Class	Register Number

Name ______________________________

6092/01
CHEMISTRY

22/4P/6092/1

PAPER 1

Monday **12 September 2022** **1 hour**

VICTORIA SCHOOL

PRELIMINARY EXAMINATION
SECONDARY FOUR

Additional materials: Multiple Choice Answer Sheet

READ THESE INSTRUCTIONS FIRST

Write in soft pencil.
Write your name, class and index number on all the work you hand in.
Do not use staples, paper clips, 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 that 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.

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

A copy of Periodic Table is printed on **page 16**.

1 Which statement about states of matter is correct?

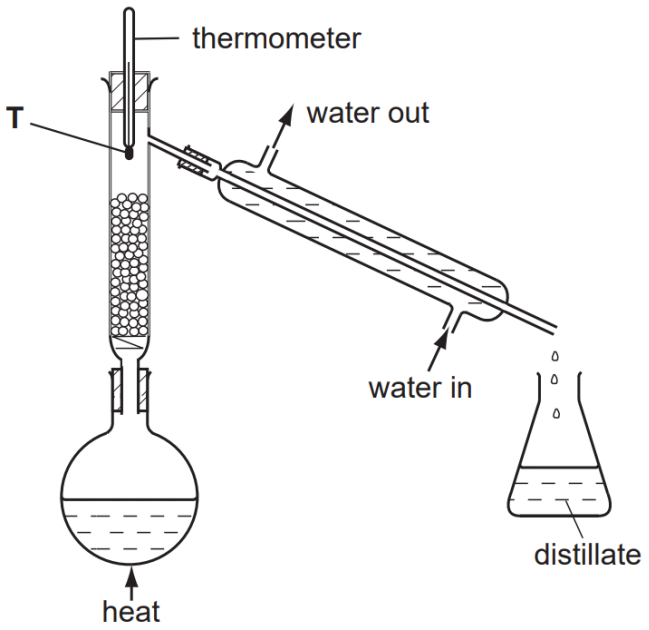
A When a liquid reaches its boiling point, it becomes a gas. This process is called evaporation.

B When a gas condenses, it becomes a liquid and energy is lost to the surroundings.

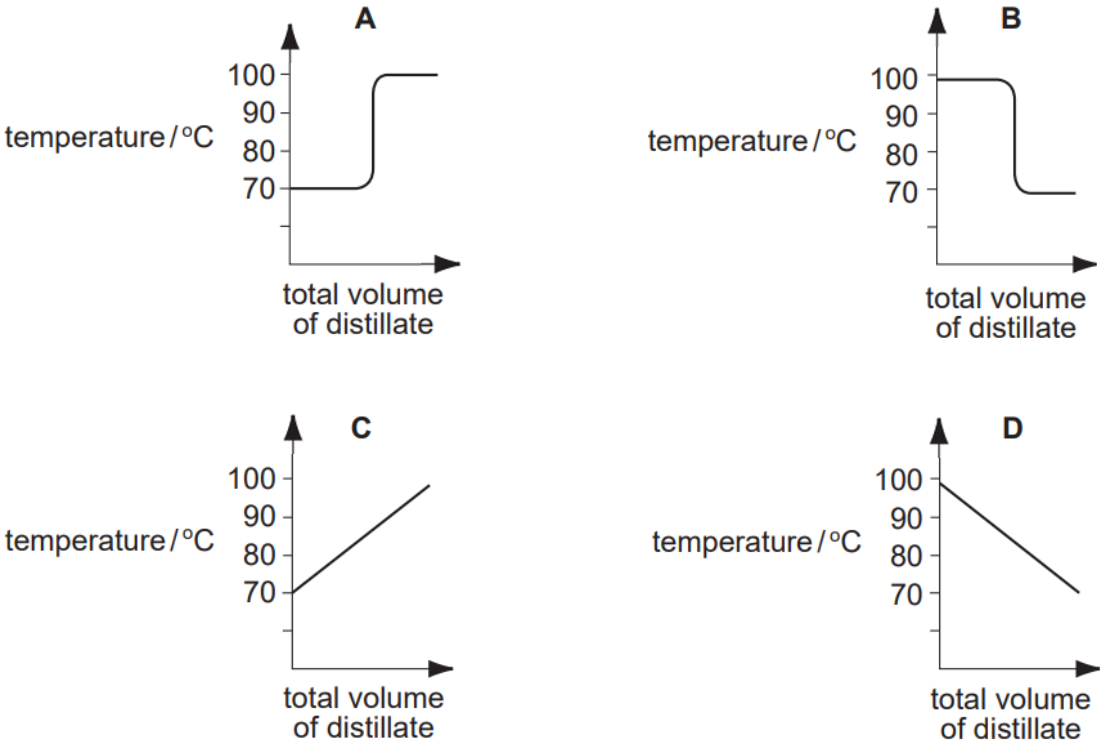
C When a solid changes directly to a gas, the process is called deposition.

D When a solid melts, the particles get further apart and have less energy.

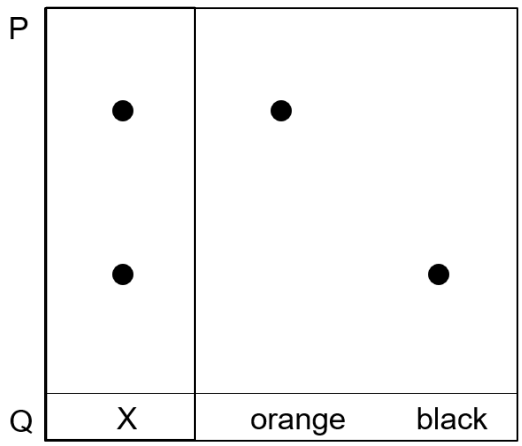
2 The diagram shows apparatus used to separate hexane (boiling point, 70 °C) and heptane (boiling point, 98 °C)?



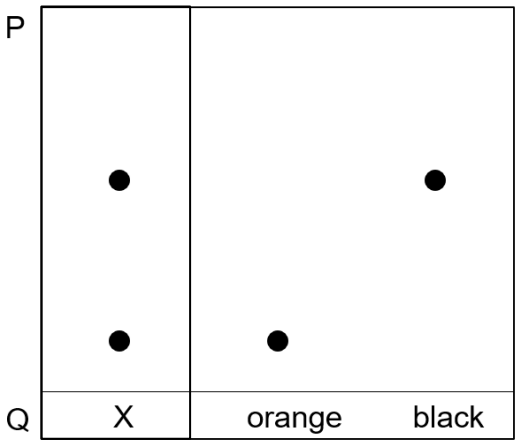
Which graph would be obtained if the temperature at point T was plotted against the total volume of distillate collected?



3 The colours in a soft drink, X, was analysed by chromatography. The experiment was performed using two different solvents, water and ethanol. The results are shown below.



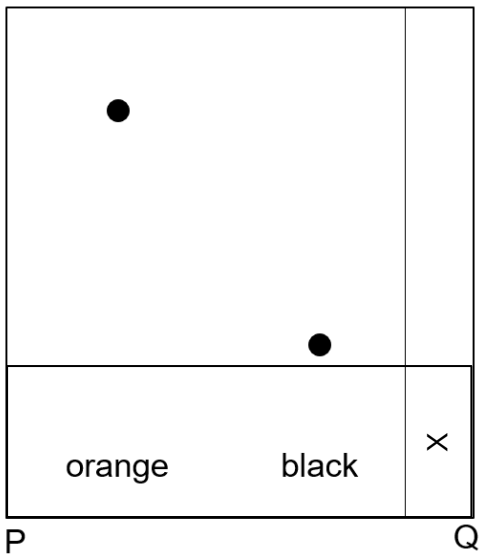
water



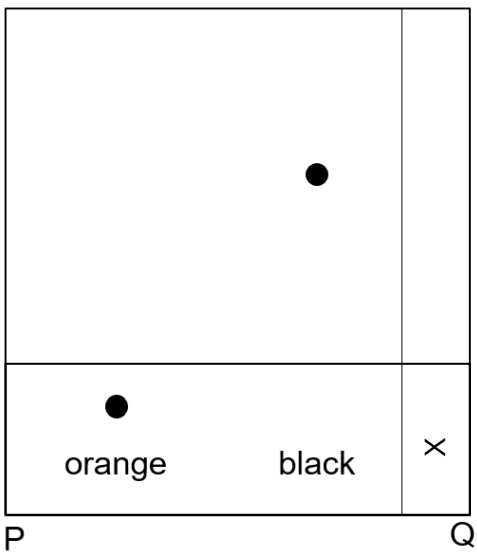
ethanol

How would the final chromatogram appear if only mixture X was first developed in water, then turned through 90° anticlockwise and edge PQ was placed in ethanol?

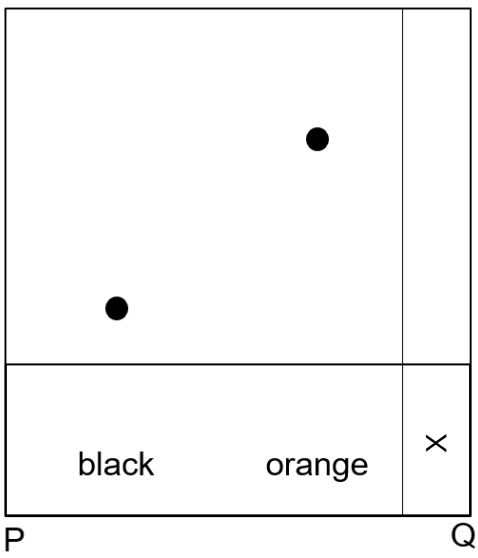
A



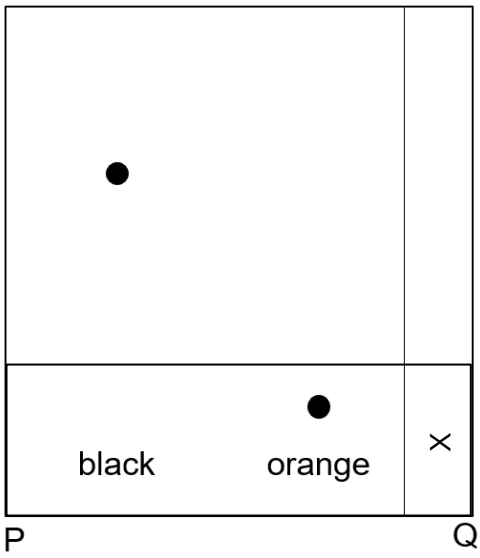
B



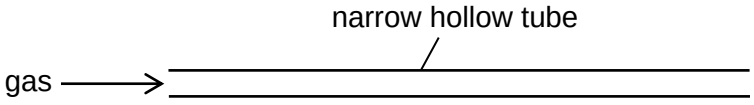
C



D



4 A gas is allowed to diffuse across a narrow hollow tube as shown below.



Which of the following changes will not affect the rate of diffusion of the gas through the tube?

A place the tube vertically

B lower the temperature of the gas from 25 °C to 20 °C

C lowering the pressure from 1 atm to 0.5 atm

D replacing the nitrogen gas with carbon monoxide gas

5 Which of the following is an element and forms crystals containing polyatomic molecules?

A copper

B graphite

C iodine

D oxygen

6 The metals Cr, Co, Fe and Mn are transition elements.

Which particles have the same number of electrons?

A Co^{2+} and Cr

B Co^{2+} and Fe^{3+}

C Cr and Mn^{2+}

D Fe^{3+} and Mn^{2+}

7 Naturally-occurring bromine has a relative atomic mass of 80 and consists entirely of two isotopes of relative atomic masses 79 and 81.

What can be deduced about naturally-occurring bromine from this information only?

A Bromine contains the two isotopes in equal proportions.

B Bromine has different oxidation states.

C Bromine isotopes have different numbers of protons.

D Bromine is radioactive.

8 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 forces of attraction between the molecules

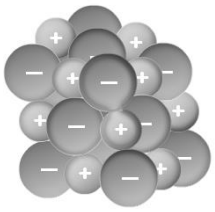
B reactivity of the molecules

C size of the molecules

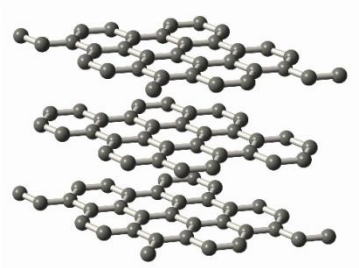
D strength of the covalent bonds in the molecules

9 The diagram below shows three substances which can conduct electricity.

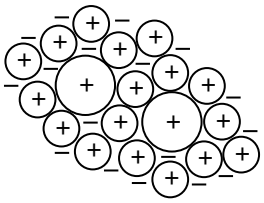
I



II



III



What are the particles that enable them to conduct electricity?

	I	II	III
A	electrons	electrons	electrons
B	ions	atoms	electrons and ions
C	ions	electrons	electrons
D	electrons and ions	atoms and electrons	electrons and ions

10 Which statement is typical of a solid non-metal element?

A It conducts electricity.

B It forms an acidic oxide.

C It has more than one oxidation state.

D It reacts vigorously with chlorine.

11 The statements below describe elements X and Y.

An atom of X has more protons than an atom of Y.

An atom of Y has more valence electrons than an atom of X.

Particles of X and Y combine to form an ionic structure.

Which of the following statements can be deduced based on the statements above?

A An atom of X has more electron shells than an atom of Y.

B X forms negatively charged ions.

C X and Y are in the same period of the Periodic Table.

D X and Y are in the same group of the Periodic Table.

12 Part of the procedure to obtain crystals of a soluble salt is shown below.

1 25.0 cm^3 of a dilute acid was accurately measured into a conical flask.

2 A known, accurate volume of alkali was gradually added to the conical flask until the solution was neutral.

3 The solution was then heated in an evaporating dish, cooled and washed with approximately 10 cm^3 of cold distilled water.

Which of the following shows the correct apparatus used in steps 1 to 3?

	1	2	3
A	burette	pipette	measuring cylinder
B	measuring cylinder	burette	pipette
C	pipette	burette	measuring cylinder
D	pipette	measuring cylinder	burette

13 An alloy of copper and zinc is added to an excess of dilute hydrochloric acid. The resulting mixture is then filtered.

Which observations are correct?

	filtrate	residue
A	colourless solution	none
B	colourless solution	red-brown
C	blue solution	grey
D	blue solution	none

14 Solid X is insoluble in water. It gives off a gas when heated and also when reacted with dilute sulfuric acid.

What is X?

A aluminium oxide

B sodium carbonate

C sodium nitrate

D zinc carbonate

15 Hydrazine (N_2H_4) is a powerful reducing agent. When reacted with aqueous solution containing silver ions, nitrogen is one of the products formed.

Which one of the following equations is the ionic equation of this reaction?

A $N_2H_4 + 2Ag^+ \rightarrow N_2 + 2AgH_2$

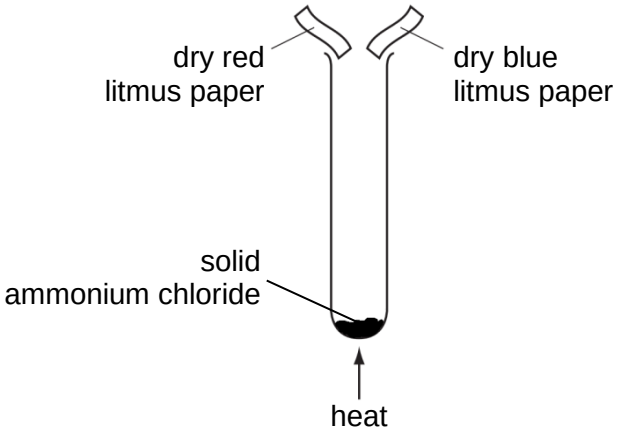
B $N_2H_4 + Ag^+ \rightarrow N_2 + 2H_2 + Ag$

C $N_2H_4 + Ag^+ \rightarrow N_2 + 4H^+ + Ag$

D $N_2H_4 + 4Ag^+ \rightarrow N_2 + 4H^+ + 4Ag$

16 Ammonium chloride decomposes to form ammonia and hydrogen chloride when heated as shown in the diagram below.

$$NH_4Cl(s) \rightleftharpoons NH_3(g) + HCl(g)$$



What will be observed after some time?

	red litmus paper	blue litmus paper
A	turns blue	turns red then blue
B	turns blue then red	turns red
C	turns blue then red	turns red then blue
D	no change	no change

17 The addition of dilute acid to a solution containing anion Q and the subsequent addition of barium nitrate can be used to identify the anion Q.

What is Q?

A carbonate

B chloride

C iodide

D sulfate

18 Which of the following is the best method to prepare a pure and dry sample of magnesium carbonate from a solid mixture of magnesium carbonate and lead(II) oxide?

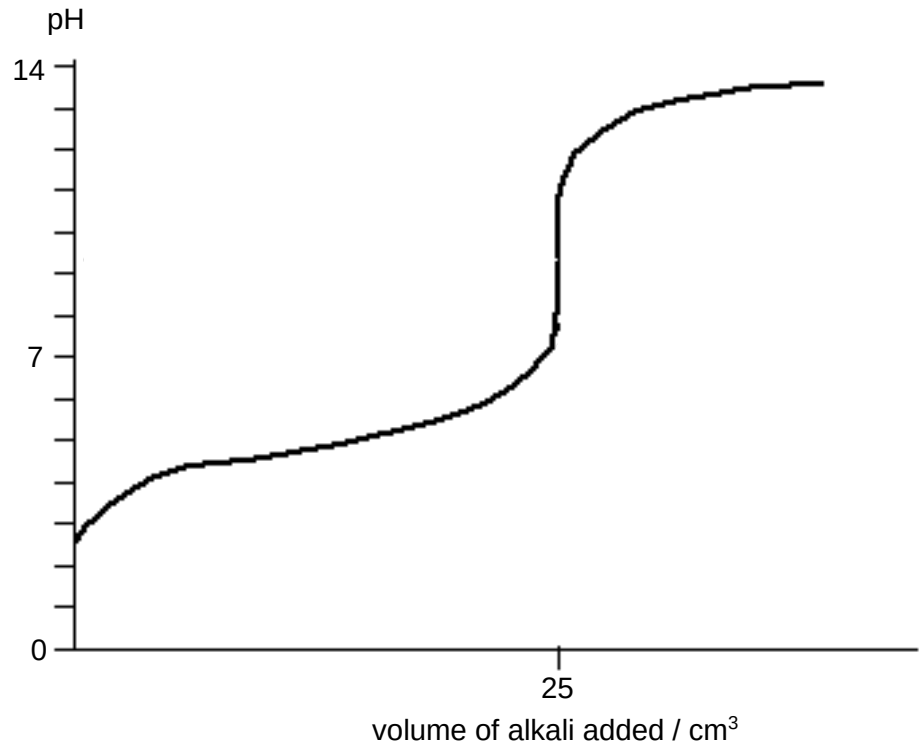
A Add excess dilute acid, filter, crystallise filtrate, filter and dry.

B Add excess dilute acid, filter, rinse residue with distilled water and dry.

C Add excess aqueous sodium hydroxide, filter, rinse residue with distilled water and dry.

D Add excess aqueous sodium hydroxide, filter and heat filtrate to dryness.

19 Joe titrated dilute ethanoic acid with aqueous sodium hydroxide. The pH changes were recorded with a pH meter and represented in the graph below.



The diagram below shows the pH ranges of three indicators.

pH	1	2	3	4	5	6	7	8	9
methyl orange	red			yellow					
phenolphthalein	colourless								pink
bromothymol blue	yellow					blue			

Which indicator(s) can Joe use to determine the end-point of the titration?

A methyl orange only

B phenolphthalein only

C bromothymol blue and phenolphthalein only

D bromothylmol blue, methyl orange and phenolphthalein

20 The Haber process is used to make ammonia at a temperature of 450 °C and a pressure of 200 atm. The temperature is changed to 700 °C but the pressure is kept the same.

What will be the effects of this change on the production of ammonia?

A It is made at an increased rate and the yield increases.

B It is made at an increased rate and the yield decreases.

C It is made at a decreased rate and the yield increases.

D It is made at a decreased rate and the yield decreases.

21 Aqueous acidified potassium manganate(VII) was added to a 2.30 g sample of ethanol. The mixture was then boiled under reflux for some time.

The percentage yield of the organic product collected by distillation was 60.0%.

What is the mass of the product collected?

A 1.32 g **B** 1.80 g **C** 3.00 g **D** 5.00 g

22 Ammonia is used to make nitric acid, HNO_3 by the Ostwald Process.

Three reactions occur in the following stages.

1 $4NH_3(g) + 5O_2(g) \rightarrow 4NO(g) + 6H_2O(g)$

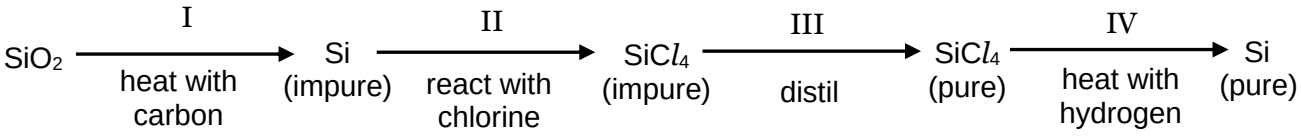
2 $2NO(g) + O_2(g) \rightarrow 2NO_2(g)$

3 $3NO_2(g) + H_2O(l) \rightarrow 2HNO_3(aq) + NO(g)$

What is the number of moles of nitric acid produced from the reaction between 50.0 dm^3 of oxygen gas and excess ammonia gas in stage 1?

A 1.11 **B** 1.25 **C** 1.39 **D** 1.74

23 The reaction scheme represents the process for obtaining pure silicon.



In which of the stages is the silicon reduced?

A I only **B** IV only **C** I and IV **D** II and III

24 Three chemical reactions are represented as shown in the equations below.

$$Cl_2 + 2H_2O + SO_2 \rightarrow 2HCl + H_2SO_4$$

$$Cl_2 + H_2S \rightarrow 2HCl + S$$

$$SO_2 + 2H_2S \rightarrow 2H_2O + 3S$$

Which of the following shows the reducing power of the reducing agents in a decreasing order?

A chlorine, hydrogen sulfide, sulfur dioxide

B chlorine, sulfur dioxide, hydrogen sulfide

C hydrogen sulfide, sulfur dioxide, chlorine

D sulfur dioxide, hydrogen sulfide, chlorine

25 Which is a property of aqueous potassium iodide?

A It does not conduct electricity.

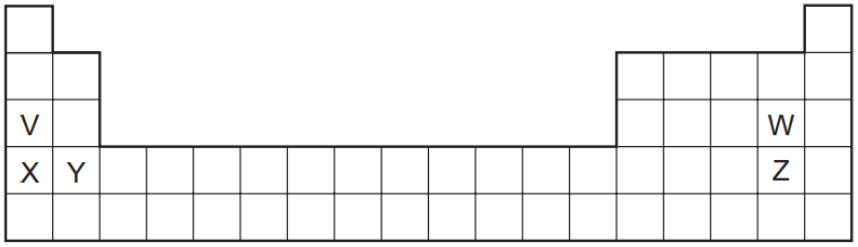
B It is a purple solution.

C It is decolourised by chlorine.

D It reacts with aqueous bromine to form iodine.

26 Part of the Periodic Table is shown.

The letters are not the symbols of the elements.



Which statement about the elements is not correct?

A V is less reactive than X.

B W is more reactive than Z.

C Y forms an ion with same electronic configuration as X.

D Z has a higher melting point than W.

27 The exhaust gas of a car fitted with a catalytic converter contains oxides of nitrogen.

Which of the following modifications should be made to lower the concentration of oxides of nitrogen present in the exhaust gas?

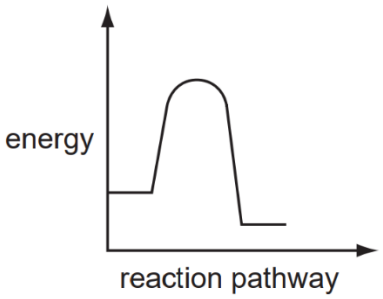
1 decrease the size of the catalyst in the converter

2 increase the temperature of combustion in the engine

3 increase the rate of exhaust gas flowing through the converter

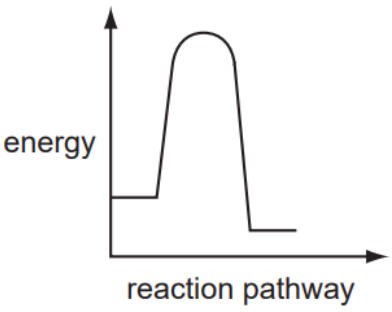
A 1 only **B** 1 and 3 only **C** 2 and 3 only **D** 1, 2 and 3

28 The diagram shows the reaction pathway for the forward reaction of a reversible reaction without a catalyst.

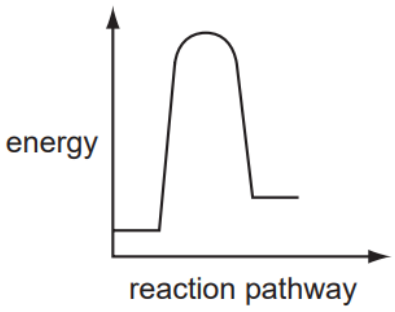


Which diagram shows the addition of a catalyst that speeds up the backward reaction?

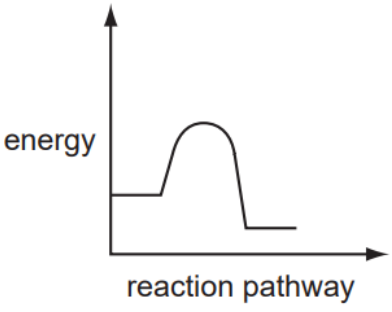
A



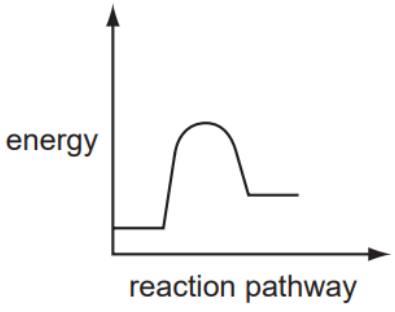
B



C



D



29 The scheme shows four stages, 1 to 4, in the conversion of solid candlewax, $C_{30}H_{62}$, into carbon dioxide and water.

1 $C_{30}H_{62}(s) \rightarrow C_{30}H_{62}(l)$

2 $C_{30}H_{62}(l) \rightarrow C_{30}H_{62}(g)$

3 $C_{30}H_{62}(g) + 45.5O_2(g) \rightarrow 30CO_2(g) + 31H_2O(g)$

4 $30CO_2(g) + 31H_2O(g) \rightarrow 30CO_2(g) + 31H_2O(l)$

Which stages are exothermic?

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

30 The properties of the compound of metals X - Z are shown below.

- Carbonate of X does not decompose upon heating.
- Metal Y displaces iron but not zinc from their sulfate salts.
- Oxide of Z decomposes slowly to its metal at room temperature.

Which metal(s) is/are suitable to be used as a sacrificial metal to protect iron?

A X only **B** Y only **C** Z only **D** X and Y

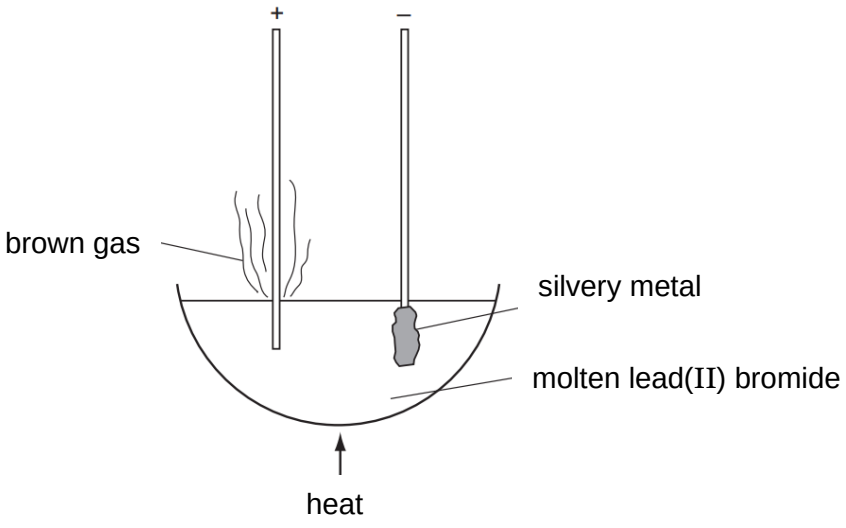
31 The products from the thermal decomposition of carbonates and hydroxides of three metals X, Y and Z are shown below.

metal	carbonate	hydroxide
X	carbon dioxide and metal oxide	metal oxide and water
Y	no reaction	metal oxide and water
Z	carbon dioxide and metal oxide	metal, oxygen and water

What is the order of reactivity of the metals, starting with the least reactive?

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

32 The diagram shows the electrolysis of molten lead(II) bromide using inert electrodes.



What happens during this electrolysis?

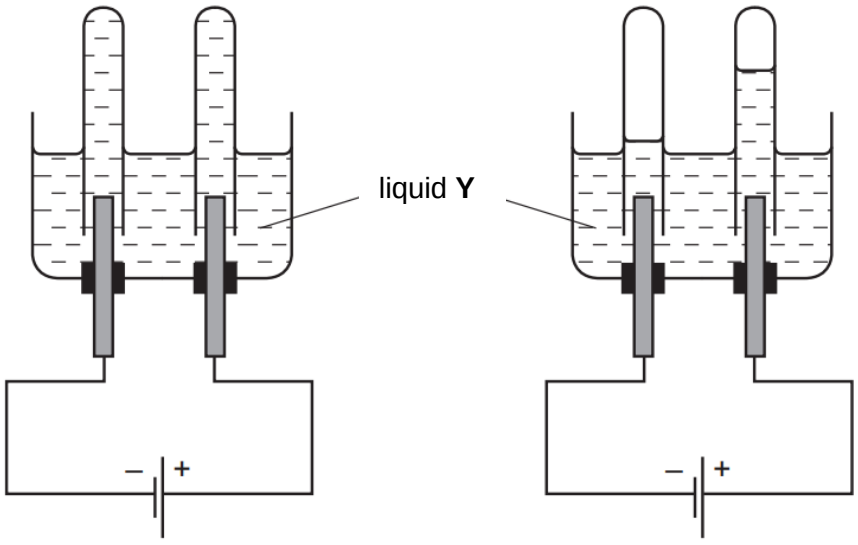
A Atoms change to ions.

B Covalent bonds are broken.

C Ions change to atoms.

D New compounds are formed.

33 The diagrams show an electrolysis experiment using inert electrodes.



Which could be the possible identity of liquid Y?

A aqueous copper(II) sulfate

B concentrated aqueous sodium chloride

C dilute sulfuric acid

D ethanol

34 These statements refer to hydrogen and its use as a fuel.

1 Both water and hydrocarbons can be used as a source of hydrogen.

2 In a fuel cell, hydrogen reacts with oxygen to generate electricity.

3 The reaction taking place in a fuel cell is a redox reaction.

Which statements are correct?

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

35 Hydrazine, N_2H_4 is widely used as a rocket fuel as it burns in oxygen to produce harmless gases as shown in the equation below.

$$N_2H_4 + O_2 \rightarrow N_2 + 2H_2O$$

However, hydrazine does not burn spontaneously in oxygen.

Which of the following explains why hydrazine does not burn spontaneously?

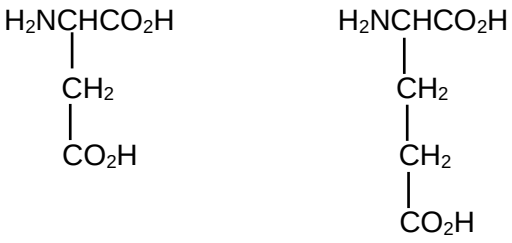
1 Hydrazine is a liquid.

2 The N≡N bond is very strong.

3 The activation energy is very high.

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

36 The diagram below shows the structural formula of aspartic acid and glutamic acid.



aspartic acid glutamic acid

Aspartic acid and glutamic acid can react with each other to form amide linkages.

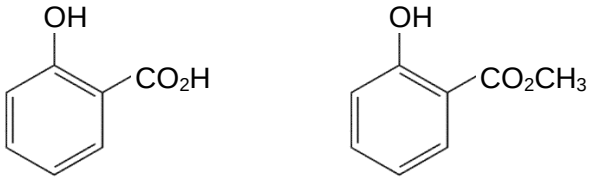
What is the maximum number of different organic compounds that can be formed when one molecule of aspartic acid reacts with one molecule of glutamic acid?

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

37 Methyl salicylate, the main ingredient used in the treatment of muscular pain and joint can be prepared from salicylic acid.

The diagram below shows the structural formula of methyl salicylic acid and methyl salicylate.

 represents the formula C_6H_6



salicylic acid methyl salicylate

What is the best method to prepare methyl salicylate from salicylic acid?

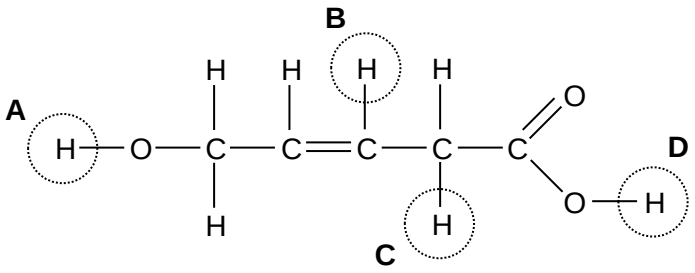
A heating with ethanol

B heating with methanol

C heating with ethanol and concentrated sulfuric acid

D heating with methanol and concentrated sulfuric acid

38 The full structural formula of compound **X** is shown below.



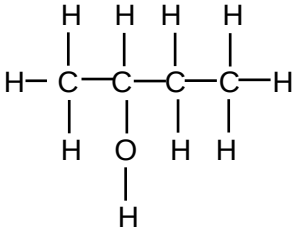
Which of the hydrogen will react with sodium carbonate?

39 Which of the following statements about alcohols is/are correct ?

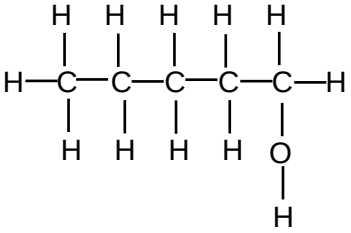
1 Alcohols contain hydroxide ions, OH^-.

2 Methanol is oxidised to methanoic acid using acidified potassium manganate(VII).

3 Alcohols X and Y shown below are isomers.



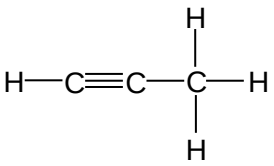
X



Y

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

40 The structure of propyne is shown below.



Propyne undergoes polymerisation to form polypropyne. 100 kg of propyne is used during polymerisation.

Which of the following statements is correct?

A The mass of polypropyne is larger than 100 kg.

B Polypropyne burns with a smokier flame than propyne.

C Polypropyne has a higher percentage by mass of carbon.

D Propyne burns in air to produce a larger volume of carbon dioxide than polypropyne.

End of Paper

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.).