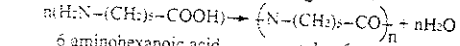
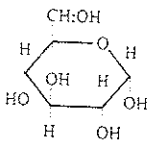
9 Biomass

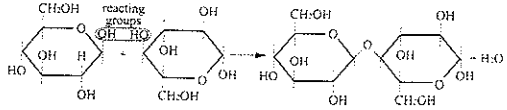
1. B
2. C
3. (a) Large molecule formed when large numbers of a smaller molecule join and also release a small molecule.
   (b) rayon, nylon, polyester, dacron
   (c) Monomers join to form a polymer and also another small molecule, e.g. water.



4. (a) (i) $C_6H_{12}O_6$
   (ii)



   (b) any sugars, e.g. glucose, sucrose, fructose, lactose; also starch; cellulose; glycogen
   (c) carbon, hydrogen, oxygen
   (d) cellulose
5. (a) organic matter produced by plants or animals
   (b)



   (c) Polymer made from plants and thus renewable. Monomer units could be used to make other polymers. Potential source of ethene.
   (d) Made of repeating units of glucose linked together. During formation a small molecule such as water is also produced.
6. (a) glucose
   (b) starch
   (c) cellulose
   (d) Side chains of starch make it soft and powdery; parallel chains in cellulose, which would be held together by hydrogen bonds, make it strong.
   (e) water
7. (a) Petroleum is non-renewable. Supplies are running out and they cannot be replaced.
   (b) Sources of biomass — waste plant matter from agriculture such as sugar and corn crops, waste from forestry such as sawdust and woodchip, and sewage.
   Advantage of using biomass — renewable.
   (c) Cellulose can be modified to make new polymers; broken down to produce a source of carbon compounds such as ethene which can be used to build polymers; and/or converted to products such as glucose that can be readily metabolised as a food source.
8. (a) Avoid contact with the skin or eyes. Wash any traces from skin immediately.
   (b) Neither test is specific for cellulose.
   Schultze's will give a positive result is there is any starch in the sample being tested; the second method will give a positive test if any glucose is present in the sample.
   (c) Yes, the cellulose of the strip would also be broken down by the cellulase enzyme and thus from the results it would appear that cellulose was present in the sample.
9. Both are chains of small monomer units joined together. However, addition polymers are made by breaking a double bond to join the monomers, whereas condensation polymers are formed when the monomers join with the release of a small molecule such as water.
10. (a) biomass
    (b) cellulose
    (c) condensation polymer
    (d) cellulose, nylon, dacron, starch, polyester, protein
    (e) During its formation from monomers, a small molecule such as water is released.

10 Biopolymers

1. A
2. Discuss — you must identify issues and provide points for and/or against.
   Include the following points in your answer:
   - the reliance on the petrochemical industry for chemicals such as ethene
   - ethene is presently obtained from fossil fuels (using about 3% of supplies) which are non-renewable resources and are also used in large quantities as fuels
   - fossil fuels are running out
   - we could find other fuels and use our fossil fuels for the petrochemical industry to make supplies last longer, but we would still eventually run out
   - we need renewable sources for ethene and polymer production and also to use as alternative sources of fuel.
3. (a) Naturally occurring polymer made using renewable resources, usually plants or microorganisms.
   (b) cellulose, starch, gluten, proteins
   (c) (i) polylactides
   (ii) xanthum gum
   (d) (i) They occur naturally in living things, e.g. plants, so they can continually be replaced as they are used up.
   (ii) They break down naturally into small molecules.
4. (a) Food industry: xanthum gum — used in emulsifiers, thickeners, in salad dressings, sauces, soups,cake mixes.
   Medicine: Biopol® — used as sutures, staples and screws.
   (b) Medicine: development of artificial skin and organs for transplant, coatings for implanted medical devices to reduce rejections and a coating for slow-release drugs.
5. (a) Assess — you should give uses and make a judgement about their value based on the evidence you present. You could include:
   Medicine:
   Biopolymers are biocompatible — they can be used for sutures, screws and devices to be inserted into the body without the problem of allergic reactions and rejection.
   Biopolymers are biodegradable — sutures, staples and screws made of biopolymers provide structural support when needed and then dissolve away so they do not have to be removed surgically. They can also be used as a coating for slow release drugs.
   These uses make biopolymers extremely valuable in medicine and replacement organs may eventually be made from them.
   One disadvantage is high cost — it is cheaper to make them from petroleum. This will change as petroleum supplies become scarcer and the price of petroleum rises. The cost of manufacturing biopolymers will also decrease as they become mass-produced.
6. The development of biopolymers means that packaging will eventually be biodegradable. It will not only be made from renewable resources but will also break down, thus reducing the volume of waste needed to be disposed of.
7. 1. glucose 2. ethanol 3. polymerisation.
   4. halogenation (addition of halogen)
   5. polymerisation
8. (a) (i) Process in which sugars are broken down by the action of enzymes present in yeast or bacteria.
   (ii) Large molecule made of repeating units of monomers.
   (iii) Substance inserted into the veins.
   (iv) Substance produced other than the main product.
   (v) Material used to stitch a wound.
   (vi) Structure that holds bones together in a joint.
   (vii) Substance that breaks down in the body and its wastes are eliminated by the body.
   (b) polylactides
   (c) food preservative, flavour enhancer
   (d) time to decay
   (e) fermentation of milk whey and from by-products of cheese industry and starchy food wastes
   (f) To be modified to replace polyethylene or polypropylene. Advantages include reducing the reliance on and use of fossil fuels and allowing the making of polymers that are biodegradable and so less polluting.
9. (a) biopolymers
   (b) lactic acid
   (c) xanthum gum
   (d) thickeners, emulsifiers, stabilisers
   (e) slow-release drug holder, biodegradable sutures and dressings
   (f) cellophane
   (g) artificial skin for burns patients
   (h) biopolymers
   (i) biodegradable; biocompatible; made from renewable materials, not from fossil fuels