



# Cambridge O Level

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**CHEMISTRY**

5070/11

Paper 1 Multiple Choice

October/November 2022

1 hour

You must answer on the multiple choice answer sheet.

You will need: Multiple choice answer sheet  
Soft clean eraser  
Soft pencil (type B or HB is recommended)

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**INSTRUCTIONS**

- 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 multiple choice answer sheet.
- Follow the instructions on the multiple choice answer sheet.
- Write in soft pencil.
- Write your name, centre number and candidate number on the multiple choice answer sheet in the spaces provided unless this has been done for you.
- Do **not** use correction fluid.
- Do **not** write on any bar codes.
- You may use a calculator.

**INFORMATION**

- The total mark for this paper is 40.
- Each correct answer will score one mark.
- Any rough working should be done on this question paper.
- The Periodic Table is printed in the question paper.

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This document has **16** pages. Any blank pages are indicated.



1 Which row shows the most appropriate apparatus for the measurement given?

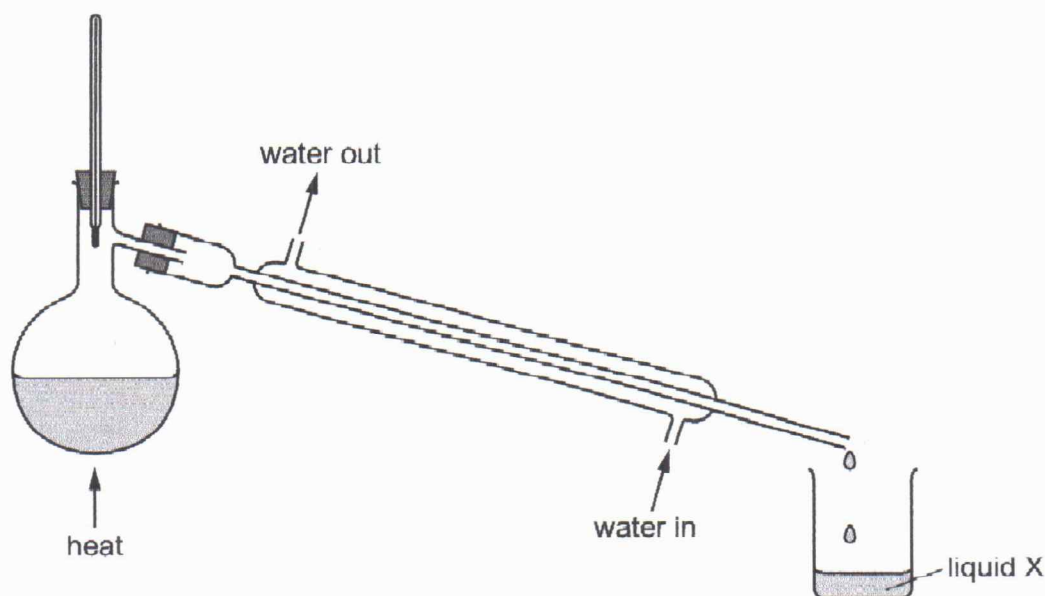
	quantity	apparatus
A	25.0 cm <sup>3</sup> of solution	measuring cylinder
B	32.7 cm <sup>3</sup> of solution	pipette
<b>C</b>	75 cm <sup>3</sup> of gas	gas syringe
D	80 cm <sup>3</sup> of solution	burette

- Pipette

- Burette (has graduated units)

Pipette and burette are used to measure exact volumes of liquids.

2 A liquid, X, is distilled from a mixture using the apparatus shown.



During the distillation, the thermometer reads from 157 °C to 160 °C.

Which information about liquid X is correct?

- A** The liquids in X may or may not be miscible (mix with each other).
- B X is a mixture that can be separated by distillation.
- C X must contain two liquids with boiling points 157 °C and 160 °C.
- D X must have been obtained by the fractional distillation of petroleum (crude oil).

Miscible liquids are separated by fractional distillation since the liquids may vary in boiling points.

3 An aqueous solution contains a salt, Y.

Addition of an aqueous solution X results in a precipitate being formed that redissolves when more X is added.

What could solution X and salt Y be?

	solution X	salt Y
A	HCl(aq)	AgNO <sub>3</sub>
B	H <sub>2</sub> SO <sub>4</sub> (aq)	Ba(NO <sub>3</sub> ) <sub>2</sub>
C	NaOH(aq)	CuSO <sub>4</sub>
<b>D</b>	NaOH(aq)	ZnSO <sub>4</sub>

→ AgCl(s) - does not re-dissolve.  
 BaSO<sub>4</sub> → Insoluble compound + excess  
 H<sub>2</sub>SO<sub>4</sub> (does not re-dissolve).  
 → Blue precipitate will be formed.  
 Cu(OH)<sub>2</sub> that does not re-dissolve.

4 Which gas diffuses the fastest at the same pressure?

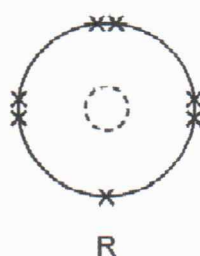
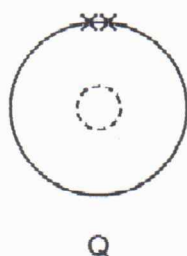
- A nitrogen at 25 °C
- B** nitrogen at 50 °C
- C oxygen at 25 °C
- D oxygen at 50 °C

R.A.M N<sub>2</sub> = 14 × 2 = 28

R.A.M O<sub>2</sub> = 16 × 2 = 32

Nitrogen diffuses faster than oxygen and at high temperature.

5 The diagram shows the outer shell electrons of the atoms of two elements, Q and R.



key  
 x = an electron  
 ○ = a nucleus

R.M.M  
 F<sub>2</sub> - gas - 19  
 Cl<sub>2</sub> gas - 35.5  
 I<sub>2</sub> liquid

The sulfate of Q is insoluble. - CaSO<sub>4</sub>, BaSO<sub>4</sub>

Element R is gaseous at room temperature and pressure.

→ Group 7 Cl 2.8.7

Which row could be correct?

	proton number of Q	relative atomic mass of R
A	12	35.5
B	12	80
C	56	80
<b>D</b>	56	35.5

Proton number of Q = 56 can't be Magnesium since it appears (MgSO<sub>4</sub>).

6 Which statement about iodine atoms and iodide ions is correct?

- A They are both isotopes of iodine.  
 B They undergo the same chemical reactions.  
 C They have the same number of protons.  
 D They have the same physical properties.

*Isotopes have same atomic number but different mass numbers.  
 → depends on the electronic structure  
 → ions affect the electrons.*

7 The element chlorine has two isotopes,  ${}^{35}_{17}\text{Cl}$  and  ${}^{37}_{17}\text{Cl}$ .

In the Periodic Table, chlorine is shown as  ${}^{35.5}_{17}\text{Cl}$ .

Which row shows the correct percentage of each isotope in a sample of naturally occurring chlorine?

	percentage of ${}^{35}_{17}\text{Cl}$	percentage of ${}^{37}_{17}\text{Cl}$
A	25	75
B	40	60
C	50	50
D	75	25

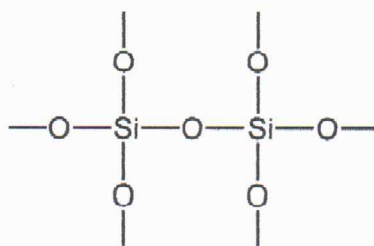
8 What is the nucleon number of the isotope of uranium,  ${}^{235}_{92}\text{U}$ ?

- A 92      B 143      C 235      D 327

*Mass number = Nucleon number.*

*Mass number = Protons + neutrons*

9 Silicon dioxide has a giant structure. Each silicon atom is joined to four oxygen atoms by covalent bonds. Part of the structure is shown.



Which property would silicon dioxide be expected to have?

- A a good conductor of electricity  
 B a high melting point  
 C reacts with hydrochloric acid  
 D soluble in water

*(all electrons of silicon are used in bonding thus no delocalised electrons)  
 - giant structure.*

*Means higher group number*

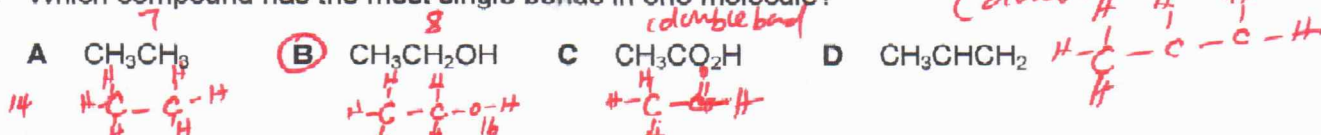
- 10 Elements X and Y react to form compound XY. Element Y has more electrons in its outer shell than element X. Compound XY conducts electricity in the molten state.

Which row correctly states the electron change that occurs during the reaction and the type of bonding in compound XY?

*X is compound in either group I, II or III*

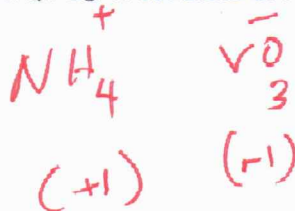
	electron change during formation of compound XY	type of bonding in compound XY
<b>A</b>	X donates electrons to Y	ionic
<b>B</b>	X shares electrons with Y	covalent
<b>C</b>	Y donates electrons to X	covalent
<b>D</b>	Y shares electrons with X	ionic

- 11 Which compound has the most single bonds in one molecule?



- 12 The formula of ammonium metavanadate is  $\text{NH}_4\text{VO}_3$ . It consists of  $\text{NH}_4$  ions and  $\text{VO}_3$  ions.

What are the charges on these ions?



	$\text{NH}_4$ ion	$\text{VO}_3$ ion
<b>A</b>	1+	1-
<b>B</b>	2+	2-
<b>C</b>	3+	4-
<b>D</b>	4+	3-

- 13 Which mass of oxygen gas combines with exactly 16 g of sulfur to form sulfur dioxide,  $\text{SO}_2$ ?

- A** 4g **B** 8g **C** 16g **D** 32g

*32g S is reacting with 32g O<sub>2</sub>. The molar ratio is 1:1. Mass of O<sub>2</sub> = 16 x 2 = 32g*

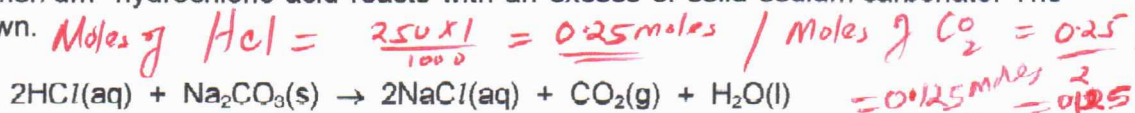
- 14 The atomic number of ruthenium is 44. One of the oxides of ruthenium is a black solid, X. 5.79 g of X contains 1.39 g of oxygen.

What is the empirical formula of X?

- A**  $\text{Ru}_2\text{O}$  **B**  $\text{RuO}$  **C**  $\text{RuO}_2$  **D**  $\text{RuO}_4$

Element	Ru	O	
Mass	5.79	1.39	
R.A.M	101	16	
Moles	$\frac{5.79}{101} = 0.057$	$\frac{1.39}{16} = 0.087$	$\approx \text{RuO}_2$
	$\frac{0.057}{0.057} = 1$	$\frac{0.087}{0.057} = 1.5$	$\approx 2$

- 15 250 cm<sup>3</sup> of 1.0 mol/dm<sup>3</sup> hydrochloric acid reacts with an excess of solid sodium carbonate. The equation is shown.

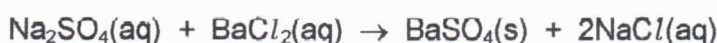


What is the volume of carbon dioxide produced when measured at room temperature and pressure?

- (A) 3.0 dm<sup>3</sup>      B 6.0 dm<sup>3</sup>      C 12 dm<sup>3</sup>      D 24 dm<sup>3</sup>

1 mole of any gas → 24 dm<sup>3</sup>  
 0.125 moles of CO<sub>2</sub> =  $0.125 \times 24 = 3 \text{ dm}^3$

- 16 When excess aqueous barium chloride is added to 25.0 cm<sup>3</sup> of 1.00 mol/dm<sup>3</sup> sodium sulfate, a white precipitate of barium sulfate is formed.



No. of moles of Na<sub>2</sub>SO<sub>4</sub> =  $\frac{25 \times 1}{1000} = 0.025$

The precipitate is filtered off, washed, dried and weighed. 5.36 g barium sulfate is obtained.

Mass of BaSO<sub>4</sub> =  $0.025 \times 233 = 5.825$  using mole ratio mass of BaSO<sub>4</sub> = 0.025

What is the percentage yield of barium sulfate?

[M<sub>r</sub>: Na<sub>2</sub>SO<sub>4</sub>, 142; BaCl<sub>2</sub>, 208; BaSO<sub>4</sub>, 233; NaCl, 58.5]

- A 2.3%      B 27%      (C) 92%      D 97%

% yield =  $\frac{5.36}{5.825} \times 100 = 92.017 = 92\%$

- 17 Aqueous copper(II) sulfate is electrolysed using inert electrodes.

Which statement is correct?

- A Copper is collected at the anode.  
 B Hydrogen is collected at the cathode.  
 (C) Oxygen is collected at the anode.  
 D Sulfur is collected at the cathode.

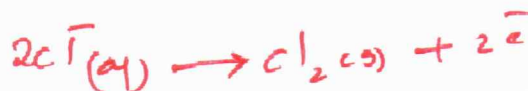
Positively charged ions are deposited at the cathode.  
 $\text{Cu}^{2+} + 2\text{e}^- \rightarrow \text{Cu}(\text{s})$  (reduction)  
 $4\text{OH}^-(\text{aq}) \rightarrow 2\text{H}_2\text{O}(\text{l}) + \text{O}_2(\text{g}) + 4\text{e}^-$  (oxidation)

- 18 Concentrated aqueous sodium chloride is electrolysed using inert electrodes.

Which equation shows the reaction that occurs at the anode?

- (A)  $2\text{Cl}^- \rightarrow \text{Cl}_2 + 2\text{e}^-$   
 B  $2\text{Cl}^- + 2\text{e}^- \rightarrow \text{Cl}_2$   
 C  $2\text{H}^+ + 2\text{e}^- \rightarrow \text{H}_2$   
 D  $4\text{OH}^- \rightarrow \text{O}_2 + 2\text{H}_2\text{O} + 4\text{e}^-$

When molten sodium chloride is electrolysed, the products at the electrodes are; anode; chlorine  
 cathode: sodium



Cl<sup>-</sup> and OH<sup>-</sup> are both attracted by the positive anode but it is easier to remove electrons from hydroxide ion than chloride ion.

- 19 Which pair of equations correctly represents the reactions taking place at the anode and at the cathode during the electrolysis of molten silver bromide?

	anode	cathode
A	$2\text{Br}^- \rightarrow \text{Br}_2 + 2\text{e}^-$	$\text{Ag}^{2+} + 2\text{e}^- \rightarrow \text{Ag}$
B	$\text{Br}^{2-} \rightarrow \text{Br}_2 + 2\text{e}^-$	$\text{Ag}^+ + \text{e}^- \rightarrow \text{Ag}$
<b>C</b>	$2\text{Br}^- \rightarrow \text{Br}_2 + 2\text{e}^-$	$\text{Ag}^+ + \text{e}^- \rightarrow \text{Ag}$
D	$\text{Ag}^+ + \text{e}^- \rightarrow \text{Ag}$	$2\text{Br}^- \rightarrow \text{Br}_2 + 2\text{e}^-$

Silver ions  $\text{Ag}^+$  are at the cathode.



Bromide ions are attracted to the anode (positively charged electrode).



- 20 Which two processes are both endothermic?

- A combustion and cracking  
 B combustion and fermentation  
**C** cracking and photosynthesis  
 D respiration and photosynthesis

Combustion is exothermic reaction and heat is given out.

Respiration is exothermic.

Endothermic reaction heat is absorbed.

- 21 A sample of sulfuric acid is added to 10g of zinc granules. A reaction occurs and a gas is produced. The rate of the reaction is increased if a small amount of copper is added. The copper is unchanged after the reaction.

Copper is the catalyst in the reaction.

Which statement about this reaction is correct?

- A Copper acts as a biological catalyst in this reaction.  
**B** Copper lowers the activation energy of this reaction.  
 C The rate of the reaction is greater as the particle size of the zinc is greater.  
 D The rate of the reaction is greater if the pressure is increased.

A catalyst works by lowering the activation energy and providing an alternative route path.

- 22 The rate of reaction between magnesium and dilute hydrochloric acid is investigated. The equation is shown.



A known mass of magnesium is added to an excess of dilute hydrochloric acid.

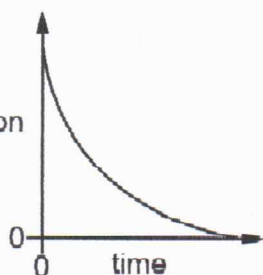
The concentration of the hydrochloric acid and the volume of hydrogen produced is measured at regular time intervals.

Which pair of graphs correctly shows the experimental results?

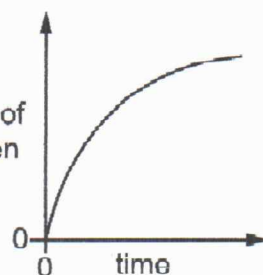
*HCl is reactant and concentration decreases over a time.*

*Volume of H<sub>2</sub> is the product (the concentration is increasing with time).*

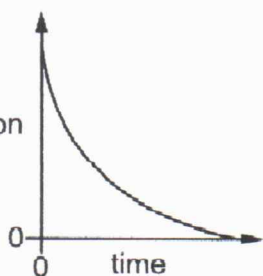
A concentration of HCl



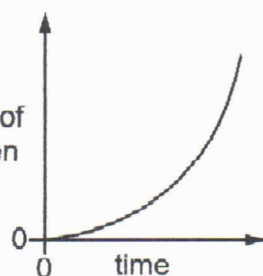
volume of hydrogen



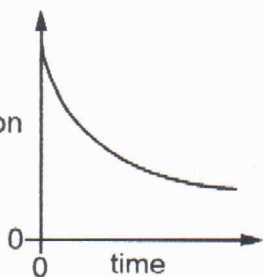
B concentration of HCl



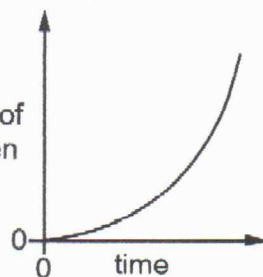
volume of hydrogen



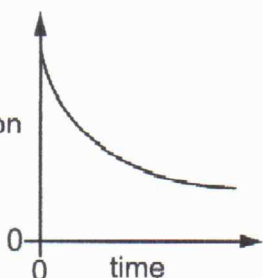
C concentration of HCl



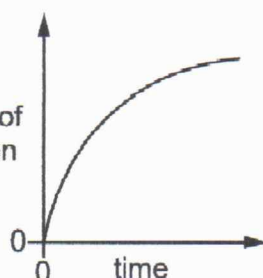
volume of hydrogen



**D** concentration of HCl



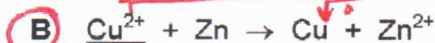
volume of hydrogen





OIL RIG

23 In which reaction is the underlined substance reduced?



*Redox reactions*  
Reduction is the gain of electrons  
Oxidation is the loss of electrons.

24 Which change involves reduction?

A calcium carbonate to calcium oxide

B copper to brass

C ethene to poly(ethene)

**D** sand to silicon

$\text{CaCO}_3 \xrightarrow{\text{heat}} \text{CaO(s)} + \text{CO}_2(\text{g})$   
 $\text{CaO} + \text{SiO}_2 \rightarrow \text{CaSiO}_3(\text{slag})$  This is neutralisation reaction.

25 Thiosulfate ions,  $\text{S}_2\text{O}_3^{2-}$ , react with iodine,  $\text{I}_2$ , in aqueous solution.



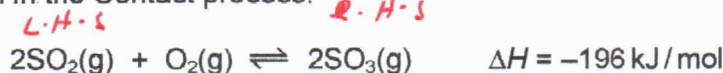
In this reaction, the  $\text{S}_2\text{O}_3^{2-}$  ions .....1..... electrons and are .....2.....

Which words correctly complete gaps 1 and 2?

	1	2
A	gain	oxidised
B	gain	reduced
<b>C</b>	lose	oxidised
D	lose	reduced

Oxidation - the loss of electrons results in oxidation.

26 The equation shows a reaction in the Contact process.



Which change would move the position of equilibrium to the left?

A adding more  $\text{O}_2$

B increasing the pressure

**C** increasing the temperature

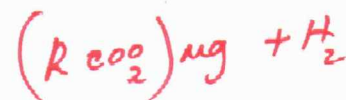
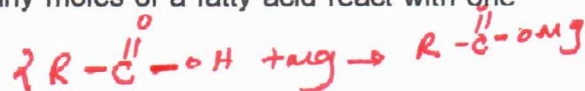
D removing  $\text{SO}_3$  from the reacting mixture

*L.H.S R.H.S*  
the equilibrium shifts towards the right.  
it shift to the right side (where there are less number of moles).

- 27 Some medicines contain the magnesium salt of a fatty acid. The fatty acids are members of the homologous series of carboxylic acids and contain one carboxylic acid group.

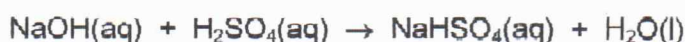
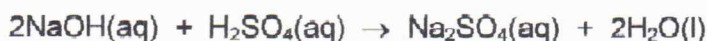
What is the carboxylic acid functional group and how many moles of a fatty acid react with one mole of magnesium?

	functional group	moles of fatty acid
A	-CO <sub>2</sub> H	1
<b>B</b>	-CO <sub>2</sub> H	2
C	-CH <sub>2</sub> OH	1
D	-CH <sub>2</sub> OH	2



-COOH 1 mole of Mg, needs  
-COOH of the fatty acids  
requires two moles.

- 28 Sodium sulfate, Na<sub>2</sub>SO<sub>4</sub>, and sodium hydrogensulfate, NaHSO<sub>4</sub>, can both be prepared using aqueous sodium hydroxide and sulfuric acid.



NaOH: H<sub>2</sub>SO<sub>4</sub>  
1:1

50 cm<sup>3</sup> of 1 mol/dm<sup>3</sup> sodium hydroxide is used each time.

No. of moles =  $\frac{50 \times 1}{1000} = 0.05 \text{ moles of NaOH}$

Which row shows the correct volumes of 1 mol/dm<sup>3</sup> sulfuric acid required to prepare a sample of sodium sulfate and a sample of sodium hydrogensulfate?

	volume of sulfuric acid required to make sodium sulfate / cm <sup>3</sup>	volume of sulfuric acid required to make sodium hydrogensulfate / cm <sup>3</sup>
<b>A</b>	25	50
B	25	12.5
C	50	12.5
D	50	25

Moles of NaOH: H<sub>2</sub>SO<sub>4</sub>  
2:1

Moles of H<sub>2</sub>SO<sub>4</sub> =  $\frac{0.05}{2} = 0.025 \text{ moles}$

$C = \frac{n \times 1000}{V}$

$\frac{0.025 \times 1000}{V} = 25 \text{ cm}^3$

$C = \frac{0.05 \times 1000}{V}$   
 $V = 50 \text{ cm}^3$

- 29 Which substance reacts with dilute sulfuric acid in the preparation of a pure sample of lead(II) sulfate?

- lead (ii) sulfate - Insoluble salt, thus we require a soluble salt.  
soluble + soluble → Insoluble (precipitation reaction)

**A** aqueous lead(II) nitrate

B lead foil

C powdered lead(II) carbonate

D powdered lead(II) oxide

30 Which statement about sulfuric acid is correct?

- A In the manufacture of sulfuric acid, iron is used as the catalyst in the Contact process. *Vanadium(V) oxide*
- B** Sulfuric acid is used in some batteries. *- iron is used as catalyst in the haber process.*
- C Sulfuric acid is used as a fertiliser.
- D Sulfuric acid is used as a food preservative. *-*

31 Two statements are given.

statement 1 Going down Group I and Group VII, the melting point of the elements increases. *decreases*

statement 2 Chlorine can displace iodine from aqueous potassium iodide but cannot displace bromine from aqueous potassium bromide. *can*

Which statements are correct?

- A both statement 1 and statement 2 *x*
- B statement 1 only
- C statement 2 only
- D** neither statement 1 nor statement 2

32 A reversible reaction involves a solid reacting with hydrogen.

Which of the metals, aluminium and iron, would catalyse the reaction and what is their effect on the position of equilibrium?

	act as a catalyst	position of equilibrium
A	both aluminium and iron	moves to the right
B	both aluminium and iron	no change
C	iron only	moves to the right
<b>D</b>	iron only	no change

*Catalyst does not change the position of equilibrium.*

*- Transition elements only can be used as catalyst.*  
*- Aluminium cannot be used as a catalyst*

33 Iron is obtained in the blast furnace from the ore haematite.

Which statement is correct?

- A** Calcium carbonate is used to remove acidic impurities.
- B Coke is reduced to carbon dioxide.
- C Haematite is oxidised by carbon monoxide.
- D Haematite undergoes thermal decomposition.



*CaO is basic and reacts with acidic impurity (SiO<sub>2</sub>) to form calcium silicate (slag).*

34 Three statements about the carbon cycle are given.

- 1 The carbon cycle regulates the amount of carbon dioxide in the atmosphere.
- 2 During photosynthesis, carbon dioxide is produced.
- 3 Combustion of hydrocarbons requires oxygen.

*Carb dioxide is used by plants to make their own food.*

Which statements are correct?

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

35 Carbon is used in the purification of the water supply.

What is the reason for this?

- A to remove mud and other insoluble solids  
 B to remove nitrates caused by the excessive use of fertiliser  
**C** to remove tastes and odours  
 D to sterilise the water by removing harmful bacteria

*r use of chlorination*

36 Octane is an alkane with eight carbon atoms per molecule.

What is the molecular formula of octane, and how does its boiling point compare with that of butane?

	molecular formula of octane	boiling point of octane
A	$C_6H_{16}$	higher than butane
B	$C_8H_{16}$	lower than butane
C	$C_8H_{18}$	lower than butane
<b>D</b>	$C_8H_{18}$	higher than butane

*alkane  $C_n H_{2n+2}$   
 $C_8 H_{18}$  - Octane.*

*Butane  $C_4 H_{10}$  (due to less number of carbon atoms, the boiling point of octane is higher than butane.)*

37 Which equation for the reaction between propane and chlorine is correct?

- A  $C_3H_6 + Cl_2 \rightarrow C_3H_6Cl_2$   
 B  $C_3H_8 + Cl_2 \rightarrow C_3H_6Cl_2 + H_2$   
 C  $C_3H_8 + Cl_2 \rightarrow CH_3Cl + C_2H_5Cl$   
**D**  $C_3H_8 + Cl_2 \rightarrow C_3H_7Cl + HCl$

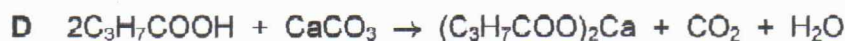
*It is a substitution reaction and occurs in the presence of ultraviolet.*



- 38 Propanoic acid reacts with calcium carbonate. The products of this reaction are calcium propanoate, carbon dioxide and water.



What is the equation for this reaction?



acids + carbonate  $\rightarrow$  salt + water +  $\text{CO}_2$ .

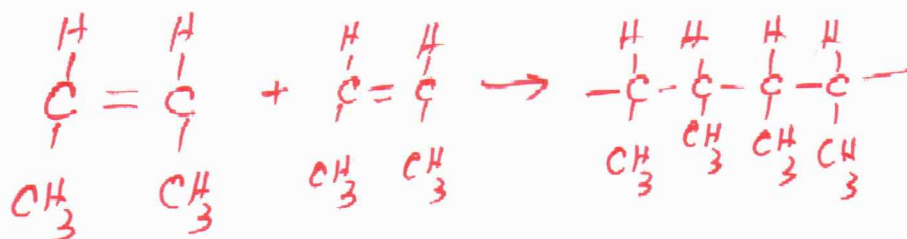
- 39 The monomer,  $\text{CH}_3\text{CH}=\text{CHCH}_3$ , can be used to make an addition polymer.

This addition polymer has a chain of carbon atoms joined to each other by C–C single bonds.

Each of these carbon atoms is also bonded to at least one other atom or group of atoms. These are called side groups.

Which statement describes the carbon atoms in the polymer chain made from  $\text{CH}_3\text{CH}=\text{CHCH}_3$ ?

- A** Every carbon atom in the chain has one  $-\text{CH}_3$  and one hydrogen atom as side groups.  
 B Every carbon atom in the chain is joined to a  $\text{CH}_3-\text{CH}-$  side group.  
 C Every carbon atom in the chain is joined to either two  $-\text{CH}_3$  or to two hydrogen atoms as side groups.  
 D Every carbon atom in the chain is joined to hydrogen atoms only as side groups.



Every carbon atom in the chain has one  $-\text{CH}_3$  and one hydrogen atom as side groups.

40 Which row correctly shows the structure of a polymer and the monomers from which it is made?

	monomers	polymer
A	$\text{HO}-\overset{\text{O}}{\parallel}{\text{C}}-\square-\text{NH}_2$	$-\overset{\text{O}}{\parallel}{\text{C}}-\square-\overset{\text{O}}{\parallel}{\text{C}}-\text{N}(\text{H})-\square-\text{N}(\text{H})-$
B	$\text{H}-\overset{\text{H}}{\underset{\text{H}}{\text{C}}}=\overset{\text{H}}{\underset{\text{H}}{\text{C}}}-\overset{\text{H}}{\underset{\text{H}}{\text{C}}}-\text{H}$	$-\overset{\text{H}}{\underset{\text{H}}{\text{C}}}-\overset{\text{H}}{\underset{\text{H}}{\text{C}}}-\overset{\text{H}}{\underset{\text{H}}{\text{C}}}-\overset{\text{H}}{\underset{\text{H}}{\text{C}}}-\overset{\text{H}}{\underset{\text{H}}{\text{C}}}-\overset{\text{H}}{\underset{\text{H}}{\text{C}}}-$
C	$\text{HO}-\overset{\text{O}}{\parallel}{\text{C}}-\square-\overset{\text{O}}{\parallel}{\text{C}}-\text{OH}$ $\text{H}_2\text{N}-\square-\text{NH}_2$	$-\text{O}-\overset{\text{O}}{\parallel}{\text{C}}-\square-\overset{\text{O}}{\parallel}{\text{C}}-\text{O}-\text{N}(\text{H})-\square-\text{N}(\text{H})-$
D	$\text{HO}-\overset{\text{O}}{\parallel}{\text{C}}-\square-\overset{\text{O}}{\parallel}{\text{C}}-\text{OH}$ $\text{HO}-\square-\text{OH}$	$-\overset{\text{O}}{\parallel}{\text{C}}-\square-\overset{\text{O}}{\parallel}{\text{C}}-\text{O}-\square-\text{O}-$

*- polypeptide*

*- Addition polymerisation*

*ester linkage → amide linkage*

*H CH<sub>3</sub> H CH<sub>3</sub>*  
 $\begin{array}{cccc} | & | & | & | \\ \text{C} & - & \text{C} & - & \text{C} & - & \text{C} \\ | & | & | & | \\ \text{H} & \text{H} & \text{H} & \text{H} \end{array}$