

Please check the examination details below before entering your candidate information

Candidate surname					Other names			
Centre Number					Candidate Number			
Pearson Edexcel International GCSE					<input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/>			
Monday 20 January 2020								
Afternoon (Time: 1 hour 15 minutes)					Paper Reference 4CH1/2C			
Chemistry Unit: 4CH1 Paper 2C								
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.
- 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 70.
- 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 Na sodium 11	24 Mg magnesium 12	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																																																																																																																																																																																																								
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																																																																																																																																																																																																				
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																																																																																																																																																																																						
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 Mn manganese 101	102 Ni nickel 102	103 Pd palladium 103	104 Ds darmstadtium 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 oganeson 118	119 Uue unbinilium 119	120 Uub ununbium 120	121 Uut ununtrium 121	122 Uuq ununquadium 122	123 Uup ununpentium 123	124 Uuq ununhexium 124	125 Uuh ununheptium 125	126 Uuq ununoctium 126	127 Uuh ununnonium 127	128 Uuq unundecium 128	129 Uuh unundundecium 129	130 Uuq ununtridecium 130	131 Uuh ununquadecium 131	132 Uuq ununpentadecium 132	133 Uuh 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1	H hydrogen 1
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relative atomic mass
atomic symbol
name
atomic (proton) number

Key

Elements with atomic numbers 112-116 have been reported but not fully authenticated

* The lanthanoids (atomic numbers 58-71) and the actinoids (atomic numbers 90-103) have been omitted.

The relative atomic masses of copper and chlorine have not been rounded to the nearest whole number.

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Answer ALL questions.

1 This question is about elements, compounds and mixtures.

(a) Name the element that burns with a lilac flame.

(1)

(b) Name the technique used to separate the mixture of colours in black ink.

(1)

(c) The box gives the names of some substances.

air	bromine	magnesium	neon	sodium chloride	sulfur
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Choose substances from the box to answer these questions.

(i) Identify the compound.

(1)

(ii) Identify the mixture.

(1)

(iii) Identify the non-metal element that is a solid at room temperature.

(1)

(Total for Question 1 = 5 marks)

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2 Crude oil is a mixture of hydrocarbons.

(a) Name the process used to separate crude oil into fractions.

(1)

(b) Give one use of the kerosene fraction.

(1)

(c) One of the hydrocarbons in the refinery gas fraction is an alkane with the structural formula $\text{CH}_3\text{CH}_2\text{CH}_2\text{CH}_3$

(i) Give the name of this alkane.

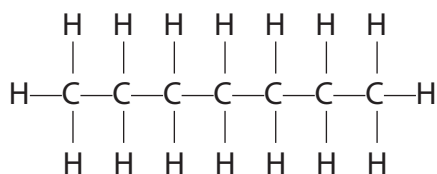
(1)

(ii) Calculate the relative molecular mass (M_r) of this alkane.

(1)

$M_r = \dots\dots\dots$

(d) One of the alkanes in the gasoline fraction has the displayed formula



(i) Determine the molecular formula of this alkane.

(1)

(ii) Give the general formula for the alkanes.

(1)

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(e) Catalytic cracking is used to convert long-chain alkanes into shorter-chain alkanes.

(i) Name the catalyst used in catalytic cracking.

(1)

(ii) Explain why it is necessary to convert long-chain alkanes into shorter-chain alkanes.

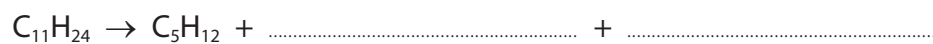
(2)

(f) Catalytic cracking also produces alkenes.

$C_{11}H_{24}$ can undergo cracking to give pentane (C_5H_{12}) and two different alkenes.

Complete the equation for this cracking reaction.

(2)



(Total for Question 2 = 11 marks)

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3 This question is about copper and its compounds.

(a) Copper is a metal used for electrical wiring.

Explain why copper is a good conductor of electricity.

(2)

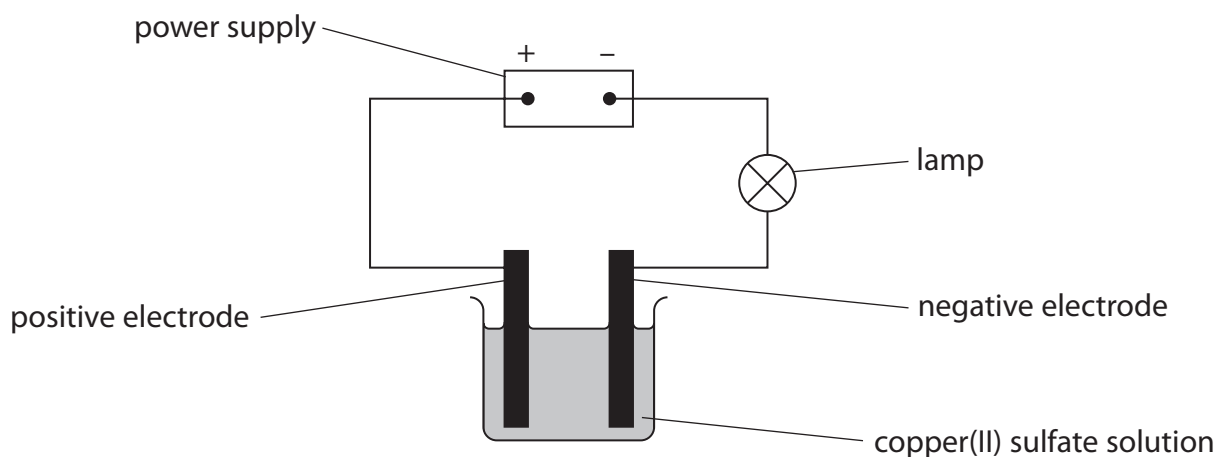
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(b) This apparatus is used to investigate the electrolysis of copper(II) sulfate solution with graphite electrodes.



Copper forms at the negative electrode and oxygen forms at the positive electrode.

(i) State what would be observed at each electrode.

(2)

negative electrode

positive electrode

(ii) The ionic half-equation for the reaction at the negative electrode is



State why this is a reduction reaction.

(1)

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(iii) Explain why the copper(II) sulfate solution becomes paler blue during the electrolysis. (2)

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(c) When hydrated copper(II) sulfate crystals are heated, anhydrous copper(II) sulfate forms.

A mass of 12.5 g of hydrated copper(II) sulfate crystals is heated in a crucible until all the water of crystallisation is removed.

A mass of 8.0 g of anhydrous copper(II) sulfate forms.

Show by calculation that the formula of hydrated copper(II) sulfate is $\text{CuSO}_4 \cdot 5\text{H}_2\text{O}$

[M_r of $\text{CuSO}_4 = 159.5$ M_r of $\text{H}_2\text{O} = 18$]

(4)

(Total for Question 3 = 11 marks)



- 4 A student investigates the reaction between sodium hydroxide solution and dilute sulfuric acid. He does a titration to find the concentration of the sulfuric acid.

This is his plan for the titration. There are some mistakes and omissions in his plan.

- rinse a conical flask with the sodium hydroxide solution
- use a measuring cylinder to measure out 25 cm^3 of the sodium hydroxide solution and add it to the conical flask
- add a few drops of methyl orange indicator to the conical flask
- rinse a burette with water and then fill it with the sulfuric acid
- add the acid from the burette to the conical flask until the indicator changes colour at the end-point of the titration
- record the final burette reading

- (a) Give the colour change of the methyl orange indicator at the end-point. (2)

from to

- (b) Describe four changes that the student could make to improve his plan. (4)

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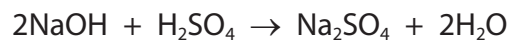
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(c) The student then does the titration correctly.

He finds that 16.70 cm^3 of the dilute sulfuric acid neutralises 25.0 cm^3 of sodium hydroxide solution of concentration 0.200 mol/dm^3

The equation for the reaction is



Calculate the concentration, in mol/dm^3 , of the sulfuric acid.

(3)

concentration of sulfuric acid = mol/dm^3

(Total for Question 4 = 9 marks)

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5 Oxygen can be prepared from hydrogen peroxide using a catalyst.

(a) Which is a correct statement about oxygen?

(1)

- A it burns with a squeaky pop
- B it relights a glowing splint
- C it turns blue litmus red
- D it turns limewater milky

(b) Explain how a catalyst increases the rate of a reaction.

(2)

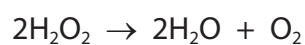
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(c) The equation for the preparation of oxygen from hydrogen peroxide is



This equation can also be written using displayed formulae to show all the covalent bonds in the molecules.



The table gives the bond energies for these bonds.

Bond	H—O	O—O	O=O
Bond energy in kJ/mol	463	143	498

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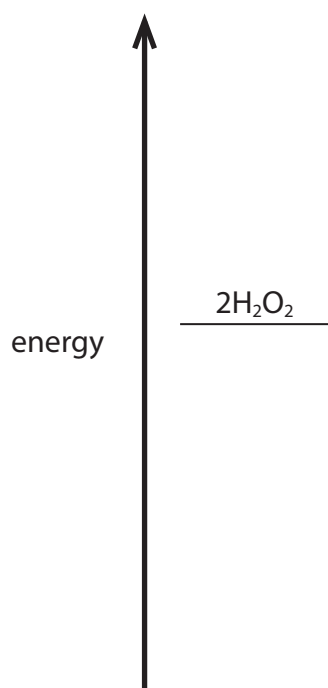
- (i) Use the values in the table to calculate the enthalpy change, ΔH , for the reaction.
Include a sign in your answer.

(3)

 $\Delta H = \dots\dots\dots$ kJ

- (ii) Complete the energy level diagram to show the position of the products and the enthalpy change, ΔH , for the reaction.

(2)

**(Total for Question 5 = 8 marks)**

6 Ethanol, C_2H_5OH , can be manufactured from ethene and steam using a phosphoric acid catalyst.

(a) (i) State the temperature and pressure used in this manufacturing process.

(2)

temperature

pressure

(ii) Draw the displayed formula of ethanol.

(1)

(b) Ethanol burns in a plentiful supply of air to form carbon dioxide and water.

(i) Give the chemical equation for this reaction.

(2)

(ii) When the air supply is limited, incomplete combustion occurs and carbon monoxide forms.

State why carbon monoxide is poisonous to humans.

(1)

(c) When ethanol reacts with ethanoic acid, an ester forms.

Give the name of this ester.

(1)

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(d) Butanedioic acid and ethanediol react together to form a polyester and water.

(i) Give the name of this type of polymerisation.

(1)

(ii) Complete the equation.

Show only one repeat unit of the polyester.

(3)



(Total for Question 6 = 11 marks)

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7 This question is about some Group 2 elements and their compounds.

(a) Calcium reacts with water to produce calcium hydroxide and hydrogen gas.

(i) Give the word equation for this reaction.

(1)

(ii) State two observations that would be made during this reaction.

(2)

1

2

(b) (i) Describe how a pure, dry sample of the insoluble salt, barium sulfate, could be made from the two solids sodium sulfate and barium chloride.

(5)

(ii) Give an ionic equation for the reaction that occurs.

Include state symbols in your equation.

(2)

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- (c) When magnesium nitrate is heated, magnesium oxide, nitrogen dioxide and oxygen form.

The equation for the reaction is



- (i) What is the name for this type of reaction?

(1)

- A addition
- B combustion
- C decomposition
- D neutralisation

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- (ii) Calculate the **total** volume, in dm^3 , of gas produced at rtp when 7.7 g of magnesium nitrate completely reacts.

[Assume that the molar volume of a gas at rtp is 24 dm^3]

[M_r of $\text{Mg}(\text{NO}_3)_2 = 148$]

Give your answer to two significant figures.

(4)

total volume of gas = dm^3

(Total for Question 7 = 15 marks)

TOTAL FOR PAPER = 70 MARKS

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