

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

Wednesday 13 June 2018 – Morning

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.
- 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 8

1	1	2	3	4	5	6	7	8																								
1	7 Li Lithium 3	8 Be Beryllium 4	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																						
2	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														
3	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														
4	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
5	87 Fr Francium 87	88 Ra Radium 88	89 Ac Actinium 89																													

1	H Hydrogen 1
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4	He Helium 2
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Key

Relative atomic mass
Symbol
Name
Atomic number

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Answer ALL questions.

1 The table shows some information about five gases.

Gas	Formula of molecule	Boiling point in °C
chlorine	Cl ₂	-35
oxygen	O ₂	-183
carbon monoxide	CO	-191
nitrogen	N ₂	-196
hydrogen	H ₂	-253

Choose gases from the table to answer this question.

You may use each gas once, more than once, or not at all.

(a) Name the gas that is a compound. (1)

(b) Name the gas necessary for rusting to occur. (1)

(c) Name the gas that bleaches moist litmus paper. (1)

(d) Name the gas that has the highest percentage by volume in air. (1)

(e) Name the gas that has the highest boiling point. (1)

(f) Determine the two gases that have the same relative formula mass. (1)

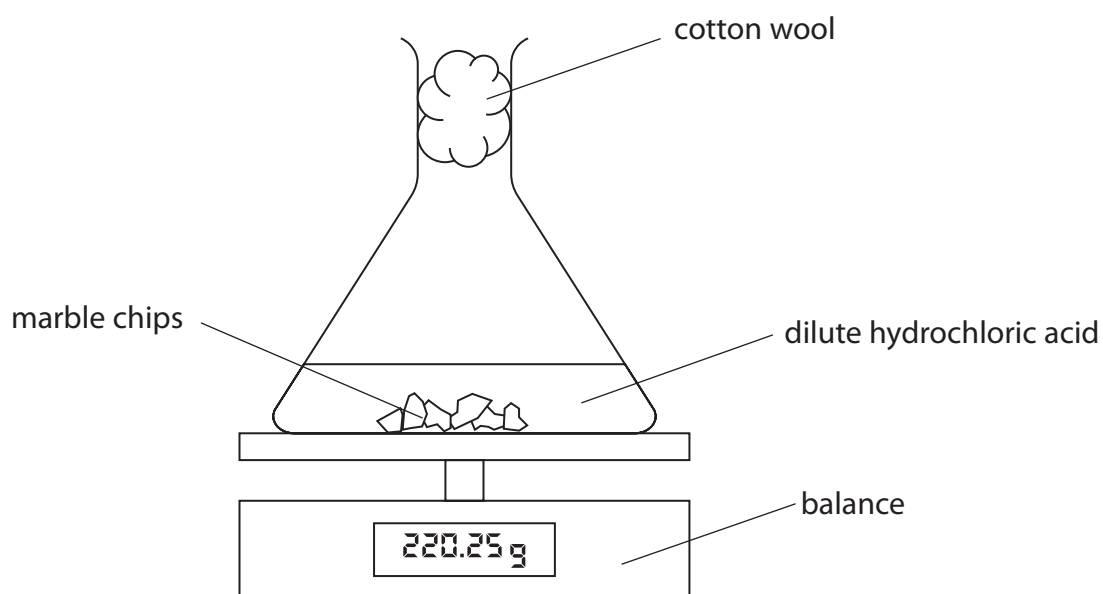
1

2

(Total for Question 1 = 6 marks)



- 2 A student uses this apparatus to study the rate of the reaction between marble chips and dilute hydrochloric acid.



She uses this method.

- place a conical flask on a balance
- put 15 g of large marble chips in the flask
- add 25 cm³ of dilute hydrochloric acid to the flask
- record the mass of the flask and contents, and start a timer
- record the mass of the flask and contents every 30 seconds until the reaction ends

The equation for the reaction is



- (a) (i) Explain what happens to the mass of the flask and contents during the reaction. (2)

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- (ii) State why the reaction ends, even though some marble chips remain in the flask. (1)

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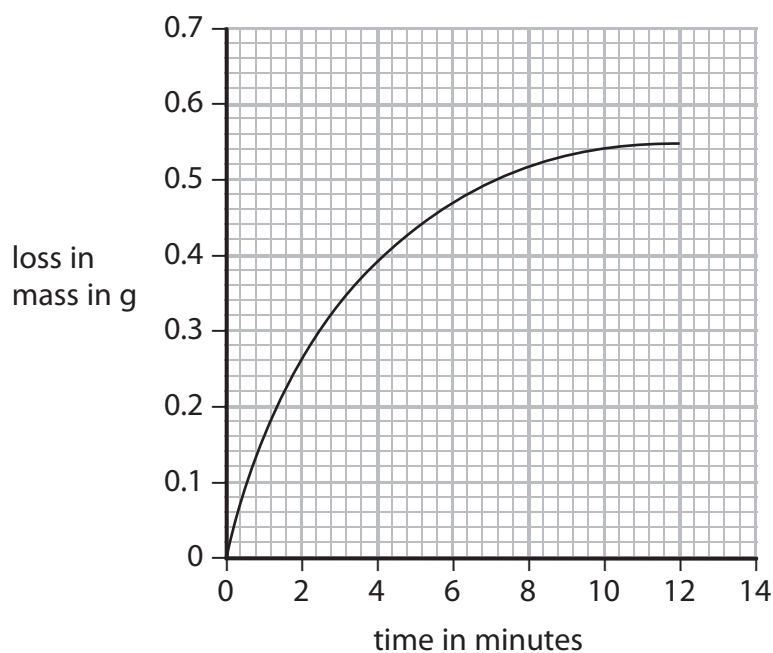
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(iii) State how the student would know when the reaction has ended.

(1)

(b) The student plots her results on a grid.



(i) At which time is the rate of reaction greatest?

(1)

- A 1 minute
- B 4 minutes
- C 6 minutes
- D 8 minutes

(ii) The student repeats the experiment with the same volume and concentration of acid, but with 15 g of smaller marble chips.

On the grid, sketch the curve you would expect for this experiment.

(2)



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(c) Explain how decreasing the concentration of the hydrochloric acid affects the rate of reaction.

Refer to particle collision theory in your answer.

(3)

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(Total for Question 2 = 10 marks)



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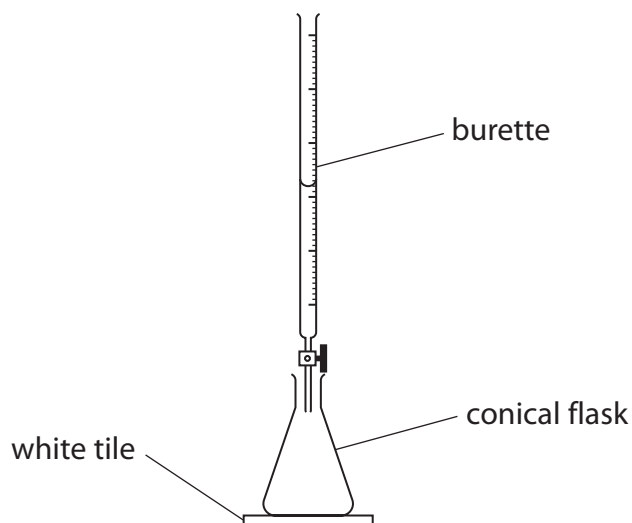
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- 3 A student is provided with a solution of sodium hydroxide, NaOH, and a solution of 0.0200 mol/dm^3 phosphoric(V) acid, H_3PO_4

She does a titration to find the volume of the phosphoric(V) acid that reacts with 25.0 cm^3 of the sodium hydroxide.



This is the student's method.

- add phosphoric(V) acid to a clean burette until it is nearly full
- record the burette reading
- use a measuring cylinder to add 25.0 cm^3 of the sodium hydroxide to a clean conical flask
- add a few drops of phenolphthalein indicator to the flask
- place the flask on a white tile
- add phosphoric(V) acid from the burette until the indicator changes colour
- record the burette reading
- wash the flask using distilled water and then dry the flask
- repeat the titration

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(a) (i) Name a piece of apparatus that would give a more precise measurement of the volume of sodium hydroxide. (1)

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(ii) Suggest why the student places the flask on a white tile. (1)

.....

.....

(iii) Give the colour change of the phenolphthalein indicator during the titration. (2)

at start.....

at end.....

(iv) The student dries the flask after washing it with distilled water. Suggest why it is not necessary to dry the flask before repeating the titration. (1)

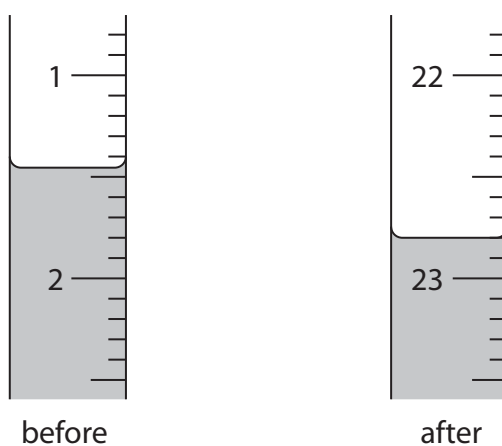
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- (b) The diagram shows the student's burette readings for her titration, before and after adding the acid.



Use the readings to complete the table, giving all values to the nearest 0.05 cm³.

(2)

burette reading after adding the acid	22.80
burette reading before adding the acid	
volume in cm ³ of acid added	



(c) Another student does the experiment four times.

The table shows his results.

Volume in cm ³ of acid added	21.80	21.50	21.35	21.40
Concordant results (✓)				

Concordant results are those within 0.20 cm³ of each other.

(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.

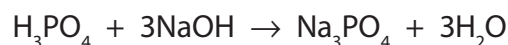
(2)

average volume = cm³

(d) The titration is repeated many times.

The average result from all these titrations shows that 25.0 cm³ sodium hydroxide reacts with 21.30 cm³ of 0.0200 mol/dm³ phosphoric(V) acid.

The equation for the reaction is



Calculate the concentration, in mol/dm³, of the sodium hydroxide solution.

(3)

concentration of sodium hydroxide solution = mol/dm³

(Total for Question 3 = 13 marks)

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4 The box shows the molecular formulae of some organic compounds.

P CH_4	Q C_2H_4	R C_2H_6
S C_3H_6	T $\text{C}_2\text{H}_4\text{Br}_2$	U C_4H_8

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(a) Choose compounds from the box to answer this question.

You may use each compound once, more than once or not at all.

(i) Identify a compound that is not a hydrocarbon. (1)

(ii) Identify a compound that has the same empirical formula as its molecular formula. (1)

(b) (i) Draw the displayed formula for compound P. (1)

(ii) Draw the displayed formula for two straight-chain isomers of compound U. (2)

Isomer 1	Isomer 2
----------	----------



- (c) (i) Compound Q reacts with bromine to form compound T.

Describe the observation that would be made during this reaction.

(1)

- (ii) Suggest how compound R could be converted into compound T.

(2)

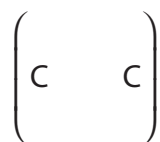
- (d) Compound Q is used as the starting material in the manufacture of polymers such as poly(ethene) and poly(chloroethene).

- (i) What type of polymers are poly(ethene) and poly(chloroethene)?

(1)

- (ii) Complete the diagram to show the displayed formula of poly(chloroethene).

(2)



- (e) Nylon is a polymer formed by a different polymerisation process.

- (i) Give the name of this polymerisation process.

(1)

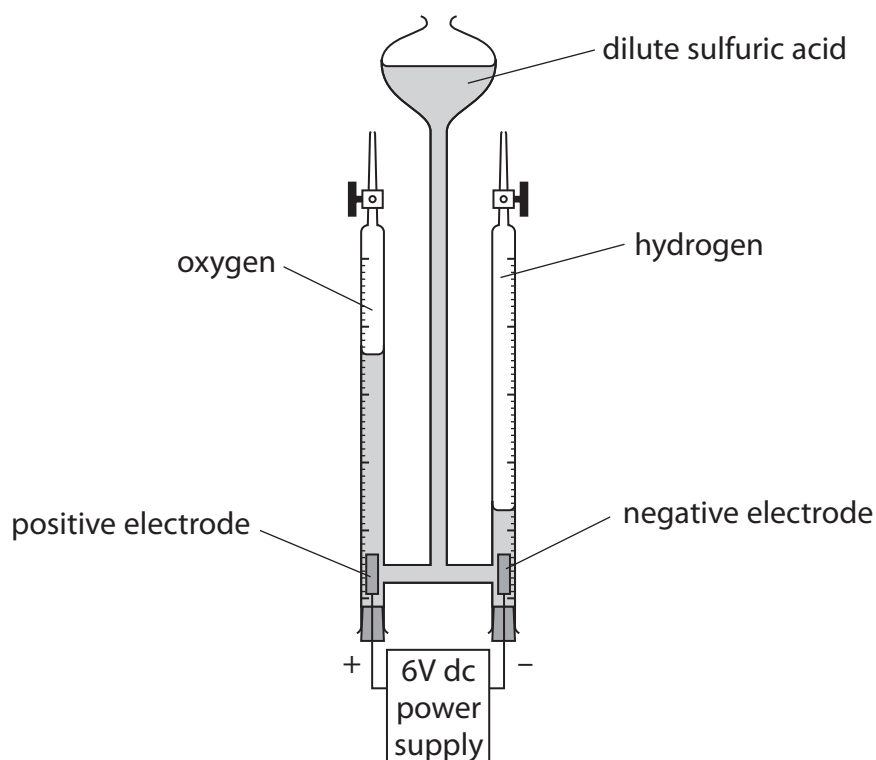
- (ii) State a difference between the two polymerisation processes.

(1)

(Total for Question 4 = 13 marks)



- 5 This apparatus is called a Hofmann voltameter. It is used to collect the gases produced when an electric current passes through a solution of dilute sulfuric acid.



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- (a) (i) Name the process that takes place in the Hofmann voltameter.

(1)

- (ii) State why zinc should not be used for the electrodes.

(1)

- (b) (i) Describe a test to show that the gas produced at the positive electrode is oxygen.

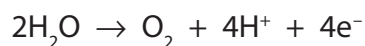
(1)

- (ii) Write an ionic half-equation to represent the reaction that produces hydrogen at the negative electrode.

(1)



- (c) An ionic half-equation for the reaction at the positive electrode is



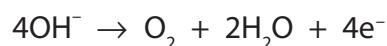
Calculate the maximum volume of oxygen that could be formed at room temperature and pressure (rtp) if a charge of 0.010 faraday is passed through the dilute sulfuric acid.

[molar volume of oxygen gas is 24 000 cm³ at rtp]

(3)

maximum volume of oxygen = cm³

- (d) The ionic half-equation for the reaction at the positive electrode is sometimes shown as



Suggest why this half-equation is not the best way to show the reaction at the positive electrode when an electric current is passed through a solution of dilute sulfuric acid.

(1)

(Total for Question 5 = 8 marks)



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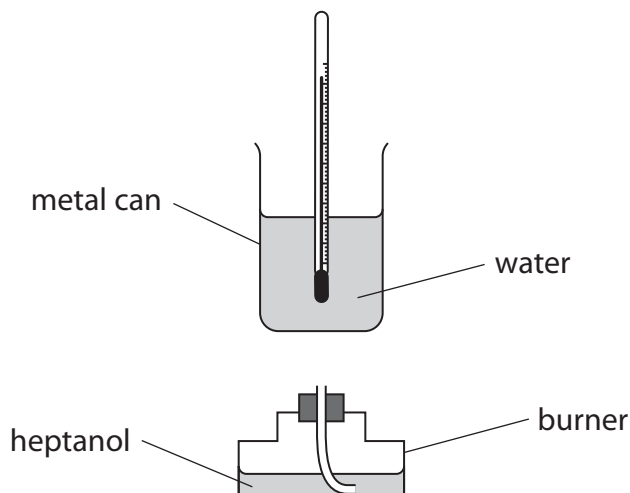
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6 Heptanol and hydrogen are both used as fuels.

(a) A student uses this apparatus to find the heat energy released from the combustion of heptanol.



He uses this formula

$$Q = m \times 4.18 \times \Delta T$$

[Q = heat energy released, m = mass of water in g, ΔT = change in temperature of water]

1.00 cm³ water has a mass of 1.00 g.

(i) State the measurements that the student needs to record to find a value for the heat energy released.

(2)

(ii) The student burns 0.75 g of heptanol and calculates Q to be 19 kJ.

Use this information to calculate the molar enthalpy change, in kJ/mol, for the combustion of heptanol.

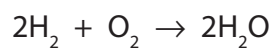
[M_r of heptanol = 114]

(3)

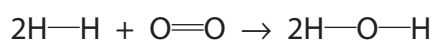
molar enthalpy change = kJ/mol



(b) The equation for the combustion of hydrogen is



(i) This equation shows the reaction, including the covalent bonds in the molecules.



The table gives the average (mean) bond energies.

Bond	Average bond energy in kJ/mol
H—H	436
O=O	498
H—O	464

Use the values in the table to calculate the enthalpy change, ΔH , for the reaction.

Include the sign in your answer.

(3)

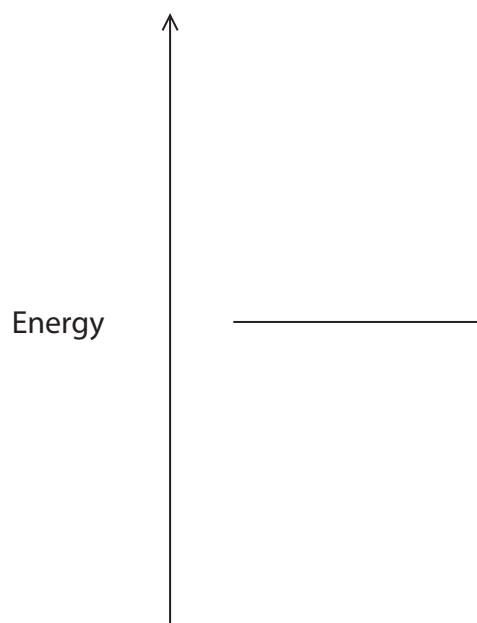
$\Delta H = \dots\dots\dots$ kJ



- (ii) Complete the energy level diagram for the reaction between hydrogen and oxygen by showing the reactants and products.

Label the enthalpy change, ΔH , for the reaction.

(2)



(Total for Question 6 = 10 marks)

TOTAL FOR PAPER = 60 MARKS

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