

Understandings:

1. Distinguish between monosaccharides, disaccharides and polysaccharides. State that they are formed by condensation.

- Monosaccharide means single sugar units.

Disaccharide means two combined monosaccharides.

Oligosaccharide means from 2-10 molecules.

Polysaccharide means more than ten monosaccharides combined.

Here is the list of the most common sugar, not the only ones.

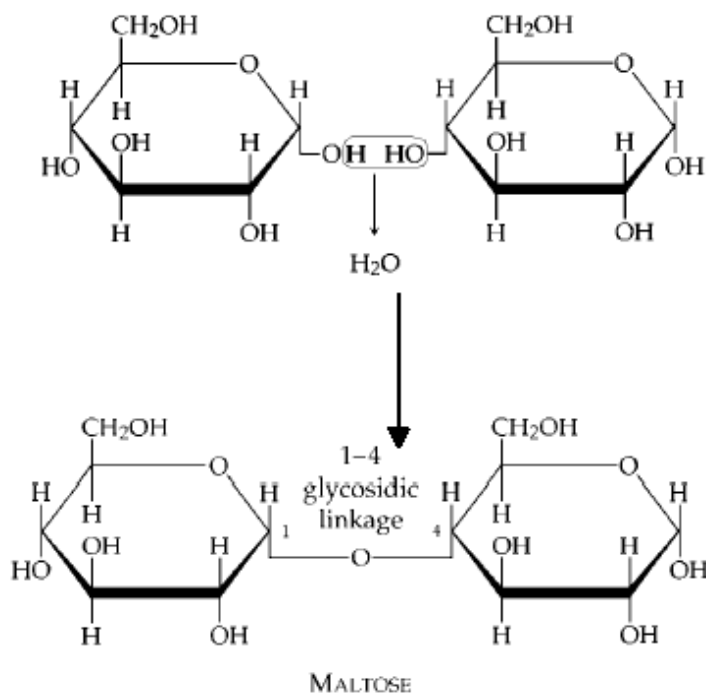
Fructose	Glucose	Galactose
Sucrose	Maltose	Lactose

Examples of polysaccharides will be explained later.

The combination of monosaccharides always gives out water. This type of reaction is called condensation.

The bond created is called glycosidic linkage.

Since this is an anabolic process, this reaction requires ATP.

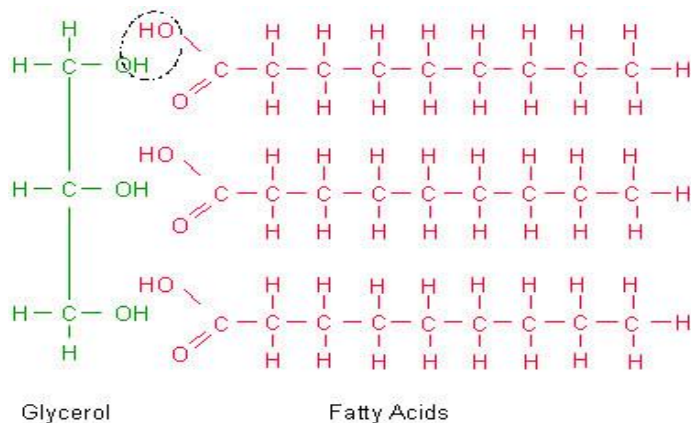


2. Explain how triglycerides are formed.

- As mentioned in the previous sections, lipid is a wide classification of all the substances that are insoluble in water. Triglyceride is one of them.

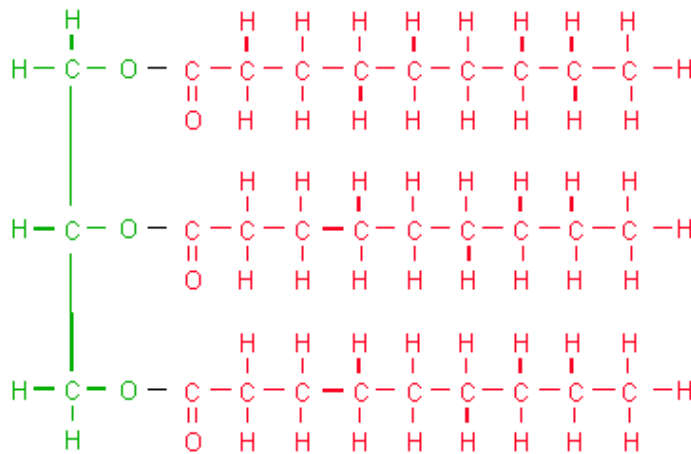
It is composed of three fatty acid chains and one glycerol. Again, the reaction is condensation.

This is before the reaction.



This is after. We can see that three water molecules are produced.

The C-O-C bond is called an ester bond (organic chemists would know).



Lipids have three main functions.

1. Store long term energy.
2. Insulate heat.
3. Buoyancy, keeps us floating on water! (It can also be for cushion/protection)

Extra notes

Fats are liquid at body temperature, 37, but solid in room temperature, 20.

Oils are liquid in both temperatures.

3. State that fatty acids may be saturated, monounsaturated or polyunsaturated and explain how.

- All fatty acids do not have only single bonds. Some have double bonds. We call the ones with single bonds saturated, and the ones with double bonds unsaturated.

So, if there is only one double bond in one fatty acid chain, it is monounsaturated. If more double bonds exist, it is polyunsaturated.

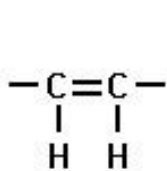
4. State that unsaturated fatty acids can be Cis or Trans isomers, and explain the difference.

- To further classify unsaturated fatty acids, we have Cis and Trans isomers.

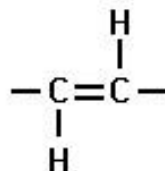
Difference is the location of hydrogen in the double bonds.

Cis has hydrogen on the same side while Trans has on opposite sides. This affects the structure and the function of the fatty acid. The structure is simply due to the electron repulsion theory.

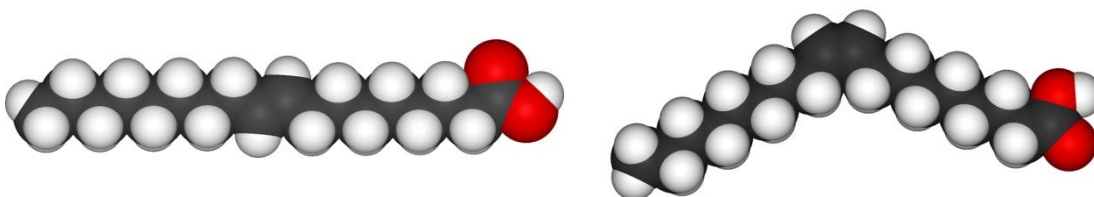
Cis will have a bent shape. This will form irregular formations, thus lower the melting point. So cis fatty acids are usually liquid at room temperature.



'Cis' Orientation



'Trans' Orientation



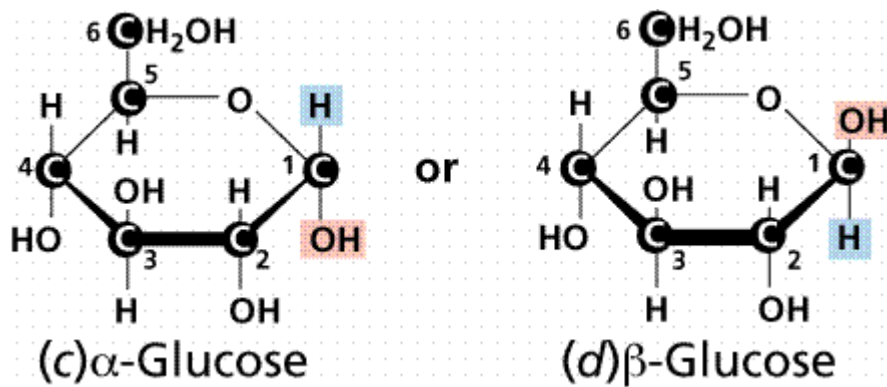
Trans on the other hand will twist, but remain straight, thus have a higher melting point than cis.

Applications and skills:

1. Explain the structure and function of cellulose and starch in plants, and glycogen in humans.

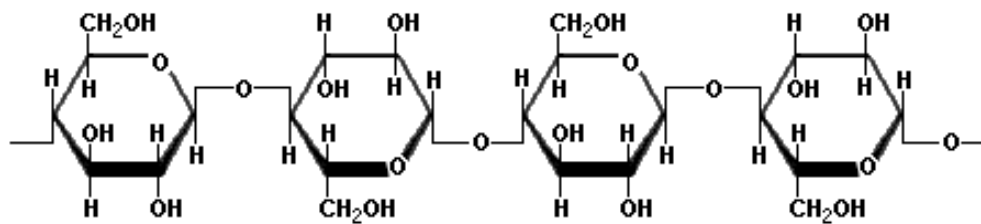
- Cellulose, starch and glycogen are all polymers of glucose. However, they differ in both function and structure because it has different type glucose and linkage.

Here are two types of D-glucose.



Cellulose is made of Beta glucose. The condensation happens between C1 and C4. So, the result will be that cellulose will be a long, straight chain.

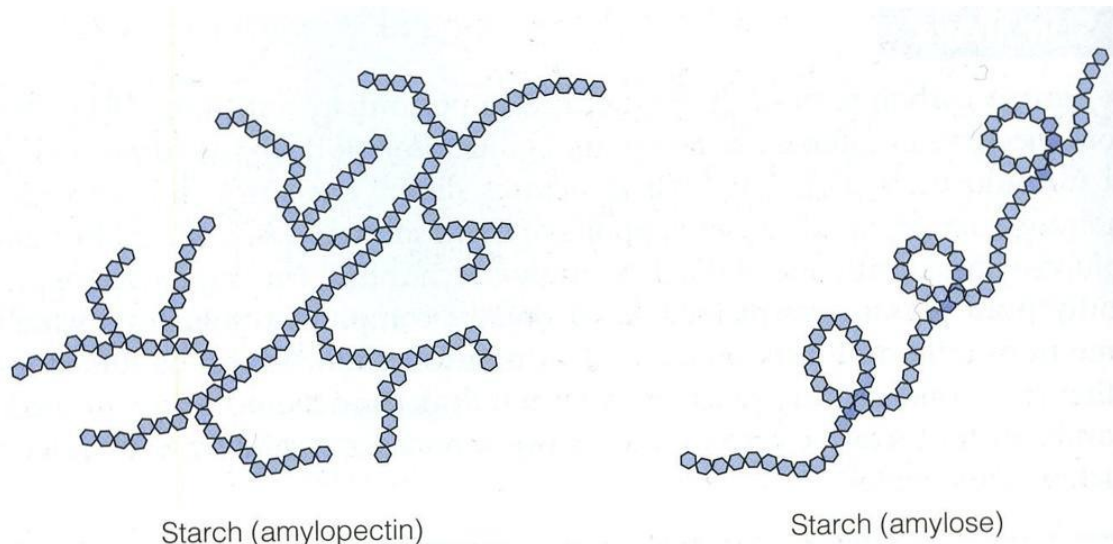
These structure can align parallel with each other through hydrogen bonds and for a strong structure. In fact, cellulose makes up the cell wall!



Starch is made of Alpha glucose. Again the condensation reaction happens between C1 and C4. However, the structure is not straight. We divide its structure into amylose and amylopectin.

Starch is only made by plants, and its function serves as storage of a large amount of glucose.

Amylose is helix shaped and amylopectin is branched.



A starch molecule contains hundreds of glucose molecules in either occasionally branched chains (amylopectin) or unbranched chains (amylose).

Glycogen is like amylopectin, but with more branches to make it compact. In humans, we store glycogen in the liver and thus can store and supply body with glucose very easily.

Also, know that the size of these three polysaccharides is not fixed.

2. Outline the scientific evidence for health risks of trans fats and saturated fatty acids.

- The biggest health risk is coronary heart disease (CHD). This disease is when the coronary arteries are blocked by fatty deposits, but which type of fats?

Scientists have researched two types of fats:

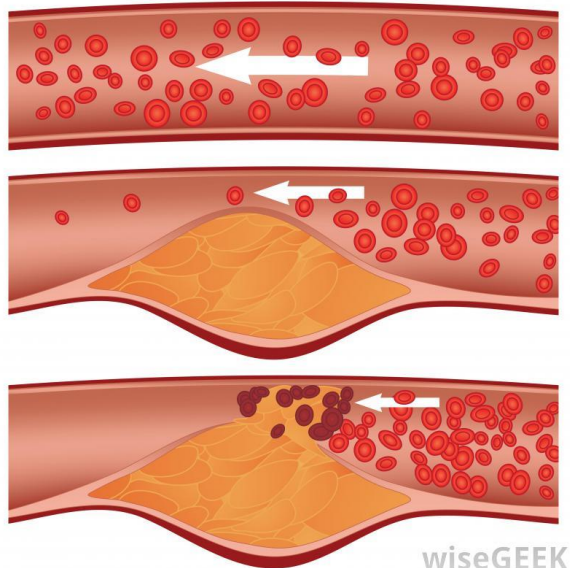
1. Saturated fatty acid

2. Trans-fat

There is a correlation between saturated fatty acid, but correlation does not mean causation. It can be other things such as the reduction of other nutrient intake. In addition, a population in Kenya, Maasai, are very exposed to saturated diets but CHD is extremely rare. Thus this suggests that saturated fats do not cause CHD.

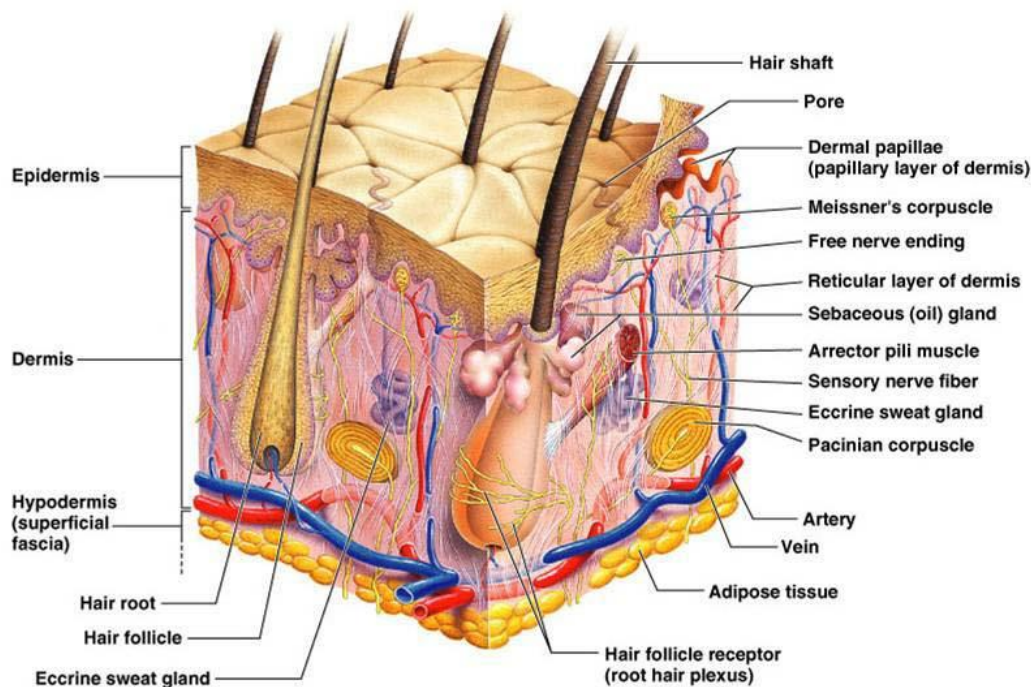
There is a correlation between trans-fats and CHD rate as well. Patients who died in CHD had high concentrations of trans-fats. To be extra sure, scientists have also tried to find positive correlation between other factors, but did not succeed. Thus so far, trans-fat is most likely to be the cause for CHD.

This is how it may look when blood vessels are blocked by fatty plaques.



3. State that lipids are for long-term energy storage than carbohydrates, in humans.

- The lipids that are used for long-term energy is fats. Where are they stored? They are stored in adipose tissue located right below the skin and around kidneys as well.



So why do we use lipids more than carbs for long-term energy?

1. The energy released per gram, J/g is greater for lipids than carbs. In fact, it is twice as much in lipids. Then we can store more energy for same body mass!
2. Lipids can act as insulators (since they are poor conductors), reducing the rate of release of energy. It may also act as cushion to reduce shocks, hence the reason why organs have some adipose tissue around.

Glycogen is not used for long-term because they can be broken down into glucose molecules much faster and be easily transported via the blood, while fats in the adipose tissue take time to break down and bind to lipoprotein and then be transported.

Thus glycogen is for both aerobic and anaerobic, while lipids are for aerobic only.

4. Discuss how evaluations about health claims of lipids are made.

- Evaluation means estimating/assessing implications and limitations.

Implication: What do the results imply? Does it support the claim strongly, moderately or not at all?

Limitations: Was the method rigorous? Is there anything that could be done to make it better?

With these in mind, question frankly all scientific papers that claim something.

5. Be able to use Jmol. Compare the structure of cellulose, starch and glycogen.

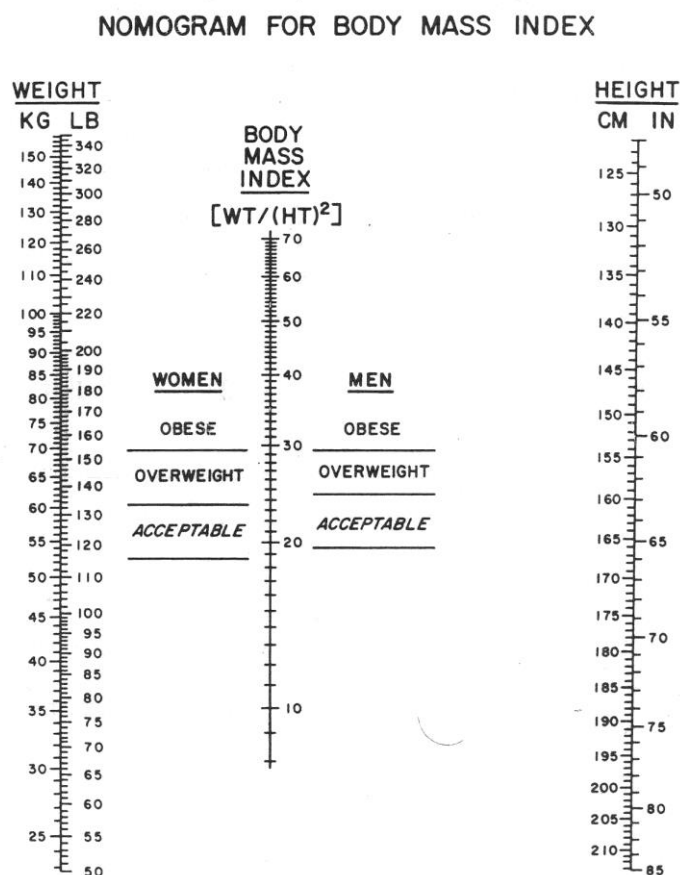
- Okay.

6. Determine body mass index, and be able to use a nomogram.

- Body mass index is calculating the relationship between height and mass. Nomograms show the relationship graphically.

Mathematically, BMI can be calculated by $\frac{\text{mass (kg)}}{(\text{height(m)})^2}$.

Another way is to just draw a line of corresponding weight and height and see where it intersects in the body mass index in the nomogram.



TOK:

1. There are conflicting views as to the harms and benefits of fats in diets. How do we decide between competing views?