



ORCHID PARK SECONDARY SCHOOL

Preliminary Examination 2022

CANDIDATE NAME

CLASS

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INDEX NUMBER

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CHEMISTRY

6092/01

Paper 1 Multiple Choice

30 August 2022

Secondary 4 Express

1 hour

Setter: Mr Goh Chye Joo

40 Marks

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 register number on the Answer Sheet in the spaces provided.

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 provided on page 17.

The use of an approved scientific calculator is expected, where appropriate.

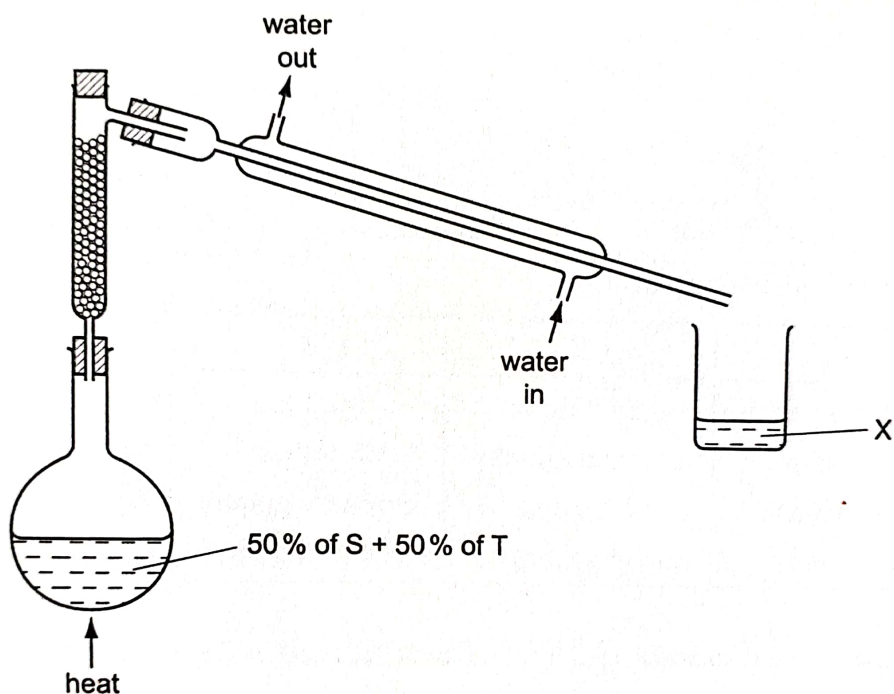
1 What is the **most** suitable method of investigating the different food colourings in some drinks?

- A crystallisation
- B filtration
- C fractional distillation
- D paper chromatography

2 A mixture contains equal volumes of two liquids.

Liquid S has a boiling point of 75°C . Liquid T has a boiling point of 69°C .

The mixture is heated in the apparatus shown.



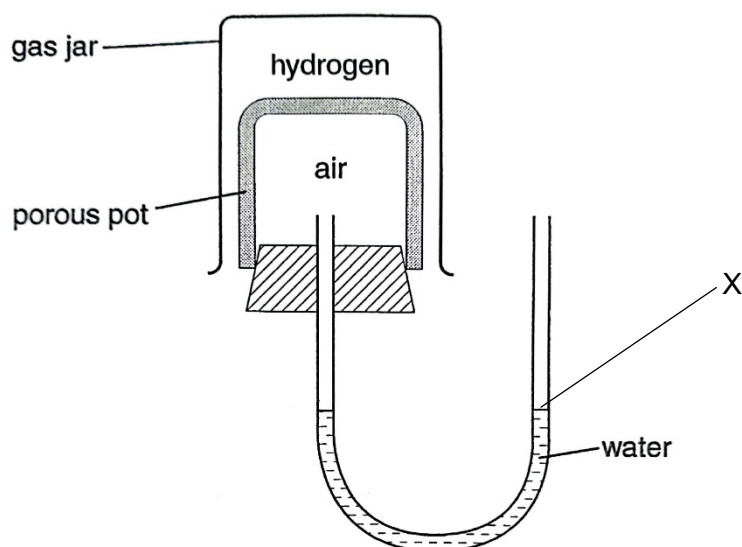
What is the initial composition of X?

- A 10 % S and 10 % T
- B 50 % S and 50 % T
- C 100 % S
- D 100 % T

- 3 If, in volumetric analysis between an acid (in the burette) and an alkali, you needed to re-use the same titration flask after the first titration.

Which is the best procedure for rinsing the flask?

- A rinse with a little of the acid
 - B rinse with a little of the alkali
 - C rinse with tap water and then with acid
 - D rinse with tap water and then with distilled water
- 4 The apparatus shown in the diagram was set up.



How will the water level at X change after a period of time?

- A It will fall and remain at a lower level.
- B It will fall, then rise and return to X.
- C It will rise and remain at a higher level.
- D It will rise, then fall and return to X.

- 5 A student carried out the following series of tests on an aqueous solution of sodium carbonate and recorded his results as shown in the table.

Which test should be repeated because of an incorrect observation entered in the table?

	test	observation
A	add barium chloride solution	white precipitate formed
B	add copper(II) sulfate solution	blue precipitate formed
C	add dilute hydrochloric acid	effervescence occurred
D	add sodium hydroxide solution	white precipitate formed

- 6 When testing for a chloride ion using silver nitrate, the solution must be acidified with dilute nitric acid.

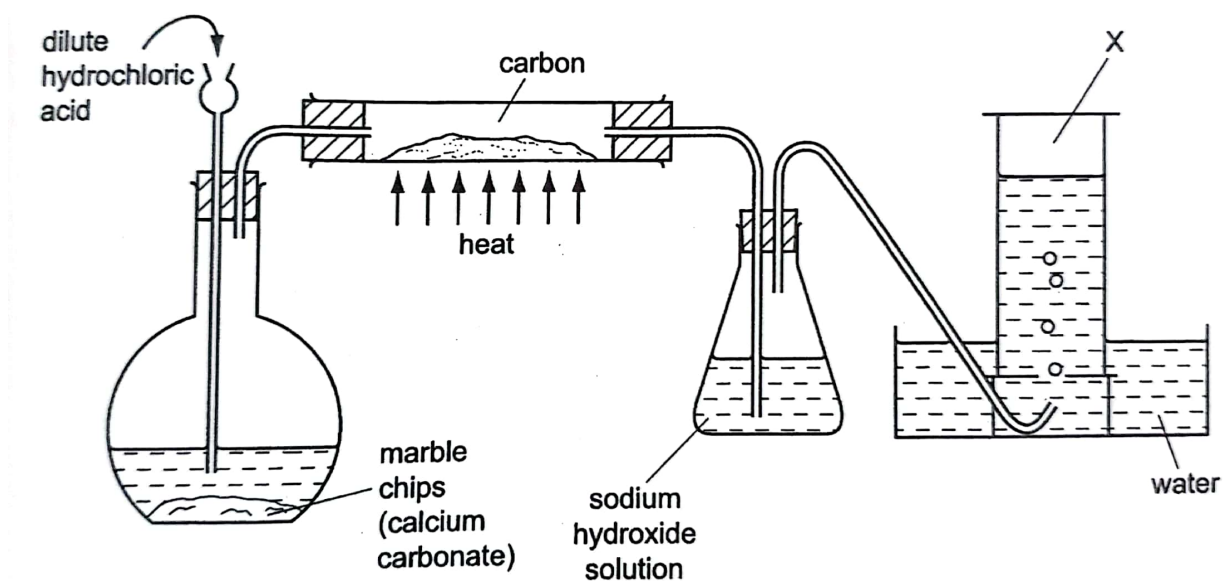
What is the purpose of acidifying with nitric acid?

- A** to neutralise hydroxide ions
- B** to oxidise the chloride ion
- C** to prevent the decomposition of any silver chloride formed
- D** to prevent the precipitation of silver carbonate
- 7 One mole of hydrated copper(II) sulfate, $\text{CuSO}_4 \cdot 5\text{H}_2\text{O}$, is dissolved in water.

How many moles of ions does the solution contain?

- A** 1
- B** 2
- C** 6
- D** 7

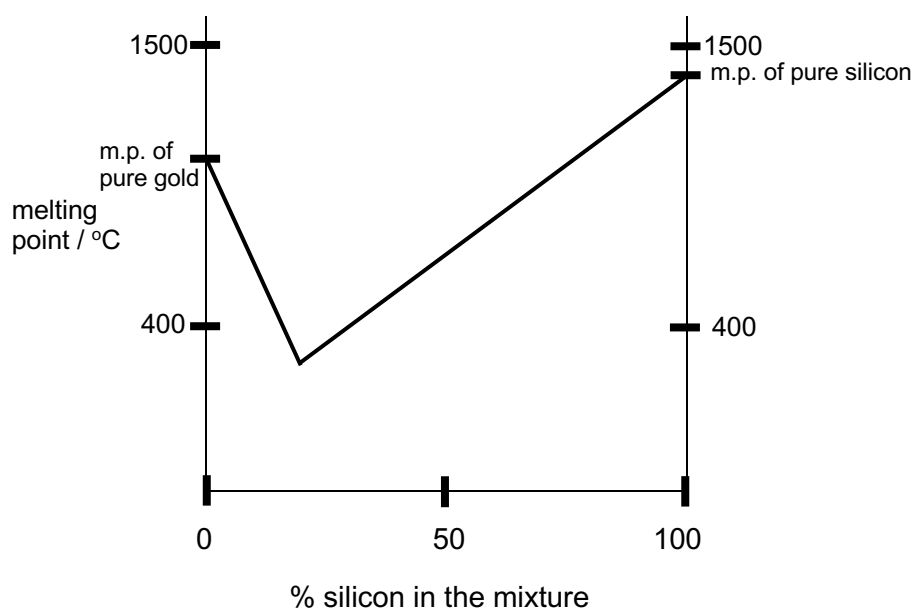
- 8 The diagram shows an experiment for the formation of gas X.



What is gas X?

- A carbon dioxide
 - B carbon monoxide
 - C chlorine
 - D hydrogen
- 9 In which pair of substances does each have a giant molecular structure?
- A diamond, iodine
 - B diamond, silica (sand)
 - C iodine, methane
 - D methane, silica (sand)

- 10 The graph gives the melting points of mixtures of silicon and gold.



The graph shows that any mixture of silicon and gold must have a melting point

- A above that of gold.
 - B below that of silicon.
 - C below that of both gold and silicon.
 - D between that of gold and silicon.
- 11 Which ion has the same number of electrons as a krypton atom?
[relative atomic mass, A_r : Kr, 36]
- A chlorine
 - B rubidium
 - C sodium
 - D xenon
- 12 An isotope of element Q has 40 nucleons and 19 protons.
What is element Q?
- A argon
 - B calcium
 - C cobalt
 - D potassium

[Turn over

- 13 Hydrogen can form both H^+ and H^- ions.

Which statement about these two ions is correct?

- A An H^+ ion has no electrons in its first shell.
- B An H^+ ion has more protons than an H^- ion.
- C An H^- ion has one more electron than an H^+ ion.
- D An H^- ion is formed when a hydrogen atom loses an electron.

- 14 A volume of ethane, at room temperature and pressure, has a mass of 10 g.

What is the mass of an equal volume of propene at room temperature and pressure?

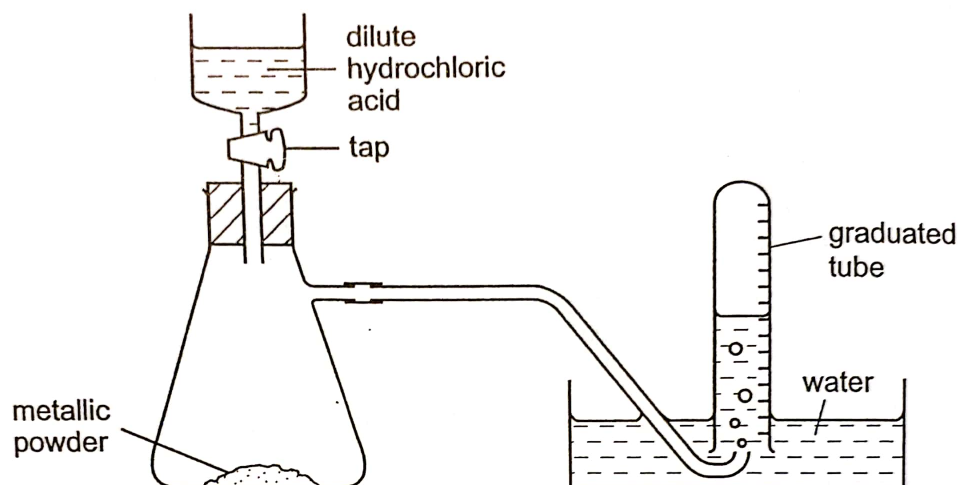
- A 10 g
- B 10.5 g
- C 14 g
- D 21 g

- 15 A compound X is the only substance formed when two volumes of ammonia react with one volume of carbon dioxide (both volumes being measured at room temperature and pressure).

What is the most likely formula of X?

- A $\text{NH}_2\text{CO}_2\text{NH}_4$
- B $(\text{NH}_2)_2\text{CO}$
- C $\text{NH}_4\text{CO}_2\text{NH}_4$
- D $(\text{NH}_4)_2\text{CO}_3$

- 16 The diagram shows apparatus for measuring the volume of hydrogen given off when an excess of dilute hydrochloric acid is added to powdered metal. The volume of gas is measured at room temperature and pressure.



The experiment is carried out three times, using the same mass of powder each time but with different powders:

- pure magnesium
- pure zinc
- a mixture of magnesium and zinc

Which powder gives the greatest volume of hydrogen and which the least volume?

	greatest volume of H ₂	least volume of H ₂
A	magnesium	zinc
B	magnesium	the mixture
C	zinc	magnesium
D	zinc	the mixture

- 17 How does the mass of a sample of copper(II) oxide change when it is heated in hydrogen and oxygen separately?

	mass after heating in hydrogen	mass after heating in oxygen
A	decreases	decreases
B	decreases	unchanged
C	unchanged	decreases
D	unchanged	unchanged

18 Some of the general physical properties of metals are shown.

- 1 Metals are good conductors of electricity.
- 2 Metals are hard solids.
- 3 Metals have high densities.
- 4 Metals have very high melting points

Which of these properties does rubidium have?

- A** 1 only
- B** 1 and 2 only
- C** 1, 2 and 3 only
- D** 1, 2, 3 and 4

19 From your knowledge of the manufacture of both aluminium and iron, what is the order of chemical reactivity of aluminium, carbon and iron towards oxygen?

	most reactive ▶ least reactive		
A	aluminium	carbon	iron
B	aluminium	iron	carbon
C	carbon	aluminium	iron
D	carbon	iron	aluminium

20 Metal carbonates decompose when heated.

Which carbonate is **most** stable to heat?

- A** calcium carbonate
- B** copper(II) carbonate
- C** lead(II) carbonate
- D** zinc carbonate

- 21** *Disproportionation* is a reaction in which the same element is both oxidised and reduced.

Which reaction is an example of *disproportionation*?

- A** $\text{Cl}_2 + 2\text{NaOH} \rightarrow \text{NaCl} + \text{NaOCl} + \text{H}_2\text{O}$
- B** $3\text{Cu} + 8\text{HNO}_3 \rightarrow 3\text{Cu}(\text{NO}_3)_2 + 2\text{NO} + 4\text{H}_2\text{O}$
- C** $\text{Fe}_2(\text{SO}_4)_3 + 2\text{KI} \rightarrow 2\text{FeSO}_4 + \text{K}_2\text{SO}_4 + \text{I}_2$
- D** $2\text{Pb}(\text{NO}_3)_2 \rightarrow 2\text{PbO} + 4\text{NO}_2 + \text{O}_2$

- 22** A colourless gas is passed into each of the two different solutions. The results are shown in the table.

solution	acidified potassium manganate(VII)	potassium iodide
result	purple to colourless	stays colourless

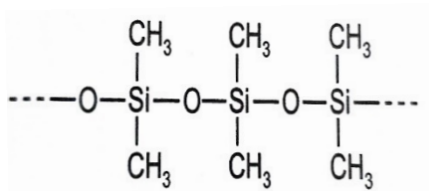
What is the colourless gas?

- A** a catalyst
- B** an alkali
- C** an oxidising agent
- D** a reducing agent
- 23** How many periods do the elements of atomic number 1 to 18 occupy in the Periodic Table?
- A** 2
- B** 3
- C** 6
- D** 8
- 24** Chlorine is an element in Group VII of the Periodic Table.

Which statement about chlorine is **not** correct?

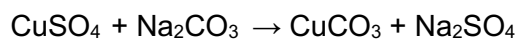
- A** It is a pale yellow gas at room temperature and pressure.
- B** Its molecules are diatomic at room temperature.
- C** It is a less powerful oxidising agent than fluorine.
- D** It gains electrons from a metal to form an ionic compound.

- 25 The structure of a silicon polymer is shown.



Which element in the polymer is present in the highest percentage by mass?

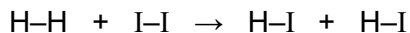
- A carbon
 - B hydrogen
 - C oxygen
 - D silicon
- 26 How many moles of iron can be extracted from 58 g of Fe_3O_4 ?
- A 0.5 mol
 - B 0.75 mol
 - C 1.0 mol
 - D 1.5 mol
- 27 The equation for one method of making copper(II) carbonate is shown.



The reaction is an example of

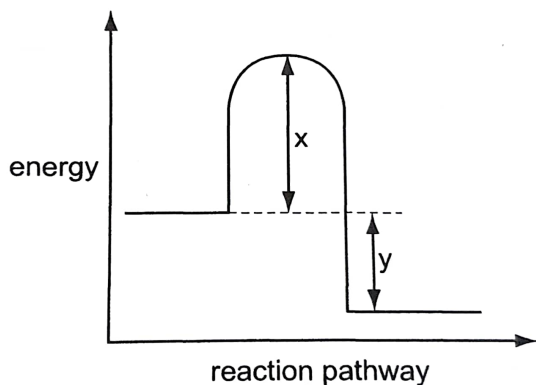
- A combustion.
- B neutralisation.
- C oxidation and reduction.
- D precipitation.

- 28 The formation of hydrogen iodide from hydrogen and iodine is an endothermic reaction.



What may be deduced from this information?

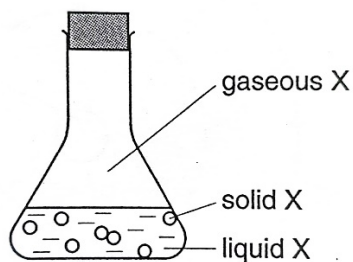
- A The number of bonds broken is greater than the number of bonds formed.
 - B The breaking of H-H bonds gives out energy.
 - C The products possess less energy than the reactants.
 - D The total energy change in bond formation is less than that in bond breaking.
- 29 The energy profile diagram for a chemical reaction is shown.



Which statement is correct?

- A The overall enthalpy change is $x - y$.
- B The reaction is endothermic.
- C The value of x would decrease in the presence of a catalyst.
- D The value of y would increase in the presence of a catalyst.

- 30** The conical flask contains compound X which is present in the solid, liquid and gaseous states.



Which statement is correct?

- A** A gaseous X molecule has a lower mass than a liquid X molecule.
- B** Energy is released when X changes from liquid to solid.
- C** Liquid X is at a higher temperature than solid X.
- D** Liquid X molecules vibrate about fixed positions.
- 31** The heat-reflecting shields of some space rockets are gold plated using electrolysis.

Which electrodes and electrolyte would be used to gold-plate the heat shield?

	negative electrode	positive electrode	electrolyte
A	carbon	heat shield	gold compound
B	gold	heat shield	copper compound
C	heat shield	carbon	copper compound
D	heat shield	gold	gold compound

- 32** Why is cryolite, Na_3AlF_6 , used in the extraction of aluminium from aluminium oxide?
- A** to dissolve aluminium oxide
- B** to prevent the anodes from burning away
- C** to prevent the oxidation of aluminium
- D** to remove the impurities from the aluminium oxide

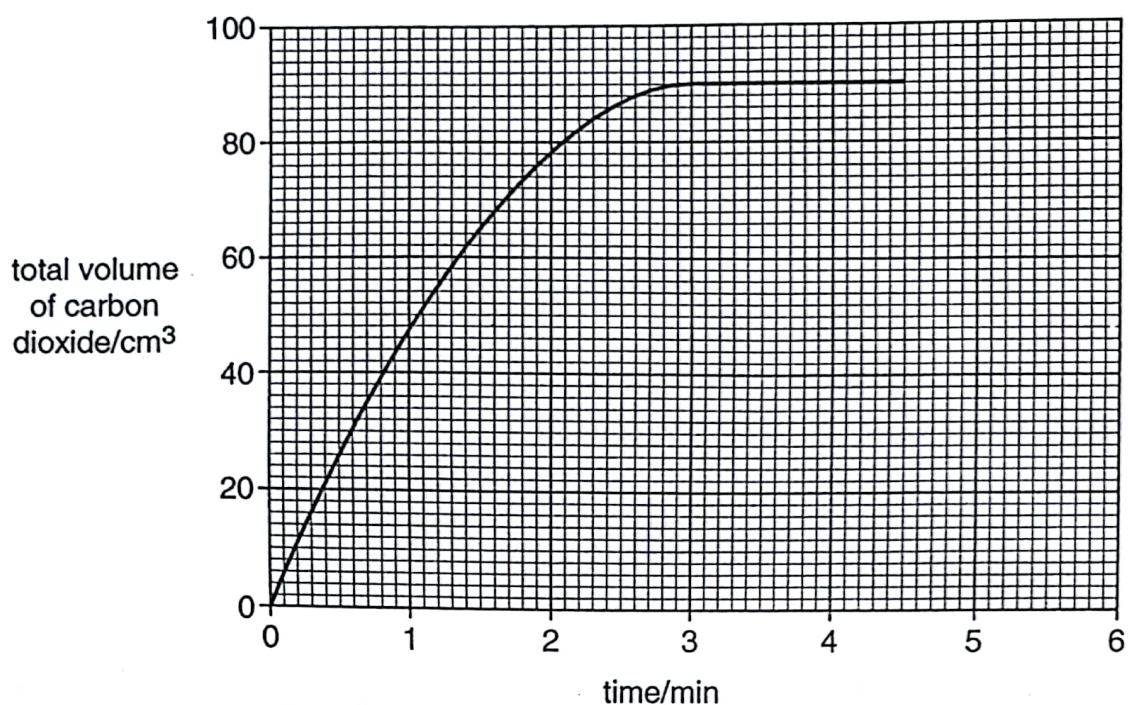
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- 33** When sodium chloride was electrolysed, sodium was produced at the negative electrode. In what form was sodium chloride during the electrolysis process?

A concentrated aqueous solution
B dilute aqueous solution
C molten
D solid

- 34** The rate of the reaction between a given mass of calcium carbonate and an excess of hydrochloric acid was studied by collecting the carbon dioxide in a graduated syringe.

The results are shown in the graph.



How much time was required for half the calcium carbonate to react?

A 0.95 min
B 1.5 min
C 2.0 min
D 3.0 min

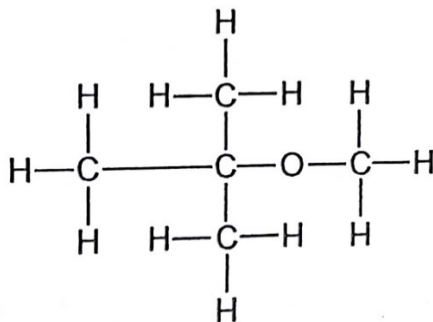
- 35 Which compound, on combustion, never forms soot?
- A carbon monoxide
B ethanol
C ethene
D methane
- 36 When must a substance be an alkane?
- A when it burns easily in oxygen
B when it contains carbon and hydrogen
C when it has the general formula C_nH_{2n+1}
D when it is generally unreactive
- 37 In the polymerisation of ethene to form poly(ethene), there is no change in
- A boiling point.
B density.
C mass.
D molecular formula.
- 38 What is the general formula of the homologous series of carboxylic acids?

methanoic acid	HCO_2H
ethanoic acid	CH_3CO_2H
propanoic acid	$C_2H_5CO_2H$
butanoic acid	$C_3H_7CO_2H$

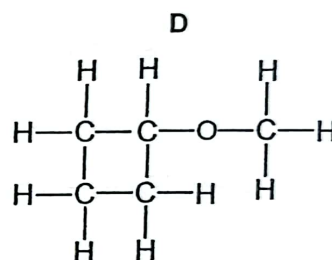
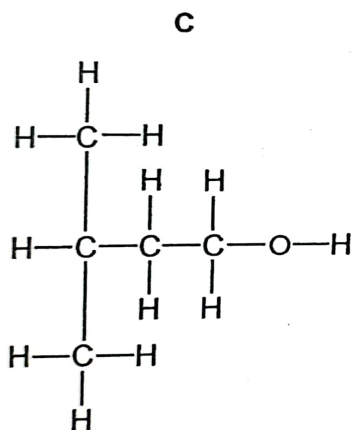
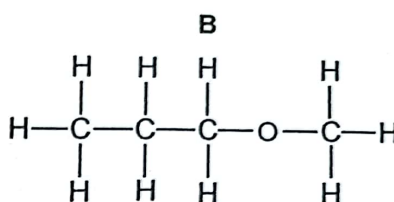
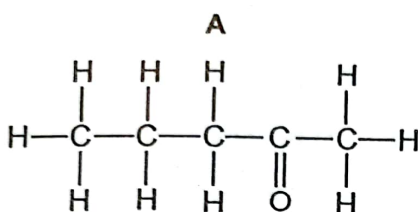
- A $C_nH_{2n-2}O_2$
B $C_nH_{2n-1}O_2$
C $C_nH_{2n}O_2$
D $C_nH_{2n+1}O_2$

- 39 A compound known in industry as 'MTBE' is used as an additive in 'lead-free' petrol.

The structural formula of MTBE is shown.



Which compound is an isomer of MTBE?



- 40 The list shows reactions in which ethanol is either a reactant or a product.

- 1 combustion of ethanol
- 2 conversion of ethene to ethanol
- 3 fermentation of glucose
- 4 oxidation of ethanol

In which reactions is water also either a reactant or a product?

- A** 1, 3 and 4 only
- B** 2, 3 and 4 only
- C** 1, 2 and 4 only
- D** 3 only

The Periodic Table of Elements

Group																	
I	II	1 H hydrogen 1										III	IV	V	VI	VII	0
Key proton (atomic) number atomic symbol name relative atomic mass																	
3 Li lithium 7	4 Be beryllium 9																
11 Na sodium 23	12 Mg magnesium 24																
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 F/ 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.)