



# FOOD

## Why do we need food?

1. As a source of **energy** - keeps our cells and us alive.
2. To make chemicals for our **metabolic** reactions.
3. As raw materials for **growth and repair** of our cells and body.





## What's in our food?

**6** common elements found in food are, **CHONPS**

Carbon (C), Hydrogen (H), Oxygen (O), Nitrogen (N),  
Phosphorous (P), Sulphur (S).

**5** elements are found as **salts**, Sodium (Na), Magnesium (Mg),  
Chlorine (Cl), Potassium (K), and Calcium (Ca).

**3** trace elements, Iron (Fe), Copper (Cu) and Zinc (Zn).

↓

### Red Blood Cells



↓

### Nervous System



↓

### Immune System





**Biomolecules - are chemicals made inside a living thing.**

The 4 major biomolecules found in food are,

**Carbohydrates, Lipids (fats and oils), Proteins and Vitamins.**

## 1. Carbohydrates

Carbohydrates are made up of Carbon, Hydrogen and Oxygen.

(C,H,O). They are in the ratio **1:2:1**.

The ratio is often written as  $C_x(H_2O)_y$ . (where  $x=y$ )

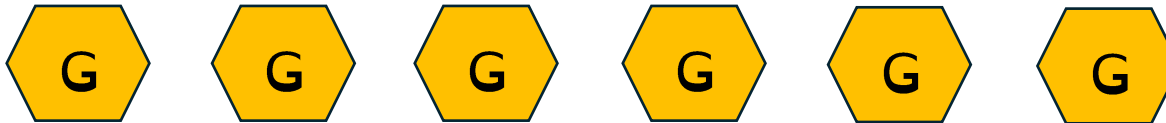
**Glucose** has the formula  **$C_6H_{12}O_6$** .



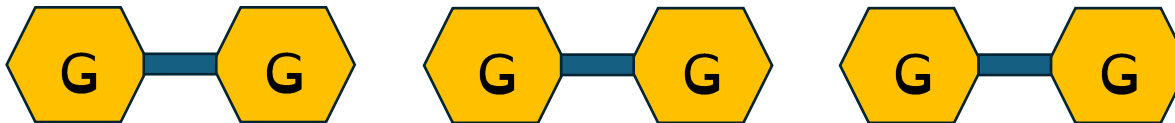


## There are 3 types of Carbohydrates:

**Monosaccharides** - Single sugars that are sweet, e.g. Glucose, Fructose



**Disaccharides** - Double sugars that are also sweet, e.g. Maltose.



**Polysaccharides** - These are chains of many sugars that are not sweet to taste. e.g. Starch.





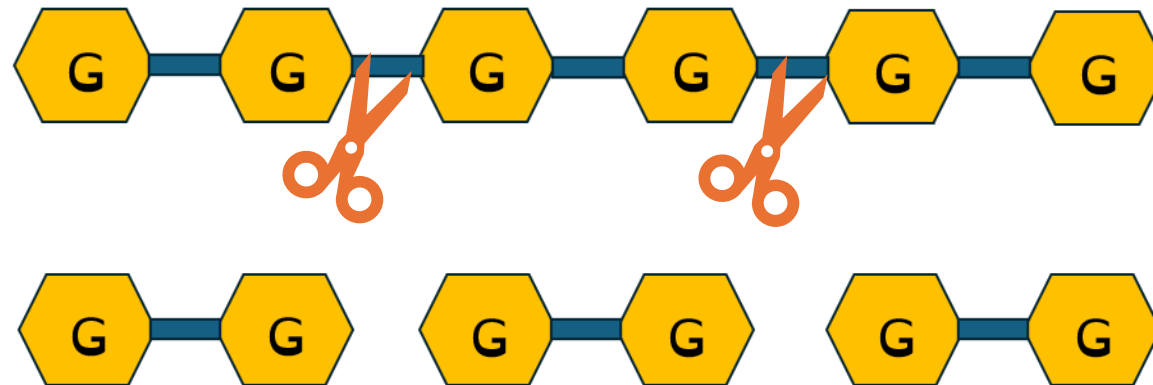
## Polysaccharides

There are 3 polysaccharides that we need to know.

1. **Starch** - made of long **chains** of glucose.

It is stored by plants as a **storage polysaccharide** e.g. potatoes.

**Starch is broken down by the enzyme Amylase into Maltose.**



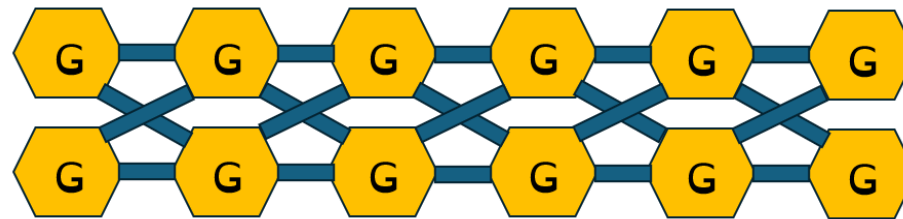
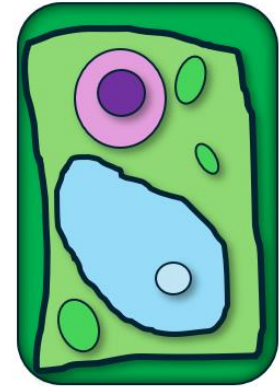
**Maltose**



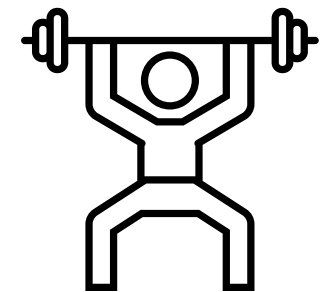


(ii) **Cellulose**- made of long chains of glucose that are **cross-chained**.

Cellulose is harder to break apart and harder to digest. It is a **structural polysaccharide** and used in **plant cell walls**. It is also used in humans as roughage or **fibre** in our diet.



(iii) **Glycogen** – is also made of long chains of glucose (like starch). It is used as a **storage polysaccharide** in animals. It is broken down to release glucose for energy in **muscles**, liver and brain.





## Questions on Food

**Q.1 Give 2 reasons why we need food?**

**Q.2 What Elements do you find in Carbohydrates?**

**Q.3 What is the ratio of these elements?**

**Q.4 Name 3 types of Polysaccharides?**





## Summary

1. We need food for:

**Energy, Metabolic reactions, Growth and repair**

2. The elements in food can be remembered with **CHONPS**

3. **Three** trace elements are Iron (Fe), Copper (Cu) & Zinc (Zn).

4. Carbohydrates can be:

**Monosaccharides** (glucose), **Disaccharides** (maltose) or  
**Polysaccharides** (starch).

5. There are **3** main Polysaccharides.

- **Starch** – storage in plants
- **Cellulose** – structural in plants, fibre in animals
- **Glycogen** – storage in animals

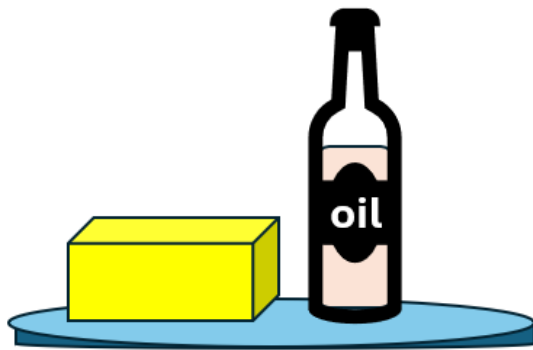






## 2. Lipids (Fats and Oils)

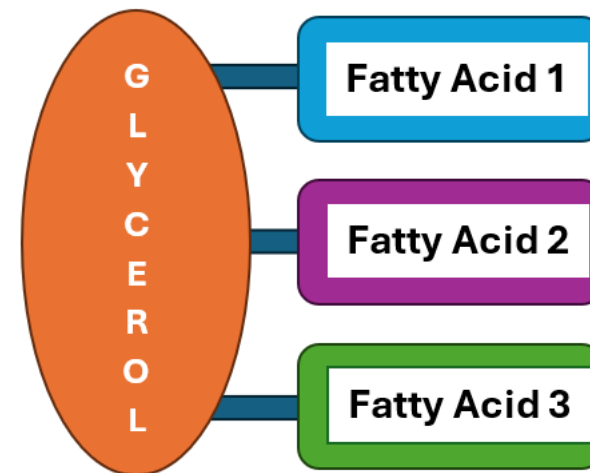
Lipids are made up of Carbon, Hydrogen and Oxygen. (**CHO**). They have **no ratio**, and they have very little Oxygen.



Fats are lipids that are **solid** at room temperature (20°C)

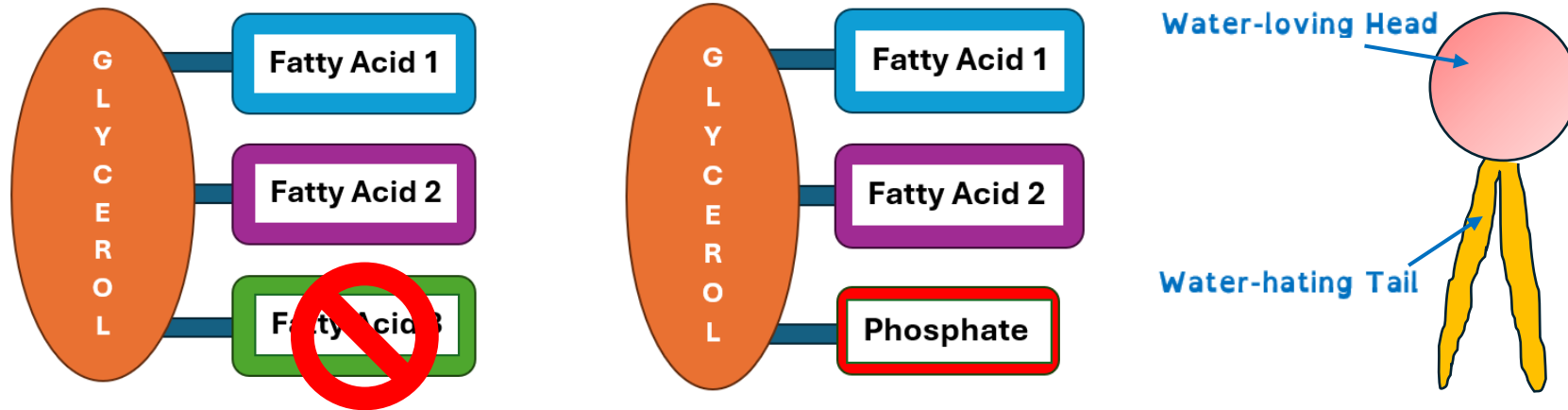
Oils are lipids that are **liquid** at room temperature.

**Triglycerides** – the structure of a lipid. They have 1 **Glycerol** unit with **3 fatty acids** attached.

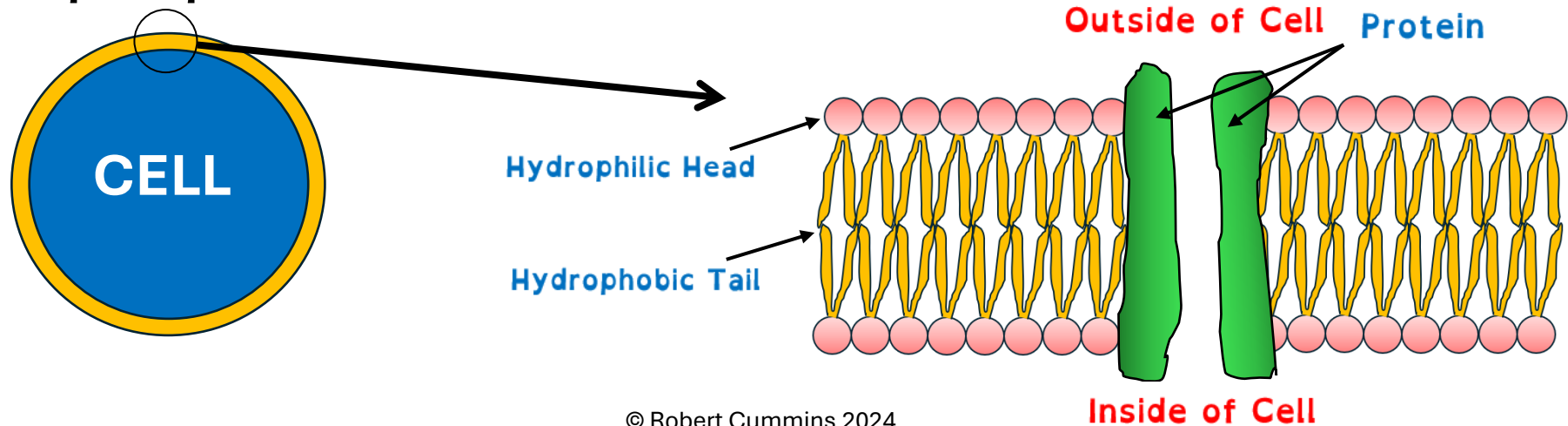




**Phospholipids**- have 1 fatty acid replaced with a **phosphate**.



**Lipid bilayer** in the cell membrane – is made up of 2 layers of Phospholipids.





## 3. Proteins

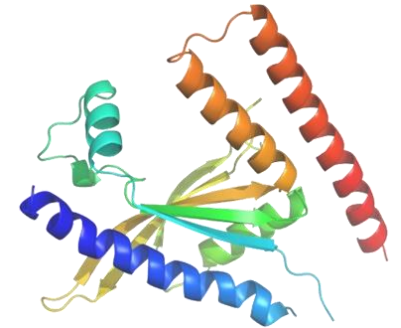
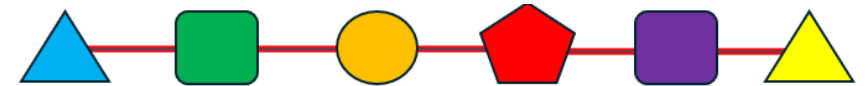
Proteins contain C, H, O and Nitrogen (N) (**CHON**)

There is **no ratio** for the atoms.

### Structure:

Proteins are made of **amino acids** (20 common types)

held together by peptide bonds.



A **peptide** is made of 20 or less amino acids.

A **polypeptide** has **more than 20** amino acids.

A **protein** is a long chain polypeptide with over **200** amino acids.

A **prion** is a protein that hasn't folded properly and causes disease. E.g. Mad Cow Disease.





**Fibrous Proteins-** are long threads with no folding  
e.g. keratin in hair, nails and feathers.



**Globular Proteins-**

have lots of folds that make round shapes.  
e.g. albumen in egg white and Enzymes.



**Source of Proteins:**

**Meat, fish, eggs, nuts, milk, peas and beans** are all rich in protein.

Amino acids are not stored in the body and must be broken down.

The **liver** pulls the amino acids apart by '**deamination**'. The amine part is converted to **urea**, which is then carried by the blood to the **kidneys** where it becomes **urine**. The urine is then excreted.





## Questions on this topic

**Q.1 What is the difference between Fats and Oils?**

**Q.2 Triglycerides are made of what 2 main components(parts)?**

**Q.3 Give an example of a fibrous protein and where would you find it?**





## Summary

- **Lipids** are made up of Carbon, Hydrogen and Oxygen. (**CHO**).
- They have **no ratio** and very little Oxygen.
- Fats are **solid** at room temperature and oils are **liquid**.
- **Triglycerides** have one Glycerol and three fatty acids.
- **Phospholipids** is where a Phosphate replaces a fatty acid.
- **Proteins** contain C, H, O and Nitrogen (N) (**CHON**)
- Proteins are composed of **amino acids** and **peptide bonds**.
- They are found as peptides, polypeptides and as proteins.
- Proteins can be **Fibrous** or **Globular**.
- Proteins are **deaminated** in the liver and converted to urea and then urine.





## Vitamins

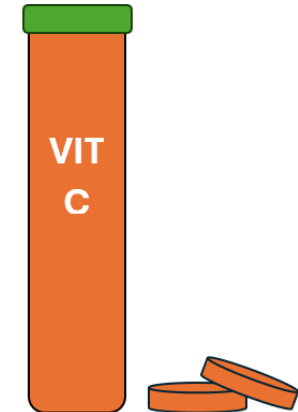
**Vitamins** are a complex substance that the **body cannot make**.

### Water soluble vitamins:

**Vitamin C (ascorbic acid)** is soluble in water.

Found in citrus fruits such as lemons and oranges.

Lack of vitamin C leads to **scurvy** (bleeding gums).



### Fat soluble vitamins:

**Vitamin D (calciferol)** is soluble in fat.

It's found in liver, fish oils, milk and egg yolk.

Vitamin D is made by UV rays on the skin.

Lack of vitamin D leads to **rickets** (weak bones).





## Minerals

Minerals are needed by plants and animals in **small amounts**.

1. Calcium - to form **cell walls** and animal **bones**.

2. Nitrogen/Sulphur - to form **muscle** tissue.

3. Sodium - to form cell and body **fluids** (tears, saliva, etc.)

4. Iron - forms **haemoglobin**, the pigment that carries Oxygen in red blood cells.

5. Magnesium - forms **chlorophyll**, the pigment that catches sunlight energy.







## Water

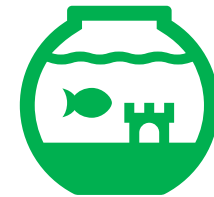
Makes up around **70% of humans** and 90% of plants.

1. It is the liquid in which all **metabolic reactions** take place.



2. It provides the basis for **transport** systems in organisms.

3. It's the environment in which many organisms **live**.



4. Water is found in cells, **cytoplasm**, blood plasma & tissue fluid

5. It absorbs heat and maintains body **temperature**.





## Questions on this topic

**Q.1 Name a water-soluble vitamin?**

**Q.2 Name one mineral needed by plants?**

**Q.3 Give 3 roles of water in the body.  
(Don't say 'to stay hydrated'!)**





## Summary

**Vitamins** - cannot be made in the body.

Vitamin **C** is water-soluble, and deficiency causes Scurvy.

Vitamin **D** is fat-soluble, and deficiency causes Rickets.



**Minerals** - are needed in small amounts.

Humans need Calcium for bones, Iron for red blood cells and Sodium for fluids. Plants need Magnesium to form chlorophyll.

**Water** - It is the liquid in which all **metabolic reactions** take place. It provides the basis for **transport** systems in organisms. Water is found in the **cytoplasm**, blood plasma and tissue fluid. It absorbs heat and maintains body **temperature**.





## Energy Transfer Reactions

**Anabolic** reactions convert **small molecules into larger ones.**

e.g. **Photosynthesis: Anabolic Adds.**



**Small + Small → Big**

**Catabolic** reactions convert **large molecules into smaller ones.**

e.g. **Respiration: Catabolic Cuts**



**Big → Small + Small**





## Roles of Biomolecules

### Structural Role:

Cellulose (Polysaccharide) is used in plant **cell walls**.

**Keratin** (protein) is used in hair, feathers and nails.

The lipids act as an **insulator** in animals and protect organs.

**Phospholipids** in cell membranes.

### Metabolic Role:

Lipids and carbohydrates are broken down to release **energy**.

Proteins are found as **enzymes** and control chemical reactions.

Some proteins are **antibodies** that fight infection and other proteins are **hormones**.





# Food Experiments

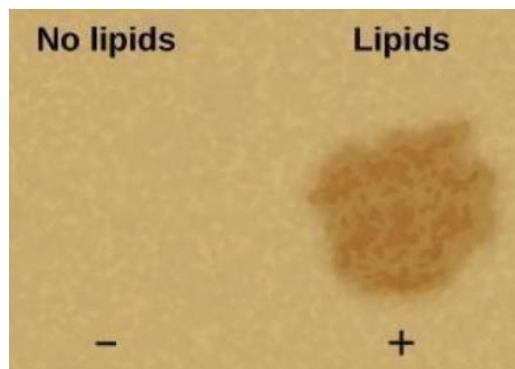
## 1. Test for a Reducing Sugar (e.g. Glucose) -

**Heat is required!**

Reagent: Benedict's Solution

Colour change: **Blue** to **Brick Red**.

Control: Water (no glucose) - no colour change.



## 2. Lipids (Fats/Oils) - No heat is required.

Brown paper and butter/oil

Colour change: from **Brown** to **translucent**.

Control: Water – spot quickly dries.





### 3. Protein - No heat required

Reagent: **Biuret Solution** (Copper sulphate + Sodium Hydroxide)

Colour change: **Blue** to **Purple** (lilac).

Control: **Water** (no protein) - no colour change.



### 4. Starch - No heat required

Reagent: **Iodine Solution**

Colour change: **Clear** to **Blue/Black**.

Control: **Water** (no starch) - no change.





## Questions on this topic

**Q.1 Which type of reactions turn cut large molecules into small ones?**

**Q.2 Give a metabolic role of protein?**

**Q.3 For which Food test is heat required?**

**Q.4 A purple colour indicates the presence of which biomolecule?**





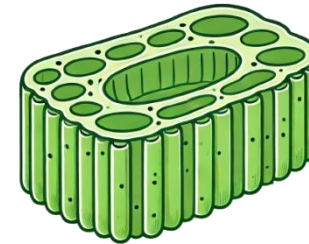


## Summary

**Anabolic** reactions: **small molecules into larger ones.** **Photosynthesis**

**Catabolic** reactions: **large molecules into smaller ones.** **Respiration**

Biomolecules have a **Structural Role:**



**Cellulose** in plant **cell walls**, **Keratin** is used in hair, lipids are for **insulation and protection**, & **phospholipids** form cell membranes.

Biomolecules have a **Metabolic Role:**

Lipids and carbohydrates release **energy**, Proteins are found as **enzymes, antibodies** and **hormones.**

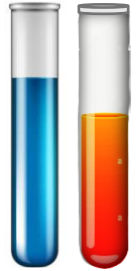




## Food Tests

1. Test for a Reducing Sugar (e.g. Glucose) - **Heat is required!**

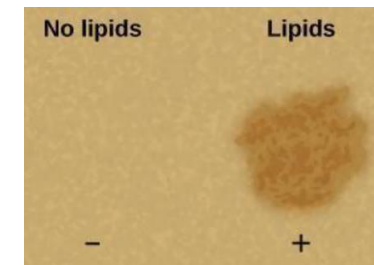
Reagent: Benedict's Solution. Colour change: **Blue** to **Brick Red**.



2. Lipids (Fats/Oils) - No heat is required.

Brown paper and butter/oil.

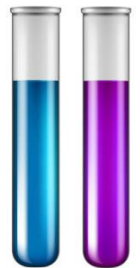
Colour change: from **Brown** to translucent.



3. Protein - No heat required

Reagent: Biuret Solution (Copper sulphate + Sodium Hydroxide)

Colour change: **Blue** to **Purple** (lilac).



4. Starch - No heat required

Reagent: Iodine Solution. Colour change: **Clear** to **Blue/Black**.

