Write your name here

Surname	Other names

Edexcel
International GCSE

Centre Number | | | | | |

Candidate Number | | | | |

Chemistry

Unit: 4CH0
Paper: 2CR

Monday 10 June 2013 – Afternoon
Time: 1 hour

Paper Reference
4CH0/2CR

You must have:
Ruler
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.

Turn over ▶

P43318A

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P 4 3 3 1 8 A 0 1 1 6

PEARSON

THE PERIODIC TABLE

Period	1	2											3	4	5	6	7	0
	Group																	
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 4 3 3 1 8 A 0 2 1 6

Answer ALL questions.

1 Use the Periodic Table on page 2 to help you answer this question.

Give the name or symbol of

(a) the element in group 3 and period 4.

(1)

.....

(b) an element in period 3 that is a good conductor of electricity.

(1)

.....

(c) the element in group 7 that is the most reactive.

(1)

.....

(d) the element in group 5 that is present in a molecule of ammonia.

(1)

.....

(e) an element with an atom containing 8 electrons in its outer shell.

(1)

.....

(Total for Question 1 = 5 marks)

2 (a) The list shows some techniques used to separate mixtures.

A crystallisation

B filtration

C fractional distillation

D paper chromatography

E simple distillation

Complete the table to show the best method of obtaining each substance from the mixture.

In each case, choose one of the letters A, B, C, D or E. Each letter may be used once, more than once or not at all.

(4)

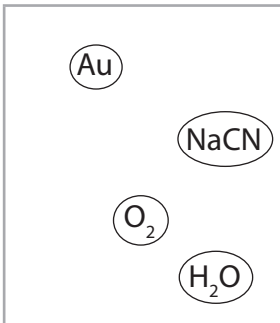
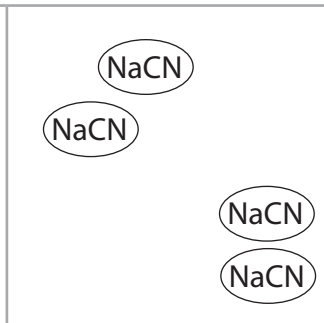
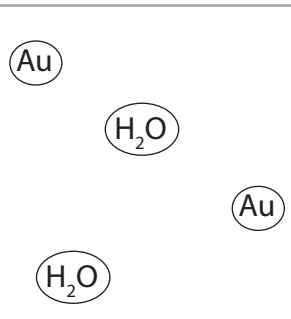
Substance	Mixture	Letter
sand	sand and water	
solid copper(II) sulfate	aqueous copper(II) sulfate	
red food dye	mixture of food dyes	
kerosene	crude oil	

(b) Gold occurs in ores, which are mixtures of gold and other substances. Several elements and compounds are used in the extraction of gold from its ores.

Each box below represents the substances present in one part of the extraction process.

Classify the contents of each box as a compound, an element or a mixture by writing your choice below each box.

(3)

			
Compound, element or mixture			

(Total for Question 2 = 7 marks)

3 A student added some pieces of iron to a boiling tube containing dilute hydrochloric acid. She observed fizzing and the formation of a solution, X.

(a) Identify the gas that causes the fizzing and describe a test for it.

(2)

Gas .....

Test .....

.....

(b) Solution X contains chloride ions.

(i) The student confirmed this by adding some silver nitrate solution. She observed a white precipitate of silver chloride.

Give the formula of the white precipitate, and name the other solution she should have added before the silver nitrate solution.

(2)

Formula of white precipitate .....

Other solution .....

(ii) Complete the word equation for the reaction in this test.

(1)

iron chloride + silver nitrate → silver chloride + ...

(c) Solution X also contains ions of iron. The student thought that these ions had the formula Fe^{2+} or Fe^{3+}.

What reagent should she add to decide whether solution X contains Fe^{2+} or Fe^{3+} ions? State the result of the test in each case.

(3)

Reagent .....

Result with Fe^{2+} ions .....

.....

Result with Fe^{3+} ions .....

.....

(Total for Question 3 = 8 marks)

4 A teacher added some of the Group 1 elements to separate samples of water.

(a) State two observations that could be made when a small piece of sodium is added to a large trough containing water.

(2)

1 .....

.....

2 .....

.....

(b) In another experiment she added a small piece of a different Group 1 element and noticed that the reaction was less vigorous.

Which element did she add in this experiment?

(1)

.....

(c) In another experiment she added a small piece of potassium to a large trough containing water. This time she observed a lilac flame.

(i) Identify the gas that burned.

(1)

.....

(ii) Give the formula of the ion that caused the flame to be lilac.

(1)

.....

(d) When the Group 1 elements react with water, each of their atoms loses an electron from its outer shell. For sodium and potassium, these processes can be represented by the equations

- $Na \rightarrow Na^+ + e^-$
- $K \rightarrow K^+ + e^-$

Explain, by referring to the electronic configurations of sodium and potassium, why potassium is more reactive than sodium.

(4)

(Total for Question 4 = 9 marks)

5 Fractional distillation and cracking are important steps in processing crude oil.

(a) Place ticks (✓) in the columns to show which statements apply to each step.
You may place a tick in one column, in both columns or in neither column.

The first one has been done for you.

(5)

Statement	Fractional distillation	Cracking
Crude oil is heated	✓	
A catalyst may be used		
Alkenes are formed		
Decomposition reactions occur		
Fuels are obtained		
Separation is the main purpose		

(b) The formula $CH_3CH_2CH_2CH_2CH_3$ represents one of the compounds in crude oil.

(i) Give the molecular formula of this compound.

(1)

.....

(ii) Give the displayed formula of this compound.

(1)

(iii) Give the empirical formula of this compound.

(1)

.....

(iv) Give the name of this compound.

(1)

.....

(v) Give the general formula of the homologous series that contains this compound.

(1)

.....

(c) The products of the complete combustion of hydrocarbons are carbon dioxide and water.

(i) Balance the equation to show the complete combustion of ethene (C_2H_4).

(2)

$$C_2H_4 + \ldots\ldots O_2 \rightarrow \ldots\ldots CO_2 + \ldots\ldots H_2O$$

(ii) Draw a dot and cross diagram to show the bonding in an ethene molecule.

Show only the outer electrons in each atom.

(2)

(d) Ethanol can be manufactured by the hydration of ethene. The equation for this reaction is

$$C_2H_4(g) + H_2O(g) \rightarrow C_2H_5OH(g)$$

(i) Identify the catalyst and state the temperature used in this process.

(2)

Catalyst .....

Temperature .....

(ii) A 20 mol sample of ethanol was produced using this reaction.

Deduce the amount, in moles, of ethene needed and the volume, in dm^3, that this amount of ethene would occupy at room temperature and pressure.

Assume that all of the ethene is converted into ethanol and that the molar volume of ethene is 24 dm^3 at rtp.

(3)

Amount of ethene ..... mol

Volume of ethene

Volume = ... dm^3

(Total for Question 5 = 19 marks)

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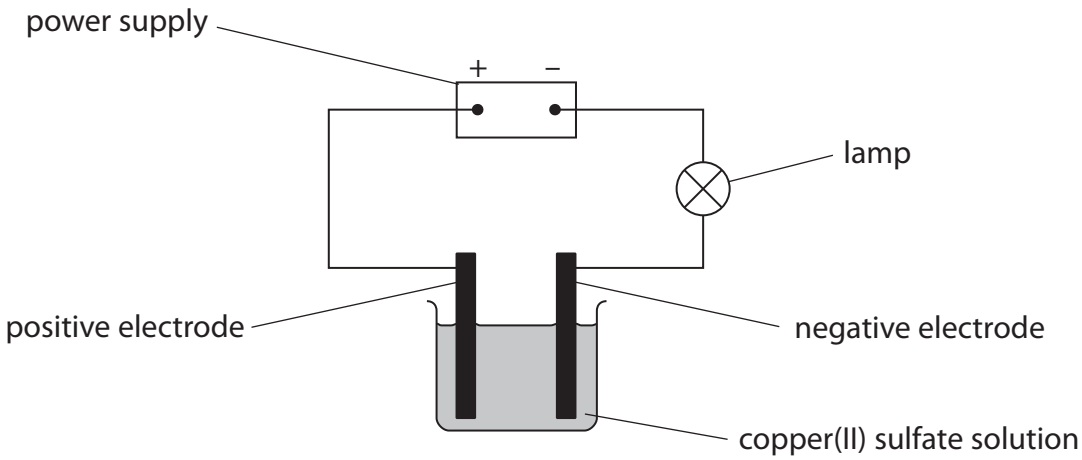
6 Most experiments involving electrolysis use inert electrodes, which do not take part in the reactions. However, in some experiments the electrodes do take part in the reactions.

A student investigates the electrolysis of copper(II) sulfate solution using copper electrodes which do take part in the reaction. She uses this apparatus.



She uses this method.

- weigh two clean strips of copper
- use one strip as the positive electrode and the other as the negative electrode
- after electrolysis wash the strips of copper with ethanol (a liquid that boils at 78 °C)
- dry the strips of copper and reweigh them

The ionic half-equations for the reactions at the electrodes are

Positive electrode $Cu(s) - 2e^- \rightarrow Cu^{2+}(aq)$

Negative electrode $Cu^{2+}(aq) + 2e^- \rightarrow Cu(s)$

(a) Suggest why the copper strips would dry more quickly when washed with ethanol rather than with water.

(1)

.....

(b) The student's results are shown in the table.

	Positive electrode	Negative electrode
Mass of electrode before electrolysis in g	8.78	7.95
Mass of electrode after electrolysis in g	8.46	8.25

The table shows that the decrease in mass of the positive electrode was 0.32 g.

(i) Calculate the increase in mass, in grams, of the negative electrode.

(1)

Increase in mass = ... g

(ii) The ionic half-equations show that the increase in mass of the negative electrode should be the same as the decrease in mass of the positive electrode.

Suggest two reasons why the increase in mass of the negative electrode in the student's experiment was less than expected.

(2)

1 .....

.....

2 .....

.....

(c) Another student investigated the effect of changing the electrical charge, in faradays, passed during the electrolysis.

He wanted to find how this affected the increase in mass of the negative electrode.

One faraday is the electrical charge of one mole of electrons.

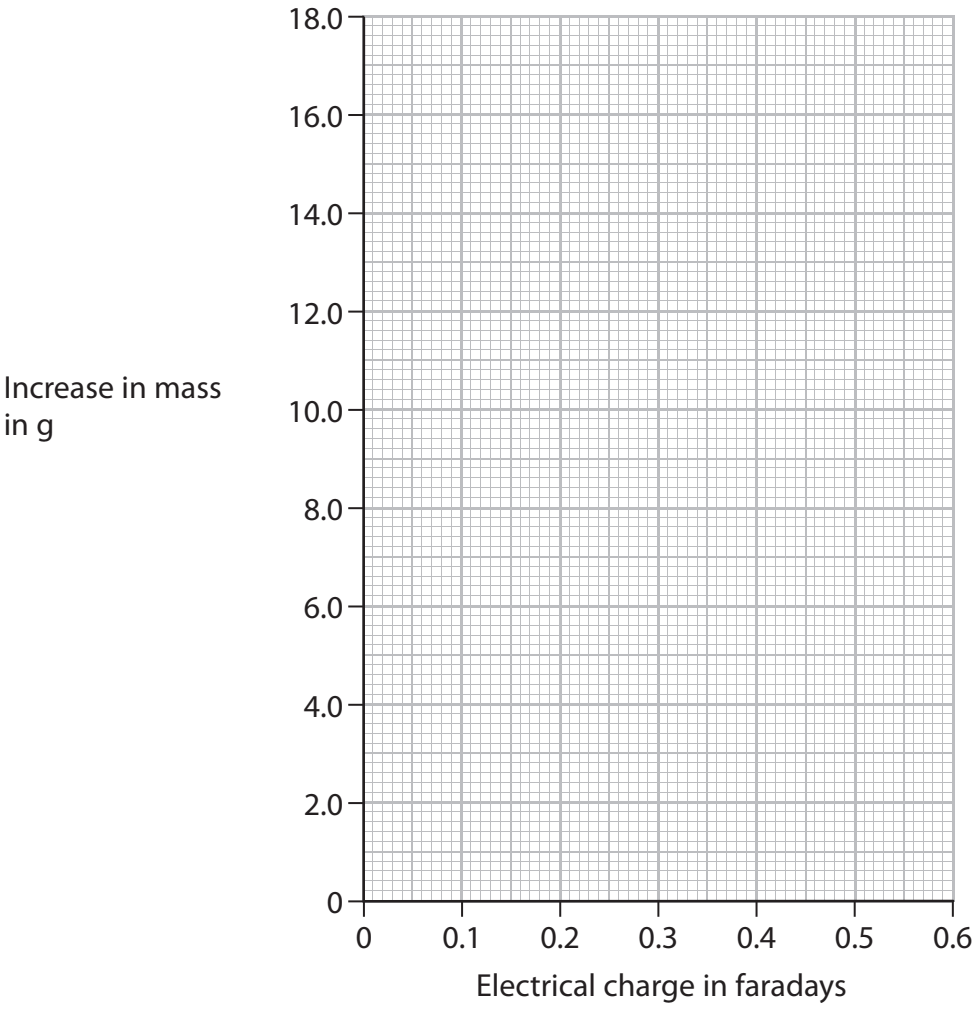
His results are shown in the table.

Experiment	1	2	3	4	5	6	7	8	9
Electrical charge in faradays	0.10	0.15	0.20	0.25	0.30	0.35	0.40	0.45	0.50
Increase in mass in g	3.20	4.80	7.40	8.00	9.60	11.20	12.80	14.40	16.00

(i) On the grid, plot a graph of increase in mass against electrical charge.

Draw a straight line of best fit. Start your line at the origin (0,0).

(3)



(ii) Draw a circle around the anomalous result.

(1)

(iii) Suggest why the straight line should go through the origin.

(1)

.....

.....

(iv) Explain why the graph shows that the increase in mass is directly proportional to the electrical charge passed.

(1)

.....

.....

(v) Use your graph to estimate the increase in mass, in grams, of the copper electrode that would be produced by passing an electrical charge of 0.55 faradays.

(2)

Increase in mass = ... g

(Total for Question 6 = 12 marks)

TOTAL FOR PAPER = 60 MARKS

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