Name:	Class:	Class Register Number:

中正中学

CHUNG CHENG HIGH SCHOOL (MAIN)

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PRELIMINARY EXAMINATION 2024

SECONDARY 4

CHEMISTRY

6092/01

Paper 1 Multiple Choice

9 September 2024

1 hour

Additional Materials: Multiple Choice Answer Sheet

READ THESE INSTRUCTIONS FIRST

Write in soft pencil.
Do not use staples, paper clips, glue or correction fluid.
Write your name, class and register number clearly in the spaces provided at the top of this page.

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 16.
The use of an approved scientific calculator is expected, where appropriate.

This document consists of **16** printed pages.

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1 A student prepares a pure sample of magnesium sulfate from dilute sulfuric acid and magnesium.

Which apparatus does the student use?

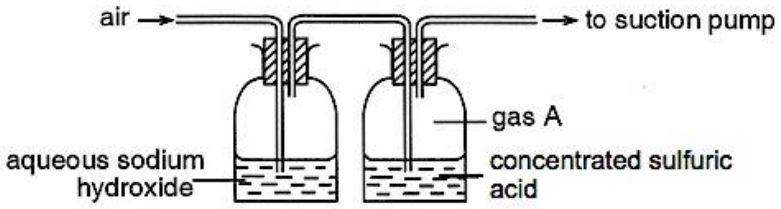
A burette, pipette and an evaporating dish

B measuring cylinder and an evaporating dish

C beaker, balance, a filter funnel and filter papers

D beaker, an evaporating dish, a filter funnel and filter papers

2 A sample of air is passed through the apparatus shown below.



What would be the composition of gas **A** after passing air through aqueous sodium hydroxide and then concentrated sulfuric acid?

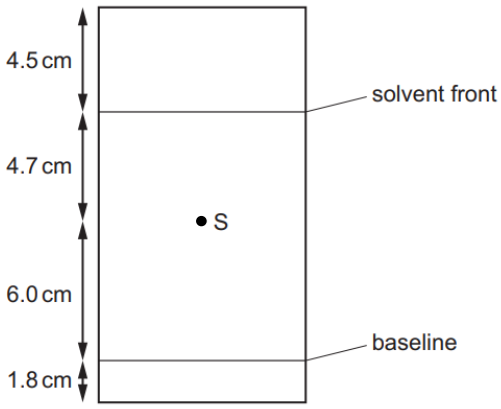
A carbon dioxide, nitrogen, water vapour

B carbon dioxide, nitrogen, oxygen

C nitrogen, noble gases, oxygen

D noble gases only

3 The chromatogram obtained from a chromatography experiment on substance S is shown.



What is the R_f value of S?

A 0.35 **B** 0.48 **C** 0.56 **D** 0.62

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4 Three separations are listed.

1. obtaining water from sodium chloride solution
2. obtaining iodine from a mixture of iodine and nickel
3. obtaining solid sodium chloride from aqueous sodium chloride

Which techniques would be involved in these separations?

	1	2	3
A	distillation	sublimation	evaporation
B	distillation	sublimation	filtration
C	filtration	crystallisation	evaporation
D	sublimation	crystallisation	filtration

5 Some tests are carried out on a sample of water from a factory. The following results were obtained.

1. A white precipitate was formed with barium nitrate and nitric acid.
2. A white precipitate was formed with aqueous ammonia; precipitate was insoluble in excess aqueous ammonia.

What compound could be present in the water?

A aluminium chloride

B aluminium sulfate

C zinc chloride

D zinc sulfate

6 Element Y burns in air to form an acidic gas that decolourises potassium manganate(VII).

What is Y?

A carbon

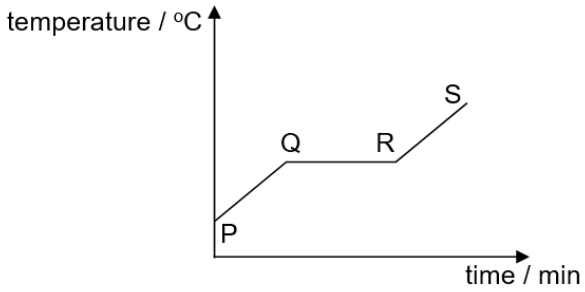
B nitrogen

C magnesium

D sulfur

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7 Solid X was heated until it was completely melted. The graph shows how its temperature varies with time as solid X is heated.



Which of the following statements are true about the particles in X?

I. They are closer to each other at stage RS than at stage PQ.
II. The forces of attraction are stronger at stage P than at stage S.
III. The arrangement is more orderly at stage RS than at stage PQ.
IV. Their total energy content at stage QR is lower than at stage RS.

A II and IV only

B II and III only

C I and III only

D I and II only

8 Which particle contains the same number of both neutrons and electrons?

A $^{40}_{20}Ca^{2+}$ **B** $^{24}_{12}Mg^{2+}$ **C** $^{19}_{9}F^{-}$ **D** $^{32}_{16}S^{2-}$

9 Carbon has three naturally occurring isotopes, carbon-12, carbon-13 and carbon-14.

Which of the following statements about carbon-14 is incorrect?

A It is found in carbon dioxide in the atmosphere.

B It reacts with limited oxygen to form carbon monoxide.

C It has different electronic configuration as the other isotopes.

D It has the greatest number of neutrons compared to the other isotopes.

10 Which of the following is an element made up of covalent molecules?

A ice **B** iodine **C** sand **D** argon

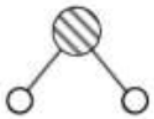
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11 The formula of the nitride of element Q is QN.

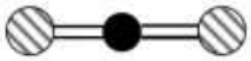
What is the formula of a compound formed between Q and an oxalate ion, $C_2O_4^{2-}$?

A $Q_3C_2O_4$ **B** $Q_2(C_2O_4)_3$ **C** $Q(C_2O_4)_2$ **D** QC_2O_4

12 The structural diagrams of two molecules, X_2Y and ZY_2, are shown below.



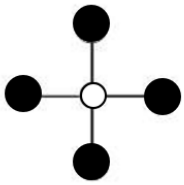
X_2Y



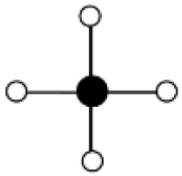
ZY_2

Which of the following represents a molecule of a compound formed between X and Z?

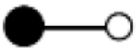
A



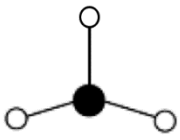
B



C



D



13 The table below shows some of the physical properties of substance P, Q, R and S.

substance	melting point /°C	boiling point /°C	electrical conductivity		Solubility in water
			solid state	liquid state	
P	122	150	Poor	Poor	Insoluble
Q	690	1790	Poor	Good	Soluble
R	1510	2489	Poor	Poor	Insoluble
S	1453	2730	Good	Good	Insoluble

Which of the following statements about the four substances is correct?

A Substances R and Q are macromolecules.

B Substance Q can conduct electricity because it has free mobile electrons.

C Substance S has a structure held together by electrostatic forces of attraction between positive ions and a 'sea of delocalised' electrons.

D Substance P has a simple molecular structure, and it has weak forces of attraction between its atoms.

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14 What is the mass of iron in 204 g of Fe_2O_3?

A 56 g **B** 70 g **C** 112 g **D** 143 g

15 Which quantities are the same for one mole of carbon monoxide and one mole of nitrogen monoxide?

I. Molar mass
II. Number of atoms
III. Number of molecules
IV. Volume at room temperature and pressure

A II, III and IV

B I, III and IV

C II and III only

D III and IV only

16 30 cm^3 of 0.1 mol/dm^3 of aqueous sodium hydroxide is required to exactly neutralise 25 cm^3 of dilute sulfuric acid. What is the concentration of the acid?

A 0.24 mol/dm^3

B 0.12 mol/dm^3

C 0.06 mol/dm^3

D 0.03 mol/dm^3

17 Tin is extracted from its ore, SnO_2, by reducing it with carbon in a furnace. The equation for the reaction is shown below.

$$SnO_2 + 2C \rightarrow Sn + 2CO_2$$

What is the percentage purity of tin ore if 600 g of the tin ore is reduced to produce 82 g of tin? [A_r of Sn: 119, M_r of SnO_2: 151]

A $\frac{82}{119} \times \frac{151}{600} \times 100$

B $\frac{82}{119} \times \frac{600}{151} \times 100$

C $\frac{119}{82} \times \frac{151}{600} \times 100$

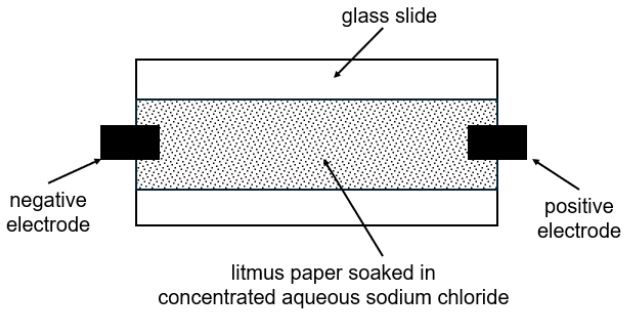
D $\frac{82}{600} \times 100$

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18 A hydrocarbon was found to contain 85.7% by mass of carbon and 14.3% by mass of hydrogen. The molar mass of the hydrocarbon was found to be 56 g/mol. What is the molecular formula of the hydrocarbon?

A CH_2 **B** C_2H_4 **C** C_3H_8 **D** C_4H_8

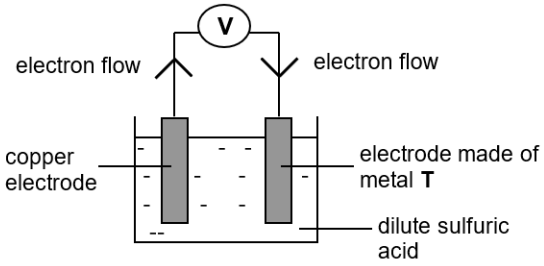
19 A piece of blue litmus paper was soaked in concentrated aqueous sodium chloride and supported on a glass slide. The paper was connected to an electrical supply as shown in the diagram.



Which of the following shows the correct observations near each electrode after some time?

	negative electrode	positive electrode
A	remain blue	turn red and then bleached
B	remain blue	remain blue
C	turn red	turn red and then bleached
D	turn red and then bleached	remain blue

20 The diagram below shows the set-up of an electric cell using electrodes of copper and metal **T**.



Which statement is correct?

A Copper is less reactive than metal **T**.

B Effervescence will be observed at metal **T**.

C Oxidation occurs at metal **T**.

D The mass of copper electrode will increase over time.

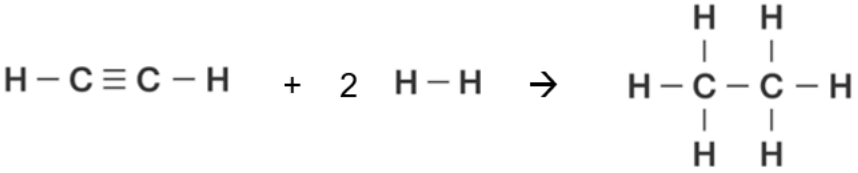
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21 Electrolysis is used to plate a metal statue with silver. Which row correctly shows the electrolyte used and the electrode that the statue should be connected to?

	electrolyte	statue
A	silver nitrate	cathode
B	silver chloride	cathode
C	silver chloride	anode
D	silver nitrate	anode

22 Ethyne (C_2H_2) reacts with hydrogen to form ethane (C_2H_6) as shown in the equation below.



The average energies of the bonds in the substances involved are shown in the table below.

bond	bond energies (kJ/mol)
C – H	413
C – C	347
C ≡ C	839
H – H	432

What is the enthalpy change for this reaction?

A +51 kJ/mol **B** −176 kJ/mol **C** −296 kJ/mol **D** −728 kJ/mol

23 Which change in the conditions in the Haber process results in a decrease in activation energy?

A increasing the concentration of the reactants

B increasing the temperature

C increasing the pressure

D using a catalyst

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24 Equations for reactions of iron and iron compounds are shown.

$Fe + 2HCl \rightarrow FeCl_2 + H_2$

$2FeCl_2 + Cl_2 \rightarrow 2FeCl_3$

$FeSO_4 + Mg \rightarrow Fe + MgSO_4$

$FeSO_4 + 2NaOH \rightarrow Fe(OH)_2 + Na_2SO_4$

How many of these are redox reactions?

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

25 Which solutions, when mixed, form an insoluble salt?

A dilute hydrochloric acid and barium nitrate

B dilute sulfuric acid and sodium hydroxide

C dilute hydrochloric acid and silver nitrate

D dilute sulfuric acid and zinc chloride

26 The following reactions are carried out.

reaction	result
ethanoic acid is added to ammonium carbonate	gas **E** is given off
ammonium ethanoate is warmed with solution **F**	gas **G** is given off and moist red litmus paper turns blue

What are **E**, **F** and **G**?

	E	**F**	**G**
A	ammonia	ethanoic acid	carbon dioxide
B	ammonia	sodium hydroxide	ammonia
C	carbon dioxide	ethanoic acid	carbon dioxide
D	carbon dioxide	sodium hydroxide	ammonia

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27 Rubidium, Rb, is an element in the same group of the Periodic Table as lithium, sodium and potassium.

Which statement about rubidium is likely to be correct?

A It sinks in water.

B It forms an insoluble hydroxide.

C It reacts slowly with cold water.

D It is produced during the electrolysis of aqueous rubidium chloride.

28 Using your knowledge of the halogens and their compounds, which statement is incorrect?

A Bromine displaces astatine from aqueous potassium astatide.

B Hydrogen astatide is a covalent molecule.

C Silver astatide is insoluble in water.

D Solid astatine is white.

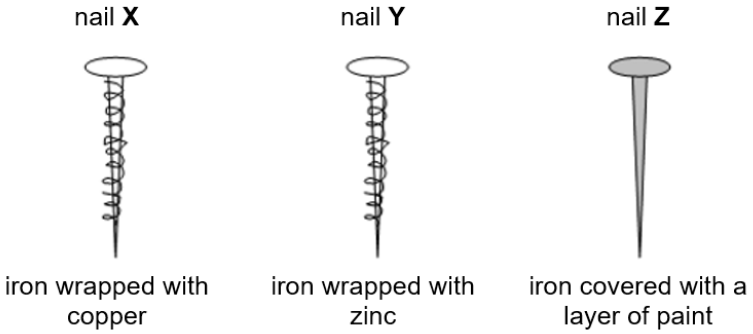
29 X, Y and Z are in the same period of the Periodic Table.

X is a non-metal, Y is a metal and Z shows the properties of both metals and non-metals.

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

A XZY **B** YXZ **C** YZX **D** ZXY

30 The experiment below investigates the rusting of iron nails.

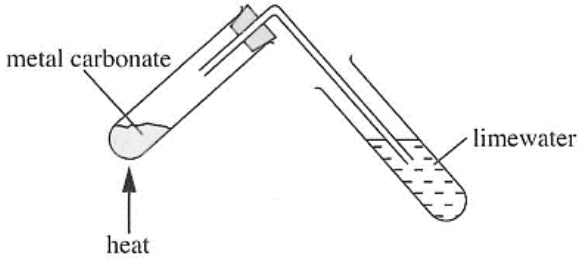


Which nails will rust?

A None **B** **X** only **C** **X** and **Z** **D** **Y** only

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31 Three metal carbonates, **X**CO_3, **Y**CO_3 and **Z**CO_3, were each heated using the setup as shown below.

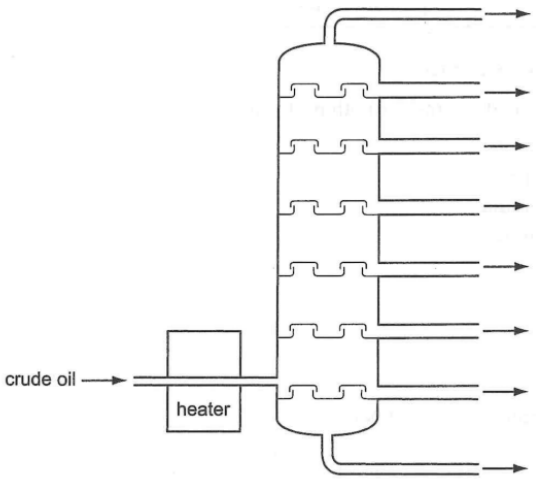


On mild heating of **Y**CO_3, white precipitate was observed forming in limewater. Heating more strongly gave the same observation for **X**CO_3 but not for **Z**CO_3.

Which of the following shows the correct order for the reactivity of metals **X**, **Y** and **Z**?

	Least reactive	⟶	**Most reactive**
A	Z	Y	X
B	Z	X	Y
C	X	Y	Z
D	Y	X	Z

32 The diagram shows the apparatus used for the fractional distillation of petroleum.



Which statement about the fractional distillation of petroleum is correct?

A At each level in the column, only one compound is collected.

B The higher up the column, the greater the temperature.

C The molecules collected at the bottom of the column are the most flammable.

D The molecules reaching the top of the column have the smallest relative molecular mass.

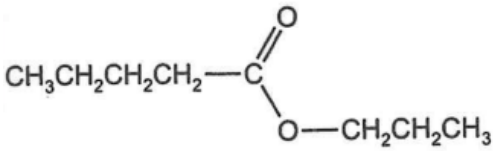
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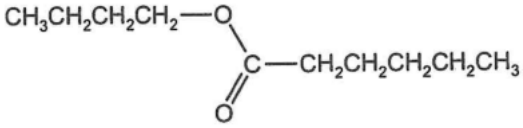
33 Pentanoic acid has the formula $CH_3CH_2CH_2CH_2CO_2H$.

Which formula represents butyl pentanoate?

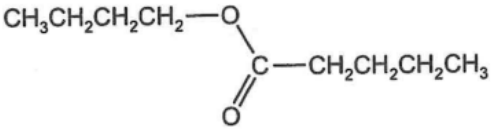
A



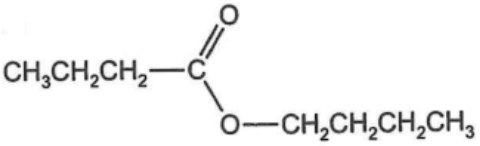
B



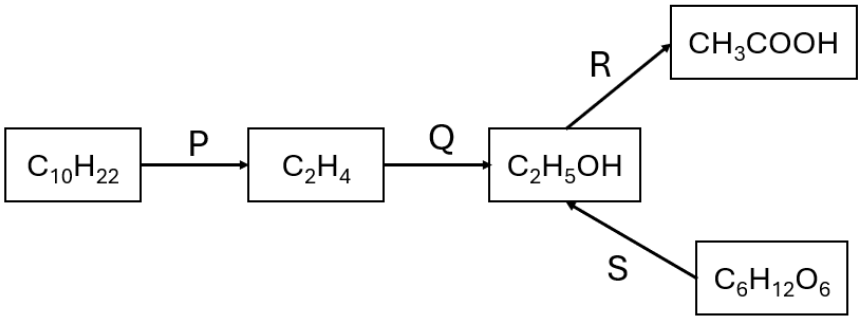
C



D



34 Study the reaction scheme below.

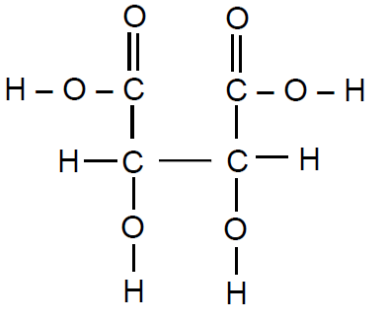


What are reactions P, Q, R and S?

	P	Q	R	S
A	cracking	addition	oxidation	fermentation
B	fractional distillation	addition	reduction	esterification
C	fractional distillation	substitution	oxidation	fermentation
D	cracking	addition	hydration	esterification

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35 The diagram below shows the structural formula of tartaric acid ($C_4H_6O_6$), commonly found in wine.



What salts could be formed upon reacting tartaric acid with sodium hydroxide?

I. $C_4H_5O_6Na$

II. $C_4H_4O_6Na_2$

III. $C_4H_3O_6Na_3$

IV. $C_4H_2O_6Na_4$

A II only **B** I and II **C** II and III **D** all the above

36 Butane reacts with chlorine in the presence of ultraviolet radiation.

What is the equation for this reaction?

A $C_4H_{10} + Cl_2 \rightarrow C_4H_8Cl_2 + H_2$

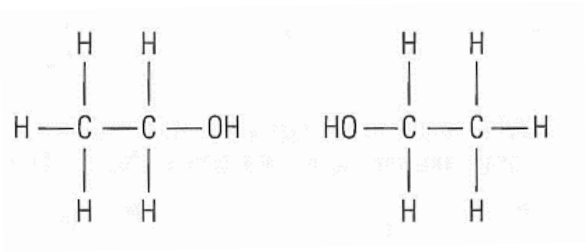
B $C_4H_{10} + Cl_2 \rightarrow C_4H_9Cl + HCl$

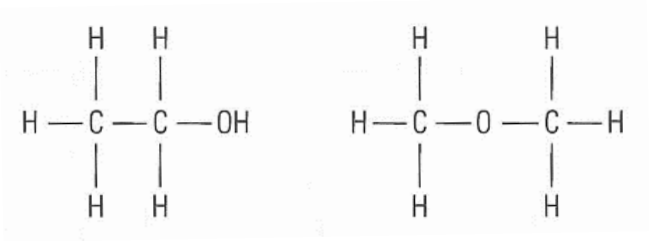
C $C_4H_{10} + Cl_2 \rightarrow 2C_2H_4Cl + H_2$

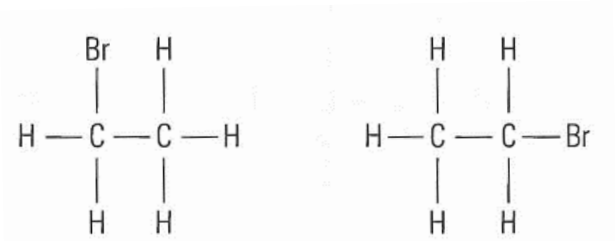
D $C_4H_{10} + Cl_2 \rightarrow C_4H_{10}Cl_2$

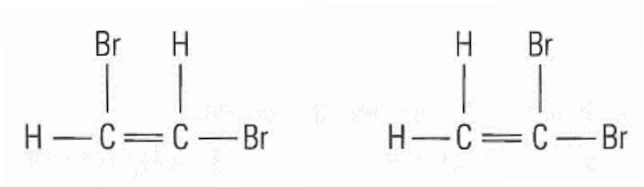
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37 Four pairs of compounds are shown below.

I. 

II. 

III. 

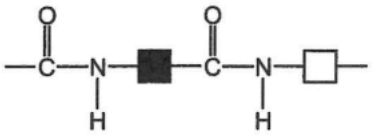
IV. 

How many pairs of isomers are shown?

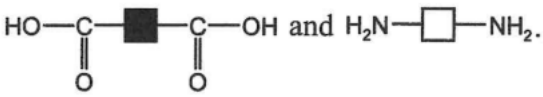
A 4 **B** 3 **C** 2 **D** 1

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38 The diagram shows the partial structure of a polymer.



What statement about this polymer is correct?

A It is formed from the monomers .

B It is formed in an addition polymerisation reaction.

C The partial structure shown is that of *Terylene*.

D It is a polyamide.

39 Oxides of nitrogen form in car engines and are removed by catalytic converters.

Which equation represents a reaction that occurs in a catalytic converter?

A $CO + NO_2 \rightarrow NO + CO_2$

B $2CO + 2NO \rightarrow N_2 + 2CO_2$

C $CO_2 + NO \rightarrow NO_2 + CO$

D $CO_2 + 2NO_2 \rightarrow N_2 + 3O_2 + C$

40 In what way do chlorofluorocarbons, methane and sulfur dioxide affect the atmosphere and the environment?

	chlorofluorocarbons	methane	sulfur dioxide
A	depletion of the ozone layer	greenhouse gas	acid rain
B	depletion of the ozone layer	acid rain	global warming
C	acid rain	depletion of the ozone layer	greenhouse gas
D	global warming	depletion of the ozone layer	acid rain

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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		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	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 –

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}

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