

Please check the examination details below before entering your candidate information

Candidate surname					Other names				
Centre Number					Candidate Number				

Pearson Edexcel Level 1/Level 2 GCSE (9–1)

Time 1 hour 45 minutes	Paper reference	1CH0/2F
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Chemistry

PAPER 2:

Foundation Tier

You must have: Calculator, ruler	Total Marks
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Instructions

- Use **black** ink or ball-point pen.
- **Fill in the boxes** at the top of this page with your name, centre number and candidate number.
- Answer **all** questions.
- Answer the questions in the spaces provided
– *there may be more space than you need.*
- Calculators may be used.
- Any diagrams may NOT be accurately drawn, unless otherwise indicated.
- You must **show all your working out** with **your answer clearly identified** at the **end of your solution**.

Information

- The total mark for this paper is 100.
- The marks for **each** question are shown in brackets
– *use this as a guide as to how much time to spend on each question.*
- In questions marked with an **asterisk (*)**, marks will be awarded for your ability to structure your answer logically, showing how the points that you make are related or follow on from each other where appropriate.
- There is a periodic table on the back cover of the paper.

Advice

- Read each question carefully before you start to answer it.
- Try to answer every question.
- Check your answers if you have time at the end.

Turn over ►

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Q:1/1/1/1/1/



Answer ALL questions. Write your answers in the spaces provided.

Some questions must be answered with a cross ☐. If you change your mind about an answer, put a line through the box ☐ and then mark your new answer with a cross ☐.

- 1 Figure 1 shows toothbrushes in a container.

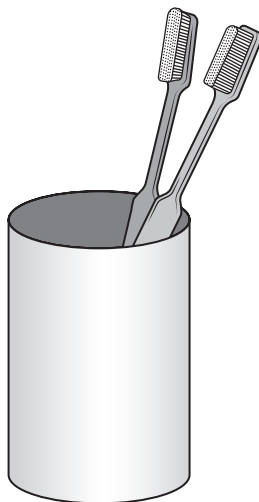


Figure 1

- (a) The toothbrush handles are made of plastic (polymer).

- (i) Give a reason why plastic is a suitable material to make a toothbrush handle.

(1)

Strong

- (ii) Some toothbrush handles are made of wood, not plastic.

Explain a disadvantage of using plastics.

(2)

plastics made from (crude) oil
which is {finite/ non-sustainable}

(b) The container is made of a ceramic material.

Which is a property of the ceramic that makes it suitable for the container?

(1)

- ☐ **A** it will break if dropped
- ☒ **B** it does not react with water
- ☐ **C** it melts at over 2 000 °C
- ☐ **D** it is a good conductor of heat

(c) In some countries, toothpastes contain nanoparticles of silver.

Which statement describes the size of a nanoparticle?

(1)

- ☐ **A** the size of an electron
- ☐ **B** the size of an atom
- ☒ **C** the size of a few hundred atoms
- ☐ **D** the size of 1 million molecules

(d) Toothpastes contain abrasives and other substances to make them effective.

Figure 2 is a pie chart of the percentage composition by volume of one toothpaste.

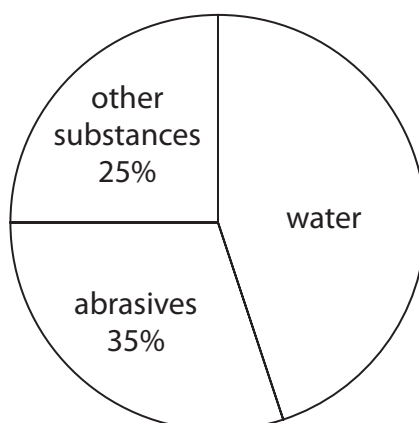


Figure 2

Calculate the volume of water in 150 cm^3 of this toothpaste.

(2)

• $\% \text{ water} = 100 - 35 - 25 = 40\%$

• $40\% \times 150 = 60 \text{ (cm}^3\text{)}$

volume of water = cm^3

(Total for Question 1 = 7 marks)

2 This question is about elements in group 1 of the periodic table.

- (a) Figure 3 shows the symbols of the first three elements in group 1 of the periodic table and their melting points.

symbol	melting point in °C
Li	181
Na	98
K	64

Figure 3

Use the periodic table to answer these questions.

- (i) Give the symbol of **another** element in group 1.

(1)

Rb.....

- (ii) Give the atomic number of lithium.

(1)

3.....

- (iii) Describe the trend in the melting points of the elements in Figure 3.

(2)

the melting points) decrease

- as the atomic number increases/
as you go down {the group / the
alkali metals / group



(b) The elements in group 1 react very vigorously with water.

A student suggests this method to see what happens when sodium reacts with water.

- step 1** put on safety glasses and a laboratory coat
- step 2** cut a $2\text{ cm} \times 2\text{ cm} \times 2\text{ cm}$ cube of sodium
- step 3** put a few drops of water in the container shown in Figure 4
- step 4** add the sodium to the water in the container and observe the reaction

(i) Figure 4 shows a diagram of the container the student suggested for step 3.



Figure 4

Give the name of the container shown in Figure 4.

(1)

Test tube

- (ii) A teacher says that the method is not safe because the reaction is too vigorous.

Explain changes that could be made to step 2 and to step 3 that would make the method safer.

(3)

step 2: change and explanation

cut a smaller piece of sodium (1)

- so less reaction / slower reaction

step 3: change and explanation

Step 3

- use a larger {container / trough} (of water) (1)
- there is more water so more heat is absorbed

(Total for Question 2 = 8 marks)

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3 Compounds are tested to see if they contain chloride, bromide or iodide ions.

Figure 5 shows a flow chart of this test.

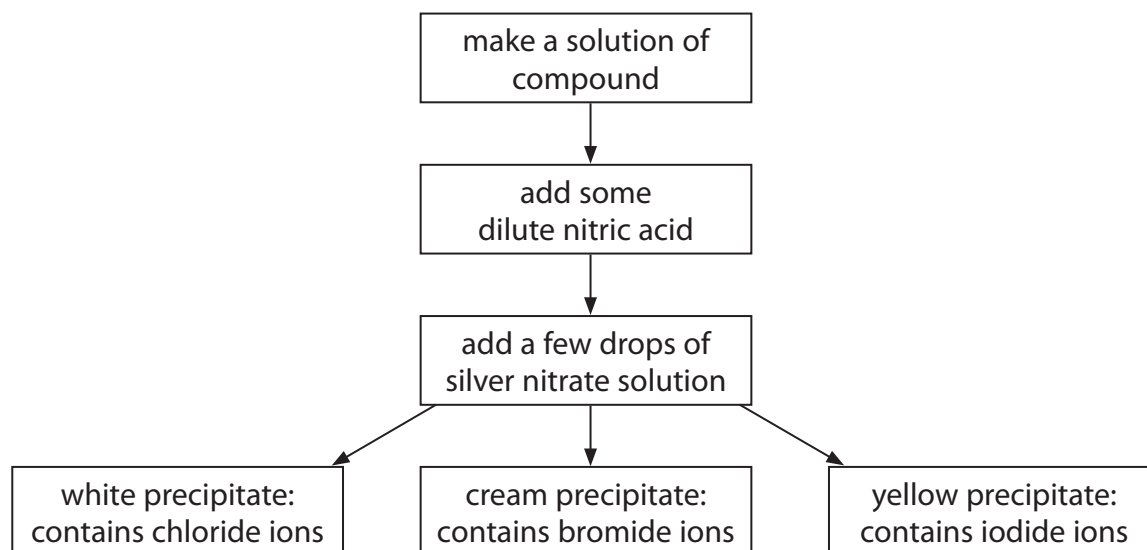


Figure 5

(a) (i) Describe how to make a solution from a solid in a test tube.

(2)

Add water

Shake

(ii) Give the name of the apparatus that should be used to add a few drops of silver nitrate solution to the test tube.

(1)

Pipette

(iii) When an equation is written for this reaction, which state symbol is used for the silver nitrate solution?

(1)

☒ A aq

☐ B g

☐ C l

☐ D s

- (b) (i) When one compound is tested, a precipitate is seen.

State what you **see** when a precipitate forms.

(1)

Solid

- (ii) Using Figure 5, name the ion in the compound that causes a cream precipitate.

(1)

ion Bromide

- (c) A compound of potassium is tested.
It forms a white precipitate.

- (i) Using Figure 5, name the compound.

(1)

Potassium chloride

- (ii) 10.0 g of the solution of the compound of potassium are tested.
1.0 g of dilute nitric acid is added.
4 drops of silver nitrate solution are added, each with a mass of 0.2 g.

Calculate the mass of the mixture at the end of the test.

(2)

11.8 (g) with or without working scores 2

• $0.2 \times 4 (= 0.8)$

• $10 + 1 + 0.8 = 11.8 \text{ (g)}$

mass = g

(Total for Question 3 = 9 marks)



P 6 9 4 8 6 A 0 9 3 2

4 Some reactions are exothermic and some reactions are endothermic.

(a) What does an exothermic reaction always give out?

(1)

- ☒ **A** heat energy
☐ **B** light
☐ **C** a gas
☐ **D** sound

(b) In an experiment, a solid is mixed with a liquid.
 The temperature change of the mixture is measured.

Figure 6 shows the apparatus that is used.

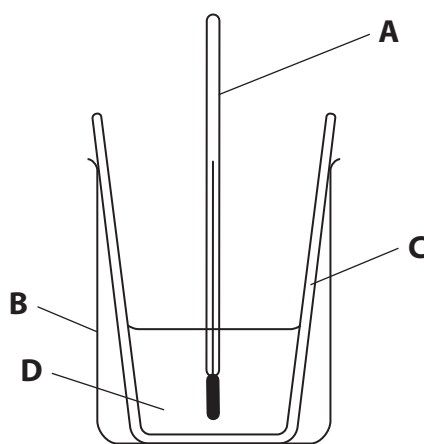


Figure 6

(i) Give the letter of the piece of apparatus, **A**, **B**, **C** or **D**, in Figure 6 that is used to measure the temperature.

(1)

Thermometer

(ii) Give the name of the piece of apparatus **B** shown in Figure 6.

(1)

Beaker

(iii) The piece of apparatus labelled **C** is made from polystyrene.

State why polystyrene is a better material than glass for this piece of apparatus.

(1)

It is an insulator



(iv) The results of the experiment are given in Figure 7.

temperature of liquid at start in °C	18.6
temperature of products at end in °C	16.1

Figure 7

Calculate the change in temperature.

Give a sign and a unit in your answer.

(3)

iv) -2.5°C scores 3 with or without working

$$16.1 - 18.6$$

$$= -2.5\text{ °C}$$

temperature change =

(v) The solid used in this experiment contained only NH_4^+ ions and NO_3^- ions.

Give the formula and the name of the solid.

(2)

formula NH_4NO_3

name Ammonium nitrate

(Total for Question 4 = 9 marks)



- 5 (a) Figure 8 shows one molecule of a compound obtained from crude oil.

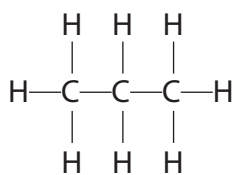


Figure 8

- (i) Give the names of the **two** elements in this molecule.

(2)

Carbon

Hydrogen

- (ii) What is the molecule in Figure 8?

(1)

- ☐ **A** an oxide
- ☒ **B** a chain molecule
- ☐ **C** a fullerene
- ☐ **D** a ring molecule

- (iii) What is the relative formula mass of the compound in Figure 8?

(relative atomic masses: H = 1.0, C = 12)

(1)

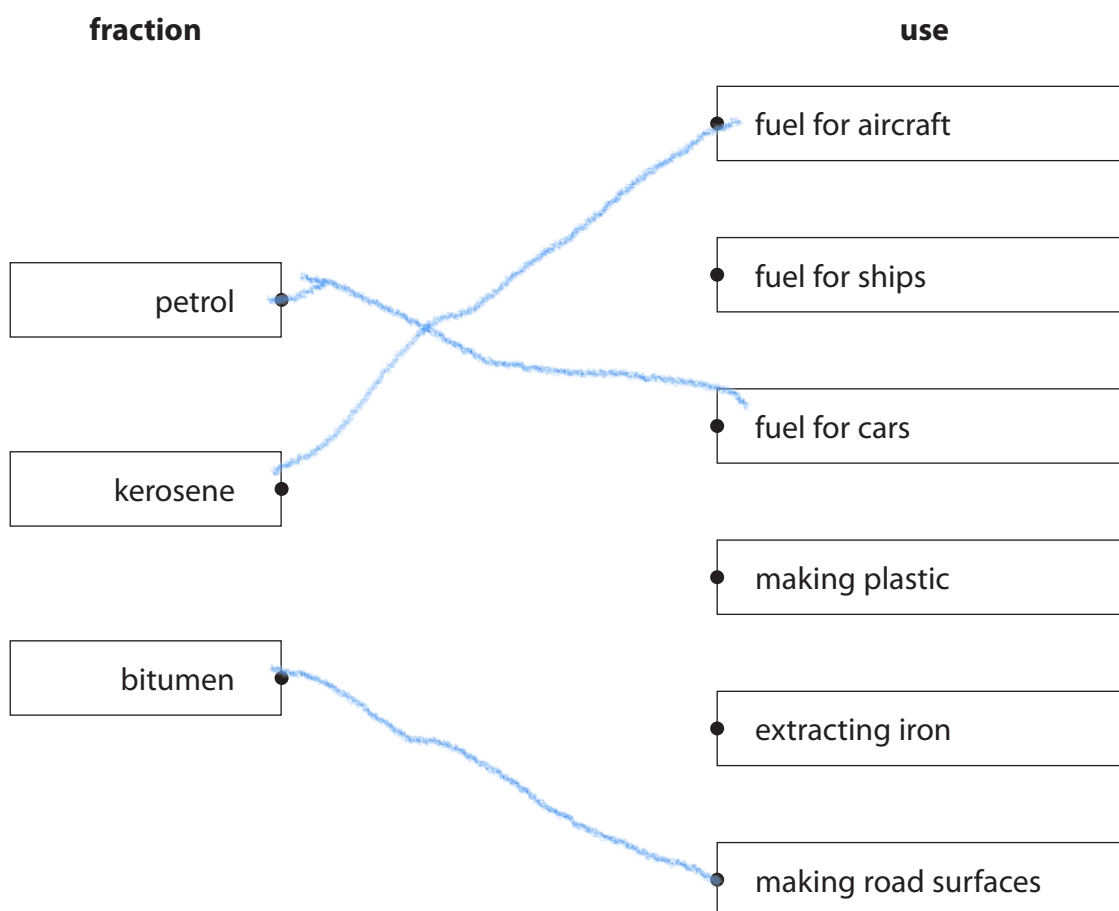
- ☐ **A** 13
- ☐ **B** 42
- ☒ **C** 44
- ☐ **D** 96



(b) Crude oil can be separated into different fractions.

Draw **one** straight line from each fraction to a use of that fraction.

(3)



(c) Hydrogen chloride gas and sulfur dioxide gas are dissolved in separate test tubes of water.

Blue litmus paper is dipped into each test tube.

State and explain the colour change you would observe in each test tube.

(3)

HCl

- goes red
- (HCl) is an acid

SO₂

- goes red
- (SO₂ solution) is an acid

(Total for Question 5 = 10 marks)

6 This question is about elements in group 7, the halogens.

(a) Which halogen is a green gas at room temperature and pressure?

(1)

- ☐ A bromine
☒ B chlorine
☐ C fluorine
☐ D iodine

(b) Bromine, chlorine and iodine all react with heated iron wool.

Figure 9 shows the speed of these reactions.

halogen	description of reaction with heated iron wool
bromine	reacts quickly
chlorine	reacts very quickly
iodine	reacts slowly

Figure 9

(i) When iron wool is heated with chlorine, iron chloride is formed.

Write the word equation for this reaction.

(2)

iron + chlorine →
→ iron chloride

(ii) Give the name of the halogen in Figure 9 that is the most reactive with iron.

(1)

Chloride

(iii) 34.4 % of the mass of iron chloride is iron.

Calculate the mass of iron and the mass of chlorine in 125 g of iron chloride.

(3)

iron = 43 and chlorine = 82 scores 3 with or
without working

34.4×125

100

= 43 given as mass of iron

$125 - 43 = 82$ given as mass of chlorine

mass of iron = g mass of chlorine = g

(c) Alkenes react with halogens.

When iron chloride is added to the reaction mixture, the reaction is much faster
but the products are the same.

Use words from the box to complete the sentences.

an acid a catalyst higher lower a reactant unchanged

(2)

The iron chloride speeds up the reaction because it is ...Catalyst.....

After the reaction, the mass of iron chloride is ...Unchanged.....

(Total for Question 6 = 9 marks)

7 The structure of one molecule of a compound is shown in Figure 10.

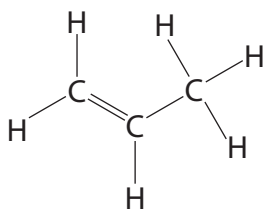


Figure 10

(a) What is the molecular formula of the compound in Figure 10?

(1)

- ☒ **A** CH
- ☒ **B** CH₂
- ☒ **C** 3C6H
- ☒ **D** C₃H₆

(b) The compound in Figure 10 is an unsaturated hydrocarbon.

State why the compound is described as an **unsaturated hydrocarbon**.

(3)

unsaturatedunsaturated)
 • it has a double bond/ C=C (1)

hydrocarbonhydrocarbon)
 • it contains carbon and hydrogen (1)
 • (carbon and hydrogen) (atoms) only

- (c) Many molecules of the compound in Figure 10 combine to form substance Y.
Figure 11 shows part of a molecule of substance Y.

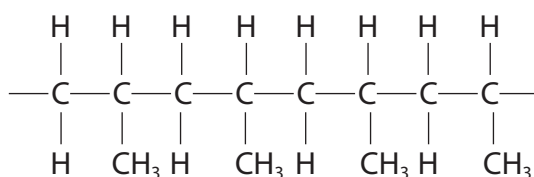


Figure 11

- (i) What type of substance is Y?

(1)

- ☐ **A** a composite
☐ **B** a nanoparticle
☒ **C** a polymer
☐ **D** a protein

- (ii) One molecule of the compound in Figure 10 has a mass of 6.98×10^{-23} g.

64 800 of these molecules combine to form one molecule of Y.

Calculate the mass of this molecule of Y in g.

(2)

4.52304 x 10-18 with or without working

scores 2

• 6.98 x 10-23 x 64800

• = 4.52(304) x 10-18 (g)

mass of one molecule of Y = g

*(d) Alkanes can be burned in air.

Different products can be formed as the combustion of alkanes can be complete or incomplete.

An investigation was carried out to compare the energy released when the first four alkanes in the homologous series were burned.

Equal amounts of these alkanes were burned to heat 100 cm^3 of water.

The temperature change for each alkane is shown in Figure 12.

alkane	temperature change in $^{\circ}\text{C}$
methane	9
ethane	16
propane	22
butane	29

Figure 12

Discuss the complete and incomplete combustion of these alkanes and the trend in the energy changes they produced.

You should give word equations in your answer.

(6)

Reactions

- combustion is reaction with oxygen
- complete combustion produces carbon dioxide
- complete combustion produces water
- incomplete combustion with lack of oxygen
- incomplete combustion produces carbon/ soot
- incomplete combustion produces carbon monoxide

Equations

- word equation shows reactants and products for complete combustion
- word equation shows reactants and products for incomplete combustion
- credit any symbol equations even if incorrectly balanced

Energy released

- as you go down table molecules get larger
- temperature rise increases as alkane molecule size increases
- temperature rise means energy released/ exothermic
- least to most is methane, ethane, propane, butane
- bigger molecules release more energy



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(Total for Question 7 = 13 marks)



- 8 A student used the apparatus in Figure 13 to investigate the rate of the reaction between a metal and dilute hydrochloric acid.

Pieces of the metal were placed in dilute hydrochloric acid in the flask, and the total volume of gas produced was measured every minute.

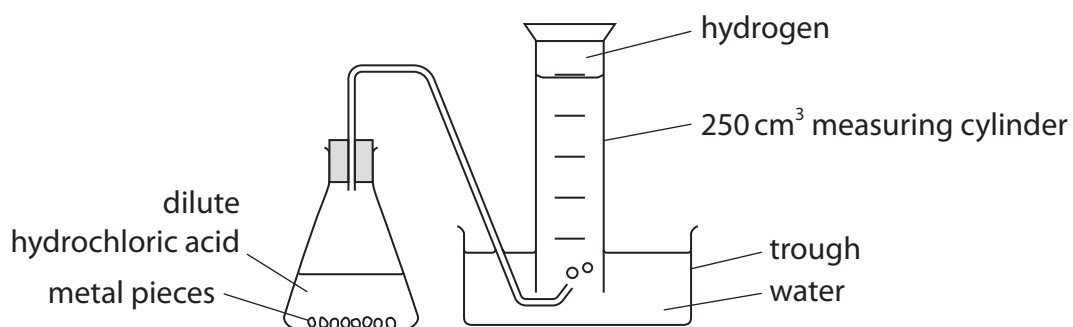


Figure 13

- (a) Figure 14 shows a graph of the student's results.

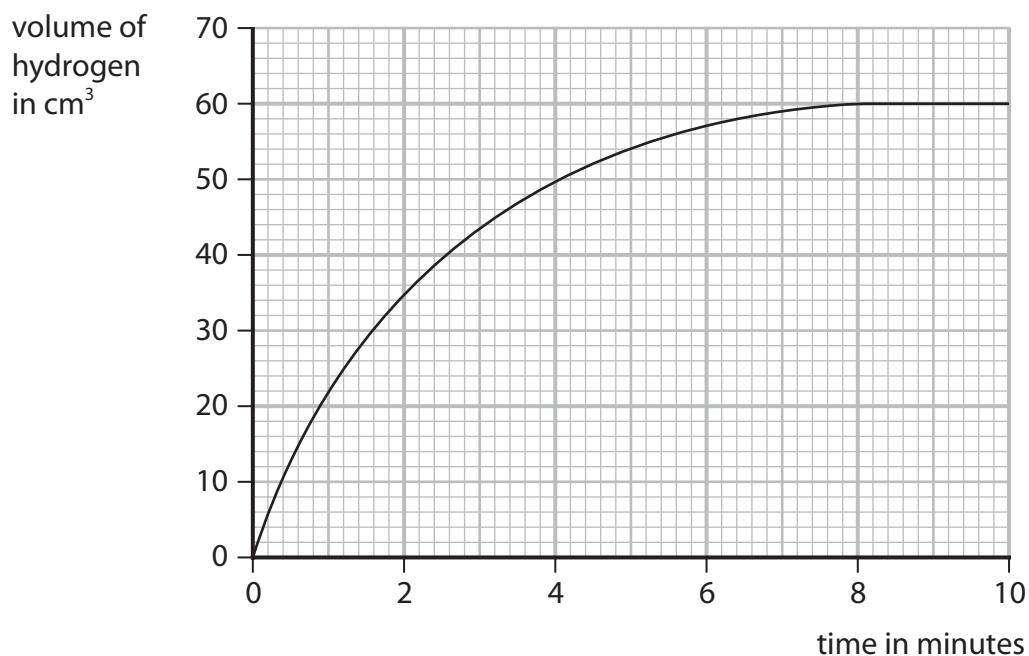


Figure 14

- (i) Name a piece of apparatus that would be better to measure the volume of gas produced, instead of the 250 cm^3 measuring cylinder.

Give a reason for your answer.

(2)

name of apparatus

100 cm³ measuring cylinder/ (gas) syringe (1)

reason

which has smaller gradations / higher resolution

- (ii) Calculate the mean rate of production of hydrogen over the first 90 seconds, in cm^3 per second.

(3)

• volume read at 90s = 29 cm^3

• rate = volume

90

• = $0.3222\dots$ (cm^3 per second)

rate = cm^3 per second

- (iii) The student measured the volume of gas for 10 minutes.

State why the measurements could have been stopped at 9 minutes.

(1)

Volume were constant

- (b) The experiment was repeated, but with acid of a higher concentration.

The rate of reaction was faster.

- (i) Explain why the rate of reaction increases when the concentration of acid is increased.

(2)

• more particles present



- (ii) Another student suggests four other ways of increasing the rate of this reaction.

Which one is correct?

(1)

- ☐ **A** use the same acid but at a lower temperature
- ☐ **B** use a larger trough
- ☐ **C** use a smaller flask
- ☒ **D** use the same metal but in a powdered form

- (c) The apparatus in Figure 13 can be used to measure the rate of the reaction between marble chips and hydrochloric acid.

The student needs different sized marble chips.

Describe how the student can make small and medium sized marble chips from large chips.

(2)

- {crush/ break} the large chips
 - in pestle and mortar
 - use sieves to separate different sized chips/
- sort the chips by size

(Total for Question 8 = 11 marks)



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9 This question is about gases.

(a) When sodium is added to water, hydrogen gas is produced.

Which observation shows that a gas has been produced?

(1)

- ☐ A a white precipitate forms
- ☒ B effervescence is seen
- ☐ C the sodium sinks in the water
- ☐ D the water changes to a pink colour

(b) Some damp litmus paper is placed in a gas.
The litmus paper is bleached.

Which gas bleaches damp litmus paper?

(1)

- ☐ A carbon dioxide
- ☒ B chlorine
- ☐ C hydrogen
- ☐ D oxygen

(c) When calcium carbonate is heated it decomposes.



When 5.000 g of calcium carbonate is heated, the mass of solid remaining is 2.800 g.

Calculate the mass of carbon dioxide that has been released.

Give your answer to three significant figures.

(2)

2.20 with or without working scores (2)

$$\bullet 5.000 - 2.800 = 2.200 \text{ (1)}$$

$$\bullet = 2.20$$

mass of carbon dioxide = g



(d) A diagram of an atom of helium is shown in Figure 15.

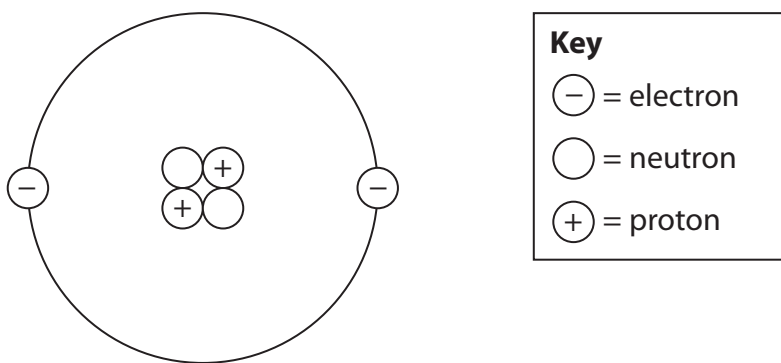


Figure 15

(i) Explain, using Figure 15, why helium is inert.

(2)

it has two electrons in outer shell/ it has a full outer shell / OWTTE

• so does not {gain/ lose/ transfer/ share} electrons

(ii) Helium is used to fill balloons.

State one property of helium, apart from it being inert, that makes it suitable for filling balloons.

(1)

Less dense than air

- *(e) Figure 16 shows the relative amounts of three gases in the early atmosphere compared to the composition of today's atmosphere.

gas	relative amount in early atmosphere	composition of today's atmosphere
water vapour	large amount	0 % to 4 %
carbon dioxide	large amount	less than 0.5 %
oxygen	little or none	21 %

Figure 16

Natural processes and human activities have altered the relative amounts of these gases in the atmosphere.

Explain how the relative amount of each of the gases in Figure 16 has increased or decreased over time.

(6)

Natural: Origins:

- {carbon dioxide / water / gases} from volcanoes
- the Earth cooled
- so water vapour condensed (to form oceans/seas) reducing amount of water vapour
- carbon dioxide {dissolves in/absorbed by} the oceans reducing amount of carbon dioxide
- some carbon dioxide incorporated into sea animals' shells

Natural: Evolution

- plants evolved
- photosynthesis
- photosynthesis releases oxygen increasing amount of oxygen
- photosynthesis absorbs carbon dioxide reducing amount of carbon dioxide

Human effects

- amounts of carbon dioxide in recent time increasing due to burning fossil fuels
- amounts of carbon dioxide in recent time increasing due to agriculture
- deforestation means less carbon dioxide absorbed
- reforestation means more oxygen produced



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(Total for Question 9 = 13 marks)



10 (a) Some acids are used in tests for ions.

A bottle of one acid is shown in Figure 17.

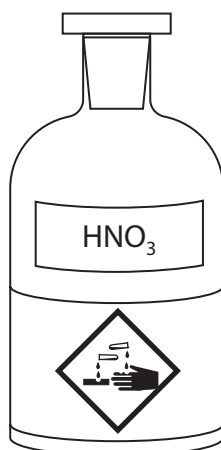


Figure 17

(i) The acid in Figure 17 can be used in the test for carbonate ions.

Explain, giving the name of the hazard symbol shown, what safety precautions should be taken when using this acid.

(2)

corrosive

• so wear gloves/ (safety) goggles

(ii) Give the name of the acid shown in Figure 17.

(1)

Nitric acid

(iii) State a property of glass that makes it a suitable material to make the container for an acid.

(1)

Inert

- (b) A teacher conducts a flame test to identify the metal ions in some unknown solids.

- step 1** dip a flame test wire into hydrochloric acid
- step 2** dip the flame test wire into the unknown solid
- step 3** hold the flame test wire above a Bunsen burner flame

- (i) This method did not work well.

Explain an improvement that needs to be made to **step 3** to enable a bright flame colour to be produced.

(2)

Hold the wire in the flame / at the tip of the

(blue) cone

- (as) it is hotter

- (ii) Figure 18 shows the results of the flame tests on three compounds, **P**, **Q** and **R**.

compound	flame colour
P	red
Q	lilac
R	blue-green

Figure 18

Use Figure 18 to identify the metal ions in compounds **P**, **Q** and **R**.

(3)

P Lithium.....

Q Potassium.....

R Copper.....

(c) A flame photometer was used to analyse samples of a solution of metal ions.

Each sample was treated with 5.00 cm^3 of dilute hydrochloric acid.
 1.00 dm^3 of the acid contained 219 g of hydrogen chloride.

Calculate the mass of hydrogen chloride in the acid used to test 20 samples.

(2)

$$20 \times 5/1000 \times 219 \text{ (2) (= 21.9 g)}$$

$$\bullet 5/1000 (= 0.005) \text{ (1)}$$

mass = g

(Total for Question 10 = 11 marks)

TOTAL FOR PAPER = 100 MARKS



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The periodic table of the elements

1	2	Key										3	4	5	6	7	0
		relative atomic mass atomic symbol name atomic (proton) number															
7 Li lithium 3	9 Be beryllium 4											11 B boron 5	12 C carbon 6	14 N nitrogen 7	16 O oxygen 8	19 F fluorine 9	20 Ne neon 10
23 Na sodium 11	24 Mg magnesium 12											27 Al aluminium 13	28 Si silicon 14	31 P phosphorus 15	32 S sulfur 16	35.5 Cl chlorine 17	40 Ar argon 18
39 K potassium 19	40 Ca calcium 20	45 Sc scandium 21	48 Ti titanium 22	51 V vanadium 23	52 Cr chromium 24	55 Mn manganese 25	56 Fe iron 26	59 Co cobalt 27	59 Ni nickel 28	63.5 Cu copper 29	65 Zn zinc 30	70 Ga gallium 31	73 Ge germanium 32	75 As arsenic 33	79 Se selenium 34	80 Br bromine 35	84 Kr krypton 36
85 Rb rubidium 37	88 Sr strontium 38	89 Y yttrium 39	91 Zr zirconium 40	93 Nb niobium 41	96 Mo molybdenum 42	[98] Tc technetium 43	101 Ru ruthenium 44	103 Rh rhodium 45	106 Pd palladium 46	108 Ag silver 47	112 Cd cadmium 48	115 In indium 49	119 Sn tin 50	122 Sb antimony 51	128 Te tellurium 52	127 I iodine 53	131 Xe xenon 54
133 Cs caesium 55	137 Ba barium 56	139 La* lanthanum 57	178 Hf hafnium 72	181 Ta tantalum 73	184 W tungsten 74	186 Re rhenium 75	190 Os osmium 76	192 Ir iridium 77	195 Pt platinum 78	197 Au gold 79	201 Hg mercury 80	204 Tl thallium 81	207 Pb lead 82	209 Bi bismuth 83	[209] Po polonium 84	[210] At astatine 85	[222] Rn radon 86

1
H
hydrogen
1

Key

relative atomic mass
atomic symbol
name
atomic (proton) number

* The elements with atomic numbers from 58 to 71 are omitted from this part of the periodic table.
The relative atomic masses of copper and chlorine have not been rounded to the nearest whole number.