Write your name here

Surname	Other names

Edexcel IGCSE

Centre Number | Candidate Number

Chemistry

Unit: 4CH0
Paper: 2C

Wednesday 15 June 2011 – Morning
Time: 1 hour

Paper Reference
4CH0/2C

You must have:
Ruler
Candidates may use a calculator.

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 60.
- 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.
- Keep an eye on the time.
- Write your answers neatly and in good English.
- Try to answer every question.
- Check your answers if you have time at the end.

P38732A

1/1/1/1/1/1/

P 3 8 7 3 2 A 0 1 2 0

edexcel
advancing learning, changing lives

THE PERIODIC TABLE

Period	Group 1	2											3	4	5	6	7	0
1							1 H Hydrogen 1											4 He Helium 2
2	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
3	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
4	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
5	86 Rb Rubidium 37	88 Sr Strontium 38	89 Y Yttrium 39	91 Zr Zirconium 40	93 Nb Niobium 41	96 Mo Molybdenum 42	99 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
6	133 Cs Caesium 55	137 Ba Barium 56	139 La Lanthanum 57	179 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	210 Po Polonium 84	210 At Astatine 85	222 Rn Radon 86
7	223 Fr Francium 87	226 Ra Radium 88	227 Ac Actinium 89															

Key

Relative atomic mass
Symbol
Name
Atomic number

P 3 8 7 3 2 A 0 2 2 0

Answer ALL questions.

1 A small piece of potassium is added to water.

The list below shows some statements.

Only four of these statements describe what happens when potassium reacts with water.

Place a cross (☒) in the box next to each of the **four** correct statements.

potassium oxide solution is formed	☒
fizzing occurs	☒
potassium sinks to the bottom of the water	☒
potassium moves around	☒
potassium melts	☒
bubbles of oxygen gas are produced	☒
a lilac flame is seen	☒
potassium reacts to form an acidic solution	☒

(Total for Question 1 = 4 marks)

2 Choose the name of a substance from the box to answer parts (a) to (e).

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

ammonia	**chlorine**	**haematite**	**iron**	**sodium hydroxide**

Give the name of

(a) a solid that conducts electricity.

(1)

....

(b) a metal ore.

(1)

....

(c) a substance formed in the Haber process.

(1)

....

(d) a substance used to make soap.

(1)

....

(e) a substance used to make fertilisers.

(1)

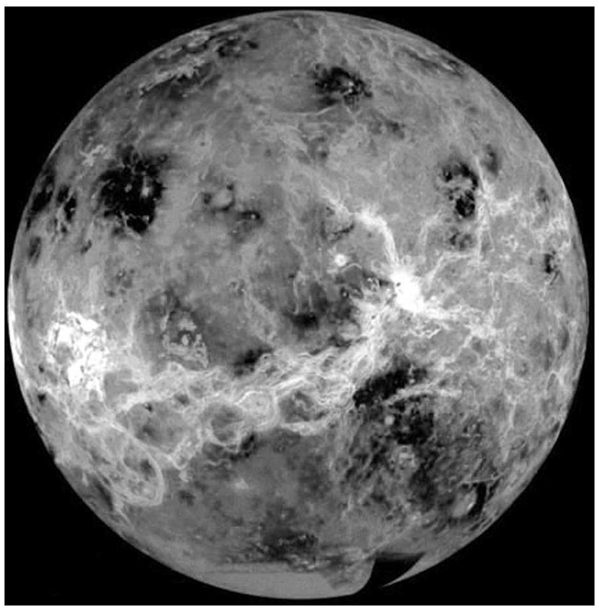
....

(Total for Question 2 = 5 marks)

BLANK PAGE

Turn over

3 The photograph shows the planet Venus.



Although Venus is similar in size to the Earth, it is very different in other ways.

The temperature at the surface of Venus is about 470 °C. The atmospheric pressure is 90 times that of the Earth.

The clouds in the atmosphere of Venus are made up of droplets of sulfuric acid.

The table lists some properties of metals that could be used to make a space probe to land on Venus.

Metal	Melting point in °C	Relative density	Reaction with sulfuric acid
copper	1083	8.9	no reaction
lead	328	11.3	no reaction
magnesium	650	1.7	fizzes vigorously
nickel	1453	8.9	fizzes slowly
titanium	1675	4.5	no reaction
zinc	420	7.1	fizzes quite vigorously

The probe needs to be launched with enough energy to escape the Earth's gravity. To make this easier, the mass of the probe needs to be as low as possible. The probe also needs to withstand the conditions on the surface of Venus.

Use the information in the table to answer parts (a) to (c).

(a) (i) Which metal in the table could be used to make a probe with the lowest density?
(1)

....

(ii) Why would this metal be unsuitable for making a probe to land on Venus?
(1)

....

....

(b) Very small amounts of lead can be used in electrical circuits.

Why would lead **not** be suitable for use in the electrical circuits of a probe to land on Venus?
(1)

....

....

(c) Choose a metal from the table that would be the **most** suitable for making a probe to land on Venus. Give **two** reasons for your choice.
(3)

Metal

....

Reasons

1 ....

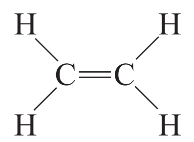
....

2 ....

....

(Total for Question 3 = 6 marks)

4 Here are some statements about the compound ethene.

- ethene has the displayed formula 
- ethene is a gas at room temperature
- ethene burns with a smoky flame
- ethene is unsaturated
- ethene is insoluble in water
- ethene can be prepared from ethanol
- ethene is used to make the polymer poly(ethene)

(a) (i) State why ethene is described as **unsaturated**.

(1)

....

....

(ii) Describe a chemical test to show that ethene is an alkene.

(2)

Test

....

Result

....

(b) (i) Complete the following equation that represents the preparation of ethene from ethanol.

(1)

$$C_2H_5OH \rightarrow C_2H_4 + \dots\dots\dots\dots$$

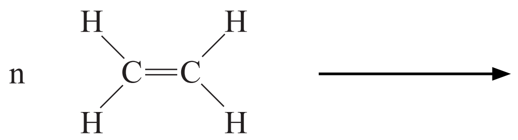
(ii) What is the name given to this type of reaction?

(1)

....

(c) Complete the equation to show the formation of poly(ethene) from ethene.

(2)



(Total for Question 4 = 7 marks)

5 When soap is shaken with water, a lather forms. A lather is a collection of small bubbles that form on the surface of the water.

Very little soap is needed to form a lather with pure water.

Water that needs a much larger quantity of soap to form a lather is called hard water.

Water becomes hard when certain compounds are dissolved in it.

A student carried out an experiment to find out which compounds make water hard.

This is the method she used.

- Equal amounts of five different compounds were dissolved in equal volumes of pure water in separate test tubes.
- Soap solution was added to each test tube, one drop at a time. One drop of soap solution has a volume of 0.05 cm^3.
- The test tubes were shaken after each addition of soap solution. Soap solution was added drop by drop until a lather formed on shaking.
- The volume of soap solution needed to form a lather was recorded.
- The experiment was repeated three times with each compound.
- Pure water was also tested in the same way.

Her results are shown in the table:

Compound	Volume of soap solution needed to form a lather in cm^3		
	Experiment 1	Experiment 2	Experiment 3
sodium chloride	0.10	0.15	0.10
magnesium chloride	1.60	1.70	1.65
calcium chloride	2.15	2.30	2.25
potassium chloride	0.10	0.05	0.10
iron(II) chloride	1.95	4.30	1.90
pure water	0.10	0.10	0.10

(a) Name **two** compounds that made the water hard.

(2)

.... and ....

(b) Why did the student carry out the experiment three times with each compound?

(1)

....

....

(c) (i) Circle the anomalous result in the table.

(1)

(ii) What should the student have done after she identified this anomalous result?

(1)

....

....

(d) Place a cross (☒) in **one** box next to the name of the apparatus that the student should use to add the soap solution.

(1)

beaker ☒

burette ☒

measuring cylinder ☒

pipette ☒

(e) Calculate the average (mean) volume of soap solution needed to form a lather with the magnesium chloride solution. Give your answer to two decimal places.

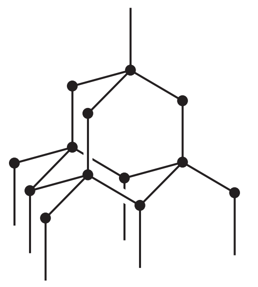
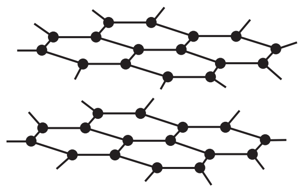
(2)

Average (mean) = ... cm^3

(Total for Question 5 = 8 marks)

6 Diamond and graphite are two naturally-occurring forms of carbon.

The diagrams below show the arrangement of the carbon atoms in diamond and in graphite. The black dots (•) represent carbon atoms.

Diamond	Graphite
	

(a) Name the type of structure in diamond and explain, in terms of its bonding, why diamond has a high melting point.

(4)

....

....

....

....

....

....

....

....

(b) Explain, in terms of its structure, why graphite can act as a lubricant.

(2)

....

....

....

....

(c) The structure of graphite has one feature in common with that of metals. This feature allows graphite to conduct electricity.

Suggest what this feature is and why it allows graphite to conduct electricity.

(2)

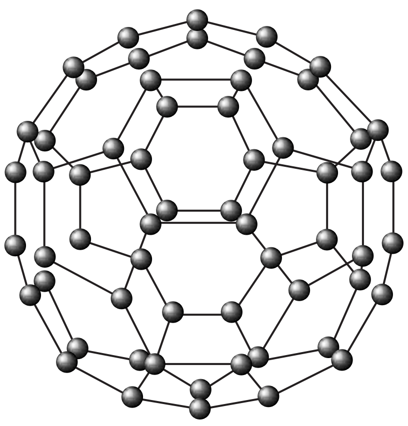
....

....

....

(d) In 1985, a new form of carbon was discovered. It was called buckminsterfullerene after the architect Buckminster Fuller, who designed buildings with complex geometric shapes.

Buckminsterfullerene (C_{60}) has a simple molecular structure containing 60 carbon atoms per molecule. It looks a little bit like a football.



Suggest why buckminsterfullerene has a much lower melting point than diamond.

(2)

....

....

....

....

(Total for Question 6 = 10 marks)

7 Sodium azide (NaN_3) is a stable compound at room temperature but decomposes when heated to 300 °C. The equation for the decomposition is:

$$2NaN_3(s) \rightarrow 2Na(l) + 3N_2(g)$$

Sodium azide is used to produce nitrogen gas to inflate car airbags.

If a car is involved in a collision, the sodium azide decomposes.

The nitrogen gas is produced very rapidly and the airbag inflates almost immediately.

(a) (i) A fully-inflated airbag has a total volume of 108 dm^3.
Calculate the amount of nitrogen, in moles, in a fully-inflated airbag.
[You should assume that the volume of one mole of nitrogen inside the airbag is 24 dm^3]

(2)

Amount of nitrogen = ... mol

(ii) Use your answer to (a)(i) to calculate the mass, in grams, of sodium azide required to produce 108 dm^3 of nitrogen.

(3)

Mass of sodium azide required = ... g

(b) The airbag also contains potassium nitrate. This reacts with sodium formed in the decomposition of sodium azide. The equation for the reaction is:

$$10Na(l) + 2KNO_3(s) \rightarrow K_2O(s) + 5Na_2O(s) + N_2(g)$$

(i) Suggest **one** reason why the makers of the airbag might want this reaction to occur.

(1)

....

(ii) The airbag also contains silicon dioxide (SiO_2) which reacts with the oxides produced in the reaction above. This forms a glassy solid which seals all the products into the airbag.

The glassy solid contains potassium silicate (K_2SiO_3).

Construct an equation for the formation of potassium silicate from potassium oxide. **Include state symbols**.

(1)

....

(c) Another use of sodium azide is to make lead(II) azide, which can be used as a detonator for explosives. Lead(II) azide has the formula of $Pb(N_3)_2$

Lead(II) azide can be made by the following reaction:

$$Pb(NO_3)_2(aq) \;+\; 2NaN_3(aq) \;\rightarrow\; Pb(N_3)_2(s) \;+\; 2NaNO_3(aq)$$

(i) What name is given to this type of reaction?

(1)

....

(ii) What method would you use to remove the lead(II) azide from the final reaction mixture?

(1)

....

(Total for Question 7 = 9 marks)

8 The following verse is about water (H_2O) and dilute sulfuric acid (H_2SO_4).

Johnny was a chemist's son

But Johnny is no more

What Johnny thought was H_2O

Was H_2SO_4

(a) Johnny looked at a beaker containing sulfuric acid and thought that it was water. He then drank the liquid.

Suggest why it is possible to mistake sulfuric acid for water.

(1)

....

(b) Anhydrous copper(II) sulfate changes from white to blue when added to dilute sulfuric acid. Suggest why.

(1)

....

....

(c) Sulfuric acid is manufactured by the contact process.

One stage of this process involves the reaction of sulfur dioxide with oxygen.

$$2\ SO_2 + O_2 \rightleftharpoons 2\ SO_3$$

State the conditions used in this stage of the process.

(3)

Pressure (in atmospheres)

....

Temperature (in °C)

....

Catalyst

....

(d) 10.0 cm^3 of a concentrated solution of sulfuric acid was carefully diluted with water. More water was then added until the final volume of the solution was 1.00 dm^3 (1000 cm^3).

In an experiment, a student found that 25.0 cm^3 of the diluted sulfuric acid reacted with 30.00 cm^3 of sodium hydroxide solution.

The concentration of the sodium hydroxide solution was 0.200 mol/dm^3.

The equation for the reaction is:

$$2NaOH + H_2SO_4 \rightarrow Na_2SO_4 + 2H_2O$$

(i) Calculate the amount, in moles, of sodium hydroxide in 30.00 cm^3 of a solution of concentration 0.200 mol/dm^3.

(2)

Amount of sodium hydroxide = ... mol

(ii) Using your answer to (d)(i), calculate the amount, in moles, of sulfuric acid in 25.0 cm^3 of the **diluted** acid.

(1)

Amount of sulfuric acid in 25.0 cm^3 = ... mol

(iii) Using your answer to (d)(ii), calculate the concentration, in mol/dm^3, of the diluted sulfuric acid.

(2)

Concentration of the diluted sulfuric acid = ... mol/dm^3

(iv) Using your answer to (d)(iii), calculate the concentration, in mol/dm^3, of the **original**, **concentrated** sulfuric acid.

(1)

Concentration of the original, concentrated acid = ... mol/dm^3

(Total for Question 8 = 11 marks)

(TOTAL FOR PAPER = 60 MARKS)

BLANK PAGE