



CHEMISTRY

6092/01

Paper 1

1 hour

Question Booklet

Additional Material: OTAS

READ THESE INSTRUCTIONS FIRST

Do not open the booklet until you are told to do so.

Write your name, index number and class on the Optical Answer Sheet.

Write in soft pencil.

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

You are not required to hand in this booklet at the end of the examination.

There are **forty** questions on this paper. Answer **all** questions. For each question there are four possible answers **A, B, C** and **D**.

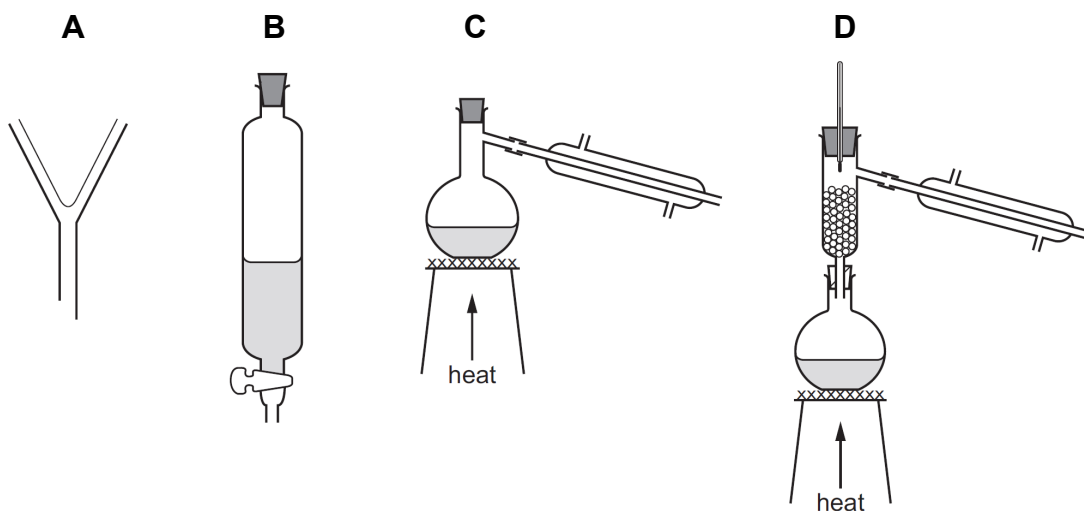
Choose the **one** you consider correct and record your choice in **soft pencil** on the separate OTAS.

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 booklet.

A copy of the Periodic Table is printed on page 17.

- 1 Hexane and octane are liquid hydrocarbons that mix together.

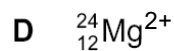
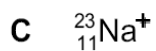
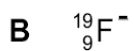
Which apparatus is used to separate a mixture of these two liquids?



- 2 When a covalent liquid boils, its molecules become more widely spaced.

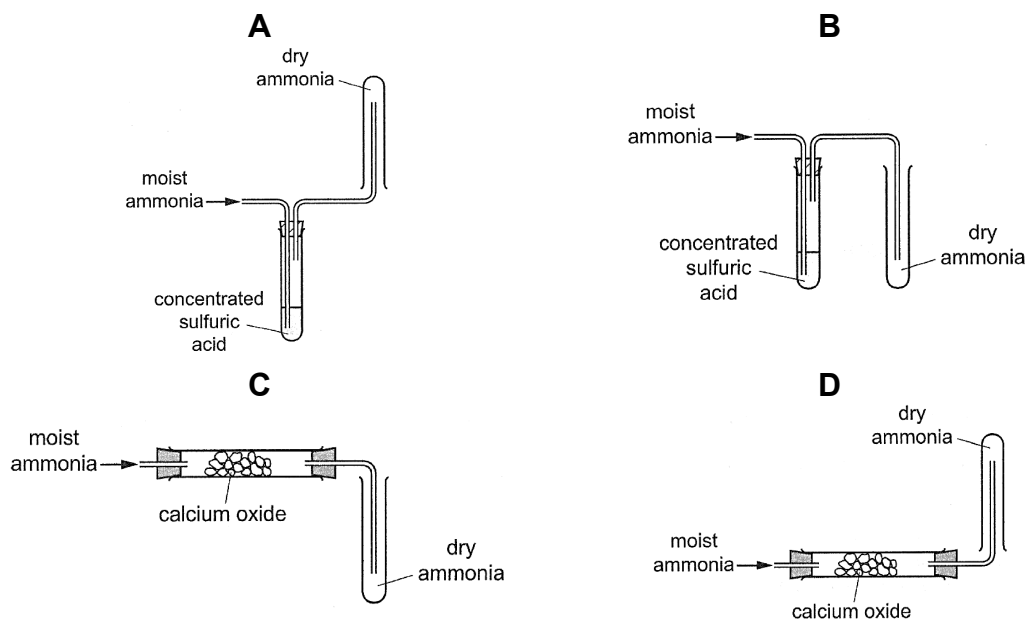
Which property of the molecules has the most influence on the energy required to boil a covalent liquid?

- A the strength of the forces of attraction between the molecules
B the reactivity of the molecules
C the shape of the molecules
D the strength of the covalent bonds in the molecules
- 3 In which particle are the number of protons, neutrons and electrons all different?



- 4 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 ammonia?



- 5 Silicon carbide, SiC, 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 SiC, BN and bronze are correct?

- 1 All are bonded covalently.
- 2 All have a giant structure.
- 3 All have high melting points.

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

- 6 Some car paints contain small flakes of silicon dioxide, SiO_2 .

In the structure of solid SiO_2 ,

- each silicon atom is bonded to x oxygen atoms,
- each oxygen atom is bonded to y silicon atoms,
- each bond is a z type bond.

What is the correct combination of x, y and z in these statements?

	x	y	z
A	2	1	covalent
B	2	1	ionic
C	4	2	covalent
D	4	2	ionic

- 7 In which compound does one of the atoms or ions have a different electronic configuration from each other?

- A** carbon dioxide
- B** phosphorus trichloride
- C** sodium oxide
- D** magnesium chloride

- 8 Which solid oxide does **not** lower the pH when added to sodium hydroxide solution?

- A** aluminium oxide
- B** silicon dioxide
- C** phosphorus oxide
- D** lithium oxide

- 9 The results of some experiments with sulfur dioxide are shown.

experiment	description	result
1	mix with dilute hydrochloric acid	does not react
2	mix with sodium hydroxide	a salt forms
3	add Universal Indicator	Universal Indicator turns purple
4	add acidified aqueous potassium manganate(VII)	purple solution turns colourless

Which results are correct?

- A** 1, 2 and 4 **B** 2, 3 and 4 **C** 1 and 2 only **D** 3 and 4 only
- 10 The table shows the concentration and pH values of the aqueous solutions L and M.

	L	M
concentration in mol/dm ³	2	2
pH	6	9

Student P concluded that L is a strong acid.

Student Q concluded that the extent of ionisation is low in L and high in M.

Which student(s) is(are) correct?

- A** both P and Q
B neither P nor Q
C P only
D Q only

- 11 A student investigates two acids W and X.

The same volumes of W and X are reacted separately with excess magnesium.

The student makes the following observations.

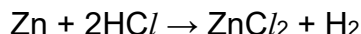
- 1 Hydrogen gas is produced at a faster rate with W than with X.
- 2 The total volume of hydrogen gas produced is the same for both acids.

Which statement explains these observations?

- A The pH of W is higher than the pH of X.
 - B W is an organic acid.
 - C W is more concentrated than X.
 - D W is a strong acid while X is a weak acid.
- 12 Which reaction does **not** involve neutralisation?

- A $\text{H}_2\text{SO}_4(\text{aq}) + 2\text{NH}_3(\text{aq}) \rightarrow (\text{NH}_4)_2\text{SO}_4(\text{aq})$
- B $\text{H}_2\text{SO}_4(\text{aq}) + \text{BaCl}_2(\text{aq}) \rightarrow \text{BaSO}_4(\text{s}) + 2\text{HCl}(\text{aq})$
- C $\text{H}_2\text{SO}_4(\text{aq}) + \text{CuO}(\text{s}) \rightarrow \text{CuSO}_4(\text{aq}) + \text{H}_2\text{O}(\text{l})$
- D $\text{H}_2\text{SO}_4(\text{aq}) + 2\text{NaOH}(\text{aq}) \rightarrow \text{Na}_2\text{SO}_4(\text{aq}) + 2\text{H}_2\text{O}(\text{l})$

- 13 Zinc reacts with hydrochloric acid according to the following equation.



The following statements were made about the reaction.

- 1 A 3.25 g sample of zinc reacts with an excess of hydrochloric acid to give 0.050 mol of zinc chloride.
- 2 A 6.50 g sample of zinc reacts completely with exactly 100 cm³ of 1.00 mol/dm³ hydrochloric acid.
- 3 A 13.0 g sample of zinc reacts with an excess of hydrochloric acid to give 9.60 dm³ of hydrogen at room temperature and pressure.

Which statements are correct?

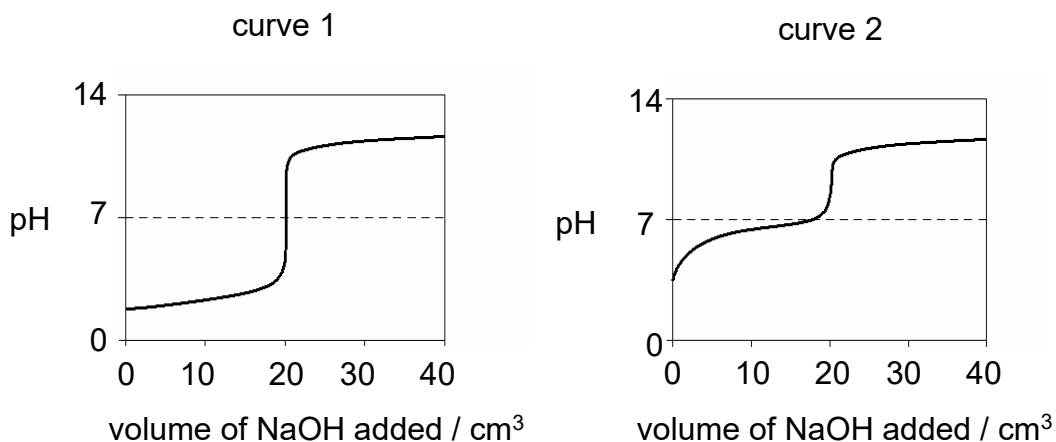
- A 1 only B 1 and 2 only C 2 and 3 only D 1, 2 and 3

14 The table shows appropriate indicators used to identify the endpoint in titrations.

indicator	acidic colour	range of colour change	alkaline colour
methyl orange	red	3.1 – 4.4	yellow
methyl red	red	4.4 – 6.2	yellow
bromothymol blue	yellow	6.0 – 7.6	blue
cresolphthalein	colourless	8.1 – 9.7	red
alizarin yellow	yellow	10.1 – 12.0	red

Curve 1 shows the changes in pH when NaOH was titrated to HCl in a conical flask.

Curve 2 shows the changes in pH when NaOH was titrated to a different acid in another conical flask.



The appropriate indicator for titration to obtain curve 1 is bromothymol blue.

Using the table, what is the appropriate indicator for curve 2?

- A** bromothymol blue
- B** cresolphthalein
- C** methyl orange
- D** methyl red

15 Which statement about ammonia is correct?

- A** Ammonia gas turns moist blue litmus paper red.
- B** Ammonia is used to increase pH of acidic soil.
- C** Ammonia is produced when a nitrate solution is warmed with sodium hydroxide.
- D** Ammonia molecule contains two pairs of electrons not involved in bonding.

- 16** One mole of compound X gives three moles of ions in aqueous solution. X reacts with ammonium carbonate to give an acidic gas.

What is compound X?

- A** calcium hydroxide
B ethanoic acid
C sodium hydroxide
D sulfuric acid
- 17** A sample of solid magnesium hydroxide is made by adding an excess of aqueous sodium hydroxide to an aqueous solution containing 1.20 g magnesium sulfate.

The mass of magnesium hydroxide formed is 0.26 g.

What is the percentage yield of magnesium hydroxide?

- A** 10.5 % **B** 21.7 % **C** 44.8 % **D** 61.9 %
- 18** Sulfur is present in two amino acids that make up proteins.

These are cysteine and methionine.

amino acid	cysteine	methionine
formula	$\text{C}_3\text{H}_7\text{NO}_2\text{S}$	$\text{C}_5\text{H}_{11}\text{NO}_2\text{S}$

Cysteine contains a higher percentage of sulfur by mass than methionine.

Which is the correct explanation for the above statement?

- A** The mass of sulfur atoms in a molecule of cysteine is greater than that in a molecule of methionine.
B The mass of carbon and hydrogen atoms in a molecule of cysteine is fewer than that in a molecule of methionine.
C The number of sulfur atoms in a molecule of cysteine is greater than that in a molecule of methionine.
D The relative molecular mass of cysteine is greater than the relative molecular mass of methionine.

- 19 Trends are seen in the physical and chemical properties of the elements of Group II and their compounds.

- 1 the rate of the reaction between the element and dilute hydrochloric acid
- 2 the solubility of the sulfates
- 3 the temperature of decomposition of the carbonates

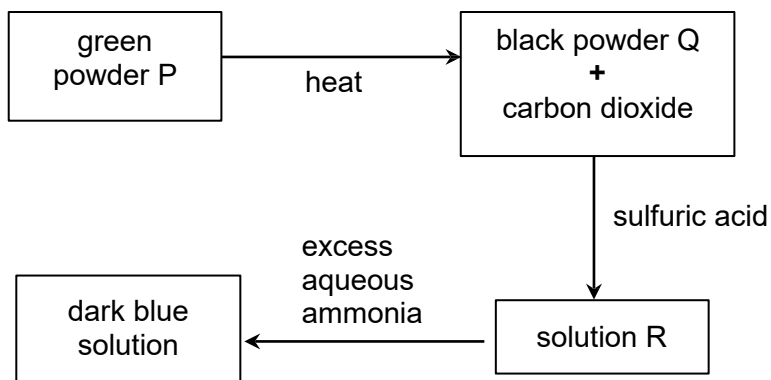
Which trend(s) show(s) a **decrease** from magnesium to barium?

- A 1, 2 and 3 B 1 and 3 only C 3 only D 2 only
- 20 An unknown aqueous solution reacts with aqueous sodium hydroxide to form a reddish-brown precipitate and then aluminium powder is added.

The mixture is heated and a gas that turns damp red litmus paper blue is given off.

What is the unknown solution?

- A ammonium chloride
 B copper(II) nitrate
 C iron(II) chloride
 D iron(III) nitrate
- 21 The diagram below shows a series of tests starting with substance P.



Which statement is true?

- A P can react directly with dilute sulfuric acid to give R.
 B Q reacts with acids to liberate hydrogen gas.
 C R is also green in colour.
 D R forms a green precipitate with aqueous sodium hydroxide.

22 The following reactions are carried out.

reaction	result
propanoic acid added to aqueous ammonia	compound P formed
propanoic acid is added to ammonium carbonate	gas Q given off
ammonium propanoate is warmed with sodium hydroxide	gas R given off

Which correctly identify the compound and gases?

	compound P	gas Q	gas R
A	ammonium carbonate	carbon dioxide	hydrogen
B	ammonium propanoate	ammonia	carbon dioxide
C	ammonium carbonate	ammonia	hydrogen
D	ammonium propanoate	carbon dioxide	ammonia

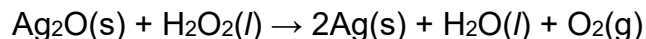
23 The formulae for four substances containing chlorine are given below.



Which correctly shows the oxidation numbers of chlorine in the above substances respectively?

	oxidation number of chlorine in			
	PCl_3	Cl_2O	ClO_3^-	ClO_4^-
A	-1	+1	+5	+7
B	+1	+1	+5	+7
C	-1	+1	+6	+8
D	+3	+2	-3	-4

- 24 Hydrogen peroxide, H_2O_2 , reacts with silver oxide according to the following equation.



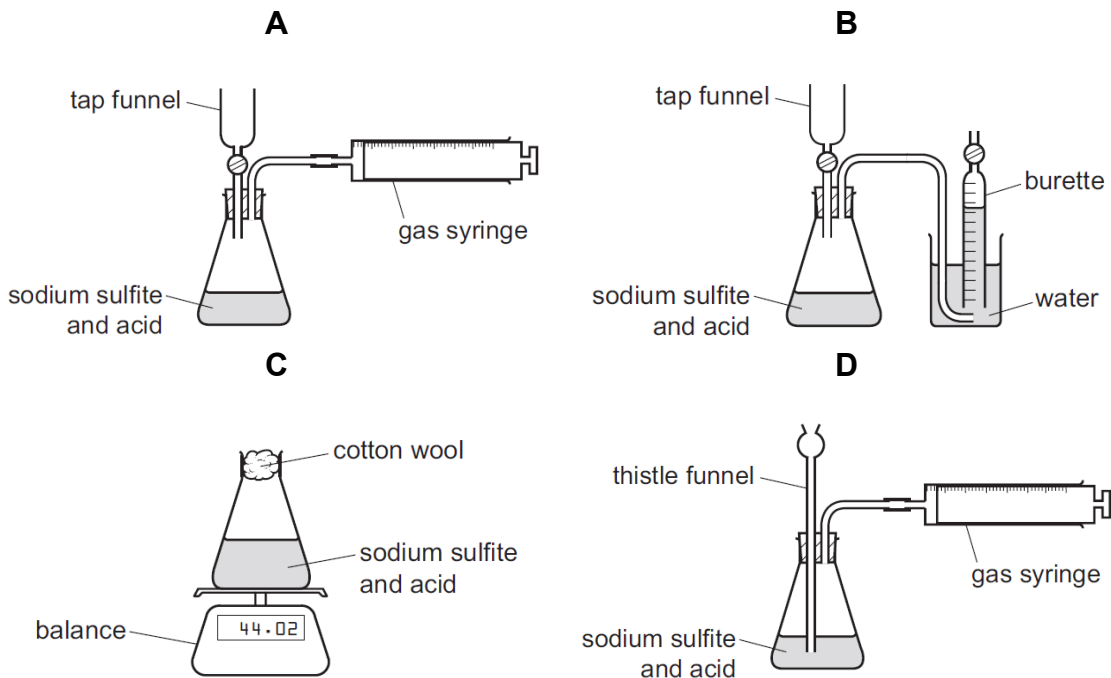
What is the role played by hydrogen peroxide in this reaction?

- A acid
 - B dehydrating agent
 - C oxidising agent
 - D reducing agent
- 25 In which reaction is sulfur dioxide acting as an oxidizing agent?

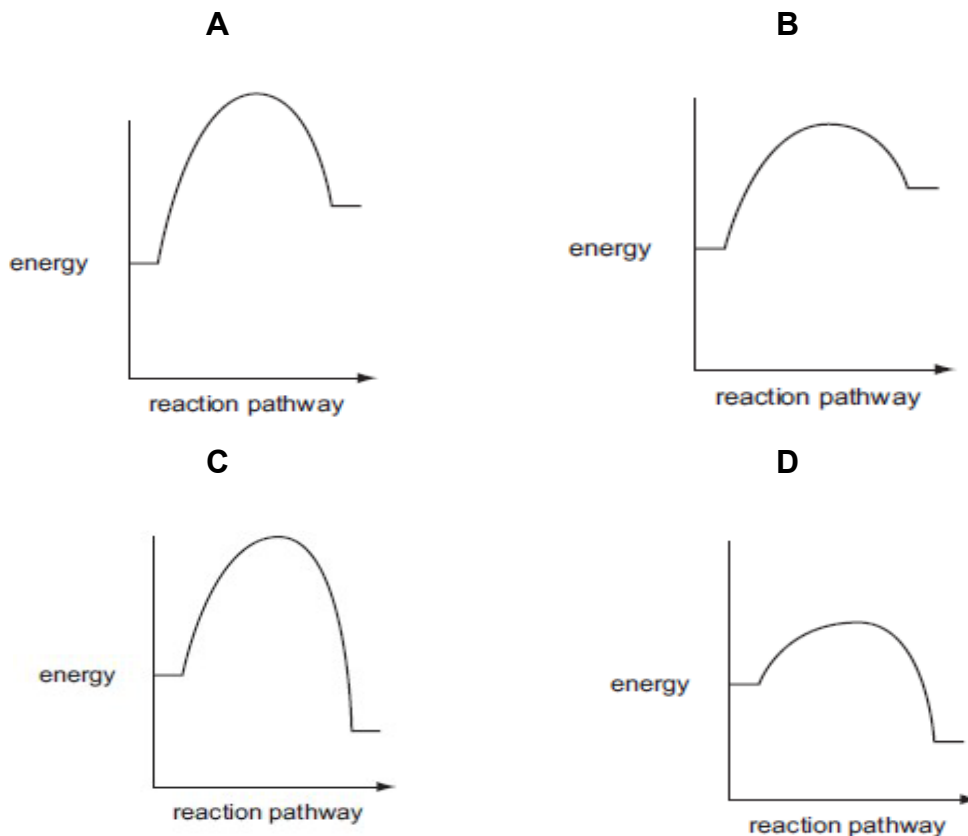
- A $\text{SO}_2 + 2\text{H}_2\text{O} + \text{Cl}_2 \rightarrow \text{H}_2\text{SO}_4 + 2\text{HCl}$
- B $\text{SO}_2 + 2\text{NaOH} \rightarrow \text{Na}_2\text{SO}_3 + \text{H}_2\text{O}$
- C $2\text{SO}_2 + \text{O}_2 \rightarrow 2\text{SO}_3$
- D $\text{SO}_2 + 2\text{H}_2\text{S} \rightarrow 2\text{H}_2\text{O} + 3\text{S}$

- 26 A student wanted to follow how the rate of the reaction of sodium sulfite with acid varies with time. The reaction produces gaseous sulfur dioxide.

Which apparatus is **not** suitable?



27 Which reaction profile shows the fastest exothermic reaction?



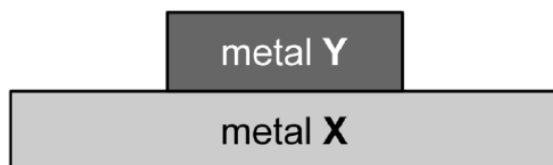
28 Four metals W, X, Y and Z and their compounds behaved as described.

- 1 Only X, Y and Z reacted with dilute hydrochloric acid.
- 2 The oxides of W, X and Y were reduced to the metal when heated with carbon powder. The oxide of Z did not react.
- 3 A displacement reaction occurred when X was added to an aqueous solution of the nitrate of Y.

Which shows the metals arranged in ascending order based on their reactivity?

- A** W, X, Y, Z
B W, Y, X, Z
C Z, X, Y, W
D Z, Y, X, W

- 29 Metals can be protected against corrosion by sacrificial protection. In the diagram shown below, metal X is being protected from corrosion by metal Y.



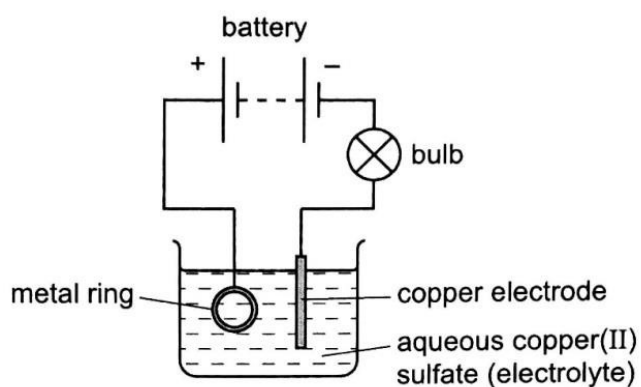
What are the possible identities of metal X and Metal Y?

	metal X	metal Y
A	aluminum	iron
B	copper	silver
C	iron	copper
D	zinc	magnesium

- 30 Over 90% of all gold but less than 50% of iron is recycled.

Which is the likely reason for this difference?

- A Gold is very scarce.
 - B Iron does not cause land pollution.
 - C Iron ores will never run out.
 - D It is more expensive to purify gold.
- 31 The diagram shows a failed attempt to copper-plate a metal ring.



Which action will plate the metal ring with copper?

- A cooling the copper(II) sulfate solution in an ice bath
- B exchange the position of copper electrode with the ring
- C heating the copper sulfate solution to boiling point
- D increasing the voltage from 3V to 6V

- 32 During the electrolysis of an aqueous solution of a cerium salt, 70 g of cerium is deposited at the cathode by 2 moles of electrons.

What is the formula of the cerium ion that has been discharged?

- A** Ce^+ **B** Ce^{2+} **C** Ce^{3+} **D** Ce^{4+}

- 33 Which statement is true for both electrolytic cells and simple cells?

	electrolytic cell	simple cell
A	electrons flow from the positive to negative terminal	electrons flow from the negative to positive terminal
B	it converts chemical energy into electrical energy	it converts electrical energy into chemical energy
C	mass of the positive electrode may remain unchanged	mass of the positive electrode will decrease
D	oxidation occurs at positive electrode	oxidation occurs at negative electrode

- 34 Petroleum is separated into useful fractions by fractional distillation. The uses of these fractions are shown.

fraction	number of carbon atoms in the molecules	uses
gasoline	$\text{C}_5 - \text{C}_{10}$	fuel for cooking and heating
naphtha	$\text{C}_7 - \text{C}_{14}$	feedstock for chemicals
paraffin	$\text{C}_{15} - \text{C}_{25}$	fuel for large vehicles
lubricating oil	C_{20} to C_{35}	making waxes and polishes
bitumen	$>\text{C}_{70}$	making road surfaces

Which fractions are indicated wrongly with their corresponding properties and/or uses?

- A** gasoline and naphtha
B lubricating oil and bitumen
C naphtha and paraffin
D paraffin and gasoline

35 The table shows some members in the alkanals homologous series.

name	chemical formula
Ethanal	CH_3CHO
Butanal	$\text{CH}_3\text{CH}_2\text{CH}_2\text{CHO}$
Hexanal	$\text{CH}_3\text{CH}_2\text{CH}_2\text{CH}_2\text{CH}_2\text{CHO}$

What is the general formula for alkanals?

- A** $\text{C}_n\text{H}_{2n+1}\text{COOH}$
B $\text{C}_n\text{H}_{2n}\text{CHO}$
C $\text{C}_n\text{H}_{2n+1}\text{CHO}$
D $\text{C}_{n-1}\text{H}_{2n+1}\text{CHO}$

36 Which of the following must be the same for molecules which are isomers?

- 1 empirical formula
- 2 functional group
- 3 structural formula
- 4 molecular formula

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

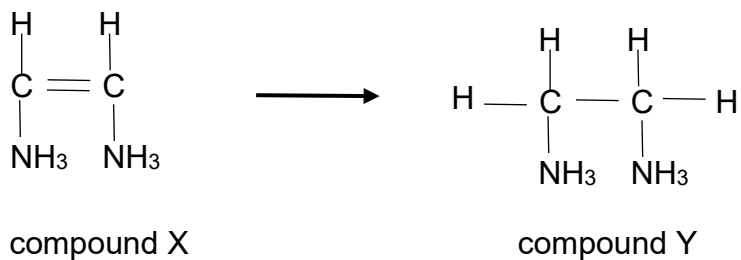
37 Ethanol can be manufactured from ethene or from glucose. The table gives statements about the processes involved.

	process using ethene	process using glucose
1	reaction is faster at 300 °C than at 200 °C	reaction is faster at 100 °C than at 30 °C
2	produces pure ethanol	produces a dilute aqueous solution of ethanol
3	is a catalytic reaction	is a catalytic reaction
4	uses steam	produces carbon dioxide

In which rows are both statements correct?

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

38 Compound X can be converted into compound Y.



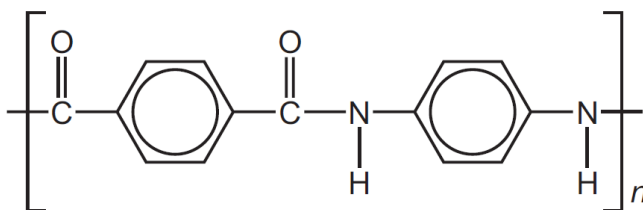
Which row correctly shows the reagents and conditions needed for the conversion?

	reagent	conditions
A	hydrogen	200 °C, nickel catalyst
B	concentrated sulfuric acid	heat
C	steam	300 °C, 60atm, phosphoric acid
D	monomer	450 °C; iron catalyst

39 What remains unchanged in the polymerisation of butene to poly(butene)?

- A** boiling point
- B** density
- C** molecular formula
- D** percentage composition of elements by mass

40 The diagram shows a polymer called *Kevlar*.



Which statement describes *Kevlar*?

- A** It is a polyester.
- B** It is formed in an addition polymerisation reaction.
- C** It is formed from the two monomers, a di-carboxylic acid and a di-amine.
- D** It has the same linkage as Terylene.

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	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											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 –			

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
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 -

actinoids

The volume of one mole of any gas is 24 dm³ at room temperature and pressure (r.t.p.).