is not a suitable indicator to use in an acid-alkali titration.

(1)

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(Total for question = 2 marks)

Q25.

The compound ammonium chloride is used as a fertiliser.

Starting with a dilute solution of ammonia, describe how you could prepare a pure solution of ammonium chloride in the laboratory.

(3)

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(Total for question = 3 marks)

Q26.

The compound ammonium chloride is used as a fertiliser.

Starting with a dilute solution of ammonia, describe how you could prepare a pure solution of ammonium chloride in the laboratory.

(3)

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(Total for question = 3 marks)

Q27.

* A student is told to prepare pure, dry crystals of ammonium sulfate.

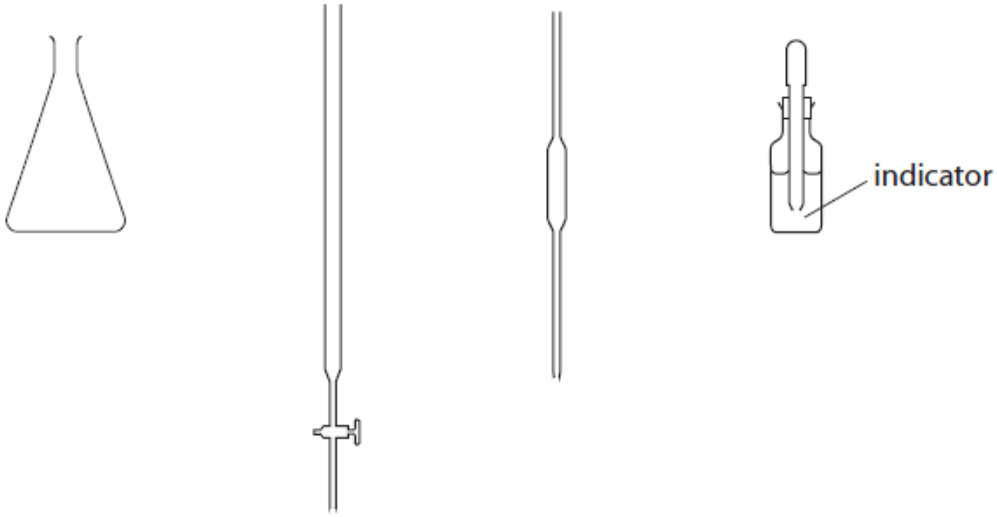
The student is told to carry out the experiment in four stages.

Stage 1: take 25.0 cm^3 of ammonia solution
Stage 2: find the volume of sulfuric acid that is needed to neutralise the ammonia solution
Stage 3: use this result to prepare an ammonium sulfate solution
Stage 4: prepare pure, dry crystals of ammonium sulfate from this solution

Describe how the student should carry out this experiment.

Some of the following apparatus may be used in the experiment.

(6)



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Q28.

Figure 1 shows the dot and cross diagram for a molecule of ammonia.

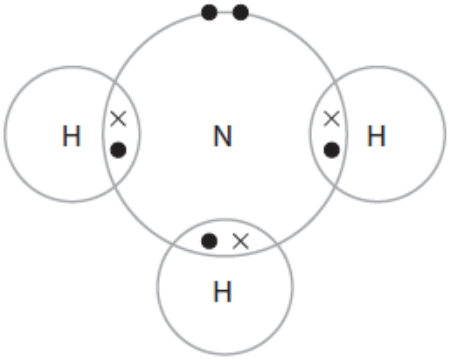


Figure 1

(i) Ammonia can be manufactured by the Haber process.

The word equation for the reaction is

$$\text{nitrogen + hydrogen} \rightleftharpoons \text{ammonia}$$

State the meaning of the $\rightleftharpoons$ symbol.

(1)

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(ii) In the Haber process, the percentage yield of ammonia at equilibrium changes with temperature.

Figure 2 shows how the percentage yield of ammonia at equilibrium changes with temperature.

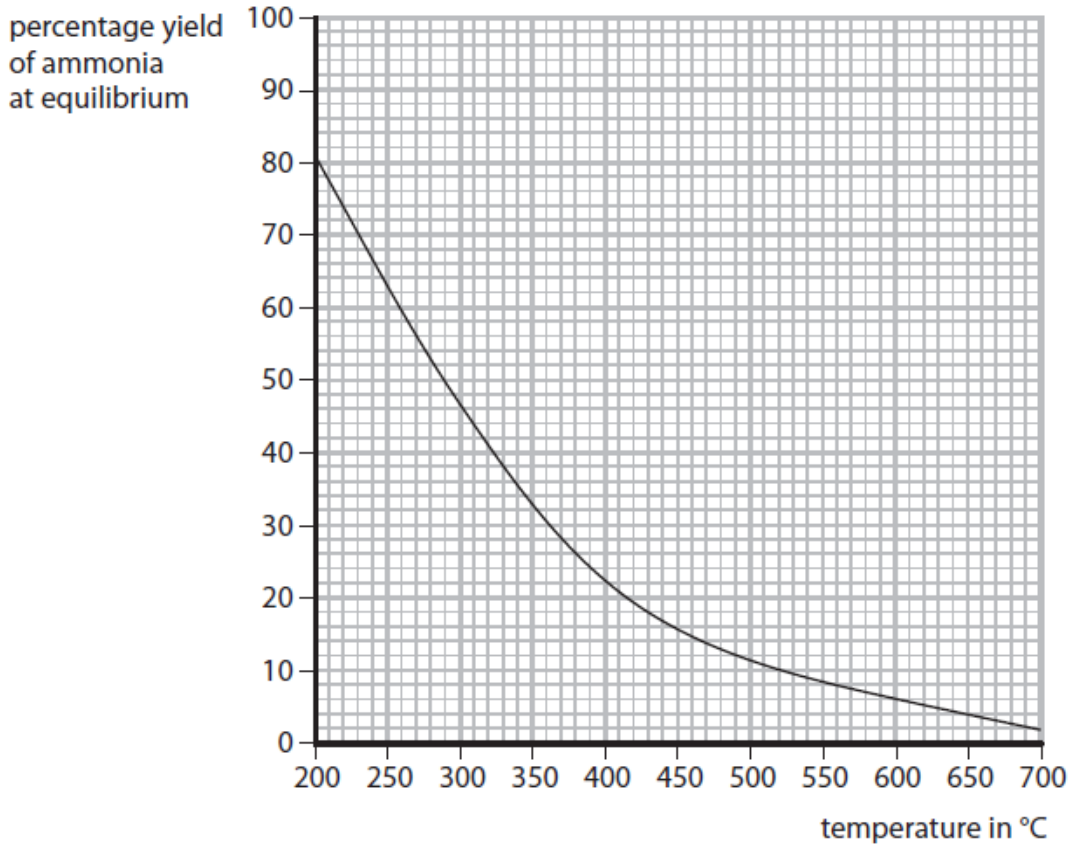


Figure 2

State what happens to the percentage yield of ammonia at equilibrium as the temperature

increases.

(1)

.....

.....

(iii) Use the graph to find the percentage yield of ammonia at equilibrium at 450°C.

(1)

percentage yield of ammonia at equilibrium = ...

(Total for question = 3 marks)

Q29.

Alloy steels are made when iron is alloyed with other transition metals such as cobalt and chromium.

Which row of the table shows the typical properties of a transition metal?

(1)

	used as a catalyst	density	colour of metal chloride
☒ **A**	yes	high	colourless
☒ **B**	no	low	colourless
☒ **C**	yes	high	coloured
☒ **D**	no	low	coloured

(Total for question = 1 mark)

Q30.

Some elements in the periodic table are called transition metals.

Iron is a transition metal.

Give **three** properties of iron that are typical of all transition metals.

(3)

property 1

.....

property 2

.....

property 3

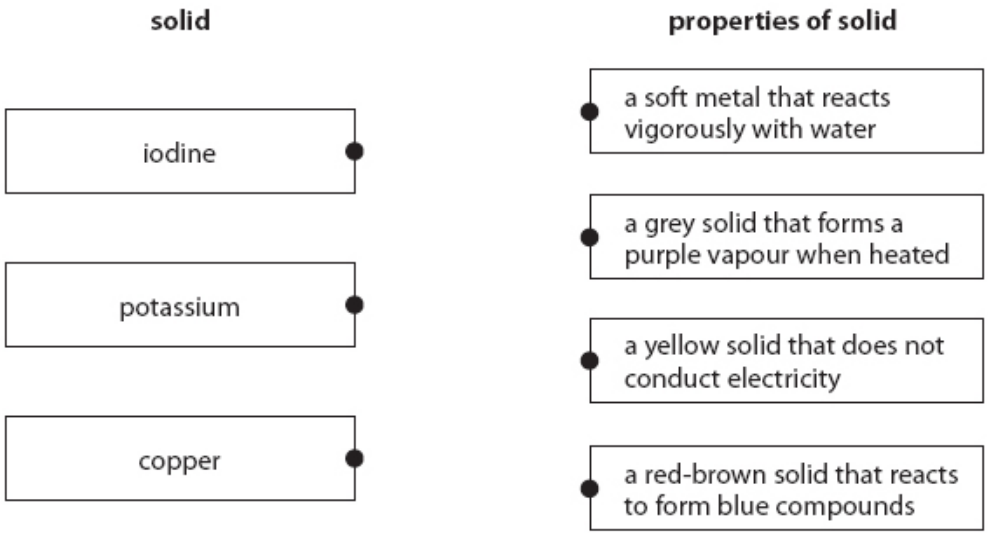
.....

(Total for question = 3 marks)

Q31.

The table shows some solids and some properties of solids.

Draw **one** straight line from each solid to properties of that solid.



Q32.

A solution is made by dissolving calcium chloride in water.

11.1 g of calcium chloride are dissolved in water.

The volume of the solution is made up to 500 cm^3.

Calculate the concentration, in mol dm^{-3}, of calcium chloride, $CaCl_2$, in this solution.

(relative atomic masses: Cl = 35.5, Ca = 40.0)

(3)

.....

.....

.....

.....

.....

.....

.....

concentration = ...mol dm^{-3}

Q33.

Complete the sentence by putting a cross (☒) in the box next to your answer.

Stainless steel is an alloy containing iron and chromium.
Stainless steel is used instead of pure iron because it is

(1)

☒ **A** more reactive

☒ **B** weaker

☒ **C** more flexible

☒ **D** more resistant to corrosion

Q34.

When there are alternative methods of producing a product, the final pathway is chosen by considering atom economy, cost of energy, yield of product and rates of reactions.

State another factor that should also be considered.

(1)

.....

(Total for question = 1 mark)

Q35.

*The pure metals aluminium, copper and gold and the alloys brass and magnalium are used to make many useful articles.

The way in which these metals and alloys are used is related to their properties, such as their density, electrical conductivity, resistance to corrosion and strength.

State some uses of aluminium, copper, gold, brass and magnalium and explain how each use is related to their properties.

(6)

(Total for question = 6 marks)

Q36.

This question is about the metal gold.

(i) Gold can be hammered into shape.

State the name of this property.

(1)

.....

(ii) Gold alloys can be used to repair teeth.
One reason that gold alloys are used is that they can be hammered into shape.

Give **one other** reason why gold alloys are used to repair teeth.

(1)

.....

.....

.....

(Total for question = 2 marks)

Q37.

Fertilisers contain compounds that promote plant growth.

(i) State the name of an element in these compounds that promotes plant growth.

(1)

.....

(ii) Potassium nitrate is present in some fertilisers.

Potassium nitrate is formed by the reaction of potassium hydroxide solution with nitric acid.

Complete the balanced equation for this reaction.

(2)

$KOH + HNO_3 \rightarrow$ ..... + ...

(Total for question = 3 marks)

Q38.

Many metals corrode.

Ammonia is used to make hydrazine.

In the industrial process to manufacture ammonia, nitrogen and hydrogen are combined in the

presence of an iron catalyst.

$$N_2 + 3H_2 \rightleftharpoons 2NH_3$$

(i) State the name of the industrial process to manufacture ammonia.

(1)

.....

(ii) Predict the effect that adding the catalyst has on the rate of attainment of equilibrium.

(1)

.....

.....

(iii) Predict the effect that adding the catalyst has on the equilibrium yield of ammonia.

(1)

.....

.....

(Total for question = 3 marks)

Q39.

Nitric acid can be titrated with a solution of ammonia.

(i) State the type of reaction occurring when nitric acid reacts with ammonia.

(1)

.....

(ii) What salt is formed in this reaction?

(1)

☒ **A** ammonia nitric

☒ **B** ammonia nitrate

☒ **C** ammonium nitric

☒ **D** ammonium nitrate

(Total for question = 2 marks)

Q40.

In a hydrogen-oxygen fuel cell, hydrogen and oxygen react at the electrodes.

Some metal objects are electroplated.

State **two** reasons for electroplating a metal object.

(2)

1 .....

.....

2 .....

.....

(Total for question = 2 marks)

Q41.

In industry, ammonia is manufactured by reacting nitrogen with hydrogen.

The formula of ammonia is NH_3.

State what the formula of ammonia shows about the number of nitrogen atoms and the number of hydrogen atoms
combined in a molecule of ammonia.

(1)

.....

.....

(Total for question = 1 mark)

Q42.

Another student carried out the experiment using a similar method.
The student used a blue, roaring Bunsen burner flame and placed a lid on the crucible.

State why the student used a blue, roaring flame and a lid.

(2)

why a blue, roaring flame .....

.....

why a lid .....

.....

(Total for question = 2 marks)

Q43.

Transition metals have many uses.

Most iron produced is converted into alloys of iron.

(i) State why alloys have more uses than pure metals.

(1)

.....

.....

(ii) An alloy of iron contains 0.40 % of molybdenum.

Calculate the mass of molybdenum contained in a 30 g sample of this alloy of iron.

(2)

.....

.....

.....

.....

mass of molybdenum = ... g

(Total for question = 3 marks)

Q44.

Fertilisers are sometimes added to soil.

(i) State why fertilisers are added to soil.

(1)

.....

.....

(ii) Fertilisers contain compounds of different elements.

Three of these elements have the symbols K, N and P.

Use the periodic table to state the names of these three elements.

(2)

K .....

N .....

P .....

(Total for question = 3 marks)

Q45.

In a hydrogen-oxygen fuel cell, hydrogen and oxygen react at the electrodes.

The electrodes of a fuel cell are in contact with water and air.
The electrodes are made of platinum rather than iron.

(i) State why iron is not a suitable metal for the electrodes of the cell.

(1)

.....

.....

.....

(ii) Platinum acts as a catalyst.

State, in terms of its position in the periodic table, why you would expect platinum to act as a catalyst.

(1)

.....

.....

.....

(Total for question = 2 marks)

Q46.

Transition metals have many uses.

Many transition metals are used to make the reactants in chemical cells.

Figure 8 shows a graph of the voltage produced by a chemical cell as it is used in a torch for many hours.

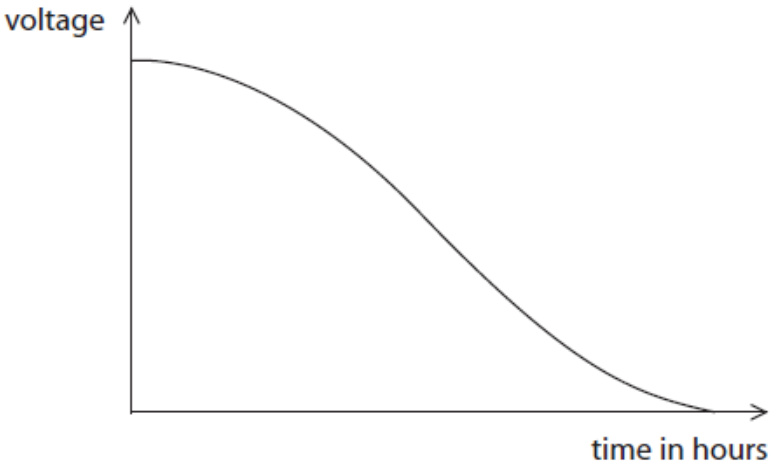


Figure 8

Suggest an explanation for the shape of the graph.

(2)

.....

.....

.....

.....

(Total for question = 2 marks)

Q47.

Answer the question with a cross in the box you think is correct ☒. If you change your mind about an answer, put a line through the box ☒ and then mark your new answer with a cross ☒.

A sample of solid potassium hydroxide contained soluble, unreactive impurities.

A student tried to find the mass of potassium hydroxide in the sample, using the following method.

step 1 measure the mass of the sample of impure potassium hydroxide

step 2 dissolve the sample in 250 cm^3 of water in a beaker

step 3 take a 25 cm^3 sample of the potassium hydroxide solution using a measuring cylinder and pour into a conical flask

step 4 add 3 drops of indicator to the solution

step 5 put the conical flask on a white tile

step 6 using a burette, add dilute sulfuric acid of known concentration drop by drop to the solution, while swirling the flask

step 7 continue adding the sulfuric acid until the colour of the solution changes

step 8 record the volume of sulfuric acid added

step 9 use this result to calculate the mass of pure potassium hydroxide in the sample.

(i) Suggest **three** ways to improve this method to obtain a more accurate mass of pure potassium hydroxide.

(3)

1 .....

.....

2 .....

.....

3 .....

.....

(ii) The indicator used was phenolphthalein.

Which row shows the colour change that would be seen in this titration?

(1)

	colour at start	colour at end point
☒ **A**	yellow	orange
☒ **B**	orange	yellow
☒ **C**	pink	colourless
☒ **D**	colourless	pink

(Total for question = 4 marks)

Q48.

The equation for the reaction that occurs in the Haber process is

$$N_2 + 3H_2 \rightleftharpoons 2NH_3$$

(i) Use the periodic table to give the number of the group and of the period of nitrogen.

(2)

group

.....

period

.....

(ii) State what is meant by the symbol $\rightleftharpoons$ in the equation.

(1)

.....

.....

(Total for question = 3 marks)

Q49.

In the Haber process nitrogen and hydrogen are reacted together to form ammonia.

Complete the sentence by putting a cross (☒) in the box next to your answer.

The nitrogen used in the Haber process is obtained from

(1)

☒ **A** air

☒ **B** coal

☒ **C** crude oil

☒ **D** sea water

Q50.

Ammonia is manufactured in the Haber process.

In this process, hydrogen reacts with nitrogen under a pressure of about 200 atmospheres and at 450 °C.

A dynamic equilibrium can be reached.

$$N_2 + 3H_2 \rightleftharpoons 2NH_3$$

Explain the effect on the **rate of attainment of equilibrium**, of carrying out the process at the same temperature but at a pressure higher than 200 atmospheres.

(3)

.....

.....

.....

.....

(Total for question = 3 marks)

Q51.

A student was asked to plan a titration experiment to find the exact volume of hydrochloric acid that would neutralise 25.0 cm^3 of sodium hydroxide solution.

The student's plan is

1. use a measuring cylinder to pour 25 cm^3 of sodium hydroxide solution into a conical flask
2. add a few drops of an indicator to the sodium hydroxide solution
3. use a burette to add hydrochloric acid to the sodium hydroxide solution until the indicator changes colour

(i) State the name of the piece of apparatus that should be used, instead of the measuring cylinder in step 1, in order to improve the accuracy of the experiment.

(1)

.....

(ii) Suggest the name of a suitable indicator and state the colour change that would occur at the end point in this experiment.

(2)

name of indicator

.....

colour change

.....

.....

(iii) Suggest **two** details that could be added to the plan to make the experiment more accurate.

(2)

1 .....

.....

2 .....

.....

(Total for question = 5 marks)

Q52.

Titration can be used to determine the exact amount of hydrochloric acid that reacts with a given amount of sodium hydroxide solution.

$$HCl + NaOH \rightarrow NaCl + H_2O$$



* Sodium chloride solution can be made from dilute hydrochloric acid and sodium hydroxide solution.

Describe a titration experiment to find the exact volume of hydrochloric acid needed to neutralise 25.0 cm^3 of sodium hydroxide solution and how you would use this result to obtain pure, dry crystals of sodium chloride.

(6)

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Q53.

Titration can be used to determine the exact amount of hydrochloric acid that reacts with a given amount of sodium hydroxide solution.

$$HCl + NaOH \rightarrow NaCl + H_2O$$



Suggest why universal indicator must not be used in titration experiments.

(1)

.....

Q54.

A titration of sodium hydroxide solution with hydrochloric acid can be carried out as follows

1 a pipette is used to measure 25.00 cm^3 of sodium hydroxide solution into a conical flask
2 a few drops of indicator are added to the sodium hydroxide solution
3 the burette is filled with hydrochloric acid
4 the hydrochloric acid is added to the sodium hydroxide solution until the indicator changes colour.

(i) Describe how the pipette should be used to measure exactly 25.00 cm^3 of sodium hydroxide solution into the conical flask.

(2)

.....

.....

.....

.....

(ii) The burette is first washed with water.

It is then rinsed with some of the acid before it is filled with the acid to begin the titration.

Explain why the burette is rinsed with the acid.

(2)

.....

.....

.....

.....

(Total for question = 4 marks)

Q55.

The concentration of a solution of an alkali can be determined by titration with an acid.

25.0 cm^3 portions of the solution of the alkali are transferred into a conical flask and titrated with the acid solution, using a suitable indicator.

(i) Describe how you would measure out and transfer 25.0 cm^3 of the solution of the alkali.

(2)

.....

.....

.....

.....

.....

(ii) Complete the sentence by putting a cross (☒) in the box next to your answer.

The burette readings of acid added were

	titration 1	titration 2	titration 3
final volume / cm^3	27.20	30.10	25.35
initial volume / cm^3	2.05	5.20	0.10
volume of acid added / cm^3	25.15	24.90	25.25

The volume of acid added that should be used in the calculation is

(1)

☒ **A** 24.90 cm^3

☒ **B** 25.00 cm^3

☒ **C** 25.10 cm^3

☒ **D** 25.20 cm^3

Q56.

The rusting of an iron nail was investigated by setting up three test tubes, as shown in Figure 6.

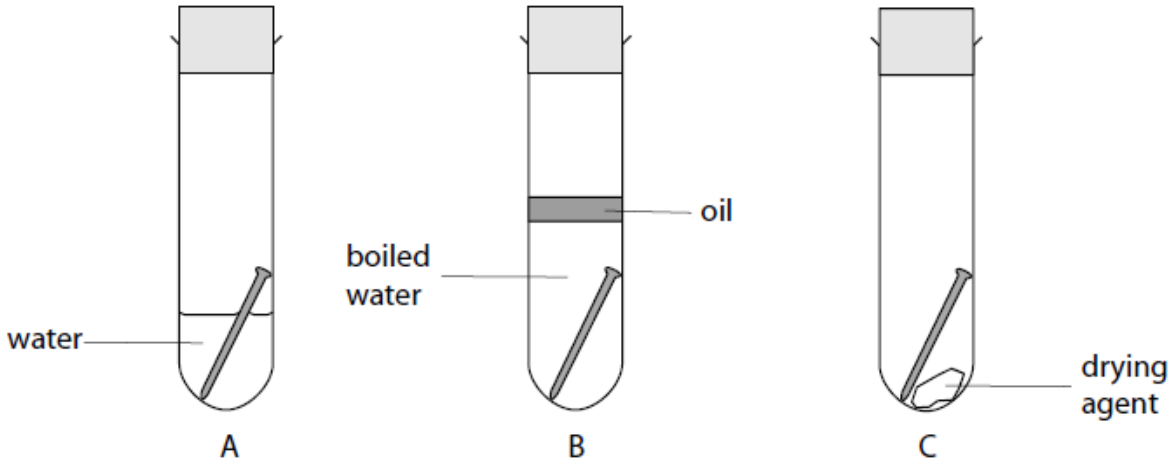


Figure 6

State and justify the result you would see in each tube after one week.

(3)

A .....

.....

B .....

.....

C .....

.....

(Total for question = 3 marks)

Q57.

In the Haber process nitrogen and hydrogen are reacted together to form ammonia.

Ammonium sulfate is used as a fertiliser.

State why farmers use fertilisers on their fields.

(1)

.....

.....

Q58.

Many metals corrode.

Hydrazine, N_2H_4, reacts with oxygen.

$$N_2H_4 + O_2 \rightarrow N_2 + 2H_2O$$

A metal in water corrodes faster than an identical piece of metal in the same volume of water containing dissolved hydrazine.

Use the information to explain how hydrazine slows corrosion.

(2)

.....

.....

.....

.....

(Total for question = 2 marks)

Q59.

Alloy steels are made when iron is alloyed with other transition metals such as cobalt and chromium.

Figure 1 shows the chain on a bicycle.



Figure 1

Explain how lubricating the chain with oil prevents corrosion of the steel chain.

(2)

.....

.....

.....

.....

(Total for question = 2 marks)

Q60.

Titration can be used to determine the exact amount of hydrochloric acid that reacts with a given amount of sodium hydroxide solution.

$$HCl + NaOH \rightarrow NaCl + H_2O$$



(a) What type of reaction takes place when hydrochloric acid reacts with sodium hydroxide

solution?

(1)

Put a cross (☒) in the box next to your answer.

- ☒ **A** neutralisation
- ☒ **B** oxidation
- ☒ **C** precipitation
- ☒ **D** reduction

(b) Suggest why universal indicator must not be used in titration experiments.

(1)

.....

*(c) Sodium chloride solution can be made from dilute hydrochloric acid and sodium hydroxide solution.

Describe a titration experiment to find the exact volume of hydrochloric acid needed to neutralise 25.0 cm^3 of sodium hydroxide solution and how you would use this result to obtain pure, dry crystals of sodium chloride.

(6)

.....

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(d) Sodium hydroxide solution is titrated with dilute hydrochloric acid.

The results of the experiment are

volume of sodium hydroxide solution = 25.0 cm^3

volume of 0.100 mol dm^{-3} hydrochloric acid used

rough titration	= 23.1 cm^3
1st titration	= 22.6 cm^3
2nd titration	= 22.8 cm^3

(i) State the volume of hydrochloric acid that must be used to calculate the concentration of sodium hydroxide solution.

(1)

volume of hydrochloric acid =..... cm^3

(ii) In a different experiment, 25.0 cm^3 of sodium hydroxide solution reacted with 23.2 cm^3 of 0.100 mol dm^{-3} hydrochloric acid, HCl.

Calculate the concentration of this sodium hydroxide solution, NaOH, in mol dm^{-3}.

(3)

$$NaOH + HCl \rightarrow NaCl + H_2O$$

.....

.....

.....

.....

.....

.....

.....

.....

concentration of sodium hydroxide solution = ...mol dm^{-3}

(Total for Question = 12 marks)

Q61.

The industrial production of sulfuric acid involves several steps.

One of these steps is the reaction of sulfur dioxide, SO_2, with oxygen to form sulfur trioxide, SO_3.

$$2SO_2(g) + O_2(g) \rightleftharpoons 2SO_3(g)$$

What volume of sulfur trioxide, in dm^3, is produced by the complete reaction of 750 dm^3 of sulfur dioxide?

(all volumes of gases are measured under the same conditions of temperature and pressure)

(1)

☒ **A** 375.5

☒ **B** 750

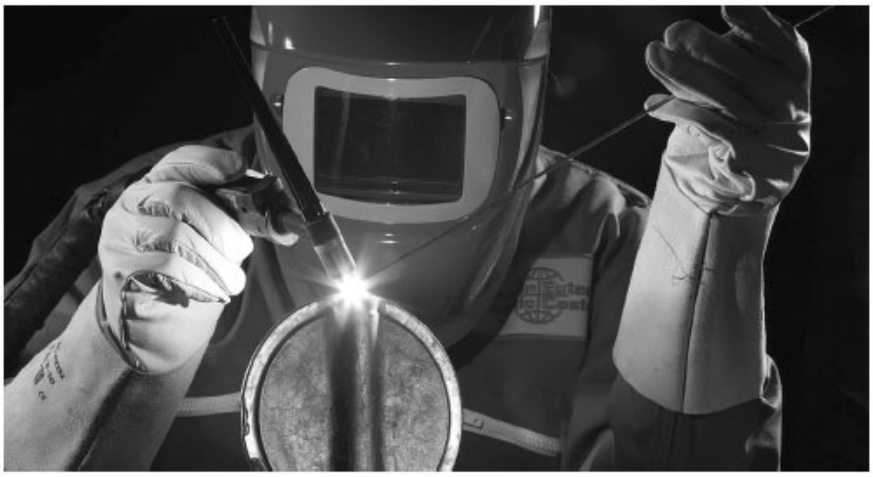
☒ **C** 1125.5

☒ **D** 1500

(Total for question = 1 mark)

Q62.

Two pieces of metal can be joined by welding them together.



(i) Complete the sentence by putting a cross (☒) in the box next to your answer.

The structure of a metal is a lattice of

(1)

- ☒ **A** anions
- ☒ **B** anions and cations
- ☒ **C** cations in a sea of electrons
- ☒ **D** molecules in a sea of electrons

(ii) To join two pieces of metal by welding, they must be melted together.

State why a high temperature has to be used.

(1)

.....

.....

(iii) The pieces of metal are welded together in an atmosphere of argon.

Explain why an atmosphere of argon is used.

(2)

.....

.....

.....

.....

Q63.

Some elements in the periodic table are called transition metals.

Which of these elements is a transition metal?

(1)

- ☒ **A** calcium
- ☒ **B** carbon
- ☒ **C** chlorine
- ☒ **D** copper

(Total for question = 1 mark)

Q64.

A Bunsen burner has a base and a chimney as shown in Figure 7.

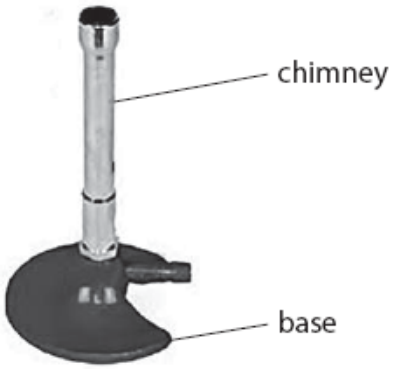


Figure 7

The base can be made of steel.

Explain why steel is a suitable material for the base.
Do not consider cost.

(2)

.....

.....

.....

(Total for question = 2 marks)

Q65.

A Bunsen burner has a base and a chimney as shown in Figure 2.



Figure 2

The base can be made of steel.

Explain why steel is a suitable material for the base.

Do not consider cost.

(2)

.....

.....

.....

(Total for question = 2 marks)

Q66.

In a hydrogen-oxygen fuel cell, hydrogen and oxygen react at the electrodes.

The overall reaction occurring in this fuel cell is a reaction of hydrogen with oxygen.

Write the balanced equation for this reaction.

(2)

.....

.....

(Total for question = 2 marks)

Q67.

Potassium hydroxide reacts with hydrochloric acid to form potassium chloride and water.

potassium hydroxide + hydrochloric acid → potassium chloride + water

A student carried out a titration to find the exact volume of dilute hydrochloric acid that reacted with 25.0 cm^3 of potassium hydroxide solution.

There were five steps in the titration.
The steps shown are not in the correct order.

step J pour the potassium hydroxide solution into a conical flask and add a few drops of indicator to this solution

step K fill a burette with the dilute hydrochloric acid and record the initial reading from the burette

step L use a measuring cylinder to obtain 25 cm^3 of potassium hydroxide solution

step M take a final reading from the burette and calculate the volume of the dilute hydrochloric acid reacted

step N run the dilute hydrochloric acid from the burette into the conical flask until the indicator changes colour

(i) Write the steps in the correct order.

Some of the steps have been completed for you.

(1)

first step				last step
K				M

(ii) Suggest an alternative piece of apparatus that could be used in step L to obtain exactly 25.0 cm^3 of potassium hydroxide solution.

(1)

.....

(Total for question = 2 marks)

Q68.

Potassium hydroxide reacts with hydrochloric acid to form potassium chloride and water.

potassium hydroxide + hydrochloric acid → potassium chloride + water

A student carried out a titration to find the exact volume of dilute hydrochloric acid that reacted with 25.0 cm^3 of potassium hydroxide solution.

There were five steps in the titration.
The steps shown are not in the correct order.

step J pour the potassium hydroxide solution into a conical flask and add a few drops of indicator to this solution

step K fill a burette with the dilute hydrochloric acid and record the initial reading from the burette

step L use a measuring cylinder to obtain 25 cm^3 of potassium hydroxide solution

step M take a final reading from the burette and calculate the volume of the dilute hydrochloric acid reacted

step N run the dilute hydrochloric acid from the burette into the conical flask until the indicator changes colour

(i) Write the steps in the correct order.

Some of the steps have been completed for you.

(1)

first step				last step
K				M

(ii) Suggest an alternative piece of apparatus that could be used in step L to obtain exactly 25.0 cm^3 of potassium hydroxide solution.

(1)

.....

(Total for question = 2 marks)