Candidate Name:	Class:	Index No.:

FUHUA SECONDARY SCHOOL

Secondary Four Express

PRELIMINARY EXAMINATION 2024

4E

CHEMISTRY **6092/01**

Paper 1 Multiple Choice

Additional Material: Optical Mark Recognition (OMR)

DATE	**28 August 2024**
TIME	**0800 – 0900**
DURATION	**1 hour**

READ THESE INSTRUCTIONS FIRST

Write in soft pencil.
Do not use staples, paper clips, glue or correction fluid.
Write your name, class, index number on the OMR and this question booklet.

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 OMR.

Each correct answer will score one mark. A mark will not be deducted for a wrong answer.
Any rough working should be done on this paper.
A copy of the Periodic Table is printed on page **15**.
The use of an approved scientific calculator is expected, where appropriate.

FOR EXAMINER'S USE		PARENT'S SIGNATURE
	40	

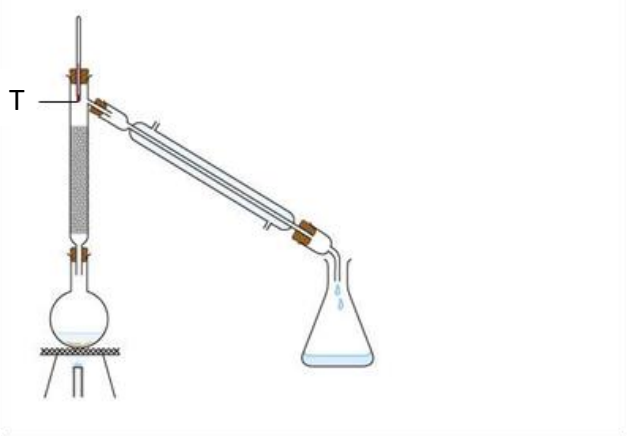
Setter: **Mr Nicholas Liu** **Vetter:** **Mdm Hia Soo Ching**

This document consists of 15 printed pages, including this page.

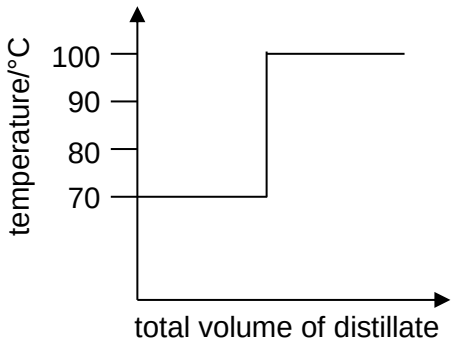
1 Nitrogen dioxide gas is almost twice as dense as nitrogen gas. A gas jar of nitrogen dioxide was placed on top of a gas jar of nitrogen gas with the open ends together. After half an hour, which of these statements would be true?

A Both gases would not have mixed.
B The bottom gas jar contained nitrogen gas only.
C The top gas jar contained nitrogen dioxide gas only.
D Some of each gas would have moved into the other gas jar.

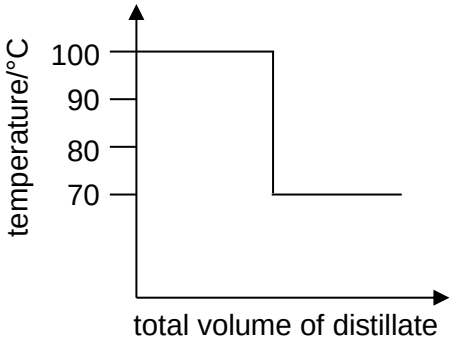
2 The diagram shows the apparatus used to separate hexane (boiling point 70°C) and water.



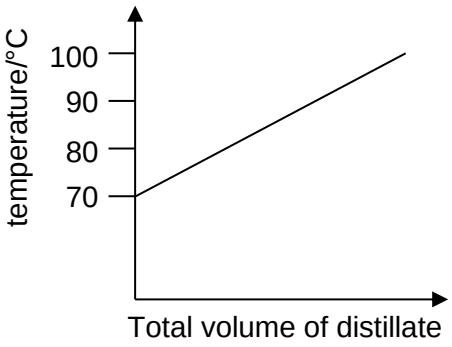
Which graph would be obtained if the temperature at point T was plotted against the total volume of distillate collected?



A



B



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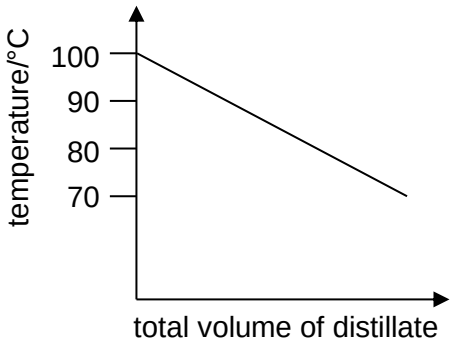
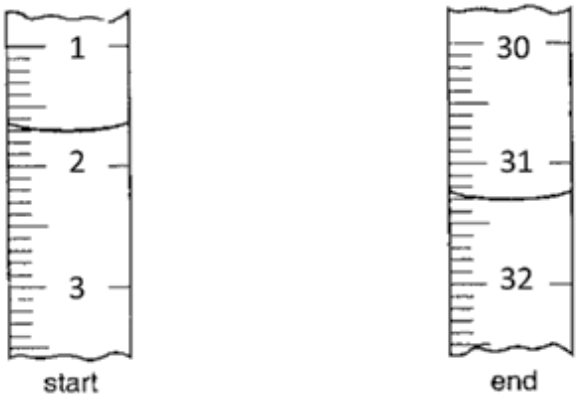


D

3 A student titrated 25.0 cm^3 of sodium hydroxide with hydrochloric acid. The diagram shows the volume of hydrochloric acid in the burette at the start and the end of the titration.



What volume of hydrochloric acid was added from the burette?

A 29.00 cm^3
B 29.60 cm^3
C 31.30 cm^3
D 32.70 cm^3

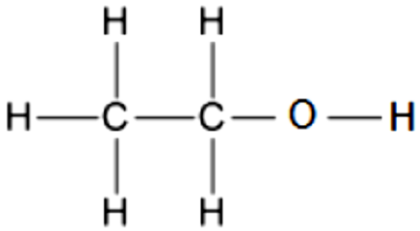
4 The formulae of the ions of some elements are shown below:

P^{3-} S^{2-} Cl^- Li^+ Mg^{2+}

Which of the following statements about these ions is correct?

A They all have more electrons than protons.
B They all have the same number of electron shells.
C They all have the same number of neutrons in their nuclei.
D They all have the same electronic structures as noble gases.

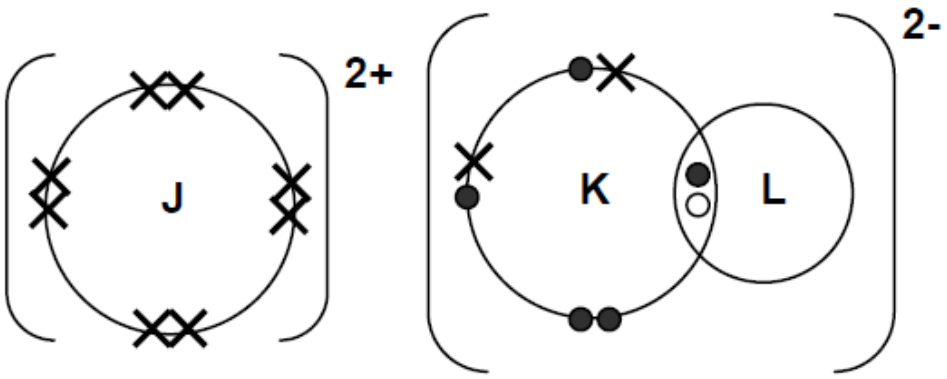
5 Ethanol has the structure shown.



How many of the electrons in a molecule of ethanol are **not** involved in bonding?

A 4
B 6
C 8
D 10

6 J, K and L are three different elements in the Periodic Table. The 'dot and cross' diagram (showing only the valence electrons) of the compound formed between J, K and L is shown:



Which of the following statements is/are correct?

1 Element L is hydrogen.
2 Element J belongs to Group 2 of the Periodic Table.
3 Elements J, K and L are bonded together by ionic bonds only.

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

7 Elements X and Y form an ionic compound of formula X_3Y. What could the atomic numbers of X and Y be?

	X	Y
A	3	1
B	8	4
C	11	7
D	13	9

8 Magnesium oxide has a similar structure to that of sodium chloride. Which of the following statements is true?

A Magnesium oxide has a lower melting point than sodium chloride.
B Magnesium oxide and sodium chloride can conduct electricity in the molten state only.
C In a lattice structure, each magnesium ion is surrounded by six oxide ions while each oxide ion is surrounded by six magnesium ions.
D When magnesium reacts with oxygen, every mole of magnesium atoms loses a mole of electrons. Likewise, every mole of oxygen molecules loses a mole of electrons.

9 Which of the following reactions shows the amphoteric property of zinc oxide?

A $2ZnO + C \rightarrow 2Zn + CO_2$
B $ZnO + Mg \rightarrow MgO + Zn$
C $ZnO + 2HCl \rightarrow ZnCl_2 + 2H_2O$
D $ZnO + 2NaOH \rightarrow Na_2ZnO_2 + H_2O$

10 The following statements about dilute sulfuric acid are all correct.

1 It reacts with copper(II) oxide, forming a blue solution.
2 It turns anhydrous copper(II) sulfate from white to blue.
3 A white precipitate is formed when aqueous barium nitrate is added.
4 Addition of methyl orange shows that the solution has a pH value of less than 4.0.

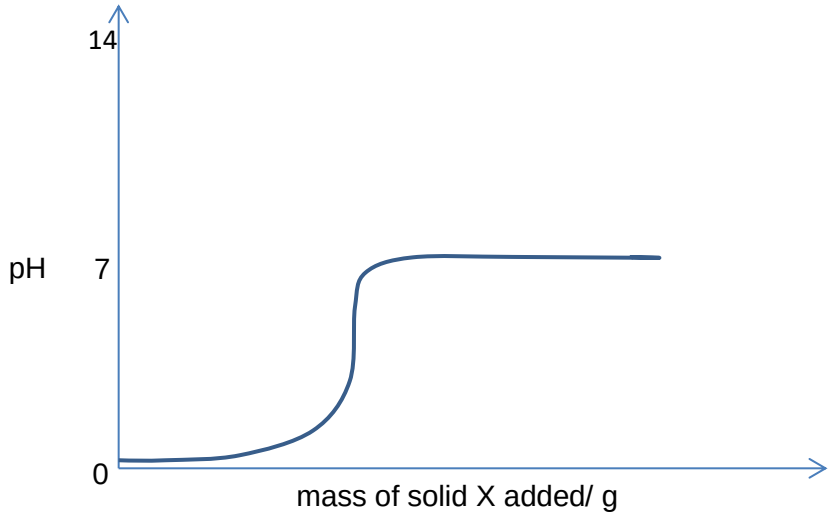
Which two statements confirm the acidic nature of the solution?

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

11 A titration method can be used to prepare aqueous potassium sulfate from potassium carbonate and dilute sulfuric acid. Which of the following conclusions from this information is correct?

A Potassium carbonate is an acidic salt.
B Potassium carbonate is insoluble in water.
C Potassium carbonate neutralises dilute sulfuric acid.
D Potassium carbonate reacts more vigorously than sodium carbonate with dilute sulfuric acid.

12 Solid X is gradually added to aqueous solution Y. The changes in pH are shown in the graph below.



What could X and Y be?

	X	Y
A	potassium carbonate	ethanoic acid
B	potassium oxide	ethanoic acid
C	sodium oxide	hydrochloric acid
D	zinc oxide	hydrochloric acid

13 An aqueous solution, Z, contains one cation and two anions. Some tests were carried out on the solution to determine the possible identities of the ions present. The observations of the tests carried out are recorded as follows:

Test 1	White precipitate forms when aqueous barium nitrate is added to solution Z.
Test 2	When solution Z is heated with aqueous sodium hydroxide and aluminium, a gas that turns moist red litmus blue is evolved.
Test 3	No visible change is observed when dilute hydrochloric acid is added to solution Z.

Which ions are likely to be present in solution Z?

A Al^{3+}, Cl^-, SO_4^{2-}
B Al^{3+}, NO_3^-, SO_4^{2-}
C Pb^{2+}, NO_3^-, SO_4^{2-}
D Pb^{2+}, Cl^-, NO_3^-

14 G is a white powder that turns yellow upon heating and gives off a colourless gas which is slightly soluble in water to produce a solution with pH less than 7. The residue reacts with dilute nitric acid and the aqueous solution formed white precipitate that is soluble in excess aqueous ammonia. Which of the following could be the identity of G?

A aluminium carbonate
B aluminium oxide
C zinc carbonate
D zinc oxide

15 One mole of a sample of hydrated sodium sulfide contains 162 g of water of crystallisation. What is the correct formula of this compound?

A $Na_2S.3H_2O$
B $Na_2S.5H_2O$
C $Na_2S.7H_2O$
D $Na_2S.9H_2O$

16 When solid sodium hydrogencarbonate is heated strongly, the following reaction occurs.

$$2NaHCO_3\ (s) \rightarrow Na_2CO_3\ (s) + H_2O\ (g) + CO_2\ (g)$$

What is the loss in mass when 33.6 g of solid sodium hydrogencarbonate is heated?

A 10.8 g
B 12.4 g
C 21.2 g
D 24.6 g

17 1.36 g of aqueous solution XCl_2 reacts with 20.0 cm^3 of 0.500 mol/dm^3 aqueous sodium hydroxide to form $X(OH)_2$. Determine the relative atomic mass of X.

A 65
B 136
C 201
D 272

18 Mixing 100 cm^3 of 0.100 mol/dm^3 aqueous lead(II) nitrate with 50 cm^3 of 0.100 mol/dm^3 dilute sulfuric acid resulted in the formation of a white precipitate. The precipitate is filtered off, dried, and weighed. What is the maximum possible mass of precipitate collected?

A $\frac{50 \text{ x } 0.100 \text{ x } 303}{1000} g$

B $\frac{100 \text{ x } 0.100 \text{ x } 303}{1000} g$

C $\frac{150 \text{ x } 0.100 \text{ x } 303}{1000} g$

D $\frac{150 \text{ x } 0.200 \text{ x } 303}{1000} g$

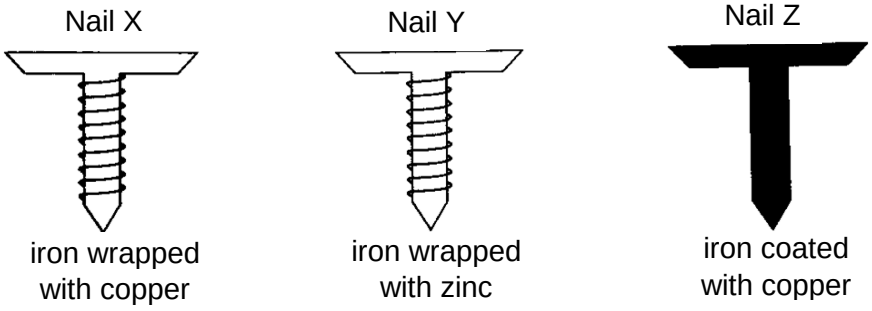
19 The table shows the solubility of some salts of metal M in cold water.

salt	solubilty in cold water
carbonate	insoluble
chloride	insoluble
sulfate	insoluble

What is metal M?

A barium
B calcium
C lead
D zinc

20 An experiment was carried out to investigate the process of rusting in iron nails.



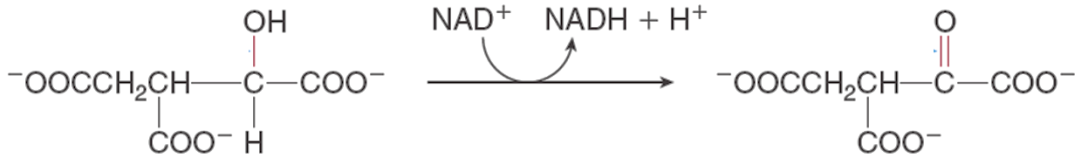
Which of the following statements is correct?

A None of the nails rusted.
B X rusted the fastest.
C Y rusted the fastest.
D Z rusted the fastest.

21 In which of the following reactions does the oxidation state of nitrogen show the greatest increase?

A ammonia to nitrogen gas
B ammonia to ammonium ion
C nitrogen dioxide to nitric acid
D nitrogen monoxide to nitrogen dioxide

22 The Krebs Cycle is part of the pathway for the breakdown of glucose and all metabolites in the human body. The following equation depicts a reaction in the Krebs Cycle.



isocitrate oxalosuccinate

Which of the following statements is true?

A Isocitrate is reduced by NAD^+ to form oxalosuccinate.
B NAD^+ serves as a reducing agent in the above reaction.
C NADH serves as an oxidising agent in the above reaction.
D The conversion of isocitrate to oxalosuccinate is an oxidation reaction.

23 What can the destruction of the ozone layer lead to?

A The number of cases of skin cancer will increase.
B The number of flooded costal regions will increase.
C The number of hurricanes and typhoons will increase.
D The temperature of the oceans will decrease.

24 Element X is one of the components found in car fuels. It forms an oxide Y when burnt in car engines and gets further oxidised into Z when it is released in the atmosphere. Which of the following statements is true about the substances X, Y and Z?

A Element X could be sulfur.
B Substances X, Y and Z exist naturally as gases.
C Substances Y and Z increase the pH of river water.
D Substance Z binds irreversibly to haemoglobin in blood cells resulting in respiratory difficulties in humans.

25 Waste gases from a coal-burning power station are passed through powdered calcium carbonate to reduce pollution to the atmosphere.

Which waste gas will **not** be removed by the powdered calcium carbonate?

A carbon dioxide
B carbon monoxide
C nitrogen dioxide
D sulfur dioxide

26 Ammonia is manufactured on a large scale by a reversible reaction in the Haber process. Which of the following is true about the reversible reaction?

A A catalyst is not required for the reaction.
B A high temperature is required for the reaction.
C The reaction must have a low activation energy.
D The yield of ammonia will always be less than 100%.

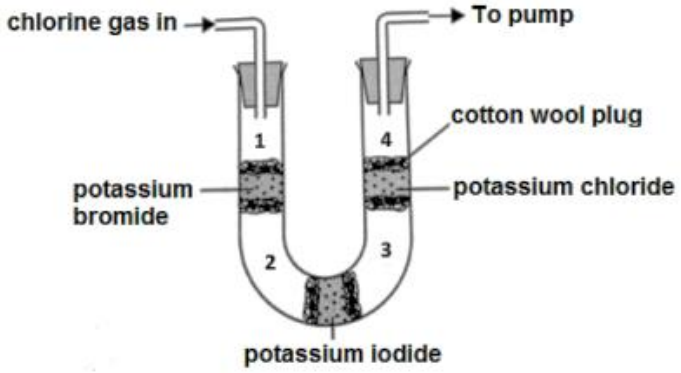
27 Elements P, Q and R have the following properties:

- P reacts with Group 1 metals to form ionic compounds.
- Q reacts with oxygen to form compounds with giant covalent structures and with very high melting and boiling points.
- R reacts violently with acids to give off hydrogen gas.

What is the arrangement order of these elements across a period in the Periodic Table?

A P, Q, R
B Q, R, P
C R, P, Q
D R, Q, P

28 Gaseous chlorine was passed through the apparatus set-up shown below. The apparatus was continuously heated throughout with a Bunsen flame and the observations were recorded.



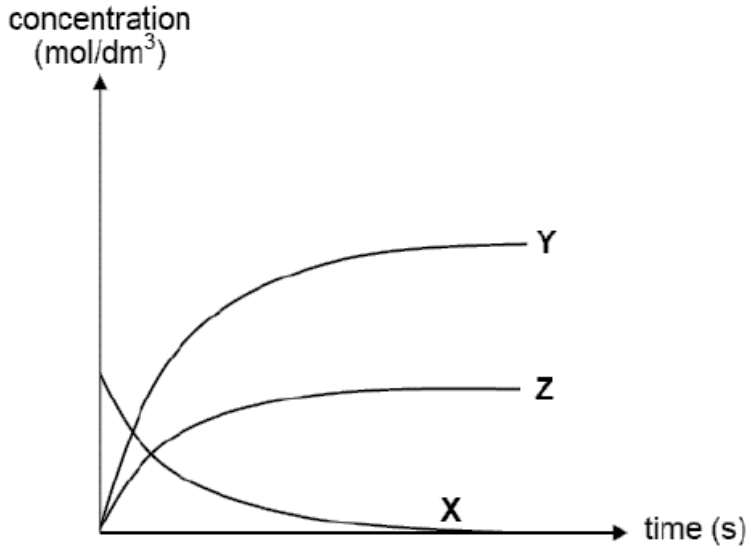
What would be the observations made at regions 1, 2, 3 and 4?

	region 1	region 2	region 3	region 4
A	brown gas	yellow-green gas	violet gas	yellow-green gas
B	violet gas	yellow-green gas	brown gas	violet gas
C	yellow-green gas	brown gas	violet gas	violet gas
D	yellow-green gas	brown gas	brown gas	brown gas

29 Phosphorus and nitrogen are both from Group 15 of the Periodic Table. Which ions would be produced if phosphine, PH_3, was dissolved in water?

A PH_3^+ , H^+
B PH_3^+ , OH^-
C PH_4^+ , H^+
D PH_4^+ , OH^-

30 The following graph shows the change in reactant and product concentrations with time during a chemical reaction.



Which equation represents the reaction shown in the graph?

A $X \rightarrow Y + Z$
B $X \rightarrow 2Y + Z$
C $Z \rightarrow 2X + Y$
D $Z \rightarrow 2Y + X$

31 Copper(II) sulfate reacts violently in excess magnesium powder to give magnesium sulfate and copper metal, as shown.

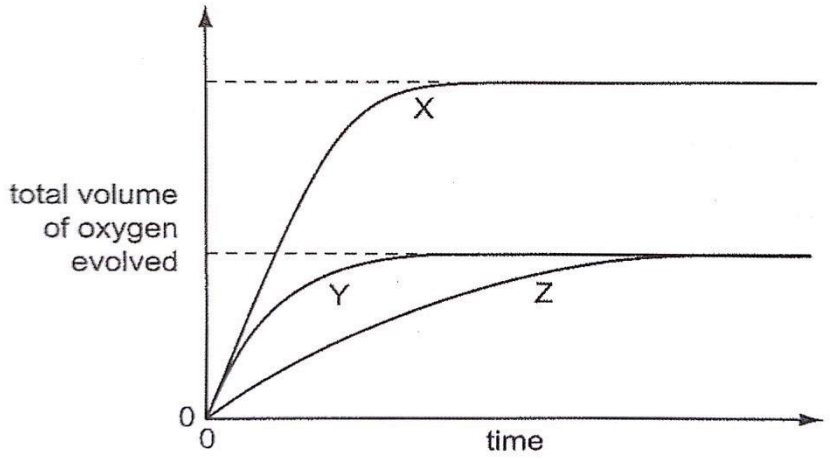
$$CuSO_4\,(aq) + Mg\,(s) \rightarrow MgSO_4\,(aq) + Cu\,(s) \qquad \Delta H = -164\ kJ/mol$$

Which of the following will be observed when 25 cm^3 of 0.05 mol/dm^3 copper(II) sulfate is reacted with 2 g of magnesium powder?

A 164 kJ of heat is absorbed in the reaction.
B 328 kJ of heat is released in the reaction.
C The temperature of the solution increases.
D The solution remains blue as there is insufficient magnesium powder.

32 Hydrogen peroxide solution is catalytically decomposed by manganese(IV) oxide to yield water and oxygen gas. To study the effect of the concentration of the solutions on the rate of reaction, the total volume of oxygen evolved was recorded against time.

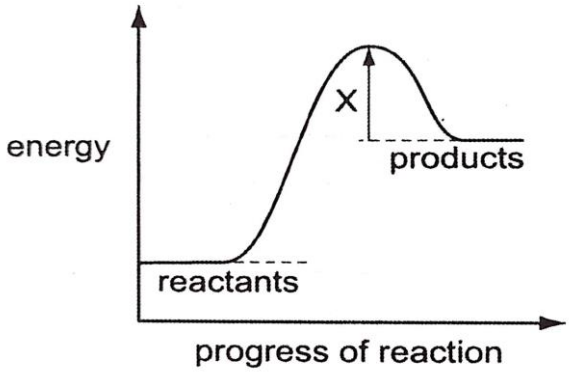
Three experiments were performed using a fixed mass of catalyst but with:
(i) 50 cm^3 of 2.0 mol/dm^3 hydrogen peroxide.
(ii) 100 cm^3 of 1.0 mol/dm^3 hydrogen peroxide.
(iii) 100 cm^3 of 2.0 mol/dm^3 hydrogen peroxide.



On the graph above, which of the curves X, Y and Z relate to the solutions (i), (ii) and (iii)?

	(i)	(ii)	(iii)
A	X	Y	Z
B	X	Z	Y
C	Y	Z	X
D	Z	Y	X

33 The energy profile diagram shows the energy changes that occur as a reaction takes place.



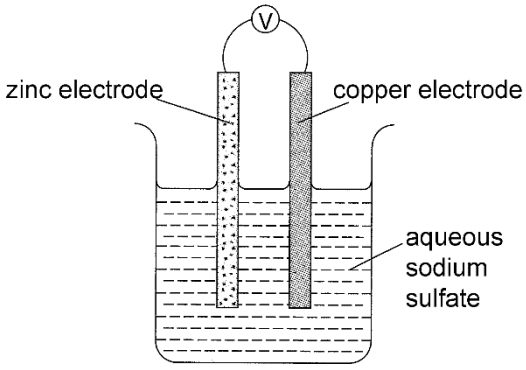
From the diagram, which statement about this reaction is correct?

A The reaction could be $CH_4 + 2O_2 \rightarrow CO_2 + 2H_2O$.
B The reaction has a negative ΔH value.
C X shows the activation energy for the reaction.
D X shows the activation energy for the reverse reaction.

34 During the electrolysis of a molten manganese salt, 27.5 g of manganese is deposited at the cathode by 2 moles of electrons. What is the formula of the manganese ion that has been discharged?

A Mn^{2+}
B Mn^{3+}
C Mn^{4+}
D Mn^{5+}

35 What happens when a current is drawn from the simple cell shown below?

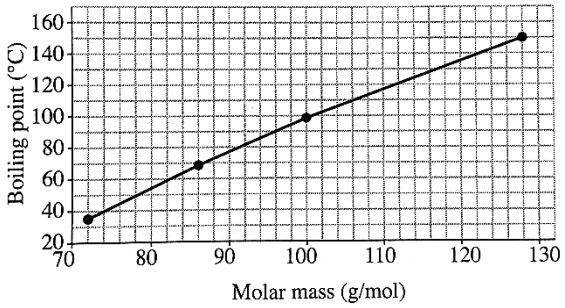


A Copper electrode dissolves to form copper(II) ions.
B Electrons flow from the copper to zinc electrode.
C Hydrogen gas is liberated at the zinc electrode.
D Zinc electrode dissolves to form zinc ions.

36 Which of the following statements about biofuel is true?

A Biofuel can be separated by simple distillation.
B Biofuel is an alternative fuel source to petroleum.
C Biofuel is formed from the remains of dead animals.
D Biofuel is the main feedstock for the petrochemical industry.

37 The following graph shows the relationship between the boiling points of some alkanes and their molar masses.



Which of the following is a likely explanation for the graph?

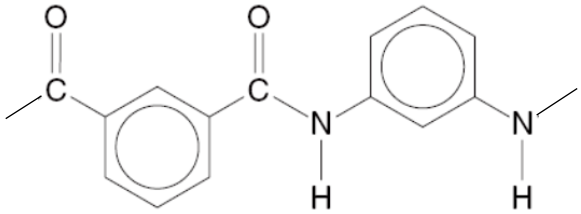
A Covalent bonds of alkane molecules become stronger as the molar mass increases.
B Higher the molar mass of the alkane, the stronger its carbon-carbon covalent bonds.
C Intermolecular forces of attraction get stronger as the alkane molecules get bigger.
D Structure of the alkane changes from simple molecular to giant molecular as the size of the molecules increases.

38 The reaction between a carboxylic acid, $C_xH_yCO_2H$ and an alcohol, $C_nH_{2n+1}OH$, produces an ester.

How many hydrogen atoms does one molecule of the ester contain?

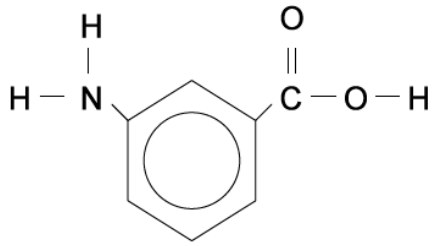
A y+2n
B y+2n+1
C y+2n+2
D y+2n+3

39 Nylon is sometimes used for electrical insulation. However, if there is a risk of high temperatures, then a polymer such as Nomex, with a higher melting point is used. The repeat unit of Nomex is shown below.

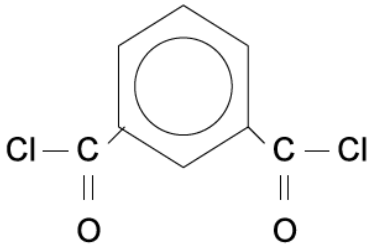


Which of the following is a possible monomer of Nomex?

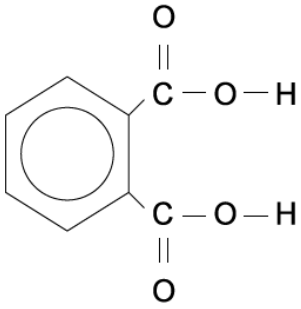
A



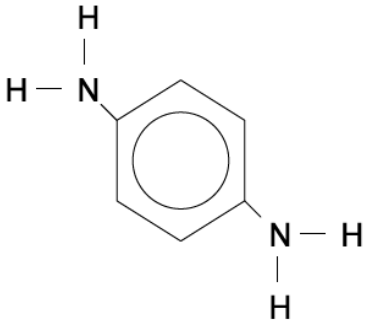
B



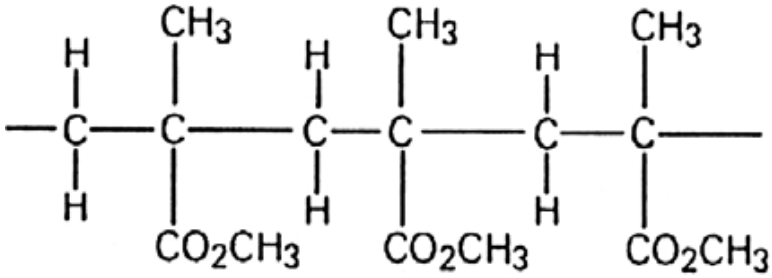
C



D

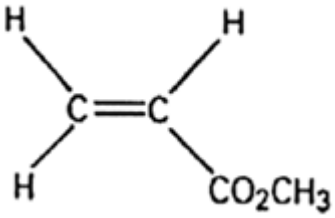


40 Poly(methyl methacrylate), PMMA, is a polymer used to make hard contact lenses. Part of the polymer structure is shown below.

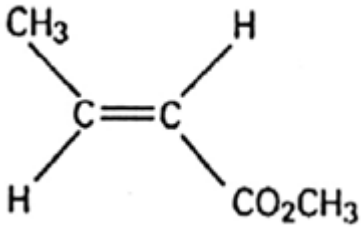


What is the structure of the monomer from which PMMA is made from?

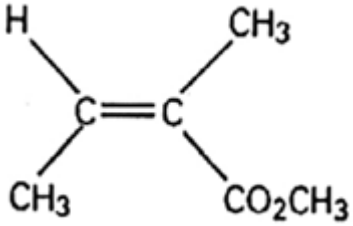
A



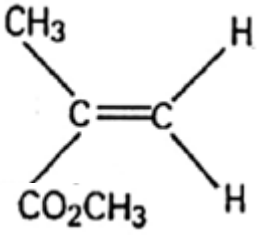
B



C



D



The Periodic Table of Elements

Group																	
1	2											13	14	15	16	17	18
							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	3	4	5	6	7	8	9	10	11	12	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 –

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