LOYANG VIEW SECONDARY SCHOOL
Preliminary Examination 2022
Secondary Four Express

CANDIDATE NAME : .....

CLASS : ..... **INDEX NUMBER** : .....

CHEMISTRY 6092/01

Paper 1 Multiple Choice **12 September 2022**

1 hour

Additional Materials: Multiple Choice Answer Sheet

READ THESE INSTRUCTIONS FIRST

Write in soft pencil.
Do not use staples, paper clips, highlighters, glue or correction fluid.
Write your name, class and index number on the Answer Sheet in the spaces provided unless this has been done for you.

There are forty questions on this paper. Answer **all** questions. For each question there are four possible answers **A**, **B**, **C** and **D**.
Choose the **one** you consider correct and record your choice in **soft pencil** on the separate Answer Sheet.

Read the instructions on the Answer Sheet very carefully.

Each correct answer will score one mark. A mark will not be deducted for a wrong answer.
Any rough working should be done in this booklet.
A copy of the Periodic Table is printed on page 17.
The use of an approved scientific calculator is expected, where appropriate.

Setter: Ms Imma Wong

1 Which group of substances consists of mixtures only?

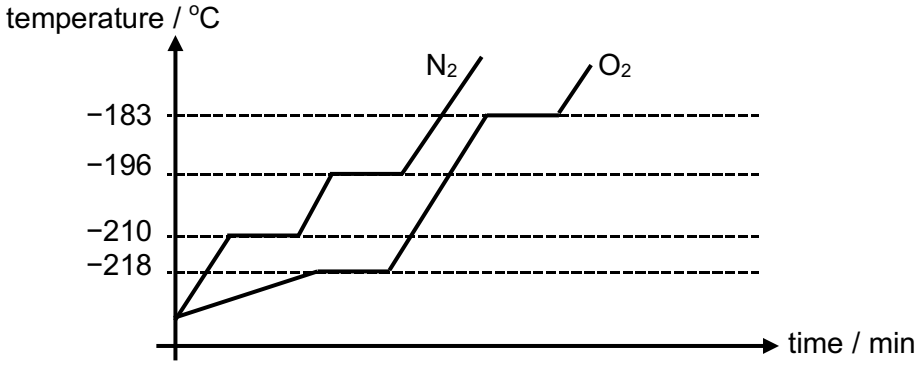
A air, petroleum and steel

B nylon, glucose and ethanol

C limestone, seawater and ozone

D haematite, brass and sodium chloride

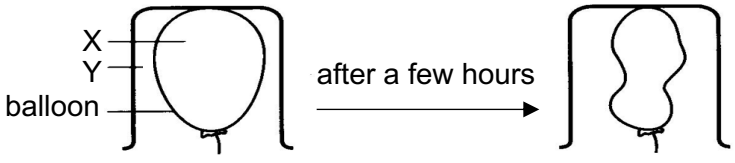
2 The graph (not drawn to scale) shows how the temperature of oxygen and nitrogen changes when they are heated.



At which temperature will there be two different states of matter in a mixture of oxygen and nitrogen under similar conditions?

A −180 °C **B** −200 °C **C** −215 °C **D** −220 °C

3 A balloon filled with gas X is placed inside a beaker that is filled with gas Y as shown. The balloon shrinks in size after a few hours.



Which could be the identities of gases X and Y?

	X	Y
A	nitrogen	ammonia
B	ammonia	argon
C	argon	oxygen
D	oxygen	nitrogen

4 An element J has a nucleon number of 45. The ion, J^{3+}, contains 18 electrons.

How many neutrons are there in an atom of J?

A 18 **B** 21 **C** 24 **D** 45

5 Which statement describes the arrangement and movement of particles of sodium hydroxide in water?

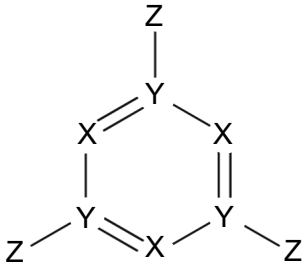
A Ions are closely packed and does not move.

B Ions are widely spaced and move randomly.

C Molecules are widely spaced and move randomly.

D Molecules are closely packed and move randomly.

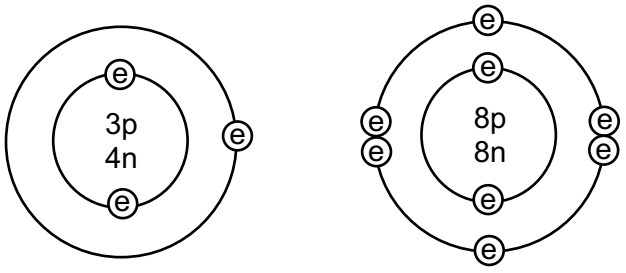
6 A stable molecule containing atoms of elements X, Y and Z has the structure shown.



What could elements X, Y and Z be?

	X	Y	Z
A	carbon	sulfur	hydrogen
B	nitrogen	silicon	sulfur
C	nitrogen	silicon	hydrogen
D	silicon	sulfur	chlorine

7 The structures of atoms of elements L and M are shown.

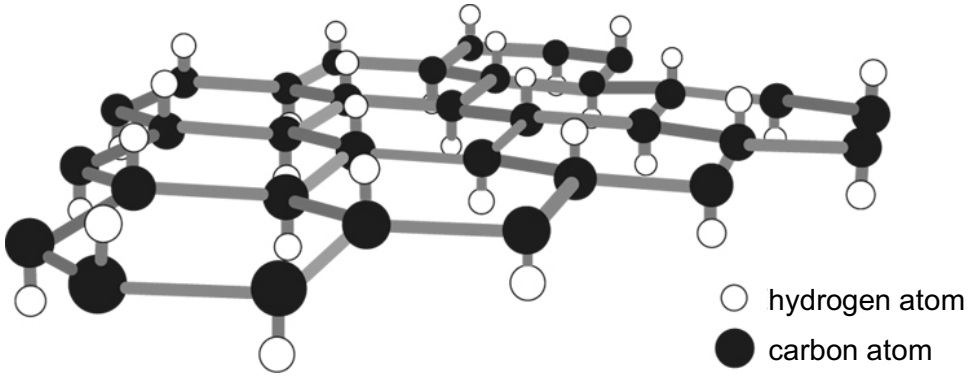


L M

What is the mass of 1 mole of the compound formed by L and M?

A 11 g **B** 12 g **C** 23 g **D** 30 g

8 Graphane, an allotrope of carbon has a similar structure to graphite, except that it has one hydrogen atom attached to each carbon as shown in the diagram.



Which of the properties listed below are properties of graphane?

1 It has a giant molecular structure.
2 It has a high melting point.
3 It is 'slippery' in nature.
4 It conducts electricity in the solid state.

A 1, 2 and 3

B 1, 2 and 4

C 1, 3 and 4

D 2, 3 and 4

9 Naphthalene is the main ingredient of mothballs. It contains 93.75 % of carbon and 6.25 % of hydrogen.

If the relative molecular mass of naphthalene is 128, what is its molecular formula?

[relative atomic masses, A_r : H, 1; C, 12]

A CH **B** C_5H_4 **C** $C_{10}H_8$ **D** $C_{10}H_{10}$

10 A pure hydrocarbon is used to heat homes.

When 10 cm^3 of the hydrocarbon is burned in 70 cm^3 of oxygen, the final gaseous mixture contains 30 cm^3 of carbon dioxide and 20 cm^3 of unreacted oxygen. All gaseous volumes are measured under identical conditions.

What is the chemical formula of the hydrocarbon?

[relative atomic masses, A_r : H, 1; C, 12; O, 16]

A C_2H_6 **B** C_3H_6 **C** C_3H_8 **D** C_4H_{10}

11 The equation for the reduction of iron ore in the blast furnace is shown.

$$Fe_2O_3 + 3CO \rightarrow 2Fe + 3CO_2$$

When 90 tonnes of the iron ore were reduced, 56 tonnes of molten iron were produced.

What is the percentage purity of the iron ore used?

[relative atomic masses, A_r : C, 12; O, 16; Fe, 56]

A 11.1 % **B** 42.2 % **C** 56.3 % **D** 88.9 %

12 What is the ionic equation for the reaction between sodium carbonate and sulfuric acid?

A $H^+ + OH^- \rightarrow H_2O$

B $2Na^+ + SO_4^{2-} \rightarrow Na_2SO_4$

C $CO_3^{2-} + 2H^+ \rightarrow CO_2 + H_2O$

D $2CO_3^{2-} + 2H^+ \rightarrow 2CO_2 + H_2O$

13 The colour changes of a recently discovered indicator is shown in the table.

pH	colour
0 – 3.5	red
3.5 – 5	green
5 - 14	purple

Which pair of substances could be distinguished by the new indicator?

A hydrochloric acid and ethanoic acid

B aqueous sodium chloride and water

C aqueous ammonia and aqueous sodium hydroxide

D aqueous potassium nitrate and aqueous potassium hydroxide

14 Which statement about oxides is true?

A Nitrogen dioxide is a neutral oxide.

B Zinc oxide dissolves readily in water to form an alkaline solution.

C Copper(II) oxide reacts with dilute sulfuric acid to give a blue solution.

D Carbon monoxide reacts with aqueous sodium hydroxide to form a salt and water.

15 A student recorded the following observations when he mixed two substances:

"no effervescence, solution changes colour, no precipitate forms"

Which two substances could have been used?

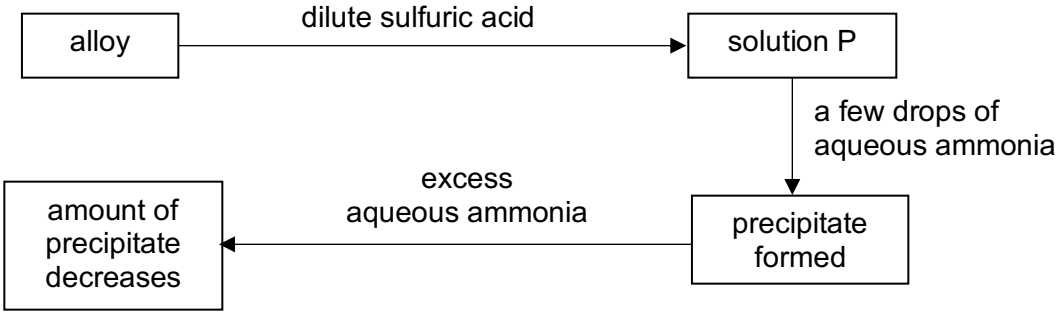
A dilute nitric acid and lead(II) carbonate

B dilute hydrochloric acid and iron(II) oxide

C aqueous sodium hydroxide and dilute sulfuric acid

D aqueous potassium chloride and aqueous silver nitrate

16 A sample of an alloy containing two metals was subjected to the following tests.



What are the two metals present in the alloy?

A iron and zinc

B iron and lead

C iron and copper

D copper and zinc

17 Which salts are best prepared by adding excess acid to an insoluble base?

A magnesium chloride, zinc sulfate, lead(II) nitrate

B sodium chloride, copper(II) nitrate, calcium sulfate

C copper(II) carbonate, barium sulfate, silver chloride

D sodium chloride, ammonium nitrate, potassium sulfate

18 Hydrogen peroxide was added to separate test tubes containing aqueous potassium iodide and aqueous acidified potassium manganate(VII). The iodide ions were oxidised and the manganate(VII) ions are reduced.

What are the colour changes seen?

	potassium iodide	**acidified potassium manganate(VII)**
A	brown to colourless	purple to colourless
B	brown to colourless	colourless to purple
C	colourless to brown	purple to colourless
D	colourless to brown	colourless to purple

19 A mineral, Jarosite, has the molecular formula $KFe_3(OH)_6(SO_4)_2$.

What is the oxidation state of iron in Jarosite?

A +2 **B** −2 **C** +3 **D** −3

20 A part of the Periodic Table is shown below. P, Q, R, S and T do not represent the actual symbols of the elements.

		Group							
		I	II	III	IV	V	VI	VII	0
	1								P
period	2	Q			R			S	
	3							T	

Which statement is correct?

A T is a strong oxidising agent.

B R forms an ionic compound with S.

C P has eight electrons in its outermost shell.

D The metallic character of the elements in period 2 increases from Q to S.

21 Rubidium, Rb, is an element in the same group of the Periodic Table as lithium, sodium and potassium.

Which statement about rubidium is correct?

A It forms an insoluble hydroxide.

B Its melting point is lower than lithium.

C It reacts slowly with water at room temperature.

D It can be produced during the electrolysis of aqueous rubidium chloride.

22 Excess zinc is added into a solution containing magnesium nitrate and copper(II) chloride. After the reaction, the mixture is filtered.

Which cations would be present in the filtrate?

1 Cu^{2+}
2 Mg^{2+}
3 Zn^{2+}

A 1 and 2 only

B 1 and 3 only

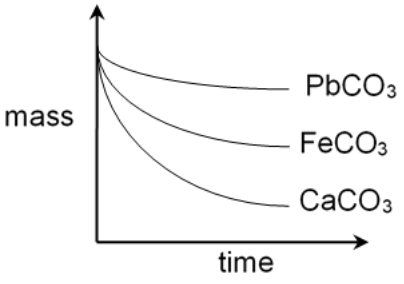
C 2 and 3 only

D 1, 2 and 3

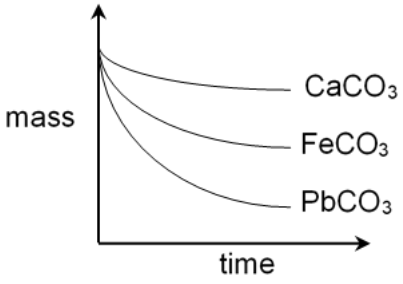
23 Equal masses of three different metal carbonates were placed in separate open crucibles and heated for two minutes.

Which graph shows what happens to the mass of the crucible and its contents?

A



B



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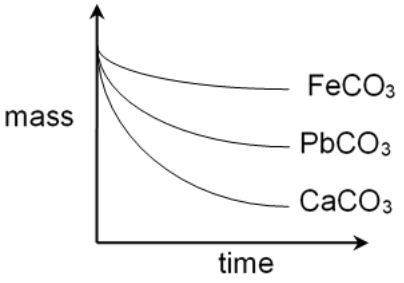
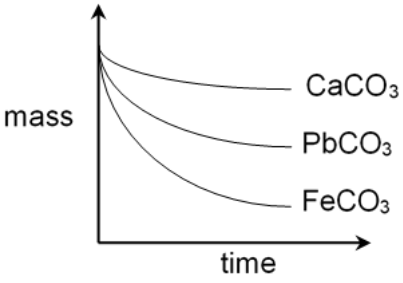
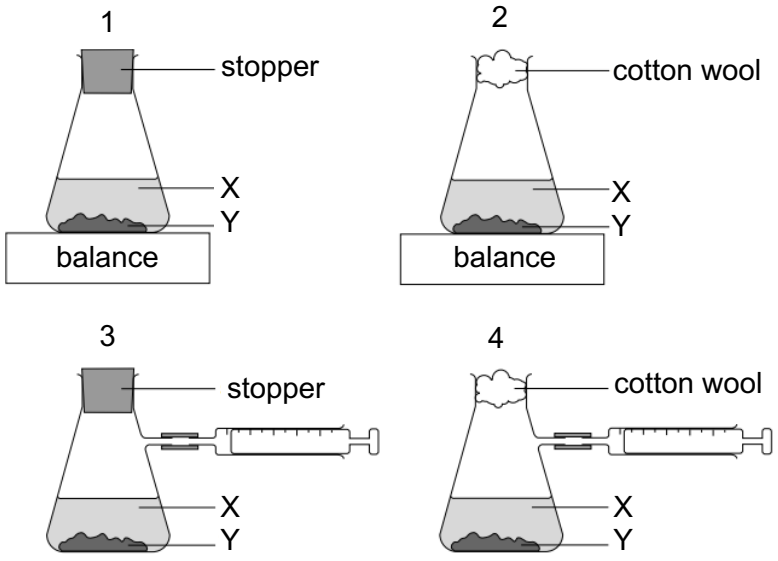


D



24 A liquid X reacts with solid Y to form a gas.

Which two diagrams show suitable methods for investigating the speed of the reaction?



A 1 and 3

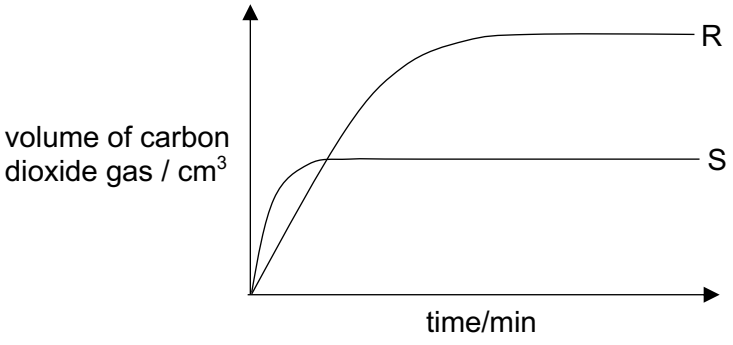
B 1 and 4

C 2 and 3

D 2 and 4

25 A student investigates the rate of reaction between copper(II) carbonate and excess nitric acid. The volume of carbon dioxide gas given off in the reaction is measured over time.

The graph shows the results of two experiments, R and S.



Which change in conditions would cause the difference between R and S?

A A catalyst is added in S only.

B The temperature of the solution in R is lower than in S.

C Half the volume of a more concentrated nitric acid is used in S than in R.

D Twice the mass of less finely powdered copper(II) carbonate used in R than in S.

26 A reaction takes place in two stages:

Stage 1
$S_2O_8^{2-}(aq) + 2I^-(aq) + 2Fe^{2+}(aq) \rightarrow 2SO_4^{2-}(aq) + 2I^-(aq) + 2Fe^{3+}(aq)$

Stage 2
$2SO_4^{2-}(aq) + 2I^-(aq) + 2Fe^{3+}(aq) \rightarrow 2SO_4^{2-}(aq) + I_2(aq) + 2Fe^{2+}(aq)$

Which ion is the catalyst in the reaction?

A Fe^{2+} **B** Fe^{3+} **C** I^- **D** SO_4^{2-}

27 Which statements about the Haber process are correct?

1 The catalyst used is a transition metal.
2 Unreacted nitrogen and hydrogen are circulated back into the system.
3 Both reactants are obtained from the fractional distillation of liquefied air.
4 The reaction is reversible and the yield achieved is only about 10 – 15%.

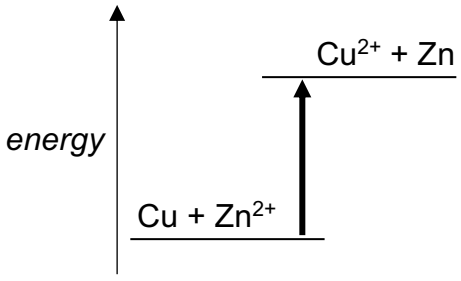
A 1 and 2 only **B** 2 and 4 only

C 1, 2 and 4 only **D** 1, 3 and 4 only

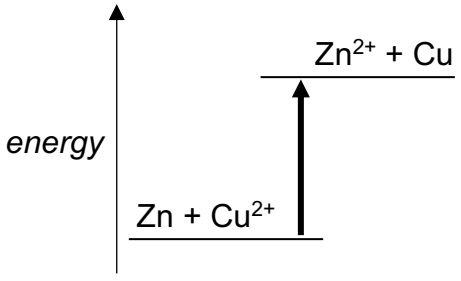
28 The reaction between zinc and aqueous copper(II) nitrate is exothermic.

Which energy level diagram represents the reaction?

A



B



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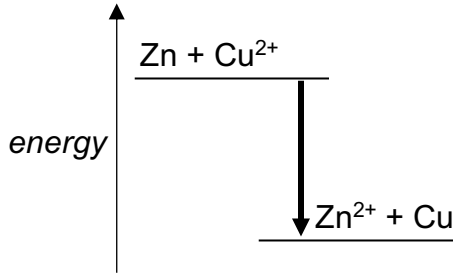
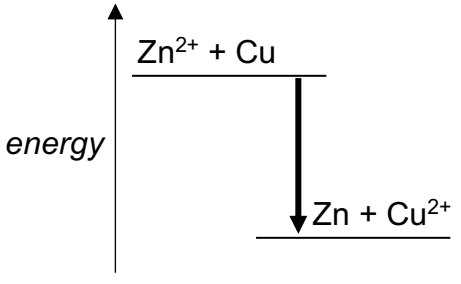


D



29 Which combination of electrode, electrolyte and products are correct?

	electrode	electrolyte	product at the anode	product at the cathode
A	carbon	concentrated hydrochloric acid	chlorine	hydrogen
B	carbon	concentrated sulfuric acid	sulfur	hydrogen
C	copper	aqueous copper(II) sulfate	oxygen	copper
D	platinum	aqueous copper(II) sulfate	hydrogen	copper

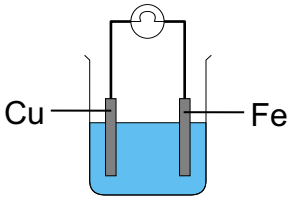
30 During the electrolysis of an aqueous solution of a cerium salt, 70 g of cerium is deposited at the cathode by 2 moles of electrons.

What is the formula of the cerium ion?
[relative atomic mass, A_r: Ce, 140]

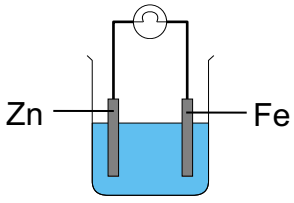
A Ce^{+} **B** Ce^{2+} **C** Ce^{3+} **D** Ce^{4+}

31 In which cell will the light bulb be the dimmest?

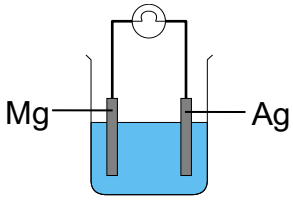
A



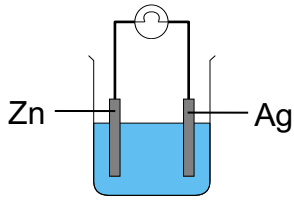
B



C



D



32 Waste gases from a coal-burning power station are passed through powdered calcium carbonate to reduce atmospheric pollution.

Which waste gas will not be removed by the powdered calcium carbonate?

A carbon dioxide
B carbon monoxide
C phosphorus(V) oxide
D sulfur dioxide

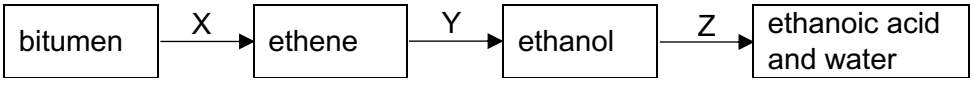
33 Four environmental problems are listed.

1 acid rain
2 depletion of the ozone layer
3 presence of greenhouse gases
4 incomplete combustion of carbon compounds

Which atmospheric pollutant is responsible for each problem?

	1	2	3	4
A	chlorofluorocarbons	sulfur dioxide	carbon dioxide	carbon monoxide
B	carbon dioxide	carbon monoxide	sulfur dioxide	chlorofluorocarbons
C	sulfur dioxide	carbon dioxide	chlorofluorocarbons	carbon monoxide
D	sulfur dioxide	chlorofluorocarbons	carbon dioxide	carbon monoxide

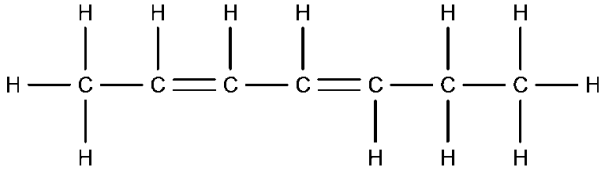
34 The diagram below shows a reaction sequence.



Which processes describe the above reactions?

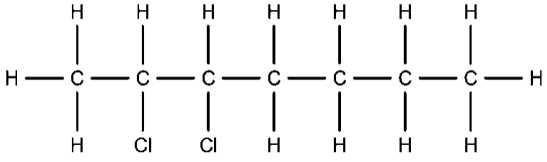
	X	Y	Z
A	cracking	fermentation	combustion
B	cracking	hydration	oxidation
C	distillation	fermentation	oxidation
D	distillation	hydration	combustion

35 The hydrocarbon shown is heated with hydrogen chloride gas under catalysed conditions.

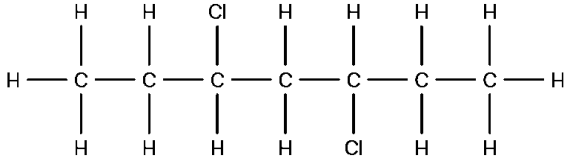


What compound could be formed during the reaction?

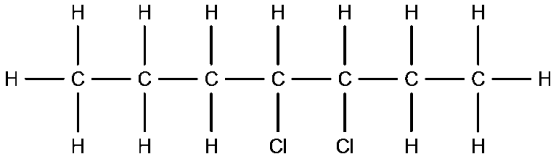
A



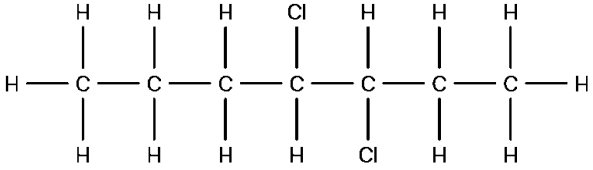
B



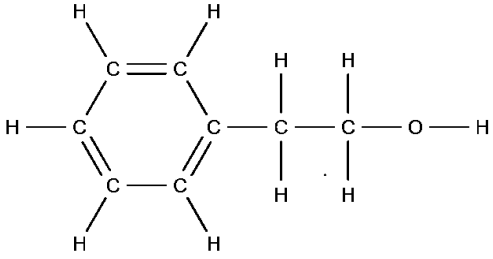
C



D



36 One substance responsible for the fragrance of roses is 2-phenylethanol.
The structure of the molecule is shown below.



Which statement about this molecule is incorrect?

A It is an unsaturated molecule.

B It can decolourise aqueous bromine at room temperature.

C It can undergo condensation polymerisation to form a polyester.

D It can be oxidised by acidified potassium manganate(VII) solution.

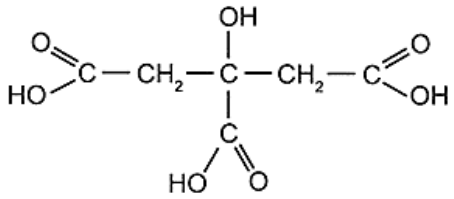
37 Propanal is a member of a homologous series called the alkanals.
The chemical formula of propanal is CH_3CH_2CHO.

What is the general formula of alkanals?

A $C_nH_{3n}CO$ **B** $C_nH_{2n}CHO$

C $C_nH_{2n+1}CHO$ **D** $C_nH_{2n+1}CH_2OH$

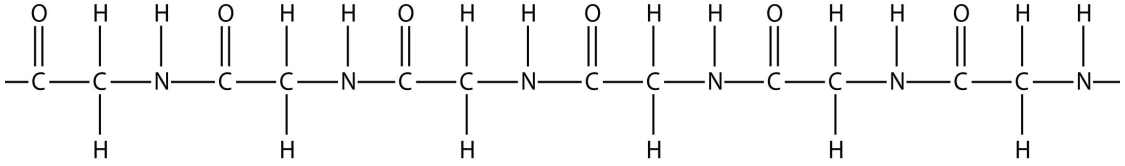
38 The structure of citric acid is shown.



How many moles of sodium hydroxide is needed to neutralise one mole of citric acid?

A 1 **B** 2 **C** 3 **D** 4

39 A section of a polymer is shown.



Which statement explains why this polymer should not be disposed by burning?

A It produces pollutants that can form acid rain.

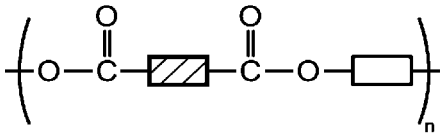
B The polymer does not burn well even at high temperature.

C It is highly flammable and may cause an explosion during burning.

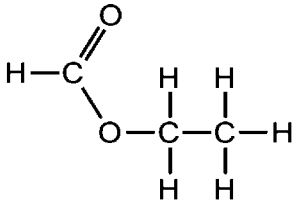
D It produces pollutants such as carbon dioxide and carbon monoxide.

40 Which compound cannot be prepared by reacting a carboxylic acid and an alcohol?

A



B



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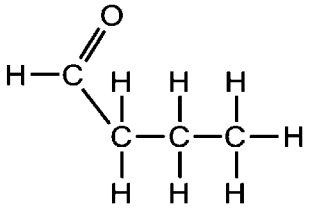
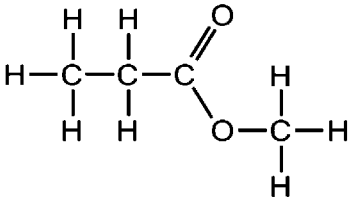


D



The Periodic Table of Elements

Group																	
I	II											III	IV	V	VI	VII	0
							1 H hydrogen 1										2 He helium 4
			Key														
3 Li lithium 7	4 Be beryllium 9		proton (atomic) number atomic symbol name relative atomic mass									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 –		114 Fl flerovium –		116 Lv livermorium –		

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.).