



**SERANGOON SECONDARY SCHOOL
PRELIMINARY EXAMINATION
SECONDARY 4 EXPRESS**

CANDIDATE
NAME

()

CLASS

--	--	--

CENTRE
NUMBER

S				
---	--	--	--	--

INDEX
NUMBER

--	--	--	--

CHEMISTRY

Paper 1 Multiple Choice

6092/01

24 Aug 2022

1 hour

Additional Materials: Multiple Choice Answer Sheet

READ THESE INSTRUCTIONS FIRST

Write in soft pencil.

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

Write your name, class and index number on the Answer Sheet in the spaces provided unless this has been done for you.

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 the last page.

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

For examiner's use
40

This question paper consists of **19** printed pages, including this cover page.

1 25 cm³ of aqueous sodium hydroxide is pipetted into a conical flask and titrated with dilute hydrochloric acid from a burette. How can the accuracy of the titration be improved?

- I. Rinse the interior of the pipette with aqueous sodium hydroxide.
- II. Rinse the interior of the pipette with aqueous hydrochloric acid.
- III. Rinse the interior of the conical flask with aqueous sodium hydroxide.
- IV. Rinse the interior of the burette with dilute hydrochloric acid.

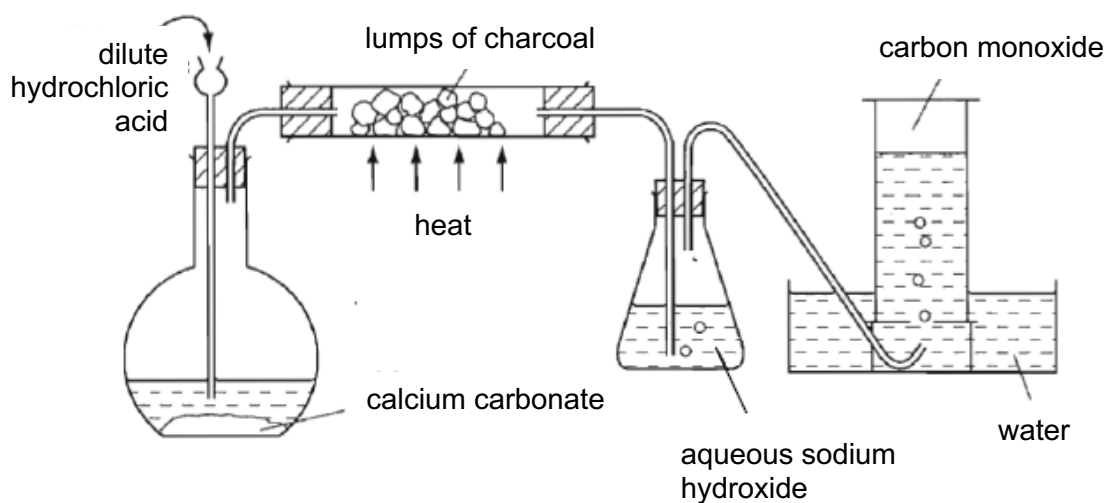
A I and III only

B I and IV only

C II and III only

D I, III and IV

2 The diagram below is a set-up used to obtain carbon monoxide.



What is the main purpose of the aqueous sodium hydroxide?

A Dry the carbon monoxide.

B Remove the carbon dioxide.

C Remove the excess acid.

D Remove the oxygen present.

- 3 Esters can be prepared by reactions of alcohols and carboxylic acids. The yield of these reactions is often low. One way of improving the yield is to remove the ester formed as the reaction proceeds and this can be done by carrying out fractional distillation.

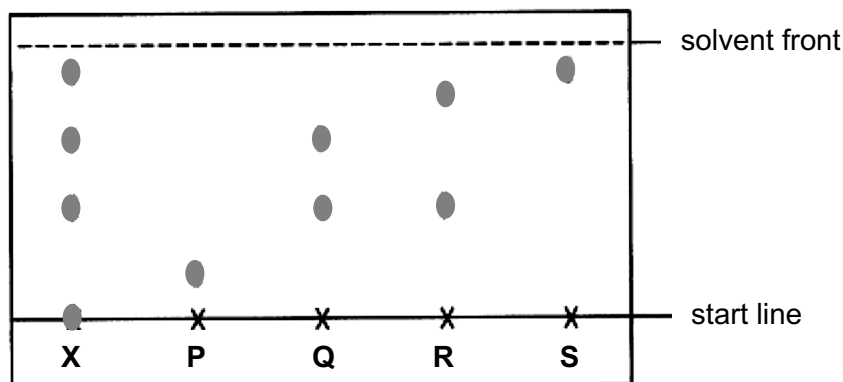
Which of the following mixtures will yield an ester as the distillate using this method?

A	ethanol (B.P: 78°C)	ethanoic acid (B.P: 118°C)	ethyl ethanoate (B.P: 77°C)
B	butanol (B.P: 117°C)	ethanoic acid (B.P: 118°C)	butyl ethanoate (B.P: 128°C)
C	ethanol (B.P: 78°C)	butanoic acid (B.P: 164°C)	ethyl butanoate (B.P: 121°C)
D	methanol (B.P: 65°C)	butanoic acid (B.P: 164°C)	methyl butanoate (B.P: 102°C)

B.P. : Boiling Point

- 4 Vitamins are essential nutrients needed in small amounts for various roles in the human body. They are either water-soluble or fat-soluble.

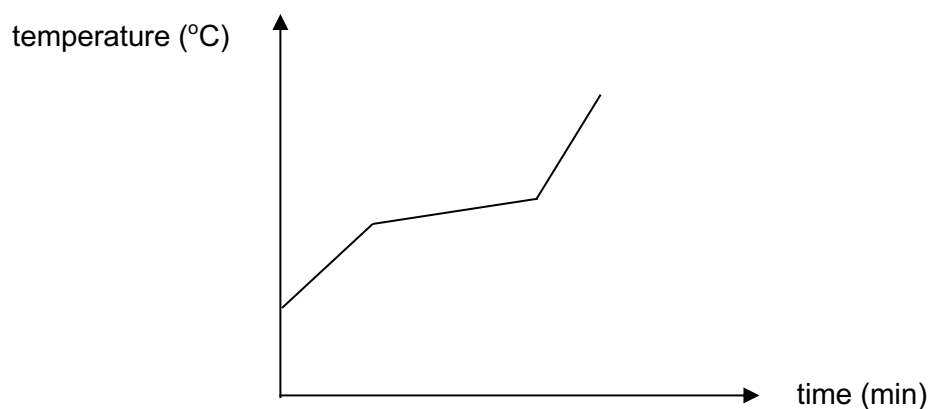
A sample of herbal tea, **X**, was analysed using chromatography with four water-soluble vitamins, P, Q, R and S, using water as the solvent. When the solvent front reached the position indicated, the chromatogram was placed under ultra-violet light. The following diagram shows the chromatogram obtained.



What can be deduced from the results?

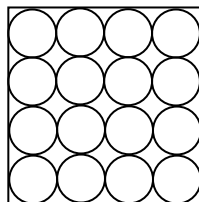
- A** All vitamins in **X** are soluble in water.
- B** One of the vitamins in **X** is not soluble in water.
- C** Vitamin **X** consists of vitamin Q, R and S.
- D** Vitamin **X** contains three different components.

- 5 The diagram below shows the heating curve of substance X.

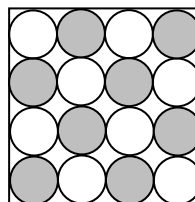


Which of the following represents the arrangement of the particles in substance X?

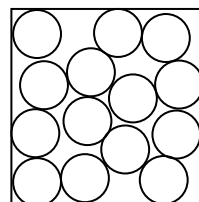
A



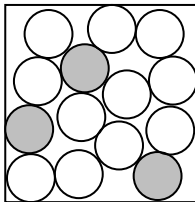
B



C



D



- 6 The chemical symbol of an element is shown below.



Which of the following describes how this element achieves a stable electronic configuration?

- A** gain electrons to form positive ion
- B** lose electrons to form negative ions
- C** lose electrons to form positive ions
- D** share electrons to form diatomic molecules

- 7 The proton number and electron number of some particles are shown below. The symbols used here do not represent the actual chemical symbol of the elements.

particle	P	Q	R	S
proton number	4	15	19	30
electron number	4	18	19	28

Which two particles are found in an ionic compound?

- A P and R
- B P and Q
- C Q and S
- D R and S

- 8 The properties of an unknown substance are given below.

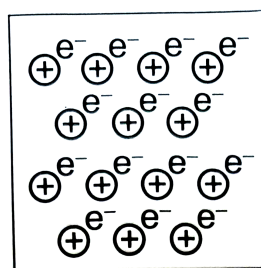
- low melting and boiling point
- low density
- good conductor of electricity in solid state

Which of the following is the substance?

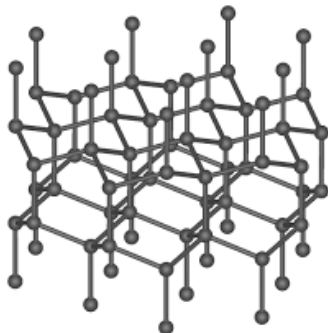
A



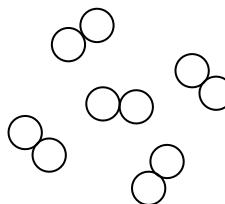
B



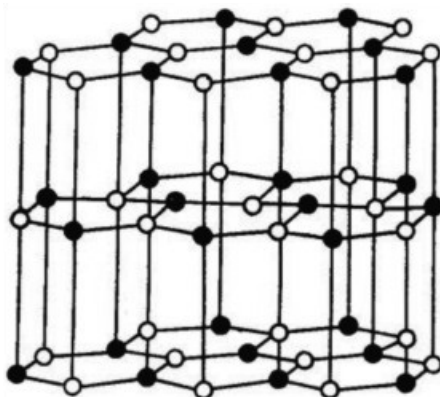
C



D



- 9 Which of the following best explains the reason why the substance with the structure shown below would be a good lubricant?



- A strong covalent bonds between the layers of atoms
- B weak forces of attraction between the layers of atoms
- C weak covalent bonds between the layers of atoms
- D weak electrostatic forces of attraction between the layers of atoms

- 10 Which statement about groups in the Periodic Table is correct?

- A All groups contain both metals and non-metals.
- B Atoms of the elements in the same group have the same number of total electrons.
- C Atomic radius decreases down the group.
- D Ionisation energy decreases down the group.



Based on the equation shown above, _____.

- A the reaction is a redox reaction
- B the reaction is a metal displacement reaction
- C X is less reactive than Y
- D X_2 is the reducing agent

- 12** The setup below was used to collect the gas produced when an excess magnesium was added to 50 cm³ of 1 mol/dm³ of hydrochloric acid.
The time taken for the reaction to be completed was also recorded.
The table below shows the results obtained.

volume of gas (cm ³)	600
time taken for reaction to complete (s)	60

Which of the following would likely be the results obtained when same concentration of propanoic acid is used instead?

	volume of gas (cm ³)	time taken for reaction to complete (s)
A	300	30
B	300	60
C	600	60
D	600	180

- 13** In an experiment, 5 cm³ of 1.0 mol/dm³ of sodium hydroxide is gradually added to 10 cm³ of 1.0 mol/dm³ of hydrochloric acid, containing methyl orange indicator.

Which change occurs in the mixture?

- A** A white precipitate is formed.
- B** Methyl orange changes in colour.
- C** The concentration of OH⁻ increases.
- D** The concentration of H⁺ decreases by half.

- 14** X, Y and Z elements are found in Period 3 of the Periodic Table.
X forms an acidic oxide when burnt in oxygen.
Y forms a basic oxide when burnt in oxygen.
Z forms an amphoteric oxide when burnt in oxygen.

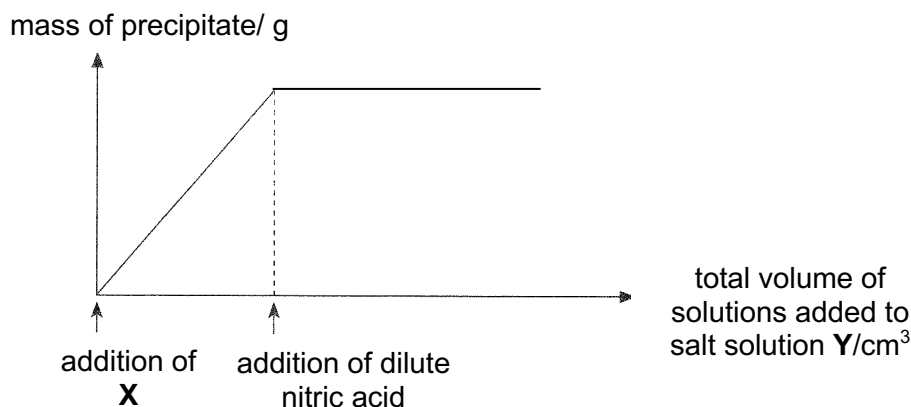
What is the order of the three elements across the Periodic Table?

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

15 Which of the following reactions is **unlikely** to take place?

- A $\text{Pb}^{2+}(\text{aq}) + 2\text{Cl}^{-}(\text{aq}) \rightarrow \text{PbCl}_2(\text{s})$
- B $\text{Fe}^{2+}(\text{aq}) + \text{Mg}(\text{s}) \rightarrow \text{Mg}^{2+}(\text{aq}) + \text{Fe}(\text{s})$
- C $2\text{H}^{+}(\text{aq}) + \text{Cu}(\text{s}) \rightarrow \text{H}_2(\text{g}) + \text{Cu}^{2+}(\text{aq})$
- D $2\text{H}^{+}(\text{aq}) + \text{CO}_3^{2-}(\text{aq}) \rightarrow \text{CO}_2(\text{g}) + \text{H}_2\text{O}(\text{l})$

16 In a chemistry experiment, solution **X** is gradually added to a salt solution **Y**, followed by the addition of a dilute nitric acid solution. The graph shows how the mass of precipitate formed changes with the addition of the different solutions.



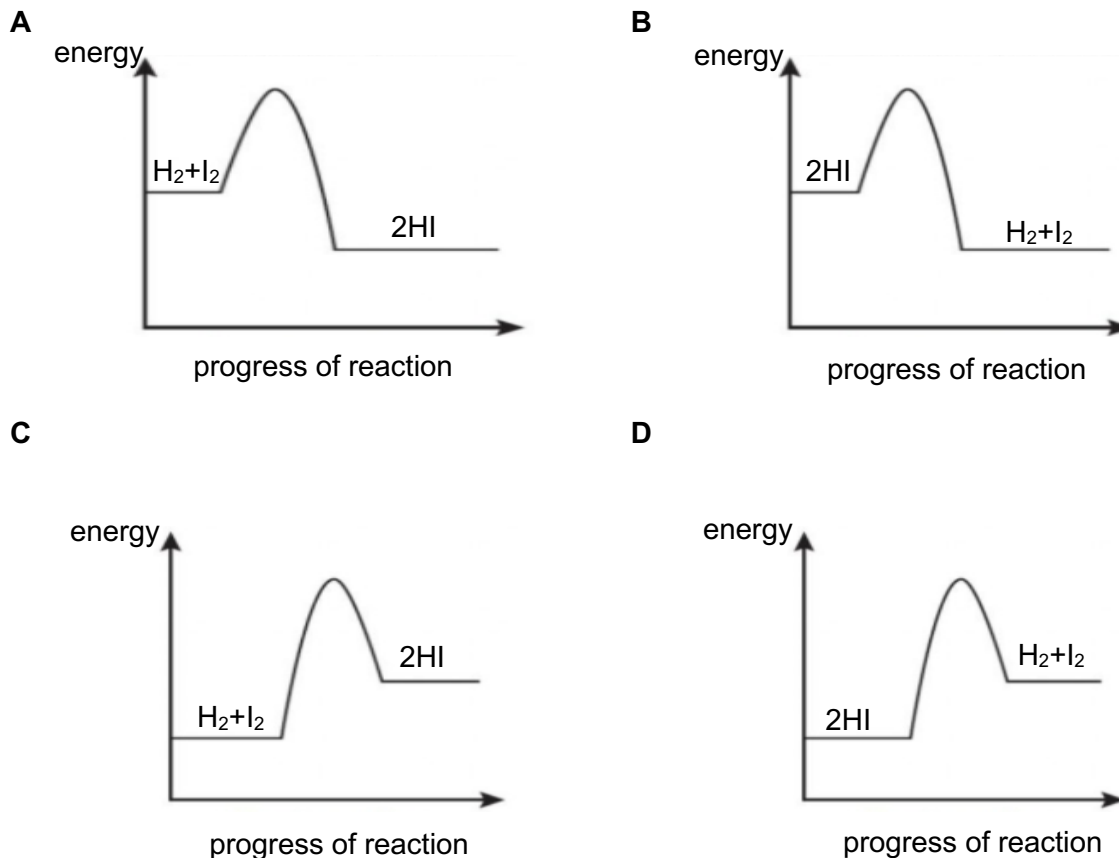
Which of the following would produce the graph as shown above?

- | | solution X | ions present in salt solution Y |
|---|------------------------|--|
| A | aqueous silver nitrate | chloride ion and carbonate ion |
| B | aqueous silver nitrate | nitrate ion and sulfate ion |
| C | aqueous barium nitrate | sulfate ion and carbonate ion |
| D | aqueous barium nitrate | sulfate ion and nitrate ion |

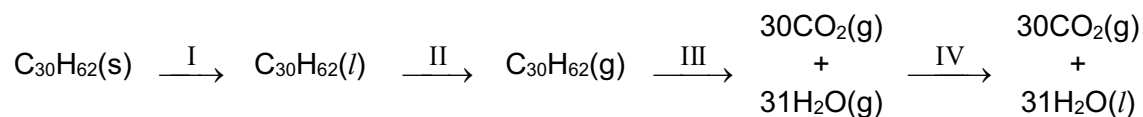
21 Hydrogen and iodine react according to the equation shown below.



Which of the following energy profile diagrams shows the backward reaction?



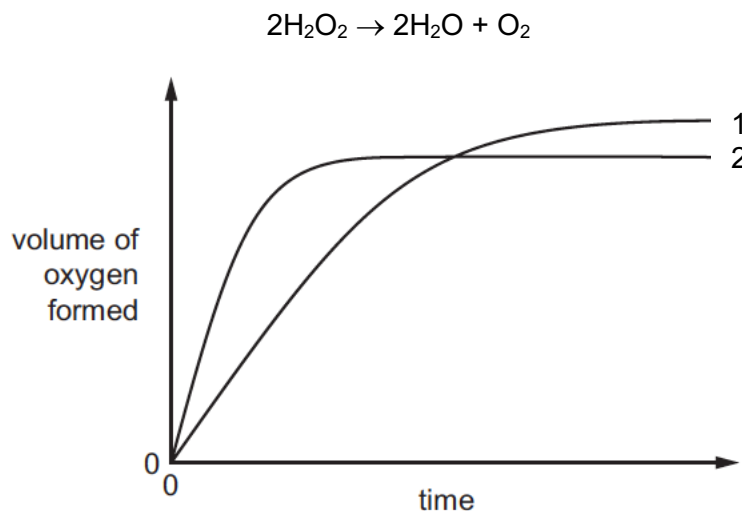
22 The scheme shows four stages I to IV in the conversion of solid candlewax, $\text{C}_{30}\text{H}_{62}$, into carbon dioxide and water.



Which stage(s) is/are exothermic?

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

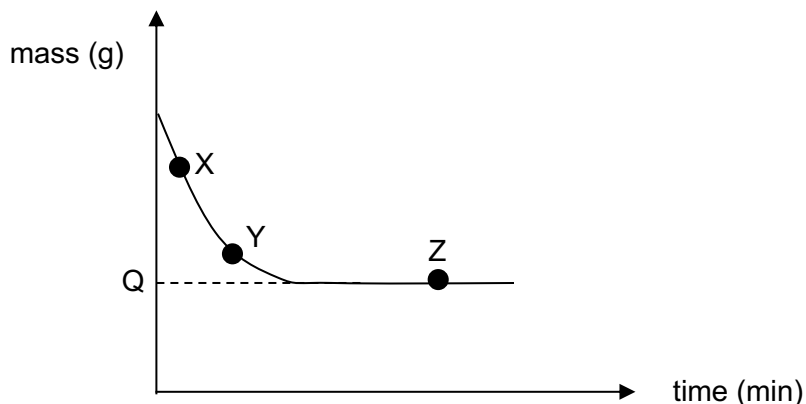
- 23** In the graph, curve 1 was obtained by observing the decomposition of 100 cm³ of 1.0 mol/dm³ hydrogen peroxide solution, catalysed by manganese(IV) oxide.



Which alteration to the original experimental conditions would produce curve 2?

- A** increase the pressure
- B** lower the temperature
- C** using 100 cm³ of 1.2 mol/dm³ hydrogen peroxide solution
- D** using 50 cm³ of 1.2 mol/dm³ hydrogen peroxide solution

- 24** The graph shows the mass of hydrogen gas evolved, plotted against time, when excess hydrochloric acid reacts with 2 g of magnesium ribbon.



Which statement is correct?

- A** The reaction is faster at point X than at point Y.
- B** The reaction first reaches completion at point Z.
- C** The mass of hydrogen gas evolved will be higher if magnesium powder is used instead.
- D** Mass of hydrogen gas evolved is Q g.

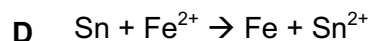
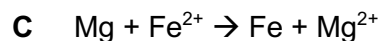
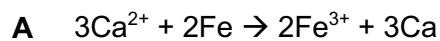
- 25** The statements below describe the reactions of metals P, Q and R.

- Metal P does not react with cold water but reacts quickly with an acid.
- Metal Q reacts slowly with an acid but has no reaction with steam.
- Metal R reacts fast with cold water.

Which of the following statements is correct?

- A** Metal P can only be extracted by electrolysis from its ore.
- B** Metal Q exists naturally uncombined.
- C** Metal R cannot be reduced by coke.
- D** Metals P and Q are positioned below hydrogen in the metal reactivity series.

26 Which of the following equations show the protection of iron from rusting?



27 Which of the following is true about steel?

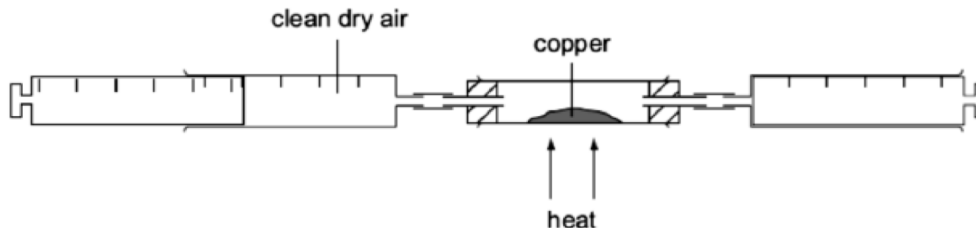
A It is resistant to corrosion.

B It is softer than pure metal.

C It is a poor conductor of electricity.

D It reacts with acid to form hydrogen gas.

28 A 150 cm^3 sample of clean, dry air is passed over hot excess copper at room temperature and pressure until there is no further change in volume. The pink copper metal turns black at the end of the reaction.



What is the minimum mass of copper metal that is needed for this reaction?

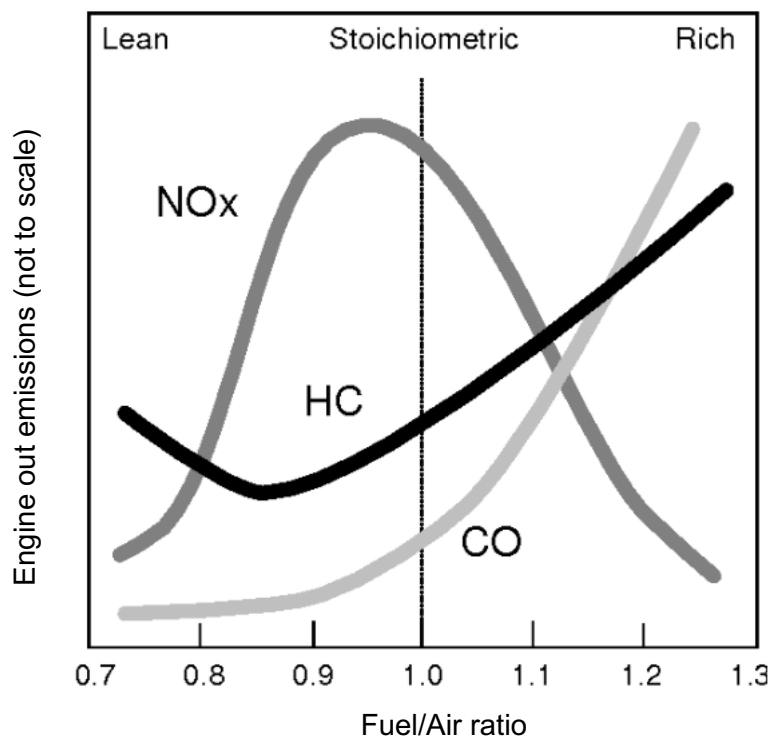
A 0.084 g

B 0.168 g

C 0.316 g

D 0.632 g

- 29 The diagram below shows the changes to the emission of different gases from a car engine at different fuel/air ratio.



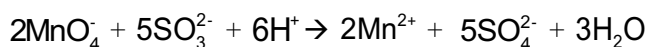
Why is there an increase in the emission of CO when the fuel/air ratio increases from 0.8 to 1.0?

- A** There is a decrease in the volume of air in the engine, leading to internal combustion.
- B** There is an increase in the volume of air in the engine, leading to internal combustion.
- C** There is a decrease in the volume of air in the engine, leading to incomplete combustion.
- D** There is an increase in the volume of air in the engine, leading to incomplete combustion.
- 30 Which two processes in the carbon cycle help to regulate the carbon level in the atmosphere?
- A** combustion and respiration **B** decomposition and respiration
- C** deforestation and photosynthesis **D** photosynthesis and combustion

31 Why is iron metal added to Haber Process?

- A** To lower the pressure needed for the reaction.
- B** To lower the temperature needed for the reaction.
- C** To lower the activation energy level of the process.
- D** To react with hydrogen and nitrogen to form ammonia.

32 Given the following reaction



Which statement about the reaction above is true?

- A** MnO_4^- is acting as the reducing agent.
- B** SO_3^{2-} is oxidised to form SO_4^{2-} .
- C** H^+ is oxidised.
- D** SO_3^{2-} is neither oxidised nor reduced.

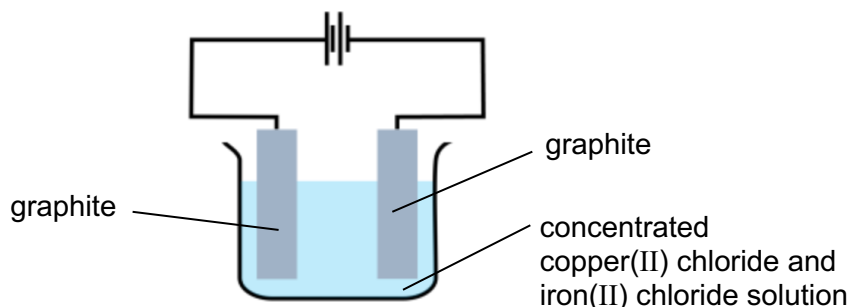
33 During electroplating process, an object is coated with silver metal. The mass of the was measured before and after the process.

mass of object before process (g)	4.78
mass of object after process (g)	6.15

The difference in the mass recorded is due to _____.

- A** a gas being produced at the object
- B** a salt being produced on the object
- C** oxidation of silver metal
- D** reduction of silver ions

34



Which of the following statements correctly describes the observations made in the setup a few hours later?

- A** Green fumes observed at the cathode.
- B** The electrolyte would be blue in colour.
- C** The electrolyte would be green in colour.
- D** The anode will increase in size.

35 In the electrolysis of an aqueous solution of cerium nitrate, 70 g of cerium, Ce, ($A_r = 140$) is deposited at the cathode by 2 moles of electrons. What is the charge on the cerium ion?

- A** 1+
- B** 2+
- C** 4+
- D** 6+

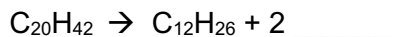
36 The table below shows the uses of two fractions obtained from fractional distillation of crude oil.

fraction	uses
X	fuel for lorries and trucks
Y	feedstock for petrol chemical industry

What is fraction X and Y based on the uses given?

	fraction X	fraction Y
A	diesel	lubricating oil
B	diesel	naphtha
C	petrol	lubricating oil
D	petrol	naphtha

- 37** One of the compounds found in bitumen has a molecular formula of $C_{20}H_{42}$. It undergoes cracking to form smaller molecules as shown in the equation below.



What is the chemical formula of the other compound formed?

- A** C_4H_8
- B** C_4H_{10}
- C** C_8H_{16}
- D** C_8H_{18}

- 38** 400 cm^3 of 5 mol/dm^3 of aqueous bromine was found to react with 1 mole of an unsaturated hydrocarbon.

What is the number of bromine atoms that would be found in the product formed?

- | | |
|------------|------------|
| A 2 | B 3 |
| C 4 | D 6 |

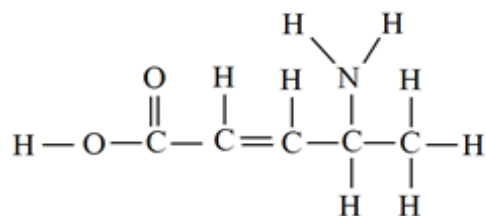
- 39** Below shows a list of reactions.

- I combustion of ethanol
- II fermentation of glucose
- III oxidation of ethanol by air in the presence of bacteria
- IV reaction of sodium carbonate with ethanoic acid

In which reaction is carbon dioxide a product?

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

40 Which of the following reactions will **not** take place with the molecule shown below?



- A** bromination
- B** condensation polymerisation
- C** oxidation
- D** reaction with magnesium

END-OF-PAPER

Group																		
I	II	Key																
		1 H hydrogen 1																
		proton (atomic) number atomic symbol name relative atomic mass																
3 Li lithium 7	4 Be beryllium 9	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	5 B boron 11	6 C carbon 12	7 N nitrogen 14	8 O oxygen 16	9 F fluorine 19	VII	0
11 Na sodium 23	12 Mg magnesium 24	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	13 Al aluminium 27	14 Si silicon 28	15 P phosphorus 31	16 S sulfur 32	17 Cl chlorine 35.5	Ar	18
19 K potassium 39	20 Ca calcium 40	20 Sc scandium 45	21 Ti titanium 48	22 V vanadium 51	23 Cr chromium 52	24 Mn manganese 55	25 Fe iron 56	26 Co cobalt 59	27 Ni nickel 59	28 Cu copper 64	29 Zn zinc 65	31 Ga gallium 70	32 Ge germanium 73	33 As arsenic 75	34 Se selenium 79	35 Br bromine 80	Kr	36
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	Xe	54
55 Cs caesium 133	56 Ba barium 137	57 – 71 lanthanoids actinoids	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 –	Rn	86
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 F/ flerovium –	114 F/ flerovium –	116 Lv livermorium –	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
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.)