YISHUN INNOVA JUNIOR COLLEGE
JC 2 PRELIMINARY EXAMINATION
Higher 1

CANDIDATE NAME					
CG		INDEX NO		H1 GROUP	

CHEMISTRY 8873/01

Paper 1 Multiple Choice **16 September 2021**

1 hour

Additional Materials: Multiple Choice Answer Sheet
Data Booklet

READ THESE INSTRUCTIONS FIRST

Write in soft pencil.
Do not use staples, paper clips, highlighters, glue or correction fluid/tape.
Write your name and class on the Answer Sheet in the spaces provided unless this has been done for you.

There are **thirty** 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.
The use of an approved scientific calculator is expected, where appropriate.

This document consists of **11** printed pages and **1** blank pages.

1 10 cm^3 of a hydrocarbon C_xH_y was exploded with an excess of oxygen. There was a contraction of 30 cm^3. When the product was treated with a solution of potassium hydroxide, there was a further contraction of 40 cm^3. What is the molecular formula of the hydrocarbon?

[All gas volumes are measured at r.t.p.]

A C_4H_8

B C_4H_{10}

C C_3H_6

D C_3H_8

[volume of hydrocarbon + volume of O_2] – [volume of CO_2 + volume of O_2 remaining] = 30
10 + volume of O_2 – [40 + volume of O_2 remaining] = 30
volume of O_2 – volume of O_2 remaining = 60
volume of O_2(reacted) = 60 cm^3

$$C_xH_y + (x + \frac{y}{4})O_2(g) \rightarrow xCO_2 + (\frac{y}{2})H_2O$$

	C_xH_y :	O_2	CO_2 :	H_2O
stoichiometric ratio from balanced equation	1 mol	$(x + \frac{y}{4})$	x mol	
volume ratio	10 cm^3	60 cm^3	40 cm^3	
	1 cm^3	6 cm^3	4 cm^3	
mole ratio	1 mol	6	4 mol	

2 Three organic molecules each have

• three elements;
• the composition, by mass, C, 54.5 %; H, 9.1 %.

What could these molecules be?

1 $CH_3CH_2CH_2CO_2H$

2 $OHCCH_2CH_2CH_2OH$

3 $CH_3CH=CHCH_2SH$

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

Suppose the 3rd element is O :

	C	H	O
Mass in 100g	54.5	9.1	36.4
No. of moles	54.5 ÷ 12.0 = 4.54	9.1 ÷ 1.0 = 9.1	36.4 ÷ 16.0 = 2.275
Ratio	2	4	1

Empirical formula : C_2H_4O

Suppose the 3rd element is S :

	C	H	S

Mass in 100g	54.5	9.1	36.4
No. of moles	54.5 ÷ 12.0 = 4.54	9.1 ÷ 1.0 = 9.1	36.4 ÷ 32.1 = 1.13
Ratio	4	8	1

Empirical formula : C_4H_8S

Statement 1 is correct as $CH_3CH_2CH_2CO_2H$ has empirical formula of C_2H_4O.

Statement 2 is correct as $OHCCH_2CH_2CH_2OH$ has empirical formula of C_2H_4O.

Statement 3 is correct as $CH_3CH{=}CHCH_2SH$ has empirical formula of C_4H_8S.

Answer: A

3 *Use of the Data Booklet is relevant to this question.*

In which series of elements do the atoms have the same number of neutrons as protons?

1 ^{4}He, ^{12}C, ^{24}Mg

2 ^{14}N , ^{20}Ne , ^{30}P

3 ^{28}Si, ^{34}S, ^{40}Ca,

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

Option 1: He(Neutrons:2, Protons:2), C(Neutrons:6, Protons:6), Mg(Neutrons:12, Protons:12)

Option 2: N(Neutrons:7, Protons:7), Ne(Neutrons:10, Protons:10), P(Neutrons:15, Protons:15)

Option 3: Si(Neutrons:14 Protons:14), S(Neutrons:**18**, Protons:**16**) , Ca(Neutrons:20, Protons:20)

4 Which of the species in their gaseous state shown below will be deflected by the largest angle in an electric field?

A $^{11}B^{3+}$

B $^{4}He^{2+}$

C $^{9}Be^{2+}$

D $^{1}H_2$

angle of deflection $\propto \frac{\textbf{charge}}{\textbf{mass}}$ of the particle

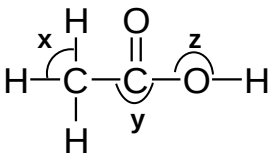
A $^{11}B^{3+}$ $\frac{3}{11} = 0.273$

B $^{4}He^{2+}$ $\frac{2}{4} = 0.5$

C $^{9}Be^{2+}$ $\frac{2}{9} = 0.222$

D $^{1}H_2$ Not deflected since it is not charged

5 Which of the following shows the correct bond angles **x**, **y** and **z** for ethanoic acid as shown below?



	x	y	z
A	90°	120°	109°
B	109°	120°	105°
C	109°	180°	109°
D	90°	180°	105°

	no. of bond pairs	no. of lone pairs	shape	angle
x	4	0	tetrahedral;	109°
y	3	0	trigonal planar	120°
z	2	2	bent	105°

6 Consider the following four compounds.

What is the order of increasing boiling point of the compounds?

1 $CH_3CH_2CH_2F$

2 $CH_3CH_2CH_2OH$

3 $CH_3CH_2CH_2CH_3$

4 $(CH_3)_3CH$

A 1 → 2 → 4 → 3

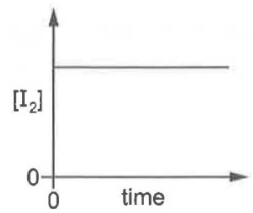
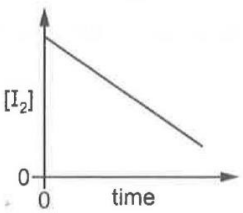
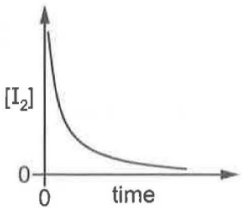
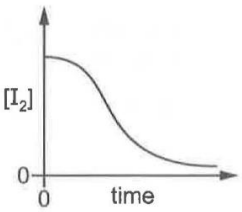
B 3 → 4 → 1 → 2

C 4 → 3 → 1 → 2

D 4 → 3 → 2 → 1

The boiling point of $(CH_3)_3CH$ is the lower as compared to $CH_3CH_2CH_2CH_3$ as $(CH_3)_3CH$ has is a branched molecule while $CH_3CH_2CH_2CH_3$ is a linear molecule. $CH_3CH_2CH_2CH_3$ has a larger surface area for van der Waals' forces to operate as compared to $(CH_3)_3CH$. This results in stronger and more extensive instantaneous dipole-induced dipole interactions between $CH_3CH_2CH_2CH_3$ molecules. More energy is required to overcome the intermolecular forces in $CH_3CH_2CH_2CH_3$. Thus the boiling point of $(CH_3)_3CH$ is the lower as compared to $CH_3CH_2CH_2CH_3$. $CH_3CH_2CH_2CH_3$ has a lower boiling point than $CH_3CH_2CH_2F$ as $CH_3CH_2CH_2F$ is a polar molecule where permanent dipole-permanent dipole attractions occur between $CH_3CH_2CH_2F$ molecules. $CH_3CH_2CH_2CH_3$ is a non-polar molecule and thus induced dipole-induced dipole attractions occur between $CH_3CH_2CH_2CH_3$ molecules. Less energy is required to overcome the induced dipole-induced dipole attractions between $CH_3CH_2CH_2CH_3$ molecules.

	$CH_3CH_2CH_2OH$ has the highest boiling point as it can form hydrogen bonds with other $CH_3CH_2CH_2OH$ molecules while $CH_3CH_2CH_2F$ is unable to form hydrogen bonds with other $CH_3CH_2CH_2F$ molecules. 4 ⟶ 3 ⟶ 1 ⟶ 2

7	The reaction of iodine with propanone in the presence of aqueous acid is zero order with respect to iodine. Which diagram represents the variation of $[I_2]$ with time? **A**  **B**  **C**  **D**  Since the order of reaction is zero order with respect to I2, rate will be constant even ass concentration of I2 changes For concentration-time graph, rate = gradient of the graph. B shows a graph where the gradient is a constant value. Since I2 is a reactant, the concentration of I2 will decrease at a constant rate.

8	Lead is the final product formed by a series of changes in which the rate-determining step is the radioactive decay of uranium – 238. This radioactive decay is a first order reaction with a half-life of 4.5×10^9 years. How long would it take for a rock sample, originally lead-free, to contain a molar proportion of uranium to lead of 1 : 3? **A** 1.5×10^9 years **B** 2.25×10^9 years **C** 9.0×10^9 years **D** 13.5×10^9 years

Answer: C

Number of half - life	Uranium	Lead
	1	
4.5×10^9	1/2	1/2
4.5×10^9	1/4	3/4

Total number of years = $4.5 \times 10^9 \times 2 = 9.0 \times 10^9$ years

9 An equilibrium is represented by the following equation.

$$N_2(g) + 3H_2(g) \rightleftharpoons 2NH_3(g) \qquad \Delta H = -92 \text{ kJ mol}^{-1}$$

What is the effect of introducing a catalyst on this reversible reaction?

A It increases the equilibrium yield of ammonia.

B It increases the equilibrium constant for the forward reaction.

C It increases the rate constant for both the forward and the reverse reaction.

D It increases the rate constant for the forward reaction but not the reverse reaction.

Answer: **C**

- Equilibrium constant is dependent on temperature only.
- A catalyst does not alter the yield of the reaction.
- Catalyst speeds up the rate of both forward and reverse reaction by decreasing the activation energy and hence increasing the rate constant (based on Arrhenius equation: rate constant, $k = Ae^{-Ea/RT}$)

10 An aqueous solution was prepared containing 1.0 mol of $AgNO_3$ and 1.0 mol of $FeSO_4$ in 2.00 dm^3 of water. When equilibrium was established, there was 0.44 mol of $Ag^+(aq)$ in the mixture.

$$Ag^+(aq) + Fe^{2+}(aq) \rightleftharpoons Ag(s) + Fe^{3+}(aq)$$

What is the numerical value of K_c?

A 1.35

B 1.62

C 2.89

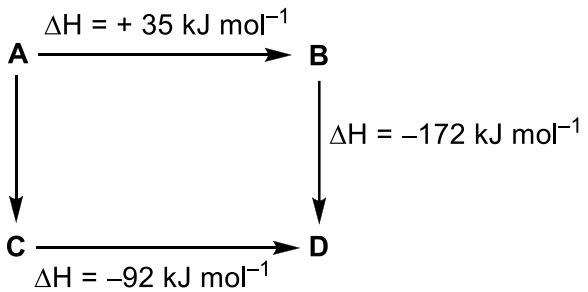
D 5.79

	$Ag^+(aq)$ + $Fe^{2+}(aq)$		$\rightleftharpoons$	$Ag(s)$ + $Fe^{3+}(aq)$	
Initial amt / mol	1.0	1.0		0	0
Change in amt / mol	- 0.56	- 0.56		+0.56	+0.56
Equilibrium amt/ mol	0.44	0.44		0.56	0.56
Equilibrium concentration/ mol dm^{-3}	0.44/2	0.44/2		-	0.56/2

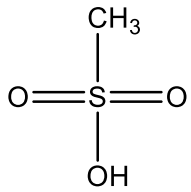
	Kc = (0.56/2) / $(0.44/2)^2$ = 5.785 = 5.79

11	Which of the following equations illustrates the lattice energy of MgO?
	A $Mg(s) + ½ O_2(g) \rightarrow MgO(s)$ **B** $Mg^{2+}(aq) + O^{2-}(aq) \rightarrow MgO(s)$ **C** $Mg^{2+}(g) + O^{2-}(g) \rightarrow MgO(s)$ **D** $Mg(g) + O(g) \rightarrow MgO(s)$
	Answer: C Lattice energy of MgO is the energy released when one mole of solid MgO is formed from its isolated gaseous ions.

12	The standard enthalpy change of formation of NO is +90 kJ mol^{-1}. What is the enthalpy change of the reaction shown below? $2NO(g) \rightarrow N_2(g) + O_2(g)$ **A** –180 kJ mol^{-1} **B** –90 kJ mol^{-1} **C** +90 kJ mol^{-1} **D** +180 kJ mol^{-1}
	Answer: A $\Delta H = \sum \Delta H_f$ (products) - $\sum \Delta H_f$ (reactants) = 0 – (2x90) = - 180 kJ mol^{-1}

13	The diagram below illustrates the energy changes for a set of reactions.  Which of the following statements is correct? **A** **D** has a higher energy content than B.

	B The transformation **A** → **D** is endothermic. **C** The transformation **C** → **B** is exothermic. **D** The enthalpy change for the transformation **A** → **C** is –45 kJ mol^{-1}.
	Ans: D Option A is a wrong statement as B loses energy to form D. Therefore, D should have a lower energy content than B. Option B is a wrong statement as enthalpy change for **A → D** is (35 – 172) = -137 $kJmol^{-1}$ Option C is a wrong statement as enthalpy change for **C → B** is (-92 + 172) = +80 kJ mol^{-1} Option D is a correct statement as enthalpy change for **A → C** is (35 – 172 + 92) = -45 kJ mol^{-1}

14	Methanesulfonic acid is a monoprotic strong acid which is used to remove calcium carbonate from kettles.  methanesulfonic acid Which statement about methanesulfonic acid is **incorrect**? **A** The K_a value of methanesulfonic acid is very small. **B** 0.1 mol dm^{-3} methanesulfonic acid has a pH value of 1. **C** The Brønsted-Lowry conjugate base of methanesulfonic acid is the $CH_3SO_3^-$ ion. **D** The gas evolved when methanesulfonic acid reacts with magnesium is H_2.
	Answer: A Option A is incorrect because a strong acid would have a very high Ka. Option B is correct as pH = -lg(0.1) = 1 Option C is correct as the conjugate base has one less proton than the acid. Option D is correct as an acid reacts a metal to produce H_2 gas.

15 At 25°C, K_w= 1.00 x 10^{-14} mol^2dm^{-6}.

At 50°C, K_w= 5.48 x 10^{-14} mol^2dm^{-6}.

Which row is correct?

	the ionisation of water is	at 50°C, water with a pH of 7.0 is
A	endothermic	alkaline
B	endothermic	neutral
C	exothermic	alkaline
D	exothermic	neutral

Ans: A

As temperature increase from 25°C to 50°C, the *K*w increased, this implies that the position of equilibrium shifted to the right (endothermic) to absorb excess heat. Hence, ionisation of water is endothermic.

At 50°C, Kw = 5.48 x 10^{-14}
$[H^+]^2 = 5.48 \times 10^{-14}$
$[H^+] = 2.34 \times 10^{-7}$ mol dm^{-3}
pH = -log(2.34 x 10^{-7}) = 6.63

neutral pH at 50°C = 6.63
Therefore, a pH of 7.0 will be alkaline

16 Which pair of solutions will produce an acidic buffer solution upon mixing equal volumes of each solution?

A 1.50 mol dm^{-3} of HC*l* and 1.00 mol dm^{-3} of NaOH

B 1.00 mol dm^{-3} of NH_3 and 2.00 mol dm^{-3} of HC*l*

C 0.50 mol dm^{-3} of H_2SO_4 and 2.00 mol dm^{-3} of NH_3

D 1.00 mol dm^{-3} of $C_6H_5CO_2H$ and 0.50 mol dm^{-3} of KOH

Ans: D

An acidic buffer is made up of a weak acid and its conjugate base/salt.

A: Not a buffer as strong acid and strong alkali are used
B: HC*l* is in excess and NH_3 will be fully neutralised. Hence not a buffer.
C: NH_3 is in excess. H_2SO_4 will be fully neutralised and NH_4^+ will be formed. The resultant solution is an alkaline buffer as NH_3 (weak alkali) and NH_4^+ (salt/conjugate acid) are present.
D: $C_6H_5CO_2H$ is in excess. KOH will be fully neutralised and $C_6H_5CO_2^-$ will be formed. The resultant solution is an acidic buffer as $C_6H_5CO_2H$ (weak acid) and $C_6H_5CO_2^-$ (salt/conjugate base) are present.

17	A non-cyclic organic compound has the molecular formula $C_4H_9O_2N$. Which pair of functional groups could **not** be present in the molecule? **A** one carboxylic acid group and one amine group **B** one alcohol group and one amide group **C** one ester group and one amine group **D** one alkene group and one carboxylic acid group
	Ans: D Based on the molecular formula, all options are possible except for option D since the presence of two double bonds will not enable the molecule to have 9 hydrogen atoms in total.

18	Which pairs of molecules are constitutional (structural) isomers? 1 $CH_3CH_2CH(CH_3)_2$ and $(CH_3)_4C$ 2 Butanone and 2-methylpropanal 3  **A** 1, 2 and 3 **B** 1 and 2 only **C** 1 and 3 only **D** 2 and 3 only Ans: A Constitutional isomers have the **same molecular formula but different connectivity of atoms**, meaning that their atoms are connected in a different order. Option 1: Both have same molecular formula of C_5H_{12}, with different connectivity of atoms. Option 2: Both have same molecular formula of C_4H_8O, with different connectivity of atoms. Option 3: Both have same molecular formula of $C_2H_2Cl_2$, with different connectivity of atoms. They are not cis-trans-isomers, but are constitutional isomers.

19 P and Q are two straight-chain unsaturated hydrocarbons with the molecular formula C_4H_8. Each react separately with bromine gas. The products of the two reactions are different isomers.

Which pair of names could identify the two organic **products** made?

A 1, 1-dibromobutane and 1,2-dibromobutane

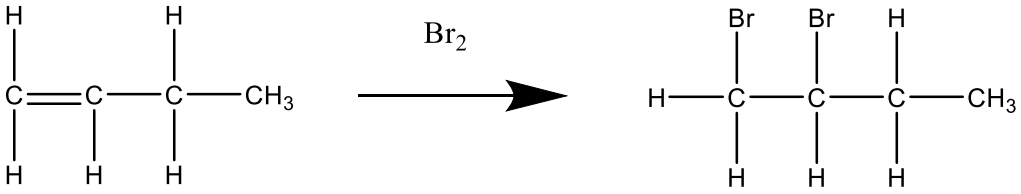
B 1,2-dibromobutane and 2,3-dibromobutane

C 1,3-dibromobutane and 2,4-dibromobutane

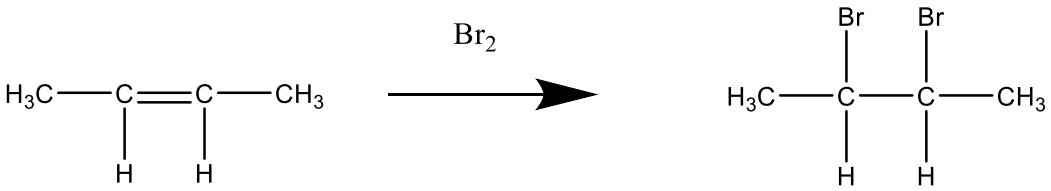
D 2,3-dibromobutane and 3,3-dibromobutane

Ans: B

P and Q contain C=C bonds. Since they are straight-chain compounds, they are but-1-ene and but-2-ene.



but-1-ene 1,2-dibromobutane



but-2-ene 2,3-dibromobutane

20 Which compound cannot undergo a reaction when treated with hot ethanolic potassium hydroxide?

A CH_2Br_2

B $CHBr_2CBr_3$

C $(CH_3)_2CHCHBr_2$

D $CH_3CBr_2CH_3$

Ans: A

To undergo elimination of HBr with hot ethanolic potassium hydroxide, the H and Br atoms need to be on adjacent carbon atoms.

Option A: there is only one carbon atom, thus elimination can't take place.
Option B to D: there are H and Br atoms on adjacent carbon atoms.

21 Pentaerythritol is used as an intermediate in the manufacture of paint. It has the molecular formula $C_5H_{12}O_4$ and contains four primary alcohol groups.

After prolonged heating under reflux with an excess of $Cr_2O_7^{2-}$ / H^+, it forms compound X which also has five carbon atoms.

What is the molecular formula of compound X?

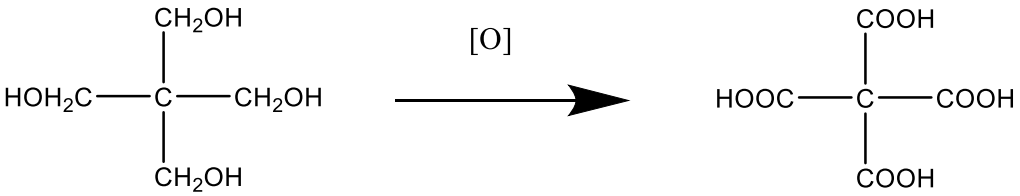
A $C_5H_4O_8$

B $C_5H_4O_4$

C $C_5H_8O_4$

D $C_5H_8O_8$

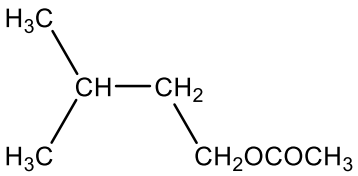
Ans: A



4 primary alcohols

X: $C_5H_4O_8$

22 The following ester, commonly known as banana oil, is used to confer banana flavour in foods.



banana oil

Which of the following substances react together to produce banana oil?

A $CH_3OH + CH(CH_3)_2CH_2CH_2CO_2H$

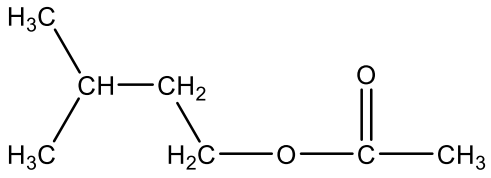
B $CH_3CO_2Na + CH(CH_3)_2CH_2CH_2Cl$

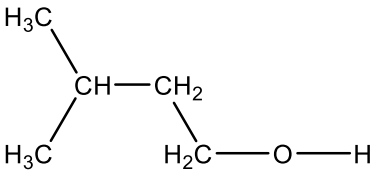
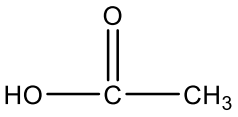
C $CH_3CO_2H + CH(CH_3)_2CH_2CH_2OH$

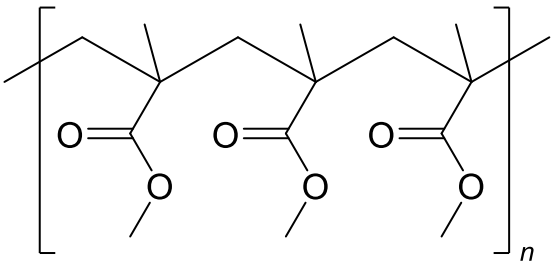
D $CH_3CO_2H + CH(CH_3)_2CH_2CH_2Cl$

Ans: C

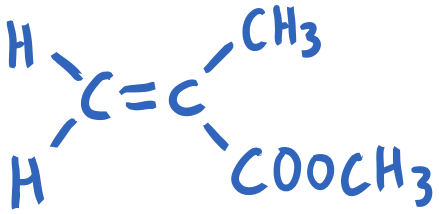
Banana oil has the structure:



	To form this ester, an alcohol and carboxylic acid are required to react together. The alcohol and carboxylic acid required are:  
23	Which of the following statement regarding the properties of high density polyethene (HDPE) and low density polyethene (LDPE) is least likely to be correct? **A** HDPE has less branching than LDPE. **B** HDPE is a harder material than LDPE. **C** HDPE has a higher melting point than LDPE. **D** HDPE is more suitable to be used to make plastic bags than LDPE.
	Ans: D A: This is a correct statement because HDPE is more linear, with less degree of branching. B: This is a correct statement because there is more extensive id-id interactions between polymer chains of HDPE C: This is a correct statement because there is more extensive id-id interactions between polymer chains of HDPE D: This is a wrong statement because HDPE is a much stiffer and less flexible material than LDPE. Thus, HDPE is not suitable to make plastic bags.

24	Poly(methyl methacrylate) is used in modern dentistry in the manufacture of artificial teeth. Part of its polymer chain is shown.  Which statement about poly(methyl methacrylate) is incorrect? **A** It can undergo alkaline hydrolysis. **B** The relative molecular mass of the monomer is 100.0. **C** Permanent dipole-permanent dipole interactions exist between polymer chains. **D** A small molecule of water is lost when polymerisation took place.
	Answer: D Option A is a correct statement because the ester group can undergo alkaline hydrolysis.

Option B is a correct statement because the monomer is:



Option C is a correct statement because the polymer chain has the polar ester group.

Option D is an incorrect statement because addition polymerisation instead of condensation polymerisation took place.

25 Poly(propene) is an example of an addition polymer.

Which statements are correct?

1 On combustion, poly(propene) can produce carbon monoxide and carbon dioxide

2 When poly(propene) is buried in a landfill site, it will not significantly biodegrade

3 The empirical formula of poly(propene) is the same as its monomer

A 2 only

B 1 and 3 only

C 2 and 3 only

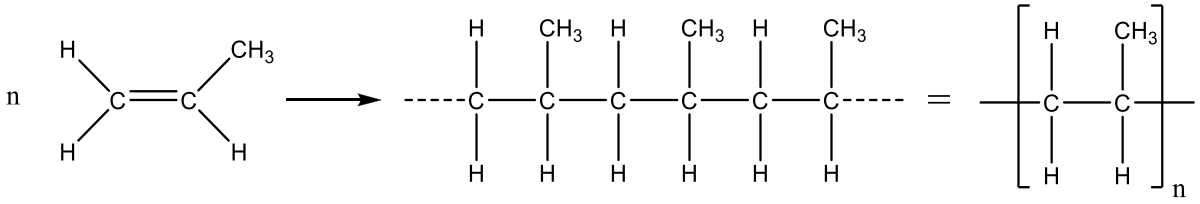
D 1, 2 and 3

Ans: D

Statement 1 is correct as incomplete combustion of hydrocarbons can give CO while complete combustion can give CO_2.

Statement 2 is correct as poly(propene) does not undergo hydrolysis to break down the polymer.

Statement 3 is correct because:



Empirical formula: C_3H_6 Empirical formula: C_3H_6

26 Which solid has more than one type of chemical bond?

A aluminium

B ammonium chloride

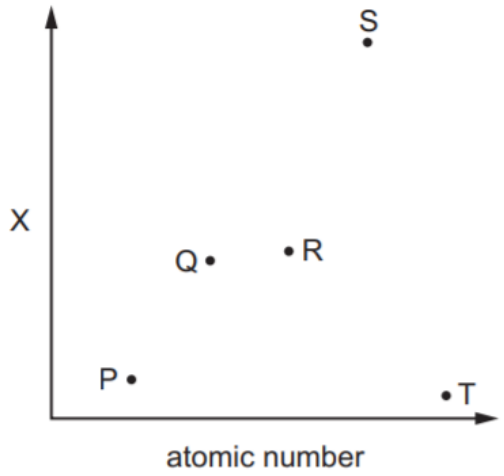
	C calcium sulfide **D** diamond
	Answer: **B** Option A: Aluminium has only metallic bonds Option B: In NH_4Cl, there are ionic bonds between the NH_4^+ and Cl^- ions. Within NH_4^+, there are covalent bonds between the N and H atoms. Option C: In CaS, there are only ionic bonds, between Ca^{2+} and S^{2-} ions. Option D: In diamond, there are only covalent bonds, between the carbon atoms.

27	Which of the following properties steadily decrease from hydrogen chloride to hydrogen bromide and to hydrogen iodide? 1 thermal stability 2 polarity of the H–X bond 3 boiling point **A** 1, 2 and 3 **B** 1 and 2 **C** 2 and 3 **D** 1 and 3
	Thermal stability decreases from HC*l* to HBr to HI as the **atomic radii** of the X atom **increases**, the **effectiveness of overlap** between the valence orbital of H atom and the valence orbital of X **decreases** and **bond length increases** the **H−X** covalent bond is thus **weaker** and easier to overcome. Polarity of the H-X bond decreases from HC*l* to HBr to HI as the electronegativity of the X atom decreases. Boiling point increases from HC*l* to HBr to HI. • HC*l*, HBr and HI has **simple molecular structures and are polar.** • **permanent dipole – permanent dipole forces of attractions** • as well as **instantaneous dipole – induced dipole interactions(id-id)** exist **between** their molecules. • From HC*l*, HBr and HI, the **number of electrons increases**, resulting in a **larger more polarisable electron cloud.** • Hence, **more energy** is required to overcome the **stronger id - id** during boiling.

28	Pure germanium is an important element in the electronics industry and is used in transistors. To manufacture pure germanium, the metal is separated from other metals by the formation of germanium tetrachloride, $GeCl_4$, followed by fractional distillation. $GeCl_4$ is a liquid at room temperature and has similar properties to $SiCl_4$. Which statement about germanium tetrachloride is correct? **A** germanium tetrachloride is an ionic compound. **B** germanium tetrachloride is hydrolysed by water. **C** germanium tetrachloride will conduct electricity.

	D the bond angle in germanium tetrachloride is 120°.
	Statement A is incorrect as $SiCl_4$ is a covalent molecule. Statement B is correct as $SiCl_4$ and other covalent chlorides can undergo hydrolysis by water. Statement C is incorrect as $SiCl_4$ is a covalent molecule hence it is unable to conduct electricity. Statement D is incorrect as $SiCl_4$ has a tetradedral shape around Si. Hence the bond angle is 109.5°.

29	What is formed when solid sodium chloride is added to water? **A** sodium chloride molecules in solution **B** sodium hydroxide solution and hydrochloric acid solution **C** sodium hydroxide solution and hydrogen chloride gas **D** sodium ions in solution and chloride ions in solution
	NaCl is an ionic salt thus it undergoes hydration in solution to form Na^+ and Cl^- ions.

30	The magnitude of property X of five elements from the third period of the Periodic Table, P, Q, R, S and T is shown. P, Q, R, S and T have consecutive atomic numbers. The letters do not represent the symbols of the elements.  Which row correctly identifies property X and element R?

	property X	element R
A	electrical conductivity	Al
B	electronegativity	Si
C	melting point	Al

	D	melting point	Si	
	For electrical conductivity, it will be increasing from Na to Mg to Al. Since Si is a semiconductor and P, S and Cl2 are non metal, the electrical conductivity should be decreasing. Al should have the highest electrical conductivity and will not be R. Electronegativity increases across period 3. Melting point will increase from Na to Mg to Al and Si has the highest melting point for period 3 elements. P will have lower melting point since it has a simple covalent structure and has weak instantaneous dipole-induced dipole interactions between molecules. Thus S is Si and R will be Al.			