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CANDIDATE NAME

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3312743550

CHEMISTRY **0620/32**

Paper 3 Theory (Core) **February/March 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. Do **not** use correction fluid or tape.
- 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 [ ].
- The Periodic Table is printed in the question paper.

This document has **16** pages.

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[Turn over

1 A list of elements is shown.

aluminium
boron
bromine
carbon
chlorine
helium
hydrogen
magnesium
nitrogen
oxygen
potassium
silver
sodium
zinc

Answer the following questions using only the elements from the list.
Each element may be used once, more than once or not at all.

Give the name of the element that:

(a) is approximately 78% of clean, dry air

..... [1]

(b) is formed when zinc reacts with dilute hydrochloric acid

..... [1]

(c) forms an ion with a 3+ charge

..... [1]

(d) has atoms with an electronic configuration of 2,8,1

..... [1]

(e) is the most reactive metal

..... [1]

(f) is a monatomic gas at room temperature and pressure

..... [1]

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(g) is a product of photosynthesis

..... [1]

(h) is found in brass

..... [1]

(i) is a gas needed for iron to rust.

..... [1]

[Total: 9]

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2 This question is about organic compounds and their reactions.

(a) **(i)** Write the general formula for alkanes.

..... [1]

(ii) Name **two** substances that are produced when ethane undergoes complete combustion.

..... and ..... [2]

(b) Compound **P** is unsaturated and colourless.

Figure 2.1 shows the displayed formula of compound **P**.

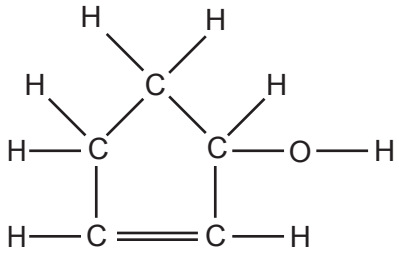

Figure 2.1

(i) On Figure 2.1, draw a circle around the alcohol functional group. [1]

(ii) Deduce the molecular formula of compound **P**.

..... [1]

(iii) A test-tube contains aqueous bromine.

Describe the colour change when excess compound **P** is added to the test-tube.

from ..... to ..... [2]

(c) Ethanol is manufactured by the fermentation of aqueous glucose.

(i) State **two** conditions needed for the fermentation of aqueous glucose.

1 .....

2 .....
[2]

(ii) Name the method used to separate ethanol from the reaction mixture after fermentation has finished.

..... [1]

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(d) Ethanoic acid is found in vinegar.

(i) Name the homologous series that includes ethanoic acid.

..... [1]

(ii) Ethanoic acid reacts with sodium.

Complete the word equation for this reaction.

ethanoic acid	+	sodium	→	....	+	.....

[2]

(e) Poly(ethene) is a polymer.

Draw the displayed formula of the monomer used to make poly(ethene).

[1]

[Total: 14]

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3 Titanium is a metal.

(a) **(i)** State the period number for titanium in the Periodic Table.

..... [1]

(ii) Deduce the number of neutrons and protons in an atom of the isotope of titanium shown.

$^{50}_{22}$Ti

number of neutrons .....

number of protons .....

[2]

(b) Titanium is a transition element that can be used as a catalyst.

State **two** other properties of transition elements.

1 .....

.....

2 .....

.....

[2]

(c) Magnesium reacts with titanium(IV) chloride, $TiCl_4$, to produce titanium.

Complete the symbol equation for this reaction.

.....Mg + $TiCl_4$ → .....$MgCl_2$ + Ti

[1]

(d) Molten magnesium chloride is electrolysed using graphite electrodes.

(i) Define the term electrolysis.

.....

.....

.....

..... [2]

(ii) State **one** property of graphite that makes it suitable for use as an electrode.

..... [1]

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(iii) State **one** use of graphite, other than as an electrode.

..... [1]

(iv) *Due to an issue with Question 3(d)(iv), the question has been removed from the question paper.*

(v) Name the product at each electrode for the electrolysis of molten magnesium chloride and give the observations at the positive electrode.

product at the negative electrode .....

product at the positive electrode .....

observations at the positive electrode .....

.....
[3]

[Total: 14]

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4 The equation shows the reaction of calcium carbonate with dilute hydrochloric acid.

$$CaCO_3(s) + 2HCl(aq) \rightarrow CaCl_2(aq) + CO_2(g) + H_2O(l)$$

(a) (i) State the meaning of the symbol (aq) in this equation.

..... [1]

(ii) Name the item of apparatus used to collect and measure the volume of carbon dioxide produced.

..... [1]

(b) Small pieces of calcium carbonate react with excess dilute hydrochloric acid of different concentrations. The time taken for each reaction to finish is recorded.

The concentrations of dilute hydrochloric acid used are:

- 0.75 mol / dm^3
- 1.50 mol / dm^3
- 3.00 mol / dm^3.

All other conditions stay the same.

Table 4.1 shows the time taken for each reaction to finish.

Table 4.1

concentration of dilute hydrochloric acid in mol / dm^3	time taken for reaction to finish in s
	16
	32
	8

(i) Complete Table 4.1 by writing the concentrations in the first column. [1]

(ii) The experiment is repeated using dilute hydrochloric acid at a higher temperature. All other conditions stay the same.

Describe the effect, if any, on the time taken for the reaction to finish.

..... [1]

(c) Manganese(IV) oxide acts as a catalyst in some reactions.

Describe what is meant by the term catalyst.

.....

.....

..... [2]

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(d) **(i)** Potassium hydroxide is an alkali.

State the colour change observed when excess aqueous potassium hydroxide is added to a solution of dilute hydrochloric acid with methyl orange indicator.

from ..... to ..... [2]

(ii) Give the formula of the ion that is present in all aqueous alkalis.

..... [1]

(iii) Choose the pH value of an alkali.

Draw a circle around your chosen answer.

pH 2 **pH 5** **pH 7** **pH 12**

[1]

(e) Copper(II) chloride crystals are prepared by reacting dilute hydrochloric acid with excess solid copper(II) oxide.

Name the method used to remove any unreacted solid copper(II) oxide from the reaction mixture.

..... [1]

(f) Copper(II) oxide is basic.

Classify the oxides shown in Table 4.2 as acidic or basic.

Table 4.2

oxide	acidic or basic
calcium oxide	
carbon dioxide	
manganese(IV) oxide	
sulfur dioxide	

[2]

[Total: 13]

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5 **(a)** NPK fertilisers are used on fields.

(i) Nitrogen and phosphorus are elements contained in NPK fertilisers.

Name the other element contained in NPK fertilisers.

..... [1]

(ii) State why fertilisers are used.

..... [1]

(iii) One compound that can be found in fertilisers contains the ions NH_4^+ and NO_3^- only.

State the name of this compound.

..... [1]

(iv) Another compound that can be found in fertilisers has the formula $Ca_3P_2O_8$.

Complete Table 5.1 to calculate the relative formula mass of $Ca_3P_2O_8$.

Table 5.1

type of atom	number of atoms	relative atomic mass	
calcium	3	40	3 × 40 = 120
phosphorus		31	
oxygen		16	

relative formula mass = ... [2]

(b) Water from natural sources can be polluted with harmful substances.

State why phosphates and some metal compounds found in river water are harmful.

phosphates .....

.....

metal compounds .....

.....

[2]

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(c) Nitrogen dioxide, NO_2, is an oxide of nitrogen and an air pollutant.

(i) Write a word equation to show how nitrogen dioxide is produced from two gases present in air.

..... [1]

(ii) State **two** adverse effects of nitrogen dioxide in air.

1 .....

2 .....

[2]

[Total: 10]

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6 This question is about substances and their uses.

(a) **(i)** Give **two** properties of aluminium that make it suitable for the manufacture of overhead electrical cables.

1 .....

2 .....

[2]

(ii) Give **one** property of diamond that makes it suitable for use in cutting tools.

..... [1]

(b) Substance **X** has a melting point of 113 °C and a boiling point of 445 °C.

Deduce the physical state of substance **X** at –5 °C.

Give a reason for your answer.

physical state .....

reason .....

.....

[2]

[Total: 5]

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7 Oxygen is an element that has isotopes.

(a) (i) State the meaning of the term isotopes.

.....

.....

..... [2]

(ii) Relative atomic mass is the average mass of an atom of an element compared to the mass of a specific isotope.

Identify the specific isotope used for this comparison.

Draw a circle around your chosen answer.

^{12}C ^{14}C ^{16}O ^{18}O [1]

(b) Oxygen is a gas at room temperature and pressure.

Describe the arrangement and separation of the particles in gaseous oxygen.

arrangement .....

.....

separation .....

.....

[2]

(c) Oxygen can exist in different states of matter.

Name the change of state for each description.

solid to liquid .....

gas to liquid .....

[2]

[Total: 7]

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8 Potassium iodide is an ionic compound.

(a) Describe tests to identify the **two** ions contained in potassium iodide.

potassium ions

test .....

observations .....

iodide ions

test .....

observations .....

[4]

(b) Potassium iodide is soluble in water.

Identify **one** other compound that is soluble in water.

Tick (✓) **one** box.

barium sulfate	☐
lead(II) sulfate	☐
magnesium carbonate	☐
sodium carbonate	☐

[1]

(c) State **two** physical properties of an ionic compound other than solubility in water.

1 .....

2 .....

[2]

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(d) Potassium reacts with iodine to produce potassium iodide.

When a 5.6 g sample of potassium reacts with excess iodine, 23.8 g of potassium iodide is produced.

Calculate the mass of potassium iodide produced when 2.8 g of potassium reacts with excess iodine.

mass = ... g [1]

[Total: 8]

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The Periodic Table of Elements

Group																	
I	II											III	IV	V	VI	VII	VIII
							1 H hydrogen 1										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 –

Key

atomic number
atomic symbol
name
relative atomic mass

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 dm^3 at room temperature and pressure (r.t.p.).

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