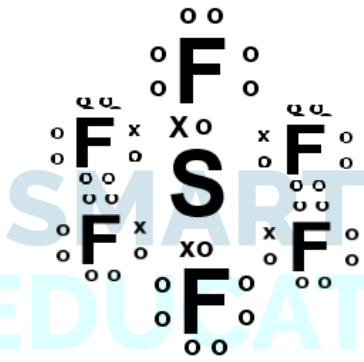
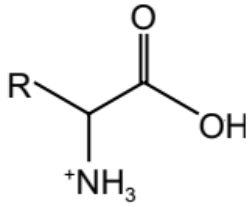
2026 H1 Chem Sample P2 Ans

<table>
<tr><td>Qn</td><td>Ans</td></tr>
<tr><td>1 a</td><td>
<table>
<tr><th>isotopic species</th><th>number of protons</th><th>number of neutrons</th><th>number of electrons</th><th>electronic configuration</th></tr>
<tr><td>$^{32}_{16}S$</td><td>16</td><td>16</td><td>16</td><td>$1s^2$ $2s^2 2p^6 3s^2 3p^4$</td></tr>
<tr><td>$^{33}_{16}S^{2-}$</td><td>16</td><td>17</td><td>18</td><td>$1s^2$ $2s^2 2p^6 3s^2 3p^6$</td></tr>
</table>
[4]
</td></tr>
<tr><td>bi)</td><td>P Group 15 ($3s^2$ $3p_x^1$ $3p_y^1$ $3p_z^1$)
S Group 16 ($3s^2$ $3p_x^2$ $3p_y^1$ $3p_z^1$)
S has additional shielding effect/lower energy required to remove the electrons as a result of inter-electronic repulsion occurring between the electrons in the fully filled $3p_x$ orbital</td></tr>
<tr><td>ci)</td><td>  </td></tr>
<tr><td>ii)</td><td>F is more electronegative than S causing the shared pair electron to be polarised such that S is δ+ and F is δ-</td></tr>
<tr><td>2 a)</td><td>enzyme, which has the active site of the enzyme (the "lock") specifically matches the shape of the substrate molecule ("key")
allowing it to bind and catalyze the breakdown of that substrate into smaller products</td></tr>
<tr><td>b)</td><td>At higher pH, R groups that are COO- may become COOH and in doing so no longer able to establish ionic interaction forces to fold the enzyme in a certain manner such that the “lock” has altered its structural shape and no longer able to interact with the food molecules.</td></tr>
<tr><td>ci)</td><td>Zwitterion is neutral in charge</td></tr>
<tr><td>ii)</td><td>When acid is added, zwitterion neutralises the H^+ by COO- and becomes a cation which is attracted towards the -ve terminal of the battery
 
When alkali is added, zwitterion neutralises the OH^- by NH_3^+ and becomes an anion which is attracted towards the +ve terminal of the battery</td></tr>
</table>

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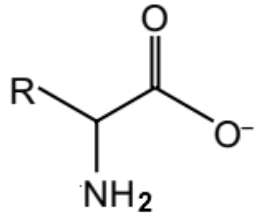
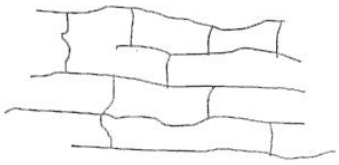
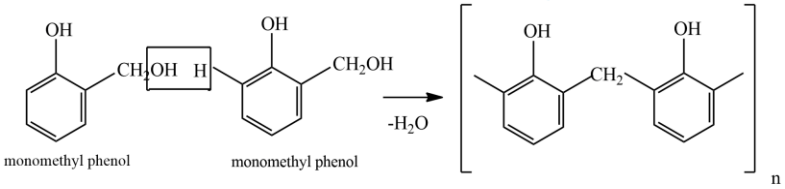
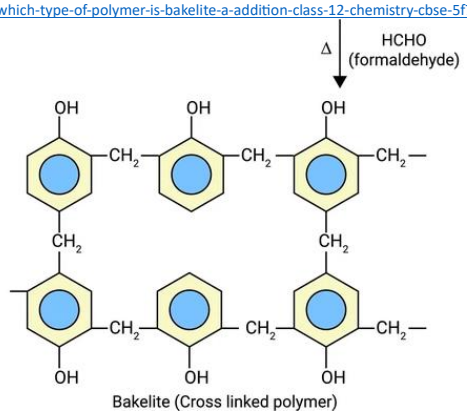
	
iii)	$^{+}NH_3$-CH(CH_3)-COO^{-}
iv)	Ionic compound which forms strong ionic bonds between COO- and NH3+ groups due to the electrostatic attraction forces btw oppositely charged ions
3 ai)	Bakelite  condensation polymer polymeric chains have strong covalent bonds cross linking covalent bonds btw polymeric chains Polymers are very hard and have high melting point Polystyrene  addition polymer polymeric chains have strong covalent bonds Instantaneous dipole-induced dipole forces btw polymeric chains Polymers are hard and low melting point **Extra information on Bakelite**  monomethyl phenol monomethyl phenol Novolac https://www.vedantu.com/question-answer/which-type-of-polymer-is-bakelite-a-addition-class-12-chemistry-cbse-5f7ea14ae89c675ac64278a5  Bakelite (Cross linked polymer) https://88guru.com/library/chemistry/bakelite-structure-monomers-preparation-properties-and-uses

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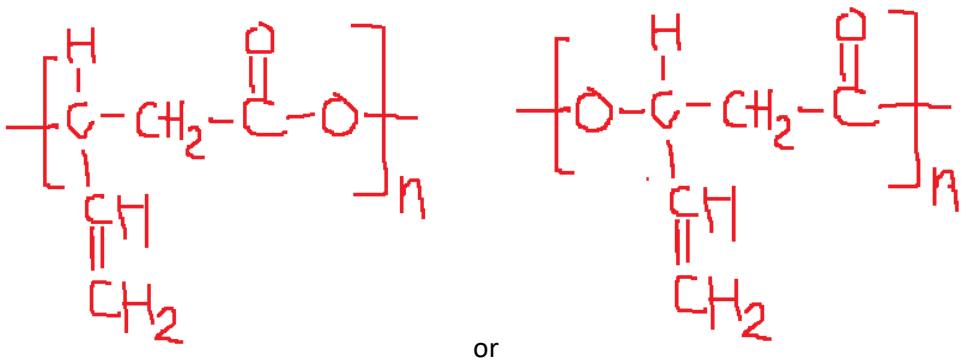
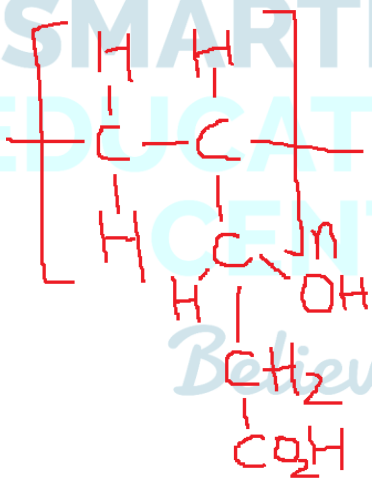
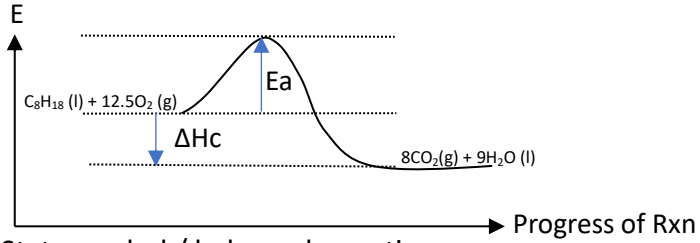
ii)	Not able to be recycled for Polystyrene which comprises strong non-polar C-C bonds that render it not possible to break down Possible for Bakelite to be recycled as high temperature produces chars which are solid carbon that can be used as a reducing agent in extraction of iron from iron ores
b)	condensation polymer  or addition polymer 
4 ai)	The **standard enthalpy change of combustion, $\Delta H_c^{\varnothing}$ of a substance** is defined as enthalpy change when 1 mole of a substance is completely burnt in excess oxygen under **standard condition of 25°C and 1 bar pressure**.
ii)	 State symbol / balanced equation Label ΔHc & Ea Label axes
b)	Bonds to break = 2x8 x BE(C-C) + 2x18 x BE (C-H) + 25 x BE (O=O) = 16x350+36x410+25x496 = 32760 Bonds to form = - [16 x 2 x BE(C=O) + 18 x 2 x BE(O-H)]=-[32x805+36x460] = -42320

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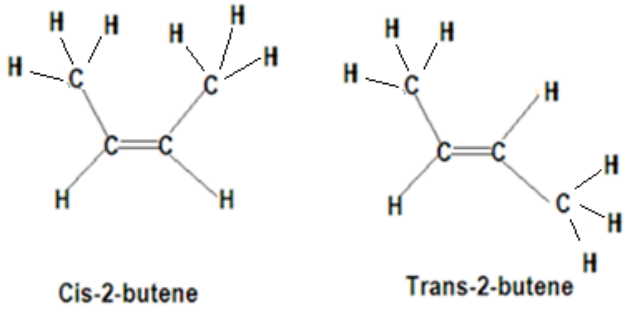
<table>
<tr><td></td><td>ΔHc = -9560 kJ/mol</td></tr>
<tr><td>c)</td><td> 
</td></tr>
<tr><td>5 ai)</td><td>Number of mol of NaOH = 23.30/1000 x 1.00 = 0.02330 mol</td></tr>
<tr><td>ii)</td><td>1 mol H_2SO_4 ≡ 2 mol NaOH
Number of mol of NaOH = 0.00500 x 2 = 0.01000 mol</td></tr>
<tr><td>iii)</td><td>CH_3CO_2H + NaOH → CH_3CO_2Na + H_2O</td></tr>
<tr><td>iv)</td><td>1 mol CH_3CO_2H ≡ 1 mol NaOH
Number of mol of NaOH reacted with CH_3CO_2H
= 0.02330 mol - 0.01000 mol
= 0.01330 mol
At equilibrium, number of mol of CH_3CO_2H = 0.01330 mol</td></tr>
<tr><td>bi)</td><td><table>
<tr><th></th><th>CH_3CO_2H</th><th>C_2H_5OH</th><th>$CH_3CO_2C_2H_5$</th><th>H_2O</th></tr>
<tr><td>initial amount / mol</td><td>0.0200</td><td>0.107</td><td>0</td><td>0.100</td></tr>
<tr><td>equilibrium amount / mol</td><td>0.01330</td><td>0.1003</td><td>0.00670</td><td>0.10670</td></tr>
</table>
[3]
number of mol of CH_3CO_2H that reacted to produce ester
= 0.0200 - 0.01330 mol = 0.0200 - 0.01330 = 0.00670 mol
Thus amt of ester produced/water produced = 0.00670 mol
Thus amt of ethanol used up = 0.00670 mol</td></tr>
<tr><td>ii)</td><td>$K_c = \frac{[CH_3CO_2C_2H_5][H_2O]}{[CH_3CO_2H][C_2H_5OH]}$</td></tr>
<tr><td>iii)</td><td>$K_c = \frac{[CH_3CO_2C_2H_5][H_2O]}{[CH_3CO_2H][C_2H_5OH]} = \frac{(0.00670/V)(0.10670/V)}{(0.01330/V)(0.1003/V)} = 0.53590 = 0.536$
no unit</td></tr>
<tr><td>c)</td><td>Position of equilibrium shifts forward
Adding more reactant favours the removal / decrease of amount of reactant by Le Chatelier's Principle when the added reactant would be converted to product</td></tr>
<tr><td>6 a)</td><td>Compared expt 2 & 3, in expt 2 $[H_2]$↑ by 4x, rate ↑ by 4x, wrt to H_2 1^{st} order
Compared expt 1 & 3,
in expt 1 $[H_2]$↑ by 2x, rate ↑ by 2x, since wrt H_2 1^{st} order, rate = 12.0×10^{-3}
in expt 2 [NO] ↓ by ½, rate ↓ by ¼, wrt to NO 2^{nd} order</td></tr>
<tr><td>b)</td><td>$R = k [H_2] [NO]^2$</td></tr>
<tr><td>c)</td><td>rate = $2.4 \times 10^{-2} = k [H_2] [NO]^2 = k [0.0040] [0.006]^2$
k = 166,667 = 167,000 $mol^{-2}\ dm^6\ h^{-1}$</td></tr>
<tr><td>7 a)</td><td>Na / giant metallic lattice structure / delocalised electrons and cations held in fixed positions / good electrical conductor</td></tr>
</table>

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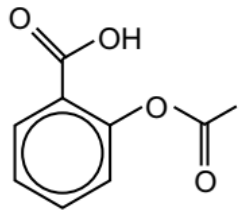
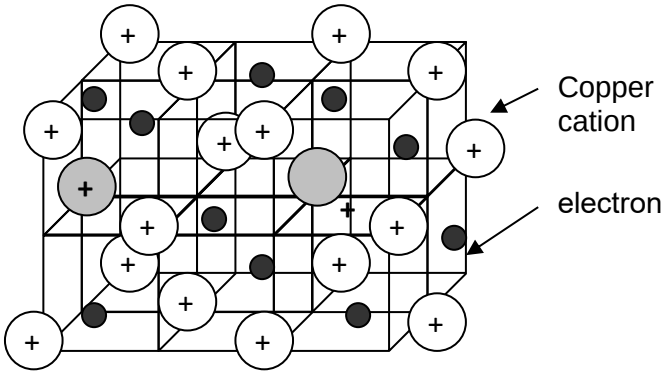
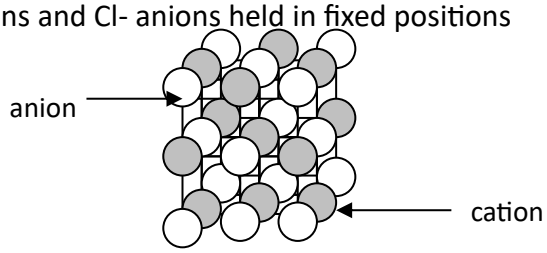
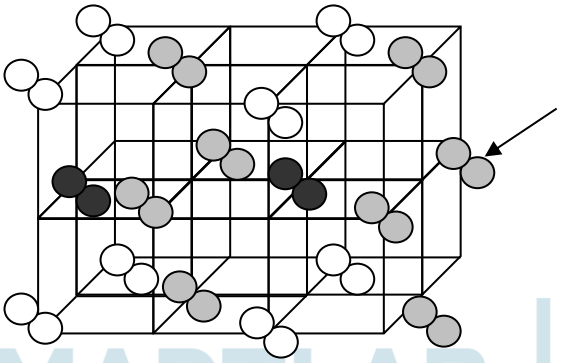
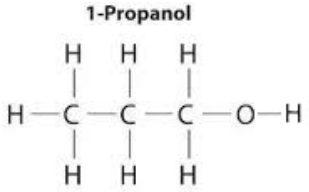
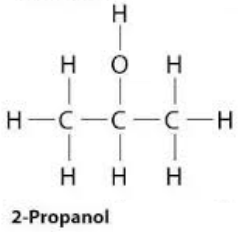
	Si / giant covalent lattice structure / covalent bonds btw Si atoms / few of the shared pair electrons may be able to be delocalised / semi conductor Cl_2 / non polar covalent molecule / absence of ions or electrons for electrical conductivity / poor electrical conductor
bi)	pH ~ 13 $Na_2O + H_2O \rightarrow 2\ NaOH$ pH ~ 1-2 $P_4O_{10} + 6H_2O \rightarrow 4\ H_3PO_4$ pH ~ 1-2 $SO_3 + H_2O \rightarrow H_2SO_4$
ii)	$Na_2O + 2HCl \rightarrow 2\ NaCl + H_2O$ $P_4O_{10} + 12\ NaOH \rightarrow 4\ Na_3PO_4 + 6\ H_2O$ $SO_3 + 2\ NaOH \rightarrow Na_2SO_4 + H_2O$
iii)	Across period, initially metal oxides are basic oxides while subsequently non-metal oxides are acidic oxides
ci)	 aspirin $C_9H_8O_4$ Mr = 180 %tage mass of carbon = 9x12/Mr x 100 = 60%
ii)	Functional group COOH: 2500-3000 cm^{-1}
iii)	Functional group CONH: 3300-3500 cm^{-1} Functional group phenol: 3200-3600 cm^{-1}
iv)	Acidic/alkaline hydrolysis (due to ester / amide group)
d)	$CH_2{=}CH{-}CH_3 + H_2 \rightarrow CH_3CH_2CH_3$ Addition reaction Heat at 140°C, Nickel or **Catalyst: Pd, rtp**
8 a)	Cu / giant metallic lattice structure / strong electrostatic attraction forces btw delocalised electrons and cations held in fixed positions 

	NaCl / giant ionic lattice structure / strong electrostatic attraction forces btw Na+ cations and Cl- anions held in fixed positions  I_2 / non polar covalent molecule / weak instantaneous dipole-induced dipole attraction forces 
bi)	**ΔH_{latt}, Lattice energy** of an ionic crystal is the heat energy evolved when **1 mole of the crystalline solid** is formed from its separate gaseous ions
ii)	**Magnitude of Lattice Energy $\propto \frac{Q^+ Q^-}{r^+ + r^-}$** • **Interionic distance between the anion and cation of MgO < NaCl; ionic size of O^{2-} < Cl^- & Mg^{2+} < Na^+** **e.g. R $_{Mg2+}$ < R $_{Na+}$** • **Charge of Mg^{2+} is twice that of Na^+** • **Charge of O^{2-} is twice that of Cl^-** • **Larger magnitude of lattice energy of MgO; stronger ionic bond, higher melting point**
ci)	One component is a rod of cadmium, Cd, metal and the other component is made of nickel(III) hydroxide, $Ni(OH)_3$ → Cd reacts with $Ni(OH)_3$; hence Cd has to oxidise & the half equation given has to be flipped to $Cd + 2OH^- \rightleftharpoons Cd(OH)_2 + 2e^-$ Overall reaction: $Cd + 2Ni(OH)_3 \rightarrow Cd(OH)_2 + 2Ni(OH)_2$
ii)	Cd (oxidation state/OS is 0) is oxidised to Cd^{2+} (OS is +2) $Ni(OH)_2$ (OS of Ni is +2) is reduced to $Ni(OH)_3$ (OS of Ni is +3)
di)	Propanol when reduced  Propanone when reduced 
ii)	Propanone cannot be oxidised $CH_3CH_2CHO + [O] \rightarrow CH_3CH_2COOH$