

1.

$\begin{array}{c} \text{CH}_3 \\ \\ \text{HO}-\text{CH}_2-\text{C}-\text{CH}_3 \\ \\ \text{OH} \end{array}$	$\begin{array}{c} \text{Cl} \\ \\ \text{CH}_3-\text{CH}-\text{CH}-\text{CH}_3 \\ \\ \text{Cl} \end{array}$
$\begin{array}{c} \text{CH}_3-\text{C}-\text{CH}-\text{CH}_2-\text{CH}_2-\text{CH}_3 \\ \quad \\ \text{O} \quad \text{CH}_2-\text{CH}_3 \end{array}$	$\begin{array}{c} \text{CH}_2-\text{CH}-\text{CH}_2 \\ \quad \quad \\ \text{OH} \quad \text{OH} \quad \text{OH} \end{array}$
$\begin{array}{c} \text{O} \\ \\ \text{H}-\text{C} \\ \\ \text{H} \end{array}$	$\begin{array}{c} \text{Br} \\ \\ \text{CH}_3-\text{C}=\text{C}-\text{CH}_2-\text{CH}_3 \\ \\ \text{Br} \end{array}$
$\begin{array}{c} \text{O} \qquad \qquad \qquad \text{O} \\ \qquad \qquad \qquad \\ \text{HO}-\text{C}-\text{CH}-\text{CH}_2-\text{CH}_2-\text{CH}_2-\text{C}-\text{OH} \\ \\ \text{I} \end{array}$	$\begin{array}{c} \text{CH}_3 \\ \\ \text{CH}_3-\text{CH}-\text{C}\equiv\text{C}-\text{CH}_2-\text{CH}_2-\text{CH}_3 \end{array}$
$\text{CH}_3-\text{CH}_2-\text{NH}_2$	$\begin{array}{c} \text{O} \\ \\ \text{CH}_3-\text{CH}_2-\text{C} \\ \\ \text{O}^- \text{Na}^+ \end{array}$

2.

a) 5-methyl heptanal
b) sodium butanoate
c) propyl propanoate

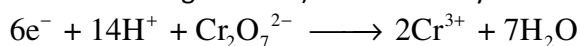
3. By boiling. Hexane has a lower boiling point than decane, because it has a shorter carbon chain and therefore is not as strongly held by dispersion forces.

4.

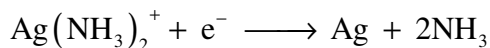
- The compounds have the same molecular formula (the same number of each element)
- Boiling point. Isomeric acids have higher boiling points than isomeric esters because they have the OH bond that ester's don't. This allows them to exhibit hydrogen bonding, which is a strong secondary interaction.

5. Ethanoic acid has a carboxyl group which means it has a C=O bond as well as the OH bond which propan-1-ol has. This means there are more sites for hydrogen bonding, which means forces between molecules is higher, hence higher m. pt. and b. pt.

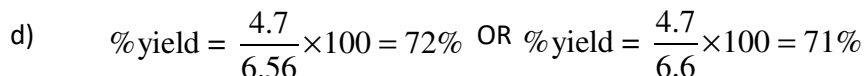
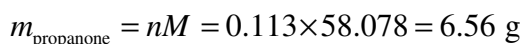
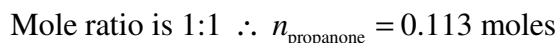
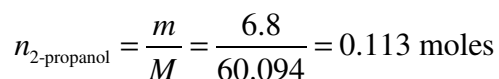
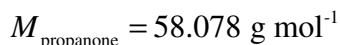
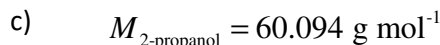
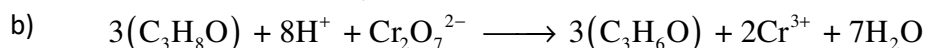
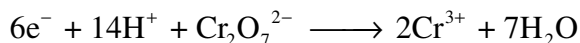
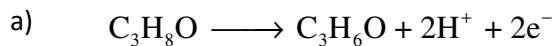
6. Add a *small* amount of acidified dichromate to each and heat. The liquid which stays orange (doesn't turn green due to the following reaction) is the 2-methyl 2-butanol.



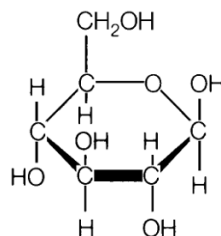
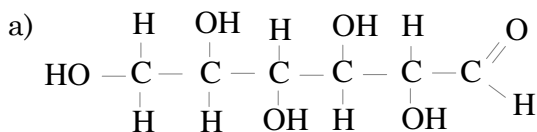
The mixture should be boiled while oxidising with acidified dichromate and the distillate collected with Tollen's reagent. The aldehyde from the primary alcohol will form a silver mirror.



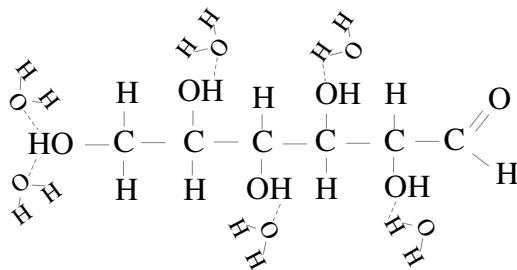
7.



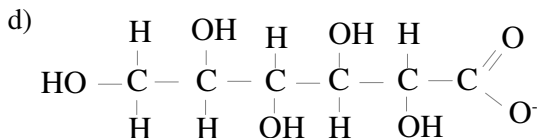
8.



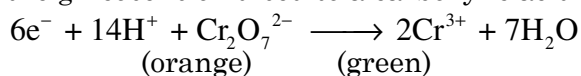
- b) In both forms, glucose has a high number of polar hydroxyl groups for its size. These polar groups form H-bonding with water, allowing it be surrounded by water molecules (hence soluble).



- c) An aldehyde group



- e) The *orange* dichromate ions would be reduced to *green* chromium ions as the aldehyde group on the glucose is oxidised to a carboxylic acid group.



9.

- Hexane
- Propanoate ion and silver metal
- Carbon dioxide and water
- Hexanal and then to hexanoic acid, also chromium ions

10.

Add sodium carbonate, which turns heptanoic acid into soluble heptanoate ions. Separate the aqueous and organic layers. *This collected organic layer is heptan-1-ol.* Add dilute hydrochloric acid to the heptanoate solution. Heptanoic acid will form. Separate the aqueous and organic layers. *This collected organic layer is heptanoic acid.*

11.

- $$\text{C}_7\text{H}_{14}\text{O}_2 + \text{NaOH} \xrightarrow{\text{reflux}} \text{C}_2\text{H}_5\text{OH} + \text{C}_5\text{H}_9\text{O}_2\text{Na}$$

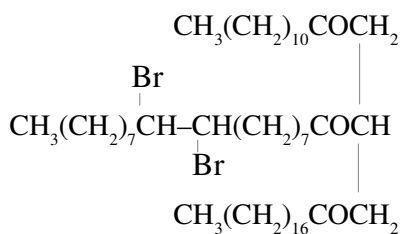
(ethyl pentanoate + sodium hydroxide → ethanol + sodium pentanoate)
- $$\text{CH}_3\text{COOH} + \text{CH}_3\text{CH}_2\text{CH}_2\text{OH} \xrightarrow{\text{reflux with H}^+\text{catalyst}} \text{C}_3\text{H}_{10}\text{O}_2 + \text{H}_2\text{O}$$

(ethanoic acid + propan-1-ol → propyl ethanoate + water)
- $$\text{C}_7\text{H}_{17}\text{N} + \text{HCl} \rightarrow \text{C}_7\text{H}_{18}\text{N}^+ + \text{Cl}^-$$

(*N*-methylhexan-2-amine and dilute hydrochloric acid → *N*-methylhexan-2-ammonium ion and chloride ion)

12.

- $$\begin{array}{c} \text{CH}_3(\text{CH}_2)_{10}\text{COOCH}_2 \\ | \\ \text{CH}_3(\text{CH}_2)_7\text{CH}=\text{CH}(\text{CH}_2)_7\text{COOCH} \\ | \\ \text{CH}_3(\text{CH}_2)_{16}\text{COOCH}_2 \end{array}$$
- 1,2,3-propantriol
- Animal (animal fats)
- Br_2 and I_2 are coloured and will react with $\text{C}=\text{C}$ groups (unsaturated groups) to produce a colourless product. The more bromine or iodine that can react, the more saturated the compound.
- (doesn't have to be trans)



- Increasing temperature increases energy of particles. Increasing the pressure increases the concentration of gas reactant (H_2). The catalyst provides an alternate reaction pathway with a lower activation energy. Each of these will increase the number of productive collisions per time, leading to a faster rate of reaction. Hydrogenation either occurs very slowly or not at all without them.

13.

- (must have an amine end and a carboxyl end, with something else connected to a C in the middle)
- (H^+ attached on amine end, OH changed to O^- on carboxyl end)
- (chain shouldn't have complete ends, should have open bond. CONH connects monomers)
- (CONH)
- Amide
- H_2O molecule(s) with dotted lines showing H bonding to $\text{C}=\text{O}$ or $\text{N}-\text{H}$
- Hydrogen bonding
- $$\begin{array}{c} \text{H}_2\text{N}-\text{CH}-\text{COOH} \\ | \\ \text{R} \end{array}$$

14.

- a) A protein's structure gives it specific sites within its structure where its function can be performed. If the spatial arrangement of the protein is altered, the sites will be modified or destroyed and hence the protein can no longer perform its function.
- b) Too much or too little H^+ will convert ionic side groups into covalent forms. The ionic bonds between side groups will be prevented and hence the structure changed.
- c) Raising the temperature causes sufficient molecular movement to weaken and break the bonding. The bonds cannot reform and so the structure is changed.