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CHEMISTRY **0620/32**

Paper 3 Theory (Core) **May/June 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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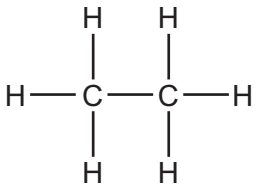
1 Six substances, **A** to **F**, are shown in Figure 1.1.

A



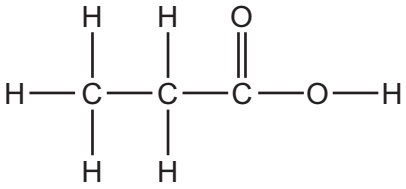
B

CO_2

C



D



E

N_2

F

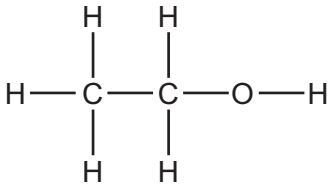


Figure 1.1

Answer the following questions about these substances.

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

(a) State which substance is:

(i) an alcohol

..... [1]

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

..... [1]

(iii) a compound in the same homologous series as ethanoic acid

..... [1]

(iv) a hydrocarbon

..... [1]

(v) a compound that is a product of the complete combustion of an alkane

..... [1]

(vi) a gas that turns limewater milky

..... [1]

(vii) a pale yellow-green gas at room temperature and pressure.

..... [1]

View solution

(b) State which **two** substances are elements.

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

View solution

[Total: 9]

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2 Table 2.1 shows some properties of the Group I elements.

Table 2.1

metal	melting point / °C	boiling point / °C	atomic radius / pm
lithium	180	1342	152
sodium		883	186
potassium	64	762	
rubidium	39	688	248

View solution

(a) Use the information in Table 2.1 to answer the following questions.

(i) Predict the melting point of sodium.

..... [1]

(ii) Predict the atomic radius of potassium.

View solution

..... [1]

(iii) Deduce the physical state of lithium at 95 °C.

View solution

Give a reason for your answer.

physical state .....

reason .....

.....

[2]

(iv) State how the density of the Group I elements changes down the group.

View solution

..... [1]

(b) Potassium hydroxide, KOH, is made by adding potassium to water.

View solution

(i) Complete the symbol equation for this reaction.

$$.....K + ...H_2O \rightarrow 2KOH + H_2$$

[2]

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(ii) Bubbles of hydrogen gas are observed.

View solution

State the test for hydrogen gas.

test .....

.....

positive result .....

.....

[1]

(c) Complete Figure 2.1 to show the dot-and-cross diagram for a molecule of ammonia.

View solution

Show outer shell electrons only.

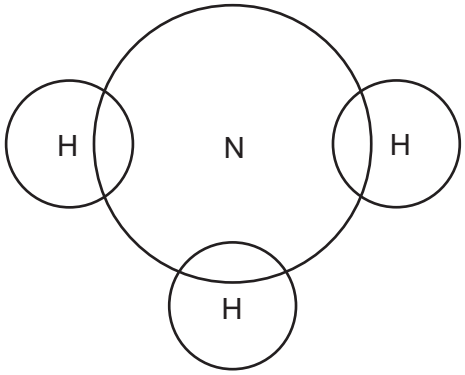

Figure 2.1

[2]

[Total: 10]

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3 The equation for the reaction of magnesium carbonate with dilute sulfuric acid is shown.

$$MgCO_3(s) + H_2SO_4(aq) \rightarrow MgSO_4(aq) + CO_2(g) + H_2O(l)$$

View solution

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

..... [1]

(ii) Name the salt formed when magnesium carbonate reacts with dilute sulfuric acid.

..... [1]

(iii) Name the piece of apparatus used to collect and measure the volume of carbon dioxide produced in this reaction.

..... [1]

(b) A student investigates the reaction of large pieces of magnesium carbonate with dilute sulfuric acid. The magnesium carbonate is in excess.

Figure 3.1 shows the total volume of carbon dioxide gas released as the reaction proceeds.

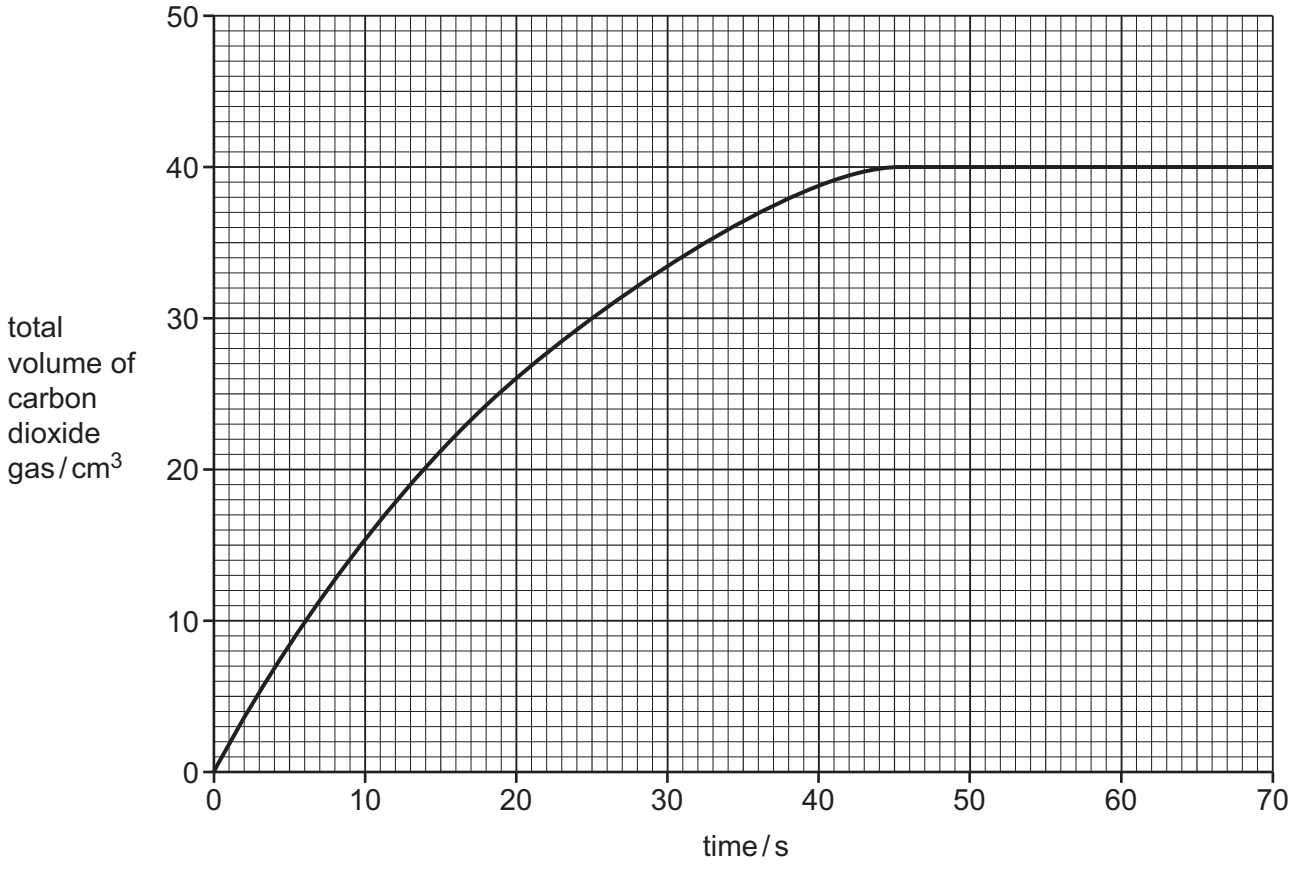

Figure 3.1

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(i) Use the graph in Figure 3.1 to determine the total volume of carbon dioxide gas released in 20 s.

total volume of carbon dioxide gas = ... cm^3 [1]

(ii) Use the graph in Figure 3.1 to deduce the time taken for the reaction to finish.

time = ... s [1]

(iii) The student repeats the experiment using the same volume of dilute sulfuric acid but with smaller pieces of magnesium carbonate.

View solution

Draw a line on the grid in Figure 3.1 to show how the total volume of carbon dioxide gas released changes over time in this second experiment. [2]

(iv) State how the rate of reaction differs, if at all, when a higher temperature is used.

..... [1]

(v) State how the rate of reaction differs, if at all, when a lower concentration of dilute sulfuric acid is used.

..... [1]

(c) (i) Write the formula of the ion that is in all acids.

View solution

..... [1]

(ii) Choose the pH value for an acidic solution.

View solution

Draw a circle around your chosen answer.

pH 2 **pH 7** **pH 9** **pH 12** [1]

[Total: 11]

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4 This question is about organic compounds and their reactions.

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(a) Compound **P** is saturated.

Figure 4.1 shows the displayed formula of compound **P**.

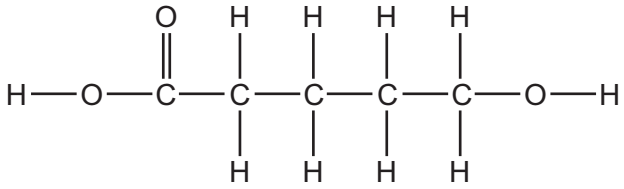

Figure 4.1

(i) On Figure 4.1, draw a circle around the alcohol functional group. [1]

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

View solution

..... [1]

(iii) State why compound **P** is saturated.

View solution

.....

..... [1]

(b) (i) Outline how ethanol is manufactured using aqueous glucose.

View solution

In your answer, include:

- the name of this process
- **two** conditions that are needed.

name of process .....

condition 1 .....

condition 2 .....

[3]

(ii) State **one** use of ethanol.

..... [1]

View solution

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(c) Ethanol is oxidised to ethanoic acid.

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Complete the word equation for the reaction of ethanoic acid with magnesium.

ethanoic acid	+	magnesium	→	....	+	.....

[2]

[Total: 9]

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5 Three states of matter are solid, liquid and gas.

(a) State **two** general properties of a liquid.

View solution

1 .....

.....

2 .....

.....

[2]

(b) Complete Table 5.1 to show the motion and separation of particles in a solid and a liquid.

View solution

Table 5.1

physical state	motion of particles	separation of particles
solid		
liquid		

[4]

(c) Draw a line from each statement to the correct change of state.

View solution

statement	change of state
liquid nitrogen turns into solid nitrogen	evaporating
liquid cobalt changes into cobalt gas	freezing
steam changes into liquid water	condensing

[2]

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(d) Name the process in which gas particles spread out from an area of high concentration to an area of low concentration.

..... [1]

[Total: 9]

View solution

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6 Nickel is a metal.

(a) (i) State the period number of nickel in the Periodic Table.

View solution

..... [1]

(ii) Deduce the number of electrons, neutrons and protons in the nickel ion shown.

View solution

$^{60}_{28}Ni^{2+}$

number of electrons .....

number of neutrons .....

number of protons .....

[3]

(b) (i) Nickel(II) chloride is a compound with ionic bonding.

View solution

State the meaning of the term ionic bond.

.....

..... [2]

(ii) State **two** physical properties of an ionic compound.

View solution

1 .....

2 .....

[2]

(c) (i) Nickel reacts with oxygen to form nickel(II) oxide.

View solution

Complete the symbol equation for this reaction.

.....Ni + ... $\rightarrow$ 2NiO [2]

(ii) State if nickel(II) oxide is an acidic oxide or a basic oxide.

View solution

Give a reason for your answer.

.....

..... [1]

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(d) Nickel(II) bromide is another compound of nickel.

View solution

Molten nickel(II) bromide is electrolysed using platinum electrodes.

(i) Name a non-metal that is used as an inert electrode.

..... [1]

(ii) Name the products formed at each electrode during the electrolysis of molten nickel(II) bromide, and give the observations at the positive electrode.

View solution

product at the negative electrode .....

product at the positive electrode .....

observations at the positive electrode .....

.....

[3]

(e) Nickel(II) hydroxide has the formula $Ni(OH)_2$.

View solution

Complete Table 6.1 to calculate the relative formula mass of $Ni(OH)_2$.

Table 6.1

type of atom	number of atoms	relative atomic mass	
nickel	1	59	1 × 59 = 59
oxygen		16	
hydrogen		1	

relative formula mass = ... [2]

(f) Stainless steel is an alloy that contains nickel.

View solution

(i) State the meaning of the term alloy.

.....

..... [1]

(ii) Name **two** elements in stainless steel, other than nickel.

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

[Total: 20]

View solution

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7 **(a)** Natural water sources can be polluted by nitrates and some metal compounds.

View solution

(i) State **one** source of nitrates that pollute natural water sources.

..... [1]

View solution

(ii) State **one** reason why nitrates in river water are harmful.

.....

..... [1]

View solution

(iii) State **one** reason why some metal compounds in river water are harmful.

.....

..... [1]

View solution

(b) Sea water contains potassium ions.

Name the test to identify potassium ions. Give the observations for a positive test.

test .....

observations .....

[2]

View solution

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

13.2 g of potassium reacts with excess iodine to produce 56.2 g of potassium iodide.

Calculate the mass of potassium iodide produced when 6.6 g of potassium reacts with excess iodine.

mass = ... g [1]

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(d) Figure 7.1 shows three stages in the treatment of the domestic water supply.

View solution

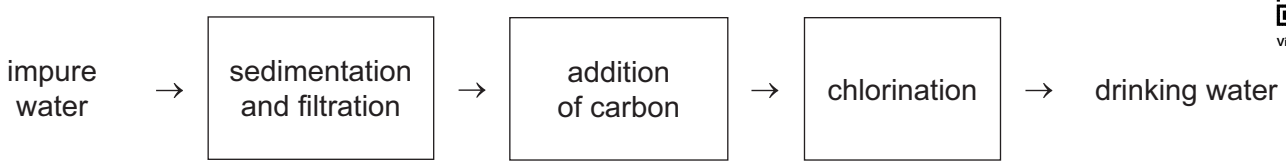

Figure 7.1

State what happens at each stage in the treatment of the domestic water supply.

sedimentation and filtration .....

.....

addition of carbon .....

.....

chlorination .....

..... [3]

(e) Explain why distilled water rather than tap water is used in practical chemistry.

View solution

.....

..... [1]

(f) State the colour change when water is added to anhydrous cobalt(II) chloride.

View solution

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

[Total: 12]

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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.).