

Please check the examination details below before entering your candidate information

Candidate surname

Other names

**Pearson Edexcel
International GCSE (9–1)**

Centre Number

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Candidate Number

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Time 1 hour 15 minutes

**Paper
reference**

4CH1/2C

**Chemistry
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.*
- 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.
- Try to answer every question.
- Check your answers if you have time at the end.
- Good luck with your examination.

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 Al aluminium 13	28 Si silicon 14	31 P phosphorus 15	32 S sulfur 16	35.5 Cl chlorine 17	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
85 Rb rubidium 37	88 Sr strontium 38	89 Y yttrium 39	91 Zr zirconium 40	93 Nb niobium 41	96 Mo molybdenum 42	[98] Tc technetium 43	101 Ru ruthenium 44	103 Rh rhodium 45	106 Pd palladium 46	108 Ag silver 47	112 Cd cadmium 48	115 In indium 49	119 Sn tin 50	122 Sb antimony 51	128 Te tellurium 52	127 I iodine 53	131 Xe xenon 54
133 Cs caesium 55	137 Ba barium 56	139 La* lanthanum 57	178 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	[209] Po polonium 84	[210] At astatine 85	[222] Rn radon 86
[223] Fr francium 87	[226] Ra radium 88	[227] Ac* actinium 89	[261] Rf rutherfordium 104	[262] Db dubnium 105	[266] Sg seaborgium 106	[264] Bh bohrium 107	[277] Hs hassium 108	[268] Mt meitnerium 109	[271] Ds darmstadtium 110	[272] Rg roentgenium 111	Elements with atomic numbers 112–116 have been reported but not fully authenticated						

1
H
hydrogen
1

Key
relative atomic mass
atomic symbol
name
atomic (proton) number

* 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. Write your answers in the spaces provided.

1 Use the Periodic Table to help you answer this question.

(a) (i) Name the element with atomic number 14 (1)

(ii) Name the element with a relative atomic mass of 11 (1)

(iii) Name the element in Group 2 and Period 3 (1)

(b) (i) Determine the number of neutrons in a phosphorus atom with mass number 31 (1)

(ii) State the electronic configuration of an aluminium atom. (1)

(iii) State why neon is unreactive. (1)

(Total for Question 1 = 6 marks)

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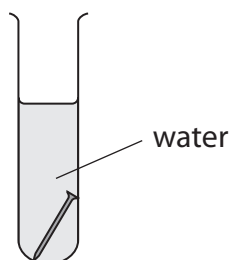
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2 A student investigates the rusting of iron.

(a) She places an iron nail in a test tube of water and leaves it for several days.



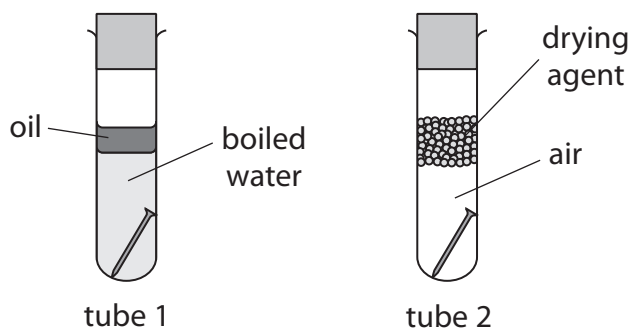
(i) Predict the appearance of the iron nail after several days.

(1)

(ii) Name the main compound in rust.

(1)

(b) The student then sets up two more test tubes containing iron nails.



Explain why the iron nail in tube 1 and the iron nail in tube 2 do not rust.

(4)

tube 1.....

tube 2.....

(Total for Question 2 = 6 marks)



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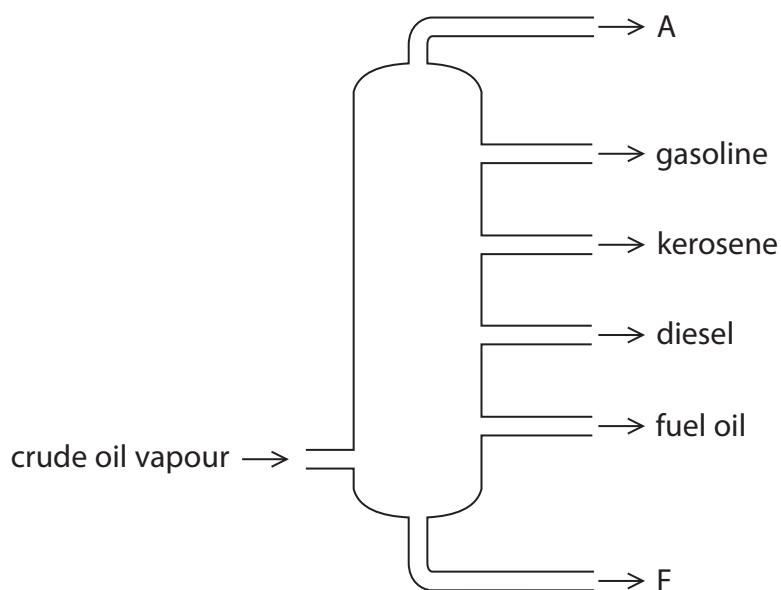
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3 The diagram shows the industrial equipment used to separate crude oil into fractions.



(a) (i) Give the name of the industrial equipment.

(1)

(ii) Give one use of the fuel oil fraction.

(1)

(iii) Give the names of fraction A and fraction F.

(2)

fraction A.....

fraction F.....

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- (b) One compound in the gasoline fraction is the alkane octane (C_8H_{18}) and one compound in the kerosene fraction is the alkane dodecane ($C_{12}H_{26}$)

These two alkanes are covalently bonded and have simple molecular structures.

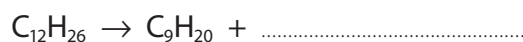
- (i) Give the general formula for the alkanes. (1)

- (ii) Explain, in terms of their structures, why $C_{12}H_{26}$ has a higher boiling point than C_8H_{18} (3)

- (c) Catalytic cracking can be used to convert the alkane $C_{12}H_{26}$ into more useful products.

- (i) Give the name of the catalyst used for catalytic cracking. (1)

- (ii) Complete the equation for this cracking reaction. (1)



(Total for Question 3 = 10 marks)

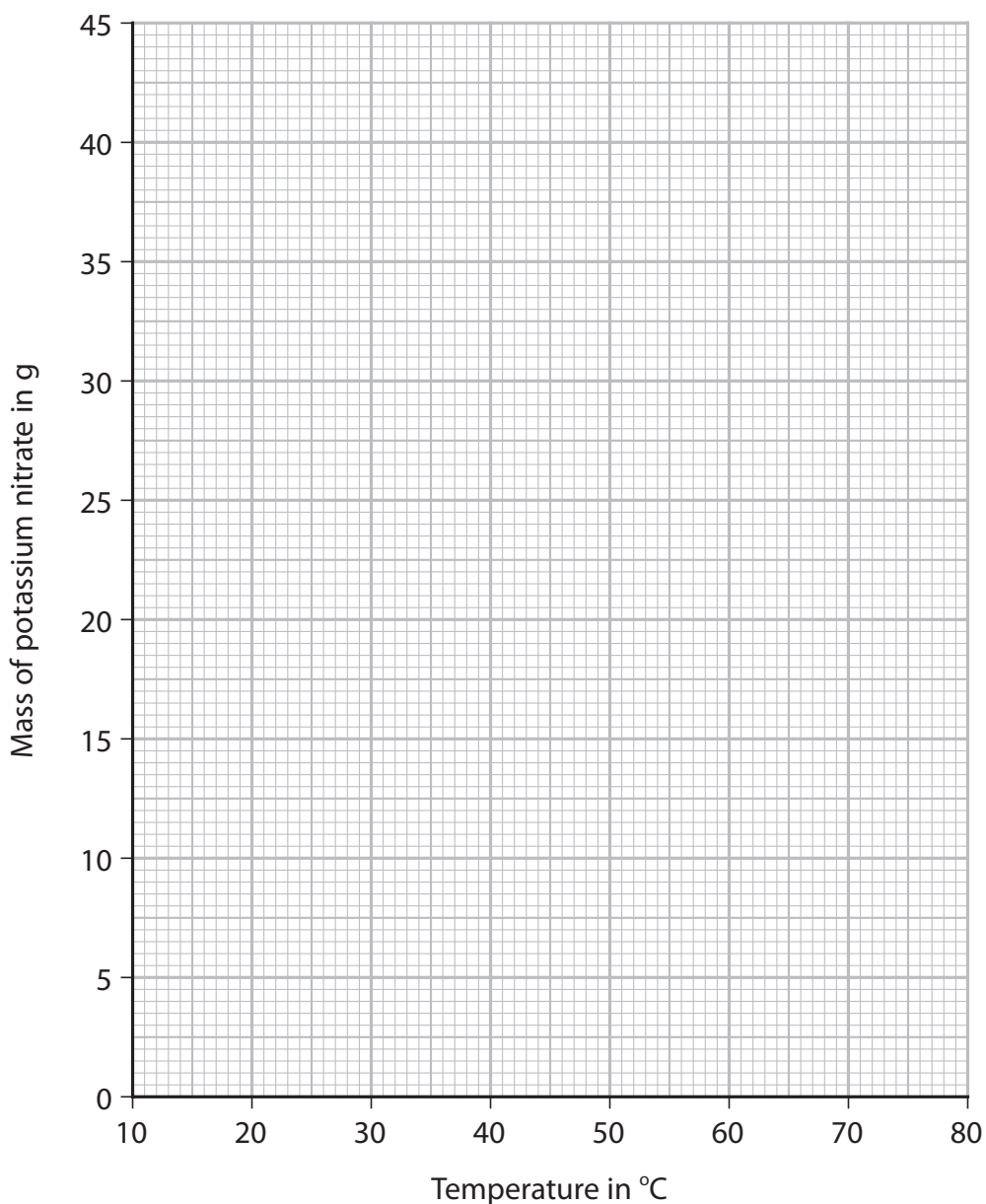


- 4 A student investigates the solubility of potassium nitrate in water. She measures the masses of potassium nitrate that dissolve in 25 cm^3 of water at different temperatures.

The table shows the student's results. One of the results is anomalous.

Temperature in $^{\circ}\text{C}$	10	20	30	40	50	60	70
Mass of potassium nitrate in g	8.0	10.0	12.5	16.0	17.5	26.5	34.0

- (a) (i) Plot the results on the grid. (1)
- (ii) Draw a circle around the anomalous result. (1)
- (iii) Ignoring the anomalous result, draw a curve of best fit. (1)



(b) Suggest **two** possible mistakes that could have caused the anomalous result. (2)

1

.....

2

.....

(c) Use your graph to find the maximum mass of potassium nitrate that dissolves in 25 cm³ of water at 75 °C.

Show on your graph how you obtained your answer. (2)

mass = g

(d) Use your graph to calculate the solubility of potassium nitrate in g per 100 g of water at 25 °C.

[1.0 cm³ of water has a mass of 1.0 g] (2)

solubility = g per 100 g of water

(Total for Question 4 = 9 marks)

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5 Ethanol, C_2H_5OH , is a member of the homologous series of alcohols.

(a) Give two characteristics of a homologous series.

(2)

1

.....

2

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(b) When ethanol is heated with potassium dichromate(VI) and one other reagent, the ethanol is oxidised to ethanoic acid, CH_3COOH

(i) Give the formula of the other reagent.

(1)

.....

(ii) State the colour change that occurs during this oxidation reaction.

(2)

from to

(iii) Draw the displayed formulae for ethanol and ethanoic acid in the boxes.

(2)

ethanol	ethanoic acid



- (c) Ethanol can be manufactured by two different methods.
The table gives some information about the two methods.

	Hydration of ethene	Fermentation of glucose
raw material	crude oil	sugar cane
rate of reaction	fast	slow
purity of ethanol	pure	impure
operating temperature	300 °C	30 °C
operating pressure	60 – 70 atmospheres	1 atmosphere
catalyst	phosphoric acid	enzymes in yeast

- (i) Discuss the advantages and disadvantages of these two methods, using information from the table.

(6)

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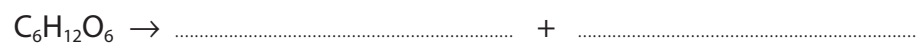


(ii) The word equation for the fermentation process is



Complete the chemical equation for this reaction.

(1)



(Total for Question 5 = 14 marks)

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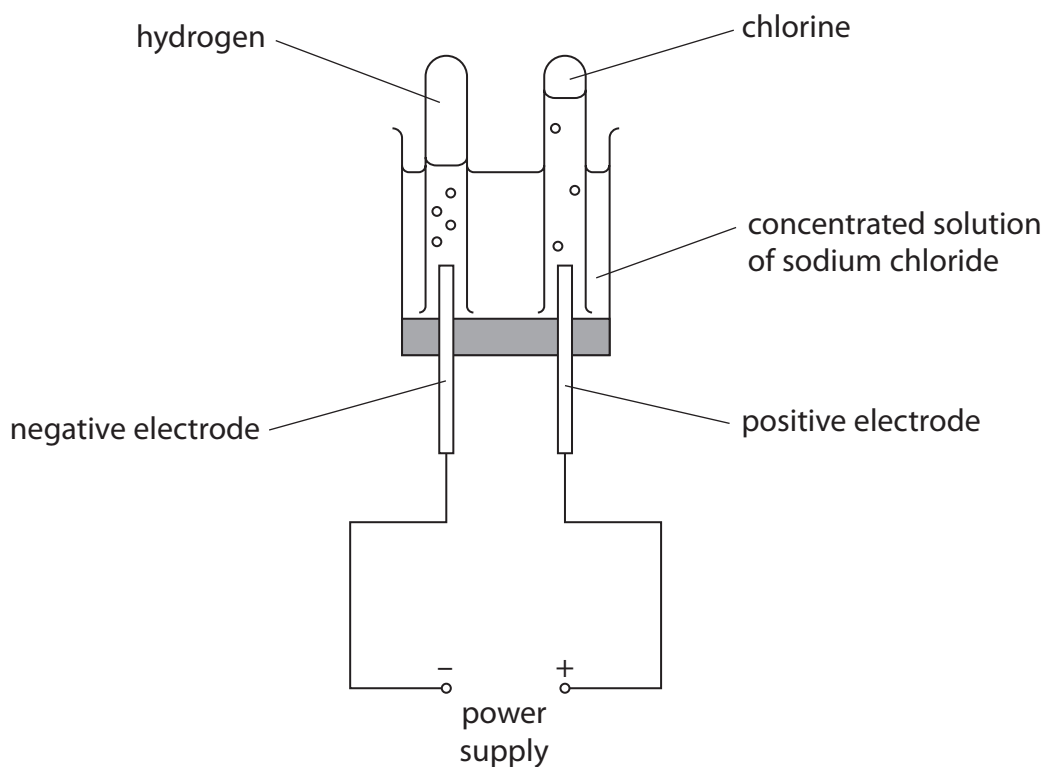
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6 The diagram shows how hydrogen gas and chlorine gas can be prepared in the laboratory by electrolysis of a concentrated solution of sodium chloride.



(a) (i) Give a test for hydrogen gas.

(1)

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(ii) Give a test for chlorine gas.

(2)

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(b) The ionic half-equation for the formation of chlorine at the positive electrode is



(i) State why this reaction is an oxidation reaction. (1)

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.....

(ii) Give the ionic half-equation for the formation of hydrogen at the negative electrode. (1)

.....

.....

(iii) State why it is safer to do this electrolysis in a fume cupboard. (1)

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(iv) Suggest why the volume of chlorine collected during this electrolysis is less than the volume of hydrogen collected. (1)

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Turn over

- (c) In the chemical industry, chlorine can be produced by the electrolysis of molten sodium chloride.

The overall equation for this reaction is



- (i) Explain why sodium chloride needs to be molten rather than solid for electrolysis to occur.

(2)

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- (ii) Calculate the maximum volume, in dm^3 , of chlorine gas at rtp that can be obtained from 23.4 tonnes of molten sodium chloride.

[1 tonne = 10^6 g]

[M_r of NaCl = 58.5]

[molar volume of chlorine at rtp = 24 dm^3]

Give your answer in standard form.

(4)

volume = dm^3

(Total for Question 6 = 13 marks)

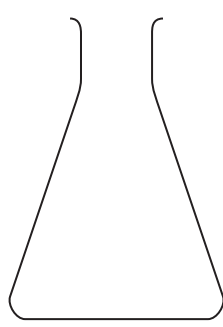


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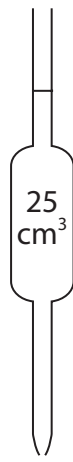
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7 A student does a titration to find the concentration of a solution of phosphoric acid. He uses these pieces of apparatus X, Y and Z in his titration.



X



Y



Z

Diagrams are not to scale.

(a) Give the names of X, Y and Z.

(3)

X

Y

Z

(b) What is the colour of phenolphthalein in phosphoric acid?

(1)

- A blue
- B colourless
- C pink
- D red



Turn over

- (c) The student titrates 25.0 cm^3 of phosphoric acid with a solution of sodium hydroxide (NaOH).

Table 1 shows the student's results.

titration number	1	2	3	4
volume of NaOH added in cm^3	30.35	30.25	30.00	30.30
concordant results				

Table 1

Concordant results are those within 0.20 cm^3 of each other.

- (i) Add ticks (\checkmark) to table 1 to show the concordant results. (1)
- (ii) Use your ticked results to calculate the mean (average) volume of NaOH added. (2)

mean volume = cm^3

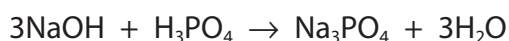


(d) Table 2 shows the titration results of another student.

volume of phosphoric acid used in cm^3	25.0
concentration of sodium hydroxide solution in mol/dm^3	0.525
mean volume of sodium hydroxide added in cm^3	30.40

Table 2

The equation for the reaction is



- (i) Calculate the amount, in moles, of NaOH in 30.40 cm^3 of sodium hydroxide solution. (2)

amount = mol

- (ii) Calculate the amount, in moles, of H_3PO_4 in 25.0 cm^3 of phosphoric acid. (1)

amount = mol

- (iii) Calculate the concentration, in mol/dm^3 , of the phosphoric acid. (2)

concentration = mol/dm^3

(Total for Question 7 = 12 marks)

TOTAL FOR PAPER = 70 MARKS



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