HUA YI SECONDARY SCHOOL
PRELIMINARY EXAM 2024

4-G3

NAME

CLASS

INDEX NUMBER

CHEMISTRY **6092/01**

PAPER 1

21 August 2024

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.

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 **19**.
The use of an approved scientific calculator is expected, where appropriate.

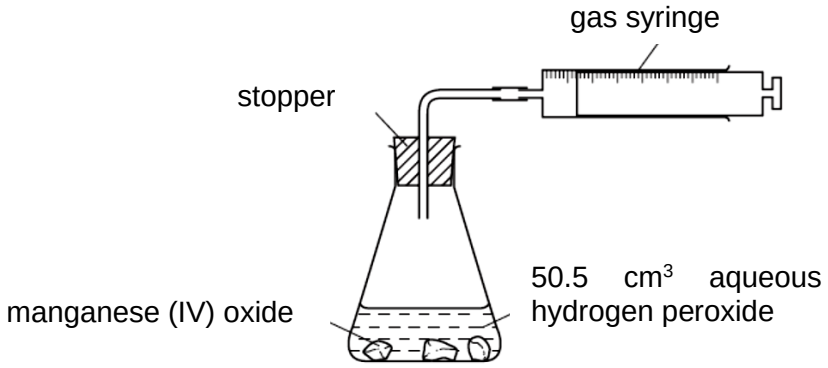
Paper 1	40

This document consists of **19** printed pages, and **1** blank page.

Setter: Chiang Wai Kit

[Turn Over

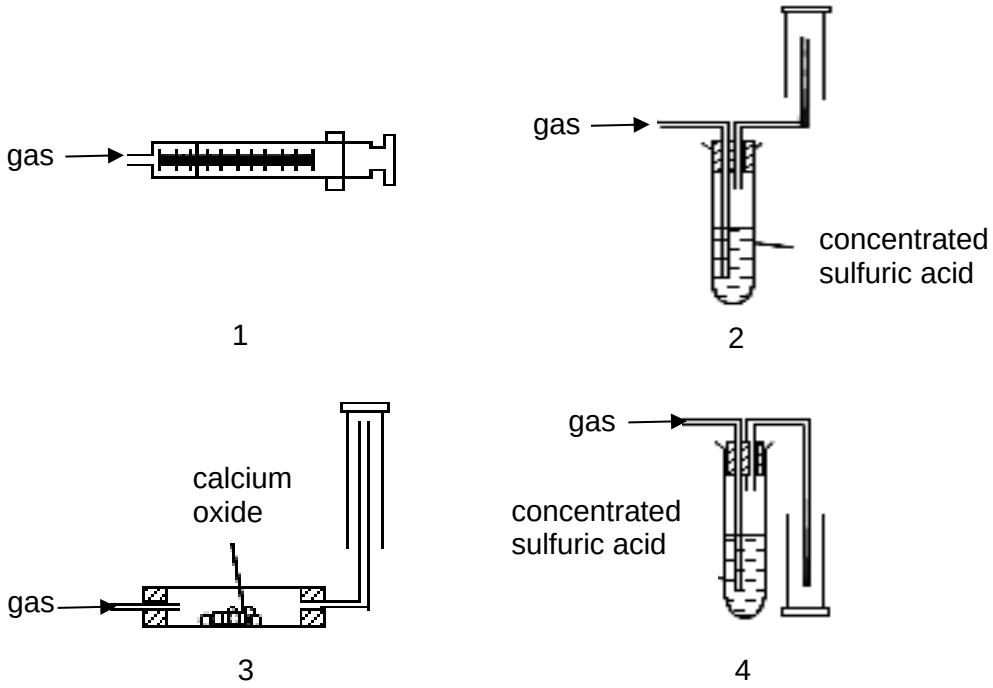
1 A student uses the apparatus shown to measure the volume of oxygen gas produced when different masses of manganese(IV) oxide are added to 50.5 cm^3 of aqueous hydrogen peroxide.



What other apparatus are needed?

A mass balance and pipette
B mass balance and measuring cylinder
C measuring cylinder and stop watch
D pipette and stopwatch

2 Ammonia gas is produced in a chemical reaction.



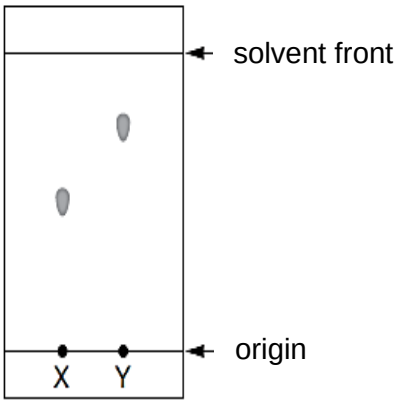
Which of the following methods can be used to collect a **dry** sample of the gas?

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

3 A student accidentally mixed 50 cm^3 of water with 50 cm^3 of oil.
Which method would allow him to obtain 25 cm^3 of the oil most easily?

A evaporation
B filtration
C fractional distillation
D using a separating funnel

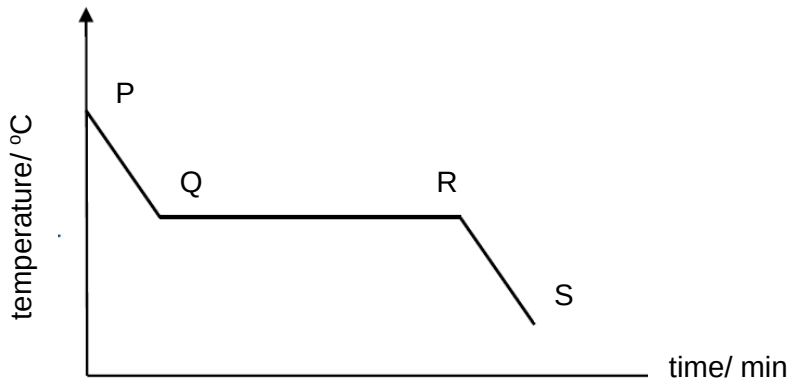
4 The diagram shows the chromatograms of an ink sample P using two different solvents.
X is an aqueous solution of a salt of a Group 1 element.
Y is an aqeuous solution of a salt of a transition element.



Which row correctly describes X and Y?

	larger R_f value	requires a locating agent
A	X	X
B	X	Y
C	Y	X
D	Y	Y

5 A sample of solid X is heated until it is 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 2 are correct
B 1 and 4 are correct
C 2 and 3 are correct
D 2 and 4 are correct

6 The table shows some information about particles P, Q, R and T.

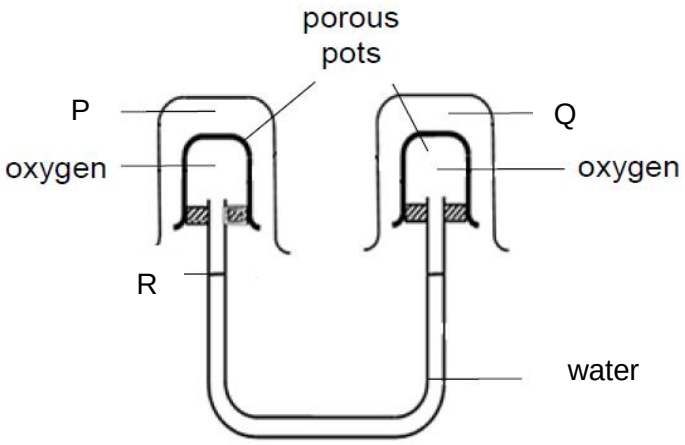
particle	proton number	nucleon number	number of electrons
P	11	23	10
Q	11	23	11
R	17	35	17
T	17	37	18

Which of the following are true about P, Q, R and T?

1 P and Q are particles of the same element.
2 P is a positive ion of atom Q.
3 Q reacts with R to form an ionic compound.
4 T is a noble gas.

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

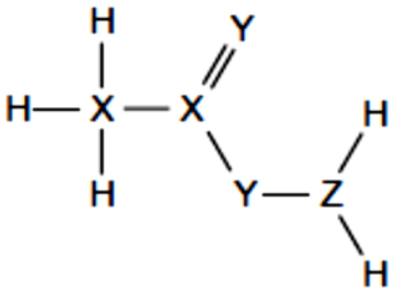
7 The diagram shown is set up using different gases placed in different beakers.



Which gases, when placed in beakers P and Q respectively, will cause the water level at R to fall initially?

	P	Q
A	carbon dioxide	nitrogen
B	argon	nitrogen
C	nitrogen	carbon dioxide
D	nitrogen	hydrogen

8 The diagram below shows the structure of a covalent compound containing the element hydrogen and three other unknown elements, X, Y and Z.



How many valence electrons **do not** take part in the bonding for elements, X, Y and Z?

	X	Y	Z
A	0	4	2
B	0	6	6
C	4	5	1
D	4	6	5

9 An unknown metal M and its compounds are found to be conductors of electricity in different physical states.

Which particles are responsible for the electrical conductivity of M (s), MO (*l*) and MCl_2 (aq) in the corresponding states?

	M (s)	MO (*l*)	MCl_2 (aq)
A	cations	electrons	electrons
B	cations and anions	electrons	cations
C	electrons	cations	cations and anions
D	electrons	cations and anions	cations and anions

10 The table below shows some information about four substances labelled P to S.

substance	appearance	change on heating
P	colourless liquid	boils away, leaving a white residue
Q	colourless gas	burns in oxygen to form water and carbon dioxide only
R	yellow solid	splits up by electricity to form a metal and a gas
S	white solid	burns in air to form an oxide as the only product

Which of these substances P, Q, R and S are compounds?

A Q and R only
B P and Q only
C R and S only
D Q, R and S only

11 Silicon dioxide, SiO_2, has a structure similar to diamond. Boron nitride, BN, has a structure similar to graphite. Bronze is an alloy of copper and tin.

Which statements about SiO_2, BN and bronze are correct?

1 All are bonded covalently.
2 All except silicon dioxide conduct electricity when solid.
3 All have high melting points.

A 1 and 2 only
B 1 and 3 only
C 2 and 3 only
D 1, 2 and 3

12 On adding 60 g of impure limestone, $CaCO_3$ (M_r = 100), to excess sulfuric acid, 10 dm^3 CO_2 was evolved at room temperature and pressure.

What is the purity of the limestone?

A 16.6%
B 25.0%
C 34.7%
D 69.4%

13 The amount of chlorine in a pesticide may be determined by precipitation of the chlorine in silver chloride.

Given 3.50 g of pesticide reacts to produce 0.318 g of silver chloride, what is the percentage by mass of chlorine in the pesticide?

A 1.80%
B 1.96%
C 2.25%
D 3.60%

14 Melamine, a plastic, has the following composition by mass.

C: 28.6%, H:4.8%, N: 66.6%

If its relative molecular mass is 126, what is its molecular formula?

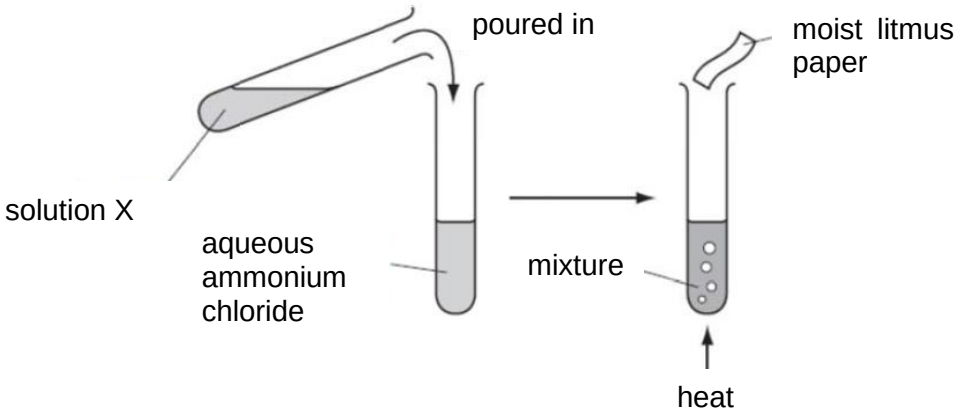
A CHN
B CH_2N_2
C $C_2H_4N_6$
D $C_3H_6N_6$

15 What is the volume of hydrogen produced at room temperature and pressure when 4.6 g of sodium is reacted with excess water?
[1 mol of gas occupies 24 dm^3 at room temperature and pressure.]

$2Na\ (s) + 2H_2O\ (l) \rightarrow 2NaOH\ (aq) + H_2\ (g)$

A 1.2 dm^3
B 2.4 dm^3
C 4.8 dm^3
D 12 dm^3

16 The diagram shows an experiment with aqueous ammonium chloride.



A gas, Y, is produced and the litmus paper changes colour.

What is solution X and gas Y?

	solution X	gas Y
A	aqueous sodium hydroxide	ammonia
B	aqueous sodium hydroxide	hydrogen chloride
C	dilute sulfuric acid	ammonia
D	dilute sulfuric acid	hydrogen chloride

17 Which of the following elements form oxides which dissolve in water to form alkaline solutions?

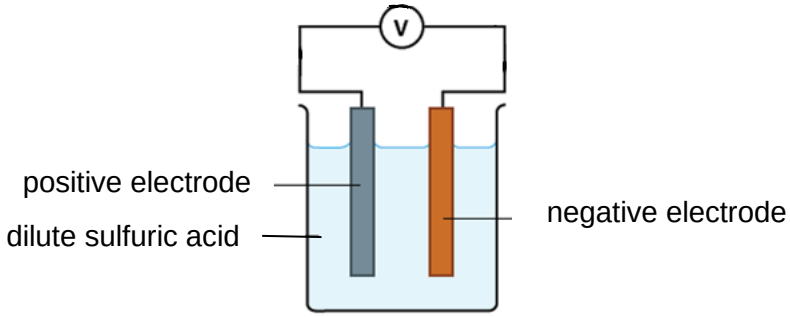
1 calcium
2 copper
3 sodium
4 sulfur

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

18 Which of the following salts is **incorrectly** matched with its method of preparation?

	salt	method of preparation
A	ammonium nitrate	titrate aqueous ammonium carbonate with dilute nitric acid
B	copper (II) sulfate	add excess copper(II) carbonate to warm dilute sulfuric acid
C	lead (II) chloride	mix aqueous lead(II) nitrate with dilute hydrochloric acid
D	silver nitrate	add excess silver to warm dilute nitric acid

19 Four metals, W, X, Y and Z were connected in pairs as shown and the voltage was recorded.



The results obtained are recorded in the table below.

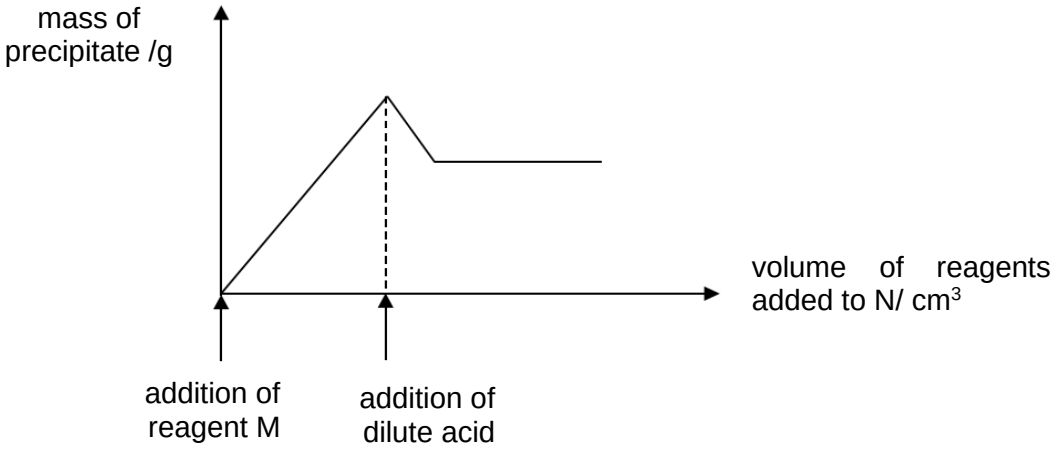
cell	metals used	voltage	positive terminal
1	W and X	1.10	W
2	X and Y	1.46	Y
3	X and Z	0.47	X

Which statement is correct?

A X is the least reactive metal.
B Y is the most reactive metal.
C The voltage obtained when W and Y are used is 0.36 V.
D W can displace metal Z from a solution containing cations of Z.

20 Reagent M is gradually added to a salt solution N (that contains either 1 or 2 different anions), followed by the addition of a dilute acid.

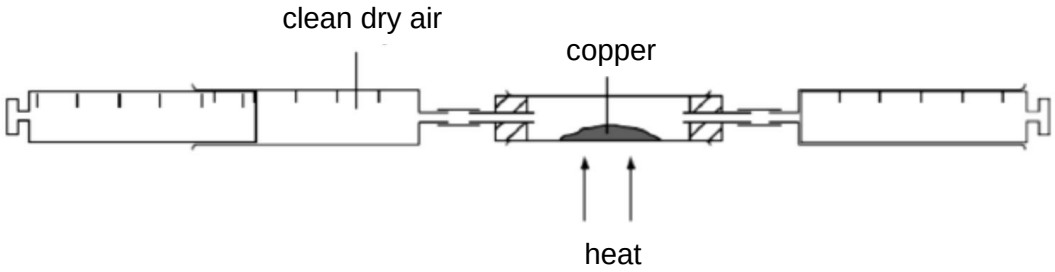
The graph below shows how the mass of precipitate formed changes with the reagents added.



Which one of the following combinations would produce the given results?

	M, followed by dilute acid	anion(s) in N
A	aqueous silver nitrate, dilute nitric acid	I^-
B	aqueous silver nitrate, dilute nitric acid	Cl^-, CO_3^{2-}
C	aqueous barium chloride, dilute hydrochloric acid	CO_3^{2-}
D	aqueous barium chloride, dilute hydrochloric acid	Cl^-, CO_3^{2-}

21 A 100 cm^3 sample of clean, dry air is passed over hot excess copper at room temperature and pressure until there is no further change in volume. The pink copper metal turns black at the end of the reaction.



What is the mass of the black solid formed when the reaction is complete?

A 0.07 g
B 0.14 g
C 0.27 g
D 0.52 g

22 The electroplating of a metal spoon is performed using silver.

1 The anode is the silver metal.
2 The concentration of the electrolyte decreases during electroplating.
3 The electrolyte used is aqueous silver nitrate
4 The spoon is made the cathode.

Which of the above statements about the process are true?

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

23 One type of fuel cell produces electricity from the controlled reaction of hydrogen with oxygen in the presence of an electrolyte.

The reaction at the anode is: $H_2 + 2OH^- \rightarrow 2H_2O + 2e^-$
The reaction at the cathode is: $O_2 + 2H_2O + 4e^- \rightarrow 4OH^-$

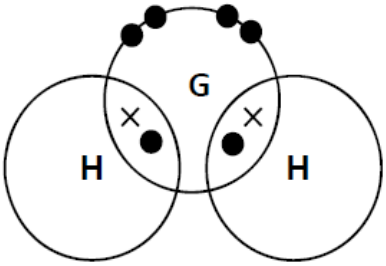
Which of the following is true?

A In fuel cells, combustion of hydrogen and oxygen provides heat energy.
B In fuel cells, chemical energy from the reaction is converted directly into electricity.
C Fuel cell is a type of rechargeable battery.
D Water molecules are reduced at the anode and discarded.

24 Which of the following properties generally decreases when going across a period of the Periodic Table from Group 1 to Group 17?

A the acidity of the oxides.
B the number of electrons in the valence shell.
C the oxidising ability of the elements.
D the tendency of the elements to form positive ions.

25 The valence electrons of element G when combined with element H is as shown.



If element G is located in the same period as the element sodium, which of the following statements is **not** correct?

A A mixture of G and iron filings can be separated by using magnetic separation method.
B G can react with rubidium to form an ionic compound.
C G cannot conduct electricity at room temperature and pressure.
D The oxide of G dissolves in water to form a solution with pH > 7.

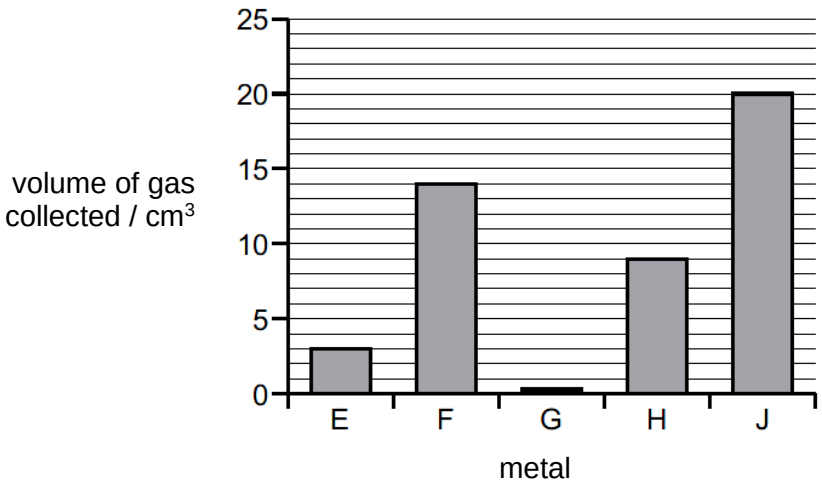
26 The diagram shows part of the Periodic Table.
The letters are not the symbols of the elements.

period	group								
	1	2	3		14	15	16	17	18
1									
2	V	W						X	
3	Y							Z	

Which statement is correct?

A V is more reactive than Y.
B W has more metallic characteristics than V.
C Y has a lower melting point than V.
D Z is more reactive than Y.

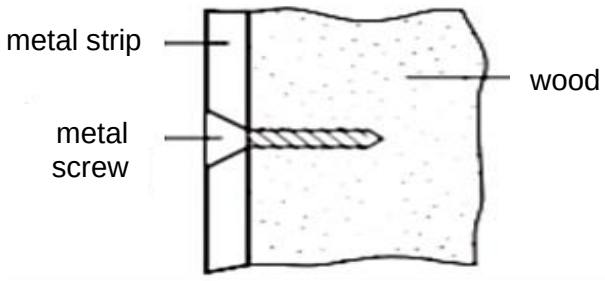
27 Samples of five different metals, E, F, G, H and J were reacted with dilute sulfuric acid. After one minute, the volume of gas produced was measured.
The results are shown on the bar chart.



What is the order of reactivity of the metals in increasing reactivity?

A E, F, G, H, J
B G, E, H, F, J
C J, F, H, E, G
D J, H, G, F, E

28 An old railway carriage is being restored by having metal strips secured to the outside of the wooden carriage by means of screws.



After a few weeks of being exposed to wind and rain, the screws are heavily corroded but the metal strips are not.

Which two metals would give this result?

	screw	strip
A	steel	copper
B	steel	magnesium
C	copper	zinc
D	copper	steel

29 The formation of liquid water from hydrogen and oxygen may occur in three stages.

1 $2H_2(g) + O_2(g) \rightarrow 4H(g) + 2O(g)$
2 $4H(g) + 2O(g) \rightarrow 2H_2O(g)$
3 $2H_2O(g) \rightarrow 2H_2O(l)$

Which stages(s) are endothermic?

A 1 only
B 3 only
C 2 and 3 only
D 1, 2 and 3

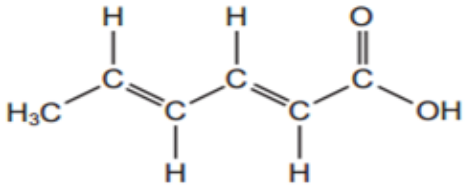
30 Which of the following best explains why bioethanol obtained from sugarcane plants is considered renewable?

A Many sugarcane plants can be grown in a small plot of land.
B Sugarcane plants can be harvested after one year.
C Sugarcane plants require carbon dioxide during photosynthesis.
D The sugar from sugarcane plants can be crystalised for food.

31 Which of the following statements correctly describes crude oil and its separation by fractional distillation?

A Crude oil is a mixture of hydrocarbons that can be separated into fractions by fractional distillation that are used only as fuels.
B Crude oil is a mixture of hydrocarbons that can be separated into fractions of specific uses as fuels and as sources of chemicals.
C Crude oil is a pure substance that can be separated into different elements by fractional distillation.
D Crude oil is a compound that can be separated into its constituent fractions with fixed boiling points.

32 Sorbic acid is used as a food preservative because it kills fungi and moulds.



sorbic acid

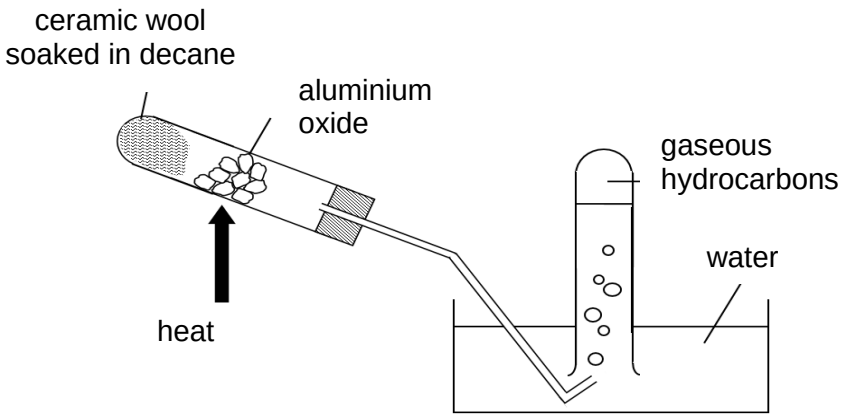
Sorbic acid will react with

- bromine in an organic solvent
- hydrogen in the presence of nickel catalyst

Given suitable conditions, how many moles of hydrogen and bromine will be incorporated into one mole of sorbic acid in separate reactions?

	moles of bromine	moles of hydrogen
A	2	2
B	2	3
C	2	1
D	3	2

33 A sample of decane ($C_{10}H_{22}$) was heated strongly in the presence of aluminium oxide, using the apparatus shown. The products obtained were a mixture of saturated and unsaturated hydrocarbons.



Which of row correctly indicates the process occuring and the equation for the change that took place?

	process	equation
A	cracking	$C_{10}H_{22} \rightarrow 3C_2H_4 + C_4H_8 + H_2$
B	cracking	$C_{10}H_{22} \rightarrow 4C_2H_4 + C_2H_6$
C	reduction	$C_{10}H_{22} \rightarrow 3C_2H_4 + C_4H_8 + H_2$
D	reduction	$C_{10}H_{22} \rightarrow 3C_2H_4 + C_4H_{10}$

34 Recycling of plastics can be carried out using the physical or chemical method. The table gives examples about the methods involved.

In which row are both examples correct?

	physical method	chemical method
A	breaking plastic waste into smaller pieces	melting small pieces of poly(ethene) waste into pellets
B	melting small pieces of poly(ethene) waste into pellets	depolymerisation and cracking of plastic waste into chemical feedstock and fuel respectively
C	depolymerisation and cracking of plastic waste into chemical feedstock and fuel respectively	sorting plastic waste by type
D	depolymerisation and cracking of plastic waste into chemical feedstock and fuel respectively	melting small pieces of poly(ethene) waste into pellets

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

reaction 1 fermentation of glucose
reaction 2 conversion of ethene to ethanol
reaction 3 oxidation of ethanol
reaction 4 esterification of ethanol and ethanoic acid

In which reactions can water also be either a reactant or a product?

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

36 Which of the following best describes the hydrolysis of a polymer?

A The process of adding monomers together to form a polymer.
B The process of heating a polymer until it melts and forms monomers.
C The reaction in which a polymer is broken down into its monomer units using water.
D The reaction in which monomers are converted into their polymer chains without any chemical reaction.

37 A student investigated the reaction of different vegetable oils with hydrogen.
An excess supply of 1 dm^3 of hydrogen gas at room temperature and pressure was passed through 0.005 mol samples of vegetable oils, P, Q, R and S containing a suitable catalyst. The volume of hydrogen remaining after each reaction was then recorded in the table.

Which vegetable oil is the most unsaturated?

	vegetable oil sample	volume of hydrogen left / cm^3
A	P	1000
B	Q	890
C	R	650
D	S	420

38 Catalytic converters are used to remove harmful pollutants from exhaust gases.

Which equations show reactions that are useful in removing harmful pollutants?

1 $N_2(g) + 2O_2(g) \rightarrow 2NO_2(g)$
2 $NO(g) + CO_2(g) \rightarrow NO_2(g) + CO(g)$
3 $2NO(g) + 2CO(g) \rightarrow N_2(g) + 2CO_2(g)$
4 $2NO_2(g) + 4CO(g) \rightarrow N_2(g) + 4CO_2(g)$

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

39 Which statements about the depletion of ozone layer by chlorofluorocarbons (CFCs) is correct?

1 CFCs are generally inert in the lower atmosphere but interact with UV radiation in the stratosphere.
2 Depletion of ozone layer Increases levels of greenhouse gases in the atmosphere.
3 The chlorine atoms from the CFCs react with ozone to form chlorine oxide which continues to attack another ozone molecule.
4 The ozone layer is able to heal if the production and release of CFCs is restricted.

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

40 The table refers to the polymers terylene and poly(ethene).

Which row is correct?

	polymer	type	use
A	poly(ethene)	addition	cling wraps
B	poly(ethene)	condensation	sleeping bags
C	terylene	addition	sleeping bags
D	terylene	condensation	cling wraps

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											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 –

Key

proton (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.).
The Avogadro constant, $L = 6.02 \times 10^{23} mol^{-1}$.

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