

## Macromolecules (Polymer)

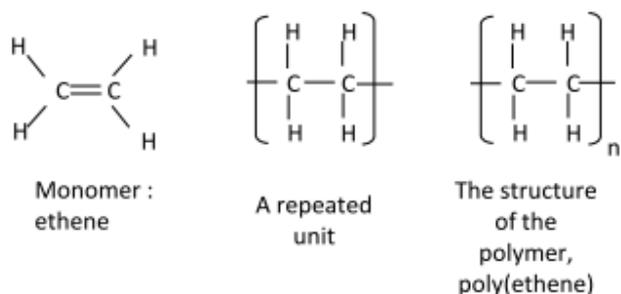
- Large molecules formed by joining many monomers by covalent bonds

### Addition Polymerisation

Monomer User: Alkene

Name of polymer: Poly(alkene)

e.g. Polyethene -> formed from ethene monomers



- Double bond broken
- Percentage composition/empirical formula of the polymer remains the same as monomer
- Molecular formula, mp/bp of polymer is higher than monomer.
  - o Mp/bp increases as Mr increases and stronger intermolecular forces of attraction between molecules

Advantages of Plastic: Light, non-fragile, cheap, durable

Disadvantages of plastic: Non-biodegradable, take up landfill site for disposal, give out poisonous HCl gas when burned

### How to draw Addition Polymer

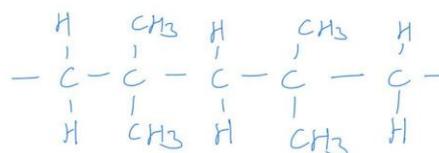
1. Put the C=C in the same line, all other bonds are put on top or below the C=C.
2. Break the double bond in C=C to form a C-C single bond
3. Draw a bond before the left carbon, and a bond after the right carbon. (This is your repeating unit)
4. To draw the polymer, take 1 repeating unit and draw a bracket across the left and right bonds drawn in step 3. Write a 'n' at the bottom right

## Example Questions:

Draw the polymer formed from the propene monomer

Draw the repeating unit when but-1-ene undergoes addition polymerization

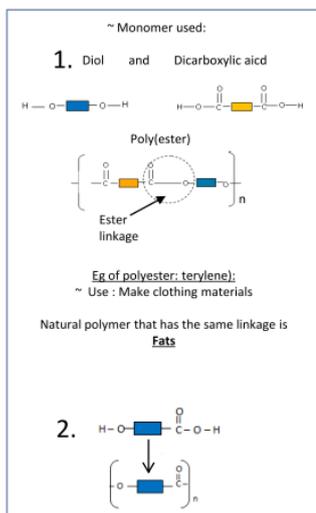
Draw the monomer used for the formation of the following polymer:



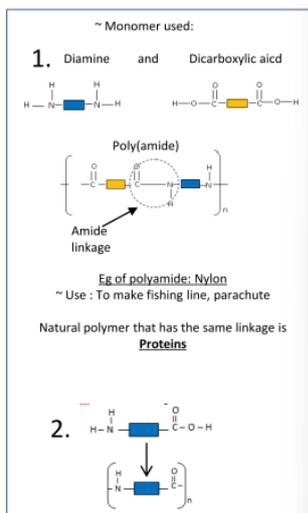
## Condensation Polymerisation

- Condensation: Combination of small molecules with removal of smaller molecule as by-product

### Polyester

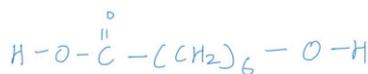


### Polyamide

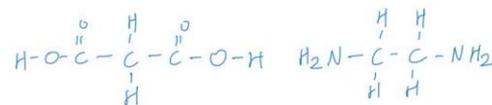


## Example Questions:

Draw the polymer formed from the following monomer



Draw 2 repeating units of the polymer formed from the following monomers



## How to draw Condensation Polymer

- Note which functional group reacts with which functional group in the monomer(s). For an ester, an alcohol functional group must react with a carboxylic acid functional group. For an amide, an amine functional group must react with a carboxylic acid functional group.
- Note the monomer, does it have both the necessary functional groups (jump to step 3), or does it have 2 of the same functional groups (jump to step 4).
- Position the alcohol group/amine group to the side, and the carboxylic acid group to the other side. Remove O-H from carboxylic acid functional group and draw a bond to replace. Remove H from the alcohol/amine functional group and draw a bond to replace. That's your repeating unit. Skip Step 4.
- Position the alcohol group/amine groups in 1 monomer to the sides. Position the carboxylic acid groups in the other monomer to the sides. Place the monomers side by side. Remove O-H from all carboxylic acid functional group. Remove H from all the alcohol/amine functional groups. Draw a bond to form the ester/amide group. Draw a bond to left and right of the molecule. That's your repeating unit.
- To draw the polymer, take 1 repeating unit and draw a bracket across the left and right bonds drawn in step 3/4. Write a 'n' at the bottom right

Draw the monomer(s) used for the formation of the following polymer

