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International Education

IGCSE Practice Paper

CANDIDATE NAME

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CHEMISTRY **0620/42**

Paper 4 Theory (Extended) **Yearly 2026**

1 hour 15 minutes

You must answer on the question paper.

No additional materials are needed.

INSTRUCTIONS

- Answer **all** questions.
- Use a black or dark blue pen. You may use an HB pencil for any diagrams or graphs.
- Write your name, centre number and candidate number in the boxes at the top of the page.
- Write your answer to each question in the space provided.
- Do **not** use an erasable pen or correction fluid.
- Do **not** write on any bar codes.
- You may use a calculator.
- You should show all your working and use appropriate units.

INFORMATION

- The total mark for this paper is 80.
- The number of marks for each question or part question is shown in brackets [ ].
- **This is not a past paper, nor does it contain any questions from past papers.**
- The Periodic Table is printed in the question paper.

This document has **16** pages.

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1 Choose from the following substances to answer the questions.

argon · chlorine · copper · ethene · iron(III) oxide · methane · nitrogen · sodium chloride · sulfur dioxide

Each substance may be used once, more than once or not at all. State which substance:

(a) is a monatomic gas

..... [1]

(b) causes acid rain

..... [1]

(c) is a hydrocarbon that decolourises aqueous bromine

..... [1]

(d) makes up about 78% of clean, dry air

..... [1]

(e) is the main constituent of natural gas

..... [1]

(f) is used in electrical wiring

..... [1]

(g) bleaches damp litmus paper

..... [1]

(h) is the main compound in hematite

..... [1]

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2 Chlorine has two isotopes, ^{35}Cl and ^{37}Cl.

(a)

(i) State what is meant by *isotopes*.

.....

..... [1]

(ii) Complete Table 2.1. [3]

Table 2.1

	number of protons	number of neutrons	number of electrons
^{37}Cl atom			
$^{35}Cl^-$ ion			

(iii) A sample of chlorine contains 75% ^{35}Cl and 25% ^{37}Cl. Calculate the relative atomic mass of chlorine.

relative atomic mass = ... [2]

(b) Phosphorus trichloride, PCl_3, is a covalent compound. Draw a dot-and-cross diagram to show the electron arrangement in a molecule of PCl_3. Show outer shell electrons only.

[2]

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(c) Calcium fluoride, CaF_2, is an ionic compound. Draw a dot-and-cross diagram to show the ions in calcium fluoride. Show outer shell electrons only and the charges on the ions.

[3]

(d) Calcium fluoride melts at 1418 °C. Phosphorus trichloride boils at 76 °C. Explain this difference in terms of structure and bonding.

.....

.....

.....

..... [3]

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3 Aluminium is extracted by the electrolysis of aluminium oxide dissolved in molten cryolite.

(a)

(i) Name the main ore of aluminium.

..... [1]

(ii) Explain why the aluminium oxide is dissolved in molten cryolite.

.....

..... [1]

(iii) Write the ionic half-equation for the reaction at the cathode.

..... [2]

(iv) Name the gas formed at the anode.

..... [1]

(v) Explain why the carbon anodes must be replaced regularly.

.....

..... [2]

(b) Concentrated aqueous sodium chloride is electrolysed using inert electrodes.

(i) Name the product formed:

at the anode .....

at the cathode .....

in the solution left ..... [3]

(ii) Describe a test for the gas formed at the cathode. Give the result.

.....

..... [1]

(c) Hydrogen–oxygen fuel cells are used to power some vehicles.

(i) Write the overall equation for the reaction in a hydrogen–oxygen fuel cell.

..... [1]

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(ii) Give **one** advantage and **one** disadvantage of hydrogen fuel cells compared with petrol engines.

advantage .....

disadvantage ..... [2]

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4 A student makes crystals of hydrated copper(II) sulfate, $CuSO_4 \cdot 5H_2O$, from copper(II) oxide and dilute sulfuric acid.

(a)

(i) Write the symbol equation for the reaction between copper(II) oxide and sulfuric acid.

..... [1]

(ii) Explain why the copper(II) oxide is added in excess.

..... [1]

(iii) Name the method used to remove the excess copper(II) oxide.

..... [1]

(iv) Describe how the student obtains dry crystals from the solution.

.....

.....

.....

..... [3]

(b) The student reacts 4.00 g of copper(II) oxide with excess acid.

(i) Calculate the number of moles of copper(II) oxide used. [M_r: CuO, 80]

moles = ... mol [1]

(ii) Calculate the maximum mass of $CuSO_4 \cdot 5H_2O$ that can be made. [M_r: $CuSO_4 \cdot 5H_2O$, 250]

mass = ... g [2]

(iii) The student obtains 10.0 g of crystals. Calculate the percentage yield.

percentage yield = ... % [1]

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(c) Zinc reacts with aqueous copper(II) sulfate.

(i) Write the ionic equation for this reaction.

..... [1]

(ii) Identify the species that is oxidised. Explain your answer in terms of electrons.

.....

..... [2]

(iii) State **one** observation during the reaction.

..... [1]

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5 Sulfur trioxide is made in the Contact process.
$2SO_2(g) + O_2(g) \rightleftharpoons 2SO_3(g)$ $\Delta H = -196$ kJ/mol

(a)

(i) Name the catalyst used.

..... [1]

(ii) State the typical temperature and pressure used.

temperature .....

pressure ..... [2]

(iii) State what the symbol $\rightleftharpoons$ shows about this reaction.

..... [1]

(iv) Explain the effect on the equilibrium yield of SO_3 of increasing the temperature.

.....

..... [2]

(v) Explain the effect on the equilibrium yield of SO_3 of increasing the pressure.

.....

..... [2]

(vi) Suggest why a lower temperature is not used, even though it would give a higher yield.

..... [1]

(b) Magnesium ribbon reacts with dilute hydrochloric acid.

(i) Use collision theory to explain why the rate increases when the concentration of the acid is increased.

.....

.....

..... [3]

(ii) Explain why magnesium powder reacts faster than magnesium ribbon.

..... [1]

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(iii) State what is meant by *activation energy*.

..... [1]

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6 Ethanol can be made from ethene.

(a)

(i) State the conditions used to make ethanol from ethene.

.....

..... [2]

(ii) Name the type of reaction.

..... [1]

(b) Ethanol can be oxidised to ethanoic acid.

(i) Name a suitable oxidising agent.

..... [1]

(ii) Draw the displayed formula of ethanoic acid.

[1]

(iii) Name the homologous series that ethanoic acid belongs to.

..... [1]

(c) Ethanoic acid reacts with ethanol to form an ester.

(i) Name the ester formed.

..... [1]

(ii) State the conditions needed.

..... [1]

(d) Ethene is a member of the alkene homologous series.

(i) Give the general formula of the alkenes.

..... [1]

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(ii) Describe a test to show that a compound is an alkene. Give the result.

.....

..... [2]

(e) Propene, $CH_2=CHCH_3$, forms the addition polymer poly(propene).

(i) Draw **one** repeat unit of poly(propene).

[2]

(ii) Nylon is a polyamide. Name the type of polymerisation used to make nylon.

..... [1]

(iii) Name the linkage in nylon.

..... [1]

(iv) Give **one** environmental problem caused by disposing of non-biodegradable plastics.

..... [1]

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The Periodic Table of Elements

Group

I	II											III	IV	V	VI	VII	VIII
1 **H** hydrogen 1	**Key** atomic number **atomic symbol** name relative atomic mass																2 **He** helium 4
3 **Li** lithium 7	4 **Be** beryllium 9											5 **B** boron 11	6 **C** carbon 12	7 **N** nitrogen 14	8 **O** oxygen 16	9 **F** fluorine 19	10 **Ne** neon 20
11 **Na** sodium 23	12 **Mg** magnesium 24											13 **Al** aluminium 27	14 **Si** silicon 28	15 **P** phosphorus 31	16 **S** sulfur 32	17 **Cl** chlorine 35.5	18 **Ar** argon 40
19 **K** potassium 39	20 **Ca** calcium 40	21 **Sc** scandium 45	22 **Ti** titanium 48	23 **V** vanadium 51	24 **Cr** chromium 52	25 **Mn** manganese 55	26 **Fe** iron 56	27 **Co** cobalt 59	28 **Ni** nickel 59	29 **Cu** copper 64	30 **Zn** zinc 65	31 **Ga** gallium 70	32 **Ge** germanium 73	33 **As** arsenic 75	34 **Se** selenium 79	35 **Br** bromine 80	36 **Kr** krypton 84
37 **Rb** rubidium 85	38 **Sr** strontium 88	39 **Y** yttrium 89	40 **Zr** zirconium 91	41 **Nb** niobium 93	42 **Mo** molybdenum 96	43 **Tc** technetium –	44 **Ru** ruthenium 101	45 **Rh** rhodium 103	46 **Pd** palladium 106	47 **Ag** silver 108	48 **Cd** cadmium 112	49 **In** indium 115	50 **Sn** tin 119	51 **Sb** antimony 122	52 **Te** tellurium 128	53 **I** iodine 127	54 **Xe** xenon 131
55 **Cs** caesium 133	56 **Ba** barium 137	57–71 lanthanoids	72 **Hf** hafnium 178	73 **Ta** tantalum 181	74 **W** tungsten 184	75 **Re** rhenium 186	76 **Os** osmium 190	77 **Ir** iridium 192	78 **Pt** platinum 195	79 **Au** gold 197	80 **Hg** mercury 201	81 **Tl** thallium 204	82 **Pb** lead 207	83 **Bi** bismuth 209	84 **Po** polonium –	85 **At** astatine –	86 **Rn** radon –
87 **Fr** francium –	88 **Ra** radium –	89–103 actinoids	104 **Rf** rutherfordium –	105 **Db** dubnium –	106 **Sg** seaborgium –	107 **Bh** bohrium –	108 **Hs** hassium –	109 **Mt** meitnerium –	110 **Ds** darmstadtium –	111 **Rg** roentgenium –	112 **Cn** copernicium –	113 **Nh** nihonium –	114 **Fl** flerovium –	115 **Mc** moscovium –	116 **Lv** livermorium –	117 **Ts** tennessine –	118 **Og** oganesson –

lanthanoids	57 **La** lanthanum 139	58 **Ce** cerium 140	59 **Pr** praseodymium 141	60 **Nd** neodymium 144	61 **Pm** promethium –	62 **Sm** samarium 150	63 **Eu** europium 152	64 **Gd** gadolinium 157	65 **Tb** terbium 159	66 **Dy** dysprosium 163	67 **Ho** holmium 165	68 **Er** erbium 167	69 **Tm** thulium 169	70 **Yb** ytterbium 173	71 **Lu** lutetium 175
actinoids	89 **Ac** actinium –	90 **Th** thorium 232	91 **Pa** protactinium 231	92 **U** uranium 238	93 **Np** neptunium –	94 **Pu** plutonium –	95 **Am** americium –	96 **Cm** curium –	97 **Bk** berkelium –	98 **Cf** californium –	99 **Es** einsteinium –	100 **Fm** fermium –	101 **Md** mendelevium –	102 **No** nobelium –	103 **Lr** lawrencium –

The volume of one mole of any gas is 24 dm³ at room temperature and pressure (r.t.p.).

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