Question 40 (Answer: **D**)

- Each functional group absorbs in its own characteristic wavenumber range.
- An impurity shows up as an absorption that the pure compound's groups cannot account for.
- So match every observed peak against the table, and look for one that the intended structure cannot explain.

4(a)(i)	free-radical substitution
4(a)(ii)	**M1** $C_3H_8 + Cl^{\bullet} \rightarrow CH_3CH_2CH_2^{\bullet} + HCl$ **OR** $C_3H_8 + Cl^{\bullet} \rightarrow C_3H_7^{\bullet} + HCl$ **M2** $CH_3CH_2CH_2^{\bullet} + Cl_2 \rightarrow CH_3CH_2CH_2Cl + Cl^{\bullet}$ **OR** $C_3H_7^{\bullet} + Cl_2 \rightarrow C_3H_7Cl + Cl^{\bullet}$ etc **M3** $CH_3CH_2CH_2^{\bullet} + Cl^{\bullet} \rightarrow CH_3CH_2CH_2Cl$ **OR** $C_3H_7^{\bullet} + Cl^{\bullet} \rightarrow CH_3CH_2CH_2Cl$
4(a)(iii)	homolytic
4(a)(iv)	1,2-dichloropropane
4(a)(v)	**M1** (type of structural isomerism) positional **M2** (type of stereoisomerism) optical
4(b)	sodium hydroxide **AND** water
4(c)(i)	orange to green
4(c)(ii)	$CH_3CH_2CH_2OH + 2[O] \rightarrow CH_3CH_2COOH + H_2O$
4(d)(i)	condensation
4(d)(ii)	**M1** absorption labelled at approx. 1750 cm^{-1} identified as C=O **M2** absorption labelled at approx. 1650 cm^{-1} identified as C=C **M3** absorption labelled at approx. 1170 cm^{-1} identified as C—O
4(d)(iii)	$(0.31 / 4.7 \times 100 / 1.1) = 6$ carbon atoms