

Write your name here	
Surname	Other names
Edexcel	Centre Number
International GCSE	Candidate Number
<h1 style="margin: 0;">Chemistry</h1> <p style="margin: 5px 0;">Unit: 4CH0</p> <p style="margin: 5px 0;">Paper: 2CR</p>	
Monday 10 June 2013 – Afternoon	Paper Reference
Time: 1 hour	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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1/1/1/



P 4 3 3 1 8 A 0 1 1 6

PEARSON

THE PERIODIC TABLE

0

7

6

5

4

3

Group

2

1

Period

4	He	Helium	2
---	----	--------	---

1	H	Hydrogen	1
---	---	----------	---

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													13	Al Aluminium	27	Si Silicon	28	P Phosphorus	31	S Sulfur	32	Cl Chlorine	35.5	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								
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	106	Rh Rhodium 45	108	Ag Silver 47	112	Cd Cadmium 48	115	In Indium 49	119	Sn Tin 50	127	I Iodine 53	131	Xe Xenon 54														
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								
223	Fr Francium 87	226	Ra Radium 88	227	Ac Actinium 89													81	Th Thorium 90	90	Pa Protactinium 91	92	U Uranium 92	94	Np Neptunium 94	96	Pu Plutonium 96	98	Am Americium 98	100	Cm Curium 100	102	Bk Berkelium 102	104	Cf Californium 104	106	Es Einsteinium 106	108	Fm Fermium 108	110	Mn Mendelevium 110	112	Lr Lawrencium 112

Key

Relative atomic mass
Symbol
Name
Atomic number



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)

Ga

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

(1)

Na, Mg, Al

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

(1)

F

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

(1)

N

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

(1)

Ne, Ar, Kr, Xe, Rn

(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	B
solid copper(II) sulfate	aqueous copper(II) sulfate	A
red food dye	mixture of food dyes	D
kerosene	crude oil	C

(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)

	<div style="display: flex; flex-direction: column; align-items: center;"> <div style="border: 1px solid black; border-radius: 50%; padding: 5px; margin: 5px;">Au</div> <div style="border: 1px solid black; border-radius: 50%; padding: 5px; margin: 5px;">NaCN</div> <div style="border: 1px solid black; border-radius: 50%; padding: 5px; margin: 5px;">O₂</div> <div style="border: 1px solid black; border-radius: 50%; padding: 5px; margin: 5px;">H₂O</div> </div>	<div style="display: flex; flex-direction: column; align-items: center;"> <div style="border: 1px solid black; border-radius: 50%; padding: 5px; margin: 5px;">NaCN</div> <div style="border: 1px solid black; border-radius: 50%; padding: 5px; margin: 5px;">NaCN</div> <div style="border: 1px solid black; border-radius: 50%; padding: 5px; margin: 5px;">NaCN</div> <div style="border: 1px solid black; border-radius: 50%; padding: 5px; margin: 5px;">NaCN</div> </div>	<div style="display: flex; flex-direction: column; align-items: center;"> <div style="border: 1px solid black; border-radius: 50%; padding: 5px; margin: 5px;">Au</div> <div style="border: 1px solid black; border-radius: 50%; padding: 5px; margin: 5px;">H₂O</div> <div style="border: 1px solid black; border-radius: 50%; padding: 5px; margin: 5px;">H₂O</div> <div style="border: 1px solid black; border-radius: 50%; padding: 5px; margin: 5px;">Au</div> </div>
Compound, element or mixture	Mix	Com	Ele

(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 H₂

Test use lit splint to see if it pops

(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 AgCl

Other solution HNO₃

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

(1)

iron chloride + silver nitrate → silver chloride + iron chloride

(c) Solution X also contains ions of iron. The student thought that these ions had the formula Fe²⁺ or Fe³⁺.

What reagent should she add to decide whether solution X contains Fe²⁺ or Fe³⁺ ions? State the result of the test in each case.

(3)

Reagent NaOH (aq)

Result with Fe²⁺ ions Green precip

Result with Fe³⁺ ions Brown precip

(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 • fizzing

• moves

2 • disappears

• melts.

(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)

Li

(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)

H₂

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

(1)

K⁺



4 (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

- $\text{Na} \rightarrow \text{Na}^+ + \text{e}^-$
- $\text{K} \rightarrow \text{K}^+ + \text{e}^-$

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

(4)

• Na is 2, 8, 1

• K is 2, 8, 8, 1

• Outer electron lost from K is further from nucleus.

• less attracted by nucleus.

(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.

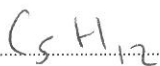
(5)

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 $\text{CH}_3\text{CH}_2\text{CH}_2\text{CH}_2\text{CH}_3$ represents one of the compounds in crude oil.

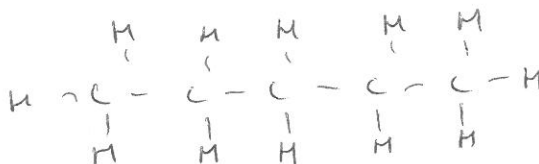
- (i) Give the molecular formula of this compound.

(1)



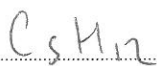
- (ii) Give the displayed formula of this compound.

(1)



- (iii) Give the empirical formula of this compound.

(1)



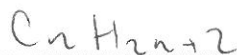
- (iv) Give the name of this compound.

(1)

Pentane

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

(1)



5 (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).

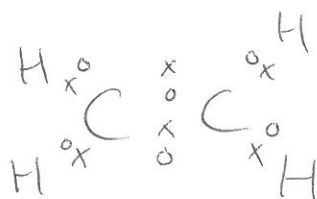
(2)



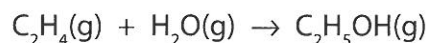
(ii) Draw a dot and cross diagram to show the bonding in an ethene molecule.

Show only the outer electrons in each atom.

(2)



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



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

(2)

Catalyst..... H_3PO_4

Temperature..... 300°C

- (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..... 20 mol

Volume of ethene..... 20×24

Volume = 480 dm^3

(Total for Question 5 = 19 marks)



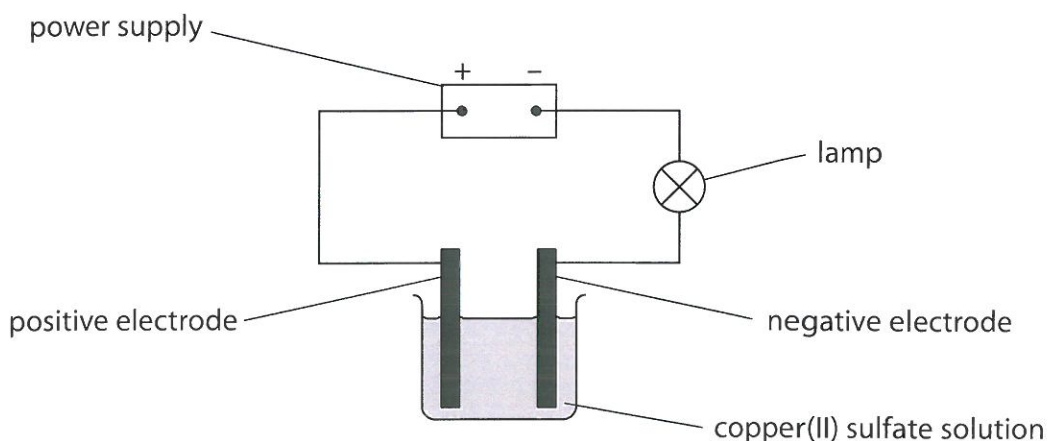
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P 4 3 3 1 8 A 0 1 1 1 6

- 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



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

(1)

lower boiling point (than water)



6 (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 = 0.30 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 some Cu did not stick to electrode
(anode)

2 positive electrode impure



- 6 (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.

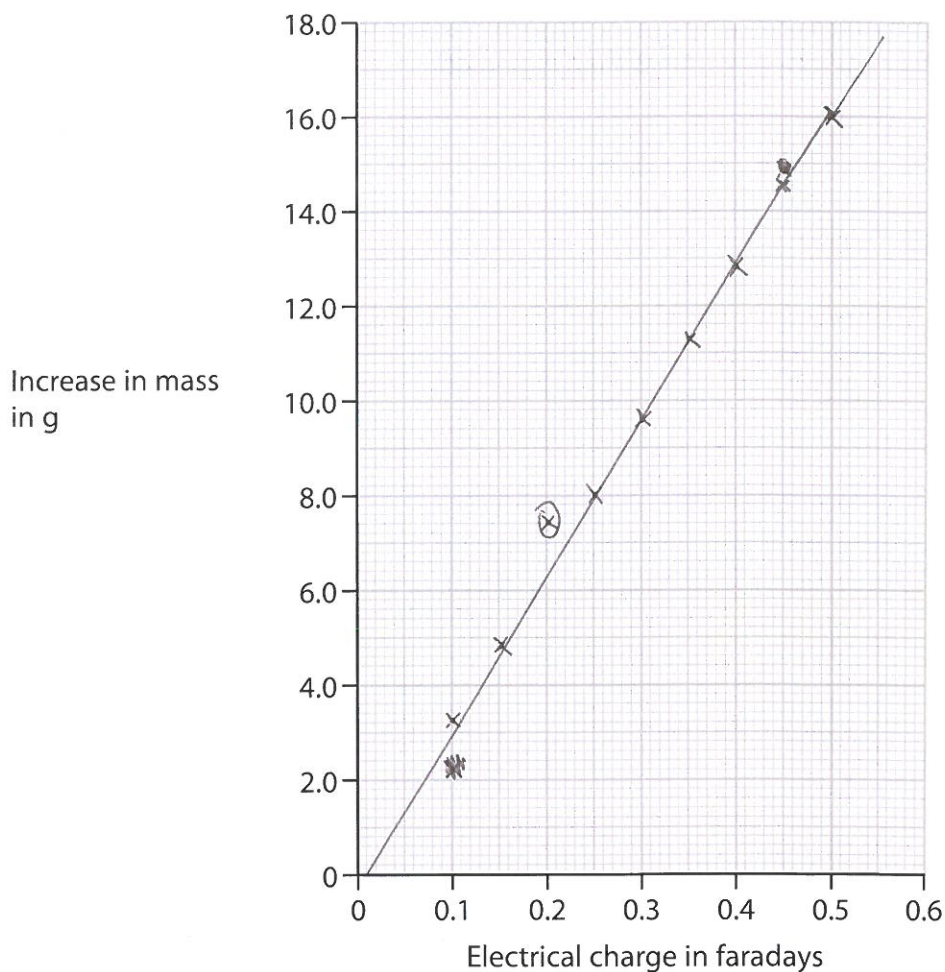
His results are shown in the table.

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)



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

(1)

no charge = no increase in mass.

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

(1)

line is straight + goes through the origin.

- (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 = 17.4 g

(Total for Question 6 = 12 marks)

TOTAL FOR PAPER = 60 MARKS



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