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BROADRICK SECONDARY SCHOOL

SECONDARY 4 EXPRESS

PRELIMINARY EXAMINATION 2022

CHEMISTRY

6092/01

Paper 1 Multiple Choice

Sept 2022

Additional Materials: Multiple Choice Answer Sheet

1 hour

READ THESE INSTRUCTIONS FIRST

Write in soft pencil.

Do not use staples, paperclips, highlighters, glue or correction fluid.

Write your name, class and register number on top of this page and on any separate answer paper used.

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 **15**.

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

This document consists of **15** printed pages including this cover page.

Setter : MR. LIANG ZW

- 1 In a titration, 25.0 cm^3 of aqueous sodium hydroxide is transferred into a conical flask. A few drops of indicator are added. Dilute hydrochloric acid is then added to the flask until the end-point is reached.

Which pieces of apparatus are used to measure volume in this experiment?

	to measure dilute hydrochloric acid	to measure aqueous sodium hydroxide
A	burette	beaker
B	burette	pipette
C	pipette	pipette
D	pipette	beaker

- 2 Which gas is **not** obtained industrially by fractional distillation?

- A** ammonia
- B** argon
- C** nitrogen
- D** oxygen

- 3 An impure sample of compound X has a melting point of 120°C .

X is purified and its melting point is measured again.

Which row is correct?

	method of purifying X	melting point of pure X / $^\circ\text{C}$
A	crystallisation	115
B	distillation	115
C	crystallisation	125
D	distillation	125

- 4 When dilute hydrochloric acid is added to a white powder, a gas is produced.

The solution remaining is tested separately with small volumes of both aqueous ammonia and aqueous sodium hydroxide.

A white precipitate is produced in both tests.

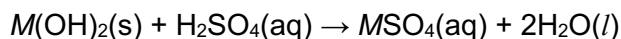
What is the white powder?

- A** aluminium oxide
- B** calcium oxide
- C** copper(II) carbonate
- D** zinc carbonate

- 5 Which statement explains why isotopes of the same element have the same chemical properties?

A They have the same electronic structure.
B They have the same relative mass.
C They have the same nucleon number.
D They have the same proton number.

- 6 An aqueous solution of a sulfate is made from a solid hydroxide, of a metal *M*, by the reaction:

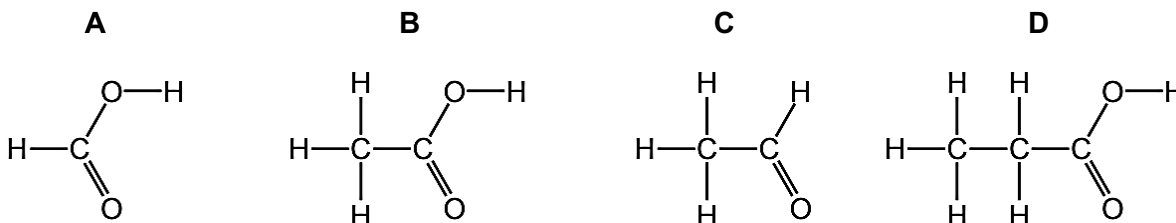


For which hydroxide would the method **not** work?

A barium hydroxide
B copper(II) hydroxide
C iron(II) hydroxide
D magnesium hydroxide

- 7 A covalent compound P has the empirical formula CH_2O .

Which structure represents P?



- 8 Which row explains why copper is a good conductor of electricity at room temperature?

	copper ions move freely	electrons move freely
A	no	no
B	no	yes
C	yes	no
D	yes	yes

- 9 What is the structure of sand?

A an ionic lattice
B a macromolecule
C a polymer
D a simple molecule

- 10 Pentane, C₅H₁₂, has a higher boiling point than propane, C₃H₈.

Which statement explains the difference in boiling point?

- A Carbon-carbon single bonds are stronger than carbon-hydrogen bonds.
 - B Pentane has more covalent bonds to break.
 - C Pentane does not burn as easily as propane.
 - D The forces of attraction between pentane molecules are stronger than those between propane molecules.
- 11 Sodium nitride contains the nitride ion, N³⁻.

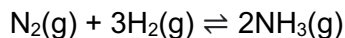
Sodium nitride is unstable and decomposes into its elements.

What is the equation for the decomposition of sodium nitride?

- A $2\text{NaN}_3 \rightarrow 2\text{Na} + 3\text{N}$
 - B $2\text{Na}_3\text{N} \rightarrow 6\text{Na} + \text{N}_2$
 - C $2\text{NaN}_3 \rightarrow \text{Na}_2 + 3\text{N}_2$
 - D $2\text{Na}_3\text{N} \rightarrow 6\text{Na} + 2\text{N}$
- 12 What is the mass of one mole of carbon-13?

- A 0.013 g
- B 0.026 g
- C 1 g
- D 13 g

- 13 The Haber process is a reversible reaction.

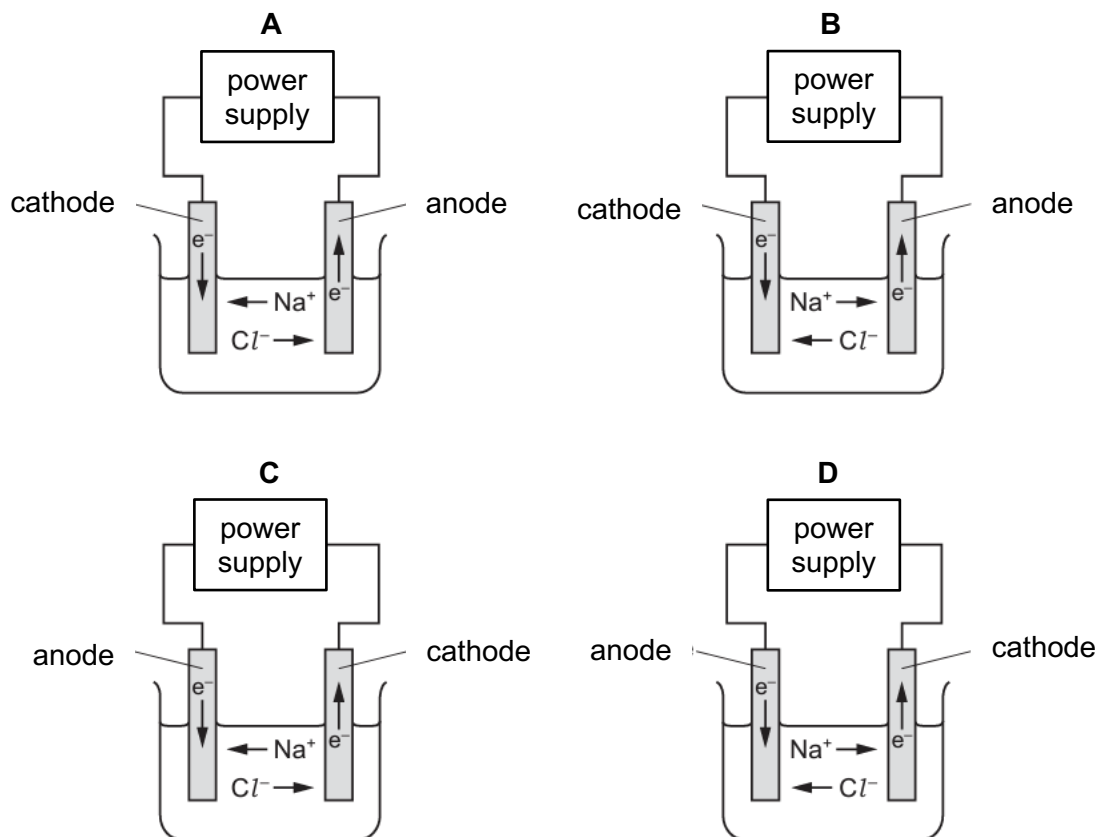


The reaction has a 30% yield of ammonia.

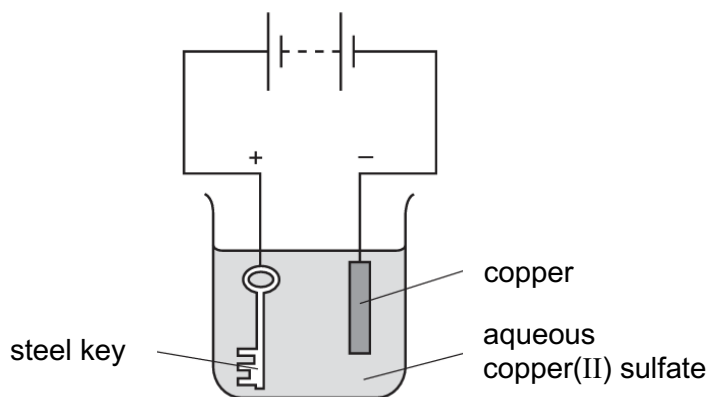
Which volume of ammonia gas, NH₃, measured at room temperature and pressure, is obtained by reacting 0.75 moles of hydrogen with excess nitrogen?

- A 3600 cm³
- B 5400 cm³
- C 12000 cm³
- D 18000 cm³

- 14 Which diagram shows the direction of movement of ions and electrons during the electrolysis of molten sodium chloride?



- 15 The apparatus shown is set up to plate a steel key with copper.

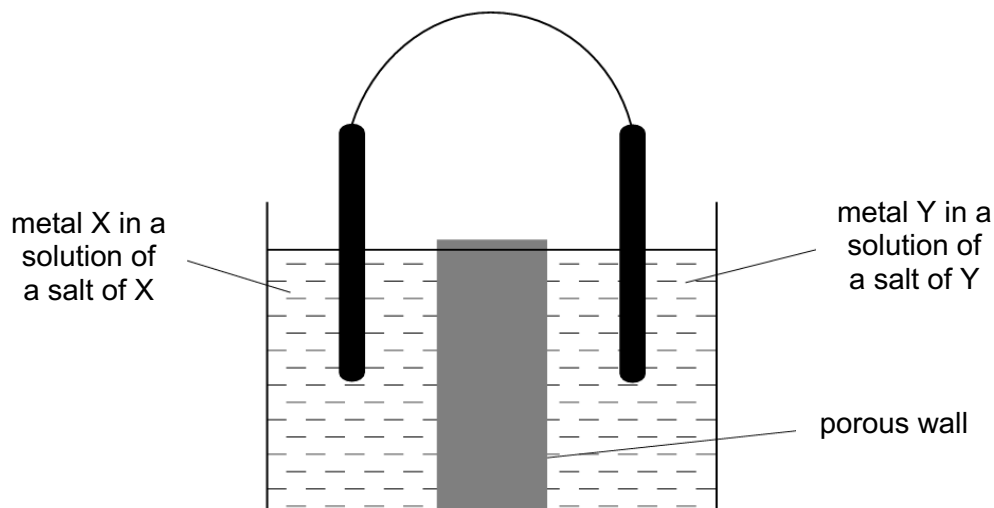


The key does **not** get coated with copper.

Which change needs to be made to plate the key?

- A increase the concentration of the aqueous copper(II) sulfate
- B increase the voltage
- C replace the solution with dilute sulfuric acid
- D reverse the electrical connections

- 16 Which pair of metals X and Y will produce the highest voltage when used as electrodes in a simple cell?



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

- 17 Which row describes the changes that occur in an endothermic reaction?

	energy change	temperature
A	energy given out to the surroundings	decreases
B	energy given out to the surroundings	increases
C	energy taken in from the surroundings	decreases
D	energy taken in from the surroundings	increases

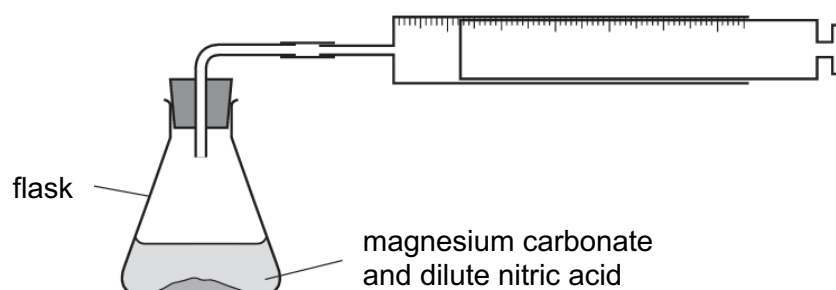
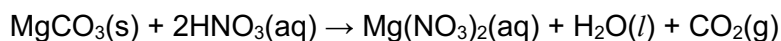
- 18 Which statement about fuels is correct?

- A** Heat energy is only produced by burning fuels.
- B** Hydrogen is used as a fuel although it is difficult to store.
- C** Methane is a good fuel because it produces only water when burned.
- D** Uranium is burned in air to produce energy.

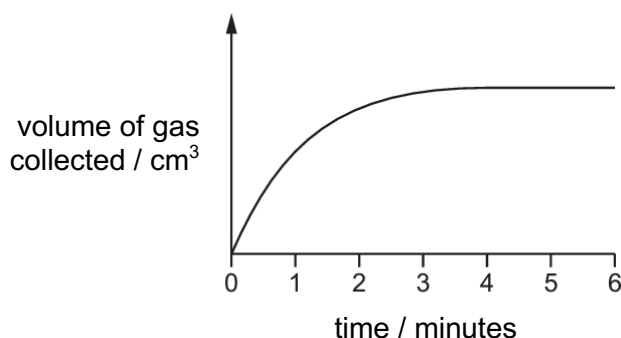
19 Which statement about endothermic and exothermic reactions is correct?

- A In an endothermic reaction, less energy is absorbed in bond breaking than is released in bond forming.
- B In an endothermic reaction, the activation energy is always higher than in an exothermic reaction.
- C In an exothermic reaction, more energy is absorbed in bond breaking than is released in bond forming.
- D In an exothermic reaction, the reactants are higher energy level than the products on an energy level diagram.

20 The apparatus shows a method of following the rate of the reaction between magnesium carbonate, MgCO_3 , and dilute nitric acid, HNO_3 .



The graph shows the volume of gas collected against time.



Three statements are made about the experiment.

- 1 The mass of the flask and its contents decreases as time increases.
- 2 The rate of the reaction decreases as time increases.
- 3 The reaction has finished after four minutes.

Which statements are correct?

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

- 21 How does increasing the concentration affect the reacting particles in a chemical reaction?

	increases the collision rate	increases the proportion of particles with the activation energy
A	✓	✗
B	✓	✓
C	✗	✗
D	✗	✓

- 22 Zinc oxide is an amphoteric oxide.

Which of the following substances will react with zinc oxide?

- A** acids and bases
 - B** acids only
 - C** bases only
 - D** neither acids nor bases
- 23 When aqueous iron(III) chloride is added to aqueous potassium iodide, a chemical reaction occurs and iodine is formed.

Which statement is correct?

- A** Iodide ions are oxidised, they gain electrons in this reaction.
 - B** Iodide ions are oxidised, they lose electrons in this reaction.
 - C** Iron(III) chloride is oxidised in this reaction.
 - D** Neither iodide ions nor iron(III) chloride is oxidised in this reaction.
- 24 In which reaction is the underlined substance behaving as an oxidising agent?

- A** $\underline{\text{BaCl}_2} + \text{Na}_2\text{SO}_4 \rightarrow \text{BaSO}_4 + 2\text{NaCl}$
- B** $3\text{CuO} + \underline{2\text{NH}_3} \rightarrow 3\text{Cu} + \text{N}_2 + 3\text{H}_2\text{O}$
- C** $2\text{FeCl}_2 + \underline{\text{Cl}_2} \rightarrow 2\text{FeCl}_3$
- D** $\text{O}_2 + \underline{2\text{SO}_2} \rightarrow 2\text{SO}_3$

- 25** The oxide of an element X increases the rate of decomposition of hydrogen peroxide. At the end of the reaction the oxide of X is unchanged.

Which details are those of X?

	proton number	mass number
A	18	40
B	20	40
C	25	55
D	82	207

- 26** The proton number of indium, In, is 49.

What is the most likely formula for the oxide of indium?

- A** In_2O
B In_2O_3
C InO
D InO_2

- 27** Which statement(s) is/are true about all the noble gases?

- 1 The number of protons in their atoms equals the number of neutrons.
- 2 The number of protons in their atoms does not equal the number of electrons.
- 3 They all have eight electrons in their outer shell.
- 4 They do not react to form ionic compounds.

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

- 28** Many metal carbonates decompose when they are heated.

Which row describes what happens when potassium carbonate, calcium carbonate and copper(II) carbonate are heated using a Bunsen burner?

	decomposes easily	decomposes with difficulty	does not decompose at Bunsen temperatures
A	calcium carbonate	copper(II) carbonate	potassium carbonate
B	copper(II) carbonate	calcium carbonate	potassium carbonate
C	copper(II) carbonate	potassium carbonate	calcium carbonate
D	potassium carbonate	calcium carbonate	copper(II) carbonate

29 Three correct statements about aluminium are listed.

- 1 Aluminium is the most common metal in the Earth's crust.
- 2 It is costly to extract aluminium from its ore, bauxite.
- 3 The world's supply of bauxite is limited.

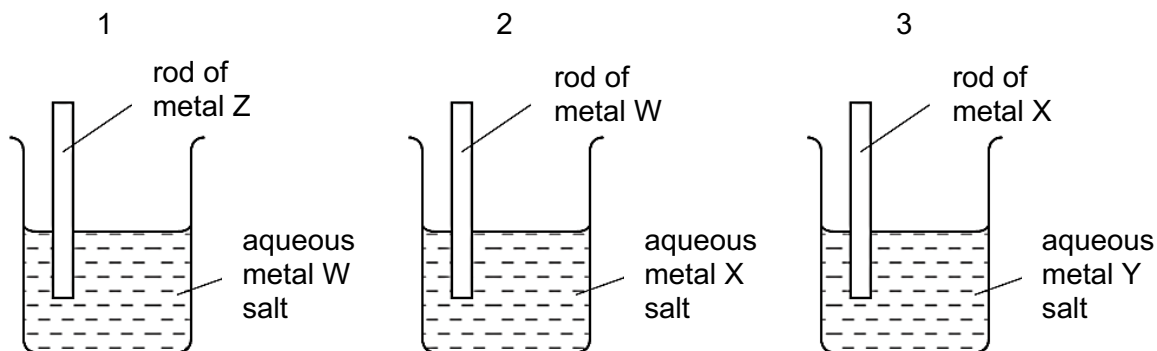
Which statement(s) explain why aluminium should be recycled?

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

30 Which process, used to prevent iron from rusting, involves sacrificial protection?

- A** alloying
B electroplating
C galvanising
D painting

31 Three different beakers are set up as shown.



In beaker 1, metal W is displaced from solution.

In beaker 2, metal X is displaced from solution.

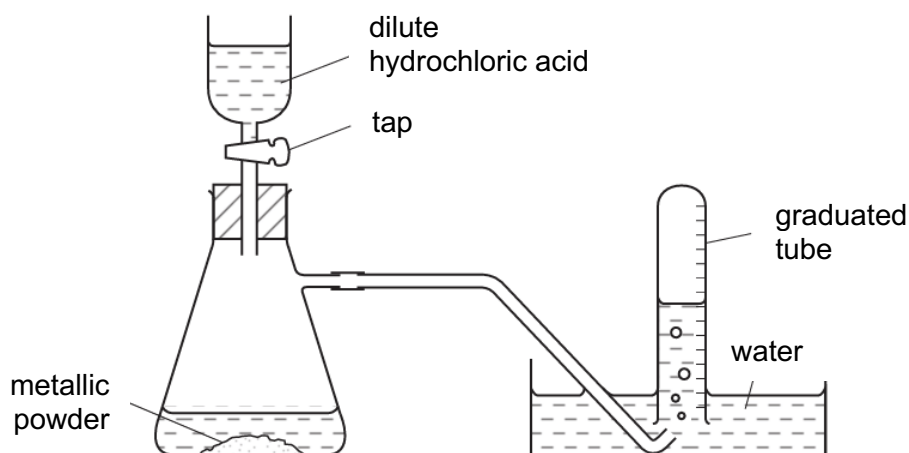
In beaker 3, metal Y is displaced from solution.

What is the order of decreasing reactivity of the four metals?

	most reactive ▶ least reactive			
A	W	X	Y	Z
B	Y	X	W	Z
C	Z	W	X	Y
D	Z	X	W	Y

- 32** The diagram shows the experimental setup for measuring the volume of hydrogen given off when an excess of dilute hydrochloric acid is added to powdered metal.

The volume of gas is measured at room temperature and pressure.



The experiment is carried out three times, using the same mass of powder each time but with different powders:

- pure magnesium
- pure zinc
- a mixture of magnesium and zinc

Which powder gives the greatest volume of hydrogen and which the least volume in 5 minutes?

	greatest volume of H ₂	least volume of H ₂
A	magnesium	zinc
B	magnesium	the mixture
C	zinc	magnesium
D	zinc	the mixture

- 33** Ammonia is produced using the Haber process.

Which row shows the source of the raw materials and the optimum reaction conditions?

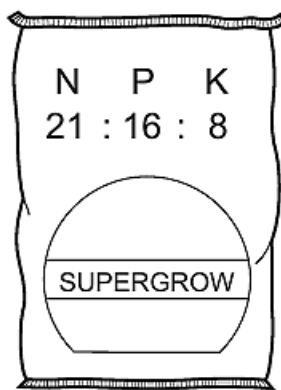
	source of nitrogen	source of hydrogen	temperature / °C	pressure / atm
A	air	hydrocarbons	200	450
B	hydrocarbons	air	450	200
C	air	hydrocarbons	450	200
D	air	hydrocarbons	450	450

- 34 The processes photosynthesis, respiration and fermentation all change the amount of carbon dioxide in the atmosphere.

Which process(es) increase(s) the amount of carbon dioxide in the atmosphere?

- A photosynthesis and fermentation
- B photosynthesis only
- C respiration and fermentation
- D respiration only

- 35 Which combination of chemical compounds can be used to produce the fertiliser shown?



- A $(\text{NH}_4)_3\text{PO}_4$, KCl
 - B NH_4NO_3 , $\text{Ca}_3(\text{PO}_4)_2$
 - C NH_4NO_3 , $\text{CO}(\text{NH}_2)_2$
 - D NH_4NO_3 , K_2SO_4 , $(\text{NH}_4)_2\text{SO}_4$
- 36 The two statements are about the fractional distillation of crude oil. The statements may or may **not** be correct. They may or may **not** be linked.

statement 1 Fractional distillation is used to separate crude oil into useful fractions.

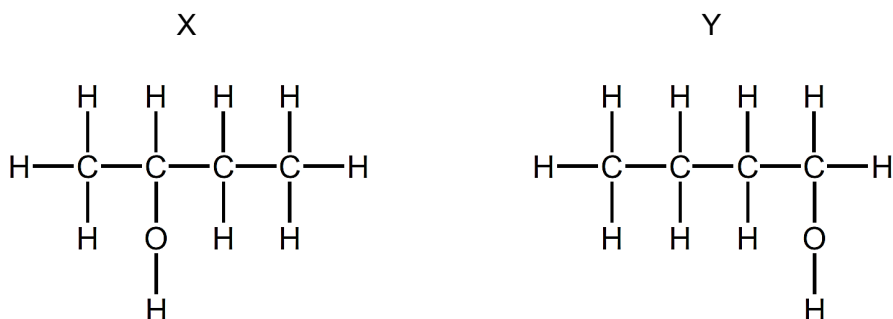
statement 2 The fractions with lower boiling points are found at the top of the fractionating column.

What is correct about these two statements?

- A Both statements are correct and statement 2 explains statement 1.
- B Both statements are correct but statement 2 does not explain statement 1.
- C Statement 1 is correct but statement 2 is incorrect.
- D Statement 1 is incorrect but statement 2 is correct.

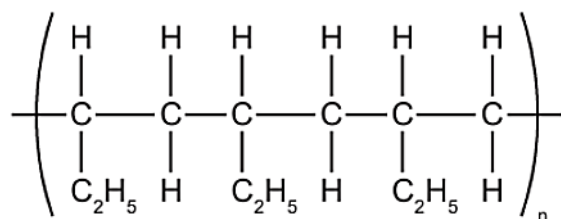
37 Which statements about alcohols are correct?

- 1 All alcohols contain the hydroxide ion, OH^- .
- 2 Ethanol can be formed from ethene using a reaction catalysed by yeast.
- 3 Methanol can be oxidised to methanoic acid.
- 4 The alcohols X and Y shown are isomers.



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

38 The section of a polymer chain is shown.



Which molecule would produce this polymer and by which type of polymerisation?

	molecule	type of polymerisation
A	$\text{CH}_3\text{—CH=CH—CH}_3$	condensation
B	$\text{CH}_3\text{—CH}_2\text{—CH=CH}_2$	addition
C	$\text{CH}_3\text{—CH}_2\text{—CH}_2\text{—CH=CH}_2$	condensation
D	$\text{CH}_3\text{—CH=CH—CH}_3$	addition

39 The formula of an ester is $\text{CH}_3\text{CH}_2\text{CH}_2\text{COOCH}_2\text{CH}_2\text{CH}_3$.

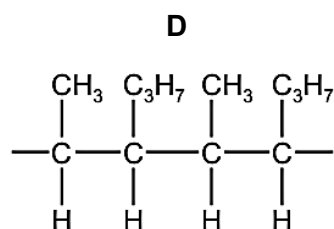
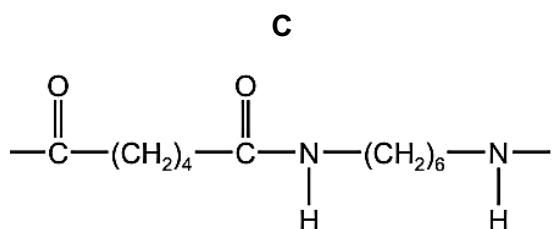
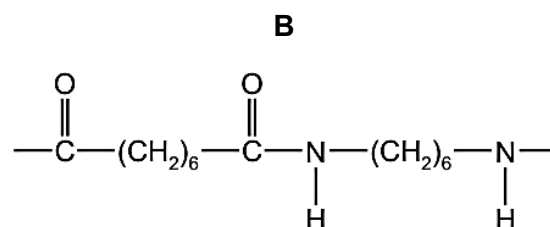
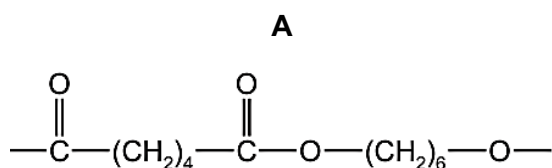
Which acid and alcohol react together to make the ester?

	acid	alcohol
A	butanoic acid	butanol
B	butanoic acid	propanol
C	propanoic acid	butanol
D	propanoic acid	propanol

40 P 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.

What is the partial structure of P?



Group																	
I	II	1 H hydrogen 1					III	IV	V	VI	VII	0					
3 Li lithium 7	4 Be beryllium 9	Key										2 He helium 4					
		proton (atomic) number atomic symbol name relative atomic mass															
	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
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											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											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.).