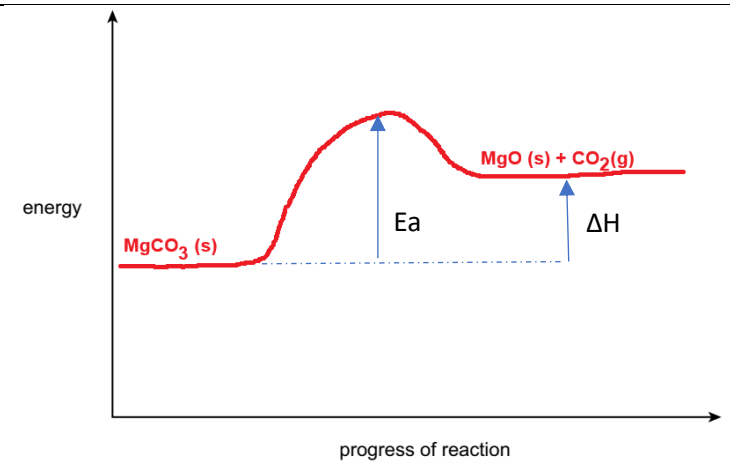
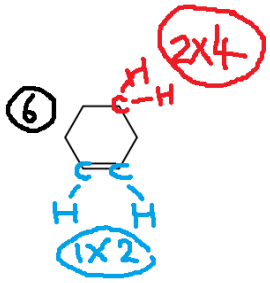
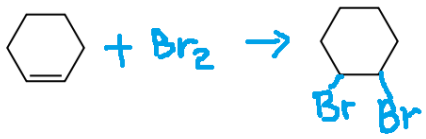
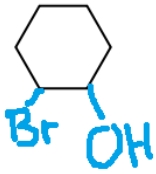
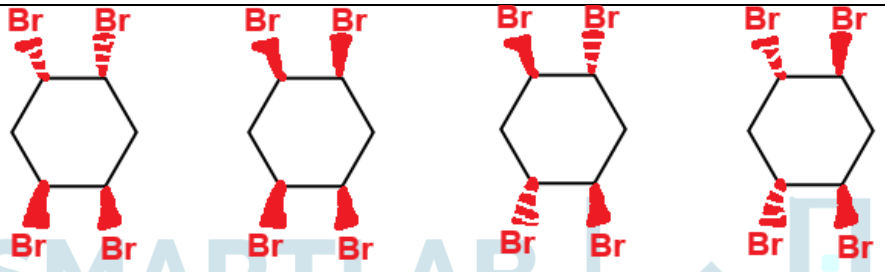
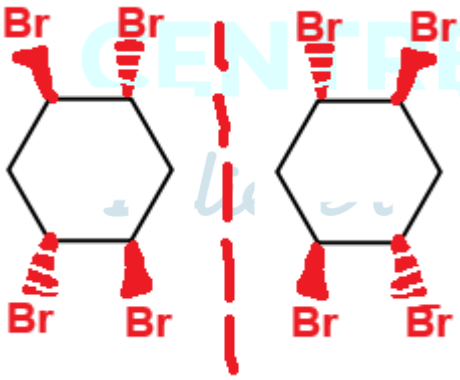
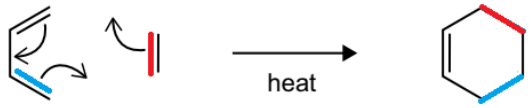
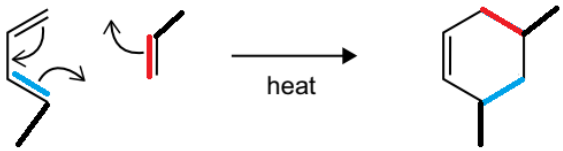
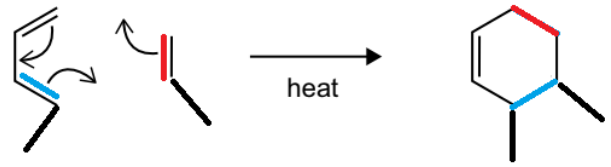
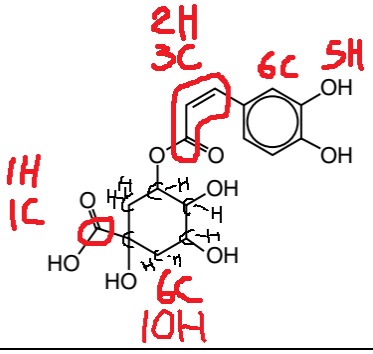
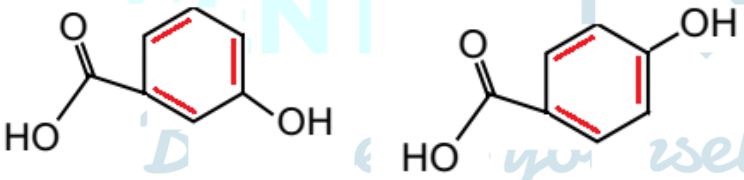
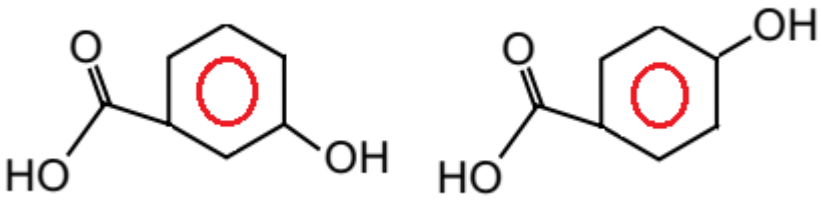
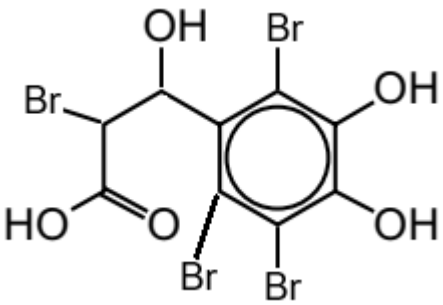
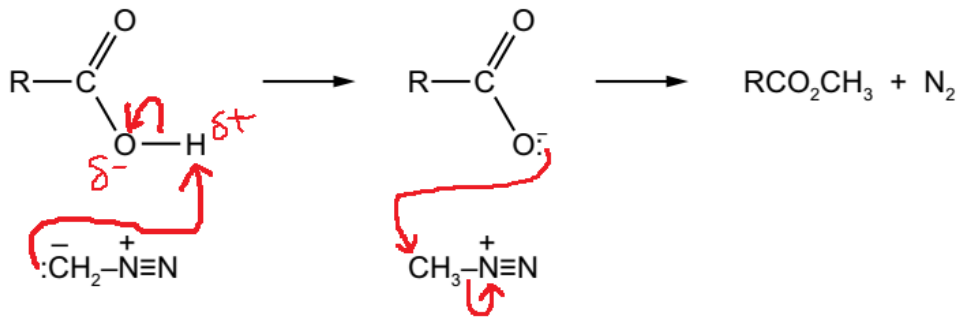
2026 H2 Chem Sample P2 Ans

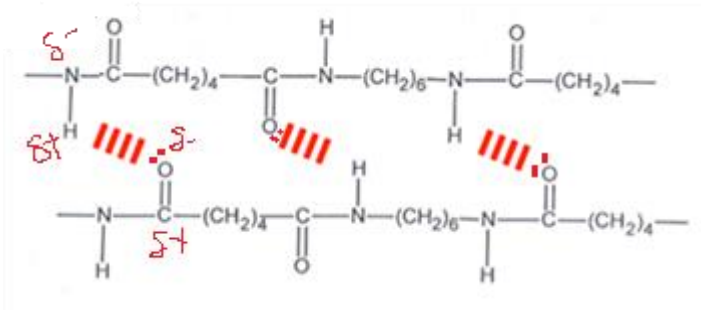
Qn	Ans
1 a	
bi)	ΔH $P_4(s) \rightarrow 2P_2(g)$ ΔH_{vap} ↓ ; $2 \times BE(P\equiv P)$ ↓ $P_4(g) \rightarrow 4P(g)$ $6 \times BE(P\text{-}P)$ $\Delta H = \Delta H_{vap} + 6 \times BE(P\text{-}P) - 2 \times BE(P\equiv P) = 242 kJmol^{-1}$
ii)	For reaction to be spontaneous, $\Delta G = \Delta H - T\Delta s < 0$ $\Delta H < T\Delta s$ $\Delta s > 0$ since number of gaseous molecules increases as reaction proceeds $T > \frac{\Delta H}{\Delta s}$
c)	Giant molecular lattice structure
di)	Oxidation state of Br decreases from +5 in BrO_3^- to -1 in Br^- 1 mole of BrO_3^- takes in 6 mol of electrons 4 moles of BrO_3^- takes in 6 mol x 4 = 24 mol of electrons
ii)	3 moles of N_2H_4 gives 24 mol of electrons 1 mole of N_2H_4 gives 8 mol of electrons 1 mol of Nitrogen gives 4 mol of electrons $N^{x-} \rightarrow N^{2+} + 4e$ Oxidation of N is -2
2 ai)	$MgCO_3 \rightarrow MgO + CO_2$

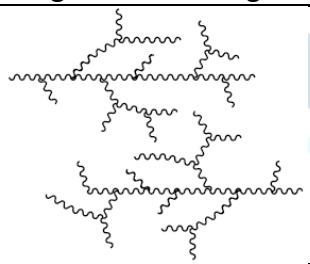
ii)	
iii)	Decomposition temperature increases down the group 2 carbonates Charge density of the group 2 cations decreases down the group 2 since the ionic radius of the cations increase higher charge density of smaller cations better able to polarise the electron cloud of carbonate anion weakening the C-O bond rendering the carbonate thermally less stable which decompose at lower temperature
bi)	$HCl + NaOH \rightarrow NaCl + H_2O$ For $10cm^3$ of excess diluted HCl $nNaOH = \frac{41.50}{1000} \times 0.100$ mol $nHCl = \frac{41.50}{1000} \times 0.100$ mol For $100cm^3$ of excess diluted HCl $nHCl = \frac{41.50}{1000} \times 0.100 \times \frac{100}{10.0}$ mol = 0.0415 mol
ii)	Total no of mol of HCl original solution = 0.0300 x 5.00 = 0.150 mol No of mol of HCl reacted with 5.00g sample = 0.150 – 0.0415 = 0.1085 = 0.109 mol
iii)	No of mol of $CO_3^{2-} = \frac{0.1085}{2} mol$ Mass of carbonate ions = no of mol x Mr = no of mol x (12+3x16) = 3.255 = 3.26g
iv)	No of mol of $MgZ(CO_3)_2$ = ½ x No of mol of CO_3^{2-} = ½ x $\frac{0.1085}{2} mol$ = 0.027125 mol Mr of $MgZ(CO_3)_2 = \frac{5.00g}{No\ of\ mol\ of\ MgZ(CO3)2}$ = 184.33 = 24.3 + Ar of Z + (60x2) *Molar mass of Z^{2+} = 40* Z is Calcium
3 a)	Sigma bond = 6 + 2x4 + 2x1 = 16 Pi bond = 1 

bi)	Presence of localised electron density in C=C due to pi electrons (nucleophilic) that attract electrophile Alkane does not have pi electrons since it comprises C-C or C-H bonds which are not polar/nucleophilic or electrophilic
ii)	
iii)	
c)	 WRONG WRONG ✓ (1) ✓ (2) Structure (1) exists as pairs of optical isomers  Structure (2) is a meso compound (hence unable to display optical isomerism)
di)	Ethene 
ii)	

	
4 ai)	$C_{16}H_{18}O_9$ 
ii)	1 mol of acid gives 6 OH groups that releases 6 H^+ to react with excess Na $2Na + 2H^+ \rightarrow H_2 + 2Na^+$ $6Na + 6H^+ \rightarrow 3H_2 + 6Na^+$ 1 mol of acid releases 3 moles of hydrogen gas
bi)	Acidic hydrolysis / nucleophilic substitution
ii)	alkene
iii)	Carboxylic acid/COOH reacts with sodium carbonate Alkene/C=C reacts with aqueous bromine
iv)	Elimination of alcohol x 3 times to remove the 3 x alcohol group creating structures below  Answer – formation of benzene 
v)	 Aq bromine reacts with phenol for full bromination Aq bromine reacts with C=C

5 a)	• **Nuclear charge** is larger for Cu as it has **larger number of protons** (29p as compared to Fe 26p) • However it has a **fully filled *3d*** for Cu ([Ar] $3d^{10}$ $4s^1$) that provides **effective shielding effect** on the outermost *4s* electrons as compared to Fe which has **partially filled 3d** • The more effective **shielding effect cancels out** the increased in **nuclear charge** for Cu resulting in similar atomic radii
b)	**Reason 1:** - They have giant metallic structures. - For transition elements, the **3d and 4s electrons are involved in delocalisation** in metallic bonding (due to their proximity in energies). - For s–block elements, **only the s electrons are involved in delocalisation** in metallic bonding. - Hence, **larger amount of energy** is required to overcome the **stronger electrostatic forces of attraction between the cations and the sea of delocalised electrons in transition elements** as compared to s–block elements. **Reason 2:** - Transition elements have **smaller atomic/metallic radius** and **highly charged metal cation**. - Hence, higher charge density. - **Larger amount of energy** is required to overcome the **stronger electrostatic forces of attraction between the cations and the sea of delocalised electrons in transition elements** as compared to s–block elements.
6 a)	cis
b)	Octadeca-6,9,12,15-tetraenoic acid
c)	2^5 = 32 cis-trans isomers
d)	Instantaneous dipole-induced dipole attraction forces
ei)	Max energy from fat intake = 25% x 2000 = 500 kcal per day Max Mass of fat = 500kcal ÷ 9 kcal = 55.56 = 55 g
ii)	1 egg ≡ 50mg DHA → 10 eggs ≡ 500mg DHA per day for good health 1 egg ≡ 5.0g fats → 10 eggs ≡ 50g fats < 55g Answer yes it is appropriate
f)	"Omega-3" refers to a fatty acid structure where the first double bond in the carbon chain is located three carbon atoms from the methyl end of the molecule, essentially meaning the unsaturated bond is positioned at the "third carbon from the tail" of the fatty acid chain; this is why it's called "omega-3" as "omega" represents the end of the chain.
gi)	
ii)	Reaction rate is fast since diazomethane or CH_2^- is a base while COOH is an acid & reaction is spontaneous as neutralisation takes place

<table>
<tr><td></td><td>N_2 gas produced would evolve and escape as a gas thus shifting the position of equilibrium forward</td></tr>
<tr><td>7 a)</td><td> 
Long pair e of O in CO and electron deficient hydrogen of NH</td></tr>
<tr><td>b</td><td>$H_2N – (CH_2)_6 – NH_2$
$HO_2C – (CH_2)_4 – CO_2H$</td></tr>
<tr><td>ci)</td><td>Compared F relative to C as both have similar tensile strength but F has at least 50% higher Mr of its repeat unit when compared to C

A and B have the same Mr on its repeat unit but they have fairly different tensile strength with B being twice stronger in tensile strength</td></tr>
<tr><td>ii)</td><td><table>
<tr><td>  </td><td>  </td></tr>
<tr><td>Chains are further apart hence Instantaneous dipole-induced dipole attraction forces are weaker</td><td>Chains are closed together hence Instantaneous dipole-induced dipole forces are stronger with larger surface area</td></tr>
</table></td></tr>
<tr><td>d)</td><td>Polymer E undergoes hydrolysis or biodegrades to form acid and amine causing contamination of soil and water resources.

Burning of amine may produce NOx – air pollutant</td></tr>
</table>