

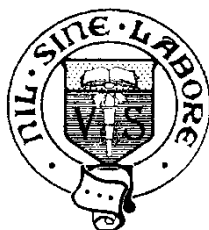
Class

Register Number

Name

**6092/01
CHEMISTRY****23/4P/6092/1****PAPER 1****Tuesday****12 September 2023****1 hour**

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**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 15**.

This question paper consists of 15 printed pages, including the cover page.**[Turn Over**

- 1 Some information on these gas particles are given below.

gas	helium	neon	argon
relative atomic mass, A_r	4	20	40
average speed / m/s	1.36×10^3	0.70×10^3	0.43×10^3

What is the average speed of the particles of oxygen gas?

- A** 0.39×10^3 m/s
B 0.63×10^3 m/s
C 1.08×10^3 m/s
D 1.47×10^3 m/s
- 2 Which of the following substances can be condensed when it passes through a water-cooled condenser?

	melting point / °C	boiling point / °C
A	-150	-120
B	-39	12
C	2	15
D	5	79

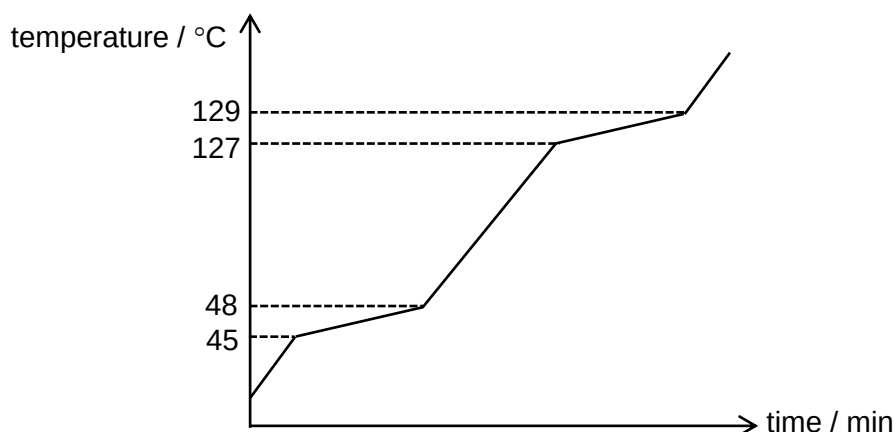
- 3 The catalytic cracking of nonane (C_9H_{20}) produces the following mixture.

compound	C_7H_{16}	C_4H_8	C_2H_6	CH_4
percentage composition by mass / %	28	47	16	9

Which method can be used to separate the constituents of the mixture?

- A** chromatography
B evaporation
C fractional distillation
D separating funnel

- 4 The heating curve of an impure sample of substance X is shown below.



What are the melting point and boiling point of pure substance X?

	melting point / °C	boiling point / °C
A	45	129
B	47	128
C	48	127
D	49	130

- 5 A student needs to measure four different volumes of a solution accurately. The volumes are 10.0 cm³, 25.0 cm³, 50.0 cm³ and 60.0 cm³.

The apparatus available includes a 25.0 cm³ pipette.

Which volumes could be measured using this pipette?

- A** 10.0 cm³ and 25.0 cm³
B 25.0 cm³ only
C 25.0 cm³ and 50.0 cm³
D 50.0 cm³ and 60.0 cm³
- 6 Which of the following statements about a compound are true?
- 1 A compound have varied percentage composition by mass of each element.
 - 2 A compound may contain both ionic and covalent bonds.
 - 3 A compound melts at a fixed temperature.
- A** 1 and 2 only **B** 1 and 3 only **C** 2 and 3 only **D** 1, 2 and 3

- 7 Which of the following correctly describes an ion of an isotope of ${}^{56}_{26}\text{Fe}$?

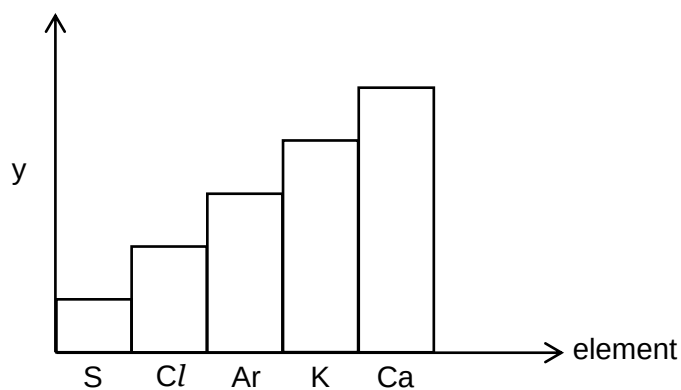
	number of electrons	number of neutrons	number of protons
A	23	30	26
B	24	28	26
C	26	30	26
D	28	32	26

- 8 The electronic configurations of three particles, X, Y and Z are shown below.

X 2.8.1
Y 2
Z 2.8.5

Which statement is true for the three particles?

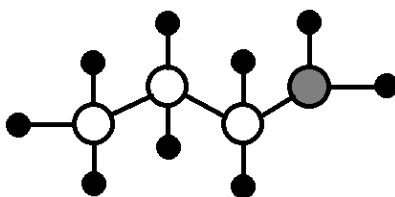
- A** X forms the ionic bonds with Z.
B Y must be a noble gas.
C Z forms covalent bonds only.
D Z forms the ion Z^{3+} .
- 9 The graph below shows how a property changes for the elements from sulfur to calcium.



What is the unknown property y on the y-axis?

- A** the charge of the ion formed by the element
B the number of neutrons in an atom
C the number of valence electron in an atom
D the sum of protons and neutrons in an atom

- 10** The structure of a molecule of a compound containing carbon, nitrogen and hydrogen is shown below.

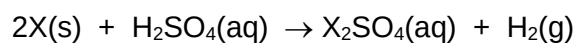


What is the molecular formula of this compound?

- A** CN_3H_7 **B** CN_3H_9 **C** $\text{C}_3\text{H}_7\text{N}$ **D** $\text{C}_3\text{H}_9\text{N}$
- 11** What is the total number of bonded and unbonded electrons in a molecule of carbon dioxide?

	bonded electrons	unbonded electrons
A	4	0
B	4	8
C	8	8
D	8	14

- 12** The equation shows the reaction between element X and dilute sulfuric acid.



What types of bonding are present in element X and in compound X_2SO_4 ?

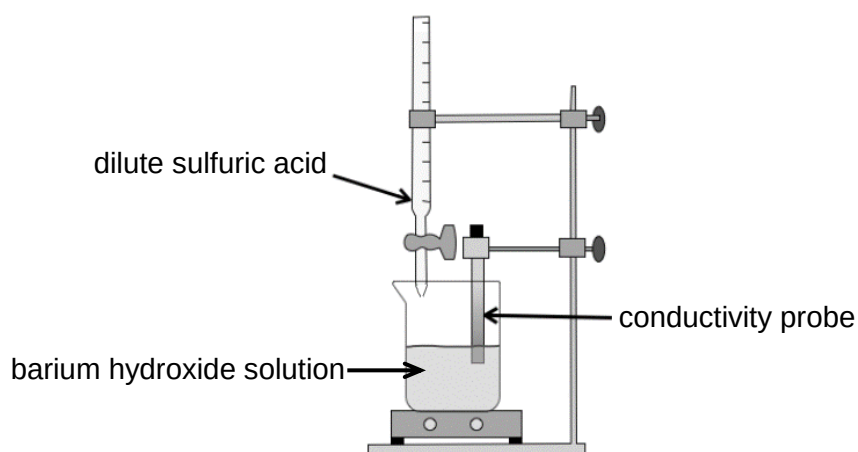
	element X	compound X_2SO_4
A	covalent	covalent
B	covalent	ionic and covalent
C	metallic	covalent
D	metallic	ionic and covalent

- 13** An element burns in air to form a compound which dissolves in dilute hydrochloric acid and aqueous sodium hydroxide.

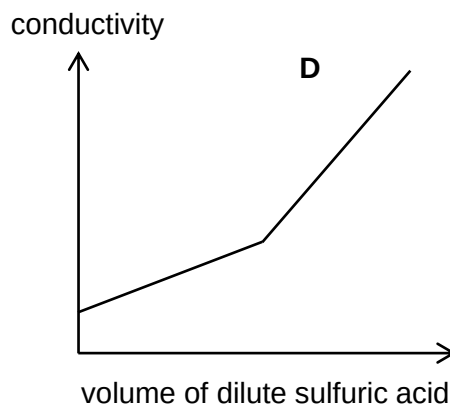
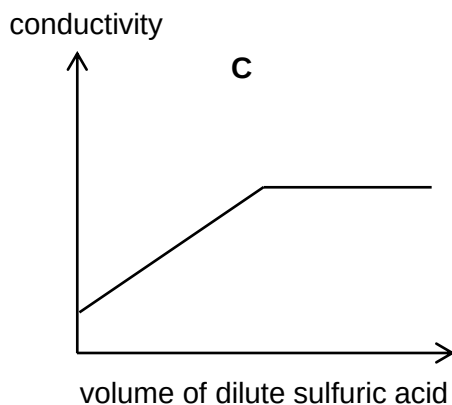
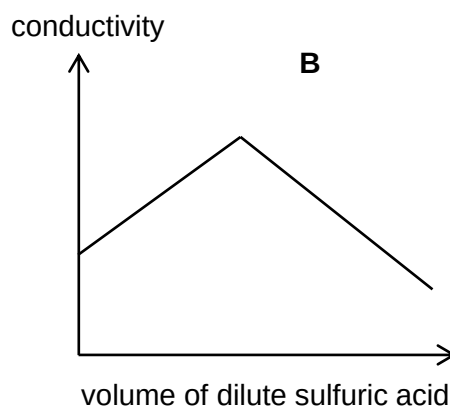
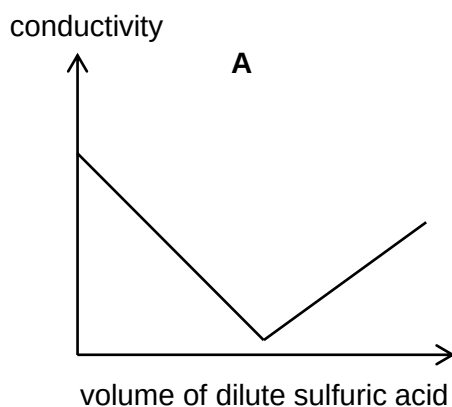
What is the element?

- A** carbon **B** iron **C** lead **D** sodium

- 14** A solution of barium hydroxide was titrated with dilute sulfuric acid from a burette. The electrical conductivity of the mixture was measured as dilute sulfuric acid was added until in excess.



Which graph shows the change in electrical conductivity over time?



- 15** Glass is silicon dioxide.

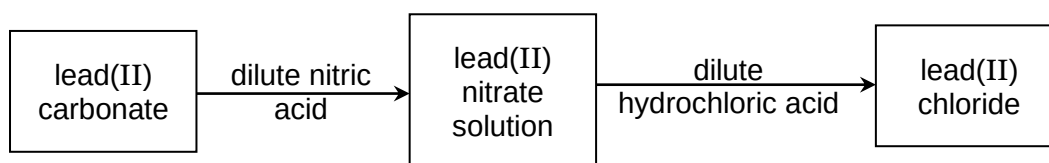
Which of the following chemicals can be added into sewage pipes to dissolve glass fragments trapped in them?

- A** aqueous sodium hydroxide
- B** dilute sulfuric acid
- C** ethanol
- D** tetrachloromethane

- 16** Which ionic equation describes the reaction between solutions of ammonium carbonate and sodium hydroxide?

- A** $\text{H}^+ + \text{OH}^- \rightarrow \text{H}_2\text{O}$
B $2\text{H}^+ + \text{CO}_3^{2-} \rightarrow \text{CO}_2 + \text{H}_2\text{O}$
C $2\text{Na}^+ + \text{CO}_3^{2-} \rightarrow \text{Na}_2\text{CO}_3$
D $\text{NH}_4^+ + \text{OH}^- \rightarrow \text{NH}_3 + \text{H}_2\text{O}$

- 17** The diagram shows the steps to prepare lead(II) chloride from lead(II) carbonate.

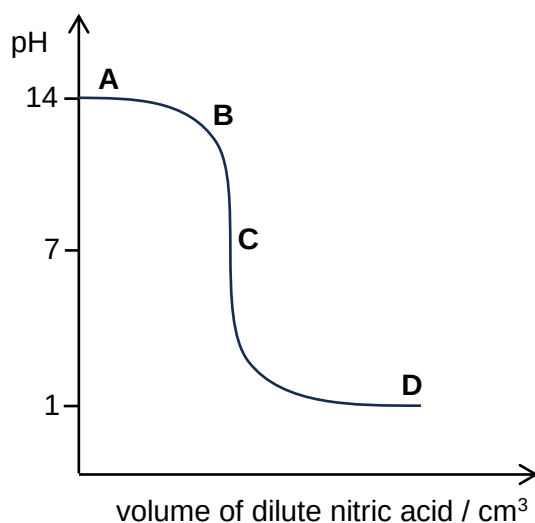


Which of the following is not a step in the preparation of lead(II) chloride from lead(II) carbonate?

- A** add lead(II) carbonate until no more can dissolve
B heat lead(II) nitrate solution until it is saturated
C remove excess lead(II) carbonate by filtration
D wash lead(II) chloride with some deionised water
- 18** Dilute nitric acid reacts with aqueous potassium hydroxide to form a salt and water.

The graph shows how the pH changes as dilute nitric acid is added to aqueous potassium hydroxide.

At which point are both dilute nitric acid and salt present?

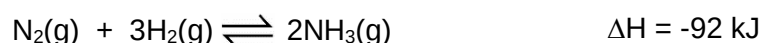


- 19** Some chemical tests were performed on a sample of polluted gas and the results are shown below.

- 1 white precipitates formed in limewater
- 2 moist blue litmus paper turned red
- 3 acidified potassium manganate(VII) was decolourised

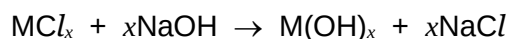
What gases could be in the sample?

- A** carbon dioxide and sulfur dioxide
B carbon monoxide and ammonia
C chlorine and carbon dioxide
D nitrogen oxides and methane
- 20** The Haber Process may be represented by the equation below.



Which of the following statements about the Haber Process is not correct?

- A** 46 kJ of heat is given out for every mole of ammonia formed.
B The process is favoured by high pressure.
C The rates of forward and backward reactions are equal at equilibrium.
D When 1 mol of N_2 and 3 mol of H_2 are used in the process, 2 mol of NH_3 are collected.
- 21** A sample of ozone gas, O_3 , contains the same number of atoms as found in 4.8 g of methane gas.
- What is the mass of the sample of ozone gas?
- A** 16 g **B** 24 g **C** 48 g **D** 72 g
- 22** Aqueous sodium hydroxide reacts with solution of a certain metal chloride MCl_x , to form a precipitate of the metal hydroxide according to the following equation.



10.0 cm³ of 3.0 mol/dm³ sodium hydroxide solution reacts exactly with 10.0 cm³ of 1.5 mol/dm³ MCl_x solution.

What is the formula of the metal chloride?

- A** MCl **B** MCl_2 **C** MCl_3 **D** MCl_4

- 23** What happens to the Cr^{3+} ion when it is converted to CrO_4^{2-} ion?
- A** The oxidation state of chromium decreases and it undergoes reduction.
B The oxidation state of chromium decreases and it undergoes oxidation.
C The oxidation state of chromium increases and it undergoes reduction.
D The oxidation state of chromium increases and it undergoes oxidation.
- 24** A disproportionation reaction occurs when the same element undergoes both oxidation and reduction simultaneously in a chemical reaction.

Which of the following is not a disproportionation reaction?

- A** $\text{FeCl}_2 + \text{Mg} \rightarrow \text{MgCl}_2 + \text{Fe}$
B $2\text{H}_2\text{O}_2 \rightarrow \text{O}_2 + 2\text{H}_2\text{O}$
C $\text{H}_2\text{SO}_4 + \text{Cu}_2\text{O} \rightarrow \text{Cu} + \text{CuSO}_4 + \text{H}_2\text{O}$
D $2\text{NO}_2 + \text{H}_2\text{O} \rightarrow \text{HNO}_2 + \text{HNO}_3$
- 25** Which property of elements increases across a period of the Periodic Table?
- A** metallic character
B number of electron shells
C number of valence electrons
D tendency to form positive ions
- 26** Why can noble gases be used to fill up light bulbs?
- A** Their outermost electron shells are fully filled.
B They are colourless odourless gases.
C They have eight valence electrons.
D They have the same number of protons and electrons and hence electrically neutral.

- 27** Which reactions are exothermic?

- 1 $2\text{C}_8\text{H}_{18} + 17\text{O}_2 \rightarrow 16\text{CO} + 18\text{H}_2\text{O}$
2 $\text{ZnCO}_3 \rightarrow \text{ZnO} + \text{CO}_2$
3 $6\text{CO}_2 + 6\text{H}_2\text{O} \rightarrow \text{C}_6\text{H}_{12}\text{O}_6 + 6\text{O}_2$
4 $2\text{H}_2 + \text{O}_2 \rightarrow 2\text{H}_2\text{O}$

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

- 28** 8.0 g of sodium nitrate was dissolved in 50 cm³ of water at 25.0 °C. The resulting solution has a temperature of 19.0 °C.

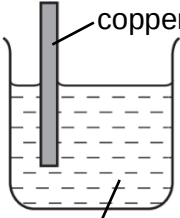
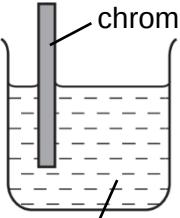
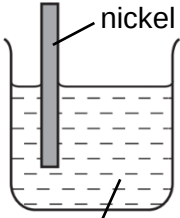
What is the temperature of the resulting solution when 8.0 g of sodium nitrate was dissolved in 100 cm³ of water at 40.0 °C?

- A** 19.0 °C **B** 25.0 °C **C** 34.0 °C **D** 37.0 °C

- 29** Which of the following substances conducts electricity but remains chemically unchanged?

- A** aqueous chlorine
B aqueous copper(II) sulfate
C molten aluminium oxide
D molten iron

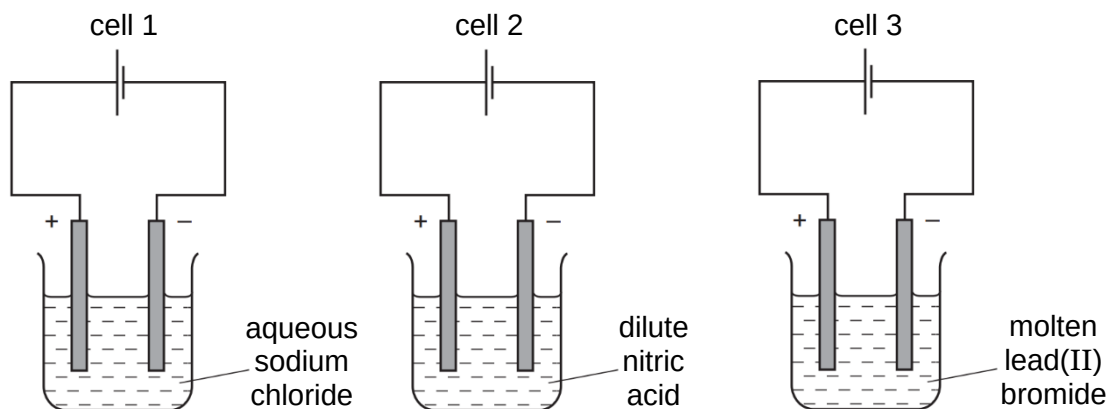
- 30** The diagrams show experiments that were carried out to determine the relative reactivities of three metals.

 aqueous nickel(II) chloride observation: no solid deposit	 aqueous copper(II) chloride observation: solid deposit	 aqueous chromium(II) chloride observation: no solid deposit
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Which of the following conclusions is correct?

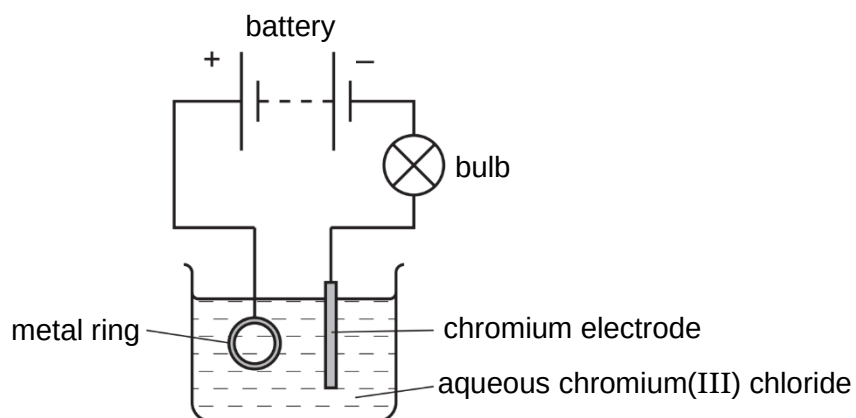
	least reactive	most reactive
A	chromium	copper
B	copper	chromium
C	copper	nickel
D	nickel	chromium

- 31 Three electrolysis cells are set up. Each cell has platinum electrodes.



In which of these cells is a gas formed at **both** electrodes?

- A 1 and 2 B 1 and 3 C 2 only D 3 only
- 32 The diagram shows apparatus used in an attempt to electroplate a metal ring with chromium.

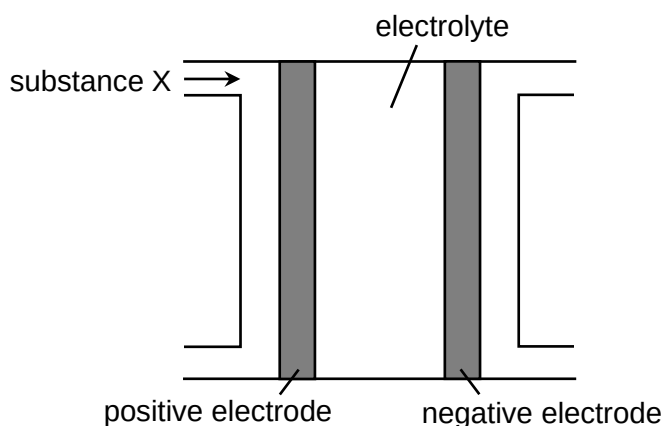


The experiment did not work.

Which change is needed in the experiment to make it work?

- A add solid chromium(III) chloride to the electrolyte
 B increase size of the chromium electrode
 C increase the temperature of the electrolyte
 D switch the ring and chromium electrode

- 33 The diagram represents a typical fuel cell.



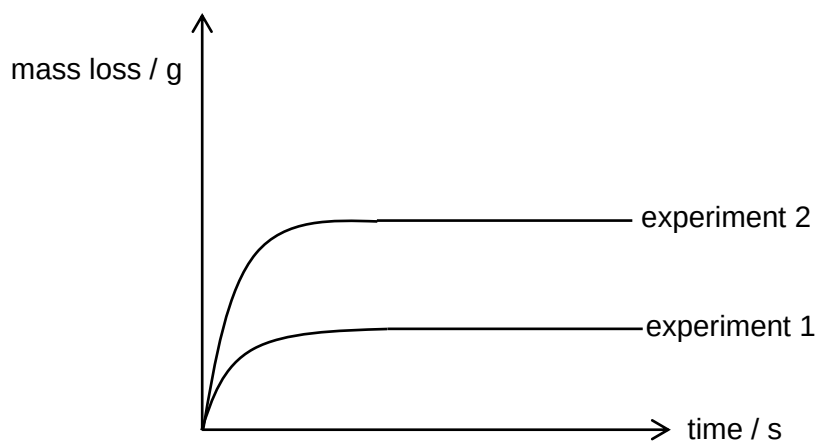
Which of the following on substance X and the reaction it undergoes is correct?

	substance X	type of reaction
A	hydrogen	oxidation
B	hydrogen	reduction
C	oxygen	oxidation
D	oxygen	reduction

- 34 Dilute hydrochloric acid was added to some marble chips in a conical flask and the total mass of the flask and its contents is weighed at regular intervals.

The graph labelled experiment 1 was obtained.

Both reactants are used up at the end of the reaction.



If the experiment is repeated again, what changes will be necessary to obtain the graph for experiment 2?

	marble chips	dilute hydrochloric acid
A	grind to powder	no change
B	no change	same volume but higher concentration
C	use less	larger volume and higher concentration
D	use more	same concentration but larger volume

35 Flour is combustible.

A sign displayed in a flour mill is shown.



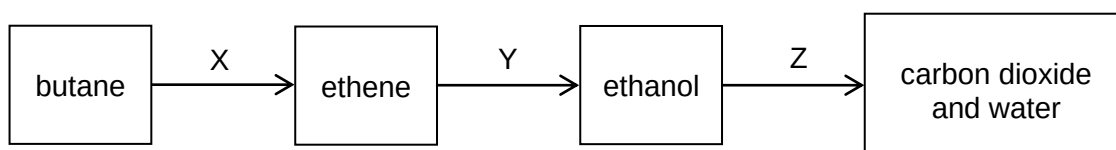
Which statement explains why there is a danger of explosion in a flour mill?

- A Flour burns very quickly because it is a fine powder.
- B Flour catalyses combustion reactions.
- C Flour mills get hot and dry which promote combustion.
- D The combustion of flour is exothermic.

36 Which of the following is true of a homologous series?

- A Each member differs from the previous one by one carbon and four hydrogen atoms.
- B The boiling point decreases as the carbon chain of the members increases.
- C The members have the same empirical formula.
- D The members have the same general formula.

37 The diagram shows a reaction sequence.



Which row names the processes X, Y and Z?

	X	Y	Z
A	cracking	fermentation	respiration
B	cracking	hydration	combustion
C	distillation	fermentation	respiration
D	distillation	hydration	combustion

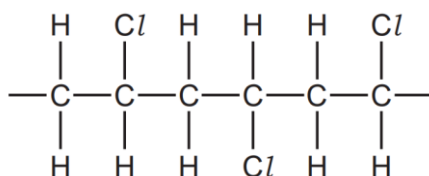
38 The following chemicals are available in the laboratory.

- 1 bromine water
- 2 litmus solution
- 3 magnesium powder
- 4 sodium carbonate

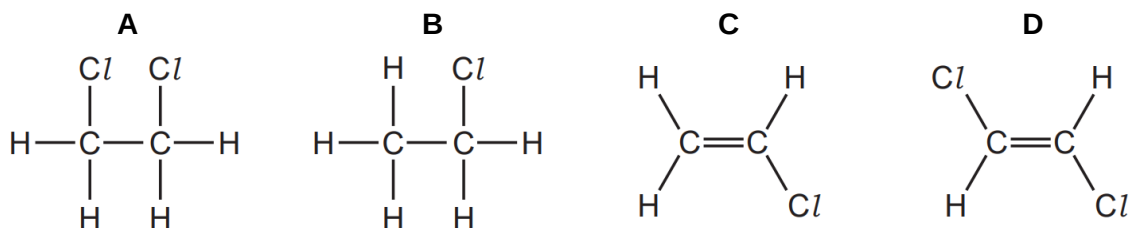
Which of these chemicals can be used to distinguish between propene and propanoic acid?

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

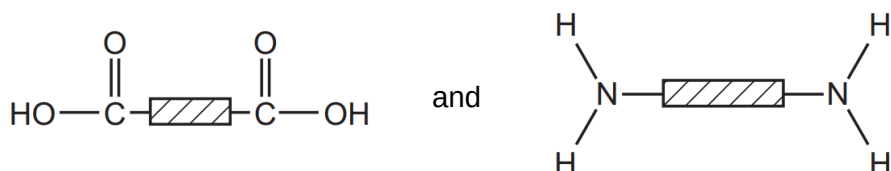
39 The diagram shows three repeat units in the structure of an addition polymer.



Which monomer is used to make this polymer?



40 A polymer X is hydrolysed and the two products are



What can be deduced about X?

- A** It contains ester linkages.
B It has a pH less than 7.
C It is a condensation polymer.
D It is Terylene.

End of Paper

The Periodic Table of Elements

Group																		
I	II											III	IV	V	VI	VII	0	
		1 H hydrogen 1																
		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				

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
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 -

actinoids

The volume of one mole of any gas is 24 dm³ at room temperature and pressure (r.t.p.).