

Write your name here

Surname

Other names

**Pearson Edexcel  
International GCSE**

Centre Number

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Candidate Number

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# Chemistry

**Unit: 4CH0**

**Paper: 2CR**

Tuesday 10 June 2014 – Afternoon

**Time: 1 hour**

Paper Reference

**4CH0/2CR**

**You must have:**

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

## 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 ►

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**PEARSON**

# THE PERIODIC TABLE

Period 1 2 3 4 5 6 7 0

Group

1	H Hydrogen 1
2	He Helium 2

1	H Hydrogen 1
2	He Helium 2

1	7 Li Lithium 3	8 Be Beryllium 4	9 B Boron 5	10 C Carbon 6	11 N Nitrogen 7	12 O Oxygen 8	13 F Fluorine 9	14 Ne Neon 10																								
2	11 Na Sodium 11	12 Mg Magnesium 12	13 Al Aluminium 13	14 Si Silicon 14	15 P Phosphorus 15	16 S Sulfur 16	17 Cl Chlorine 17	18 Ar Argon 18																								
3	19 K Potassium 19	20 Ca Calcium 20	21 Sc Scandium 21	22 Ti Titanium 22	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	31 Ga Gallium 31	32 Ge Germanium 32	33 As Arsenic 33	34 Se Selenium 34	35 Br Bromine 35	36 Kr Krypton 36														
4	37 Rb Rubidium 37	38 Sr Strontium 38	39 Y Yttrium 39	40 Zr Zirconium 40	41 Nb Niobium 41	42 Mo Molybdenum 42	43 Tc Technetium 43	44 Ru Ruthenium 44	45 Rh Rhodium 45	46 Pd Palladium 46	47 Ag Silver 47	48 Cd Cadmium 48	49 In Indium 49	50 Sn Tin 50	51 Sb Antimony 51	52 Te Tellurium 52	53 I Iodine 53	54 Xe Xenon 54														
5	55 Cs Caesium 55	56 Ba Barium 56	57 La Lanthanum 57	58 Ce Cerium 58	59 Pr Praseodymium 59	60 Nd Neodymium 60	61 Pm Promethium 61	62 Sm Samarium 62	63 Eu Europium 63	64 Gd Gadolinium 64	65 Tb Terbium 65	66 Dy Dysprosium 66	67 Ho Holmium 67	68 Er Erbium 68	69 Tm Thulium 69	70 Yb Ytterbium 70	71 Lu Lutetium 71	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	79 Au Gold 79	80 Hg Mercury 80	81 Tl Thallium 81	82 Pb Lead 82	83 Bi Bismuth 83	84 Po Polonium 84	85 At Astatine 85	86 Rn Radon 86
6	87 Fr Francium 87	88 Ra Radium 88	89 Ac Actinium 89	90 Th Thorium 90	91 Pa Protactinium 91	92 U Uranium 92	93 Np Neptunium 93	94 Pu Plutonium 94	95 Am Americium 95	96 Cm Curium 96	97 Bk Berkelium 97	98 Cf Californium 98	99 Es Einsteinium 99	100 Fm Fermium 100	101 Md Mendelevium 101	102 No Nobelium 102	103 Lr Lawrencium 103	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	111 Rg Roentgenium 111	112 Cn Copernicium 112	113 Nh Nihonium 113	114 Fl Flerovium 114	115 Mc Moscovium 115	116 Lv Livermorium 116	117 Ts Tennessine 117	118 Og Oganesson 118

Key

Relative atomic mass
Symbol
Name
Atomic number



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**Answer ALL questions.**

**1** Neon is an element with atomic number 10.

(a) Which sub-atomic particles are present in the nucleus of a neon atom?

(1)

- A** electrons and neutrons
- B** electrons and protons
- C** electrons and neutrons and protons
- D** neutrons and protons

(b) Use words from the box to complete the sentences about the particles in a neon atom.

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

(3)

electrons	neutrons	nuclei	protons
-----------	----------	--------	---------

The particles with the smallest mass are .....

An atom of neon has no overall charge because it contains equal numbers  
of ..... and .....

The chemical properties of neon depend on the number of  
..... in the outer shell.

(c) What is the electronic configuration of a neon atom?

(1)

- A** 2.8
- B** 2.2.6
- C** 2.8.8
- D** 2.8.8.2



(d) Neon has two main isotopes that can be represented as  $^{20}\text{Ne}$  and  $^{22}\text{Ne}$ .

(i) Explain, with reference to sub-atomic particles, what is meant by the term **isotopes**.  
(2)

.....

.....

.....

.....

(ii) The relative atomic mass of neon is 20.2

How does this information support the fact that a sample of neon contains more  $^{20}\text{Ne}$  than  $^{22}\text{Ne}$ ?

(1)

.....

.....

(e) Neon belongs to the family of noble gases and is inert.

(i) What is meant by the term **inert**?  
(1)

.....

.....

(ii) Why are noble gases inert?  
(1)

.....

.....

**(Total for Question 1 = 10 marks)**



2 This question is about the reactions of some metals and their compounds.

(a) A student adds a sample of four metals R, S, T and U separately to water and to dilute sulfuric acid.

The table shows the observations in each experiment.

Metal	Observation with water	Observation with dilute sulfuric acid
R	no change	bubbles form slowly
S	bubbles form quickly	bubbles form very quickly
T	no change	no change
U	bubbles form slowly	bubbles form quickly

(i) State two properties of the metals that the student should keep the same in all of the experiments in order to compare their reactivity.

(2)

1 .....

.....

2 .....

.....

(ii) Which is the least reactive metal?

(1)

- A metal R
- B metal S
- C metal T
- D metal U

(iii) Which gas forms during the reactions with dilute sulfuric acid?

(1)

- A carbon dioxide
- B hydrogen
- C oxygen
- D sulfur dioxide



(b) The student carries out a test to show that the solution formed when metal U reacts with dilute sulfuric acid contains sulfate ions.

Use words from the box to complete the sentence about this test.

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

(2)

brown precipitate

solution of barium chloride

solution of silver nitrate

solution of sodium hydroxide

white precipitate

yellow precipitate

He adds a ..... and observes

the formation of a .....

(c) The student observes a lilac colour in a flame test on a small sample of a different metal compound.

Which metal ions cause the formation of this colour?

(1)

**A** copper

**B** magnesium

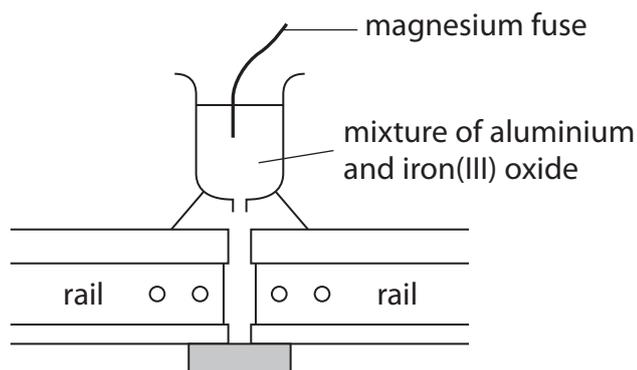
**C** potassium

**D** zinc

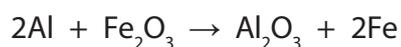
**(Total for Question 2 = 7 marks)**



- 3 The thermite reaction is used on railways to produce molten iron for joining rails together. The diagram shows how this is done.



The equation for this thermite reaction is



- (a) What does this reaction show about the reactivity of iron compared to the reactivity of aluminium?

(1)

- (b) Why is this reaction described as displacement?

(1)

- (c) State two reasons why the term oxidation applies to aluminium in this reaction.

(2)

1 .....

.....

2 .....

.....

- (d) Although the thermite reaction is exothermic, it only begins after a lot of heat energy is supplied.

How is this heat energy supplied?

(1)

.....

.....

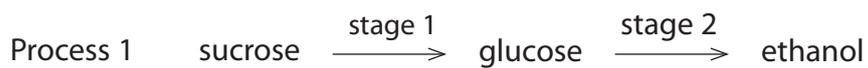
**(Total for Question 3 = 5 marks)**



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4 (a) Ethanol can be manufactured by two different processes.



(i) What is the general name for compounds such as sucrose and glucose? (1)

---

(ii) What type of reaction occurs in stage 2? (1)

---

(iii) What is the catalyst used in stage 2? (1)

---

(iv) What type of reaction occurs in process 2? (1)

---

(b) The table shows the displayed formulae of four organic compounds.

ethene	propene
ethanol	compound D

Ethanol and compound D are members of the homologous series of alcohols.

(i) The first member of this homologous series is methanol.

Draw the displayed formula of methanol.

(1)

(ii) Suggest the name of compound D.

(1)

(c) In industry, the conversion of propene to compound D uses the same conditions as those used in the conversion of ethene to ethanol.

Identify a suitable catalyst and temperature for these conversions.

(2)

catalyst .....

temperature ..... °C



(d) Ethene and acetylene can both be used for welding metals.

The equations for the reactions of these gases in welding are



One problem with using hydrocarbons as fuels is incomplete combustion.

(i) Incomplete combustion is a bigger problem with ethene than with acetylene.

Suggest why.

(1)

.....

.....

.....

(ii) One of the gases produced during incomplete combustion is dangerous to humans.

Identify this gas and explain how it is dangerous.

(3)

.....

.....

.....

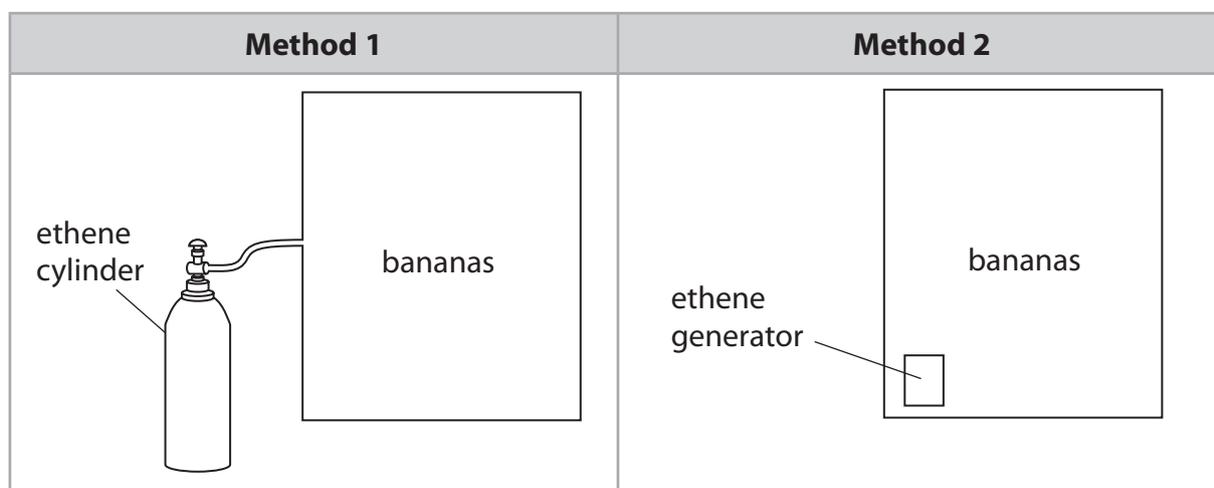
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(e) Ethene can be used to ripen bananas.

Bananas are placed in a large container and ethene is added. The ethene can be added in two different ways.



(i) In method 1, ethene is stored under pressure and passed through a pipe into the container.

Suggest one risk in using this method.

(1)

(ii) In method 2, the generator contains a known quantity of ethanol that is slowly decomposed to ethene using a catalyst.

Write a chemical equation for this decomposition.

(1)

**(Total for Question 4 = 14 marks)**



5 Solutions of lead(II) nitrate and sodium sulfate react together to form the insoluble salt lead(II) sulfate.

(a) A student wrote this plan to prepare a pure dry sample of lead(II) sulfate.

- step 1    pour some lead(II) nitrate solution into a beaker
- step 2    add sodium sulfate solution until the reaction is complete
- step 3    filter the mixture
- step 4    heat the filtrate to evaporate some of the water
- step 5    cool the filtrate and remove the crystals

(i) How will the student know when the reaction in step 2 is complete? (1)

.....

.....

(ii) Which compound could the student use in this preparation instead of sodium sulfate? (1)

- A lead(II) hydroxide
- B nitric acid
- C sodium hydroxide
- D sulfuric acid

(iii) State why the student should not have included steps 4 and 5 in his plan. (1)

.....

.....

(iv) Suggest replacement steps to obtain a pure dry sample of lead(II) sulfate. (2)

step 4 .....

.....

step 5 .....

.....



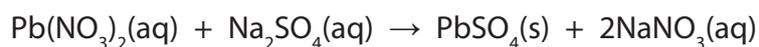
(v) Lead(II) carbonate cannot be used instead of lead(II) nitrate in this preparation.

This is because lead(II) carbonate

(1)

- A** contains ionic bonding
- B** has a high relative formula mass
- C** is insoluble in water
- D** is toxic

(b) The equation for the reaction in the student's plan is



(i) Deduce the amount of each reactant needed to form 0.150 mol of lead(II) sulfate.

(1)

$\text{Pb}(\text{NO}_3)_2$  ..... mol

$\text{Na}_2\text{SO}_4$  ..... mol

(ii) What volume of 0.500 mol/dm<sup>3</sup> lead(II) nitrate solution is needed to form 0.150 mol of lead(II) sulfate?

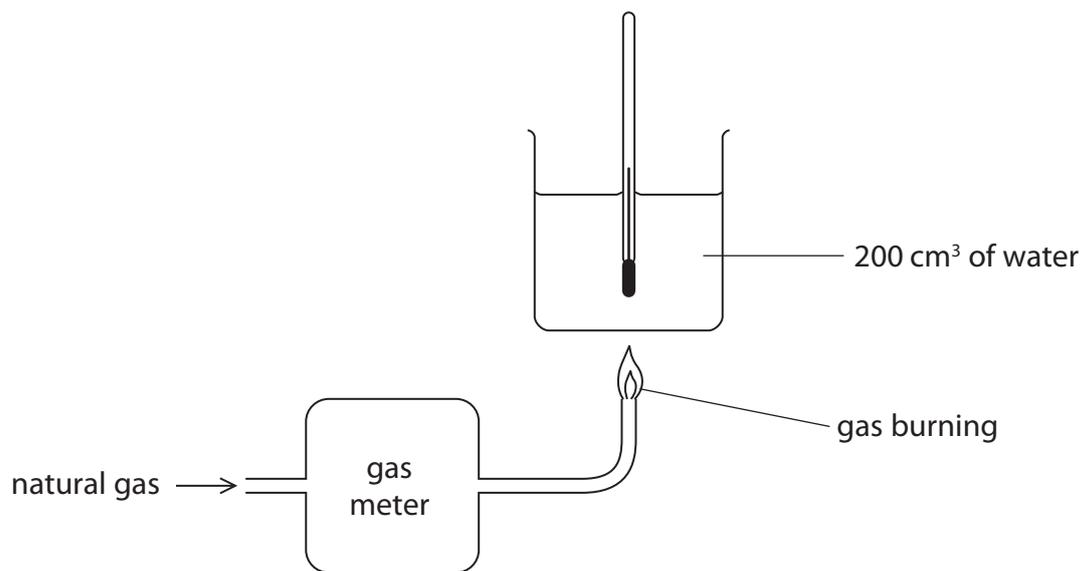
(2)

volume = .....

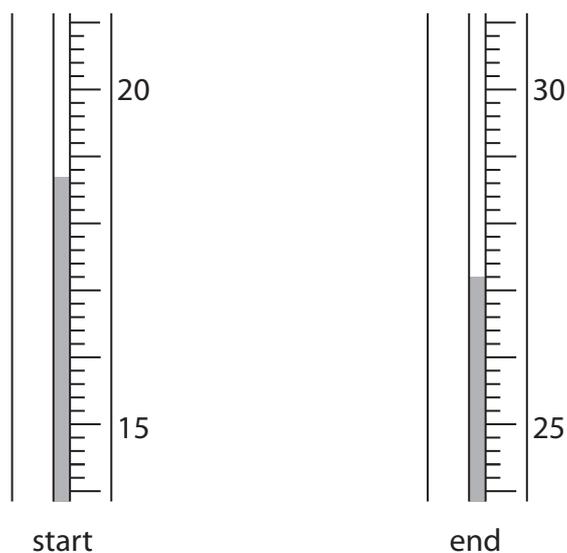
**(Total for Question 5 = 9 marks)**



- 6 A student does some experiments to find the heat energy released when natural gas burns. She uses this apparatus.



- (a) The diagram shows the thermometer readings in one of her experiments.



Use these readings to complete the table, entering all values to the nearest 0.1°C.

(3)

temperature of water at start in °C	
temperature of water at end in °C	
temperature change in °C	

(b) The student repeats the experiment three times.

The table shows her results.

Experiment	Volume of gas burned in cm <sup>3</sup>	Temperature rise of water in °C
1	1450	34.8
2	1875	41.2
3	1620	37.7

(i) Calculate the amount, in moles, at room temperature and pressure, of methane burned in experiment 1.

Assume that natural gas contains only methane.

(The volume of 1 mol of a gas at room temperature and pressure is 24 000 cm<sup>3</sup>)

(2)

amount = ..... mol

(ii) The quantity of heat energy released in experiment 1 is 29 200 J.

Calculate the molar enthalpy change, in kJ/mol, for the combustion of methane.

(2)

molar enthalpy change = ..... kJ/mol

(iii) The temperature rise in experiment 2 is 41.2 °C.

Calculate the heat energy change in experiment 2 using the expression

heat energy change = volume of water × 4.2 × temperature change

(in J)

(in cm<sup>3</sup>)

(in °C)

(2)

heat energy change = ..... J



(iv) The student uses the results from experiment 3 to calculate the molar enthalpy change, in kJ/mol, for the combustion of methane.

She compares her value with the value in a data book.

student's value	$\Delta H = -510 \text{ kJ/mol}$
data book value	$\Delta H = -890 \text{ kJ/mol}$

Which is the best explanation for the large difference between these two values?

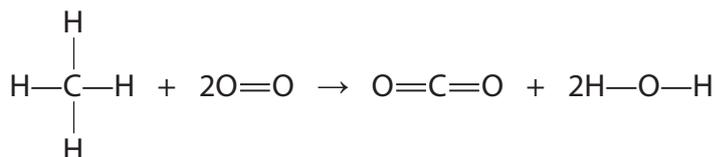
(1)

- A** natural gas contains other gases that release heat energy when burned
- B** not all of the heat energy is transferred to the water
- C** some of the water evaporates during the experiment
- D** the student measures the gas by volume instead of by mass

- (c) The student uses a table of average bond energies to calculate another value for the molar enthalpy of combustion of methane.

<b>Bond</b>	C—H	O=O	C=O	H—O
<b>Average bond energy in kJ/mol</b>	412	496	743	463

The equation for the combustion can be shown using displayed formulae.



- (i) Use values from the table to calculate the energy taken in when the bonds in the reactants are broken.

(2)

energy taken in = ..... kJ

- (ii) Use values from the table to calculate the energy given out when the bonds in the products are formed.

(2)

energy given out = ..... kJ

- (iii) Use your answers to (i) and (ii) to calculate the molar enthalpy change for the combustion of methane.

(1)

molar enthalpy change = ..... kJ/mol

**(Total for Question 6 = 15 marks)**

**TOTAL FOR PAPER = 60 MARKS**



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