

Please check the examination details below before entering your candidate information

Candidate surname

Other names

Centre Number

Candidate Number

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Pearson Edexcel International GCSE (9–1)

Time 2 hours

Paper
reference

4CH1/1C 4SD0/1C

Chemistry

Unit: 4CH1

Science (Double Award) 4SD0

PAPER: 1C

You must have:

Calculator, ruler

Total Marks

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.*
- Show all the steps in any calculations and state the units.

Information

- The total mark for this paper is 110.
- The marks for **each** question are shown in brackets
– *use this as a guide as to how much time to spend on each question.*

Advice

- Read each question carefully before you start to answer it.
- Write your answers neatly and in good English.
- Try to answer every question.
- Check your answers if you have time at the end.

Turn over ►

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The Periodic Table of the Elements

	1	2	3	4	5	6	7	0		
	7 Li lithium 3	9 Be beryllium 4	11 Na sodium 11	12 C carbon 6	13 Al aluminium 13	14 N nitrogen 7	15 P phosphorus 15	16 O oxygen 8	17 F fluorine 9	18 Ne neon 10
	19 K potassium 19	20 Ca calcium 20	23 V vanadium 23	24 Cr chromium 24	25 Mn manganese 25	26 Fe iron 26	27 Co cobalt 27	28 Ni nickel 28	29 Cu copper 29	30 Zn zinc 30
	37 Rb rubidium 37	38 Sr strontium 38	40 Y yttrium 39	41 Zr zirconium 40	42 Nb niobium 41	43 Tc technetium 43	44 Ru ruthenium 44	45 Rh rhodium 45	46 Pd palladium 46	47 Ag silver 47
	55 Cs caesium 55	56 Ba barium 56	57 La* lanthanum 57	72 Hf hafnium 72	73 Ta tantalum 73	74 W tungsten 74	75 Re rhenium 75	76 Os osmium 76	77 Ir iridium 77	78 Pt platinum 78
	87 Fr francium 87	88 Ra radium 88	89 Ac* actinium 89	104 Rf rutherfordium 104	105 Db dubnium 105	106 Sg seaborgium 106	107 Bh bohrium 107	108 Hs hassium 108	109 Mt meitnerium 109	110 Ds darmstadtium 110
	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
	223 Fr francium 87	226 Ra radium 88	227 Ac* actinium 89	261 Rf rutherfordium 104	262 Db dubnium 105	266 Sg seaborgium 106	264 Bh bohrium 107	277 Hs hassium 108	268 Mt meitnerium 109	271 Ds darmstadtium 110
	233 Cs caesium 55	237 Ba barium 56	239 La* lanthanum 57	278 Hf hafnium 72	281 Ta tantalum 73	284 W tungsten 74	286 Re rhenium 75	290 Os osmium 76	292 Ir iridium 77	295 Pt platinum 78
	287 Cs caesium 55	291 Ba barium 56	293 La* lanthanum 57	342 Hf hafnium 72	345 Ta tantalum 73	348 W tungsten 74	350 Re rhenium 75	354 Os osmium 76	356 Ir iridium 77	363 Pt platinum 78
	349 Cs caesium 55	353 Ba barium 56	355 La* lanthanum 57	414 Hf hafnium 72	417 Ta tantalum 73	420 W tungsten 74	422 Re rhenium 75	426 Os osmium 76	428 Ir iridium 77	435 Pt platinum 78
	401 Cs caesium 55	405 Ba barium 56	407 La* lanthanum 57	482 Hf hafnium 72	485 Ta tantalum 73	488 W tungsten 74	490 Re rhenium 75	494 Os osmium 76	496 Ir iridium 77	503 Pt platinum 78
	449 Cs caesium 55	453 Ba barium 56	455 La* lanthanum 57	544 Hf hafnium 72	547 Ta tantalum 73	550 W tungsten 74	552 Re rhenium 75	556 Os osmium 76	558 Ir iridium 77	565 Pt platinum 78
	501 Cs caesium 55	505 Ba barium 56	507 La* lanthanum 57	624 Hf hafnium 72	627 Ta tantalum 73	630 W tungsten 74	632 Re rhenium 75	636 Os osmium 76	638 Ir iridium 77	645 Pt platinum 78
	559 Cs caesium 55	563 Ba barium 56	565 La* lanthanum 57	744 Hf hafnium 72	747 Ta tantalum 73	750 W tungsten 74	752 Re rhenium 75	756 Os osmium 76	758 Ir iridium 77	765 Pt platinum 78
	609 Cs caesium 55	613 Ba barium 56	615 La* lanthanum 57	864 Hf hafnium 72	867 Ta tantalum 73	870 W tungsten 74	872 Re rhenium 75	876 Os osmium 76	878 Ir iridium 77	885 Pt platinum 78
	669 Cs caesium 55	673 Ba barium 56	675 La* lanthanum 57	1024 Hf hafnium 72	1027 Ta tantalum 73	1030 W tungsten 74	1032 Re rhenium 75	1036 Os osmium 76	1038 Ir iridium 77	1045 Pt platinum 78
	729 Cs caesium 55	733 Ba barium 56	735 La* lanthanum 57	1284 Hf hafnium 72	1287 Ta tantalum 73	1290 W tungsten 74	1292 Re rhenium 75	1296 Os osmium 76	1298 Ir iridium 77	1305 Pt platinum 78
	789 Cs caesium 55	793 Ba barium 56	795 La* lanthanum 57	1544 Hf hafnium 72	1547 Ta tantalum 73	1550 W tungsten 74	1552 Re rhenium 75	1556 Os osmium 76	1558 Ir iridium 77	1565 Pt platinum 78
	849 Cs caesium 55	853 Ba barium 56	855 La* lanthanum 57	1804 Hf hafnium 72	1807 Ta tantalum 73	1810 W tungsten 74	1812 Re rhenium 75	1816 Os osmium 76	1818 Ir iridium 77	1825 Pt platinum 78
	909 Cs caesium 55	913 Ba barium 56	915 La* lanthanum 57	2064 Hf hafnium 72	2067 Ta tantalum 73	2070 W tungsten 74	2072 Re rhenium 75	2076 Os osmium 76	2078 Ir iridium 77	2085 Pt platinum 78
	969 Cs caesium 55	973 Ba barium 56	975 La* lanthanum 57	2324 Hf hafnium 72	2327 Ta tantalum 73	2330 W tungsten 74	2332 Re rhenium 75	2336 Os osmium 76	2338 Ir iridium 77	2345 Pt platinum 78
	1029 Cs caesium 55	1033 Ba barium 56	1035 La* lanthanum 57	2584 Hf hafnium 72	2587 Ta tantalum 73	2590 W tungsten 74	2592 Re rhenium 75	2596 Os osmium 76	2598 Ir iridium 77	2605 Pt platinum 78
	1089 Cs caesium 55	1093 Ba barium 56	1095 La* lanthanum 57	2844 Hf hafnium 72	2847 Ta tantalum 73	2850 W tungsten 74	2852 Re rhenium 75	2856 Os osmium 76	2858 Ir iridium 77	2865 Pt platinum 78
	1149 Cs caesium 55	1153 Ba barium 56	1155 La* lanthanum 57	3104 Hf hafnium 72	3107 Ta tantalum 73	3110 W tungsten 74	3112 Re rhenium 75	3116 Os osmium 76	3118 Ir iridium 77	3125 Pt platinum 78
	1209 Cs caesium 55	1213 Ba barium 56	1215 La* lanthanum 57	3364 Hf hafnium 72	3367 Ta tantalum 73	3370 W tungsten 74	3372 Re rhenium 75	3376 Os osmium 76	3378 Ir iridium 77	3385 Pt platinum 78
	1269 Cs caesium 55	1273 Ba barium 56	1275 La* lanthanum 57	3624 Hf hafnium 72	3627 Ta tantalum 73	3630 W tungsten 74	3632 Re rhenium 75	3636 Os osmium 76	3638 Ir iridium 77	3645 Pt platinum 78
	1329 Cs caesium 55	1333 Ba barium 56	1335 La* lanthanum 57	3884 Hf hafnium 72	3887 Ta tantalum 73	3890 W tungsten 74	3892 Re rhenium 75	3896 Os osmium 76	3898 Ir iridium 77	3905 Pt platinum 78
	1389 Cs caesium 55	1393 Ba barium 56	1395 La* lanthanum 57	4144 Hf hafnium 72	4147 Ta tantalum 73	4150 W tungsten 74	4152 Re rhenium 75	4156 Os osmium 76	4158 Ir iridium 77	4165 Pt platinum 78
	1449 Cs caesium 55	1453 Ba barium 56	1455 La* lanthanum 57	4404 Hf hafnium 72	4407 Ta tantalum 73	4410 W tungsten 74	4412 Re rhenium 75	4416 Os osmium 76	4418 Ir iridium 77	4425 Pt platinum 78
	1509 Cs caesium 55	1513 Ba barium 56	1515 La* lanthanum 57	4664 Hf hafnium 72	4667 Ta tantalum 73	4670 W tungsten 74	4672 Re rhenium 75	4676 Os osmium 76	4678 Ir iridium 77	4685 Pt platinum 78
	1569 Cs caesium 55	1573 Ba barium 56	1575 La* lanthanum 57	4924 Hf hafnium 72	4927 Ta tantalum 73	4930 W tungsten 74	4932 Re rhenium 75	4936 Os osmium 76	4938 Ir iridium 77	4945 Pt platinum 78
	1629 Cs caesium 55	1633 Ba barium 56	1635 La* lanthanum 57	5184 Hf hafnium 72	5187 Ta tantalum 73	5190 W tungsten 74	5192 Re rhenium 75	5196 Os osmium 76	5198 Ir iridium 77	5205 Pt platinum 78
	1689 Cs caesium 55	1693 Ba barium 56	1695 La* lanthanum 57	5444 Hf hafnium 72	5447 Ta tantalum 73	5450 W tungsten 74	5452 Re rhenium 75	5456 Os osmium 76	5458 Ir iridium 77	5465 Pt platinum 78
	1749 Cs caesium 55	1753 Ba barium 56	1755 La* lanthanum 57	5704 Hf hafnium 72	5707 Ta tantalum 73	5710 W tungsten 74	5712 Re rhenium 75	5716 Os osmium 76	5718 Ir iridium 77	5725 Pt platinum 78
	1809 Cs caesium 55	1813 Ba barium 56	1815 La* lanthanum 57	5964 Hf hafnium 72	5967 Ta tantalum 73	5970 W tungsten 74	5972 Re rhenium 75	5976 Os osmium 76	5978 Ir iridium 77	5985 Pt platinum 78
	1869 Cs caesium 55	1873 Ba barium 56	1875 La* lanthanum 57	6224 Hf hafnium 72	6227 Ta tantalum 73	6230 W tungsten 74	6232 Re rhenium 75	6236 Os osmium 76	6238 Ir iridium 77	6245 Pt platinum 78
	1929 Cs caesium 55	1933 Ba barium 56	1935 La* lanthanum 57	6484 Hf hafnium 72	6487 Ta tantalum 73	6490 W tungsten 74	6492 Re rhenium 75	6496 Os osmium 76	6498 Ir iridium 77	6505 Pt platinum 78
	1989 Cs caesium 55	1993 Ba barium 56	1995 La* lanthanum 57	6744 Hf hafnium 72	6747 Ta tantalum 73	6750 W tungsten 74	6752 Re rhenium 75	6756 Os osmium 76	6758 Ir iridium 77	6765 Pt platinum 78
	2049 Cs caesium 55	2053 Ba barium 56	2055 La* lanthanum 57	7004 Hf hafnium 72	7007 Ta tantalum 73	7010 W tungsten 74	7012 Re rhenium 75	7016 Os osmium 76	7018 Ir iridium 77	7025 Pt platinum 78
	2109 Cs caesium 55	2113 Ba barium 56	2115 La* lanthanum 57	7264 Hf hafnium 72	7267 Ta tantalum 73	7270 W tungsten 74	7272 Re rhenium 75	7276 Os osmium 76	7278 Ir iridium 77	7285 Pt platinum 78
	2169 Cs caesium 55	2173 Ba barium 56	2175 La* lanthanum 57	7524 Hf hafnium 72	7527 Ta tantalum 73	7530 W tungsten 74	7532 Re rhenium 75	7536 Os osmium 76	7538 Ir iridium 77	7545 Pt platinum 78
	2229 Cs caesium 55	2233 Ba barium 56	2235 La* lanthanum 57	7784 Hf hafnium 72	7787 Ta tantalum 73	7790 W tungsten 74	7792 Re rhenium 75	7796 Os osmium 76	7798 Ir iridium 77	7805 Pt platinum 78
	2289 Cs caesium 55	2293 Ba barium 56	2295 La* lanthanum 57	8044 Hf hafnium 72	8047 Ta tantalum 73	8050 W tungsten 74	8052 Re rhenium 75	8056 Os osmium 76	8058 Ir iridium 77	8065 Pt platinum 78
	2349 Cs caesium 55	2353 Ba barium 56	2355 La* lanthanum 57	8304 Hf hafnium 72	8307 Ta tantalum 73	8310 W tungsten 74	8312 Re rhenium 75	8316 Os osmium 76	8318 Ir iridium 77	8325 Pt platinum 78
	2409 Cs caesium 55	2413 Ba barium 56	2415 La* lanthanum 57	8564 Hf hafnium 72	8567 Ta tantalum 73	8570 W tungsten 74	8572 Re rhenium 75	8576 Os osmium 76	8578 Ir iridium 77	858

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Answer ALL questions.

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

1 This question is about mixtures and compounds.

(a) The box gives some methods used to separate mixtures.

chromatography	crystallisation
fractional distillation	simple distillation

Choose methods from the box to answer the following questions.

Each method may be used once, more than once or not at all.

(i) Identify a method to separate a single food dye from a mixture of food dyes. (1)

.....
(ii) Identify a method to separate gasoline from crude oil. (1)

.....
(iii) Identify a method to separate water from copper(II) sulfate solution. (1)

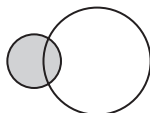
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(b) The diagram represents a molecule.



Explain why this molecule is a compound.

(2)

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.....

.....

.....

(c) The molecular formula of another compound is $C_3H_5N_3O_9$

(i) State the number of different elements in $C_3H_5N_3O_9$

(1)

.....

(ii) Determine the number of atoms in a molecule of $C_3H_5N_3O_9$

(1)

.....

(Total for Question 1 = 7 marks)



2 This question is about rusting.

(a) A simplified formula for rust is Fe_2O_3

(i) Name the two substances needed for iron to rust.

(2)

1

2

(ii) Give the chemical name for rust.

(1)

(iii) What type of reaction occurs in the rusting of iron?

(1)

- A** combustion
- B** neutralisation
- C** oxidation
- D** thermal decomposition

(b) Some iron objects are coated with a layer of zinc to prevent rusting.

(i) Name this type of rust prevention.

(1)

(ii) Explain how this type of rust prevention continues to protect iron when the layer of zinc is damaged.

(2)

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(iii) Give two other methods used to prevent iron from rusting.

(2)

1

.....

2

.....

(Total for Question 2 = 9 marks)

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3 This question is about states of matter.

(a) The box gives words relating to changes of state.

condensation	cooling	evaporation
freezing	melting	sublimation

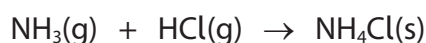
Complete the table by giving the correct word from the box for each change of state.

(3)

Change of state	Name of change
solid to liquid	
solid to gas	
liquid to solid	

(b) When ammonia gas and hydrogen chloride gas mix, they react together to form a white solid called ammonium chloride.

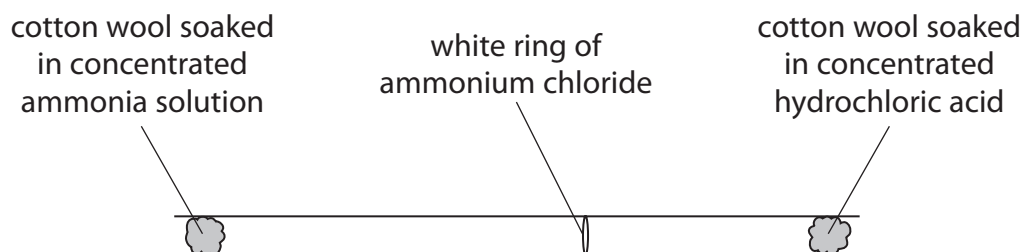
The equation for the reaction is



A teacher soaks a piece of cotton wool in concentrated ammonia solution and another piece of cotton wool in concentrated hydrochloric acid.

The teacher places the two pieces of cotton wool at opposite ends of a glass tube at the same time.

After several minutes, a white ring of solid ammonium chloride forms.



(i) State the name given to the spreading out of gas particles. (1)

(ii) State how the diagram shows that the particles of ammonia gas are travelling at higher speeds than the particles of hydrogen chloride gas. (1)

(iii) Gas particles travel at high speeds.
Give a reason why the white ring of ammonium chloride takes several minutes to form. (1)

(iv) Concentrated ammonia solution and concentrated hydrochloric acid are corrosive.
Give one safety precaution the teacher should take. (1)

(Total for Question 3 = 7 marks)

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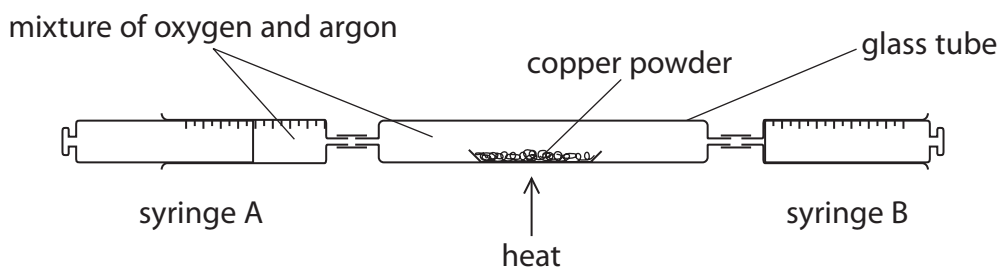
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- 4 A teacher uses this apparatus to find the percentage of oxygen in a gaseous mixture of oxygen and argon.



This is the teacher's method.

Step 1 heat the copper powder

Step 2 push the plunger on syringe A to pass the mixture of oxygen and argon over the hot copper so that the mixture moves into syringe B

Step 3 push the plunger on syringe B to pass the mixture of oxygen and argon over the hot copper so that the mixture moves into syringe A

Step 4 record the reading on syringe A

Step 5 repeat Steps 2, 3 and 4 a number of times

The volume of gas decreases as the oxygen reacts with the copper.

Argon is unreactive so does not react with the copper.

The copper powder turns black.

- (a) (i) Give a reason why the copper powder is heated.

(1)

- (ii) State why argon is unreactive.

(1)

- (iii) Give the name of the black powder that forms when the oxygen reacts with the copper.

(1)



(b) The table shows the teacher's results.

Reading number	Reading on syringe A in cm^3
Start	78
1	70
2	67
3	65
4	63
5	61
6	60
7	59
8	58
9	58
10	58

(i) State how the results show that all the oxygen has reacted.

(1)

(ii) The volume of gas in the glass tube and connecting tubes is 175 cm^3 .

Use this value and the results table to calculate the percentage of oxygen in the mixture of oxygen and argon.

(3)

percentage of oxygen = %



(iii) Suggest one reason why the calculated percentage of oxygen in the mixture may not be accurate.

(1)

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.....

(Total for Question 4 = 8 marks)

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- 5 (a) Complete the table to show the relative mass and relative charge of a proton and a neutron.

(2)

	Proton	Electron	Neutron
Relative mass		1/2000	
Relative charge		-1	

- (b) Magnesium has three isotopes.

- (i) State the meaning of the term **isotopes**.

(2)

.....

.....

.....

.....

- (ii) The symbol for an atom of one isotope of magnesium is



Give the number of protons, neutrons and electrons in one atom of this isotope.

(2)

number of protons

.....

number of neutrons

.....

number of electrons

.....



(iii) A sample of magnesium contains these percentages of the three isotopes.

Mg-24 = 79.00% Mg-25 = 10.00% Mg-26 = 11.00%

Use this information to show that the relative atomic mass of magnesium is 24.32

(2)

(iv) One mole of magnesium has a mass of 24.32 g.
There are 6.022×10^{23} atoms in one mole.

Calculate the mass, in grams, of one atom of magnesium.

Give your answer to 4 significant figures.

(2)

mass = g

(c) The equation for the reaction between magnesium and oxygen is



Determine the maximum amount, in moles, of magnesium oxide that can be produced from 0.50 mol of magnesium and 0.20 mol of oxygen.

(1)

amount = mol

(Total for Question 5 = 11 marks)

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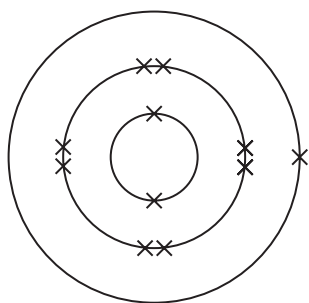
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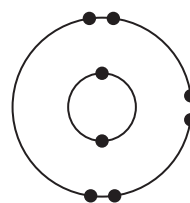
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6 This question is about sodium oxide, Na_2O

(a) The diagram shows the electronic configuration of atoms of sodium and oxygen.



Sodium



Oxygen

Describe the changes in the electronic configuration of the atoms of sodium and oxygen to form the ions in sodium oxide.

(3)

.....

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.....

.....

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.....

(b) Calculate the relative formula mass (M_r) of sodium oxide, Na_2O , using information from the Periodic Table.

(1)

$M_r =$



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(c) Explain why solid sodium oxide does not conduct electricity.

(2)

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.....

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.....

(d) Give a test to show that sodium oxide contains sodium ions.

(2)

.....

.....

.....

.....

(e) When sodium oxide is heated it reacts to form sodium metal and sodium peroxide, Na_2O_2

Complete the equation for this reaction.

(1)



(Total for Question 6 = 9 marks)



7 This question is about soluble and insoluble compounds.

A precipitate is an insoluble compound formed when solutions of soluble compounds react after mixing.

(a) Different solutions are mixed in separate test tubes.

Tube 1 copper(II) sulfate solution and calcium chloride solution

Tube 2 magnesium nitrate solution and potassium sulfate solution

Tube 3 sodium carbonate solution and copper(II) sulfate solution

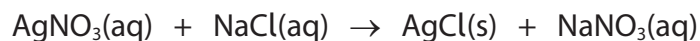
In which of the tubes will a precipitate form?

(1)

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

(b) A student mixes solutions, containing equal amounts in moles, of silver nitrate and sodium chloride.

The equation for the reaction between silver nitrate solution and sodium chloride solution is



(i) State the colour of the precipitate of silver chloride.

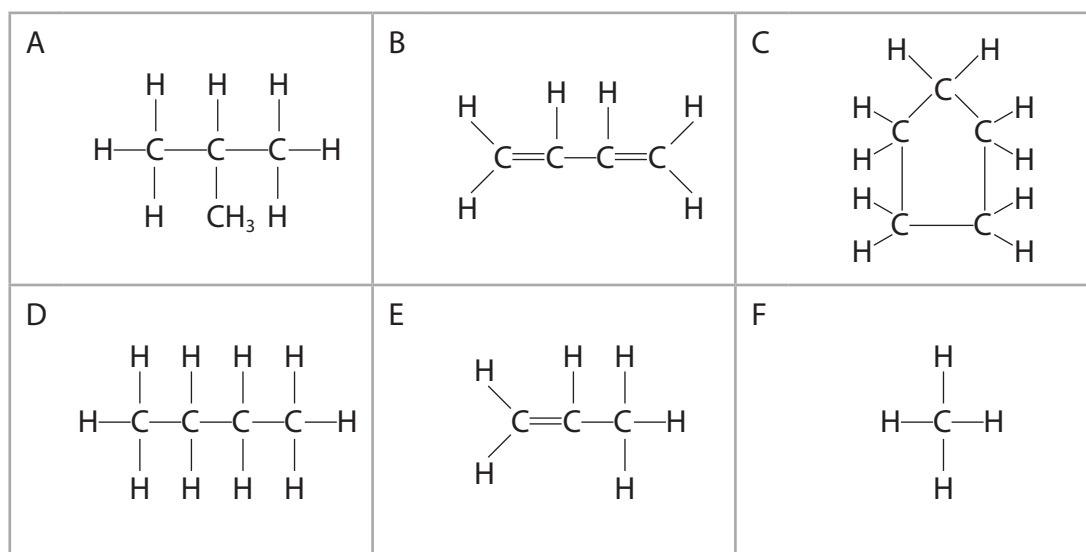
(1)

.....

.....



8 The table shows the structures of six organic compounds.



(a) (i) Give the letter of a compound **not** shown as a displayed formula. (1)

(ii) Give the letter of a saturated compound with the general formula C_nH_{2n} (1)

(iii) Name compound E. (1)

(iv) Explain why compound A and compound D are isomers. (2)

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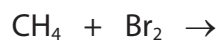
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(b) Compound F reacts with bromine in the presence of ultraviolet radiation.

(i) Complete the equation for the reaction.

(1)



(ii) Give the name of this type of reaction.

(1)

(c) (i) Another compound, G, has this percentage composition by mass.

C = 37.8% H = 6.3% Cl = 55.9%

Show by calculation that the empirical formula of compound G is $\text{C}_2\text{H}_4\text{Cl}$

(3)

(ii) The relative formula mass (M_r) of G is 127

Determine the molecular formula of G.

(2)

molecular formula =



(d) Compound E is used to make an addition polymer.

- (i) Complete the equation to show part of the polymer formed from two molecules of compound E.

(2)



- (ii) Give one problem caused by the disposal of addition polymers.

(1)

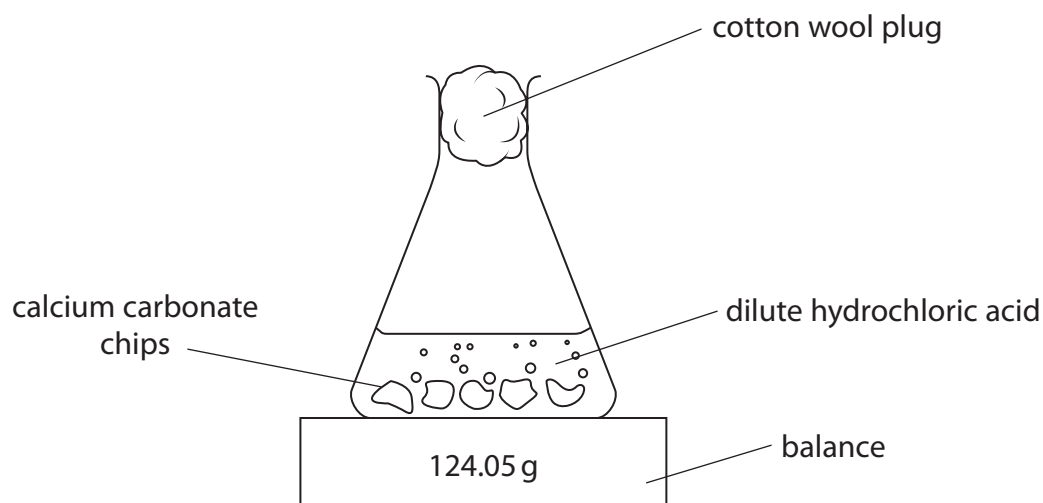
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(Total for Question 8 = 15 marks)



- 9 A student uses this apparatus to investigate the rate of reaction between calcium carbonate chips and dilute hydrochloric acid.



Every 20 seconds the student records the reading on the balance.

- (a) Explain why using a cotton wool plug increases the accuracy of the student's results.

(2)

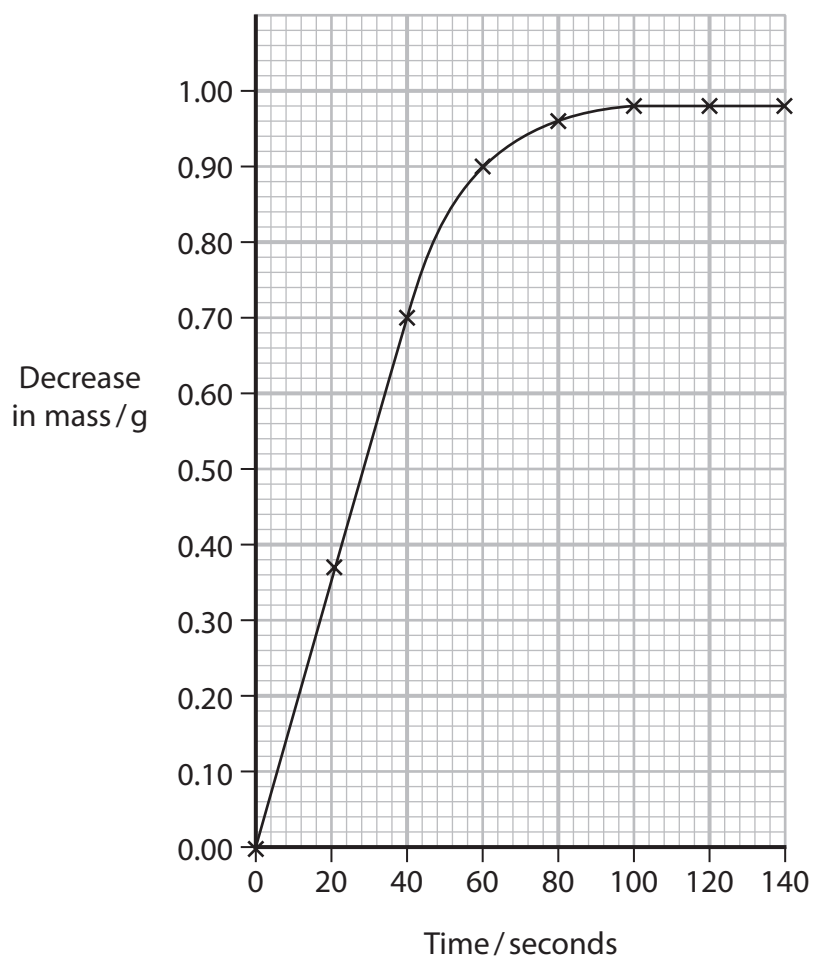
- (b) Complete the equation for the reaction by adding the state symbols.

(2)



- (c) The student uses the balance readings to find the decrease in mass of the flask and contents.

The graph shows the student's results.



- (i) Give a reason why there are some calcium carbonate chips remaining in the flask when the reaction stops.

(1)

- (ii) State how the student would know when the reaction has stopped.

(1)



(iii) Use the graph to determine the amount, in moles, of carbon dioxide produced during the reaction.

[M_r of $\text{CO}_2 = 44$]

(2)

amount = mol

(iv) Use the graph to calculate the rate of reaction, in grams per second, at time 60 seconds.

Show your working on the graph.

(3)

rate of reaction = g/s

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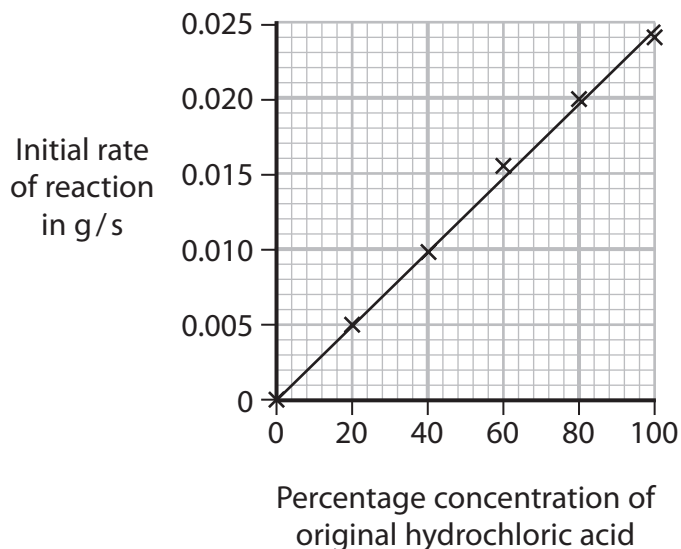


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(d) The student repeats the investigation by diluting the original hydrochloric acid.

The student then determines the initial rate of reaction at different percentage concentrations of the original hydrochloric acid.

The graph shows the student's results.



(i) Describe the relationship between the initial rate of reaction and percentage concentration of the original hydrochloric acid.

(2)

.....

.....

.....

.....

(ii) Explain why changing the concentration of hydrochloric acid has an effect on the initial rate of reaction.

(2)

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(Total for Question 9 = 15 marks)



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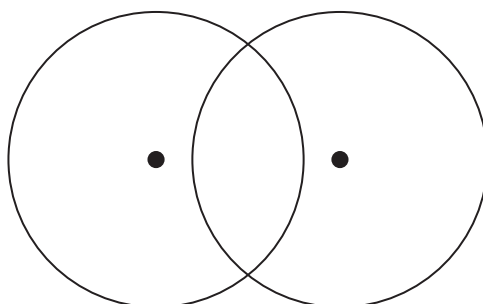


P 7 0 7 0 1 A 0 2 7 3 2

10 This question is about substances with covalent bonds.

- (a) (i) Draw a dot and cross diagram to show the outer shell electrons in a molecule of nitrogen, N_2

(2)



- (ii) Describe the forces of attraction in a covalent bond.

(2)

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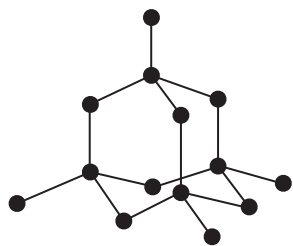
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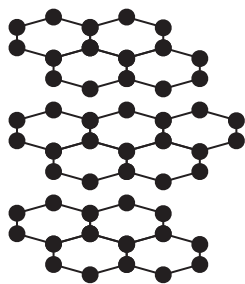
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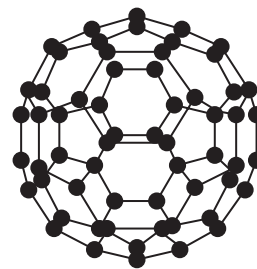
(b) The diagram shows three different structures of carbon.



Structure A



Graphite



C₆₀ fullerene

(i) Name structure A.

(1)

(ii) Graphite and C₆₀ fullerene contain covalent bonds, but have different structures.

Explain why C₆₀ fullerene has a much lower melting point than graphite.

Refer to structure and bonding in your answer.

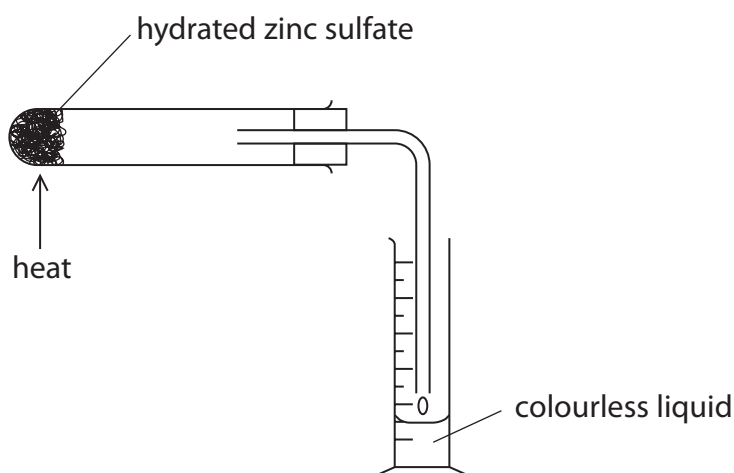
(4)

(Total for Question 10 = 9 marks)



P 7 0 7 0 1 A 0 2 9 3 2

11 A student uses this apparatus to heat crystals of hydrated zinc sulfate and collect the liquid produced.



(a) (i) Describe a chemical test to show that the colourless liquid contains water. (2)

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(ii) Describe a physical test to show the colourless liquid is pure water. (2)

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(b) The equation for the decomposition of hydrated zinc sulfate is



The student records these masses.

mass of boiling tube = 41.64 g

mass of boiling tube + $\text{ZnSO}_4 \cdot 7\text{H}_2\text{O}$ = 54.46 g

Calculate the maximum volume, in cm^3 , of pure water that could be produced.

Give your answer to 1 decimal place.

[1.00 cm^3 of pure water has a mass of 1.00 g]

[M_r of $\text{ZnSO}_4 \cdot 7\text{H}_2\text{O}$ = 287 M_r of H_2O = 18]

(5)

maximum volume of pure water = cm^3

(c) In an experiment using a different mass of $\text{ZnSO}_4 \cdot 7\text{H}_2\text{O}$ the maximum volume of pure water that could be produced is 8.5 cm^3 .

The student collected the pure water and calculated the percentage yield to be 20.3%.

(i) Calculate the volume, in cm^3 , of pure water collected.

(1)

volume of pure water = cm^3



(ii) Explain an improvement to the apparatus that would increase the percentage yield of pure water.

(2)

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(Total for Question 11 = 12 marks)

TOTAL FOR PAPER = 110 MARKS

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