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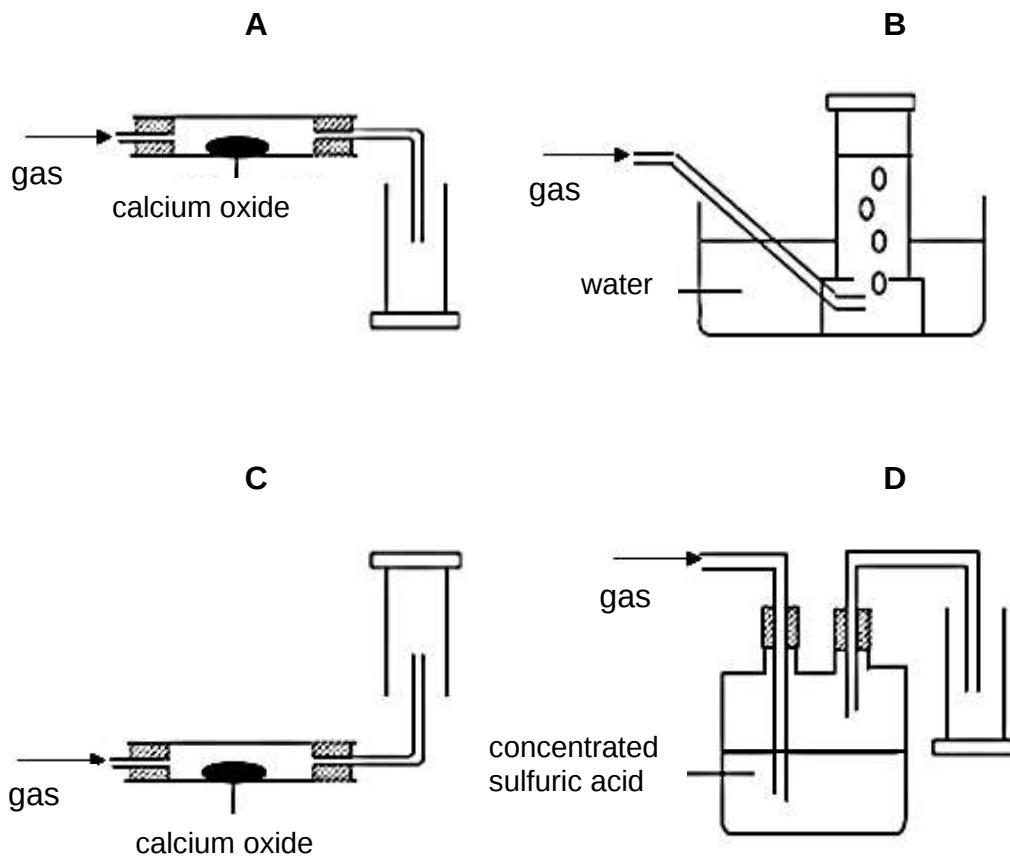
	HUA YI SECONDARY SCHOOL Preliminary Examination	
	4E CHEMISTRY Paper 1	4E 6092/1 16 September 2022 1 hour
	Candidates answer on the Multiple Choice Answer Sheet Additional Materials: Multiple Choice Answer Sheet	

READ THESE INSTRUCTIONS FIRST Write your Name, Index Number and Class on all the work you have done. Write in soft pencil. Do not use staples, paper clips, highlighters, 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 20.					
<table border="1"> <tr> <th colspan="2">For Examiner's Use</th> </tr> <tr> <td>Paper 1</td> <td></td> </tr> </table>		For Examiner's Use		Paper 1	
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Paper 1					

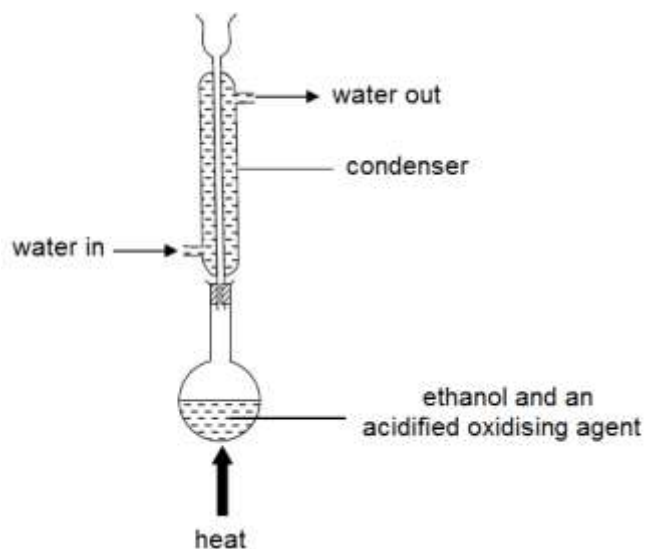
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- 1 A gas turns moist red litmus blue, is soluble in water and is less dense than air.

Which diagram shows a correct way of drying and collecting the gas?



- 2 The apparatus shown is commonly used to oxidise ethanol to ethanoic acid.



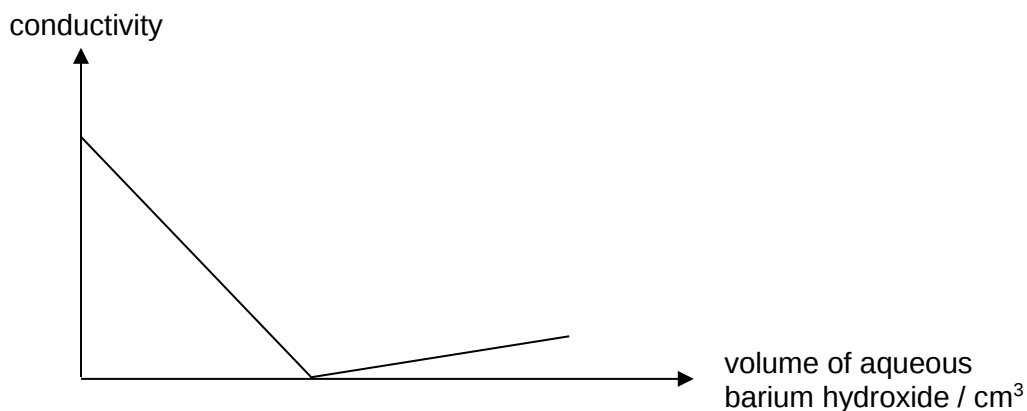
Which is the purpose of the condenser?

- A prevents air from oxidising ethanoic acid formed
 - B prevents ethanoic acid from reforming back to ethanol
 - C prevents ethanol from being converted to ethene
 - D prevents the escape of any unreacted ethanol
- 3 Ethyl acetate is an organic compound that is insoluble in water.

Given a mixture of ethyl acetate and aqueous copper(II) sulfate at room temperature, which two steps should be carried out to obtain samples of ethyl acetate and copper(II) sulfate crystals?

	step 1	step 2
A	fractional distillation	crystallisation
B	simple distillation	evaporation
C	using a separating funnel	crystallisation
D	using a separating funnel	evaporation

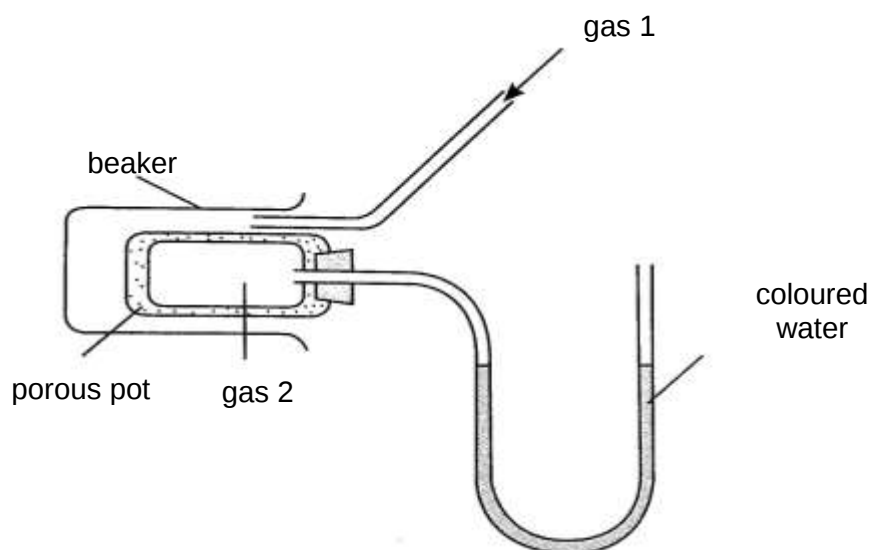
- 4 The diagram shows the change in electrical conductivity when aqueous barium hydroxide is added to a fixed volume of substance X.



Which of the following is **not** a possible identity for substance X?

- A aqueous zinc sulfate
 - B aqueous iron(III) nitrate
 - C aqueous sodium fluoride
 - D aqueous copper(II) chloride
- 5 Oxygen consists of two isotopes, oxygen-16 and oxygen-18.
- Which statement correctly describes the two isotopes of oxygen?
- A Both oxygen-16 and oxygen-18 have the same relative atomic mass.
 - B Both oxygen-16 and oxygen-18 form ions with a charge of -2.
 - C Oxygen-16 has different chemical properties from oxygen-18.
 - D Oxygen-16 and oxygen-18 have different electronic configurations.

- 6 The apparatus shown is used to investigate the diffusion of gases.



It was observed that the water level of the coloured water did not change even after gas 2 was delivered into the beaker for some time.

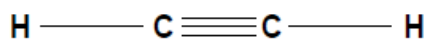
Which of the following could be the identities of gases 1 and 2?

	gas 1	gas 2
A	C_2H_4	N_2
B	C_2H_6	O_2
C	CO_2	NH_3
D	SO_2	HCl

- 7 How does rubidium bond with fluorine?

- A** Each atom of rubidium receives an electron from a fluorine atom.
B Each atom of rubidium shares a pair of electrons with a fluorine atom.
C Each atom of rubidium shares an electron with a fluorine atom.
D Each atom of rubidium gives an electron to a fluorine atom.

- 8 The structural formula of ethylene molecule is shown.



What is the total number of shared electrons in each ethylene molecule?

- A** 3 **B** 5 **C** 6 **D** 10

- 9 Which statement explains why graphite and copper can conduct electricity in solid state?
- A Both graphite and copper contain mobile electrons.
B Both graphite and copper contain mobile ions.
C Graphite contains mobile electrons while copper contains mobile ions.
D Graphite and copper contain both mobile electrons and mobile ions.

- 10 On complete combustion, a sample of hydrocarbon gives 11.0 g of carbon dioxide and 9.0 g of water.

What is the molecular formula of the hydrocarbon?

- A CH_4
B C_2H_4
C C_3H_6
D C_3H_8
- 11 The main ore of zinc is zinc blende, ZnS . When this ore is heated in air, the reaction is represented by the following equation.

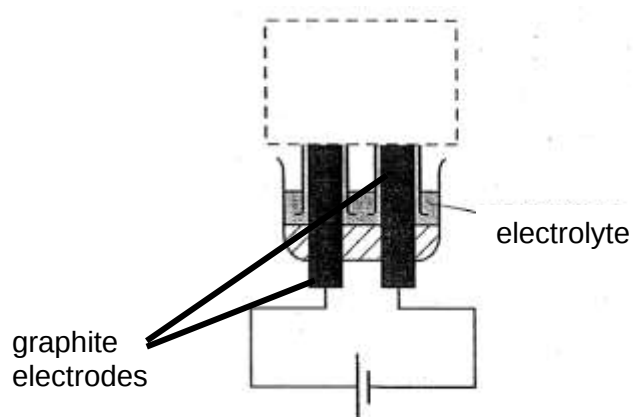


What volume of oxygen at room temperature and pressure would be required to react completely with 194 g of ZnS ?

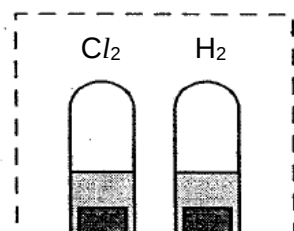
- A 3 dm^3 B $\frac{3 \times 24}{2} \text{ dm}^3$ C $3 \times 24 \text{ dm}^3$ D $3 \times 32 \text{ dm}^3$
- 12 When 20 g of impure calcium carbonate is heated, 6.6 g of carbon dioxide is obtained.
- What is the percentage purity of the sample of calcium carbonate?
(assume that none of the impurity produce carbon dioxide on heating)

- A 15.0% B 25.0% C 55.0% D 75.0%

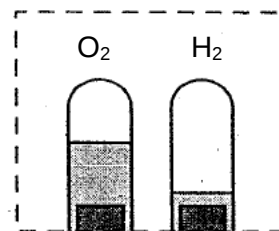
- 13 The diagram shows an incomplete diagram of an electrolysis experiment.



A student carries out the experiment above and obtains two different results 1 and 2 as shown.



result 1

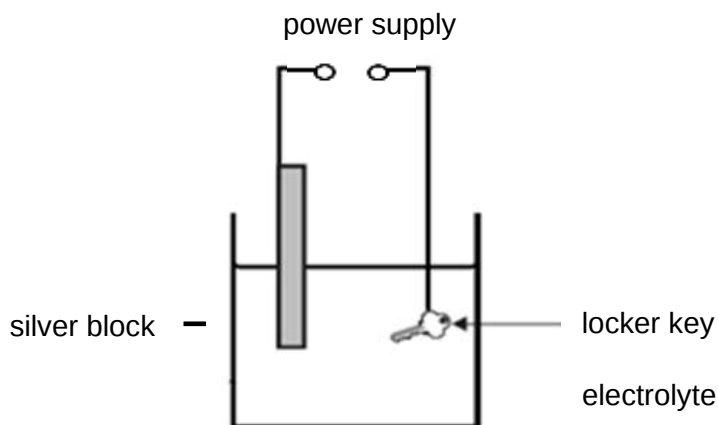


result 2

Which of the following correctly identifies the electrolyte used in the experiment to obtain results 1 and 2?

	electrolyte used to obtain result 1	electrolyte used to obtain result 2
A	dilute hydrochloric acid	dilute sodium chloride
B	concentrated hydrochloric acid	dilute nitric acid
C	concentrated sodium chloride	concentrated hydrochloric acid
D	dilute sodium chloride	dilute nitric acid

- 14** A student decided to silver-plate a locker key.



Which of the following combination gives the most suitable set-up for the electroplating?

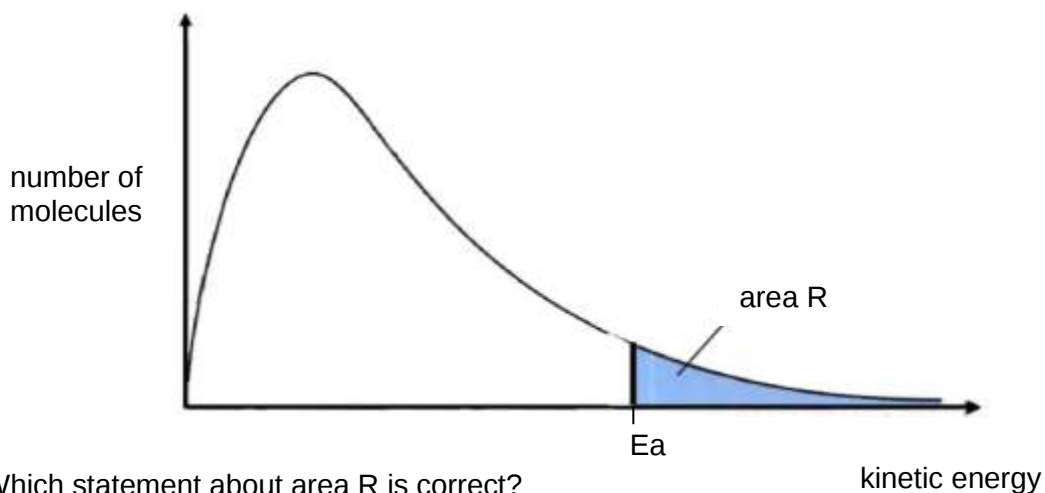
	anode	cathode	electrolyte
A	locker key	silver block	sulfuric acid
B	locker key	silver block	aqueous silver nitrate
C	silver block	locker key	sulfuric acid
D	silver block	locker key	aqueous silver nitrate

- 15** A reversible reaction is exothermic in the forward direction and the heat given out is 196 kJ/mol. The activation energy for the forward direction is 75 kJ/mol.

What is the activation energy of the reverse direction?

- A** 75 kJ/mol
- B** 121 kJ/mol
- C** 196 kJ/mol
- D** 271 kJ/mol

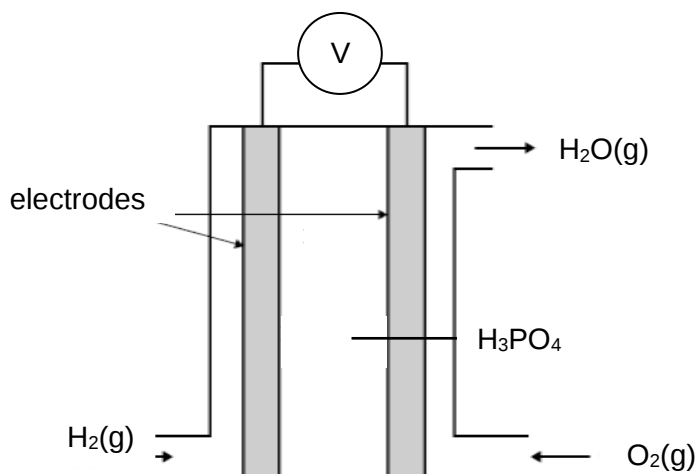
- 16 The diagram shows the distribution of kinetic energy of a sample of gaseous molecules at a fixed temperature. E_a is the activation energy for the decomposition of this gas.



Which statement about area R is correct?

- A Addition of a catalyst moves the position of the E_a to the right.
 - B All the molecules in area R possess energy no higher than the E_a .
 - C Molecules in area R have enough energy for the reaction.
 - D The collisions between molecules in area R are not successful.
- 17 Phosphoric acid fuel cell, PAFC, is a fuel cell that can provide power for vehicles.

A simplified sketch of PAFC is shown.

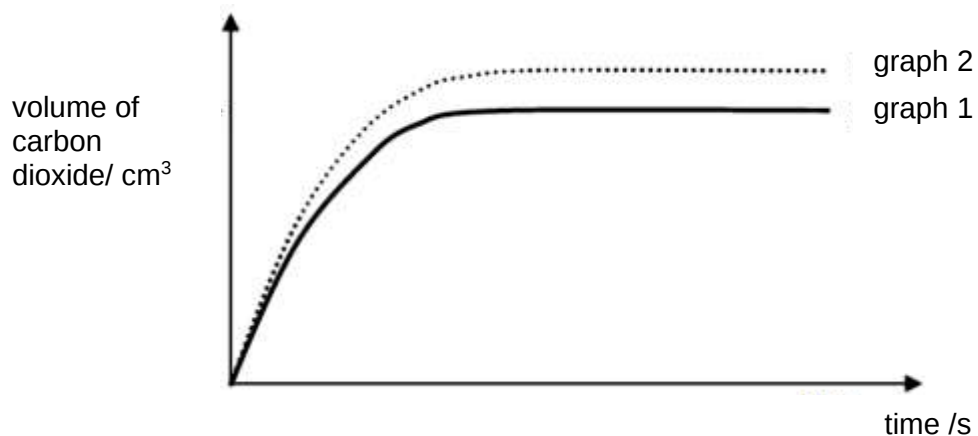


Which statement about the above PAFC is **incorrect**?

- A Phosphoric acid acts as a fuel.
- B The only waste product is non-polluting.
- C The fuel cell uses hydrogen gas and oxygen gas to produce electricity.
- D The fuel cell requires reactants to be continuously supplied to produce electricity.

- 18** In an experiment, an excess of 2 mol/dm^3 dilute hydrochloric acid was reacted with 50 cm^3 of 1 mol/dm^3 aqueous potassium carbonate.

The results of the experiment are shown in graph 1.



Which of the following changes to graph 1 would produce graph 2?

- A** adding a catalyst to the reaction mixture
- B** adding a small amount of solid potassium carbonate to the reaction mixture
- C** adding water to the reaction mixture
- D** increasing the concentration of hydrochloric acid
- 19** A textbook writes “Nitric acid, HNO_3 , is a strong oxidising agent”.
- Which of the following cannot be a product of nitric acid in its reaction with a reducing agent?
- A** N_2
- B** N_2O_5
- C** NO
- D** NO_2

- 20** An excess of iron(II) chloride is added to acidified potassium manganate(VII).

Which statements are correct?

- 1 Iron(II) ions are reduced to iron(III) ions.
- 2 Manganate(VII) ions are oxidised to manganese(II) ions.
- 3 Potassium manganate(VII) is an oxidising agent.
- 4 The purple solution disappears.

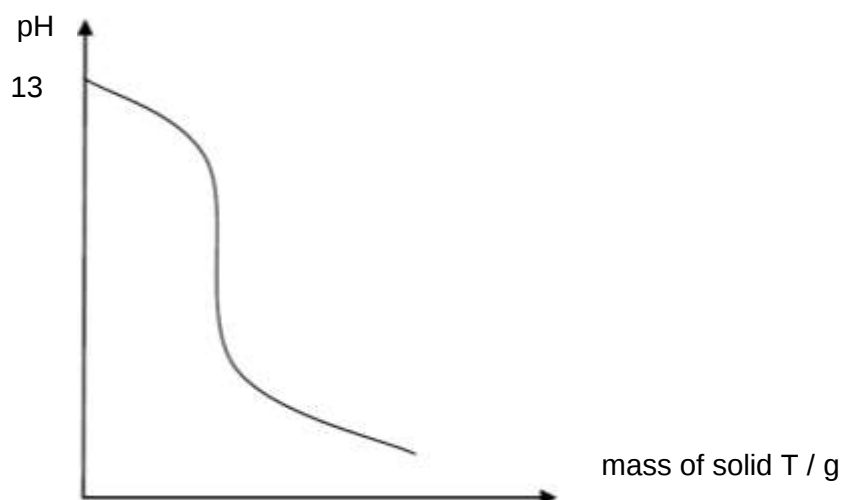
- A** 1 and 2
B 1 and 4
C 2 and 3
D 3 and 4

- 21** An unknown acid dissociate completely in water to produce 0.5 mol of H^+ ion.

Which of the following acids will produce the same amount of H^+ ion when dissociated in water?

- A** 200 cm^3 of 2.0 mol/dm^3 of ethanoic acid
B 200 cm^3 of 2.0 mol/dm^3 of hydrochloric acid
C 500 cm^3 of 1.0 mol/dm^3 of nitric acid
D 500 cm^3 of 1.0 mol/dm^3 of sulfuric acid

- 22 Solid T is gradually added to aqueous solution U. The changes in pH are shown on the graph.



What are substances T and U?

	substance T	substance U
A	insoluble metal oxide	nitric acid
B	soluble metal oxide	hydrochloric acid
C	soluble non-metal oxide	aqueous ammonia
D	soluble non-metal oxide	sodium hydroxide

- 23 Which of the following pairs of reactants is most suitable for preparing the given salt?

	reactants	salt
A	copper and sulfuric acid	copper(II) sulfate
B	lead(II) carbonate and sulfuric acid	lead(II) sulfate
C	sodium nitrate and hydrochloric acid	sodium chloride
D	zinc oxide and nitric acid	zinc nitrate

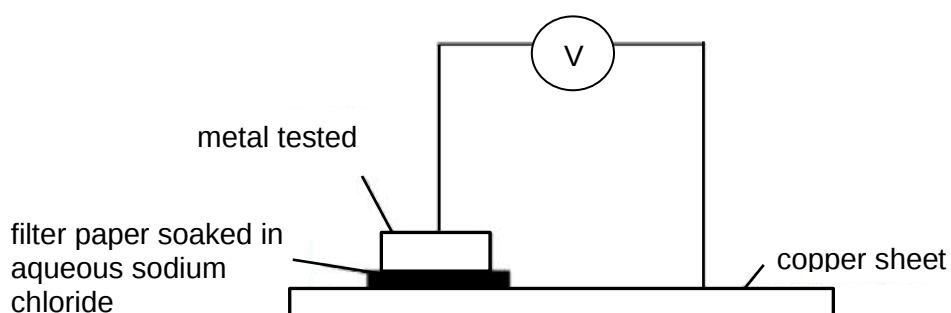
- 24 Which reaction will **not** produce ammonia gas?

- A heating ammonium chloride
- B heating a mixture of ammonium chloride and limewater
- C heating a mixture of sodium nitrate and dilute sulfuric acid
- D heating nitrogen gas and hydrogen gas

- 25** Across a period of the Periodic Table, there is a trend from metallic to non-metallic elements.

Which statement provides the explanation for the trend?

- A** This is due to an increase in mass number.
B This is due to an increase in number of electron shells.
C This is due to an increase in number of neutrons.
D This is due to an increase in number of valence electrons.
- 26** The reactivity of Group II metals follows a similar trend as that of Group I metals. The diagram shows four Group II metals A, B, C and D being tested in an electric cell.



The voltage produced is recorded and shown in the table.

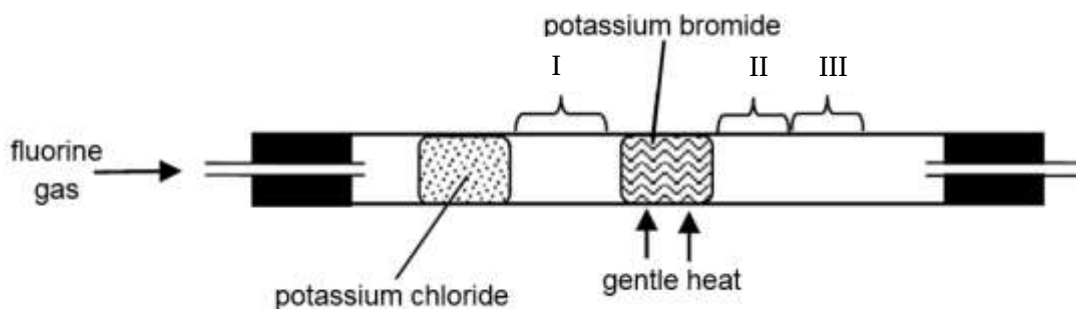
metal	voltage / V
A	0.2
B	0.6
C	0.4
D	0.8

The four metals tested are calcium, magnesium, strontium and barium.

What is the possible identity of metal C?

- A** barium
B calcium
C magnesium
D strontium

- 27 Using the apparatus shown, fluorine gas was passed through the tube. After a short time, coloured substances were seen at points I, II and III.



Which row correctly shows the observations at I, II and III?

	I	II	III
A	green gas	orange-brown vapour	reddish-brown liquid
B	green gas	yellow gas	orange-brown vapour
C	pale-yellow gas	green gas	reddish-brown liquid
D	pale-yellow gas	orange-brown vapour	reddish-brown liquid

- 28 Zirconium, Zr, is a transition metal. It burns with a white light to form a mixture of zirconium(II) oxide and zirconium(IV) oxide.

These oxides react with both acids and bases. Zirconium is resistant to corrosion. Zirconium oxide can speed up the rate of some chemical reactions hence is widely used in the chemical industry.

Which statements show that zirconium is a transition metal?

- 1 The oxides of zirconium are amphoteric.
- 2 Zirconium has oxidation states of +2 and +4 in its oxides.
- 3 Zirconium is resistant to corrosion.
- 4 Zirconium oxide can speed up chemical reactions.

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

29 The reactions of four metals, P, Q, R and S, are as described.

- Metals Q and S can be extracted by reacting their metal oxides with carbon but metals P and R can only be extracted by electrolysis of its molten compounds.
- Metal Q can also be extracted by heating its metal oxide with metal S.
- The metal carbonate of P decomposes more readily than the metal carbonate of R.

What is the correct order in decreasing reactivity for the four metals?

- A** P, R, Q, S
- B** P, R, S, Q
- C** R, P, Q, S
- D** R, P, S, Q

30 Three metal oxides each have the formula G_2O_3 .

Which statements about these oxides are correct?

- 1 If the relative molecular mass, M_r , for the oxide is 152, metal G is chromium.
- 2 If the relative molecular mass, M_r , for the oxide is 160, metal G does not corrode in dry air.
- 3 If the relative molecular mass, M_r , for the oxide is 102, the oxide of metal G is amphoteric.

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

- 31** The properties of three common types of steel are listed in the table.

steel H	brittle
steel J	malleable
steel K	resistant to corrosion

Which row matches the type of steel to its properties?

	steel H	steel J	steel K
A	high carbon steel	low carbon steel	stainless steel
B	low carbon steel	high carbon steel	stainless steel
C	stainless steel	high carbon steel	low carbon steel
D	stainless steel	low carbon steel	high carbon steel

- 32** Blocks of magnesium were bolted onto steel hull of a ship.

This is done to increase the working life of the steel hull by preventing or slowing down the formation of rust.

Which statement provides the explanation?

- A** Magnesium reacts with steel hull to form an alloy.
- B** Magnesium has corrosion resistant properties.
- C** Magnesium is oxidised in preference to iron found in the steel hull.
- D** Magnesium minimises contact of oxygen and water with the steel hull.

- 33** Acid rain contains sulfuric acid and causes lakes to become acidic. Acidic lakes may be treated with powdered limestone (impure calcium carbonate) to neutralise the acidity. Calcium sulfate is formed. If large lumps of limestone are used, instead of powdered limestone, the reaction starts but soon stops, leaving most of the limestone unreacted.

Which statements explains why the reaction starts but soon stops?

- A** A layer of insoluble calcium sulfate forms on the surface of the lumps.
- B** Limestone only contains small amounts of calcium carbonate.
- C** Powdered limestone is more reactive than lumps of limestone.
- D** The acid reacts with the calcium sulfate instead of the calcium carbonate.

- 34** Cars are installed with either diesel or petrol engines. The combustion of fuels such as diesel and petrol produces air pollutants.

The table shows the mass of air pollutants found in exhaust fumes when 1 kg of each fuel is combusted under identical conditions.

air pollutant produced	mass of air pollutant after diesel is combusted / g	mass of air pollutant after petrol is combusted / g
carbon monoxide	15	300
unburnt hydrocarbons	20	25
oxides of nitrogen	95	40

Which of the following can be inferred from the above data?

- A** A diesel engine has a higher temperature than a petrol engine.
- B** Burning of petrol contributes more towards formation of acid rain.
- C** Combustion of petrol is more exothermic than that of diesel.
- D** Petrol requires less oxygen for complete combustion.
- 35** Which one of the following substances can be used to remove sulfur dioxide from flue gases?
- A** calcium carbonate
- B** carbon dioxide
- C** dichlorofluoromethane
- D** dilute hydrochloric acid
- 36** Which property shows an increase in the alkane series from butane → propane → ethane → methane?
- A** boiling point
- B** flammability
- C** melting point
- D** viscosity
- 37** Which property does not change in the polymerisation of ethene to form poly(ethene)?
- A** boiling point
- B** density
- C** empirical formula
- D** mass

- 38** X is an organic compound containing four carbon atoms. It gives negative results with the following tests.

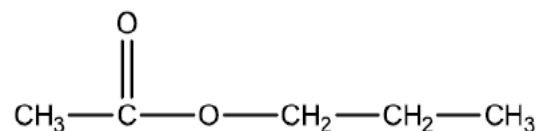
- reacting X with aqueous bromine
- reacting X with acidified potassium manganate (VII) solution
- reacting X with sodium carbonate solution

Which of the following could be the structural formula of X?

- A** $\text{CH}_3\text{CH}_2\text{CO}_2\text{CH}_3$
B $\text{CH}_3\text{CH}_2\text{CH}=\text{CH}_2$
C $\text{CH}_3\text{CH}_2\text{CH}_2\text{CO}_2\text{H}$
D $\text{CH}_3\text{CH}_2\text{CH}_2\text{OH}$

- 39** Esters are sweet smelling substances found in fruits and flowers.

The diagram shows an ester found in pears.

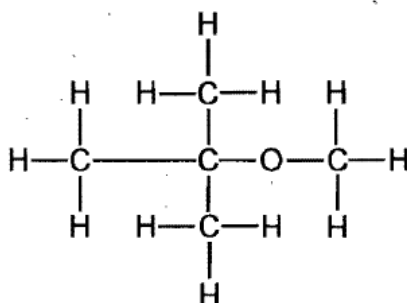


Which of the following pair of compounds react together to form the ester shown?

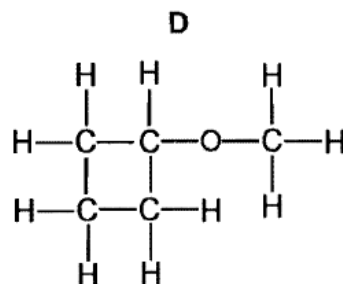
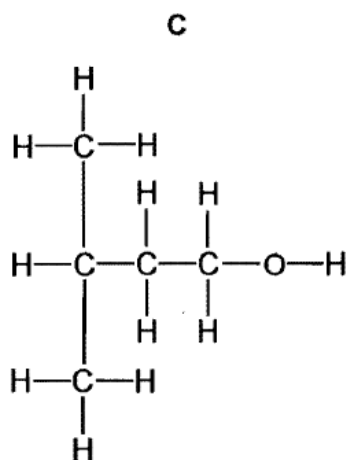
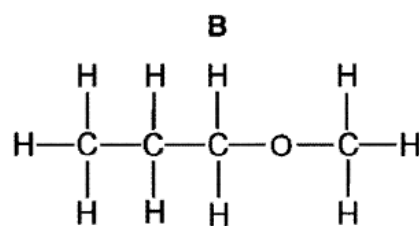
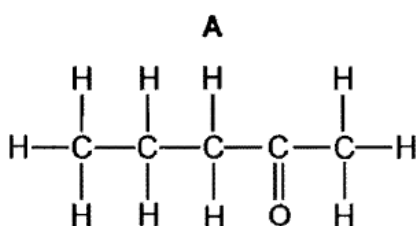
- A** butanoic acid and methanol
B ethanoic acid and propanol
C methanoic acid and butanol
D propanoic acid and ethanol

- 40 A compound known in industry as 'MTBE' is used as an additive in 'lead-free' petrol.

The structural formula of MTBE is shown.



Which compound is an isomer of MTBE?



End of Paper

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Group																	
I	II	1 H hydrogen 1										III	IV	V	VI	VII	0
Key proton (atomic) number atomic symbol name relative atomic mass																	
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 -	117 Ts tennessine -	118 Og oganesson -	119 Nh nihonium -	120 Ds darmstadtium -

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 americum -	96 Cm curium -	97 Bk berkelium -	98 Cf californium -	99 Es einsteinium -	100 Fm fermium -	101 Md mendelevium -	102 No nobelium -	103 Lr lawrencium -

