Name: ( )	Class/TG:

GREENDALE SECONDARY SCHOOL

Preliminary Examination 2023

CHEMISTRY **6092/01**

Paper 1 Multiple Choice **25 August 2023**
Secondary 4 Express **1 hour**

Additional Materials: Multiple Choice Answer Sheet

READ THESE INSTRUCTIONS FIRST

Write in soft pencil.
Do not use staples, paper clips, glue or correction fluid.
Write your name, class and register number on the Answer Sheet and on the Question Paper 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 on this question paper.
A copy of the Periodic Table is printed on Page 16.
The use of an approved scientific calculator is expected, where appropriate.

1 In a volumetric experiment involving the addition of hydrochloric acid to 25.0 cm^3 of aqueous sodium hydroxide it is necessary to determine when the reaction is just complete.

Which piece of apparatus could be used to determine the end-point of the reaction?

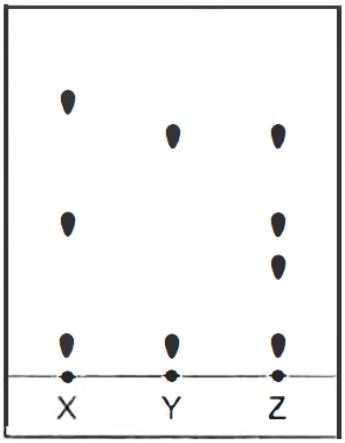
A balance

B gas syringe

C stopwatch

D thermometer

2 X, Y and Z are all mixtures of alcohols. A paper chromatogram is obtained for the samples of X, Y and Z.



Which row is correct?

	statement 1	statement 2
A	Z contains at least four alcohols.	X, Y and Z could contain the same alcohol.
B	Z contains at least four alcohols.	X, Y and Z could not contain the same alcohol.
C	Z contains no more than four alcohols.	X, Y and Z could contain the same alcohol.
D	Z contains no more than four alcohols.	X, Y and Z could not contain the same alcohol.

3 A crystalline product contains a mixture of two salts.

A student tests the mixture to determine which ions are present. The results are shown.

test number	test	observations
1	add dilute nitric acid, then	effervescence as a gas is produced which gives a white precipitate with limewater
	add aqueous silver nitrate	no precipitate is formed
2	add aqueous sodium hydroxide and warm, then	dissolves and a gas is produced turning moist red litmus paper blue
	add aluminium foil	effervescence as a gas is produced which turns moist red litmus paper blue

Which is present in the mixture?

A ammonium carbonate and sodium chloride

B ammonium carbonate and sodium sulfate

C ammonium nitrate and sodium carbonate

D ammonium nitrate and sodium chloride

4 The nucleus of N^{3-} contains a total of 31 particles. 15 of the particles have a charge.

Which statement about the ion is correct?

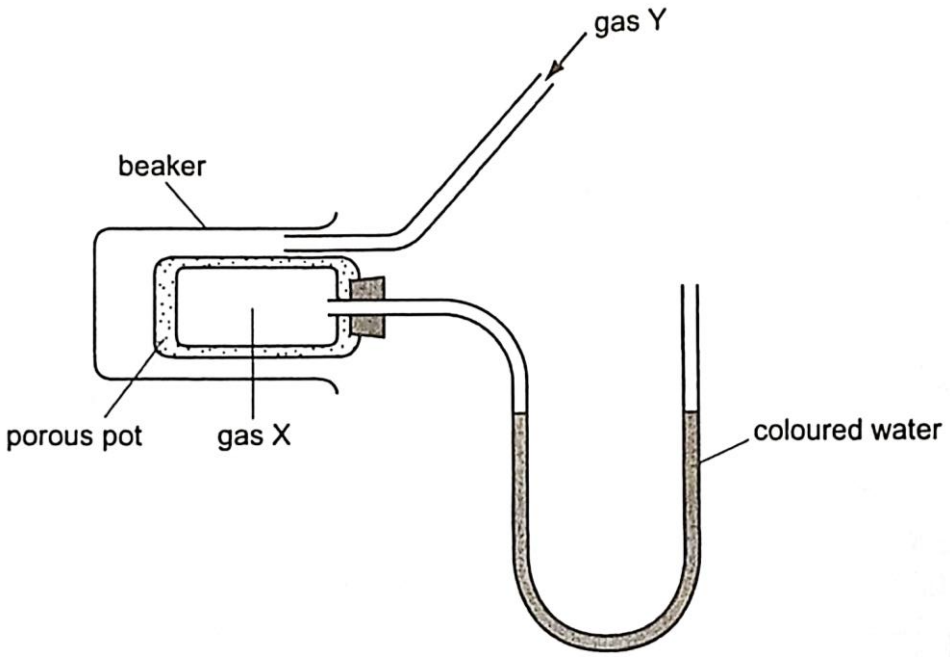
A It contains 15 neutrons and 12 electrons.

B It contains 15 protons and 12 electrons.

C It contains 15 protons and 15 electrons.

D It contains 16 neutrons and 18 electrons.

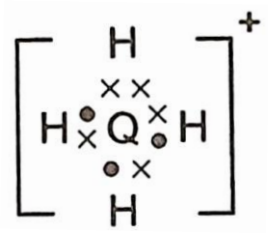
5 The apparatus can be used to show the diffusion of gases.



Which pair of gases X and Y would cause **no** movement of the water?

	X	Y
A	C_2H_4	C_2H_6
B	C_2H_4	N_2
C	CO_2	C_2H_6
D	CO	NO_2

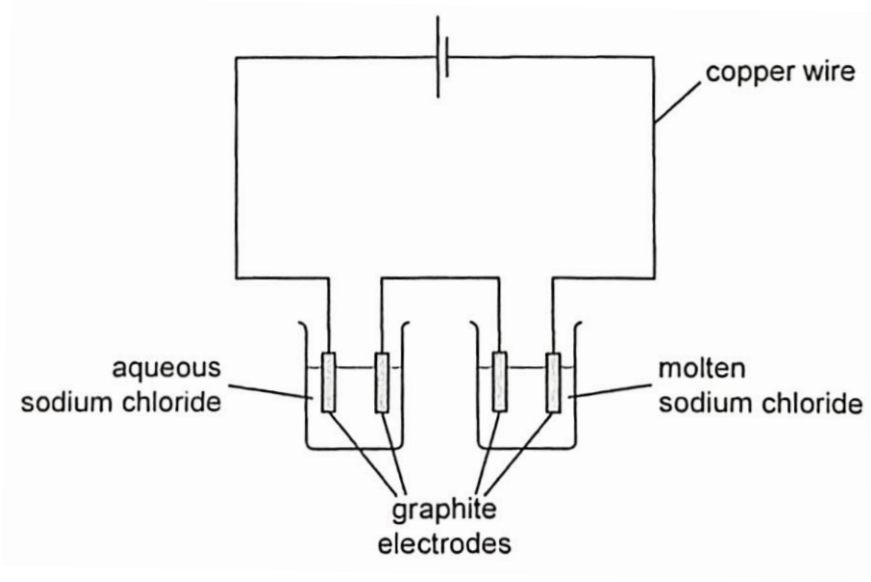
6 The ion QH_4^+ can be represented by the "dot-and-cross" diagram shown.



To which Group in the Periodic Table does Q belong?

A I **B** III **C** IV **D** V

7 The diagram shows the electrolysis of aqueous sodium chloride and of molten sodium chloride.



Which substance has both positive ions and mobile electrons?

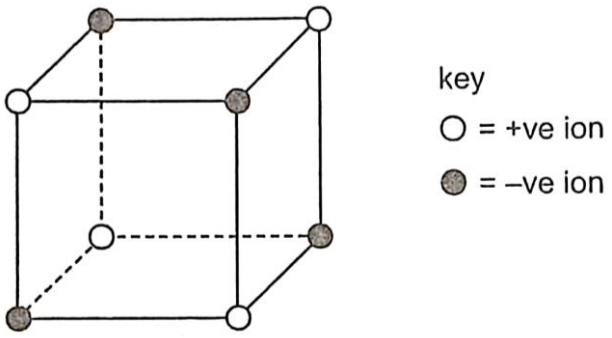
A aqueous sodium chloride

B copper wire

C graphite electrodes

D molten sodium chloride

8 The diagram shows the arrangement of the ions in an ionic crystal.



Which compound **cannot** have this arrangement of the ions?

A calcium oxide, CaO

B copper(II) sulfate, $CuSO_4$

C magnesium chloride, $MgCl_2$

D sodium chloride, $NaCl$

9 8 g of X_2O_3, an oxide of element X, contains 5.6 g of X.

How many moles of X does 5.6 g of the element contain?

A $\frac{2.4}{16} \times \frac{2}{3}$ **B** $\frac{2.4}{16} \times \frac{3}{2}$ **C** $\frac{8}{16} \times \frac{2}{3}$ **D** $\frac{8}{16} \times \frac{3}{2}$

10 What is the ratio of the volume of 2 g of hydrogen to the volume of 16 g of methane, both volumes at r.t.p.?

A 1 to 1 **B** 1 to 2 **C** 1 to 8 **D** 2 to 1

11 Which volume of 0.1 mol/dm^3 hydrochloric acid is required to react completely with 25 cm^3 of 0.2 mol/dm^3 aqueous sodium carbonate?

A 100 cm^3 **B** 50 cm^3 **C** 25 cm^3 **D** 6.25 cm^3

12 The equation for the burning of hydrogen is

$$2H_2(g) + O_2(g) \rightarrow 2H_2O(g)$$

One mole of hydrogen gas is mixed with one mole of oxygen gas and burnt.

What will be present after the reaction?

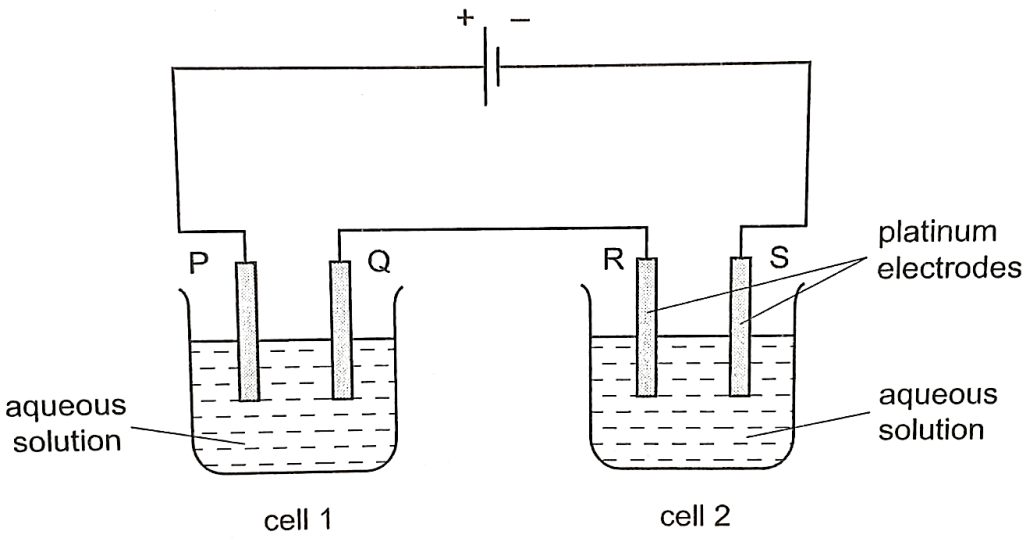
A 1 mol of steam only

B 1 mol of steam + 0.5 mol of oxygen gas

C 1 mol of steam + 0.5 mol of hydrogen gas

D 2 mol of steam only

13 In the diagram, each cell contains an aqueous solution of a single salt and all four electrodes are platinum. Electrodes Q and S increase in mass during the electrolysis but no gas is given off at Q or S.



If the increase in mass of Q is greater than the increase of mass of S in the same time, which statement must be true?

1 The cation of the solution in cell 1 is different from the cation of the solution in cell 2.

2 The current flowing in cell 1 is greater than the current flowing in cell 2.

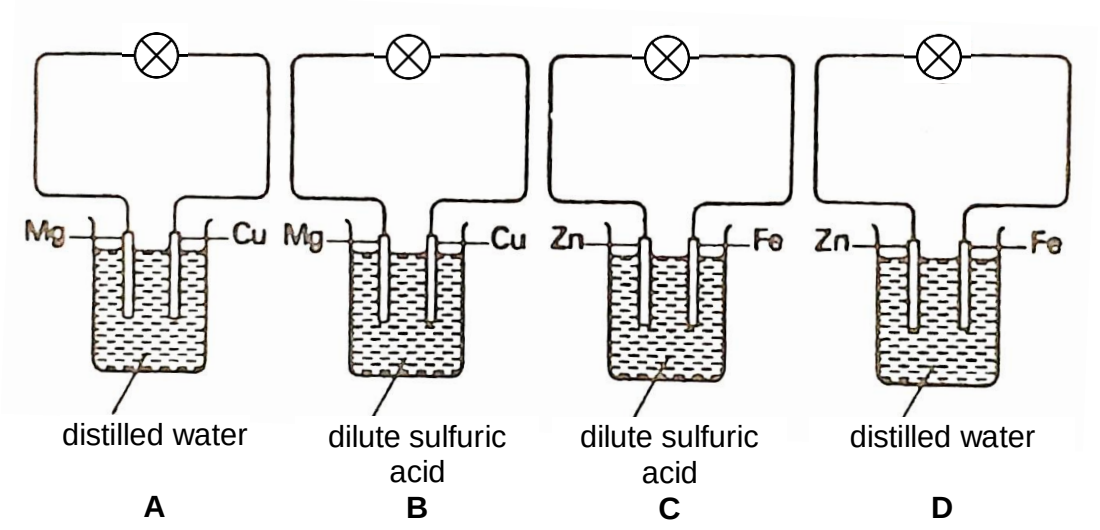
3 The cation in cell 1 is the same as in cell 2 but the solution in cell 1 is more concentrated than in cell 2.

4 The loss of mass of electrode P is less than the loss of mass of electrode R.

A 1 only **B** 1 and 2

C 2 and 3 **D** 4 only

14 In which of the following circuits is the bulb likely to shine most brightly?



15 The scheme shows four stages, I to IV, in the conversion of solid candlewax, $C_{30}H_{62}$, into carbon dioxide and water.

I $C_{30}H_{62}(s) \rightarrow C_{30}H_{62}(l)$

II $C_{30}H_{62}(l) \rightarrow C_{30}H_{62}(g)$

III $C_{30}H_{62}(g) + 45.5O_2(g) \rightarrow 30CO_2(g) + 31H_2O(g)$

IV $30CO_2(g) + 31H_2O(g) \rightarrow 30CO_2(g) + 31H_2O(l)$

Which stages are exothermic?

A I and II **B** II and III

C III and IV **D** I and IV

16 These statements are about the activation energy of a chemical reaction.

1 Chemical reactions in gases and liquids take place when molecules collide with sufficient energy to overcome the activation energy.

2 If the activation energy for a reaction is high, many of the collisions have enough energy to be successful and the reaction is fast.

3 A catalyst reduces the activation energy for a reaction and therefore the overall enthalpy change of the reaction is lower.

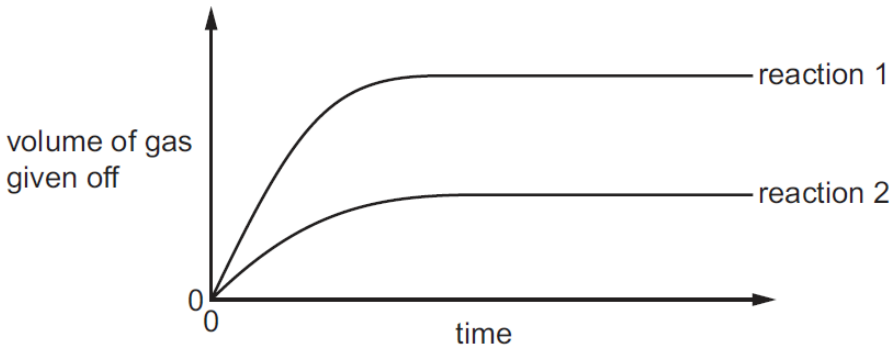
Which statements are correct?

A 1 only **B** 1 and 2

C 2 and 3 **D** 3 only

17 Excess magnesium ribbon is reacted with a fixed volume of hydrochloric acid and the volume of gas given off over time is measured.

The results of two different experiments are shown.



Which statement explains the differences between the results of the two experiments?

A Reaction 1 uses a catalyst.

B The acid used is twice as concentrated in reaction 1.

C The magnesium ribbon is in smaller pieces in reaction 2.

D The temperature is higher in reaction 2.

18 Disproportionation is a reaction in which the same element is both oxidised and reduced.

Which reaction is an example of disproportionation?

A $3Cu + 8HNO_3 \rightarrow 3Cu(NO_3)_2 + 2NO + 4H_2O$

B $Cl_2 + 2NaOH \rightarrow NaCl + NaOCl + H_2O$

C $Fe_2(SO_4)_3 + 2KI \rightarrow 2FeSO_4 + K_2SO_4 + I_2$

D $2Pb(NO_3)_2 \rightarrow 2PbO + 4NO_2 + O_2$

19 The oxides of two elements, X and Y, are separately dissolved in water and the pH of each solution tested.

oxide tested	pH of solution
X	1
Y	13

Which information about X and Y is correct?

	oxide is acidic	oxide is basic	metal	non-metal
A	X	Y	X	Y
B	X	Y	Y	X
C	Y	X	X	Y
D	Y	X	Y	X

20 Salt PQ is to be prepared by reacting the carbonate of P with the acid HQ. The titration method is to be used to carry out the preparation.

What are the solubilities of the carbonate, the acid and the salt?

	carbonate of P	acid HQ	salt PQ
A	insoluble	soluble	insoluble
B	insoluble	soluble	soluble
C	soluble	insoluble	insoluble
D	soluble	soluble	soluble

21 What is the source of hydrogen in the industrial production of ammonia?

A cracking of hydrocarbons

B electrolysis of aqueous sodium hydroxide

C fractional distillation of liquefied air

D reaction of a Group I metal with water

22 The elements sodium to argon form Period 3 of the Periodic Table.

Which row describes the trend across Period 3 from left to right?

	number of outer-shell electrons	tendency to lose electrons
A	decreases	decreases
B	decreases	increases
C	increases	decreases
D	increases	increases

23 These statements are about the Group I elements of the Periodic Table.

1 They are equally reactive.
2 They become less metallic as the proton number increases.
3 They form chlorides of similar formulae.
4 Their melting points increase as the proton number increases.

Which statements are correct?

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

24 Which element in the table is most likely to be a transition metal?

element	melting point in ^{o}C	density in g/cm^3	number of chlorides known
A	–7	3.10	2
B	113	2.07	1
C	1083	8.92	2
D	1521	1.12	1

25 The reactions of metals P, Q, R and S are shown.

metal	reaction with water	reaction with hydrochloric acid	reduction of the metal oxide with carbon
P	no reaction	no reaction	reduced
Q	slow	vigorous	no reaction
R	vigorous	vigorous	no reaction
S	very slow	vigorous	reduced

Which is the order of reactivity of the metals?

	least reactive → most reactive			
A	P	S	Q	R
B	P	Q	S	R
C	R	S	Q	P
D	R	Q	S	P

26 Iron is extracted from its ore in a blast furnace in a redox reaction.

Which substance is reduced in the blast furnace?

1 carbon dioxide
2 coke
3 haematite
4 limestone

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

27 Carbon dioxide and methane are both greenhouse gases.

Which activity produces both gases?

A farming animals
B cracking alkanes
C the thermal decomposition of limestone
D use petrol-powered cars

28 Which gas can be removed from the exhaust gases of a petrol-powered car by its catalytic converter?

A carbon monoxide **B** carbon dioxide

C nitrogen **D** steam

29 Which statement about the fractional distillation of petroleum is correct?

A Only one compound is collected at each level of the fractionating column.

B The higher the fractionating column, the greater the temperature.

C The most flammable molecules are collected at the bottom of the fractionating column.

D The molecules reaching the top of the fractionating column have the smallest relative molecular masses.

30 Two alkane molecules are isomers.

Which properties will be the same for both molecules?

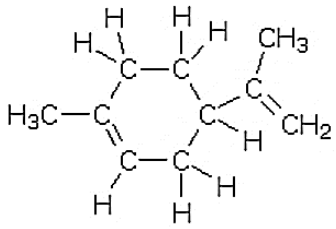
1 general formula

2 molecular formula

3 structural formula

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

31 The liquid limonene can be extracted from oranges. It has the structural formula shown.



A student made a few statements about limonene.

1 It is a hydrocarbon.

2 It is saturated.

3 It undergoes addition reaction with hydrogen.

Which statements about limonene are correct?

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

32 Alkenes can be produced by cracking large hydrocarbon molecules.

Which equations represent possible reactions when tetradecane, $C_{14}H_{30}$, is cracked?

1 $C_{14}H_{30} \rightarrow C_2H_6 + C_3H_6 + C_4H_8 + C_5H_{10}$

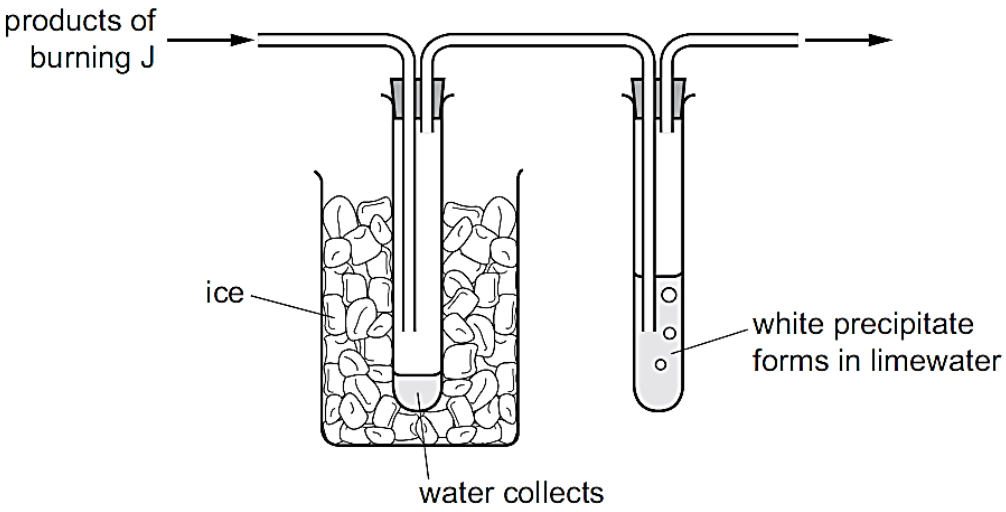
2 $C_{14}H_{30} \rightarrow H_2 + C_2H_4 + C_3H_6 + C_4H_8 + C_5H_{10}$

3 $C_{14}H_{30} \rightarrow C_2H_6 + 4C_3H_6$

4 $C_{14}H_{30} \rightarrow C_2H_6 + C_3H_8 + C_9H_{18}$

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

33 The products formed by burning substance J are passed through the apparatus shown.



What substance is J?

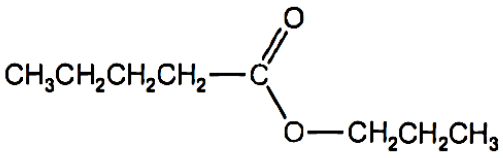
A carbon monoxide **B** ethanol

C hydrogen **D** sulfur

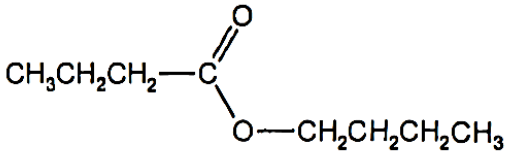
34 Pentanoic acid has the formula $CH_3CH_2CH_2CH_2COOH$.

Which formula represents butyl pentanoate?

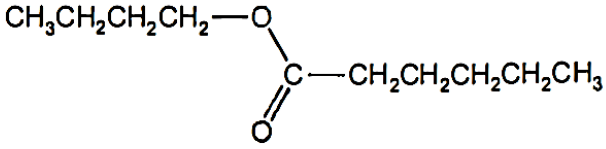
A



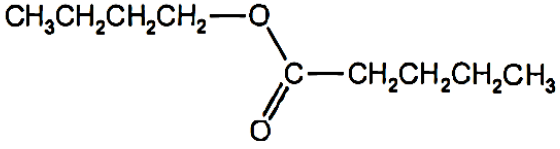
B



C



D

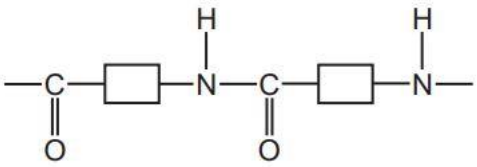


35 In the hydrogenation of a vegetable oil, 3 mol of hydrogen is used for 1 mol of the vegetable oil.

How many moles of carbon-carbon double bonds are there in 1 mol of the vegetable oil?

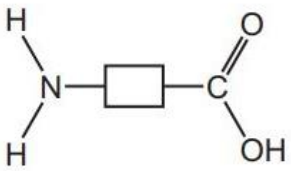
A 1 mol **B** 1.5 mol **C** 3 mol **D** 6 mol

36 The partial structure of a polyamide is shown.



Which monomers would produce this polymer?

1



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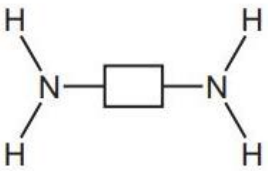
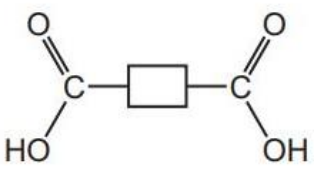
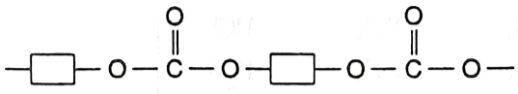


3



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

37 Poly(carbonates) are synthetic polymers. Their structure can be as shown.



Which of the following has a type of linkage similar to that of a poly(carbonate)?

A nylon

B poly(ethene)

C polyvinyl chloride

D Terylene

38 Scrap iron is often recycled.

Which reason for recycling is **not** correct?

A It reduces the amount of pollution at the site of the ore extraction.

B It reduces the amount of waste taken to landfill sites.

C It reduces the need to collect the scrap iron.

D It saves natural resources.

39 High carbon steel is used in manufacturing processes.

Which properties does high carbon steel have?

1 It is brittle.

2 It is malleable.

3 It is soft.

4 It is strong.

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

40 The table gives information about the ability of four substances to conduct electricity.

substance	
W	does not conduct under any conditions
X	conducts only in aqueous solution
Y	conducts when molten and when solid
Z	conducts when molten and in aqueous solution

What could these four substances be?

	W	X	Y	Z
A	Pb	HC*l*	NaC*l*	S
B	S	HC*l*	NaC*l*	Pb
C	S	HC*l*	Pb	NaC*l*
D	S	NaC*l*	HC*l*	Pb

The Periodic Table of Elements

Group																	
I	II											III	IV	V	VI	VII	0
							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											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 –		114 Fl flerovium –		116 Lv livermorium –		

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.).