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**AASSUMPTION ENGLISH SCHOOL
PRELIMINARY EXAMINATION 2024**

**CHEMISTRY
6092 / 01**



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LEVEL: Sec 4 Express

DATE: 28 August 2024

CLASS: Sec 4/1

DURATION: 1 hour

Additional materials provided: 1 sheet of OAS paper

INSTRUCTIONS TO CANDIDATES

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

Write your NAME and INDEX NUMBER at the top of this page and on the OAS paper.

Shade your index number on the OAS paper.

MULTIPLE CHOICE QUESTIONS (40 marks)

There are 40 questions in this section.

Answer **ALL** questions.

For each question, there are four possible answers

A, B, C and D.

**Choose the correct answer and record your choice
in soft or 2B pencil on the OAS paper provided.**

For Examiner's use:	
Paper 1	/ 40

Do NOT fold or bend the OAS paper.

A copy of the Periodic Table is provided on **Page 19**.

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

At the end of the examination, hand in your OAS paper and question booklet separately.

This Question Paper consists of 19 printed pages including this page.

[Turn over

SECTION A: MULTIPLE CHOICE QUESTIONS [40 marks]

There are **forty** questions in this section. 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 on the OAS in soft pencil.

- 1** An experiment was conducted to measure the temperature change caused by adding a known quantity of sodium carbonate to an excess of dilute acid.

Besides a thermometer and styrofoam cup, these apparatus are available.

- 1 gas syringe
- 2 mass balance
- 3 measuring cylinder
- 4 stopwatch

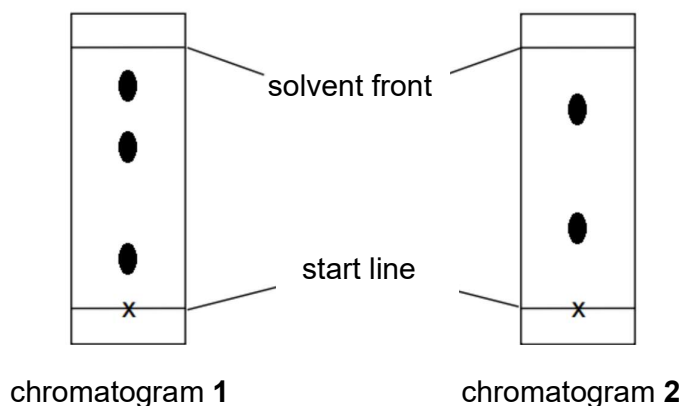
Which pieces of apparatus are needed for this experiment?

- A** 1, 2, 3 and 4
 - B** 2 and 3 only
 - C** 2 and 4 only
 - D** 4 only
- 2** An impure sample of compound **X** melted over a range of 162°C – 168°C. **X** was purified and its melting point was measured again.

Which row correctly shows the method of purifying **X** and the melting point of pure **X**?

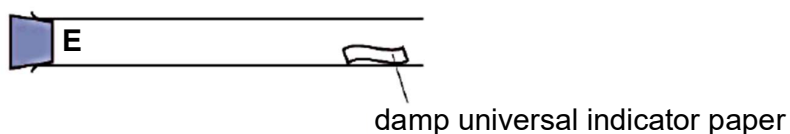
	method of purifying X	melting point of pure X / °C
A	crystallisation	160
B	distillation	160
C	crystallisation	170
D	distillation	170

- 3 Chromatography was carried out to examine the dyes present in a sample of paint. The same sample of paint was used for the two chromatograms shown below.



Which statement best explains the difference in the results observed?

- A A more concentrated sample of paint was used in chromatogram 1.
 - B Chromatogram 1 proceeded for a longer time than chromatogram 2.
 - C Different solvents were used in both chromatograms.
 - D The solvents moved up the paper at different speeds.
- 4 A gas was released at point E in the set-up shown below.

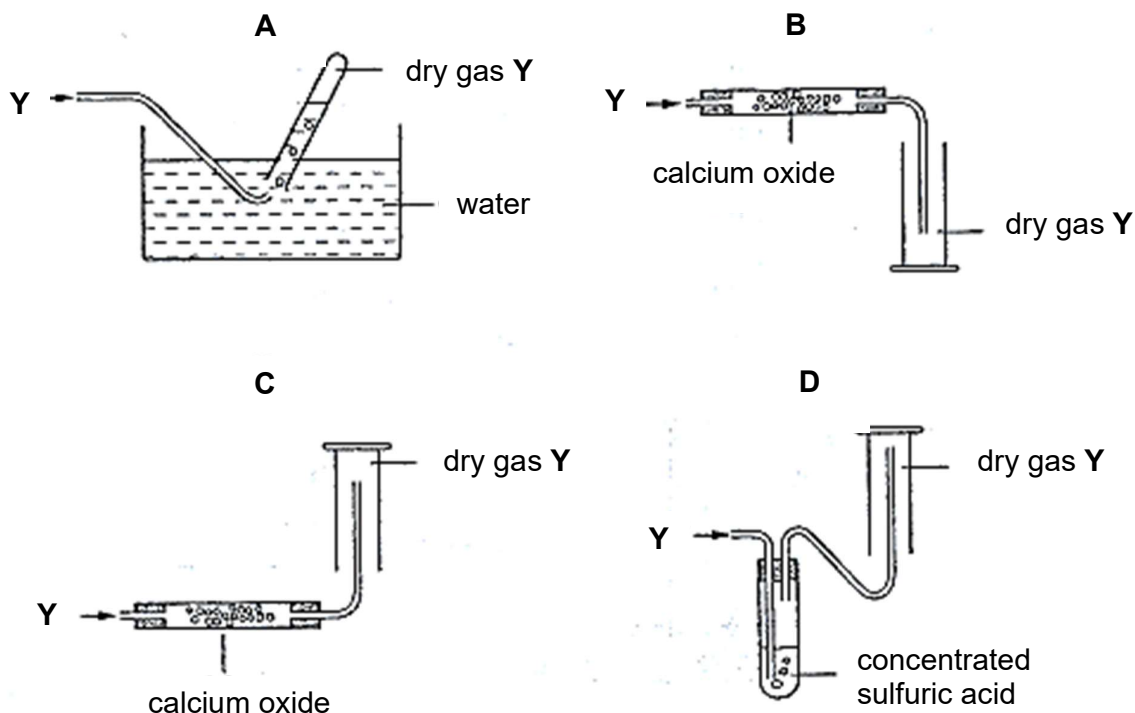


Which gas turns damp universal indicator paper red most quickly?

- A carbon monoxide
- B chlorine
- C hydrogen bromide
- D nitrogen dioxide

- 5 Gas Y turns moist red litmus paper blue, is soluble in water and less dense than air.

Which diagram shows the best method to collect a dry sample of gas Y?



- 6 Solid samples of ammonium chloride, silver chloride and sodium chloride were accidentally mixed together.

Which sequence outlines the best method to obtain a pure and dry sample of each substance?

- A** dissolving, filtration, sublimation, crystallisation
- B** dissolving, fractional distillation, filtration, evaporation
- C** sublimation, dissolving, filtration, evaporation
- D** sublimation, filtration, evaporation, crystallisation

- 7 An aqueous solution of a salt is tested and the following results are obtained.

test	result
addition of a few drops of aqueous ammonia followed by addition of excess aqueous ammonia	white precipitate forms precipitate remains
addition of 2 cm ³ of aqueous barium nitrate	white precipitate forms

What is the identity of the salt?

- A** aluminium sulfate
B calcium chloride
C zinc chloride
D zinc sulfate
- 8 A giant molecule contains a large amount of carbon-12 and carbon-13 isotopes. The average relative atomic mass of carbon in the giant molecule is 12.2.

What proportion of carbon-12 atoms is present in the giant molecule?

- A** 20% **B** 50%
C 60% **D** 80%
- 9 Element **Q** has p protons and n neutrons in its nucleus.

What row gives the correct number of sub-atomic particles in a positive ion of an isotope of **Q**?

	electron	proton	neutron
A	p	p	$n + 1$
B	$p - 1$	p	$n - 1$
C	$p - 1$	$p + 1$	n
D	$p + 1$	p	n

- 10** A student made four statements about elements, compounds and mixtures.

statement 1: Elements are made up of only one type of atom.

statement 2: Compounds have similar properties to the elements they are made of.

statement 3: Little or no energy change is involved when a compound is formed.

statement 4: Mixtures have a fixed ratio of components.

How many of the above statement(s) is / are correct?

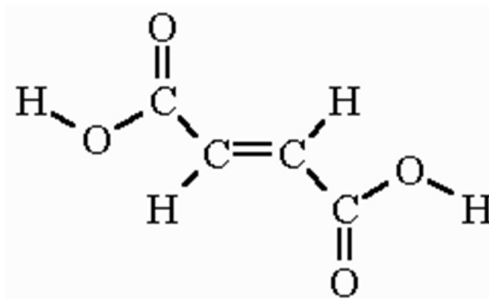
- A** one **B** two
C three **D** four

- 11** The melting point of magnesium oxide is much higher than the melting point of sodium oxide.

Which statement best explains the difference in their melting points?

- A** Magnesium ion has more protons than sodium ion.
- B** Magnesium is less reactive than sodium.
- C** Sodium has a greater number of ions per formula unit in its oxide than magnesium.
- D** Sodium ion has a smaller charge than magnesium ion.

- 12** The bonding in fumaric acid can be represented by the structure shown.



How many electrons are involved in bonding in a molecule of fumaric acid?

- | | | | |
|----------|----|----------|----|
| A | 11 | B | 14 |
| C | 22 | D | 28 |

- 13** Which statement is true about the oxides formed by carbon and silicon?
- A** Both elements form only one oxide each with the same general formula of XO_2 , where X represents C or Si.
 - B** Oxides of carbon contain covalent bonds while oxides of silicon contain ionic bonds.
 - C** Oxides of carbon have a low melting point while oxides of silicon have a high melting point.
 - D** Oxides of carbon are insoluble in water while oxides of silicon are soluble in water.

- 14** 7.5 g of an unknown hydrocarbon has a volume of 6 dm^3 at room temperature and pressure.

What is the molecular formula of the unknown hydrocarbon?

- | | |
|---|---|
| <p>A C_2H_4</p> <p>C C_3H_6</p> | <p>B C_2H_6</p> <p>D C_3H_8</p> |
|---|---|
- 15** Sodium carbonate is produced by strongly heating sodium hydrogencarbonate using the reaction shown.



In an experiment, 21.0 g of sodium hydrogencarbonate produced 10.6 g of sodium carbonate.

What was the percentage yield of sodium carbonate?

[M_r : NaHCO_3 , 84; Na_2CO_3 , 106]

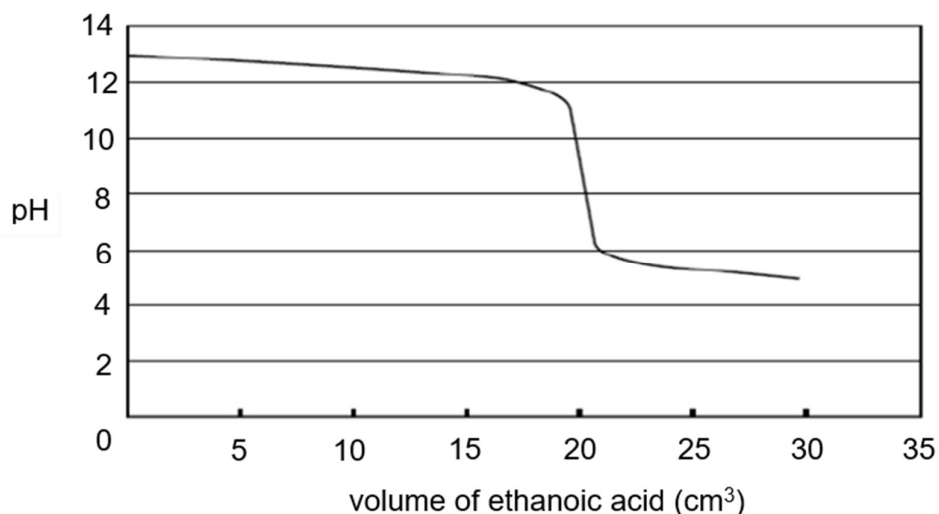
- A** $\frac{21 \times 106}{84}$
- B** $\frac{10.6 \times 84 \times 100}{21 \times 106}$
- C** $\frac{10.6 \times 106 \times 100}{21 \times 84}$
- D** $\frac{10.6 \times 84 \times 2 \times 100}{21 \times 106}$

- 16 A sample of lithium oxide, Li_2O , is dissolved in 250 cm^3 of distilled water. 25.0 cm^3 of the solution is neutralised by 30.0 cm^3 of 0.5 mol/dm^3 dilute sulfuric acid.

What is the mass of lithium oxide dissolved in 250 cm^3 of distilled water?

- A 0.6 g
- B 4.5 g
- C 9.0 g
- D 18.0 g

- 17 The change in pH is monitored during a titration experiment between sodium hydroxide solution and ethanoic acid.



Which indicator is most suitable to determine the end point of this titration?

	indicator	approximate pH range for colour change
A	bromocresol green	3.8 – 5.4
B	litmus solution	5.5 – 8.2
C	methyl orange	3.2 – 4.4
D	phenolphthalein	8.2 – 10

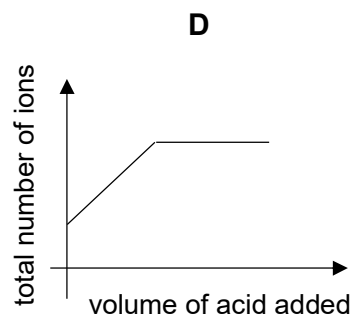
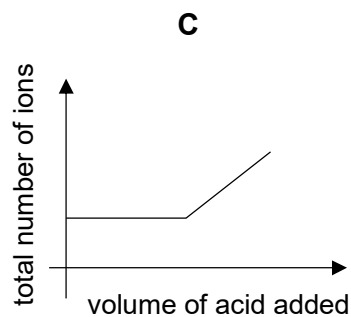
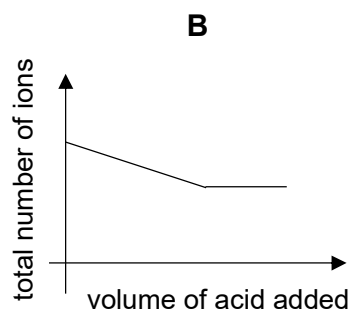
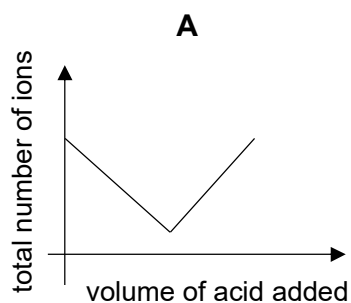
- 18 A farmer fertilises his plants with an ammonium sulfate fertiliser. Not soon after, a pungent smell started coming from the field where the fertiliser was added.

Which statement best explains this phenomenon?

- A Ammonium sulfate decomposed in soil to give sulfur dioxide.
- B Ammonium sulfate reacted with water in the soil to give ammonia gas.
- C The farmer added too much fertiliser to the soil.
- D The farmer had previously limed his soil.

- 19 Dilute sulfuric acid is added in excess to aqueous barium nitrate.

Which graph best represents the change in the total number of ions in the mixture?



20 What pair of reagents is suitable to prepare a soluble salt by titration method?

- A** copper(II) oxide and sulfuric acid
- B** potassium carbonate and nitric acid
- C** sodium chloride and silver nitrate
- D** sodium sulfate and lead(II) nitrate

21 In which reactions are redox reactions taking place?

1. $4\text{Fe} + 3\text{O}_2 \rightarrow 2\text{Fe}_2\text{O}_3$
2. $\text{HCl} + \text{NaOH} \rightarrow \text{NaCl} + \text{H}_2\text{O}$
3. $2\text{NO}_2 + \text{H}_2\text{O} \rightarrow \text{HNO}_3 + \text{HNO}_2$
4. $\text{Zn} + \text{CuSO}_4 \rightarrow \text{ZnSO}_4 + \text{Cu}$

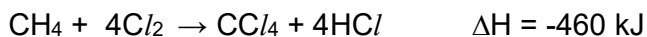
- A** 1 and 4 only
- B** 2 and 3 only
- C** 1, 3 and 4 only
- D** 1, 2, 3 and 4

22 Ilmenite is a mineral primarily composed of a mixture of iron(II) titanate, FeTiO_3 , and iron(III) titanate, $\text{Fe}_2(\text{TiO}_3)_3$. Ilmenite can be mined for the manufacture of titanium.

What row shows the oxidation state of titanium in the two compounds?

	FeTiO_3	$\text{Fe}_2(\text{TiO}_3)_3$
A	+2	+3
B	+4	+2
C	+4	+3
D	+4	+4

- 23** The equation for the reaction between methane and chlorine is shown.



bond	C – H	C I – C I	C – C I
bond energy in kJ/mol	412	242	338

What is the bond energy of the H – C I bond?

- A** 194 kJ/ mol
B 201 kJ/ mol
C 399 kJ/ mol
D 431 kJ/ mol

- 24** The position of four elements are shown in the outline of part of the Periodic Table.

[illegible]

Which statement is **not** correct?

- A** An atom of element **X** has a greater mass than an atom of element **Y**.
B Element **W** can react with steam.
C Elements **Y** and **Z** can react to form a compound that has a low melting point.
D Only one of these elements has variable oxidation states.

- 25** Which property shows an increasing trend in the elements across a period of the Periodic Table?

- A** melting point
B non-metallic character
C number of electron shells
D reactivity with water

- 26 Elements **P** and **Q** belong to Group 17 of the Periodic Table.
P is a liquid while **Q** is a solid at room temperature and pressure.

Which statement is correct?

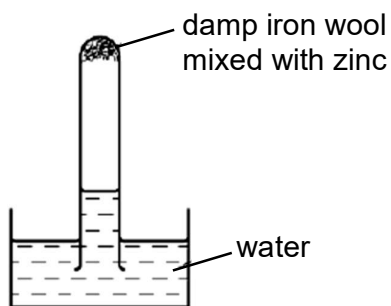
- A** Atoms of **P** has more electron shells than atoms of **Q**.
B Molecules of **Q** have more atoms than molecules of **P**.
C **P** is a stronger oxidizing agent than **Q**.
D **Q** displaces **P** from an aqueous solution of **P**.
- 27 Pieces of different metals were placed in separate test tubes containing aqueous solutions of their ions.

solution	metal added				
	X	copper	nickel	zinc	Y
nitrate of metal X		no reaction	no reaction	metal X displaced	metal X displaced
copper(II) chloride	copper displaced		copper displaced	copper displaced	copper displaced
nickel(II) chloride	nickel displaced	no reaction		nickel displaced	nickel displaced
zinc chloride	no reaction	no reaction	no reaction		zinc displaced
nitrate of metal Y	no reaction	no reaction	no reaction	no reaction	

What is the order of reactivity of the metals?

	most reactive → least reactive				
A	copper	nickel	X	zinc	Y
B	zinc	Y	nickel	copper	X
C	Y	zinc	nickel	X	copper
D	Y	zinc	X	nickel	copper

- 28 A test tube containing damp iron wool mixed with zinc was inverted in water.



What happens to the iron and water level in the tube?

	iron	water level
A	does not rust	rises
B	does not rust	no change
C	rusts	rises
D	rusts	falls

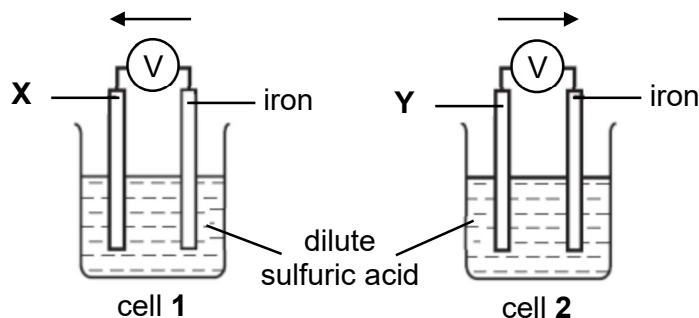
- 29 The oxides of metals **R** and **S** were heated with carbon and hydrogen. Carbon can reduce the oxides of **R** and **S** but hydrogen can only reduce the oxide of **R**.

Which statement(s) is/are correct?

- 1 Metal **R** is less reactive than metal **S**.
- 2 **S** reacts readily with cold water.
- 3 Carbon is a stronger reducing agent than hydrogen.

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

- 30 Two different pairing of metals were connected to the simple cells shown below. The arrow indicates the direction of electron flow in the external circuit.

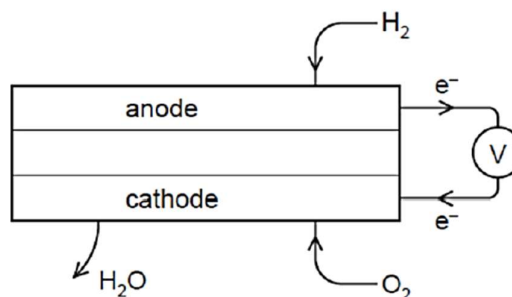


The table shows the voltages recorded in each simple cell:

cell	1	2
voltage / V	+0.32	+1.62

What is the voltage produced in a cell that has metals **X** and **Y** connected together using dilute sulfuric acid?

- A 0.32 V
 B 1.30 V
 C 1.62 V
 D 1.94 V
- 31 Hydrogen is an alternative fuel for cars. In the simplified hydrogen fuel cell shown below, hydrogen is supplied as a fuel to produce electricity.



Which statement is correct?

- A Hydrogen is oxidised at the anode to form water.
 B Hydrogen is reduced at the cathode to form water.
 C Oxygen is oxidised at the cathode to form water.
 D Oxygen is reduced at the anode to form water.

- What is the charge of vanadium ion?

A 2+ **B** 3+

C 4+ **D** 5+

- The table below shows the conditions changed for the two experiments, with all other conditions kept the same.

f gas evolved was plotted against time

Which graph shows the results obtained from the two experiments?

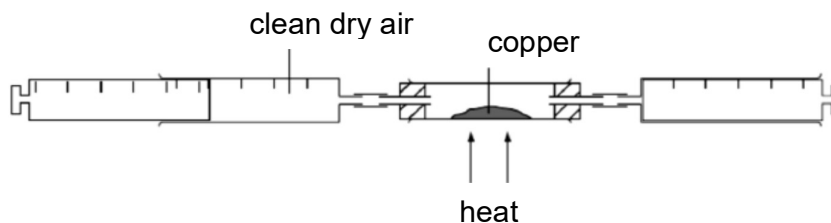
- 34 How does the activation energy for the reaction between two gases change when the following conditions of the reaction are altered?

	change in activation energy	
	increase in pressure	addition of catalyst
A	decreases	increases
B	decreases	decreases
C	stays the same	decreases
D	stays the same	increase

- 35 Which statement is **not** true of the Haber process?

- A** A yield of 100% of ammonia is obtained.
- B** Nitrogen and hydrogen are fed into the reactor in the ratio of 1: 3.
- C** The raw material, hydrogen gas, is obtained from the cracking of petroleum.
- D** Unreacted nitrogen and hydrogen are recycled and transferred back into the converter.

- 36 A sample of clean, dry air is passed over hot copper until there is no further change in volume.



The volume of air decreased by 45 cm^3 .

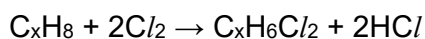
Which was the estimated original volume of the sample of air?

- A** 65 cm^3
- B** 100 cm^3
- C** 215 cm^3
- D** 250 cm^3

37 Which air pollutant is correctly paired with its effect?

	air pollutant	effect
A	carbon monoxide	greenhouse effect
B	carbon dioxide	depletes the ozone layer
C	nitrogen dioxide	contributes to acid rain
D	sulfur dioxide	forms photochemical smog

38 A reaction between hydrocarbon, C_xH_8 , and chlorine gas is shown.



Which statement is correct?

- A** It is an addition reaction.
- B** High pressure and temperature is required for this reaction to occur.
- C** The molecular formula of the hydrocarbon is C_4H_8 .
- D** The reaction needs to be carried out in the presence of UV light.

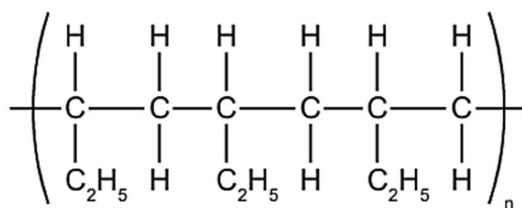
39 The table below shows a list of chemicals found in a school laboratory.

	chemical
1	acidified potassium dichromate(VI)
2	aqueous bromine
3	magnesium ribbon
4	sodium carbonate

Which chemicals can be used to distinguish between ethanol and ethanoic acid?

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

- 40 The diagram shows a section of a polymer.



Which statement about the polymer is correct?

- A** It can be made by the addition polymerisation of $\text{CH}_3\text{--CH=CH--CH}_3$.
- B** It can be made by the addition polymerisation of $\text{CH}_3\text{--CH}_2\text{--CH=CH}_2$.
- C** It can be made by the condensation polymerisation of $\text{CH}_3\text{--CH=CH--CH}_3$.
- D** It can be made by the condensation polymerisation of $\text{CH}_3\text{--CH}_2\text{--CH=CH}_2$.

– End of Paper –

The Periodic Table of Elements

The Periodic Table of Elements																	
Group												13	14	15	16	17	18
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											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 —

19

lanthanoids

actinoids

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 –

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

The Avogadro constant, $L = 6.02 \times 10^{23} \text{ mol}^{-1}$

