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Pearson Edexcel
International GCSE

Centre Number

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Candidate Number

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Chemistry

Unit: 4CH0

Paper: 2C

Wednesday 13 June 2018 – Morning

Time: 1 hour

Paper Reference

4CH0/2C

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 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.
- 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

Period 1 2 3 4 5 6 7 0

Group

1	1	2	3	4	5	6	7	0				
1								1	4			
								H	He			
								Hydrogen	Helium			
								1	2			
2	7	9					11	12	14	16	19	20
	Li	Be					B	C	N	O	F	Ne
	Lithium	Beryllium					Boron	Carbon	Nitrogen	Oxygen	Fluorine	Neon
	3	4					5	6	7	8	9	10
3	23	24					27	28	31	32	35.5	40
	Na	Mg					Al	Si	P	S	Cl	Ar
	Sodium	Magnesium					Aluminium	Silicon	Phosphorus	Sulfur	Chlorine	Argon
	11	12					13	14	15	16	17	18
4	39	40					70	73	75	79	80	84
	K	Ca					Ga	Ge	As	Se	Br	Kr
	Potassium	Calcium					Gallium	Germanium	Arsenic	Selenium	Bromine	Krypton
	19	20					31	32	33	34	35	36
5	86	88					115	119	122	128	127	131
	Rb	Sr					In	Sn	Sb	Te	I	Xe
	Rubidium	Strontium					Indium	Tin	Antimony	Tellurium	Iodine	Xenon
	37	38					49	50	51	52	53	54
6	133	137					204	207	209	210	210	222
	Cs	Ba					Tl	Pb	Bi	Po	At	Rn
	Caesium	Barium					Thallium	Lead	Bismuth	Polonium	Astatine	Radon
	55	56					81	82	83	84	85	86
7	223	226					201	197	195	192	192	201
	Fr	Ra					Hg	Au	Pt	Ir	Os	Hg
	Francium	Radium					Mercury	Gold	Platinum	Iridium	Osmium	Mercury
	87	88					80	79	78	77	76	80
	227	227					201	197	195	192	190	201
	Ac	Ac					Hg	Au	Pt	Ir	Os	Hg
	Actinium	Actinium					Mercury	Gold	Platinum	Iridium	Osmium	Mercury
	89	89					80	79	78	77	76	80

Key

Relative atomic mass
Symbol
Name
Atomic number

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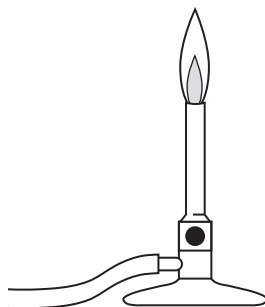
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Answer ALL questions.

- 1 The diagram shows a Bunsen burner.



- (a) The Bunsen burner uses methane as a fuel.

Methane has the formula CH_4

Give the names of the two elements in methane.

(2)

..... and

- (b) When methane burns it reacts with a gas in the air.

Give the name of this gas.

(1)

- (c) (i) Name the two substances that form when methane burns in plenty of air.

(2)

1

2

- (ii) Name the poisonous gas that forms when methane burns in a shortage of air.

(1)

(Total for Question 1 = 6 marks)

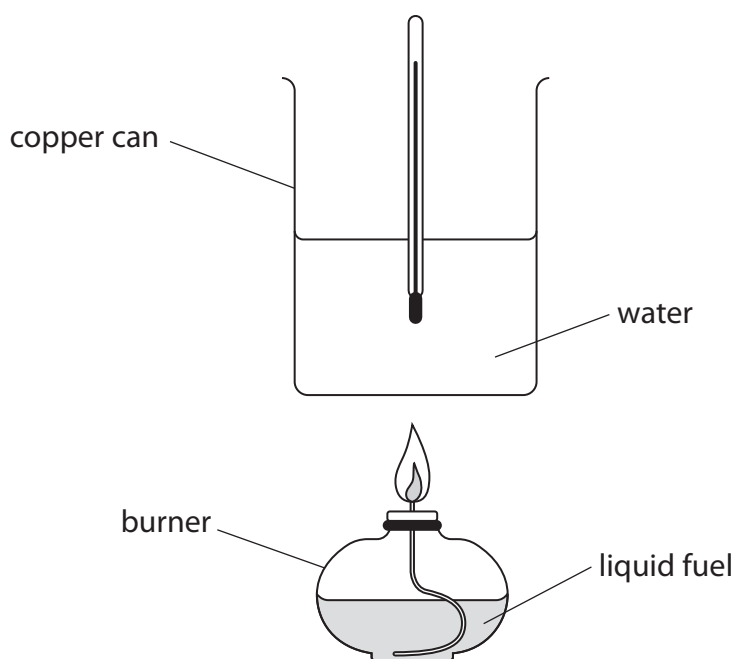
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- 2 A student uses this apparatus to investigate the burning of four different liquid fuels, W, X, Y and Z.



The table shows the student's results.

Fuel	Initial temperature in °C	Final temperature in °C	Increase in temperature in °C
W	19.0	31.3	12.3
X	18.4	28.7	
Y	19.5	35.4	
Z	18.7	29.8	

- (a) Complete the table by giving the increase in temperature for fuels X, Y and Z. (1)
- (b) The student uses the same mass of water and burns each fuel for the same period of time. Explain which fuel releases the most heat energy. (2)

.....

.....

.....

.....



(c) What is the name given to reactions that release heat energy?

(1)

- A decomposition
- B endothermic
- C exothermic
- D reduction

(Total for Question 2 = 4 marks)

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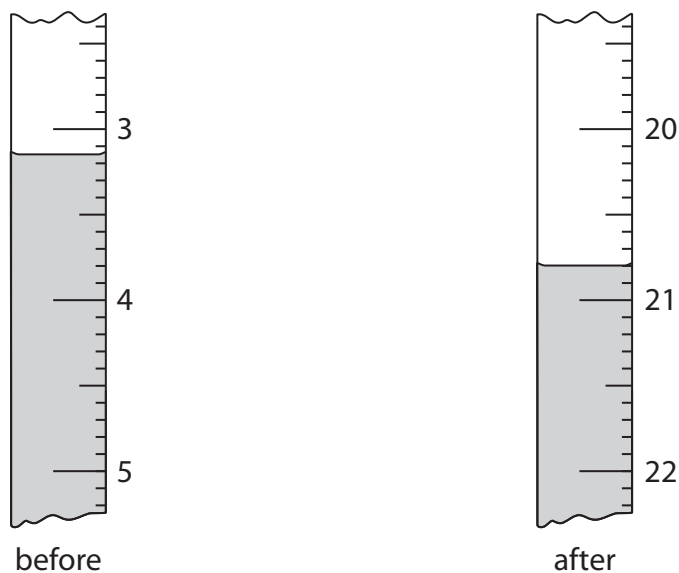
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3 A student makes an alkali solution by dissolving a small volume of cleaning liquid in deionised water.

He then titrates a sample of this solution with an acid until neutralisation is complete.

(a) The diagram shows the burette readings for his titration.



Use the readings to complete the table, giving all values to the nearest 0.05 cm^3 .

(2)

Burette reading after adding the acid	20.80
Burette reading before adding the acid	
Volume of acid added in cm^3	

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(b) Another student does a titration using a solution of a different cleaning liquid.

The table shows her results.

Burette reading after adding the acid	29.65	28.70	29.25	29.10	28.55
Burette reading before adding the acid	3.40	3.60	3.50	3.80	3.35
Volume of acid added in cm³	26.25	25.10	25.75	25.30	25.20
Concordant results (✓)					

Concordant results are those that differ by 0.20 cm³ or less.

(i) Place ticks in the table to show which results are concordant.

(1)

(ii) Use the concordant results to calculate the average (mean) volume of acid added.

(1)

average volume of acid = cm³

(Total for Question 3 = 4 marks)

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4 Bromine, chlorine, fluorine and iodine are elements in Group 7 of the Periodic Table.

(a) Which element is the most reactive?

(1)

- A bromine
- B chlorine
- C fluorine
- D iodine

(b) Which element is a solid at room temperature?

(1)

- A bromine
- B chlorine
- C fluorine
- D iodine

(c) Which element has the darkest colour at room temperature?

(1)

- A bromine
- B chlorine
- C fluorine
- D iodine

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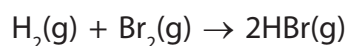
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(d) Bromine reacts with hydrogen to form hydrogen bromide.

The equation for the reaction is



The table shows some average bond energies.

Bond	H—H	Br—Br	H—Br
Average bond energy in kJ/mol	436	193	366

Use the values in the table to calculate the enthalpy change for the reaction between hydrogen and bromine.

(3)

enthalpy change = kJ/mol

(Total for Question 4 = 6 marks)

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5 Ethanol can be manufactured by fermentation or by the direct hydration of ethene.

(a) In Brazil, the main source of sugar for fermentation is sugar cane.

- sugar cane is added to water
- sugar cane contains sucrose ($C_{12}H_{22}O_{11}$) that dissolves in the water
- during the fermentation process the sucrose is broken down into glucose ($C_6H_{12}O_6$)
- this glucose is then converted into ethanol (C_2H_5OH) and carbon dioxide

(i) Name the substance that is added to the sucrose solution to allow fermentation to take place.

(1)

(ii) Complete the equation for the conversion of sucrose into glucose.

(1)



(iii) Write a chemical equation for the conversion of glucose into ethanol and carbon dioxide.

(1)

(iv) Fermentation produces a solution that is a mixture of ethanol and water.

Which of these is the most effective method of obtaining ethanol from this mixture?

(1)

- A crystallisation
- B filtration
- C fractional distillation
- D simple distillation

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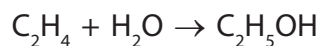
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(b) In the direct hydration method, ethene reacts with steam.

The equation for the reaction is



(i) Name the catalyst used in this reaction.

(1)

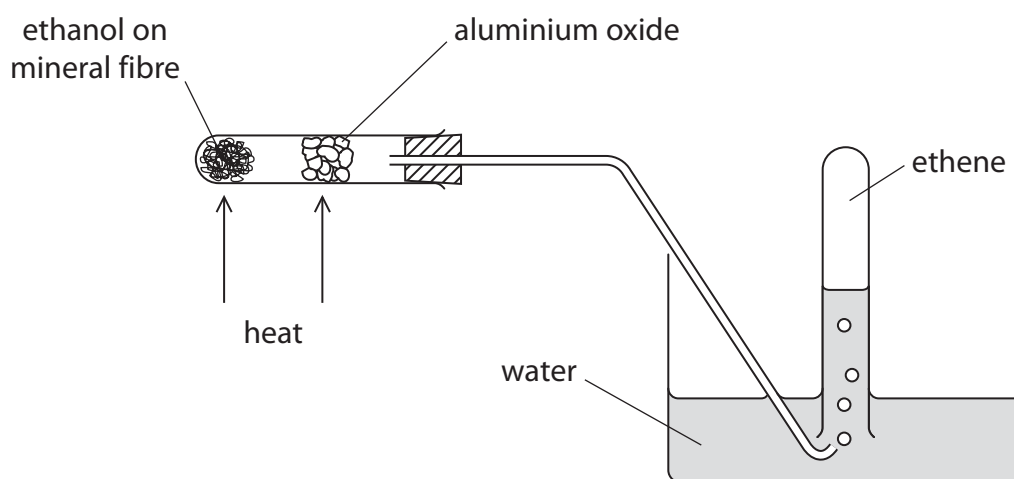
(ii) State the temperature and pressure used in this reaction.

(2)

temperature

pressure

(c) This apparatus is used to convert ethanol into ethene.



(i) Name the type of reaction taking place.

(1)

(ii) State the function of the aluminium oxide in this reaction.

(1)



(d) Ethene belongs to a homologous series of unsaturated hydrocarbons called alkenes.

(i) State what is meant by the term **unsaturated**.

(1)

(ii) State the colour change that is observed when bromine water is shaken with ethene in a test tube.

(2)

from to

(Total for Question 5 = 12 marks)



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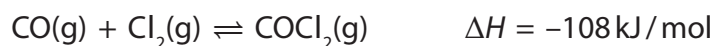
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6 Phosgene (COCl_2) is used in industry to make polymers.

(a) Phosgene is formed when carbon monoxide reacts with chlorine.



- (i) The reaction mixture is kept at temperatures between 50 and 150 °C. If a temperature above 200 °C is used, only a small amount of phosgene is formed.

Suggest why only a small amount of phosgene is formed at temperatures above 200 °C.

(2)

- (ii) Predict how the yield of phosgene will change if the reaction is carried out at a higher pressure.

Give a reason for your answer.

[assume the reaction reaches a position of equilibrium]

(2)

(b) Phosgene reacts with water to form hydrochloric acid and carbon dioxide.

Write a chemical equation for this reaction.

(1)

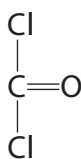
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(c) The diagram shows the displayed formula of phosgene.



Draw a dot and cross diagram to show the arrangement of all the outer electrons in a molecule of phosgene.

(3)

(Total for Question 6 = 8 marks)

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- 7 Magnesium carbonate decomposes when heated to form magnesium oxide and carbon dioxide. The equation for the reaction is



A student uses this method to investigate the reaction.

- Step 1 weigh a clean, dry crucible and record the mass
 Step 2 add some magnesium carbonate
 Step 3 reweigh the crucible and contents and record the new mass
 Step 4 heat the crucible and contents for five minutes
 Step 5 allow the crucible and contents to cool and then reweigh
 Step 6 repeat steps 4 and 5 until the mass of the crucible and contents does not change

The student does the experiment four times.

The table shows her results.

	Mass in g			
	Experiment 1	Experiment 2	Experiment 3	Experiment 4
mass of empty crucible	19.20	21.31	19.83	20.45
mass of crucible and magnesium carbonate before heating	23.40	24.94	24.65	26.92
mass of crucible and contents after heating for 5 minutes	22.85	23.21	22.13	24.02
mass of crucible and contents after heating for a total of 10 minutes	21.94	23.04	22.13	23.53
mass of crucible and contents after heating for a total of 15 minutes	21.60	23.04	22.13	23.53

- (a) State why the mass of the crucible and contents decreases during heating.

(1)

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(b) (i) State the reason for Step 6.

(1)

.....

.....

(ii) Explain in which experiment the student should have heated for a fourth period of five minutes.

(2)

.....

.....

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(Total for Question 7 = 4 marks)



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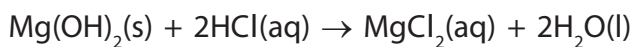
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8 Acid indigestion is caused by having too much hydrochloric acid in the stomach.

A suspension of magnesium hydroxide, Mg(OH)₂, in water, can be used to cure acid indigestion.

The equation for the reaction between magnesium hydroxide and hydrochloric acid is



A student investigates how much magnesium hydroxide is needed to neutralise 100 cm³ of hydrochloric acid with a concentration of 0.0968 mol/dm³.

He uses 0.29 g of magnesium hydroxide to neutralise the hydrochloric acid.

(a) Calculate the amount, in moles, of HCl in the hydrochloric acid. (2)

amount of HCl mol

(b) Calculate the amount, in moles, of Mg(OH)₂ used by the student. (2)
 [*M_r* of Mg(OH)₂ = 58]

amount of Mg(OH)₂ mol

(c) Explain whether the student used the right amount of magnesium hydroxide to neutralise the hydrochloric acid. (2)

.....

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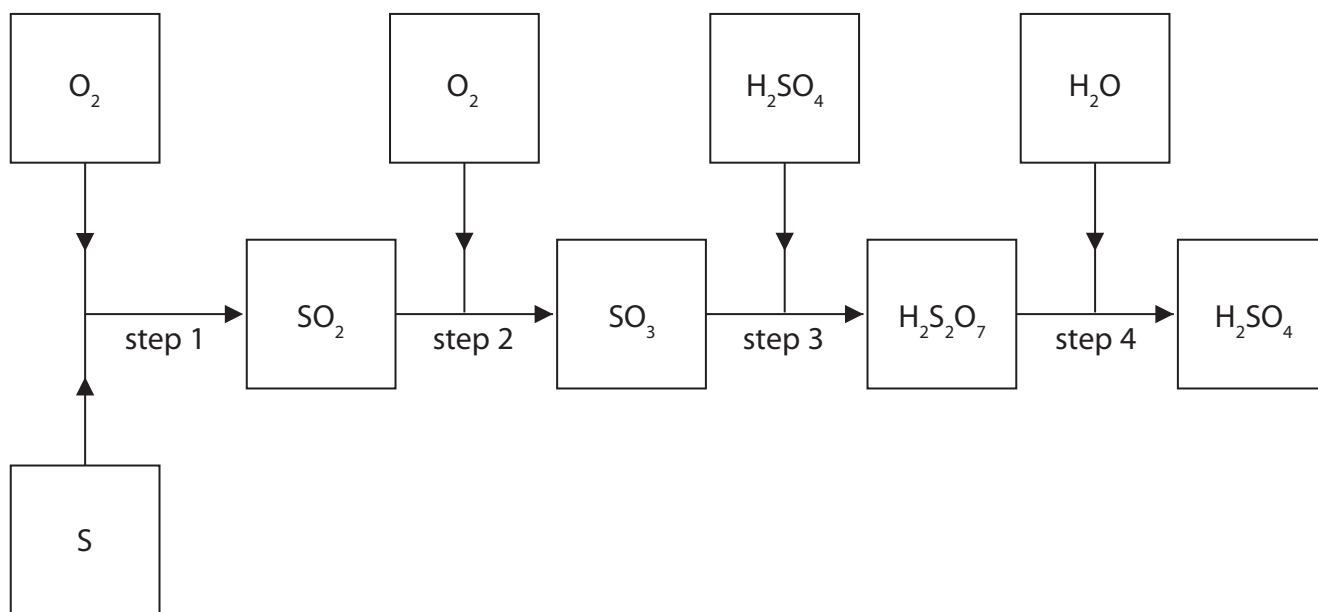
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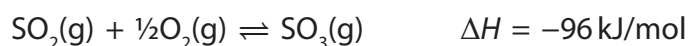
(Total for Question 8 = 6 marks)



9 The flow chart shows the steps in the manufacture of sulfuric acid.



(a) The equation for the reaction in step 2 is



(i) State what the symbols \rightleftharpoons and ΔH represent.

(2)

\rightleftharpoons

ΔH

(ii) Name the catalyst used in step 2.

(1)

(iii) State the temperature and pressure used in the reaction in step 2.

(2)

temperature

pressure

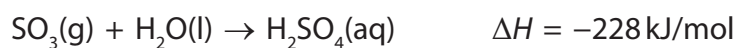
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- (b) Sulfur trioxide reacts with water to form sulfuric acid.
This reaction is very exothermic.



- (i) State why the sulfur trioxide is not dissolved in water to form sulfuric acid in step 3. (1)

- (ii) Write chemical equations for the reactions that take place in step 3 and step 4. (2)

step 3.....

step 4.....

- (c) Give two industrial uses for sulfuric acid. (2)

1.....

2.....

(Total for Question 9 = 10 marks)

TOTAL FOR PAPER = 60 MARKS



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