

EXP

PUNGGOL SECONDARY SCHOOL
SECONDARY 4
EXPRESS
PRELIMINARY EXAMINATION
QUESTION & ANSWER BOOKLET



NAME

CLASS

INDEX
NUMBER**Chemistry****6092****Paper 1****30 August 2022**

Additional materials: MCQ answer Sheet

1 hour**READ THESE INSTRUCTIONS FIRST**

Write your class, register number and name on all the work you hand in.

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 18.

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

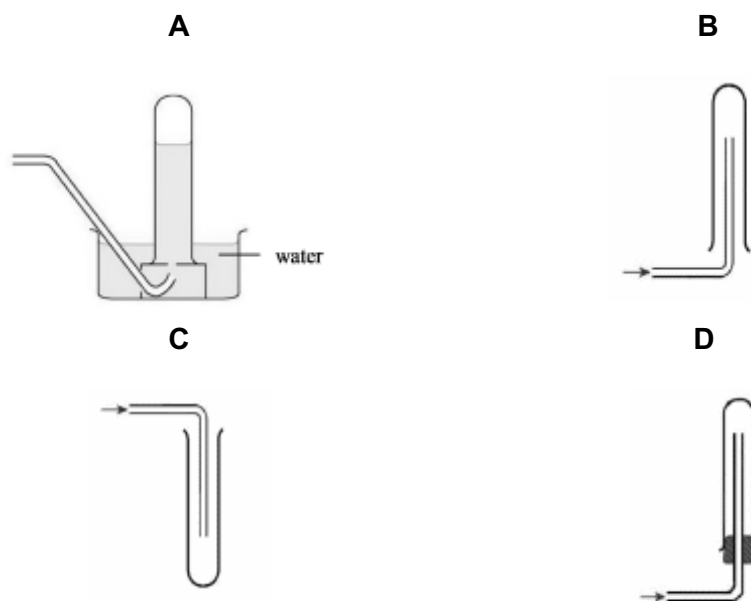
For Examiner's use	
Section A	/40
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Total	/40

Parent's Signature

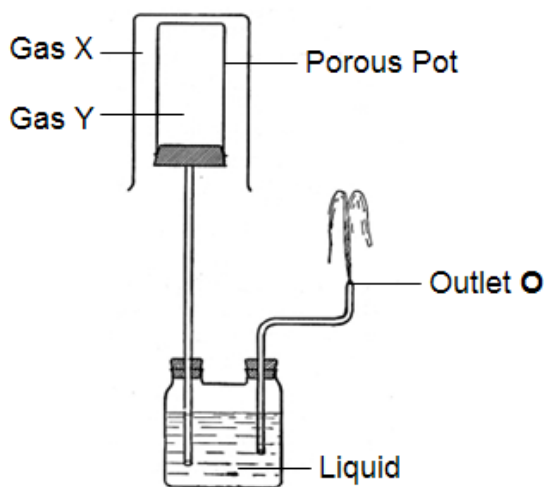
This paper consists of **18** printed pages and **0** blank page.

- 1 A student is preparing a gas in the laboratory that is soluble in water and less dense than air.

What is the most suitable method for collecting the gas?



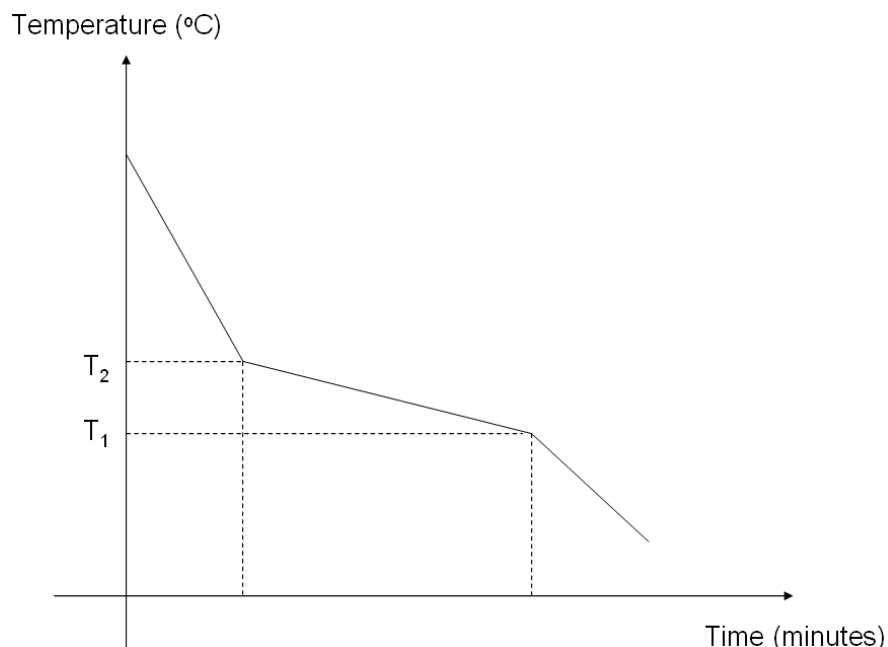
- 2 The diagram shows a beaker full of gas X inverted over a porous pot containing gas Y. A known liquid is used in the container. None of the gases provided below is soluble in the liquid.



Which pair of gases will lead to the liquid spilling out at the outlet O?

	Gas X	Gas Y
A	chlorine	hydrogen
B	argon	neon
C	flourine	helium
D	neon	flourine

- 3 The diagram below shows the cooling curve for an unknown substance. The substance changes from liquid to solid.



- 1 The particles in the substance below temperature T_1 vibrate about their fixed position.
- 2 The substance could be a sample of crude oil.
- 3 The freezing point is the average of T_1 and T_2 .

Which statement(s) is/are correct?

- A** 1, 2 and 3
B 1 and 2 only
C 1 only
D 2 only
- 4 A salt, **R**, on warming with excess aqueous sodium hydroxide, evolved a gas that turned damp red litmus paper blue. When no more gas was evolved, a piece of aluminium foil was added, and a further evolution of the same gas occurred.

What could be **R**?

- A** ammonium nitrate
B ammonium sulfate
C zinc nitrate
D zinc sulfate

- 5 An ion Y^{2+} contains 19 neutrons and 18 electrons. Which of the following shows the proton number and nucleon number of Y ?

	proton number	nucleon number
A	16	35
B	18	37
C	19	38
D	20	39

- 6 The electronic configuration of X is 2,8,4.

X reacts with an element Y from Group VII to form a compound.

Which of the following best describes the compound formed?

	type of bonding	formula of compound
A	ionic	XY_4
B	ionic	X_4Y
C	covalent	XY_4
D	covalent	X_4Y

- 7 The boiling points of beryllium oxide and sodium oxide are shown below.

	boiling point / $^{\circ}\text{C}$
beryllium oxide	3900
sodium oxide	1950

Beryllium oxide does not conduct electricity in both solid and molten states.

Which of the following best explain the difference in boiling points between the two compounds?

- A** Electrostatic forces of attraction between the oppositely charged ions in beryllium oxide is stronger.
- B** Metallic bonds in beryllium oxide are stronger.
- C** Covalent bonds in beryllium oxide are stronger.
- D** Intermolecular forces of attraction in beryllium oxide is stronger.

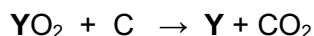
- 8 Which structure **does not** contain atoms bonded to other atoms by four covalent bonds?
- A graphite
 - B silicon dioxide
 - C poly(propene)
 - D carbon tetrachloride

- 9 Some of the medicinal tablets contain calcium. When the calcium in these tablets reacts with oxygen, it forms calcium oxide.

A sample of 100.0 g of calcium tablets yields 28.0 g of calcium oxide.

What is the percentage by mass of calcium in the tablet?

- A 10.0%
 - B 15.0%
 - C 20.0%
 - D 25.0%
- 10 4.00 g of a metal oxide, YO_2 , is heated with carbon. 3.15 g of metal **Y** is obtained.



What is the identity of **Y**?

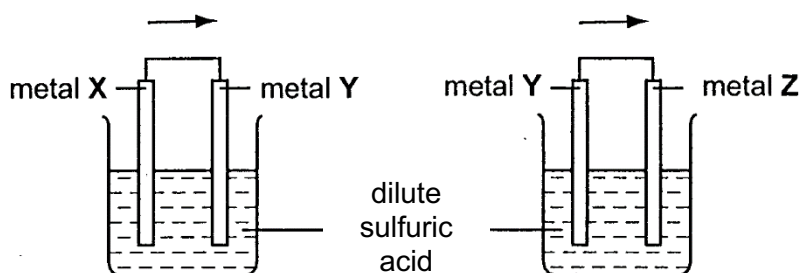
- A $^{59}_{27}\text{Co}$
 - B $^{91}_{40}\text{Zr}$
 - C $^{115}_{49}\text{In}$
 - D $^{119}_{50}\text{Sn}$
- 11 Which statement about the electrolysis of molten sodium chloride is correct?
- A A gas that bleaches damp litmus paper is produced at the anode.
 - B A gas that relights a glowing splint is produced at the anode.
 - C Sodium metal is deposited at the anode.
 - D A gas that extinguishes a lighted splint is produced at the cathode.

- 12 Inert electrodes are used in the electrolysis of an aqueous solution containing both copper(II) sulfate and zinc sulfate.

What will be produced at the cathode?

- A copper
- B zinc
- C hydrogen
- D oxygen

- 13 Two cells were set up as shown in the diagram. The arrows show the direction of electron flow in the external circuits.



Which set of metals would give the electron flow in the directions shown?

	metal X	metal Y	metal Z
A	iron	zinc	copper
B	copper	iron	zinc
C	zinc	iron	copper
D	zinc	copper	iron

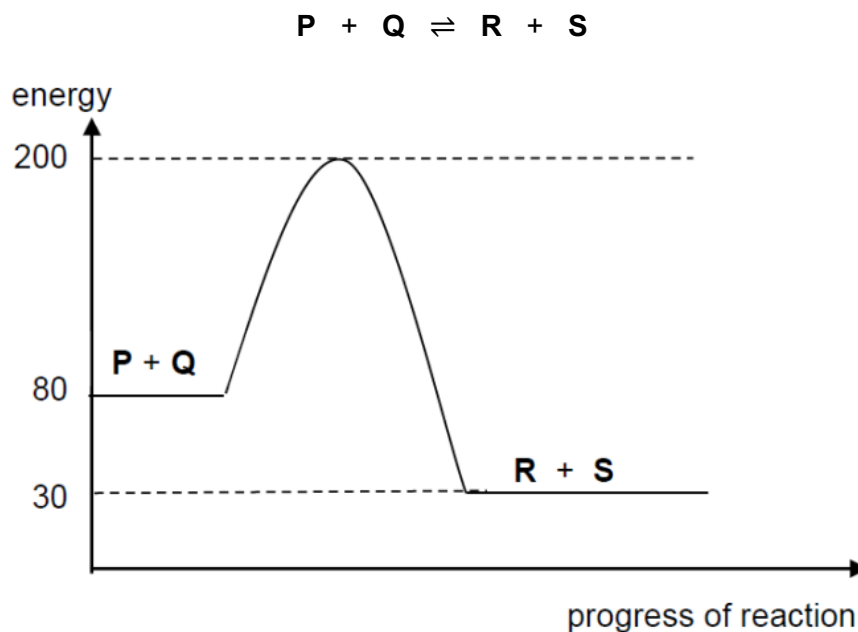
- 14 The enthalpy change of combustion of four different fuels are shown below.

Reaction	Enthalpy change/kJ
$2\text{C}_2\text{H}_6 + 7\text{O}_2 \rightarrow 4\text{CO}_2 + 6\text{H}_2\text{O}$	-3120
$\text{C}_2\text{H}_5\text{OH} + 3\text{O}_2 \rightarrow 2\text{CO}_2 + 3\text{H}_2\text{O}$	-1367
$2\text{C}_4\text{H}_8 + 12\text{O}_2 \rightarrow 8\text{CO}_2 + 8\text{H}_2\text{O}$	-5432
$2\text{C}_4\text{H}_{10} + 13\text{O}_2 \rightarrow 8\text{CO}_2 + 10\text{H}_2\text{O}$	-5756

Which fuel releases the most energy **per gram** of fuel?

- A C_2H_6
- B $\text{C}_2\text{H}_5\text{OH}$
- C C_4H_8
- D C_4H_{10}

- 15 The diagram below shows the energy profile diagram of a reversible reaction.



What is the enthalpy change of reaction, ΔH and activation energy, E_a for the **reverse** reaction?

	ΔH in kJ / mol	E_a in kJ / mol
A	- 50	120
B	+ 50	120
C	- 50	170
D	+ 50	170

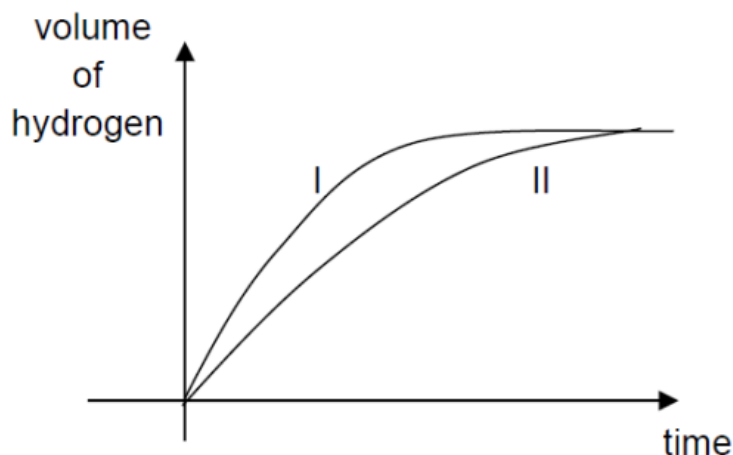
- 16 In the reaction between magnesium and sulfuric acid, the following changes could be made to the conditions.

- 1 increase concentration of the acid
- 2 increase in particle size of magnesium
- 3 increase in pressure on the system
- 4 increase in temperature of the system

Which changes will increase the rate of reaction?

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

- 17 In the graph, curve I was obtained when 1 g of granulated zinc was reacted with an excess of 0.1 mol/dm^3 nitric acid at 50°C .



Which of the following changes would give curve II?

- A increasing the temperature
 - B using 1 g of powdered zinc
 - C adding 25 cm^3 of 0.025 mol/dm^3 of nitric acid to the original acid
 - D reducing the pressure of the reacting mixture
- 18 In which of the following reactions is the underlined substance oxidised?
- A $\underline{\text{Cl}_2} + 2\text{I}^- \rightarrow \text{I}_2 + 2\text{Cl}^-$
 - B $3\text{CuO} + 2\underline{\text{NH}_3} \rightarrow \text{N}_2 + 3\text{H}_2\text{O} + 3\text{Cu}$
 - C $\text{MgCO}_3 + 2\underline{\text{H}^+} \rightarrow \text{Mg}^{2+} + \text{CO}_2 + \text{H}_2\text{O}$
 - D $\underline{\text{Pb}^{2+}} + \text{SO}_4^{2-} \rightarrow \text{PbSO}_4$
- 19 The table below shows the results of adding weighed pieces of nickel metal in salt solutions of metals **P**, **Q**, **R** and **S**.

solution	initial mass of nickel/ g	mass of nickel after 10 minutes/ g
P	5.0	4.0
Q	5.0	4.5
R	5.0	3.5
S	5.0	0.0

Which of the following statements is correct?

- A Metal **S** can displace the metal in solution **R**.
- B Metal **S** is below nickel in the reactivity series.
- C Metal **R** is above nickel in the reactivity series
- D Metal **P** is above metal **Q** in the reactivity series.

20 The diagram shows three types of item.



cutlery



cooking pan

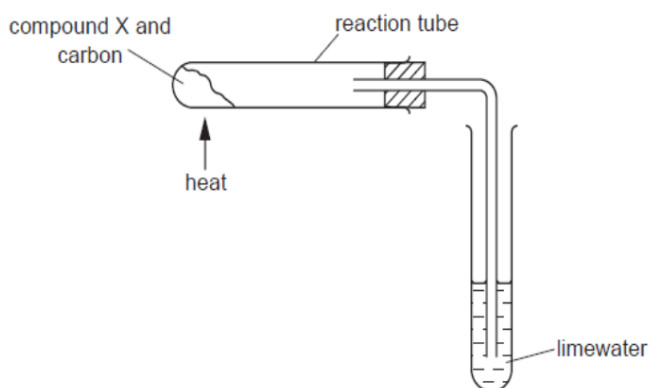


instruments used in hospitals

Which method of rust prevention can be used for all three types of item?

- A coating with paint
- B galvanising
- C using alloy such as stainless steel
- D coating with grease

21 Compound **X** is heated with carbon using the apparatus shown.



No precipitate is formed in limewater after heating for some time.

What could be **X**?

- A calcium oxide
- B zinc oxide
- C lead(II) oxide
- D copper(II) oxide

- 22 The table below refers to four metals and some of their compounds.

Metal	Action of heat on metal carbonate	Effect of hydrogen on heated oxide	Action of dilute hydrochloric acid on metal
P	Decompose	Reduced	No reaction
Q	No reaction	No reaction	Hydrogen evolved
R	Decompose	No reaction	Hydrogen evolved
S	Decompose	Reduced	Hydrogen evolved

Which one of the following is the order of reactivity of the four metals?

	more reactive	→	less reactive	
A	Q	R	S	P
B	Q	S	R	P
C	R	S	P	Q
D	R	Q	P	S

- 23 Ammonia is produced by the reaction of the elements, hydrogen and nitrogen, in the Haber Process. One of these elements is obtained from air.

The ammonia formed can react with substance **X** to form a salt.

Ammonia can be displaced from this salt by reacting with substance **Y**.

Which row correctly shows the element obtained from air and the type of substances of **X** and **Y**?

	Element obtained from air	X	Y
A	hydrogen	acid	base
B	hydrogen	base	acid
C	nitrogen	acid	base
D	nitrogen	base	acid

24 Hydrazine has the formula H_2NNH_2 . It has properties similar to those of ammonia.

- 1 It dissolves in water to produce hydroxide ions.
- 2 It is a covalent compound.
- 3 It reacts with hydrochloric acid to form a compound with the formula $\text{C}/\text{H}_3\text{NNH}_3\text{Cl}$.

Which of the following correctly describe the properties of hydrazine?

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

25 What does the term *strong acid* mean in relation to nitric acid?

- A** Each molecule of nitric acid can produce one hydrogen ion.
B It is fully ionised in aqueous solution.
C Its aqueous solution has a pH lower than 7.
D All nitrates are soluble in water.

26 The formulae of some oxides are shown below.



Which one of the following in the table gives the correct number of each type of oxide?

	number of each type of oxide		
	acidic	amphoteric	basic
A	1	1	2
B	2	0	3
C	2	1	2
D	1	1	3

27 Which equation describes the most suitable reaction for making copper(II) sulfate?

- A** $\text{Cu} + \text{H}_2\text{SO}_4 \rightarrow \text{CuSO}_4 + \text{H}_2$
B $\text{Cu}(\text{NO}_3)_2 + \text{H}_2\text{SO}_4 \rightarrow \text{CuSO}_4 + 2\text{HNO}_3$
C $\text{Cu}(\text{NO}_3)_2 + \text{Na}_2\text{SO}_4 \rightarrow \text{CuSO}_4 + 2\text{NaNO}_3$
D $\text{CuCO}_3 + \text{H}_2\text{SO}_4 \rightarrow \text{CuSO}_4 + \text{H}_2\text{O} + \text{CO}_2$

28 **R**, **S** and **T** are in period 3 of the Periodic Table.

The oxide of **R** reacts with water to form a solution with a pH less than 7 and contributes to acid rain.

S reacts violently with cold water to produce a gas which extinguishes lighted splint with a 'pop' sound.

Oxide of **T** is soluble in both hydrochloric acid and aqueous sodium hydroxide.

Which statement is **incorrect**?

- A** **R** has more protons than **S**.
- B** Carbonate of **S** does not decompose on heating.
- C** **T** has lower electricity conductivity than **S**.
- D** **R** forms two oxides. One oxide of **R** decolourises purple potassium manganate(VII) solution.

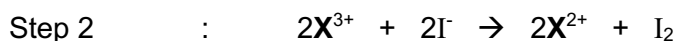
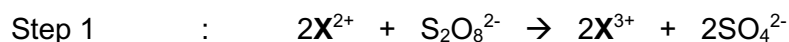
29 Elements **U** and **V** are in Group VII of the Periodic Table.

U is a liquid at room temperature and **V** is a solid at room temperature.

Which statement is correct?

- A** **V** has lighter colour than **U**.
- B** **U** reacts with aqueous sodium chloride to form chlorine.
- C** **V** is a solid and can act as a catalyst.
- D** **U** displaces astatine from an aqueous solution of At^- ions.

30 The following reactions takes place in the presence of an ion of the element **X**.

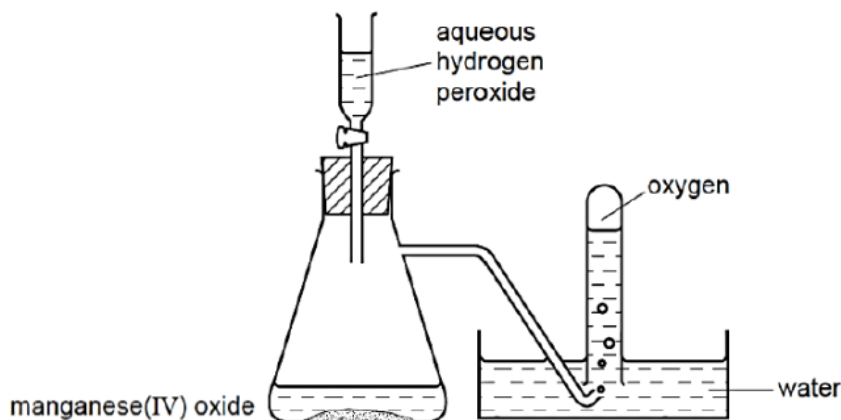
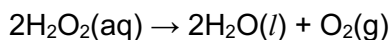


- 1 1 mol of $\text{S}_2\text{O}_8^{2-}$ produces 0.5 mol of I_2 .
- 2 Compounds of **X** are coloured.
- 3 Oxide of **X** is basic.

Which statement(s) is/are correct?

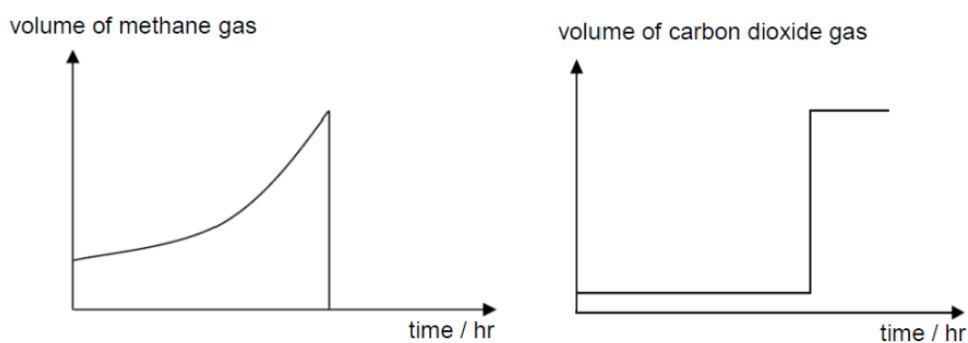
- A** 1, 2 and 3
- B** 1 and 3 only
- C** 2 and 3 only
- D** 2 only

- 31 Oxygen gas was prepared from hydrogen peroxide and collected as shown.



Which substance contaminated the first few tubes of oxygen collected?

- A H_2
 - B H_2O
 - C H_2O_2
 - D N_2
- 32 The graphs below show how the volume of methane and carbon dioxide in the air inside a coal mine change with time.



What is likely to have caused the sudden change shown in the graphs?

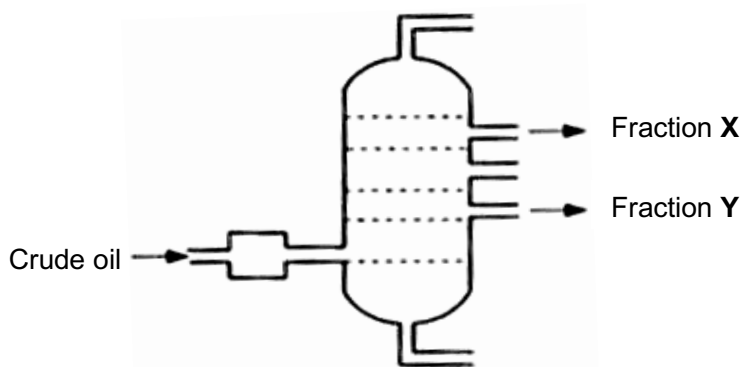
- A A mixture of methane and air exploded.
- B The coal mine was ventilated by having fresh air blown in.
- C The temperature in the mine was lowered in the night.
- D Methane reacts with carbon dioxide inside the coal mine.

33 An atmospheric pollutant can be removed by the process of reduction.

Which pollutant is removed by this process?

- A** carbon monoxide in a catalytic convertor
- B** sulfur dioxide by reaction with calcium oxide
- C** nitrogen monoxide in a catalytic converter
- D** sulfur dioxide from flue gases by reaction with calcium carbonate

34 The diagram shows the fractional distillation of crude oil.



Which of the following statements about fractions **X** and **Y** is correct?

- A** **X** is less flammable than **Y**.
- B** **X** has a higher boiling point than **Y**.
- C** **X** is less viscous than **Y**.
- D** Both **X** and **Y** can be used for making road surfaces.

35 Which manufacturing process does **not** require the use of catalyst?

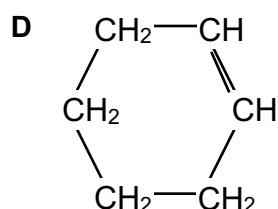
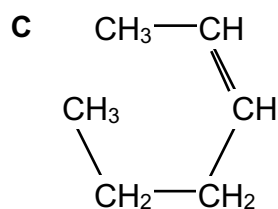
- A** Extraction of iron in blast furnace
- B** Manufacturing of margarine from vegetable oil
- C** Manufacturing of ammonia
- D** Production of petrol from long-chain hydrocarbon in cracking

36 During combustion, 10 cm^3 of the vapour of a hydrocarbon **R** produces 60 cm^3 of carbon dioxide measured under room temperature and pressure.

When **R** reacts with hydrogen over a nickel catalyst, a compound of relative molecular mass 84 is formed.

What is the formula of **R**?

- A** $(\text{CH}_3)_2\text{CHCH}_2\text{CH}_2\text{CH}_3$
- B** $\text{CH}_3\text{CH}_2\text{CH}_2\text{COOCH}_2\text{CH}_3$



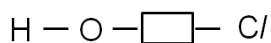
37 Which of these equations does **not** represent an addition reaction?

- A** $\text{CH}_4 + \text{Br}_2 \rightarrow \text{CH}_3\text{Br} + \text{HBr}$
- B** $\text{C}_2\text{H}_4 + \text{Br}_2 \rightarrow \text{C}_2\text{H}_4\text{Br}_2$
- C** $n\text{ C}_2\text{H}_4 \rightarrow (\text{—CH}_2\text{—CH}_2\text{—})_n$
- D** $\text{C}_3\text{H}_6 + \text{H}_2\text{O} \rightarrow \text{C}_3\text{H}_7\text{OH}$

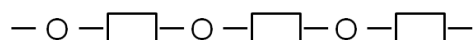
38 Which compound can be oxidised to ethanoic acid?

- A** CH_3OH
- B** $\text{C}_2\text{H}_5\text{OH}$
- C** $\text{C}_3\text{H}_7\text{OH}$
- D** C_4H_8

39 The following monomer undergoes condensation polymerisation to produce a polymer.



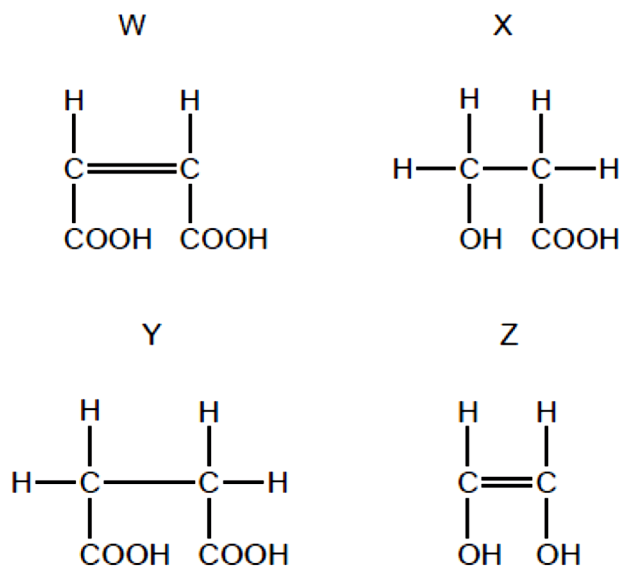
Three repeat units of this polymer are shown below.



Which compound is formed each time a monomer is added to the polymer?

- A** Cl_2
- B** H_2
- C** HCl
- D** H_2O

40 The structures of 4 compounds **W**, **X**, **Y** and **Z** are shown below.



Which row correctly describes the reactions of the compounds?

	decolourises aqueous bromine	has a pH of less than 7	reacts with a carboxylic acid to form an ester
A	W and Z	W, X and Y	X and Z
B	W and Z	X and Z	X
C	X and Y	W, X and Y	X and Z
D	X and Y	X and Z	X

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	Key proton (atomic) number atomic symbol name relative atomic mass										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 –			

lanthanoids

57	58	59	60	61	62	63	64	65	66	67	68	69	70	71
La	Ce	Pr	Nd	Pm	Sm	Eu	Gd	Tb	Dy	Ho	Er	Tm	Yb	Lu
lanthanum	cerium	praseodymium	neodymium	promethium	samarium	europium	gadolinium	terbium	dysprosium	holmium	erbium	thulium	ytterbium	lutetium
139	140	141	144	–	150	152	157	159	163	165	167	169	173	175
89	90	91	92	93	94	95	96	97	98	99	100	101	102	103
Ac	Th	Pa	U	Np	Pu	Am	Cm	Bk	Cf	Es	Fm	Md	No	Lr
actinium	thorium	protactinium	uranium	neptunium	plutonium	americium	curium	berkelium	californium	einsteinium	fermium	mendelevium	nobelium	lawrencium
–	232	231	238	–	–	–	–	–	–	–	–	–	–	–

actinoids

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