



COMPASSVALE SECONDARY SCHOOL
Secondary Four Express
Preliminary Examination 2024

NAME

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CENTRE
NUMBER

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CLASS

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INDEX
NUMBER

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CHEMISTRY

6092/01

Paper 1 Multiple Choice

28 August 2024

1 hour

Additional Materials: Multiple Choice Answer Sheet

READ THESE INSTRUCTIONS FIRST

Write your Centre number, class, index number and name on all the work you hand in.

Write in soft pencil.

Do not use staples, paper clips, glue or correction fluid.

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.

This document consists of **17** printed pages and **1** blank page.

Set by: Ms Tay SW

[Turn over

- 1 A student makes aqueous copper(II) sulfate by adding an excess of copper(II) oxide powder to warm dilute sulfuric acid and stirs the mixture.

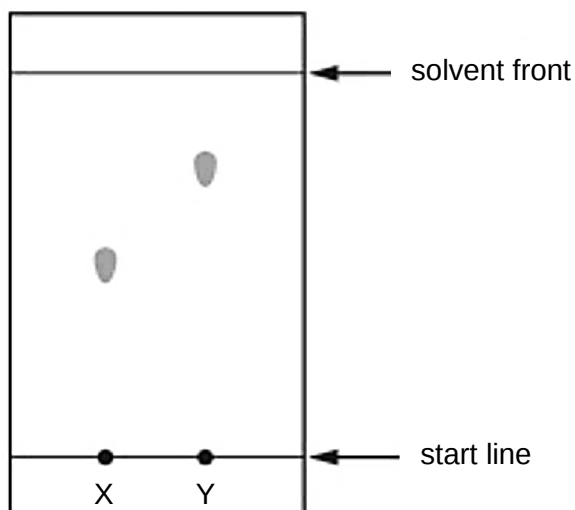
Which apparatus should be used to separate aqueous copper(II) sulfate from the excess copper(II) oxide?

- A beaker and tripod stand
- B burette
- C filter funnel and paper
- D measuring cylinder

- 2 The results of a paper chromatography experiment are shown.

X is an aqueous solution of a salt of a Group 1 element.

Y is an aqueous solution of a salt of a transition element.



Which row is correct?

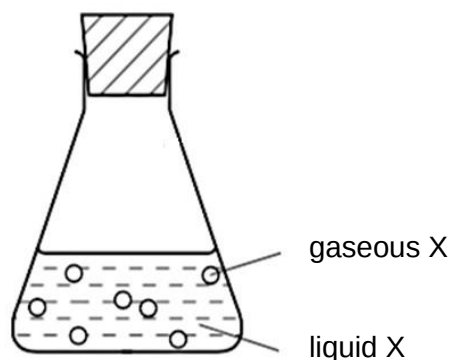
	larger R_f value	requires a locating agent
A	X	X
B	X	Y
C	Y	X
D	Y	Y

- 3 The boiling point of liquid X is 118°C and it is soluble in water.

Which is most likely to be the boiling point of water if it contains a small quantity of X?

- A 98°C B 102°C C 116°C D 120°C

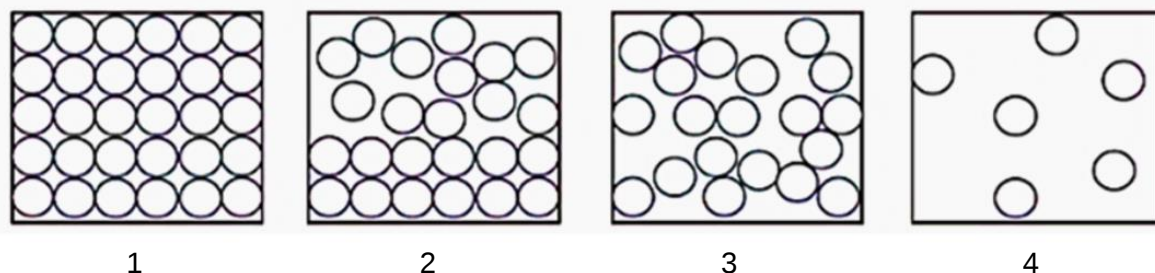
- 4 The conical flask contains compound X which is present in liquid and gaseous states.



Which statement is correct?

- A Energy is gained when X changes from liquid to gas.
 B In gaseous state a molecule of compound X has a smaller mass than in liquid state.
 C Liquid X sublimed to form gaseous X.
 D Molecules of liquid X vibrate about in fixed positions.
- 5 Bromine melts at -7°C and boils at 59°C . A container filled with bromine at 30°C is cooled to -7°C .

Which diagram best represents the arrangement of bromine particles at -7°C and at 30°C ?



	at -7°C	at 30°C
A	1	3
B	2	3
C	1	2
D	2	4

- 6 The table gives some statements about atoms and explanations for these statements.

Which row is correct?

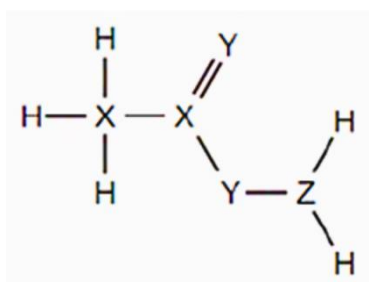
	statement	explanation
A	atoms are electrically neutral	same number of neutrons
B	atoms of metals tend to gain electrons	to form electronic configuration of a noble gas
C	mass of an atom is concentrated in the nucleus	presence of electrons and neutrons in nucleus
D	nucleus and electrons attract each other	presence of protons in nucleus

- 7 The numbers of electrons, protons and neutrons in four different particles are shown.

particle	electrons	protons	neutrons
W	19	19	20
X	18	19	20
Y	20	20	20
Z	19	19	22

Which particles are isotopes of the same element?

- A** W and X **B** W and Z **C** X and Z **D** W, X and Z
- 8 The structure of a covalent compound containing the elements hydrogen, X, Y and Z is shown.



To which groups of the Periodic Table do these elements, X, Y and Z, belong?

	X	Y	Z
A	1	15	16
B	14	15	1
C	14	16	15
D	15	1	14

9 Which statement explains why aluminium is malleable?

- A Aluminium has layers of cations that can slide over one another.
- B Aluminium has layers of electrons that can slide over one another.
- C Aluminium has weak bonds between cations and a 'sea of electrons'.
- D Aluminium is covered with a layer of unreactive aluminium oxide.

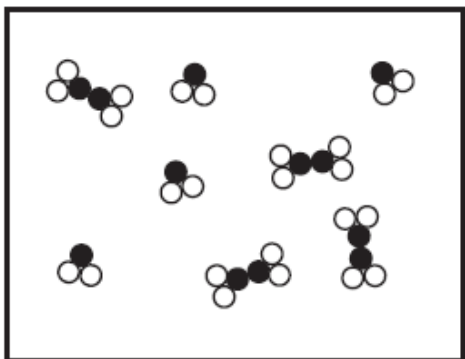
10 Brass is an alloy of copper and zinc.

Which statement is correct?

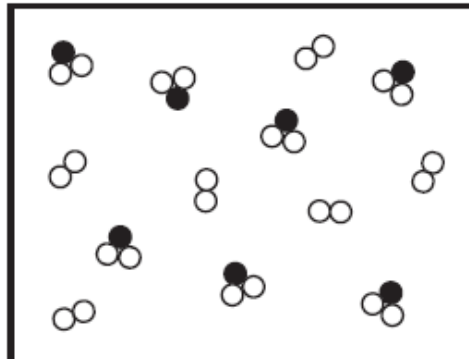
- A Brass can be represented by a chemical formula.
- B Brass is formed by a chemical reaction between copper and zinc.
- C Brass will react completely with dilute hydrochloric acid.
- D The zinc in brass will react with dilute hydrochloric acid.

11 Which diagram represents a mixture of compounds?

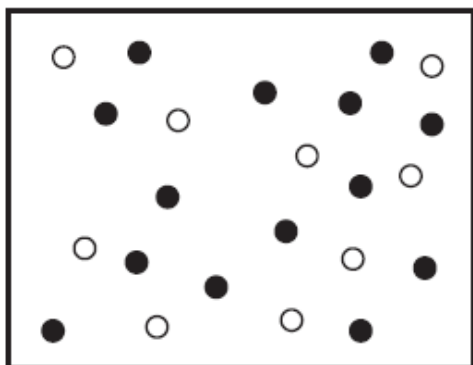
A



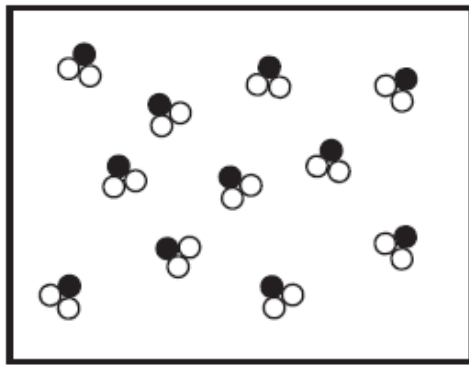
B



C



D



[Turn over

- 12** The table shows three elements P, Q and R with their proton numbers.

element	P	Q	R
proton number	6	8	11

Which are the likely formulae of the ionic compound and covalent compound formed from the three elements?

	ionic compound	covalent compound
A	PR ₄	QR
B	R ₂ Q	PQ ₂
C	PQ	PR ₄
D	QR	PQ

- 13** How many sodium ions are there in 53 g of sodium carbonate?

A 1.52×10^{23} **B** 2.54×10^{23} **C** 6.02×10^{23} **D** 1.20×10^{24}

- 14** Methanethiol, CH₃SH, exists as a gas at room temperature and pressure. It reacts with oxygen as shown in the equation.



A sample of 20 cm³ of methanethiol was reacted with 30 cm³ of oxygen.

What would be the final volume of the resultant mixture of gases when cooled to room temperature and pressure?

A 20 cm³ **B** 30 cm³ **C** 40 cm³ **D** 50 cm³

- 15** A black solid, X, is an oxide of ruthenium. 5.79 g of X contains 1.39 g of oxygen.

What is the empirical formula of X?

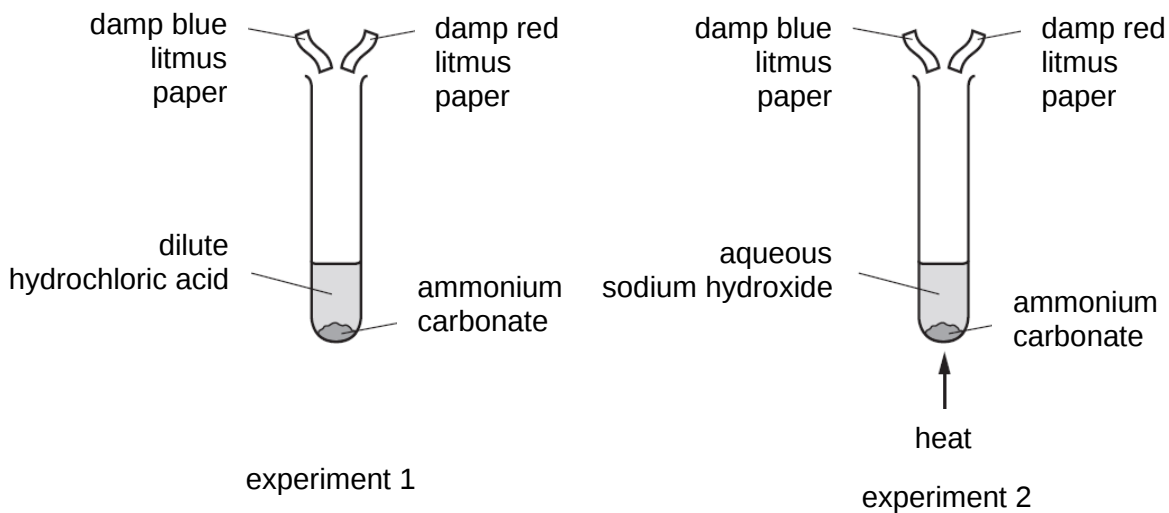
A RuO **B** RuO₂ **C** Ru₂O **D** RuO₄

16 Two experiments were carried out by a student.

In experiment 1, ammonium carbonate is reacted with dilute hydrochloric acid.

In experiment 2, ammonium carbonate is heated with aqueous sodium hydroxide.

In each experiment, the gas evolved is tested with damp blue litmus paper and damp red litmus paper.



Which row correctly shows the colour of both pieces of litmus paper at the end of each experiment?

	experiment 1	experiment 2
A	blue	blue
B	blue	red
C	red	blue
D	red	red

17 An aqueous solution has a pH value of 13.

What information does this fact give about the ions present in the solution?

	concentration of H^+ ions	concentration of OH^-
A	high	low
B	high	high
C	low	high
D	none	high

18 Which pair of substances would **not** be suitable for producing a large quantity of carbon dioxide?

- A calcium carbonate and sulfuric acid
- B copper(II) carbonate and nitric acid
- C sodium carbonate and hydrochloric acid
- D zinc carbonate and sulfuric acid

19 Ammonia is produced by the Haber process.

Which statement is **not** correct?

- A A small amount of iron catalyst is used.
- B Each hydrogen molecule reacts with three nitrogen molecules to form two molecules of ammonia.
- C Hydrogen for the process can be obtained by cracking of crude oil.
- D The reaction is reversible.

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

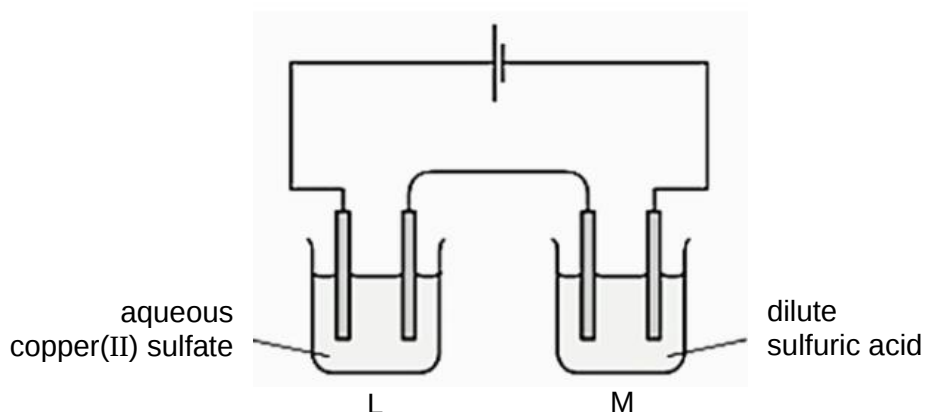
Which test should be repeated because of an incorrect observation entered in the table?

	test	observation
A	add barium chloride solution	white precipitate formed
B	add iron(III) sulfate solution	red-brown precipitate formed
C	add dilute nitric acid	effervescence observed
D	add aqueous sodium hydroxide	white precipitate formed

21 Which reaction is **not** a redox reaction?

- A $\text{CH}_4(\text{g}) + 2\text{O}_2(\text{g}) \rightarrow \text{CO}_2(\text{g}) + 2\text{H}_2\text{O}(\text{g})$
- B $\text{Cu}^{2+}(\text{aq}) + \text{Zn}(\text{s}) \rightarrow \text{Cu}(\text{s}) + \text{Zn}^{2+}(\text{aq})$
- C $\text{KOH}(\text{aq}) + \text{HNO}_3(\text{aq}) \rightarrow \text{KNO}_3(\text{aq}) + \text{H}_2\text{O}(\text{l})$
- D $\text{Zn}(\text{s}) + \text{H}_2\text{SO}_4(\text{aq}) \rightarrow \text{ZnSO}_4(\text{aq}) + \text{H}_2(\text{g})$

- 22 The diagram shows an electrolysis experiment using inert electrodes.



Which row shows what happens to the concentration of the electrolyte in L and in M as the electrolysis proceeds?

	L	M
A	remains the same	remains the same
B	remains the same	changes
C	changes	remains the same
D	changes	changes

- 23 Three statements about hydrogen-oxygen fuel cells are given.

- 1 A hydrogen-oxygen fuel cell requires a continuous input of fuel and oxygen.
- 2 In a hydrogen-oxygen fuel cell, hydrogen is burned in oxygen to produce electricity.
- 3 When a hydrogen-oxygen fuel cell is operating, water is the only chemical product.

Which statements are correct?

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

- 24 Many properties of an element and its compounds can be predicted from the position of the element in the Periodic Table.

Which property could **not** be predicted in this way?

- A its metallic or non-metallic properties
 B the acidic or basic nature of its oxide
 C the formula of its oxide
 D the number of isotopes it has

[Turn over

25 Which statement about the properties of the elements in Group 18 of the Periodic Table is correct?

- A** Helium is less dense than air.
- B** Neon reacts with magnesium to form a compound.
- C** The elements change from gas to solid down the group.
- D** The elements exist as diatomic molecules.

26 Some of the reactions of three metals, X, Y and Z, or compounds of these metals are described.

- The oxide of X is reduced by heating with carbon.
- Y is extracted from its compound by electrolysis.
- X displaces Z from an aqueous solution of the sulfate of Z.

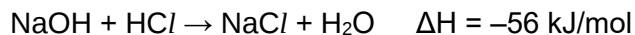
What is the order of reactivity of metals X, Y and Z?

	most reactive —————> least reactive		
A	Y	X	Z
B	Y	Z	X
C	X	Y	Z
D	Z	X	Y

27 How do the masses of separate samples of copper(II) oxide change when heated in hydrogen and in oxygen separately?

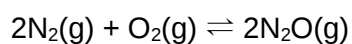
	mass after heating in hydrogen	mass after heating in oxygen
A	decreases	decreases
B	decreases	remains the same
C	remains the same	decreases
D	remains the same	remains the same

- 28 Aqueous sodium hydroxide reacts with dilute hydrochloric acid in the equation shown.

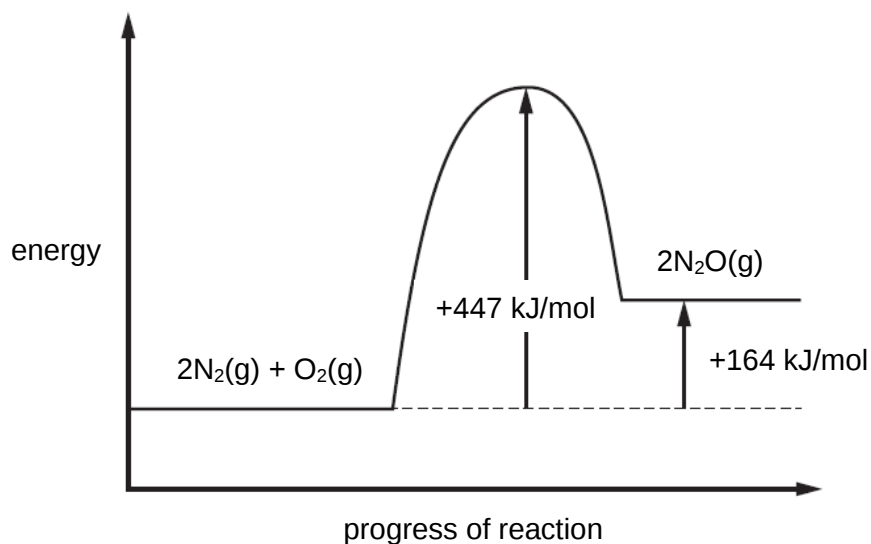


Which explains the energy change that occurred?

- A More bonds are broken than formed.
 - B More bonds are formed than broken.
 - C More energy is given out when forming bonds than taken in to break bonds.
 - D More energy is taken in to break bonds than it is given out when forming bonds.
- 29 Under certain conditions, nitrogen reacts with oxygen to form N_2O .



The energy profile diagram is shown.

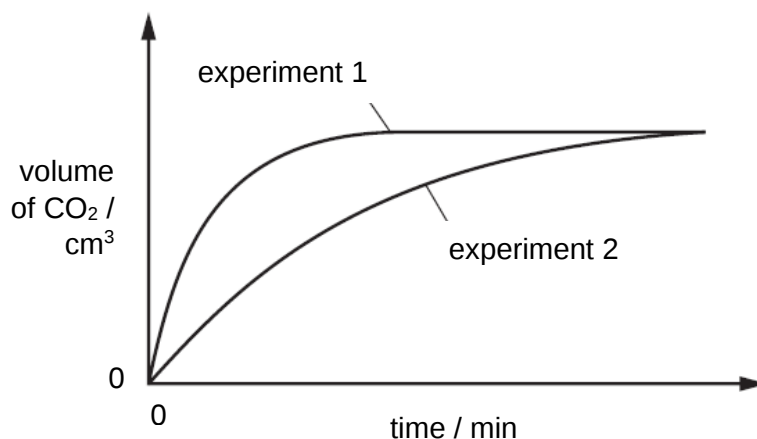


What is the activation energy of the reverse reaction?

- A -447 kJ/mol
- B -283 kJ/mol
- C $+141.5 \text{ kJ/mol}$
- D $+283 \text{ kJ/mol}$

- 30** The graph shows the results of two experiments investigating the rate of reaction between excess calcium carbonate and dilute hydrochloric acid.

In each experiment the volume of carbon dioxide produced is measured at fixed time intervals.

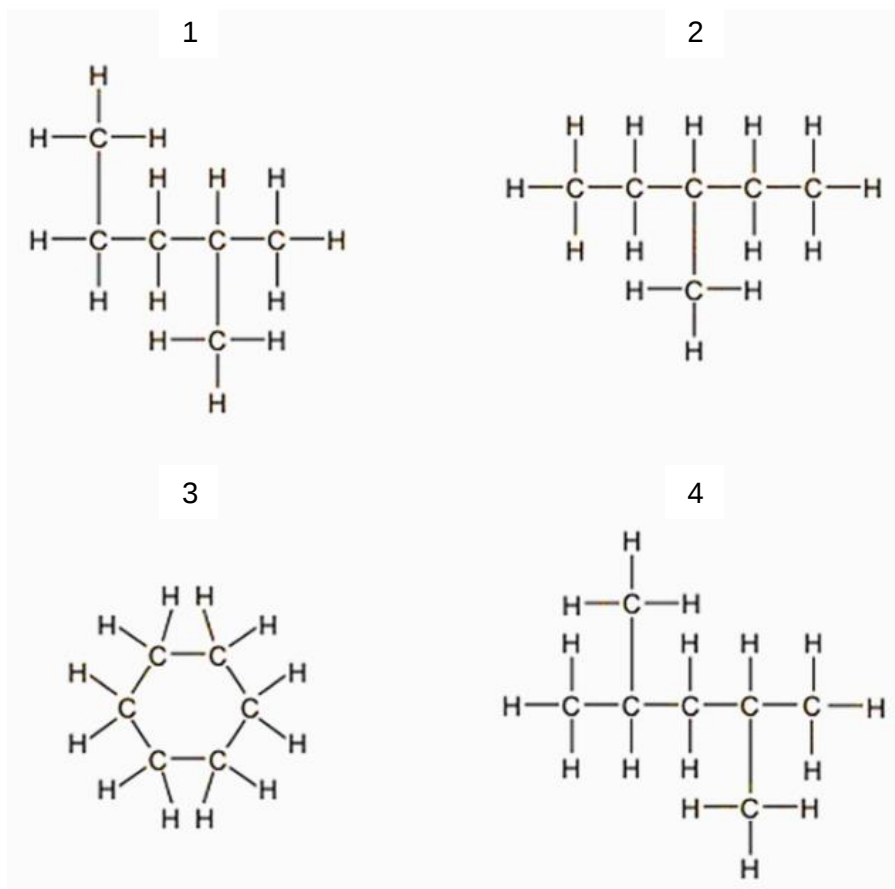


Which statement describes the difference in conditions between experiments 1 and 2?

- A** A higher concentration of dilute hydrochloric acid is used in experiment 2.
 - B** A higher temperature is used in experiment 2.
 - C** The mass of calcium carbonate used is greater in experiment 2.
 - D** The particle size of calcium carbonate is greater in experiment 2.
- 31** Why is nickel used in the hydrogenation of alkenes?
- A** It increases the yield of products.
 - B** It lowers the activation energy of the reaction.
 - C** It makes the reaction more exothermic.
 - D** It prevents a reverse reaction from occurring.
- 32** Which statement about the fractional distillation of petroleum is correct?
- A** Only one compound is collected at each level of the column.
 - B** The molecules change from liquid to gaseous state in the column.
 - C** The molecules collected at the bottom of the column has the highest boiling points.
 - D** The molecules collected at the top of the column have the biggest molecular sizes.

- 33** Alkanes are saturated compounds containing carbon and hydrogen only.

Structures 1, 2, 3 and 4 are saturated hydrocarbons.



Which pair of structures are isomers?

- A** 1 and 2 **B** 1 and 4 **C** 2 and 3 **D** 2 and 4
- 34** Eleostearic acid, $C_{18}H_{30}O_2$, is a fatty acid present in bitter melon oil.
- How many carbon-carbon double bonds are present in one molecule of the acid?
- A** 2 **B** 3 **C** 4 **D** 5

35 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 to ethanoic acid

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

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

36 The reaction between a carboxylic acid, $C_xH_yCO_2H$, and an alcohol, $C_nH_{2n+1}OH$, produced an ester.

How many hydrogen atoms does one molecule of the ester contain?

- A** $y + 2n$
B $y + 2n + 1$
C $y + 2n + 2$
D $y + 2n + 3$

37 Which change takes place as propene is converted to poly(propene)?

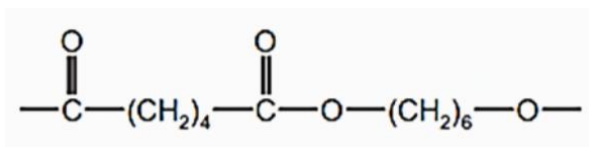
- A** a change in empirical formula
B a decrease in relative molecular mass
C the loss of electrons as new bonds form
D unsaturated molecules produce a product that is saturated

38 Q is a polymer that:

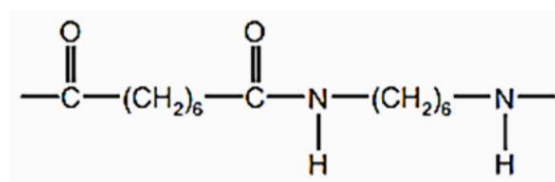
- has six carbon atoms in each of the monomers from which it is formed,
- is not a polyester,
- is formed using condensation polymerisation.

Which shows the partial structure of Q?

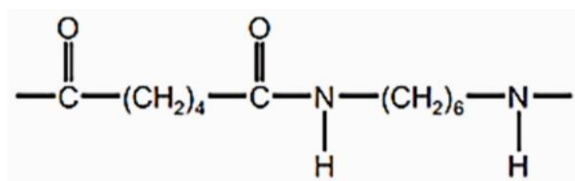
A



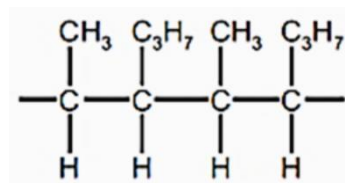
B



C



D



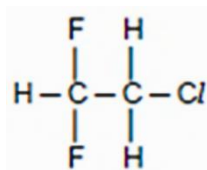
39 A catalytic converter in a car exhaust system changes pollutants into less harmful products.

Which change does **not** occur in a catalytic converter?

- A carbon dioxide $\rightarrow$ carbon
- B carbon monoxide $\rightarrow$ carbon dioxide
- C nitrogen oxides $\rightarrow$ nitrogen
- D unburned hydrocarbons $\rightarrow$ carbon dioxide and water

- 40** In the past, CFC compounds were used as aerosol propellants.

The structure of one CFC compound is shown.



Which element in this compound can cause a depletion in ozone?

- A** carbon
- B** chlorine
- C** fluorine
- D** hydrogen

The Periodic Table of Elements

Group																					
1	2	1 H hydrogen 1												13	14	15	16	17	18		
		Key																			
3	4	proton (atomic) number atomic symbol name relative atomic mass																			
Li lithium 7	Be beryllium 9																				
11	12																				
Na sodium 23	Mg magnesium 24																				
19	20																				
K potassium 39	Ca calcium 40	3	4	5	6	7	8	9	10	11	12						5	6	7	8	9
		21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36				
		Sc scandium 45	Ti titanium 48	V vanadium 51	Cr chromium 52	Mn manganese 55	Fe iron 56	Co cobalt 59	Ni nickel 59	Cu copper 64	Zn zinc 65	Ga gallium 70	Ge germanium 73	As arsenic 75	Se selenium 79	Br bromine 80	Kr krypton 84				
37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54				
Rb rubidium 85	Sr strontium 88	Y yttrium 89	Zr zirconium 91	Nb niobium 93	Mo molybdenum 96	Tc technetium —	Ru ruthenium 101	Rh rhodium 103	Pd palladium 106	Ag silver 108	Cd cadmium 112	In indium 115	Sn tin 119	Sb antimony 122	Te tellurium 128	I iodine 127	Xe xenon 131				
55	56	57–71 lanthanoids	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86				
Cs caesium 133	Ba barium 137		Hf hafnium 178	Ta tantalum 181	W tungsten 184	Re rhenium 186	Os osmium 190	Ir iridium 192	Pt platinum 195	Au gold 197	Hg mercury 201	Tl thallium 204	Pb lead 207	Bi bismuth 209	Po polonium —	At astatine —	Rn radon —				
87	88	89–103 actinoids	104	105	106	107	108	109	110	111	112	113	114	115	116	117	118				
Fr francium —	Ra radium —		Rf rutherfordium —	Db dubnium —	Sg seaborgium —	Bh bohrium —	Hs hassium —	Mt meitnerium —	Ds darmstadtium —	Rg roentgenium —	Cn copernicium —	Nh nihonium —	Fl flerovium —	Mc moscovium —	Lv livermorium —	Ts tennessine —	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 dm³ at room temperature and pressure (r.t.p.).
The Avogadro constant, $L = 6.02 \times 10^{23} \text{ mol}^{-1}$.

