Name:	Index Number:	Class:

YIO CHU KANG SECONDARY SCHOOL
O-LEVEL PRELIMINARY EXAMINATION 2024
SECONDARY FOUR EXPRESS

CHEMISTRY 6092/01
Paper 1 1 hour

23 August 2024 (Friday)

Additional Materials:
Optical Answer Sheet (OAS)

READ THESE INSTRUCTIONS FIRST

Write in soft pencil on the OAS.
Do not use staples, paper clips, glue or correction fluid.
Write your name, index number and class on the OAS 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 OAS.
Read the instructions on the OAS 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 question paper.
The use of an approved scientific calculator is expected, where appropriate.

A copy of the Periodic Table is printed on page **20**.

For Examiner's Use
40

Setter: Mdm Connie Yeo

1 At which temperature does a dilute solution of sodium chloride begin to boil?

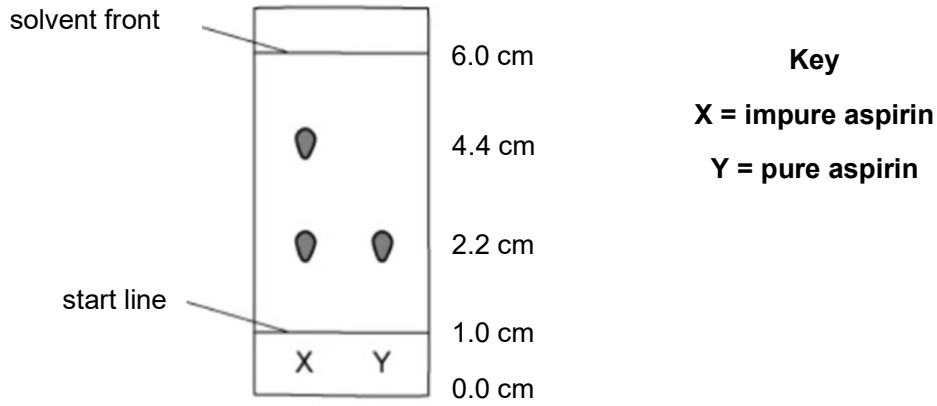
A 90°C

B 98°C

C 100°C

D 102°C

2 Samples of pure and impure aspirin were analysed using chromatography. The resulting chromatogram is shown below.



The impure sample of aspirin was contaminated with one of the raw chemicals used during production.

What is the R_f value of the chemical?

A 0.24

B 0.37

C 0.68

D 0.73

3 Four mixtures, each containing two substances, are shown in the table.
The two substances need to be separated and collected.

Which row is correct?

	mixture	separation method
A	ethanol and methanol	evaporation
B	ink and water	chromatography
C	oxygen and nitrogen	fractional distillation
D	sand and calcium sulfate	filtration

4 In which changes do the particles move further apart?

1 A gas is heated from 0°C to 25°C.
2 Iodine vapour coming into contact with cold surface.
3 Pressure is applied to a gas at a constant temperature.
4 Water boiling to form steam.

A 1 and 2

B 1 and 4

C 2 and 3

D 3 and 4

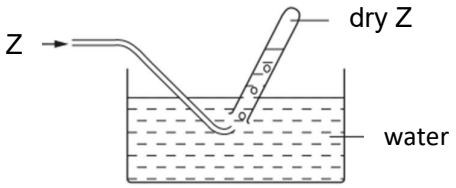
5 The table gives data about four substances.

Which substance has particles in an orderly arrangement at room temperature?

	melting point/°C	boiling point/°C
A	–101	–34
B	-39	357
C	-7	59
D	113	445

6 A gas Z, is less dense than air, very soluble in water and is alkaline.
Which method is used to collect a dry sample of the gas?

A



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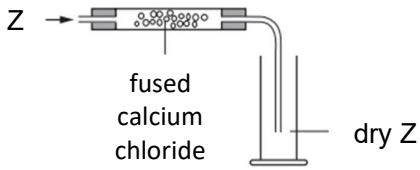

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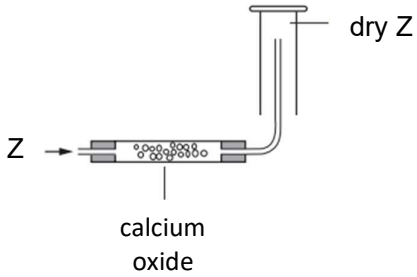

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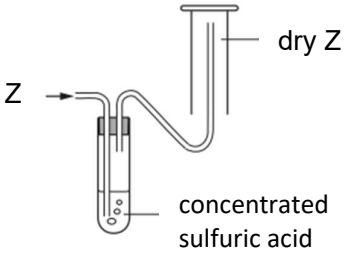
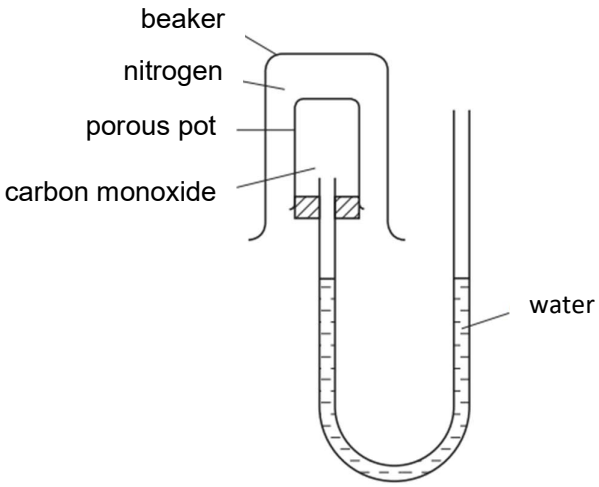


7 Gases can diffuse through porous pots. The diagram shows a beaker full of nitrogen inverted over a porous pot containing carbon monoxide.



The water level does not move.

Which statement explains this?

A Both gases are insoluble in water.

B Both gases are neutral.

C Both gases have the same molecular masses.

D Both gases have two atoms in a molecule.

8 Substances can be elements, compounds or mixtures.

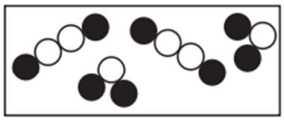
Which row is correct?

	element	compound	mixture
A	carbon	glucose	petroleum
B	nitrogen	brass	air
C	oxygen	carbon dioxide	methane
D	zinc	steel	seawater

9 The symbols ○ and ● represent atoms of different elements.

Which diagram shows a mixture of elements?

A



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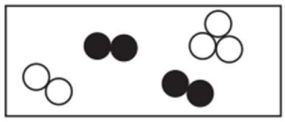

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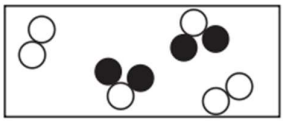

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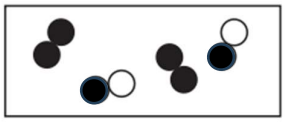


10 Two particles K and L have the composition shown in the table.

particle	number of electrons	number of neutrons	number of protons
K	10	12	11
L	18	20	20

What are particles K and L?

A metal atoms

B non-metal atoms

C negative ions

D positive ions

11 Two particles have the symbols $^{58}_{26}Fe^{2+}$ and $^{58}_{27}Co^{3+}$.

Which statement about these particles is/are correct?

1 They contain the same number of electrons.
2 They contain the same number of neutrons.
3 They have different number of protons, neutrons or electrons.
4 They have the same mass number.

A 1 and 2 only

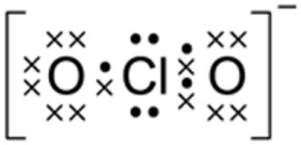
B 1 and 4 only

C 2 and 4 only

D 3 only

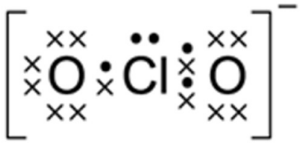
12 The octet rule may or may not be obeyed by the atoms in the chlorite ion, ClO_2^-.
Which is the correct structure of the chlorite ion?

A



B

C



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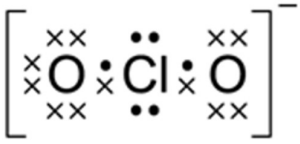


13 The relative molecular mass of liquid P is 60. P contains 40.0% carbon, 6.70% hydrogen and 53.3% oxygen.
Which row shows the correct empirical and molecular formulae of P?

	empirical formula	molecular formula
A	CH_2O	CH_2O
B	CH_2O	$C_2H_4O_2$
C	CH_3O	$C_2H_6O_2$
D	$C_2H_4O_2$	$C_2H_4O_2$

14 Hydrogen sulfide reacts with sulfur dioxide to produce sulfur.

$$H_2S\ (aq) \rightarrow S\ (s) + 2H^+\ (aq) + 2e^-$$
$$SO_2\ (aq) + 4H^+\ (aq) + 4e^- \rightarrow S\ (s) + 2H_2O\ (l)$$

How many moles of hydrogen sulfide are needed to produce one mole of sulfur?

A $\frac{1}{3}$ mol

B $\frac{2}{3}$ mol

C $\frac{3}{2}$ mol

D 2 mol

15 A student made calcium chloride by reacting 15.0 g of calcium carbonate with hydrochloric acid. The equation for the reaction is

$$CaCO_3 + 2HCl \rightarrow CaCl_2 + CO_2 + H_2O$$

The percentage yield of calcium chloride was 85%.

Calculate the mass of calcium chloride the student actually produced.

A 13.8 g

B 14.2 g

C 16.2 g

D 16.7 g

16 Elements X and Y combine to form a covalent compound.
Atoms of X have more protons than atoms of Y.
Atoms of Y have more valence electrons than atoms of X.

Which statement is correct?

A Atoms of X have more electron shells than atoms of Y.

B Ions of X are positively charged.

C X and Y are in the same period of the Periodic Table.

D X and Y are in the same group of the Periodic Table.

17 The elements in Group 1 of the Periodic Table show trends in both their reactivities and their melting points. Rubidium is in Group 1.

Which statement about rubidium is correct?

A It has a higher melting point than potassium.

B It is more reactive than potassium.

C It reacts with water to produce an acidic solution.

D It reacts with water to produce oxygen gas.

18 A solution of potassium halide and a halogen are mixed together. A reaction occurs and the mixture darkens in colour.

What is the mixture?

A bromine and potassium fluoride

B chlorine and potassium iodide

C fluorine and potassium chloride

D iodine and potassium bromide

19 Which statement are true about all the noble gases?

1 They all have eight electrons in their outer shell.
2 They are insoluble in water.
3 They do not react to form compounds.
4 They exist as diatomic molecules.

A 1, 2 and 3 only

B 1, 3 and 4 only

C 2 and 3 only

D 3 and 4 only

20 Which one of the following elements burns in excess oxygen to form an amphoteric oxide?

A carbon

B copper

C iron

D lead

21 Aqueous ammonium chloride is warmed with an excess of aqueous sodium hydroxide.
The resulting mixture is neutralised with dilute nitric acid.
The mixture is then mixed with aqueous silver nitrate.
The precipitate is filtered off and the filtrate is evaporated to leave a white solid.

What is the white solid?

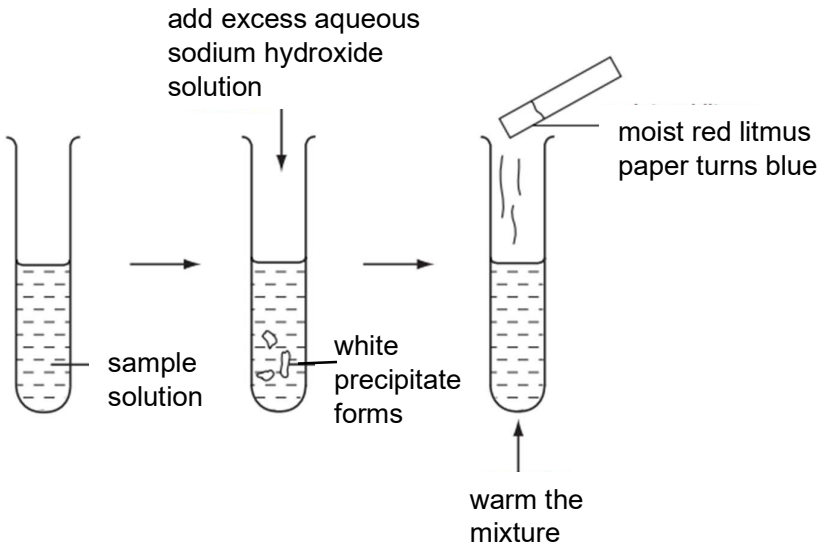
A ammonium nitrate

B silver chloride

C sodium chloride

D sodium nitrate

22 A sample solution was tested as shown.



Which ions must be present in the solution?

A Al^{3+} and NO_3^-

B Ca^{2+} and NO_3^-

C NH_4^+ and Al^{3+}

D NH_4^+ and Ca^{2+}

23 A student is provided with solutions of dilute hydrochloric acid, dilute sulfuric acid, solid magnesium oxide, zinc carbonate and copper.

How many different salts could the student make?

A 2

B 3

C 4

D 6

24 Which of the following are redox reactions?

1 $Ba(NO_3)_2 + Na_2SO_4 \rightarrow BaSO_4 + 2NaNO_3$

2 $2Fe + 3Cl_2 \rightarrow 2FeCl_3$

3 $H_2SO_4 + Mg \rightarrow MgSO_4 + H_2$

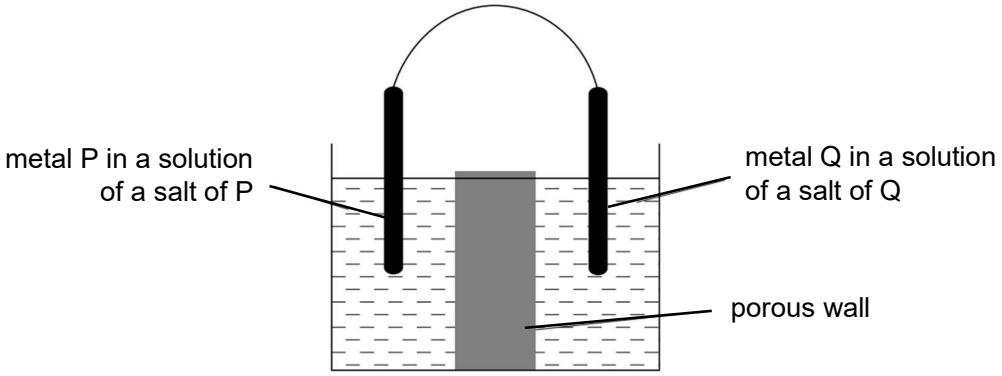
A 1, 2 and 3

B 1 and 2 only

C 1 and 3 only

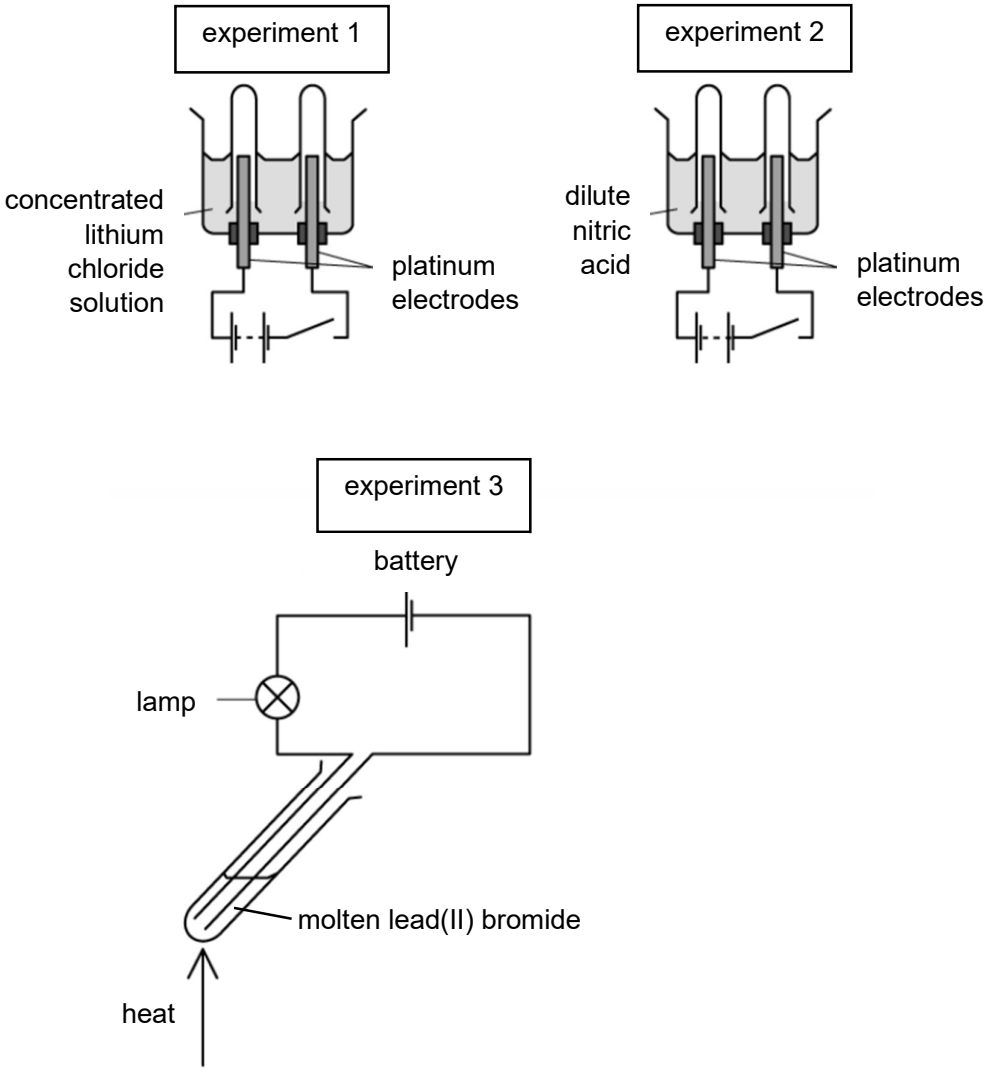
D 2 and 3 only

25 Which pair of metals P and Q will produce the highest voltage when used as electrodes in a simple cell?



	metal P	metal Q
A	copper	silver
B	iron	copper
C	magnesium	iron
D	zinc	silver

26 Concentrated aqueous lithium chloride, dilute nitric acid and molten lead(II) bromide were electrolysed separately in experiments 1, 2 and 3.



Which statement about the electrode products is correct?

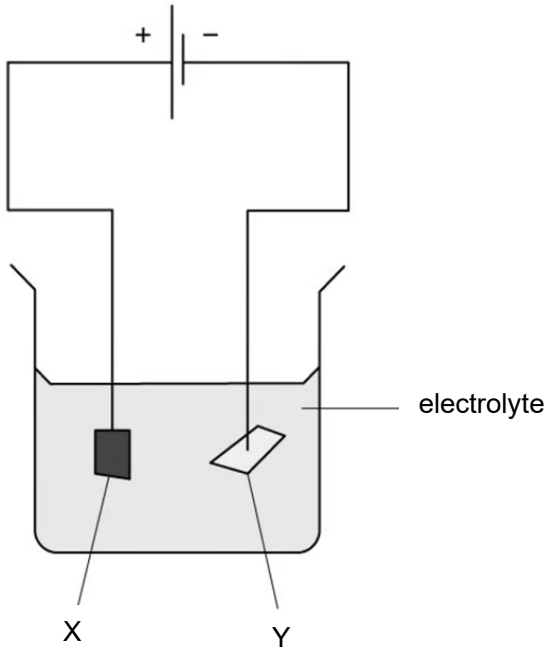
A Gases are given off at the cathode in experiments 1 and 2 only.

B Gases are given off at the anode in experiments 2 and 3 only.

C Metals were formed at the anode in experiments 1 and 3 only.

D Metals were formed at the cathode in experiments 1 and 3 only.

27 The diagram shows an electrolysis experiment using X and Y as electrodes.



Silver is used to coat the other metal.

Which metal becomes coated with silver and which electrolyte is used?

	electrolyte	metal
A	AgCl	X
B	AgCl	Y
C	$AgNO_3$	X
D	$AgNO_3$	Y

28 The global atmospheric concentration of carbon dioxide has increase in the last 200 years.

What could be causing this increase?

1 emission from motor vehicles
2 photosynthesis
3 power stations using coal and oil
4 ocean uptake

A 1, 2 and 4 only

B 1 and 3 only

C 1, 3 and 4 only

D 1 and 4 only

29 A coil of copper wire is suspended in aqueous silver nitrate. Crystals of silver are deposited on the copper wire.

Which statement is **not** correct?

A The copper is reduced.

B The reaction is exothermic.

C The solution turns blue.

D The total mass of the crystals of silver increases gradually.

30 Which metal can react rapidly with steam, but reacts only very slowly with cold water?

A calcium

B copper

C magnesium

D sodium

31 In which process is energy released?

A electrolysis of water to form hydrogen and oxygen

B forming a hydrogen molecule from two hydrogen atoms

C fractional distillation of crude oil

D photosynthesis

32 Zinc carbonate was reacted with an excess of dilute hydrochloric acid at room temperature.

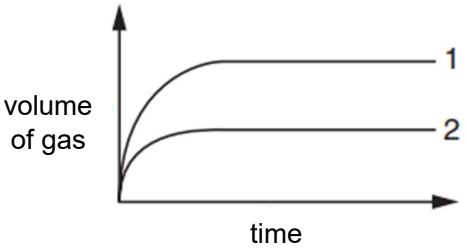
$$ZnCO_3 + 2HCl \rightarrow ZnCl_2 + H_2O + CO_2$$

Two experiments were carried out.

Experiment 1 : 10 g of zinc carbonate in large lumps
Experiment 2 : 5 g of zinc carbonate as a fine powder

Which of the graphs is correct?

A



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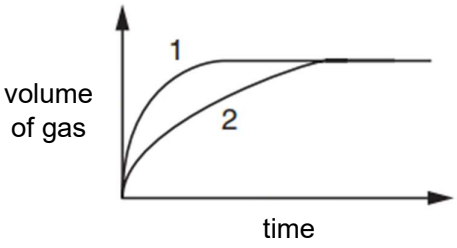

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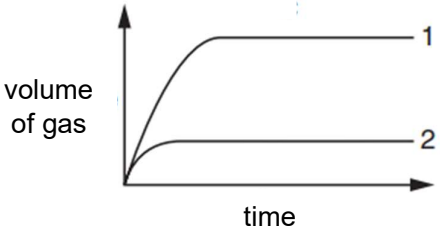

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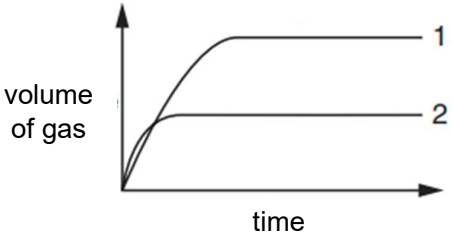
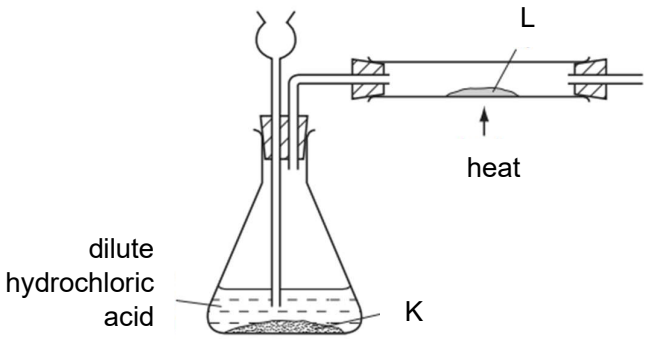


33 Which row correctly shows two ways of reducing the formation of acid rain?

A	plant more trees	reduce the amount of livestock farming
B	reduce the amount of livestock farming	use a catalytic converter
C	use a catalytic converter	use fuels containing low levels of sulfur
D	use fuels containing low levels of sulfur	plant more trees

34 The diagram shows the apparatus used in an experiment to reduce substance L with the gas generated in the flask.



What are substances K and L?

	K	L
A	copper	lead(II) oxide
B	lead	magnesium oxide
C	magnesium	zinc oxide
D	zinc	copper(II) oxide

35 Which statement about gases in the atmosphere is correct?

A Carbon monoxide is a pollutant which causes acid rain.

B Catalytic converters reduce carbon monoxide to carbon dioxide.

C Methane forms photochemical smog with nitrogen oxides under sunlight.

D Chlorofluorocarbons deplete the ozone layer in the upper atmosphere.

36 Under certain conditions, 1 mole of ethane reacts with 3 moles of chlorine in a substitution reaction.

What is the molecular formula of the organic product in this reaction?

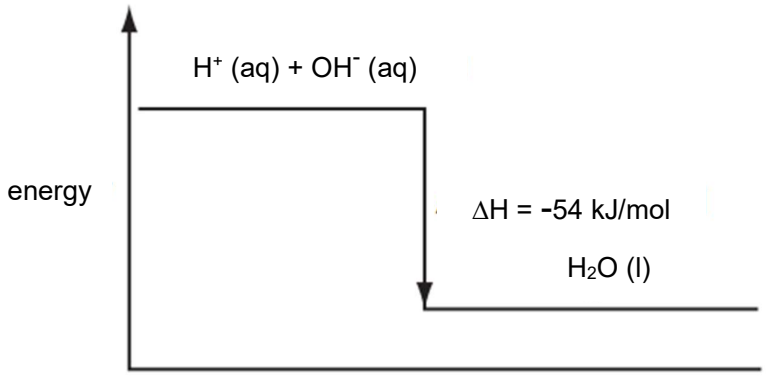
A $C_2H_2Cl_4$

B $C_2H_3Cl_3$

C $C_2H_4Cl_2$

D C_2H_5Cl

37 The energy diagram for the reaction between potassium hydroxide and sulfuric acid is shown.



Which quantity of heat is liberated when 100 cm^3 of 1 mol / dm^3 sulfuric acid reacts with 100 cm^3 of 2 mol / dm^3 potassium hydroxide?

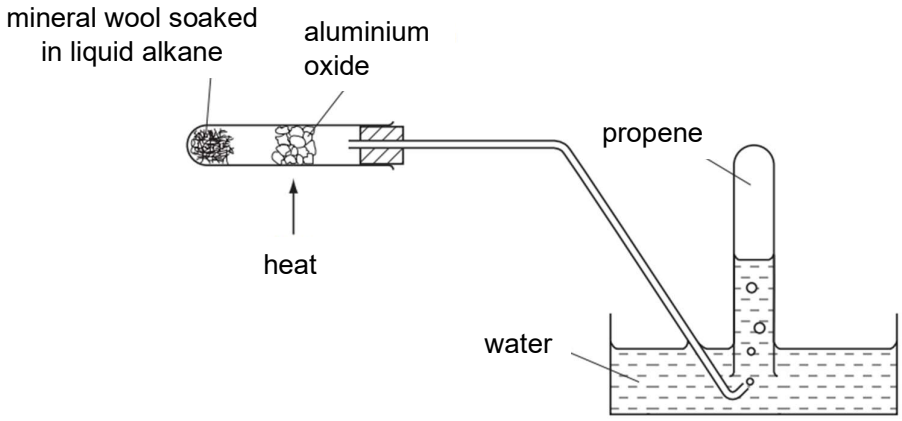
A 0.54 kJ

B 2.70 kJ

C 5.40 kJ

D 10.8 kJ

38 The diagram shows the breakdown of an alkane to propene.

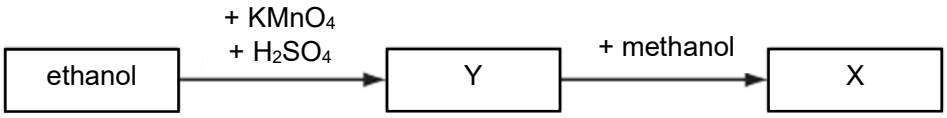


The propene is then tested with aqueous bromine.

Which information about propene is correct?

	solubility of propene gas	action on aqueous bromine
A	insoluble	decolourised
B	insoluble	no reaction
C	soluble	decolourised
D	soluble	no reaction

39 A compound, X, can be prepared by the reactions shown.



What is the structural formula of X?

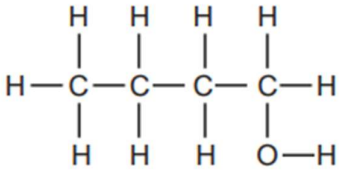
A $CH_3CH_2CO_2H$

B $CH_3CH_2CO_2CH_3$

C $CH_3CO_2CH_3$

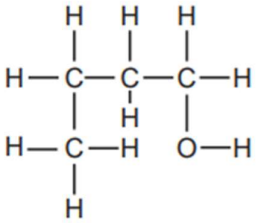
D $HCO_2CH_2CH_3$

40 Compound Z has the structure shown.



Which structure is an isomer of Z?

A



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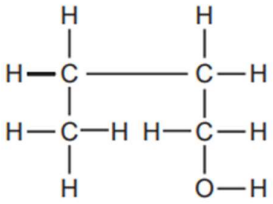

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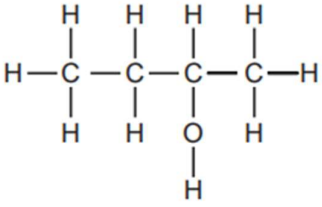

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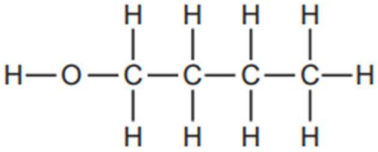

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The Periodic Table of Elements

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, $L = 6.02 \times 10^{23}\ mol^{-1}$.