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Practice 1-foundation and higher tier

Questions 1 to 16 - Foundation tier . Higher tier starts at question 17.

Lithium is a metal.
Lithium reacts with cold water to produce hydrogen.

1. Lithium is
 - A a transition metal
 - B an alkali metal
 - C a halogen
 - D a noble gas

2. The test for hydrogen is that it
 - A relights a glowing splint
 - B pops when mixed with air and ignited
 - C turns limewater cloudy
 - D turns damp red litmus paper blue

3. The symbol for an atom of lithium is
 - A L
 - B li
 - C Li
 - D LI

4. Potassium is in the same group of the periodic table as lithium.
When potassium is added to cold water it is most likely to
 - A sink and react slowly
 - B react vigorously and give off hydrogen
 - C react vigorously and give off carbon dioxide
 - D float and show no reaction

5. An atom of lithium contains electrons, protons and neutrons.
Which of these particles are found in the nucleus of this atom?
 - A electrons and protons
 - B electrons and neutrons
 - C protons and electrons
 - D protons and neutrons

6. This hazard symbol is used on bottles which contain potassium and lithium.



This symbol shows that potassium and lithium are

- A corrosive
- B toxic
- C explosive
- D flammable

7. The positions of four elements in the periodic table are shown by the letters S, T, X and Y. The letters shown are not the symbols of atoms of the elements.

	1	2													3	4	5	6	7	0	
	X																				S
	Y																				T

Which letters show the positions of the metals lithium and potassium?

- A X and S
 - B X and Y
 - C S and T
 - D Y and T
8. Lithium chloride, potassium chloride and sodium chloride are all colourless, crystalline solids. Which of the following tests could be used to identify these solids?
- A flame tests
 - B adding limewater
 - C testing with indicator paper
 - D applying a lighted splint

Turn over

9. Some salts can be made by reacting an acid with an alkali.
The reaction between the acid and alkali is called
- A thermal decomposition
 - B combustion
 - C neutralisation
 - D a physical change
10. Baking powder is often used in cake mixtures.
The baking powder is used to
- A make the cake rise
 - B add flavour
 - C preserve the cake
 - D help the cake set
11. Baking powder contains sodium hydrogencarbonate and an acidic substance.
Baking powder is
- A an element
 - B a compound
 - C a mixture
 - D a solution
12. Some cakes contain artificial sweeteners.
Artificial means that the sweetener
- A contains no chemical substances
 - B is man-made
 - C has no taste
 - D is obtained from sea water
13. When a cake is cooked, the cake mixture changes.
Cooking always causes
- A a physical change
 - B a chemical change
 - C neutralisation
 - D precipitation

14. Gold can be found uncombined in the Earth's crust.
The gold is uncombined because it is

- A expensive
- B rare
- C unreactive
- D an element

15. Iron ore is found in the Earth's crust.
Iron is extracted from its ore by

- A electrolysis
- B distillation
- C heating with carbon
- D heating with oxygen

16. The table shows some possible uses of gold, copper and iron.
Which row of the table is correct?

	use of gold	use of copper	use of iron
A	jewellery	electrical wiring	making steel
B	jewellery	making steel	electrical wiring
C	making steel	jewellery	making steel
D	making steel	electrical wiring	jewellery

Turn over

Use the following information to answer questions 17 to 19.

The positions of five elements in the periodic table are shown by letters P, Q, R, S and T. The letters shown are not the symbols of atoms of the elements.

17. Which letter shows the position of an unreactive gas?
 - A P
 - B Q
 - C R
 - D S

18. Which letter shows the position of the transition metal, iron?
 - A P
 - B Q
 - C R
 - D T

19. In the periodic table, elements are arranged in order of increasing atomic number. Which letter shows the position of the element with atomic number 9?
 - A P
 - B Q
 - C R
 - D T

20. An atom of an element contains 19 electrons, 20 neutrons and 19 protons.

The element has an atomic number of

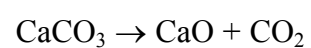
- A 19
- B 20
- C 38
- D 39

21. Which row in the table shows the correct charges on an electron, a neutron and a proton?

	electron	neutron	proton
A	negative	positive	no charge
B	negative	no charge	positive
C	no charge	positive	negative
D	positive	no charge	negative

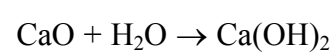
Turn over

22. When calcium carbonate is heated strongly, calcium oxide is formed.
The equation for the reaction is



This reaction is an example of

- A hydration
 - B neutralisation
 - C oxidation
 - D thermal decomposition
23. Calcium oxide can be used to make calcium hydroxide.
The equation for the reaction is



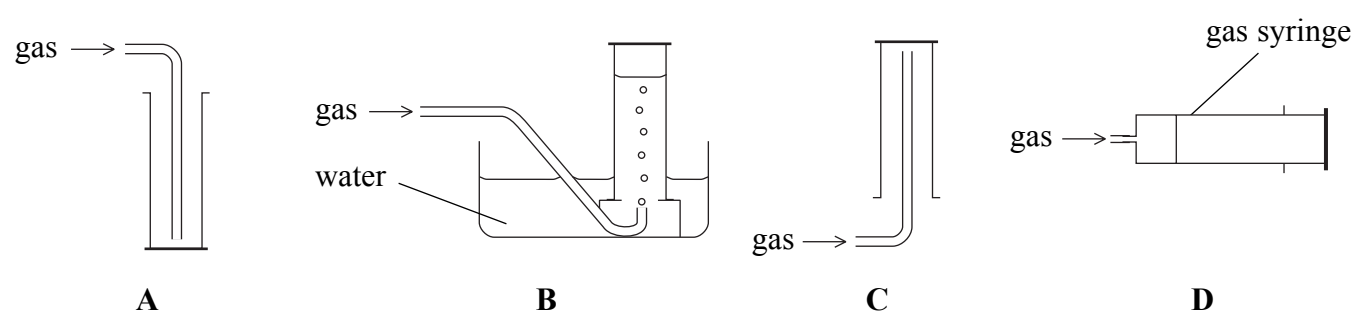
This reaction is an example of

- A hydration
 - B neutralisation
 - C oxidation
 - D thermal decomposition
24. A solution of calcium hydroxide is used to test for
- A oxygen
 - B carbon dioxide
 - C chlorine
 - D argon

TOTAL FOR FOUNDATION TIER PAPER: 24 MARKS

25. A gas has been produced by a chemist.
It is not known if the gas is soluble in water nor how dense it is.

Which diagram shows the method of collection that can be used whatever the properties of the gas?



26. The chemist thought the gas might be ammonia.
To test if she was correct, she should test the gas with
- A a lighted splint and expect a pop sound
 - B a glowing splint and expect the splint to relight
 - C moist red litmus paper and expect the litmus paper to turn blue
 - D limewater and expect the limewater to go milky
27. The formula of a molecule of ammonia is
- A NH^3
 - B NH_3
 - C N_3H
 - D NH_4
28. Which of the following statements about ammonia are true?
- 1 ammonia can be used to make nitric acid
 - 2 ammonia is more dense than air and is collected by downward delivery
- A 1 only
 - B 2 only
 - C 1 and 2
 - D neither 1 nor 2

Turn over

29. Lead nitrate solution is reacted with potassium iodide solution.
A precipitate of lead iodide is formed.
A pure, dry sample of the lead iodide could be obtained from the reaction mixture by
- A evaporating
 - B filtering, then drying
 - C filtering, then washing, then drying
 - D washing, then filtering, then drying

30. KNO_3 is the formula of a salt.
The name of this salt is
- A potassium nitride
 - B potassium nitrogen oxide
 - C potassium nitrate
 - D potassium nitro-oxide

31. Salts of copper, potassium and sodium are used to produce colours in firework flames.
Which row of the table shows the correct colour produced by each of these salts?

	copper salt	potassium salt	sodium salt
A	green-blue	yellow	lilac
B	green-blue	lilac	yellow
C	lilac	green-blue	yellow
D	lilac	yellow	green-blue

32. The balanced equation for the reaction of calcium carbonate with hydrochloric acid is
- A $\text{CaCO}_3 + \text{HCl} \rightarrow \text{CaCl} + \text{H}_2\text{O} + \text{CO}_2$
 - B $\text{CaCO}_3 + \text{HCl}_2 \rightarrow \text{CaCl}_2 + \text{H}_2\text{O} + \text{CO}_2$
 - C $\text{CaCO}_3 + 2\text{HCl} \rightarrow \text{CaCl}_2 + \text{H}_2\text{O} + \text{CO}_2$
 - D $\text{CaCO}_3 + \text{H}_2\text{Cl} \rightarrow \text{CaCl} + \text{H}_2\text{O} + \text{CO}_2$

33. Which row of the table shows a halogen with its correct colour and state at room temperature?

	halogen	colour	state at room temperature
A	fluorine	pale yellow	gas
B	chlorine	grey	solid
C	bromine	yellow-green	liquid
D	iodine	purple	solid

34. Which of these statements about the halogens are correct?

- 1 the halogens all exist as diatomic molecules
2 the halogens increase in reactivity with increasing atomic number

- A 1 only
B 2 only
C 1 and 2
D neither 1 nor 2

35. Chlorine reacts with potassium bromide solution.
The equation for the reaction is

- A $\text{Cl} + \text{KBr} \rightarrow \text{KCl} + \text{Br}$
B $\text{Cl}_2 + 2\text{KBr} \rightarrow 2\text{KCl} + 2\text{Br}$
C $\text{Cl}_2 + \text{KBr}_2 \rightarrow \text{KCl}_2 + \text{Br}_2$
D $\text{Cl}_2 + 2\text{KBr} \rightarrow 2\text{KCl} + \text{Br}_2$

Acids

36. The table shows some possible uses of ethanoic acid, citric acid and phosphoric acid.
Which row of the table is correct?

	use of ethanoic acid	use of citric acid	use of phosphoric acid
A	as food flavouring	in rust remover	as vinegar
B	in rust remover	as food flavouring	as vinegar
C	in rust remover	as vinegar	as food flavouring
D	as vinegar	as food flavouring	in rust remover

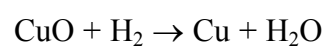
Turn over

37. Many metals can be found in the Earth's crust.
Platinum is found uncombined.
Aluminium is extracted using electrolysis.
Lead is extracted using carbon.

Which is the correct order of reactivity of platinum, aluminium and lead?

	most reactive	—————>	least reactive
A	aluminium	platinum	lead
B	platinum	lead	aluminium
C	aluminium	lead	platinum
D	lead	aluminium	platinum

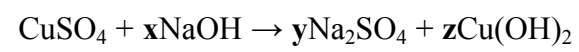
38. When copper oxide is heated in hydrogen, copper is produced.



Which of these statements about this reaction are correct?

- | | | |
|---|-----------------|--|
| | 1 | copper oxide is reduced |
| | 2 | the reaction is a dehydration reaction |
| A | 1 only | |
| B | 2 only | |
| C | both 1 and 2 | |
| D | neither 1 nor 2 | |
39. When sodium hydroxide solution is added to copper sulphate solution, a precipitate forms.
The colour of the precipitate is
- | | |
|---|------------|
| A | pale green |
| B | red-brown |
| C | pale blue |
| D | white |

40. The equation for the reaction between sodium hydroxide solution and copper sulphate solution is



Which row of the table shows values of **x**, **y** and **z** that give a balanced equation?

	x	y	z
A	2	1	2
B	2	1	1
C	2	2	1
D	2	2	2

TOTAL FOR HIGHER TIER PAPER: 24 MARKS

END

Practice 2-foundation and higher tier

Questions 1 to 16 - Foundation tier . Higher tier starts at question 17.

1. Global warming is an increase in the
 - A number of hours of sunshine
 - B temperature of the Sun
 - C temperature of the Earth
 - D number of days with no rain

2. Which of these may cause an increase in global warming?
 - A growing more trees
 - B growing crops to make bio-fuels
 - C walking instead of travelling by car
 - D burning fossil fuels

3. What percentage of the Earth's atmosphere is carbon dioxide?
 - A 70%
 - B 20%
 - C 5%
 - D less than 1%

4. The formula for carbon dioxide is
 - A CO
 - B CO²
 - C Co
 - D CO₂

5. Some people think that it would be better to use hydrogen rather than petrol as a fuel for cars. This is because
 - A large amounts of hydrogen gas are present in the atmosphere
 - B when hydrogen burns carbon dioxide is removed from the atmosphere
 - C when hydrogen burns the only substance formed is water
 - D burning hydrogen produces oxygen

6. Some plant pots are made from bamboo plants.
The bamboo used is from a sustainable source.
The fact that bamboo is from a sustainable source means
- A bamboo is a waste product
 - B new bamboo is grown to replace the bamboo plants cut down to make pots
 - C bamboo is unsuitable for other uses
 - D there are large amounts of bamboo available from this source
7. People are encouraged to recycle empty drink cans made of aluminium.
This is because
- A aluminium is a very rare metal
 - B aluminium rusts quickly
 - C drink cans made of aluminium are refilled
 - D recycling reduces waste
8. Sea water contains dissolved salts.
Pure water for drinking can be obtained from sea water by
- A distillation
 - B adding chlorine to the sea water
 - C filtration
 - D boiling the water before using it

Turn over

9. Instruments used by dentists can be put in a special pouch before being sterilised at a high temperature.
These pouches have a pink arrow on the outside.
The arrow turns brown when sterilisation is complete.

The arrow is likely to be made of

- A a smart material
 - B universal indicator
 - C litmus
 - D Thinsulate
10. Tom likes to go sea fishing.



Tom's fishing rod is reinforced with fibres.
The best fibres for this reinforcing would be

- A carbon fibres that are strong and light
 - B Nomex fibres that are flame resistant
 - C steel fibres that are strong and dense
 - D Dacron fibres that provide good thermal insulation
11. Tom wears a coat to keep him warm.
Which of these is the most important property of the material used to make this coat?
- A flame retardant
 - B strong
 - C good thermal insulator
 - D brightly coloured

12. Tom's boots have a waterproof, breathable lining. This lining could be made from
- A Kevlar
 - B Gore-Tex
 - C Lycra
 - D Thinsulate

This is part of a label from a pack containing coffee.

This packet contains coffee in a protective atmosphere of an unreactive gas.

13. The coffee is packed in a protective atmosphere to
- A prevent the pack being damaged by sharp objects
 - B prevent oxygen causing the coffee to deteriorate
 - C make the packaging smart
 - D reduce the amount of caffeine in the coffee
14. The gas used in the packaging is likely to be
- A nitrogen
 - B air
 - C hydrogen
 - D carbon monoxide
15. Alcoholic drinks are made by converting sugars into ethanol. This process is
- A distillation
 - B nanotechnology
 - C emulsification
 - D fermentation
16. Drinking alcoholic drinks can cause
- A improved thinking
 - B faster reactions
 - C liver damage
 - D clearer vision

Turn over

17. Common salt is often added to food.
This salt is
- A sodium
 - B sodium hydroxide
 - C sodium carbonate
 - D sodium chloride
18. Hydrogen is used in the food industry.
An important use of hydrogen is
- A as a solvent
 - B in the sterilisation of milk
 - C in the manufacture of margarine
 - D as an oven cleaner
19. Mayonnaise is made from egg yolks, oil and vinegar.
If the egg yolks are not added to the mixture, the oil and vinegar
- A react
 - B separate
 - C deteriorate
 - D solidify
20. Beer is made using hops and malt.
Sugar from the malt is converted into ethanol by yeast.
The complete word equation for the reaction that takes place is
- A sugar + yeast → ethanol
 - B sugar → ethanol
 - C sugar → ethanol + carbon dioxide
 - D sugar + carbon dioxide → ethanol
21. Some saucepans have a non-stick coating made of Teflon.
Teflon
- A was first produced as a coating for saucepans
 - B is a natural substance
 - C has uses which only became apparent some time after it was first made
 - D is only used for coating saucepans

22. Bio-ethanol can be used as a fuel for cars.
An advantage of using bio-ethanol instead of petrol is
- A growing plants to produce bio-ethanol removes carbon dioxide from the atmosphere
 - B incomplete combustion of bio-ethanol cannot produce carbon monoxide
 - C complete combustion of bio-ethanol does not produce carbon dioxide
 - D growing plants to produce bio-ethanol does not affect the amount of land available for food production
23. Nanotechnology is being used to produce catalysts which make diesel fuel burn more efficiently.
Use of these catalysts will
- A prevent waste products being produced
 - B reduce the percentage of toxic gases in exhaust fumes
 - C allow diesel-fuelled cars to use petrol as a fuel
 - D allow diesel-fuelled cars to travel more safely at high speeds
24. Kerosene fuel is a mixture of hydrocarbons.
The complete combustion of kerosene will produce
- A carbon monoxide only
 - B carbon dioxide only
 - C carbon monoxide and water
 - D carbon dioxide and water

TOTAL FOR FOUNDATION TIER PAPER: 24 MARKS

Turn over

Nanotechnology is used to produce nanoparticles.

- 25.** Scientists are interested in nanoparticles because the nanoparticles
- A** are the major cause of global warming, when released into the atmosphere
 - B** are intelligent
 - C** can make copies of themselves
 - D** have some unusual properties
- 26.** Nanoparticles of titanium(IV) oxide are used in some sunscreens. These particles are
- A** just visible to the naked eye
 - B** smaller than atoms of titanium
 - C** smaller than molecules of oxygen but larger than atoms of titanium
 - D** smaller than conventional particles of titanium(IV) oxide
- 27.** Which of these statements are correct?
- 1 the media always produce reliable reports about nanotechnology
 - 2 the risks involved in the use of nanotechnology are fully understood
- A** 1 only
 - B** 2 only
 - C** both 1 and 2
 - D** neither 1 nor 2

Some food substances are emulsions.

28. An emulsion consists of an emulsifier in a mixture of

- A two liquids
- B a soluble solid and a liquid
- C an insoluble gas and a liquid
- D two aqueous solutions

29. Lecithin is a common emulsifier.
Which of these statements are correct?

- 1 lecithin molecules have a hydrophilic part and a hydrophobic part
- 2 the hydrophilic part of a lecithin molecule is attracted to oil

- A 1 only
- B 2 only
- C both 1 and 2
- D neither 1 nor 2

30. Some food packaging has a special coloured spot on it.
This spot changes colour to show when the food is no longer fresh enough to eat.
This method of packaging

- A stops the food from decaying
- B makes the packaging microbe resistant
- C makes the packaging easier to recycle
- D is intelligent packaging

31. These ingredients are used to brew beer.

- 1 hops
- 2 water
- 3 sugar
- 4 yeast

Which of these must be present to produce the ethanol in the beer?

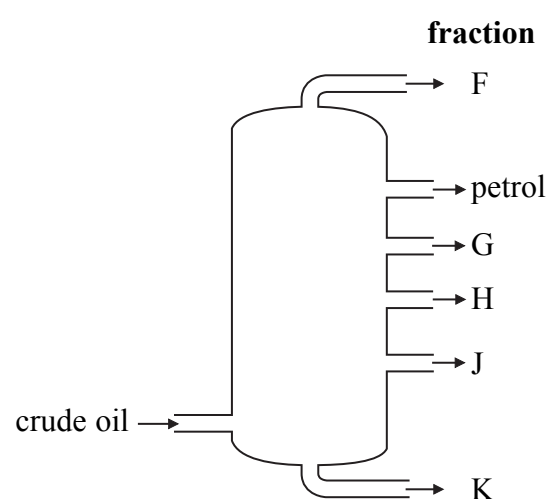
- A 3 and 4 only
- B 1, 3 and 4 only
- C 2, 3 and 4 only
- D 1, 2, 3 and 4

Turn over

32. In industry, oxygen is obtained from air.
This is done by
- A cooling the air until the oxygen separates as a liquid
 - B liquefying the air and then raising the temperature to boil the liquid air
 - C reacting the nitrogen in air with hydrogen and removing the ammonia formed
 - D passing the air into sodium hydroxide solution to remove all gases except oxygen

Use this information to answer questions 33 to 35.

The diagram shows a fractionating column used to separate crude oil into useful fractions.



33. Which of these statements is **not** correct?
- A crude oil enters the bottom of the column as a liquid
 - B each fraction contains more than one compound
 - C different fractions condense at different temperatures
 - D different crude oils have different compositions
34. The table gives names, average numbers of carbon atoms in a molecule and uses of the fractions F, H, J and K.
The average number of carbon atoms in the molecules in the petrol fraction is 8.

Which row of the table is correct?

	fraction	name	average number of carbon atoms in the molecules	used as a fuel for
A	F	gases	15	camping stoves
B	H	bitumen	20	lorries
C	J	fuel oil	45	ships
D	K	kerosene	13	aeroplanes

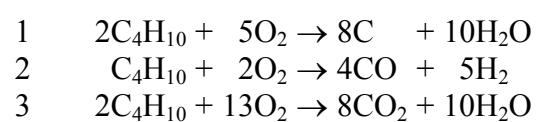
35. Compare fractions J and H.

Which row of the table is correct?

	boiling point of J	viscosity of J
A	higher than H	lower than H
B	higher than H	higher than H
C	lower than H	lower than H
D	lower than H	higher than H

Burning fuels

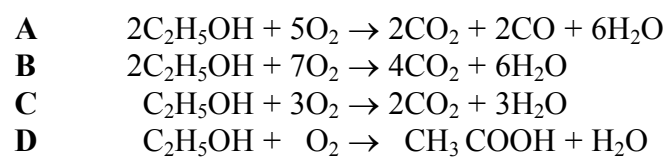
36. Butane is used as a fuel.
Which of these equations are for reactions involving the incomplete combustion of butane?



- A 1 only
B 2 only
C 1 and 2 only
D 1 and 3 only
37. Some cars use hydrogen as a fuel.
Which of these statements about the use of hydrogen as a fuel are correct?
- 1 waste products are not released into the environment
2 hydrogen can be produced from water but large amounts of energy are required
- A 1 only
B 2 only
C both 1 and 2
D neither 1 nor 2
38. The incomplete combustion of fuels can produce carbon monoxide.
This occurs with
- A fossil fuels only
B fuels obtained from crude oil only
C all fuels
D any fuel containing carbon

Turn over

39. Ethanol can be used as a fuel.
Which of these is the balanced equation for the complete combustion of ethanol?



40. Carbon monoxide is very dangerous because it is difficult to detect and toxic.
Which row of the table explains why carbon monoxide is difficult to detect and toxic?

	difficult to detect because it is	toxic because it combines with
A	colourless and odourless	oxygen
B	heavier than air	oxygen
C	colourless and odourless	haemoglobin in the blood
D	heavier than air	haemoglobin in the blood

TOTAL FOR HIGHER TIER PAPER: 24 MARKS

END

Practice 1-foundation

1. Elements are either metals or non-metals.

(a) Put a cross (☒) to show the correct words to complete the sentences.

(i) A sample of magnesium conducts electricity.

This shows magnesium is a

metal

non-metal

solid

(1)

(ii) A sample of carbon in the form of graphite conducts electricity.

This shows that graphite

is a metal

contains free electrons

is a solid

(1)

(iii) One of the following describes a metal.

The metal is

Buckminsterfullerene

the element that is the main part of steel

an element found on the right hand side of the periodic table

(1)

(b) Two elements, a metal and a non-metal react to form the compound with the formula NaCl.

Identify the **two** elements that react.

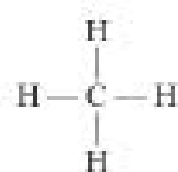
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(2)

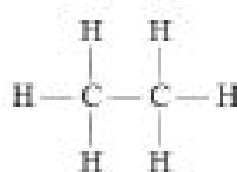
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Q1

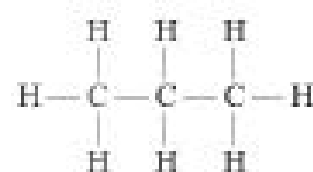
2. The structures of molecules of methane, ethane and propane are



methane



ethane



propane

(a) Are these substances alkanes, alkenes or polymers?

Put a cross (☒) in the correct box.

alkanes

alkenes

polymers

(1)

(b) What is the formula of a molecule of ethane?

Put a cross (☒) in the correct box.

C_2H_4

C_2H_6

C_3H_8

(1)

(c) Carbon forms many more stable compounds than any other element.
What is the best reason for this?

Put a cross (☒) in the correct box.

each carbon atom forms four stable bonds

carbon is a non-metal

carbon exists as diamond and graphite

(1)

(d) Calculate the relative formula mass of methane, CH_4 .
(Relative atomic masses: H = 1, C = 12)

.....

(1)

(e) Bromine water is used to test for alkenes.

(i) What colour is bromine water?

.....
(1)

(ii) When propane gas is bubbled into bromine water, no colour change occurs.
Explain why.

.....
.....
(1)

(Total 6 marks)

Q2

3. Luke and Cian were investigating the rate of the reaction of marble chips with dilute hydrochloric acid.
Luke added one marble chip to 50 cm³ dilute hydrochloric acid at room temperature. He measured the time taken for the reaction to finish.
Cian repeated the experiment, except that he used marble powder instead of a marble chip. The mass of marble was the same in both experiments.

(a) Cian's reaction occurred faster.
Explain why.

.....
.....
(2)

(b) How can Cian make his reaction even faster?

.....
.....
(1)

(c) Potatoes are a common food.

(i) When a potato is eaten, chemical reactions involving enzymes occur as it is digested.
What is an enzyme?

.....
(1)

(ii) Potatoes can be grown using natural fertilisers.
Give an advantage and a disadvantage of using natural fertilisers.

advantage

.....

disadvantage

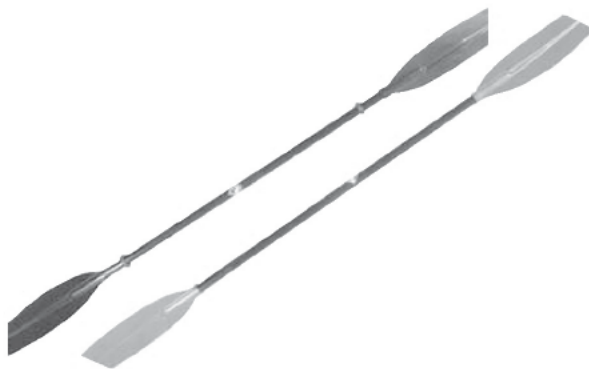
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(2)

(Total 6 marks)

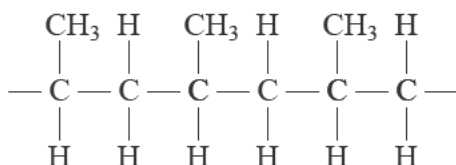
Q3

5. Poly(propene) is an addition polymer with many uses. Canoe paddles are often made of poly(propene).



Poly(propene) is formed from propene, C_3H_6 .

A section of a poly(propene) chain which is formed from three propene molecules is shown.



- (a) (i) What is a polymer?

.....

(1)

- (ii) Why is poly(propene) described as an **addition** polymer?

.....

(1)

- (b) Draw the structure of a propene molecule, C_3H_6 , showing all covalent bonds.

(2)

(c) In terms of the covalent bonds, explain how molecules of propene combine to form a poly(propene) molecule.

.....
.....
.....

(2)

(d) Poly(propene) is a thermoplastic.

If the canoe paddle is heated, but not to a temperature at which it burns, its shape changes.

Explain, in terms of its structure, why this happens.

.....
.....
.....

(2)

(e) The following symbol appears on the canoe paddle to show that the poly(propene) can be recycled.



Give one reason why recycling is important.

.....
.....

(1)

Q5

(Total 9 marks)

TOTAL FOR PAPER: 30 MARKS

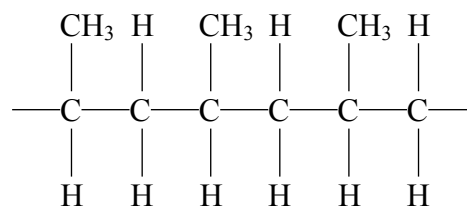
END

Practice 2-higher

1. Poly(propene) is an addition polymer with many uses.
Canoe paddles are often made of poly(propene).



Poly(propene) is formed from propene, C_3H_6 .
A section of a poly(propene) chain which is formed from three propene molecules is shown.



- (a) (i) What is a polymer?

.....
..... (1)

- (ii) Why is poly(propene) described as an **addition** polymer?

.....
..... (1)

- (b) Draw the structure of a propene molecule, C_3H_6 , showing all covalent bonds.

(2)

(c) In terms of the covalent bonds, explain how molecules of propene combine to form a poly(propene) molecule.

.....
.....
.....

(2)

(d) Poly(propene) is a thermoplastic.

If the canoe paddle is heated, but not to a temperature at which it burns, its shape changes.

Explain, in terms of its structure, why this happens.

.....
.....
.....

(2)

(e) The following symbol appears on the canoe paddle to show that the poly(propene) can be recycled.



Give **one** reason why recycling is important.

.....
.....

(1)

Q1

(Total 9 marks)

Turn over

2. Sodium and chlorine react to form sodium chloride.

- (a) A sodium atom has a mass number of 23 and an atomic number of 11.
Use this information to complete the table to show the number of protons, neutrons and electrons in this atom.
The information for a chlorine atom, mass number 35, atomic number 17, has been provided.

atom	number of protons	number of neutrons	number of electrons
chlorine	17	18	17
sodium			

(2)

- (b) (i) Describe, in terms of electron transfer, how a sodium atom and a chlorine atom react to form particles in sodium chloride.

.....
.....
.....

(2)

- (ii) Give the name of the type of bonding in sodium chloride.

.....

(1)

- (c) Sodium chloride has a high melting point of 801 °C.
Explain why sodium chloride has a high melting point.

.....
.....
.....

(2)

(Total 7 marks)

Q2

3. The noble gases are in group 0 of the periodic table.

(a) Argon is the most abundant noble gas.
It has been used for many years in lightbulbs.

(i) The atomic number of argon is 18.

Give the electronic structure of an argon atom.

..... (1)

(ii) State and explain, in terms of the electronic structure, why argon is used in lightbulbs.

.....
.....
..... (2)

(b) Neon exists as two isotopes.

isotope	atomic number	mass number	abundance (%)
neon-20	10	20	90.9
neon-22	10	22	9.10

Calculate the relative atomic mass of neon to 3 significant figures.

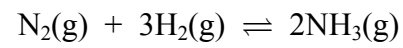
Answer = (2)

(Total 5 marks)

Q3

Turn over

4. Ammonia, NH₃, is made from nitrogen and hydrogen gases, by the Haber process.
The reaction can reach equilibrium.
The equation for the reaction is



The conditions are a pressure of 150 atmospheres and an iron catalyst at 450 °C.

- (a) The boiling point of nitrogen is -196 °C.
Explain why nitrogen has a very low boiling point.

.....
.....
.....

(2)

- (b) Draw the dot and cross diagram of a molecule of ammonia, NH₃.
Show the outer shell electrons only.

(2)

- (c) The forward reaction is exothermic.

State and explain what would happen to the equilibrium yield of ammonia if a higher temperature of 600 °C were used.

.....
.....
.....

(2)

(d) Explain why a catalyst is used in the process.

.....
.....
.....

(1)

(e) Ammonia reacts with nitric acid to form ammonium nitrate.
Write the balanced equation for this reaction.

.....

(2)

Q4

(Total 9 marks)

TOTAL FOR PAPER: 30 MARKS

END

Practice 1-foundation

1 Potassium sulfate and ammonium nitrate are both fertilisers.

Potassium sulfate has the formula K_2SO_4 .

Ammonium nitrate has the formula NH_4NO_3 .

Fertilisers contain one or more of the essential elements needed by plants.

(a) Ammonium nitrate contains the essential element nitrogen.

Potassium sulfate, K_2SO_4 , contains another one of these essential elements.

Which one?

..... [1]

(b) What is the total number of atoms shown in the formula K_2SO_4 ?

..... [1]

(c) Ammonium nitrate has a relative formula mass (M_r) of 80.

What is the relative formula mass of potassium sulfate, K_2SO_4 ?

The relative atomic mass of O is 16, of S is 32 and of K is 39.

.....
.....
.....

relative formula mass = [1]

(d) Potassium sulfate dissolves in water.

A **neutral** solution is made.

(i) What is the pH of potassium sulfate solution?

Choose from the list.

5

7

8

14

answer [1]

(ii) Why is it important that a fertiliser dissolves in water?

.....
..... [1]

(e) Clare makes ammonium nitrate.

She neutralises 25.0 cm³ of an alkali called ammonia.

She slowly adds an acid until the alkali is just neutralised.

(i) What is the name of the acid she must use?

Choose from the list.

hydrochloric acid

nitric acid

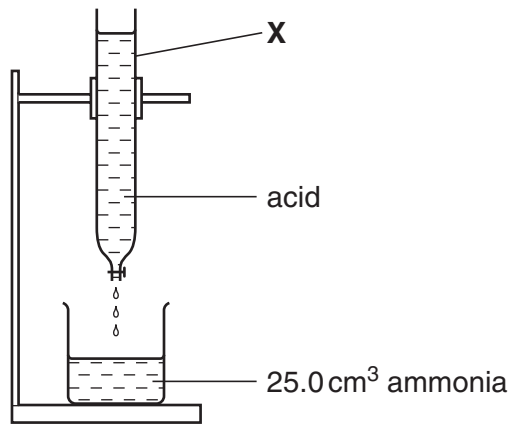
phosphoric acid

sulfuric acid

answer [1]

[Turn over for remainder of question 1

(ii) Look at the apparatus she uses.



What is the name of the apparatus labelled X?

..... [1]

(iii) Clare makes 0.45 g of ammonium nitrate.

She predicts she should make 0.50 g.

What is her percentage yield?

.....
.....
.....

percentage yield = % [2]

[Total: 9]

2 This question is about the manufacture of chemicals.

(a) Lots of ammonia is manufactured each year in the United Kingdom.

Ammonia is made by the reaction of nitrogen and hydrogen in a continuous process.

The conditions used for this reaction are

- 450 °C
- high pressure
- iron catalyst.

One of the costs of making ammonia is buying the raw materials.

Write about **two** other costs of making ammonia.

.....
.....
..... [2]

(b) A new anti-cancer drug is made from a rare plant only found in South America.

Less than 100 kg of the drug is made each year.

It is made in a batch process.

(i) What is the difference between a continuous process and a batch process?

.....
..... [1]

(ii) The cost of manufacturing and developing the drug is very high.

Write about some of the reasons why this cost is very high.

.....
.....
..... [2]

[Total: 5]

[Turn over

3 In the year 2006 many areas of the United Kingdom suffered drought conditions.

Water companies take water from rivers and store it in reservoirs.

Unfortunately in the year 2006 many rivers were almost dry.

Reservoirs were often less than half full.

(a) Look at the table.

It shows the annual rainfall in 1998 and 2001 for some regions of the United Kingdom.

region	rainfall in 1998 in mm	rainfall in 2001 in mm
Anglia	713	731
Northumbria	1039	807
North West	1435	1081
Severn Trent	885	767
Southern	875	865
South West	1428	1008
Thames	812	779
Wales	1642	1250
Wessex	1005	825
Yorkshire	964	787

(i) Which region had the **most** rainfall in the year 2001?

..... [1]

(ii) One region had **more** rainfall in the year 2001 than in 1998.

Which one?

..... [1]

(b) Rivers and reservoirs are two sources of drinking water.

Write down the name of one **other** source of drinking water in the United Kingdom.

..... [1]

(c) Water from rivers sometimes contains dangerous microbes.

These must be killed before the water is safe to drink.

How are these microbes killed when water is purified?

..... [1]

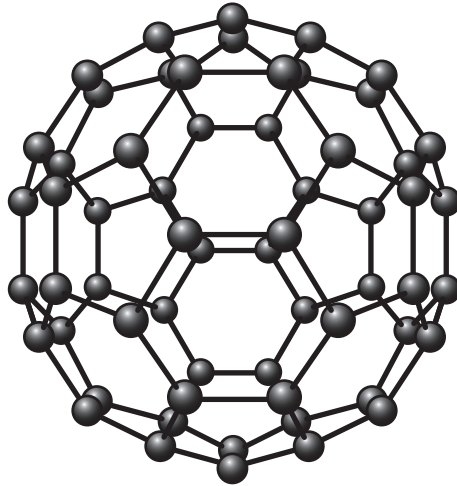
[Total: 4]

[Turn over

4 This question is about fullerenes and nanotubes.

(a) Look at the diagram of a fullerene.

It is called buckminster fullerene.



Buckminster fullerene is an element.

Which element?

..... [1]

(b) Fullerenes can be joined together to make nanotubes.

Nanotubes are used to make semiconductors and to reinforce graphite in sports equipment.

Put a tick (✓) in the box next to a correct property of nanotubes.

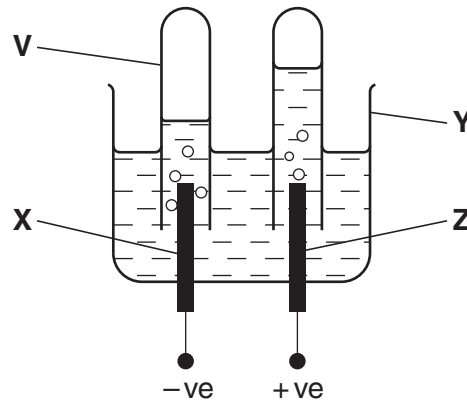
- electrical insulator
- soluble in water
- strong
- very low melting point

[1]

[Total: 2]

5 Hannah investigates the electrolysis of aqueous potassium sulfate.

Look at the apparatus she uses.



(a) Look at the table. It shows some of the names of the apparatus used.

Finish the table.

name of apparatus	letter
anode	
cathode	
test tube	

[3]

(b) There are bubbles of gas made at both electrodes.

What are the names of the **two** gases made during this electrolysis?

Choose from the list.

carbon dioxide

hydrogen

nitrogen

oxygen

sulfur dioxide

answer and [2]

[Total: 5]

[Turn over

6 Monty investigates the properties of two acids

- dilute ethanoic acid, CH_3COOH
- dilute hydrochloric acid, HCl .

(a) How many different **elements** are chemically bonded in ethanoic acid?

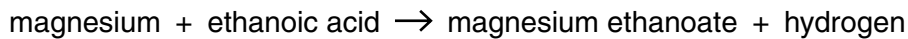
..... [1]

(b) Describe how Monty can measure the pH value of dilute ethanoic acid.

.....
..... [2]

(c) Monty adds a small piece of magnesium ribbon to a sample of dilute ethanoic acid.

Look at the word equation for this reaction.



A gas is made when magnesium reacts with ethanoic acid.

What is the name of this gas?

..... [1]

(d) Ethanoic acid and hydrochloric acid both react with calcium carbonate.

A gas is made when these acids react with calcium carbonate.

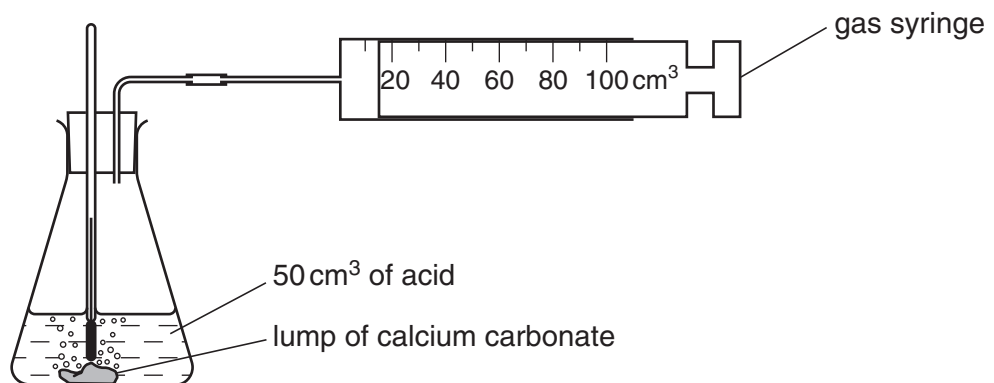
What is the name of this gas?

..... [1]

(e) Monty investigates the reaction of both acids with a lump of calcium carbonate.

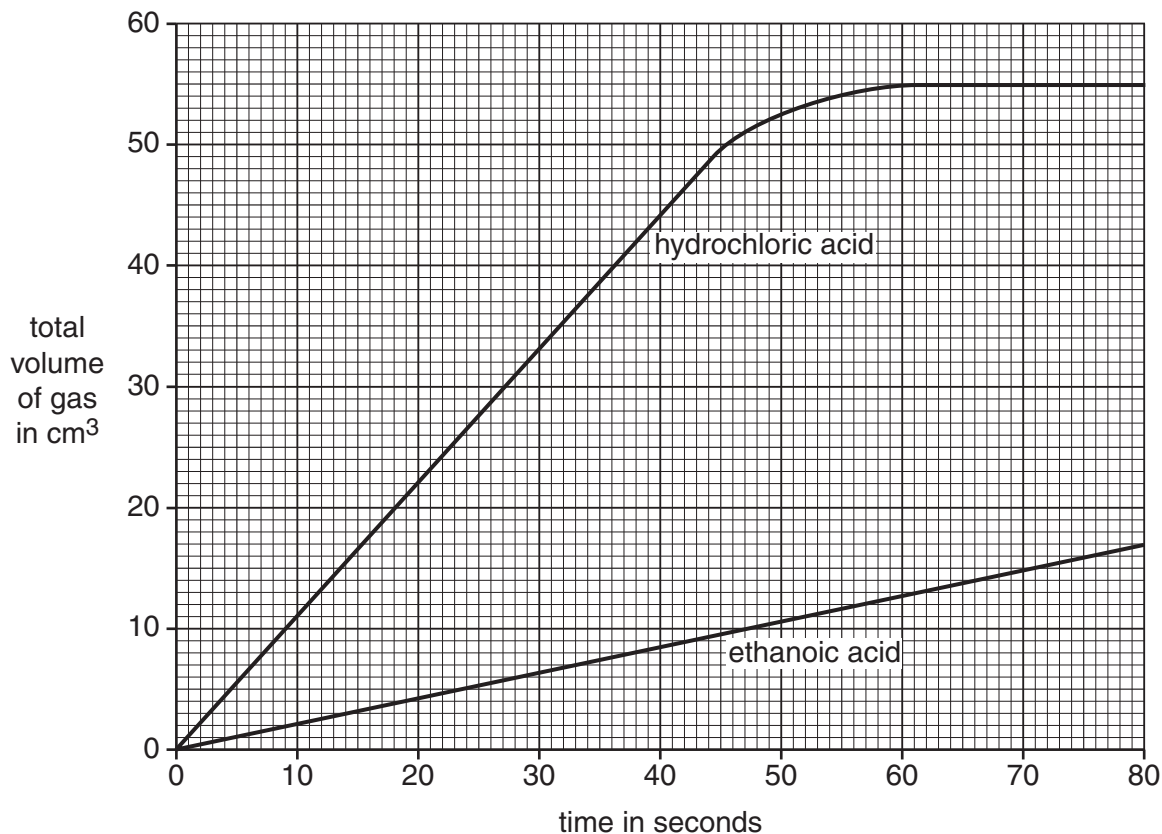
He wants to find out the volume of gas made every 10 seconds.

Look at the apparatus he uses.



He does two experiments, one with dilute ethanoic acid and one with dilute hydrochloric acid.
He makes sure he does a fair test.

Look at the graph of his results.



(i) Which acid reacts faster?

.....

Use the graph to explain your answer.

.....

..... [1]

(ii) How long does it take for the reaction with hydrochloric acid to stop?

..... seconds [1]

(iii) The reaction between calcium carbonate and ethanoic acid is still happening after 80 seconds.

What will be the total volume of gas collected at the **end** of this reaction?

..... cm³ [1]

[Total: 8]

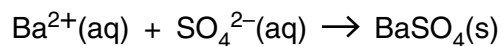
[Turn over

7 Zoe tests an unknown solution.

(a) She uses barium ions in solution to test for sulfate ions.

Look at the ionic equation.

It shows the reaction between barium ions and sulfate ions.



(i) What is the meaning of (s) in $\text{BaSO}_4(\text{s})$?

..... [1]

(ii) What is the meaning of (aq) in $\text{Ba}^{2+}(\text{aq})$?

..... [1]

(b) Zoe tests the unknown solution again.

This time she adds silver nitrate solution.

She sees a pale yellow precipitate.

Which ion is in the solution?

Choose from the list.

chloride, Cl^-

bromide, Br^-

iodide, I^-

answer [1]

[Total: 3]

8 This question is about equilibrium and reversible reactions.

Ethene reacts with steam in a reversible reaction to make ethanol.



This reversible reaction can reach equilibrium if it is in a sealed container.

(a) At equilibrium there is a connection between the rate of the forward reaction and the rate of the backward reaction.

What is this connection?

..... [1]

(b) What happens to the concentration of ethene and of water at equilibrium?

..... [1]

(c) Look at the table.

It shows how the percentage of ethene at equilibrium changes as the **temperature** changes and as the **pressure** changes.

	temperature		
pressure	200 °C	260 °C	320 °C
30 atmospheres	37%	26%	21%
40 atmospheres	40%	30%	25%
50 atmospheres	44%	35%	30%
60 atmospheres	48%	40%	34%

(i) Look at the row at 30 atmospheres.

What happens to the percentage of ethene as the temperature increases?

..... [1]

(ii) What happens to the percentage of ethene as the pressure increases but the temperature stays the same?

..... [1]

[Total: 4]

[Turn over

9 People living in hard water areas find they use more soap when washing.

The hardness of water can be measured by adding soap to the water until it makes permanent bubbles.

Look at the table.

It shows the results for some samples of water.

The volume of water in each sample was the same.

	sample of water			
	distilled water	A	B	C
volume of soap added to cold water in cm ³	3	3	15	14
volume of soap added to boiled water in cm ³	3	3	15	3

(a) (i) Which sample of water shows **permanent** hardness?

Choose from **A**, **B** or **C**.

answer

[1]

(ii) Which sample of water shows **temporary** hardness?

Choose from **A**, **B** or **C**.

answer

[1]

(b) Look at the list.

calcium hydrogencarbonate

calcium sulfate

ethanoic acid

sodium chloride

sodium hydroxide

(i) Write down the name of a substance that causes **permanent** hardness.

Choose from the list.

answer [1]

(ii) Write down the name of a substance that causes **temporary** hardness.

Choose from the list.

answer [1]

(iii) Hard water causes limescale to form on the heating element of a kettle.

Write down the name of a substance that could be used as a limescale remover.

Choose from the list.

answer [1]

[Total: 5]

[Turn over

10 Chlorofluorocarbons, CFCs, are substances that damage the ozone layer.

$\text{CFC}l_3$ is the formula for a chlorofluorocarbon.

(a) Write down the **names** of the three elements found in $\text{CFC}l_3$.

element 1

element 2

element 3

[2]

(b) What is the main use of CFCs?

Choose from the list.

cooking oil

disinfectants

refrigerants

rocket fuel

answer [1]

(c) Damage to the ozone layer causes increased levels of ultraviolet light.

This can lead to medical problems.

Write about **two** of these medical problems.

.....

.....

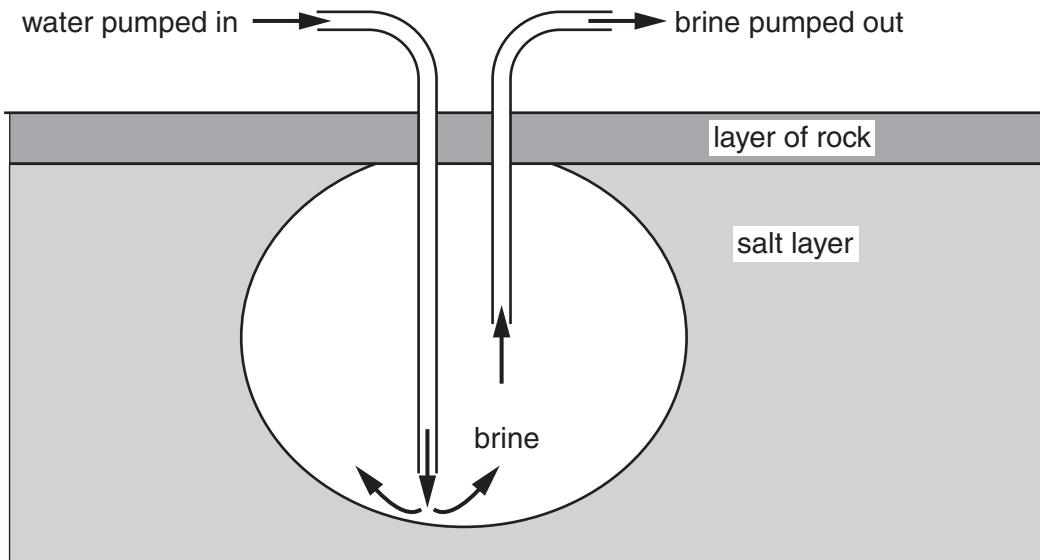
..... [2]

[Total: 5]

11 Brine is a solution of sodium chloride.

Solution mining is used to get brine out of the ground.

Look at the diagram of solution mining.



(a) Write about one major environmental problem caused by solution mining.

..... [1]

(b) Hydrogen and chlorine can be obtained by the electrolysis of brine.

(i) Describe a chemical test for hydrogen gas.

test

result

..... [2]

(ii) Describe a chemical test for chlorine gas.

test

result

..... [2]

[Total: 5]

[Turn over

12 Ethanol is made by the fermentation of glucose.

Carbon dioxide is also made in the process.

(a) Complete the **word** equation for fermentation.

glucose → + [1]

(b) What is the best temperature for fermentation to happen?

Choose from the list.

0 °C

40 °C

100 °C

400 °C

answer [1]

(c) Fermentation makes a dilute solution of ethanol.

What method of separation could be used to get almost pure ethanol?

Choose from the list.

crystallisation

electrolysis

evaporation

filtration

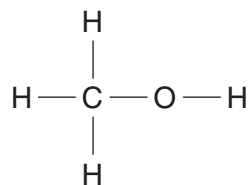
fractional distillation

answer [1]

(d) Write down **one** of the uses of ethanol.

..... [1]

(e) Look at the displayed formula for methanol, CH₃OH.



Draw the displayed formula of ethanol, C₂H₅OH.

[1]

[Total: 5]

END OF QUESTION PAPER

Practice 2-higher

1 Ammonium sulfate and ammonium nitrate are both fertilisers.

Ammonium sulfate has the formula $(\text{NH}_4)_2\text{SO}_4$.

Ammonium nitrate has the formula NH_4NO_3 .

(a) What is the total number of **atoms** shown in the formula $(\text{NH}_4)_2\text{SO}_4$?

..... [1]

(b) Ammonium nitrate has a relative formula mass (M_r) of 80.

What is the relative formula mass of ammonium sulfate?

The relative atomic mass of H is 1, of N is 14, of O is 16, and of S is 32.

.....
.....
.....

relative formula mass = [1]

Ammonium nitrate contains 35% by mass of nitrogen.

What is the percentage by mass of nitrogen in ammonium sulfate?

.....
.....

percentage by mass = [1]

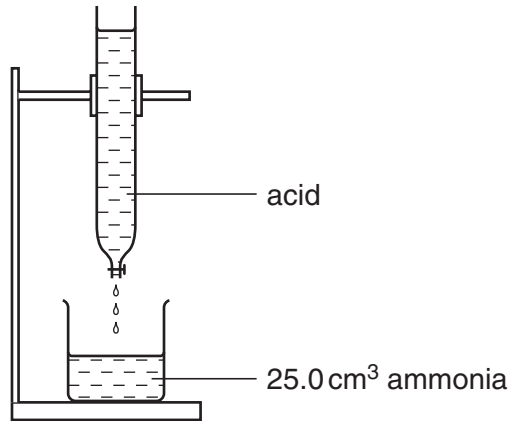
(c) Ammonium sulfate dissolves in water.

Why is it important that a fertiliser dissolves in water?

.....
..... [1]

(d) Clare makes ammonium nitrate.

Look at the apparatus she uses.



She uses 25.0 cm³ of an alkali called ammonia.

She slowly adds an acid until the alkali is just neutralised.

(i) What is the name of the acid she must use?

Choose from the list.

hydrochloric acid

nitric acid

phosphoric acid

sulfuric acid

answer..... [1]

(ii) The pH value in the beaker changes as the acid is added.

Describe how the pH value changes.

.....

Explain why.

.....

.....

..... [2]

[Turn over for remainder of question 1

(iii) Clare makes 0.45 g of ammonium nitrate.

She predicts she should make 0.50 g.

What is her percentage yield?

.....
.....
.....

percentage yield = % [2]

[Total: 9]

2 This question is about the manufacture of chemicals.

(a) Many millions of tonnes of ammonia are manufactured each year in the United Kingdom.

Ammonia is made by the reaction of nitrogen and hydrogen in a continuous process.

The conditions used for this reaction are

- 450 °C
- high pressure
- iron catalyst.

Explain why these conditions are chosen.

Use ideas about rate of reaction and percentage yield in your answer.

.....
.....
.....
.....
..... [3]

(b) A new anti-cancer drug is made from a rare plant only found in South America.

Less than 100 kg of the drug is made each year.

It is made in a batch process.

The cost of manufacturing and developing the drug is very high.

Write about some of the reasons why this cost is very high.

.....
.....
..... [2]

(c) The anti-cancer drug is made in a batch process rather than a continuous one.

Suggest one reason why.

.....
..... [1]

[Total: 6]

[Turn over

3 Washing up liquids contain a detergent.

Washing up liquid will clean plates covered in fat.

(a) Look at the diagram of a detergent molecule.

Label the diagram to show

- the hydrophilic part of the molecule
- the hydrophobic part of the molecule.



[1]

(b) Detergent molecules help to remove fat from a dirty plate.

Explain how.

A labelled diagram will help you to answer this question.

.....

.....

.....

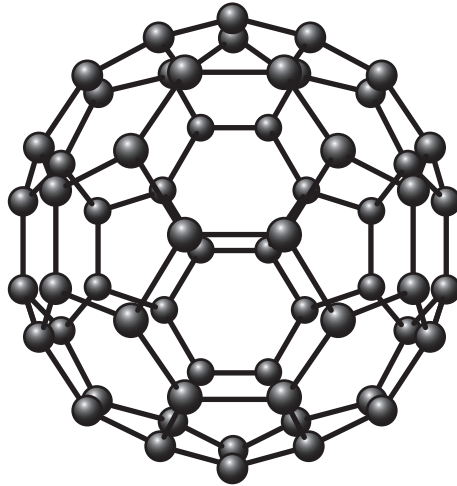
..... [2]

[Total: 3]

4 This question is about fullerenes and nanotubes.

(a) Look at the diagram of a fullerene.

It is called buckminster fullerene.



What is the chemical formula of buckminster fullerene?

..... [1]

(b) Fullerenes can be joined together to make nanotubes.

Nanotubes are used to make very effective industrial catalysts.

Give **one** reason why.

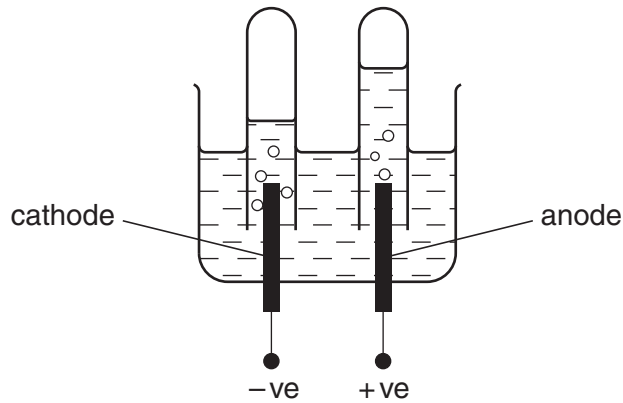
..... [1]

[Total: 2]

[Turn over

5 Hannah investigates the electrolysis of aqueous potassium sulfate.

Look at the apparatus she uses.



(a) There are bubbles of gas made at both electrodes.

What are the names of the **two** gases made during this electrolysis?

Choose from the list.

carbon dioxide

hydrogen

nitrogen

oxygen

sulfur dioxide

answer and [2]

(b) Write down **two** factors that affect the amount of gas made when aqueous potassium sulfate is electrolysed.

1

2 [2]

[Total: 4]

[Turn over

6 Monty investigates the properties of two acids

- dilute ethanoic acid, CH_3COOH
- dilute hydrochloric acid, HCl .

(a) Monty adds a small piece of magnesium ribbon to dilute ethanoic acid.

Monty sees bubbles of a gas. At the end of the reaction a colourless solution is left.

The colourless solution contains magnesium ethanoate, $\text{Mg}(\text{CH}_3\text{COO})_2$.

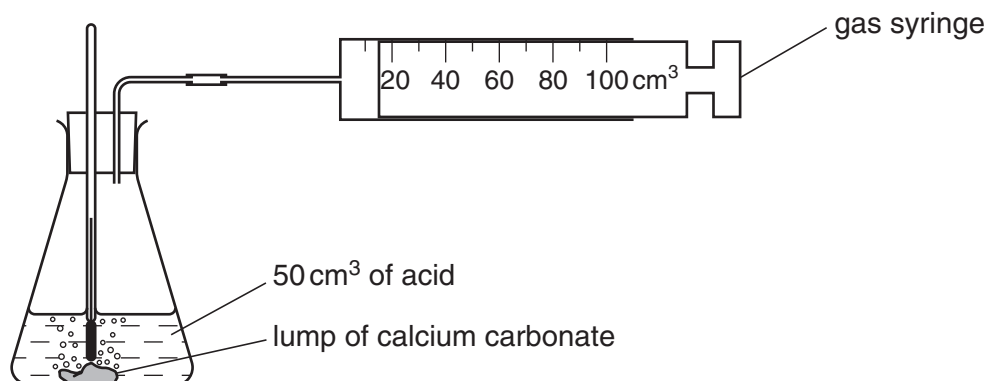
Write down the balanced **symbol** equation for the reaction between magnesium and ethanoic acid.

..... [2]

(b) Monty investigates the reaction of both acids with a lump of calcium carbonate.

He wants to find out the volume of gas made every 10 seconds.

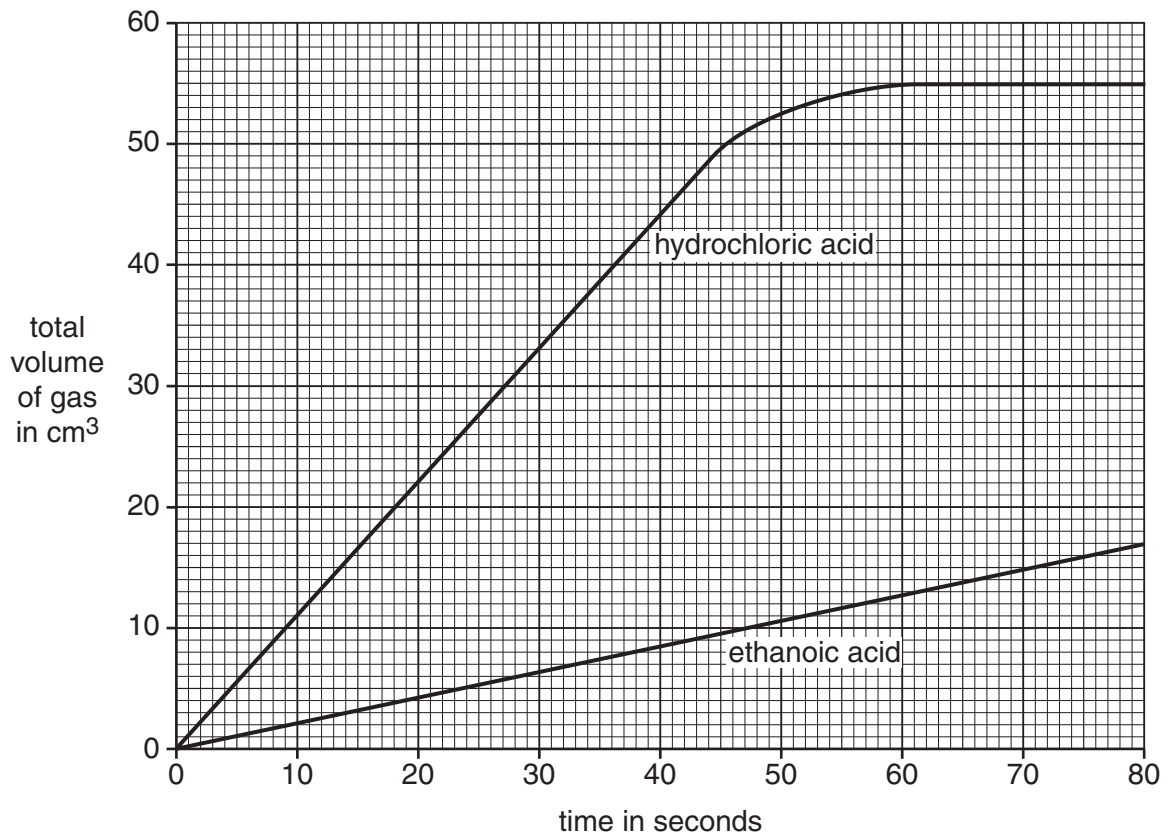
Look at the apparatus he uses.



He does two experiments, one with dilute ethanoic acid and one with dilute hydrochloric acid.

He makes sure he does a fair test.

Look at the graph of his results.



- (i) The reaction between calcium carbonate and ethanoic acid is still happening after 80 seconds.

What will be the total volume of gas collected at the **end** of this reaction?

..... cm³ [1]

- (ii) Dilute hydrochloric acid reacts much faster than dilute ethanoic acid.

Explain why.

Use ideas about

- hydrogen ions
- collisions between particles.

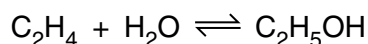
.....
.....
.....
..... [3]

[Total: 6]

[Turn over

7 This question is about equilibrium and reversible reactions.

Ethene reacts with steam in a reversible reaction to make ethanol.



This reversible reaction can reach equilibrium if it is in a sealed container.

(a) At equilibrium there is a connection between the rate of the forward reaction and the rate of the backward reaction.

What is this connection?

..... [1]

(b) What happens to the concentration of ethene and of water at equilibrium?

..... [1]

(c) Look at the table.

It shows how the percentage of ethene at equilibrium changes as the **temperature** changes and as the **pressure** changes.

	temperature		
pressure	200 °C	260 °C	320 °C
30 atmospheres	37%	26%	21%
40 atmospheres	40%	30%	25%
50 atmospheres	44%	35%	30%
60 atmospheres	48%	40%	34%

What happens to the percentage of ethene as the pressure increases but the temperature stays the same?

..... [1]

(d) Calculate the maximum mass of ethanol that can be made from 5.6 tonnes of ethene.

The relative atomic mass for H is 1, for C is 12 and for O is 16.

.....
.....
.....
.....

maximum mass of ethanol = [3]

[Total: 6]

[Turn over

8 Zoe tests copper(II) sulfate solution.

(a) Zoe adds barium chloride solution to copper(II) sulfate solution.

A white precipitate appears.

Write down the **word** equation for this reaction.

..... [1]

(b) Zoe adds sodium hydroxide solution to copper(II) sulfate solution.

This time she gets a blue precipitate of copper(II) hydroxide, $\text{Cu}(\text{OH})_2$.

Write down the **ionic** equation for the reaction between aqueous Cu^{2+} and aqueous OH^- .

Include **state** symbols.

..... [3]

[Total: 4]

9 This question is about the hardness of water.

(a) Look at the list.

calcium hydrogencarbonate

calcium sulfate

ethanoic acid

sodium chloride

sodium hydroxide

(i) Write the name of a substance that causes **permanent** hardness.

Choose from the list.

answer..... [1]

(ii) Write the name of a substance that causes **temporary** hardness.

Choose from the list.

answer..... [1]

(b) Calcium carbonate, CaCO_3 , reacts with water and carbon dioxide to make calcium hydrogencarbonate, $\text{Ca}(\text{HCO}_3)_2$.

Write a balanced **symbol** equation for this reaction.

..... [1]

(c) Ion exchange resins can be used to soften water.

Explain how ion exchange resins soften water.

.....
.....
.....
..... [2]

[Total: 5]

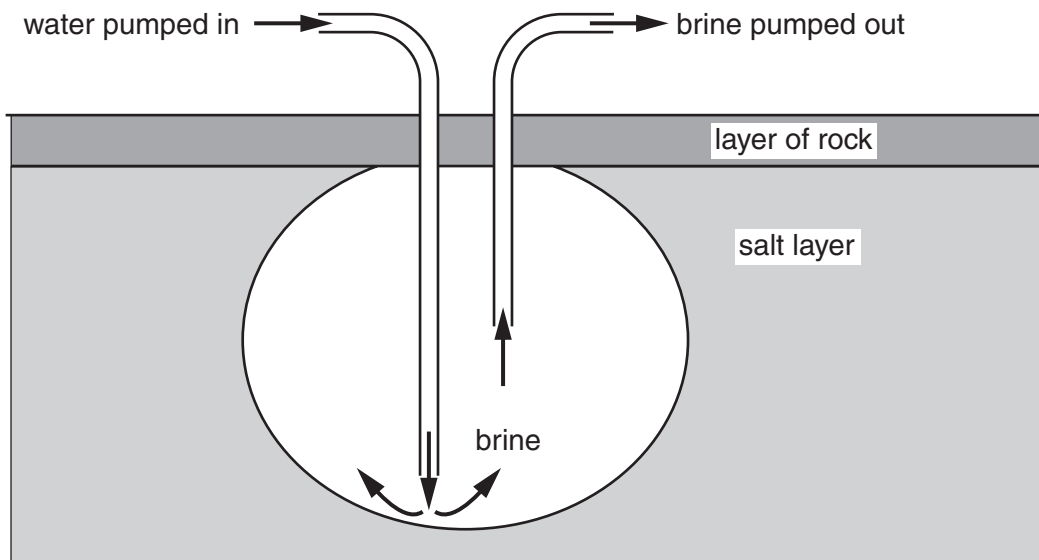
[Turn over

10 This question is about sodium chloride.

Brine is a solution of sodium chloride.

Solution mining is used to get brine out of the ground.

Look at the diagram of solution mining.



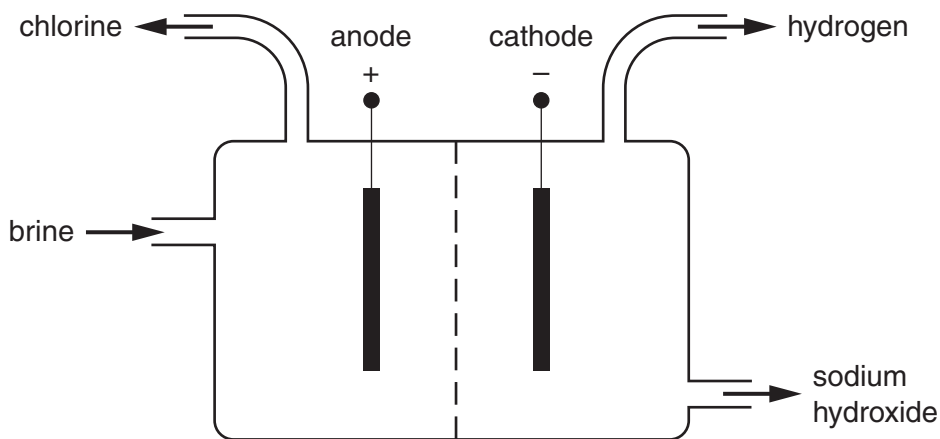
(a) Write about one major environmental problem caused by solution mining.

..... [1]

(b) Look at the diagram.

It shows the apparatus used for the electrolysis of sodium chloride solution (brine).

Chlorine, hydrogen and sodium hydroxide are made.



(i) Hydrogen ions, H^+ , react to make hydrogen gas, H_2 .

Write an equation for this reaction.

Use e^- to show an electron.

..... [1]

(ii) Chloride ions, Cl^- , react to form chlorine gas.

Write an equation for this reaction.

Use e^- to show an electron.

..... [1]

(iii) Sodium hydroxide is also made in this electrolysis.

Explain why.

..... [1]

[Total: 4]

[Turn over

11 Ethanol is made by the fermentation of glucose.

Carbon dioxide is also made in the process.

(a) Complete the **word** equation for fermentation.

glucose \rightarrow + [1]

(b) Fermentation makes a dilute solution of ethanol.

What method of separation could be used to get almost pure ethanol?

Choose from the list.

crystallisation

electrolysis

evaporation

filtration

fractional distillation

answer [1]

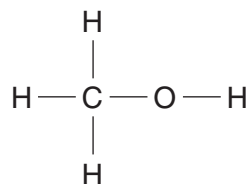
(c) A fermentation reaction takes place at 40 °C.

When the temperature is raised to 80 °C, fermentation stops.

Explain why.

.....
..... [1]

(d) Look at the displayed formula for methanol, CH₃OH.



Draw the displayed formula of ethanol, C₂H₅OH.

[1]

(e) Look at this table.

It shows the formulae of some alcohols.

alcohol	formula
methanol	CH ₃ OH
ethanol	C ₂ H ₅ OH
propanol	
butanol	C ₄ H ₉ OH

(i) Complete the table by writing the formula for propanol. [1]

(ii) The general formula for an **alkene** is C_nH_{2n}.

Write down the general formula for an **alcohol**.

..... [1]

[Total: 6]

[Turn over

12 This question is about fats and oils.

(a) In a saturated fat all the bonds between carbon atoms are single bonds.

How is an unsaturated fat different?

..... [1]

(b) Describe a chemical test for unsaturation in a fat.

test..... [1]

result [1]

(c) Fats and oils can be heated with sodium hydroxide to make soap.

Look at the list.

displacement

neutralisation

oxidation

reduction

saponification

Put a (ring) around the word that best describes the process. [1]

(d) How is margarine manufactured from vegetable oils?

..... [1]

[Total: 5]

END OF QUESTION PAPER