Candidate Name: _____ ( ) Class: _____

4E
Session 2

KRANJI SECONDARY SCHOOL
Preliminary Examination
Secondary 4 Express

CHEMISTRY **6092/01**
Paper 1 Multiple Choice

Wednesday **28 August 2024** 1 hour

Additional Materials: Multiple Choice Answer Sheet

READ THESE INSTRUCTIONS FIRST

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

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 18.
The use of an approved scientific calculator is expected, where appropriate.

Set by: Mrs Toh-Chong Keting

This Question Paper consists of **18** printed pages.

[Turn over

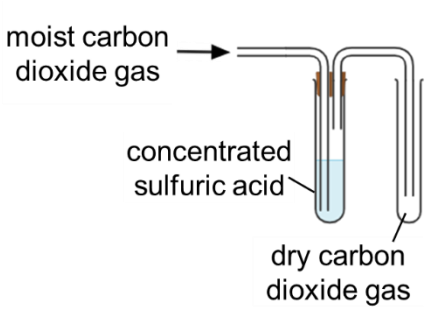
1 Which piece of apparatus could be used to determine the end-point of the reaction between hydrochloric acid and potassium hydroxide?

A electronic balance
B gas syringe
C stopwatch
D thermometer

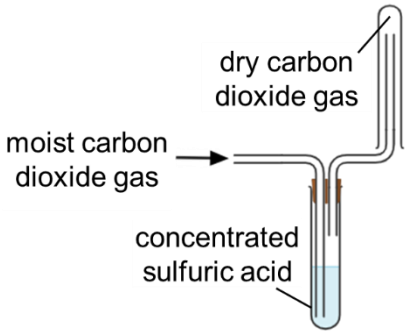
2 A student is provided with two drying agents: concentrated sulfuric acid and calcium oxide.

Which method should he use to collect a sample of dry carbon dioxide gas?

A



B



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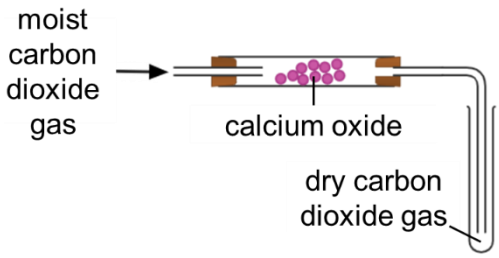
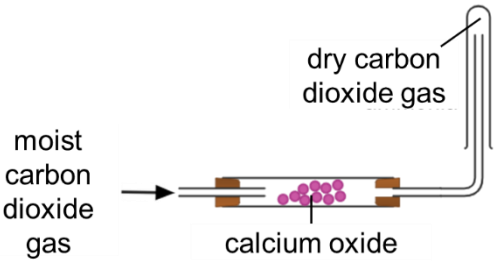
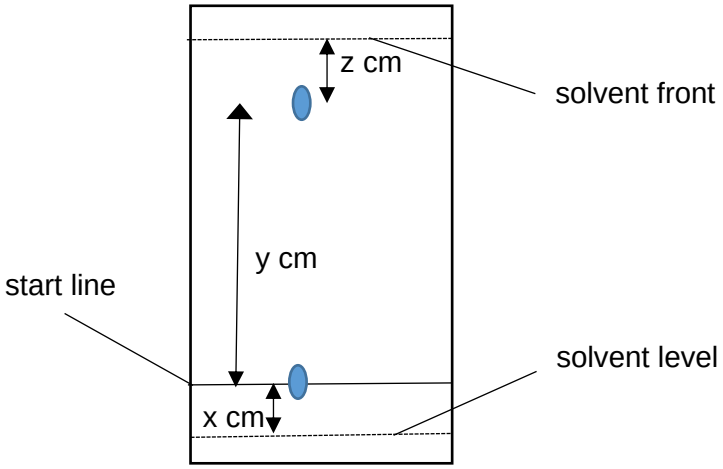


D



3 The diagram shows the chromatogram obtained by analysis of a single dye. Three measurements are shown in the diagram below.



How is the R_f value of the dye calculated?

A x/(x+y) **B** y/(y+z) **C** y/(x+y+z) **D** z/(x+y+z)

4 The labels fell off two bottles each containing a colourless solution, one of which was sodium carbonate solution and the other was sodium chloride solution.

Which of the following tests would allow for the identification of the solutions?

A addition of aqueous ammonia

B addition of dilute nitric acid

C addition of lead(II) nitrate solution

D addition of sodium hydroxide solution

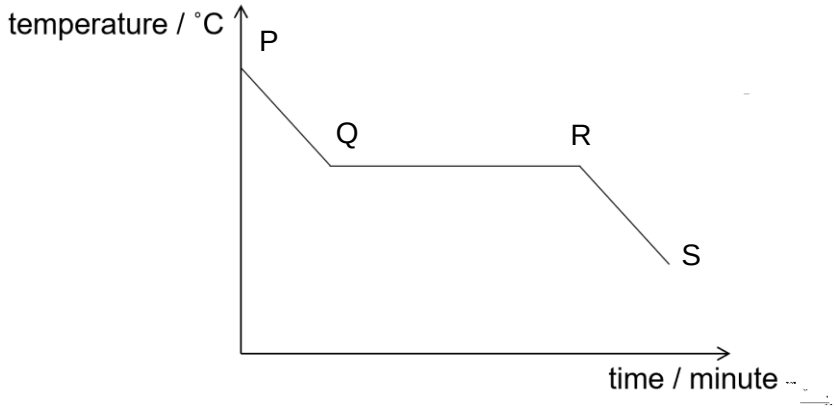
5 Two solutions, W and X, were tested as shown.

	W	X
dilute sulfuric acid	no visible reaction	no visible reaction
dilute nitric acid added, then aqueous barium nitrate	white precipitate	white precipitate
aqueous ammonia added	no precipitate seen	white precipitate, soluble in excess, forming a colourless solution
aqueous sodium hydroxide and aluminium foil added, then warmed	gas given off which turns red litmus paper blue	no gas given off

What are solutions W and X?

	W	X
A	sodium carbonate	zinc sulfate
B	lead(II) nitrate	ammonium carbonate
C	sodium nitrate	ammonium carbonate
D	ammonium sulfate	zinc sulfate

6 A sample of solid X is heated strongly until it has completely melted. The graph shows how its temperature varies with time as molten X is cooled.



Which of the following statements are true about the particles in X?

1 The arrangement is more orderly at stage RS than at stage PQ.
2 The forces of attraction are stronger at stage P than at stage S.
3 Their total energy content at stage QR is lower than at stage RS.
4 They are closer to each other at stage RS than at stage PQ.

A 1 and 3 only

B 1 and 4 only

C 1, 2 and 3 only

D 1, 3 and 4 only

7 The table shows the boiling points of the elements found in a sample of liquid air.

element	argon	helium	neon	nitrogen	oxygen
boiling point / ^{o}C	-186	-269	-246	-196	-183

Which elements would be gaseous at -190 ^{o}C?

A argon, helium and nitrogen

B argon, nitrogen and oxygen

C helium, neon and nitrogen

D helium, neon and oxygen

8 The descriptions of three substances are given as follows:

substance	description
P	When heated, carbon dioxide and a black solid are produced.
Q	Grey solid that reacts with water to give bubbles of gas.
R	It is a white solid that melts over a range of temperature.

Which row correctly classifies substances P, Q and R?

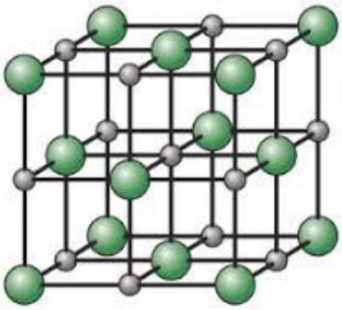
	P	Q	R
A	compound	compound	mixture
B	compound	element	mixture
C	element	element	compound
D	element	mixture	element

9 Which element has the most number of electrons in the outermost shell of its atoms?

A argon **B** boron

C chlorine **D** potassium

10 The diagram shows the arrangement of the particles in a compound.



Which compound would likely have this arrangement?

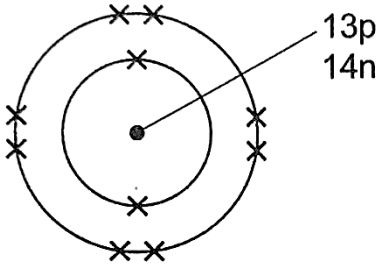
A diamond **B** graphite

C sodium chloride **D** water

11 Which of the following substances contains both ionic and covalent bonds?

A aluminium carbonate
B hydrogen chloride
C silicon dioxide
D sodium

12 The diagram shows a structure of an ion.



p = proton
n = neutron
× = electron

What is the correct position in the Periodic Table of the element from which this ion was formed?

	period	group
A	2	13
B	2	18
C	3	13
D	3	18

13 A cartoon hero was famous for his shiny armour, a gold-titanium alloy, which allowed him to fly to Mars and back to Earth without melting.

Which of the following best describes the chemical bonds that exist within the structure of his armour?

A Ions and atoms of gold and titanium are held by strong ionic forces.
B Ions and atoms of gold and titanium are held by strong electrostatic forces.
C Ions and electrons of gold and titanium are held by strong ionic forces.
D Ions and electrons of gold and titanium are held by strong electrostatic forces.

14 Which quantity is the same for one mole of ethanol and one mole of ethane?

A mass
B number of atoms
C number of molecules
D volume at room temperature and pressure

15 Zinc oxide is produced by heating zinc carbonate.

$$ZnCO_3 \rightarrow ZnO + CO_2$$

What is the percentage yield of zinc oxide if 125 g of zinc carbonate produces 75 g of zinc oxide on heating?
[M_r: $ZnCO_3$, 125]

A $125 \times \frac{81}{75} \times 100$

B $125 \times \frac{75}{81} \times 100$

C $\frac{1}{125} \times \frac{75}{81} \times 100$

D $\frac{75}{81} \times 100$

16 20 cm^3 of propene C_3H_6, reacts with 500 cm^3 of oxygen according to the equation shown below.

$$2C_3H_6\,(g) + 9O_2\,(g) \rightarrow 6CO_2\,(g) + 6H_2O\,(l)$$

What is the total volume of gas remaining at the end of the reaction? (all volumes are measured at room temperature and pressure)

A 120 cm^3 **B** 410 cm^3

C 470 cm^3 **D** 530 cm^3

17 An organic acid, W, contains the elements carbon, hydrogen and oxygen.

The composition by mass of each element is shown.

element in W	percentage composition by mass
carbon	35.8
hydrogen	4.5
oxygen	59.7

What is the empirical formula of W?

A CH_2O **B** $C_2H_3O_3$ **C** $C_4H_6O_5$ **D** $C_8H_{12}O_{10}$

18 What does the term strong acid mean in relation to hydrochloric acid, HC*l*?

A Each molecule can produce a maximum of one hydrogen ion.

B It forms an insoluble salt, silver chloride.

C It is completely dissociated in aqueous solution.

D Its aqueous solution has a pH above 7.

19 Elements H, J, L are in the same period in the Periodic Table.

The oxide of H dissolves in water to form a solution with a pH 12.5. The oxide of J forms a solution with a pH less than 4.5. The oxide of L is soluble in both aqueous potassium hydroxide and dilute nitric acid.

Which option shows the position of the elements in order of increasing atomic number?

A H, J, L

B H, L, J

C J, L, H

D L, J, H

20 Which pair of compounds could be used in the preparation of calcium sulfate?

A calcium and sulfuric acid

B calcium carbonate and sodium sulfate

C calcium chloride and ammonium sulfate

D calcium nitrate and lead(II) sulfate

21 A method used to make copper(II) sulfate crystals is shown.

1 Place dilute sulfuric acid in a beaker.
2 Warm the acid.
3 Add copper(II) oxide until it is in excess.
4 Filter the mixture.
5 Evaporate the filtrate until it is saturated.
6 Leave the filtrate to cool.

What are the purposes of carrying out step 3 and step 4?

	step 3	step 4
A	to ensure all of the acid has reacted	to obtain solid copper(II) sulfate
B	to ensure all of the acid has reacted	to remove excess copper(II) oxide
C	to speed up the reaction	to obtain solid copper(II) sulfate
D	to speed up the reaction	to remove excess copper(II) oxide

22 When aqueous potassium iodide is added to hydrogen peroxide, the following reactions are observed.

$$H_2O_2\,(aq) + I^-\,(aq) \rightarrow IO^-\,(aq) + H_2O\,(l)$$

$$H_2O_2\,(aq) + IO^-\,(aq) \rightarrow I^-\,(aq) + H_2O\,(l) + O_2\,(g)$$

There is a vigorous reaction and energy is liberated very rapidly, leading to a rise in temperature of the reaction mixture.

What is one of the roles of aqueous potassium iodide during any of the reactions?

A as a base

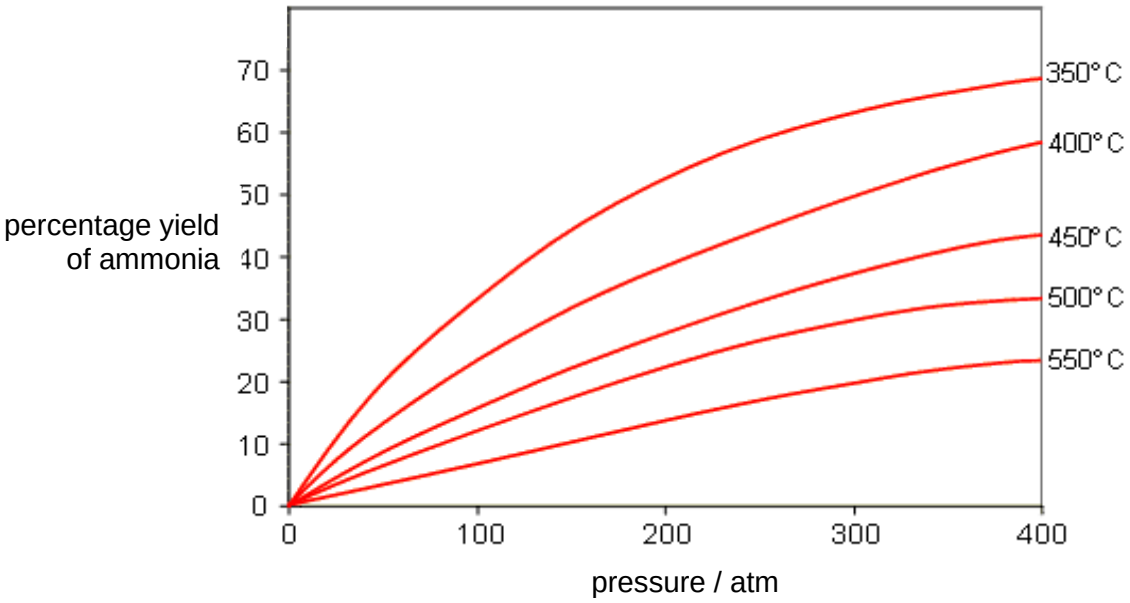
B as a dehydrating agent

C as a reducing agent

D as an oxidising agent

23 Ammonia is a very important intermediate in the manufacture of fertilisers. Ammonia is made in the Haber process by the reversible reaction between nitrogen and hydrogen at 450 °C.

The graph gives the percentage yield of ammonia gas under different conditions of temperature and pressure.



Which of the following statements is true of the process above?

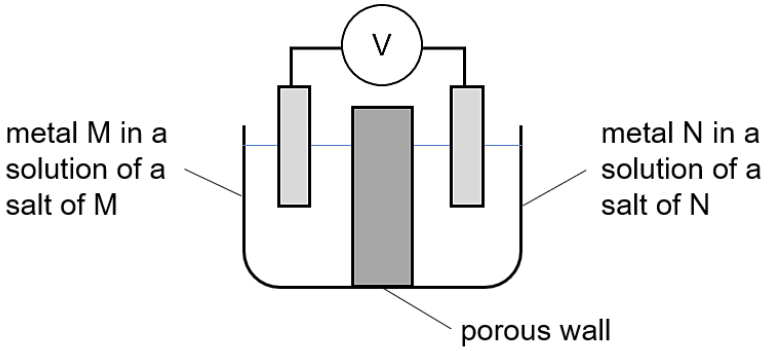
A The process is usually carried out at 450 °C rather than 200 °C as the speed of reaction would be faster.

B The yield of ammonia increases at higher temperature.

C The yield of ammonia increases at lower pressure.

D The yield of ammonia increases when a catalyst is added.

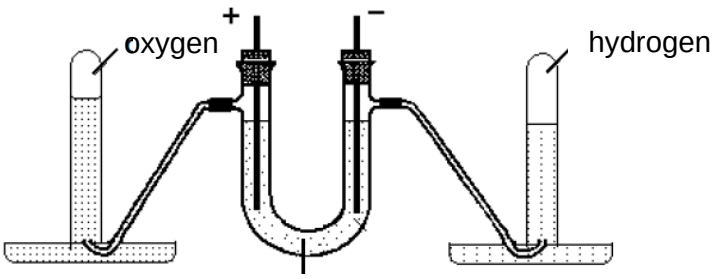
24 The diagram shows a simple cell with electrodes M and N.



Which pair of metals, M and N, will produce the highest voltage?

	M	N
A	copper	magnesium
B	magnesium	silver
C	silver	zinc
D	zinc	copper

25 The diagram shows the electrolysis of dilute sulfuric acid solution using inert electrodes.



Given that, at room temperature and pressure, x moles of electrons were passed in the circuit, which of the following statement is correct?

A $6x$ dm^3 of oxygen was collected at the anode.

B $6x$ dm^3 of hydrogen was collected at the cathode.

C $12x$ dm^3 of oxygen was collected at the cathode.

D $12x$ dm^3 of hydrogen was collected at the anode.

26 Four different conditions under which sodium chloride is electrolysed using inert electrodes are listed.

1 concentrated aqueous sodium chloride
2 dilute aqueous sodium chloride
3 molten sodium chloride
4 solid sodium chloride

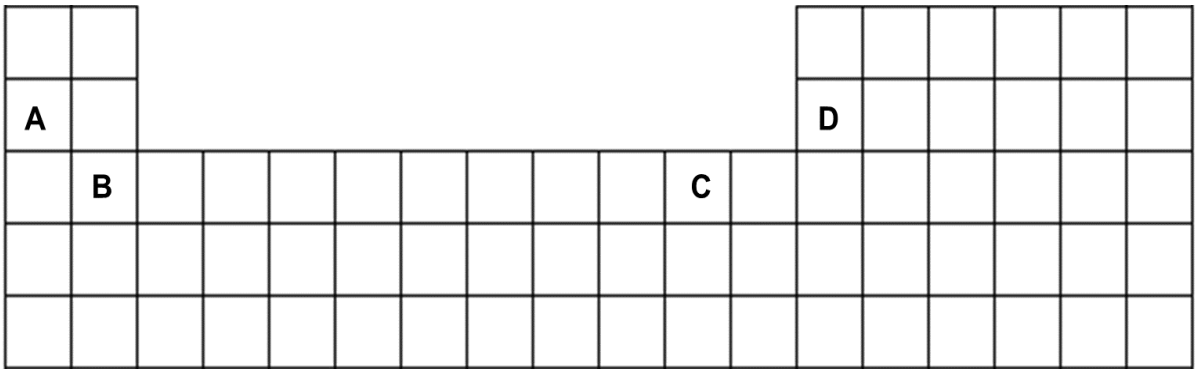
Under which conditions is a yellowish green gas formed?

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

27 The positions of four elements are shown in the outline of part of the Periodic Table.

Element X has a high melting point and is a good conductor of electricity.
It forms chlorides XCl and XCl_2.

Which element is X?



28 Which of the following statements regarding the element caesium are correct?

1 It is more reactive than potassium.
2 It reacts with chlorine to form an ionic compound.
3 It has a higher density than sodium.
4 It has a higher melting point than lithium.

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

29 The table below refers to four metals and some of their compounds.

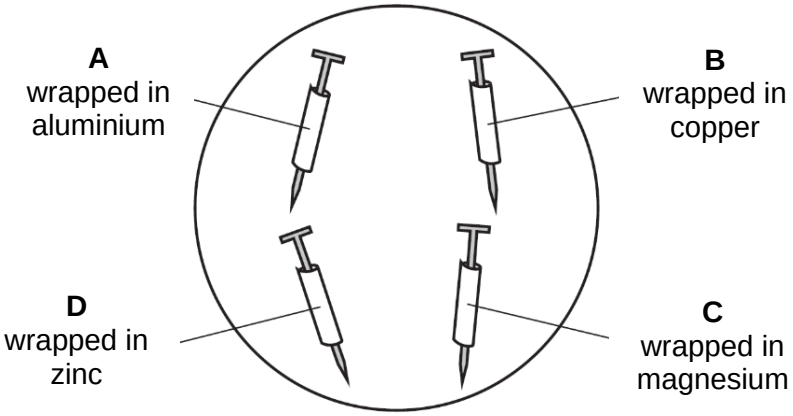
metal	action of dilute acid on metal	effect of hydrogen on heated oxide	action of metal on a solution of sulfate of J
G	hydrogen evolved	reduced	no reaction
H	no reaction	reduced	no reaction
I	hydrogen evolved	no reaction	J formed
J	hydrogen evolved	no reaction	no reaction

What is the correct order of reactivity of the metals?

	least reactive ⟶ most reactive			
A	H	G	J	I
B	H	J	G	I
C	I	J	G	H
D	I	G	J	H

30 Four iron nails had different metals wrapped around them.
The nails were placed in an open dish filled with water and left for a week.

Which iron nail has no protection against rusting?



31 Which change is endothermic?

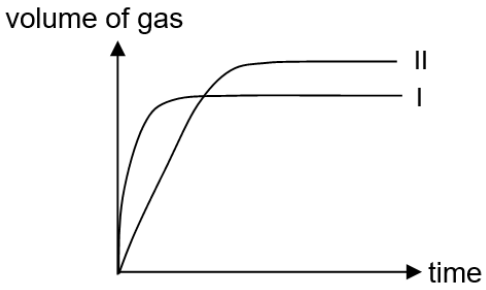
A $CH_4\ (g) + 2O_2(g) \rightarrow CO_2\ (g) + 2H_2O\ (l)$

B $H\ (g) + Cl\ (g) \rightarrow HCl\ (g)$

C $H_2O\ (g) \rightarrow 2H\ (g) + O\ (g)$

D $H_2O\ (l) \rightarrow H_2O\ (s)$

32 In the graph, curve I represents the result of a reaction between 1.0 g of calcium granules and excess water at 25 °C.



Which conditions would produce curve II?

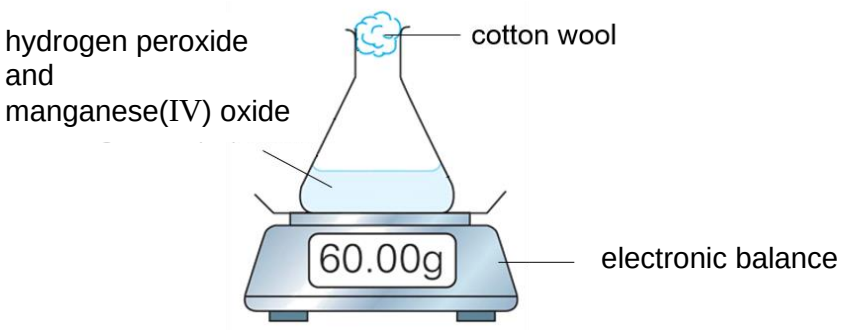
A 1.0 g of calcium granules with excess water at 15 °C

B 1.0 g of calcium powder with excess water at 25 °C

C 1.15 g of calcium granules with excess water at 15 °C

D 1.15 g of calcium granules with excess water at 50 °C

33 A small amount of manganese(IV) oxide powder is used as a catalyst in the decomposition of hydrogen peroxide to form oxygen gas and water.



Which of the following is **not** true about the reaction?

A The manganese(IV) oxide can be recovered by filtration.

B The mass of the flask and its contents decreases.

C The reaction becomes slower as the reaction proceeds.

D The reaction stops when all the manganese(IV) oxide is used up.

34 Which statement correctly describes the members of any homologous series?

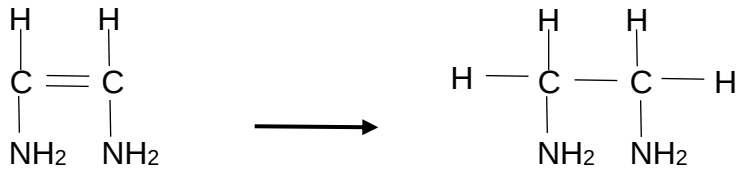
A They have the same empirical formula.

B They have the same physical properties.

C They undergo similar chemical reactions.

D The relative molecular masses of consecutive members differ by 12.

35 Compound X can be converted into compound Y as shown.



Compound X compound Y

Which correctly shows the reagents and conditions needed for the conversion?

	reagent	conditions
A	concentrated sulfuric acid	heat
B	hydrogen	high temperature, nickel catalyst
C	monomer	high temperature, iron catalyst
D	steam	high temperature and high pressure, phosphoric acid

36 What process/reaction is occurring when ethene and octane are obtained from decane, $C_{10}H_{22}$?

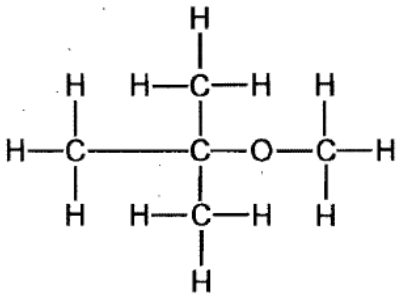
A combustion

B cracking

C fractional distillation

D polymerisation

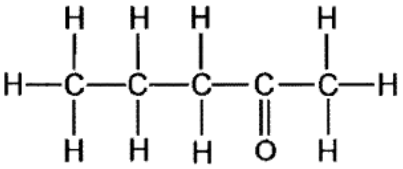
37 The structural formula of compound Z is shown.



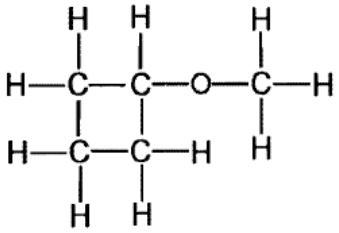
Compound Z

Which of the following compound is an isomer of compound Z?

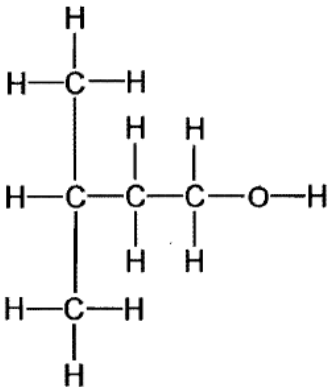
A



B



C



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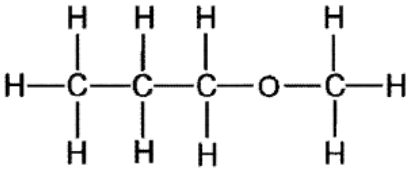


38 Which statement about alcohols are correct?

1 All alcohols contain the hydroxide ion, OH^-.

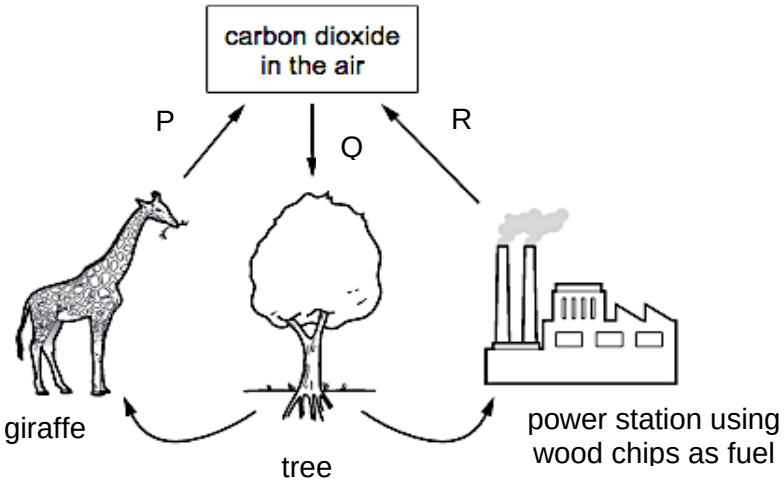
2 Ethanol can be formed from ethene using a reaction catalysed by yeast.

3 Ethanol can undergo neutralisation with aqueous sodium hydroxide.

4 Methanol can be oxidised to methanoic acid.

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

39 The diagram shows part of the carbon cycle. P, Q and R refer to specific processes of the carbon cycle.



Which row correctly describe the energy changes of these processes?

	P	Q	R
A	endothermic	endothermic	exothermic
B	endothermic	exothermic	endothermic
C	exothermic	endothermic	exothermic
D	exothermic	exothermic	endothermic

40 Methane, chlorofluorocarbons (CFCs) and carbon dioxide are all gases which affect the atmosphere and the environment.

In what way do these gases affect the environment?

	methane	chlorofluorocarbons (CFCs)	carbon dioxide
A	acid rain	global warming	photochemical smog
B	depletion of ozone layer	photochemical smog	global warming
C	global warming	depletion of ozone layer	global warming
D	global warming	depletion of ozone layer	acid rain

The Periodic Table of Elements

Group																	
1	2											13	14	15	16	17	18
							1 H hydrogen 1										2 He helium 4
3 Li lithium 7	4 Be beryllium 9		**Key** 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	3	4	5	6	7	8	9	10	11	12	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 dm^3 at room temperature and pressure (r.t.p.).
The Avogadro constant, $L = 6.02 \times 10^{23}\ mol^{-1}$.