3. Geometric isomers → structural isomers

4. The minor image are not superimposable

2-butanol

Chiral Carbon (has 4 different substituents)

5. OH

K₂Cr₂O₇

HOH

6. OH

K₂Cr₂O₇

7. OH

K₂Cr₂O₇

N.R. (tertiary alcohol)

8. OH

K₂Cr₂O₇

COOH

Remember: every point is a carbon atom. Assume that the carbon is saturated w/ bonds to hydrogen, unless shown otherwise.

9. 3,5-dimethyl-heptane

2,2-dimethyl-heptane

2,5-dimethyl-heptane

Lots of structural isomers:

n-nonane

2-methyl-octane

2,2-dimethyl-heptane

Many more:
28. \[ C_4H_8 \] | color: colorless | state: gas | soluble in \( H_2O \): no | soluble in nonpolar: yes

\[ C_{12}H_{26} \] | color: colorless | state: liquid | soluble in \( H_2O \): no | soluble in nonpolar: yes

34. \( \text{L} + \text{Br}_2 \rightarrow \text{Br}_2 \text{Br} \) 1,2-dibromo-propane

6. \( \text{CH}_2=\text{C} + \text{H}_2 \rightarrow \text{CH}_3\text{CH}_2\text{CH}_2\text{CH}_3 \) n-pentane

41. \[ \text{NO}_2 \text{CH} \] 2-chloro-nitrobenzene

[Chemical structure]

41. \[ \text{NO}_2 \text{CH} \] 2-nitro-chlorobenzene

[Chemical structure]

[Chemical structure]

41. \[ \text{NO}_2 \text{CH} \] 1,4-dinitrobenzene or para-dinitrobenzene

[Chemical structure]

C. \[ \text{ClCH}_2\text{C}_6\text{H}_5 \] 2-chloro-ethylbenzene or 2-ethyl-chlorobenzene
(a) \[ \text{OH} \quad = \quad \text{CH}_3 \quad \text{CH}_2 \quad \text{OH} \quad \text{CH}_2 \quad \text{CH}_3 \quad \text{1\textdegree} \text{ alcohol} \]

(b) \[ \text{OH} \quad \text{2\textdegree} \text{ alcohol} \]

(c) \[ \text{OH} \quad \text{2\textdegree} \text{ alcohol} \]

(d) \[ \text{OH} \quad \text{1\textdegree} \text{ alcohol} \]

52. (a) \[ \text{O} - \text{NH}_2 \quad (aq) + \quad \text{HCl} \quad (aq) \rightarrow \quad \text{O} - \text{NH}_3 \quad \text{Cl}^{-} \quad (aq) \]

(b) \[ \text{CH}_3 \quad \text{CH}_3 \quad (aq) + \quad \text{H}_2\text{SO}_4 \quad (aq) \rightarrow \quad \text{H}^+ \quad (aq) + \quad \text{H}_2\text{SO}_4^{-} \quad (aq) \]

58. (a) \[ \text{CH}_3 \quad \text{CO} \quad \text{Kmno}_4 \rightarrow \quad \text{CH}_3 \quad \text{COOH} \quad \text{pentanoic acid} \]

(b) \[ \text{CH}_3 \quad \text{LiAlH}_4 \rightarrow \quad \text{CH}_3 \quad \text{OH} \quad \text{pentanol} \]

(c) \[ \text{CH}_3 \quad \text{LiAlH}_4 \rightarrow \quad \text{CH}_3 \quad \text{OH} \quad \text{2-octanol} \]

(d) \[ \text{CH}_3 \quad \text{LiAlH}_4 \rightarrow \quad \text{CH}_3 \quad \text{OH} \quad \text{N.R.} \]
64. C-3 is trigonal planar.
   - The O-C-O angle is approximately 120°.
   - Phenylalanine is chiral. C-2 has 4 inequivalent substituents and is therefore chiral.
   - The acidic hydrogen is attached to one of the O atoms.

66. A. Alcohol
    B. Amide
    C. Carboxylic acid
    D. Ester

72. Glycine - Histidine - Alanine
\( \text{C}_3\text{H}_6\text{Cl}_2 \)

1,2 - dichloropropane

1,1 - dichloropropane

2,2 - dichloropropane

1,3 - dichloropropane

86) cyclohexane or benzene?

88) \( \text{C}_3\text{H}_6\text{O} \)

\( \text{C}_3\text{H}_6\text{O} \)

This gives acidic solution due to the acidic proton
\[ C_2H_6(g) + \frac{7}{2}O_2(g) \rightarrow 2CO_2(g) + 3H_2O(g) \]

\[ \Delta H^\circ_{\text{rxn}} = \sum \Delta H^\circ_f(\text{prod}) - \sum \Delta H^\circ_f(\text{react}) \]
\[ = \left(2 \times -393.51 \frac{\text{kJ}}{\text{mol}} + 3 \times -241.83 \frac{\text{kJ}}{\text{mol}}\right) - (-83.85 \frac{\text{kJ}}{\text{mol}} + 0) \]
\[ = (-1512.5 \frac{\text{kJ}}{\text{mol}}) + 83.85 \frac{\text{kJ}}{\text{mol}} = -1428.7 \frac{\text{kJ}}{\text{mol}} \]

\[ C_2H_5OH(g) + 3O_2(g) \rightarrow 2CO_2(g) + 3H_2O(g) \]

\[ \Delta H^\circ_{\text{rxn}} = \left(2 \times -393.51 \frac{\text{kJ}}{\text{mol}} + 3 \times -241.83 \frac{\text{kJ}}{\text{mol}}\right) - (-277 \frac{\text{kJ}}{\text{mol}} + 0) \]
\[ = (-1512.5 \frac{\text{kJ}}{\text{mol}}) + 277 \frac{\text{kJ}}{\text{mol}} = -1235.5 \frac{\text{kJ}}{\text{mol}} \]

2. ethane has a more negative \(\Delta H^\circ_{\text{combustion}}\).

1. ethanol can be viewed as partially burned ethane, which means that some of the combustion enthalpy has already been released.
0.125 g malic acid + O₂ → 0.190 g CO₂ + 0.03885 g H₂O

Empirical Formula is C₅H₇O₄

12.01 + 1.01 + 16 = 29.03 g empirical unit

1.25 g = Mass O + Mass C + Mass H

1.25 g = ( ) + (4.32E⁻³ mol x 12.01 g/mol) + (4.32E⁻³ mol x 1.01 g/mol)

Mass O = 0.0688 g

\[ \text{Mass O} = 0.0688 g \times \frac{1 \text{ mol O}}{16 \text{ g}} \]

\[ 4.30E⁻³ \text{ mol} \]

0.261 g Acid is neutralized by NaOH

\[ 3.460 \text{ mL} \times \frac{1 \text{ L}}{1000 \text{ mL}} = 0.03460 \text{ L} \]

\[ (0.03460 \text{ L}) \times (0.130 \frac{\text{ mol NaOH}}{\text{ L}}) = 4.50E⁻³ \text{ mol NaOH} \]

0.261 g Acid release 4.50E⁻³ mol of H⁺.

\[ \text{H}_2(\text{malic}) + 2 \text{ NaOH} \rightarrow 2 \text{ H}_2\text{O} + (\text{malic})^{2⁻} + 2 \text{ Na}⁺ \]

\[ \frac{0.261 \text{ g malic acid}}{(4.50E⁻³ \text{ mol H}⁺)(2 \text{ mol H}⁺)} = \frac{116 \text{ g malic acid}}{\text{ mol malic acid}} \]

\[ \frac{116}{29} = 4 \]

So 4 units per molecule → C₅H₇O₄
(1) Each C is $sp^2$ hybridized.

(2) Each bond angle is roughly $120^\circ$ about each C.