

# Food Preparation and Nutrition



**Year 10**

**Knowledge Organisers - Part 1**

# MACRO NUTRIENTS

## PROTEINS:

### Functions in the body:

- ⇒ Body growth
- ⇒ Repair of the body when it is injured
- ⇒ Secondary source of energy.

## CLASSIFICATION OF PROTEIN

### HIGH BIOLOGICAL VALUE PROTEIN

- Contains all essential amino acids
- Essential amino acids are the amino acids the body needs but cannot make so must get them from food
- Normally come from animal foods

### LOW BIOLOGICAL VALUE PROTEIN

- Do not contain all essential amino acids
- Normally come from vegetable foods

15%

Energy from protein

So, protein foods are made up of **AMINO ACIDS**.

If the protein food contains all of the **ESSENTIAL AMINO ACIDS** needed by the body we say the food is **HIGH BIOLOGICAL VALUE (HBV)**.

If some of the essential amino acids are missing, we say the food is **LBV—low biological value**.

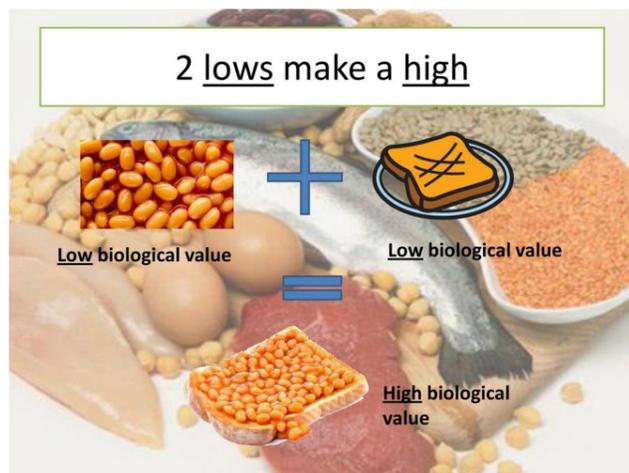
**Adults** require **8** essential amino acids (EAA's)

**Children** require **10** essential amino acids (EAA's)

**Plant foods** such as beans, peas, lentils etc are LBV.

**Animal foods** such as meat, fish, eggs, cheese etc are HBV.

SOYA BEANS are the only plant based HBV protein food and that is why soya is used to make meat alternatives.



Too much protein (excess) = weigh gain (as excess is stored as fat)

Not enough (deficiency) - Poor growth, poor nails and skin.

## CARBOHYDRATES:

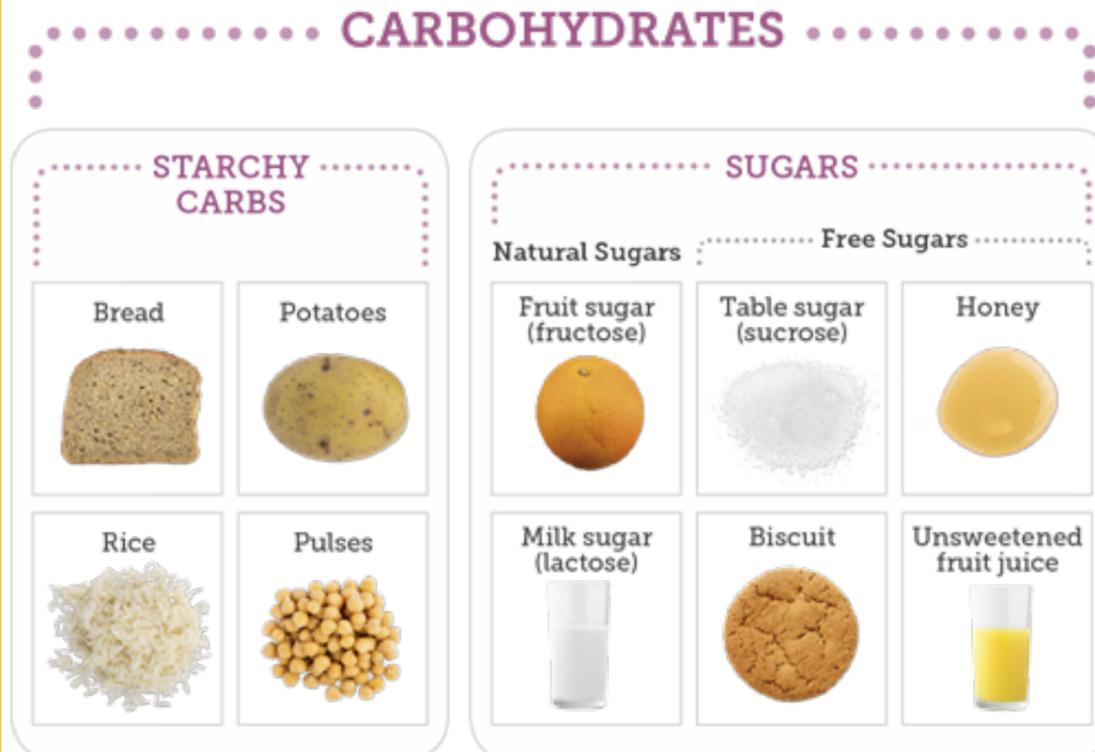
### Function in the body:

- ⇒ Main source of energy.
- ⇒ Contain fibre for digestion
- ⇒ Helps remove waste from the body.

50%

Of our energy should come from carbohydrates, but only 5% from free sugars.

There are 2 main groups of carbohydrates and these are **STARCHES** (complex carbohydrates) and **SUGARS** (simple carbohydrates):



**Free sugars** are the sugars that are added to foods (sucrose), and honey, syrup and fruit juices.

	Monosaccharide	Disaccharide	Polysaccharide
Subunits	One	Two	Many
Main Function	Energy Source	Transport Form	Storage Form
Examples	Glucose Galactose Fructose	Lactose Sucrose Maltose	Cellulose Glycogen Starch
Mnemonic	Gives Good Flavour	Length Supports Movement	Can Get Stored

## Key words:

**AMINO ACIDS** Are the **BUILDING BLOCKS** that join together to make protein molecules.

**ESSENTIAL AMINO ACIDS (EAA'S)** are amino acids that the body cannot make by itself and must get from the food we eat.

**BIOLOGICAL VALUE** The number of EAA's that a protein food contains.

**PROTEIN COMPLIMENTATION** Eating different LBV proteins together in order to get all of the EAA's needed by the body.

**PHOTOSYNTHESIS**—The process where green plants trap energy from the sun and form carbohydrates.

**Sugars** a group of carbohydrates that taste sweet.

**Monosaccharides**—a group of sugars made up of **1 sugar molecule** to include **GLUCOSE** (found in ripe fruit and veg), **GALACTOSE** (milk sugars), and **FRUCTOSE** (fruit sugars).

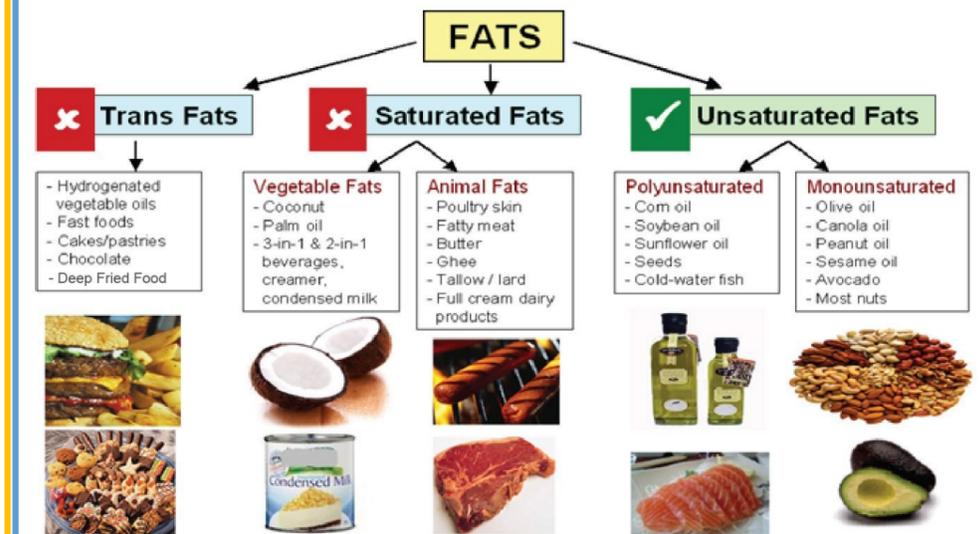
**Disaccharides**—a group of sugars that are made up of **2 sugar molecules** to include **SUCROSE** (white granulated sugar), **LACTOSE** (milk sugar) and **MALTOSE** (found in barley, malt and cereals).

**Polysaccharides**—a group of carbohydrates made from **many sugar molecules** joined together, but do not taste sweet.

## FATS:

### Function in the body:

- ⇒ Gives energy that is stored in the body (1g of fat gives 9 calories)
- ⇒ Fat also insulates the body from cold.
- ⇒ Fat foods provide vitamins A, D, E and K. <https://thumbs.dreamstime.com/b/golden->



percent-off-discount-sign-



35%

We should obtain 35% of our energy from fatty foods, but only 11% from saturated fats.

# Vitamins



Vitamin Name	Major Functions	Deficiency Effects	Toxicity Effects	Food Sources
<b>A</b> Retinol, retinal, Retinoic acid, (Beta carotene)	Vision, immunity, reproduction and growth	Blindness, infections, stunted growth	Bone fractures, liver damage, birth defects	Fortified milk, eggs, liver (dark green leafy and yellow/orange vegetables)
<b>D</b> Cholecalciferol	Bone growth and maintenance, absorption of calcium	Rickets, osteomalacia	Calcium imbalance	Sunlight, fortified milk, fatty fish, eggs, liver
<b>E</b> Tocopherol	Antioxidant, protects cell membranes	Red blood cell breakage, nerve damage	Interferes with blood-clotting drugs	Vegetable and seed/nut oils, seeds and nuts, wheat germ and whole grains
<b>K</b> Phylloquinone	Blood clotting, bone health	Hemorrhage	None reported	Dark leafy greens, cabbage family, liver
<b>B1</b> Thiamin	Energy metabolism	Beriberi, neurological problems	None reported	Whole and enriched grain products, leafy greens, pork
<b>B2</b> Riboflavin	Energy metabolism	Inflammation of the mouth, skin	None reported	Whole and enriched grain products, milk products
<b>B3</b> Niacin	Energy metabolism	Pellagra	Niacin flush, liver damage, impaired glucose tolerance	Whole and enriched grain products, protein-rich foods
<b>B5</b> Pantothenic acid	Protein, fat and carbohydrate metabolism	Extremely rare	Mild intestinal distress	Almost all foods, especially avocados, broccoli, meats
<b>B6</b> Pyridoxine, pyridoxal, pyridoxamine	Protein and fat metabolism	Scaly dermatitis, anemia, convulsions	Nerve degeneration	Protein-rich foods
<b>B7</b> Biotin	Protein, fat and carbohydrate metabolism; beneficial to hair, skin and nails	Extremely rare	Unlikely	Egg yolk, liver, peanuts; also produced by gut bacteria
<b>B9</b> Folate, folic acid, folacin	Helps make DNA for new cells, activates B12	Anemia, birth defects	Masks a B12 deficiency	Fortified grain products, vegetables, legumes
<b>B12</b> Cobalamin	Helps make DNA for new cells, activates folate, protects nerve cells	Anemia, irreversible nerve damage and paralysis	None reported	Meat, fish, poultry, eggs, milk products
<b>C</b> Ascorbic acid	Antioxidant, collagen synthesis, immune function	Scurvy	Diarrhea	Fruits and vegetables

## REVISION TIP:

When answering questions about VITAMINS, make sure you show your knowledge and understanding of how some of them work with other nutrients in the body. E.g:

**VITAMIN C** helps the body absorb the mineral **IRON**.

**VITAMIN D** helps the body absorb the mineral **CALCIUM**.

**VITAMINS B1, B2 AND B3** help the body release energy from **CARBOHYDRATES, FATS** and **PROTEINS**.

**VITAMIN B9** WORKS WITH **vitamin B12** to make healthy red blood cells.

## 6 WAYS TO COOK YOUR VEGGIES

GET HEALTHY 10

- ROASTING
- STEAMING
- GRILLING
- BOILING
- SAUTÉING
- BLANCHING

### HOW TO PREVENT LOSS OF VITAMINS TO VEGETABLES AND FRUIT:

#### STORAGE:

- \* Store away from heat and light as this will destroy vitamins
- \* Store in airtight containers in a cool place.
- \* Store for as little time as possible as vitamins are lost with age.

#### PREPARATION:

- \* Cut, grate, squeeze or chop just before cooking and serving
- \* Avoid buying damaged and bruised fruit and vegetables.

#### DURING COOKING:

- \* Use only a little water and cook for minimum time.
- \* Choose cooking methods that do not use water like stir frying, roasting, steaming, grilling.
- \* Save the cooking water to make soup or stock

## Simple ways to reduce vitamin loss

- Swap long for short cooking times – less heat
- Add any 'vegetable water' to soups, gravies or casseroles
- Swap peeling for scrubbing – more fibre and vitamins
- Brightly coloured fresh produce will have more vitamins than produce that looks old
- Swap small pieces for large pieces – less exposure to the air
- Prepare fruit and vegetables as needed – less exposure to the air
- Swap boiling for steaming, roasting or grilling – less water
- Store ripe fruit and vegetables in the refrigerator – less exposure to light and heat

## KEY WORDS:

**FAT SOLUBLE** Vitamins that are found in foods containing fats.

**WATER SOLUBLE** Vitamins that are found in foods with a high content of water.

**RICKETS** caused by a vitamin D deficiency in children, which means that calcium can't be absorbed and put into bones.

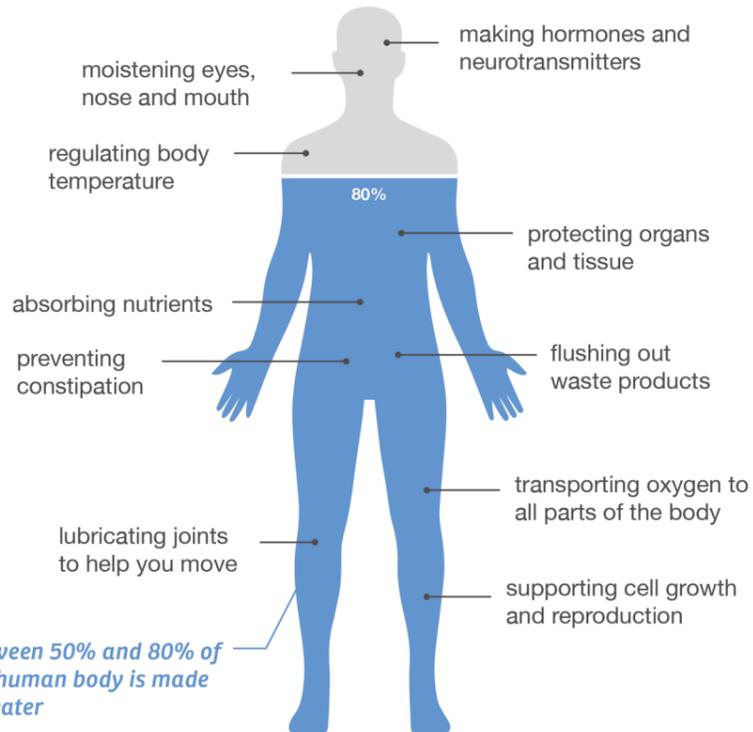
**OSTEOPOROSIS** After peak bone mass is reached, the bones naturally start to lose minerals and gradually weaken. The minerals are not replaced. The bones weaken and in elderly people can break easily.



MINERALS	FUNCTIONS / BENEFITS	FOOD SOURCES
Calcium	Builds bones, teeth, helps blood clot, assists nerves, muscles & heart to function	Milk, cheese, yogurt, buttermilk, tofu
Phosphorous	Builds teeth and bones, helps body get energy from foods	Milk, milk products, meat, fish, poultry, eggs, nuts, dried peas & beans
Iron	Forms part of red blood cells, helps body get energy from foods	Liver, organ meats, egg yolk, meat, poultry, oysters, whole-grain & enriched breads & cereals, dried peas & beans
Sodium	Controls water balance, regulates nerve impulses & muscle contractions	Salt, meat, fish, poultry, milk, and milk products
Potassium	Helps control water balance, regulates nerve impulses, muscle contractions & heart rhythm	Fruits, vegetables, meat, fish, poultry, milk and milk products
Iodine	Regulates energy	Seafood, iodized salt
Magnesium	Part of teeth & bones, helps body use carbohydrates, helps to regulate nerve & muscle contractions	Whole-grain cereal, nuts, dried peas & beans, milk, meat, leafy greens
Copper	Builds body cells, aids digestion & absorption, lubricates joints & organs, regulates body temperature	All liquids- water, coffee, tea, soft drinks, fruit & vegetable juices, milk, ice

# Water and your health

Drinking plenty of water every day is important for good health. Your body relies on water for many functions, such as:



We get about one fifth of the water we need from food and the rest from drinking fluids.

Men need about 10 cups\* of fluids every day, women need about 8 cups and kids need 4-8 cups depending on their sex and age.

It's a good idea to choose water over other drinks that contain added sugars or alcohol.

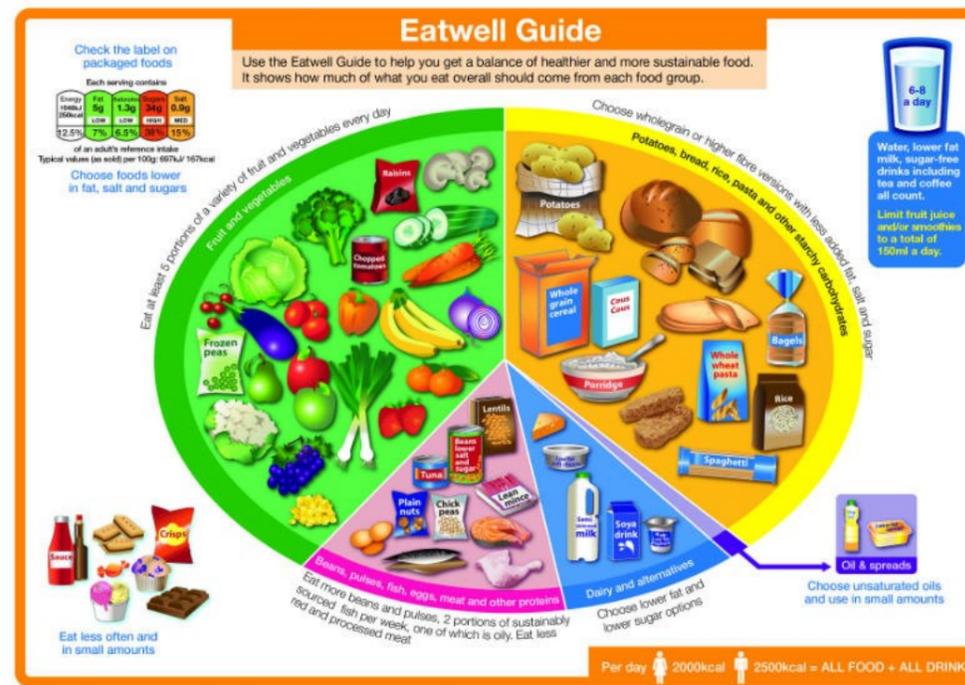
## KEY WORDS:

**HYDRATED** the body has enough water

**DEHYDRATED** The body does not have enough water. This will result in:

- Increased thirst
- A headache
- Dark urine
- Feeling weak and sick
- The body overheats
- You become confused
- Blood pressure and heartrate changes.

What happens when your body does not get enough water?



Source: Public Health England in association with the Welsh Government, Food Standards Scotland and the Food Standards Agency in Northern Ireland

## KEY WORDS:

**EATWELL GUIDE** This is the governments recommendations for a healthy balanced diet. Made up 5 main food groups. Applies to everyone over the age of 2.

**DIET**—means the food you eat every day.

**BALANCED DIET**—contains the correct amount of carbohydrates, fats, proteins, dairy and fats and oils that people need for good health.

**FACTORS TO CONSIDER WHEN MEAL PLANNING:**

**SEASONALITY**

**COST OF INGREDIENTS**

**LIFESTYLE**

**TIME AVAILABLE TO COOK**

**NUTRITION NEEDS**

**PORTION SIZES**

**OCCASION**

**RELIGION**

**HEALTH CONDITIONS**

**FOOD ALLERGIES**

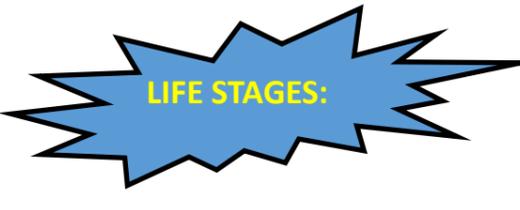
## eatwell 8 TIPS for HEALTHY EATING

- 1 Base your meals on starchy foods**  
They're the best fill-you-up foods and sources of energy. Choose wholegrain, wholemeal or "high fibre" varieties.
- 2 Eat lots of fruit and veg**  
Good for vitamins, minerals, fibre, antioxidants. Fresh, frozen, tinned, dried or 100% juice all count.
- 3 Eat more fish – including a portion of oily fish each week**  
They're an excellent source of protein and other nutrients. Oily fish are rich in omega-3 fatty acids – good for heart health.
- 4 Cut down on saturated fat and sugar**  
Eat in small amounts. They're high in calories but low in nutrients. Choose lower fat and lower sugar versions when you can.
- 5 Eat less salt – no more than 6g a day for adults**  
Throw away the salt cellar. Choose lower salt foods. Too much salt can raise your blood pressure.
- 6 Get active and try to be a healthy weight**  
If you eat more than your body needs, you'll put on weight. Get at least 30 minutes exercise on at least 5 days of the week.
- 7 Drink plenty of water**  
Drink six to eight glasses of water and other fluids a day. Drink more when it's hot and when you're active.
- 8 Don't skip breakfast**  
A good breakfast gives you energy, as well as vitamins and minerals. Wholegrain cereals or bread, with fruit, make a great start to the day.

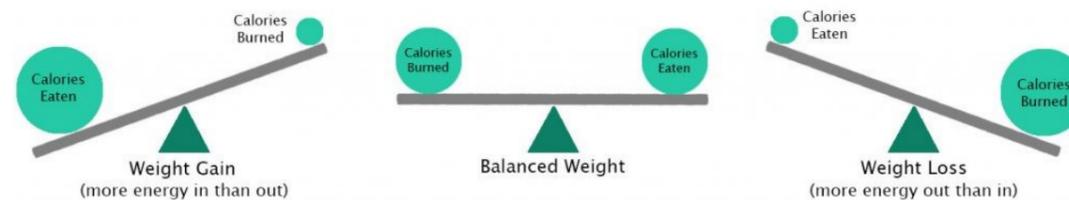
## 8 HEALTHY EATING TIPS

For good health, eat a balanced diet with a wide variety of foods. Be physically active and only eat as much as you need.

- 1 Base meals on starchy foods – bread, cereals, rice, potatoes, pasta...**  
They're the best fill-you-up foods and sources of energy. Choose wholegrain, wholemeal or "high fibre" varieties.
- 2 Eat lots of fruit and veg. At least 5 portions.**  
Good for vitamins, minerals, fibre, antioxidants. Fresh, frozen, tinned, dried or 100% juice all count.
- 3 Eat more fish – including a portion of oily fish each week.**  
They're an excellent source of protein and other nutrients. Oily fish are rich in omega-3 fatty acids – good for heart health.
- 4 Cut down on saturated fat and sugar. Eat only occasionally.**  
Eat in small amounts. They're high in calories but low in nutrients. Choose lower fat and lower sugar versions when you can.
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Throw away the salt cellar. Choose lower salt foods. Too much salt can raise your blood pressure.
- 6 Get active and try to be a healthy weight. Walking is good.**  
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	<b>The best eating habits and lifestyle choices for this group:</b>	<b>Further higher level information:</b>
<b>Pre-school children (1–4 years)</b> 	<ul style="list-style-type: none"> <li>Regular meals</li> <li>Small portions</li> <li>Fresh and raw foods as well as cooked.</li> <li>Drink water and whole milk</li> <li>Happy meal times</li> </ul>	<ul style="list-style-type: none"> <li>Body growth is rapid so high demand for <b>PROTEIN</b>.</li> <li>Energy needs are high</li> <li>Eatwell guide does not apply for 2 years and below.</li> <li>Limit free sugars to prevent tooth decay.</li> </ul>
<b>Children 5 – 12</b> 	<ul style="list-style-type: none"> <li>Regular meals, eat breakfast</li> <li>Follow the Eatwell guide</li> <li>Try new foods</li> <li>Drink plenty of water</li> <li>Go shopping and help prepare meals to learn about nutrition.</li> </ul>	<ul style="list-style-type: none"> <li>Energy needs are high—children should be physically active</li> <li>Protein for growth and vitamins and minerals (such as calcium and vitamin D for growth)</li> <li>Limit free sugars to 5% energy intake and limit salt to less than 5g per day.</li> <li>Discourage sugary drinks, ready meals and unhealthy snacking.</li> </ul>
<b>Teenagers (adolescents)</b> 	<ul style="list-style-type: none"> <li>Regular meals and drinks, always eat breakfast</li> <li>Follow the Eatwell guide</li> <li>Take regular exercise and spend time outside for sunlight vitamin D to support calcium absorption.</li> <li>Get plenty of sleep</li> <li>Get involved planning meals at home and shopping.</li> </ul>	<ul style="list-style-type: none"> <li><b>Calcium &amp; vitamin D</b> (complimentary nutrients).</li> <li><b>Iron and vitamin C</b> (complimentary nutrients)</li> <li>B-group vitamins—to help the body release energy from foods.</li> <li>Fibre—to maintain and healthy digestive system.</li> <li>Discourage bad eating habits and over consumption of energy dense foods.</li> </ul>
<b>Adults:</b> 	<ul style="list-style-type: none"> <li>Regular meals, always eat breakfast</li> <li>Take regular exercise and be out in the sun</li> <li>Get plenty of sleep and avoid stress</li> <li>Limit salt to 6g per day.</li> </ul>	<ul style="list-style-type: none"> <li>Metabolic rate slows down so more susceptible to weight gain</li> <li>Must maintain an <b>energy balance</b></li> <li><b>Calcium-vitamin D, Iron-vitamin C</b> very important.</li> </ul>
<b>Elderly:</b> 	<ul style="list-style-type: none"> <li>Eat regular well balanced meals—always eat breakfast</li> <li>Eat smaller portions as metabolic rate will have really decreased.</li> <li>Plenty of fresh fruit and vegetables and iron rich foods.</li> </ul>	<ul style="list-style-type: none"> <li><b>Complimentary nutrients</b> are vital. To avoid <b>anaemia</b> (in the case of vitamin C and iron) and <b>osteoporosis</b> (in the case of Vitamin D and calcium).</li> <li><b>Vitamins A, C and E</b> to prevent age related eye conditions.</li> <li><b>B-group vitamins</b> to help the body use energy and prevent memory loss.</li> </ul>

**Energy in the diet:**



**Why does the body need energy?**

- ⇒ Growth
- ⇒ Movement/activity
- ⇒ Body warmth
- ⇒ Brain function

**50%** of our energy should come from starchy **CARBOHYDRATES**

**35%** of our energy should come from **FATS** (of which only **11%** should come from **SAT FATS**)

**15%** of our energy should come from **PROTEINS**.

- Energy is measured in:
- ⇒ kilocalories (Kcal) or
  - ⇒ Kilojoules (Kj)
  - ⇒ 1 kcal = 4.2 kj
  - ⇒ 1g of pure carbohydrate = 3.75cals
  - ⇒ 1g of pure fat = 9cals
  - ⇒ 1g of pure protein =



**Male Resting Metabolic Rate**

The equation:  
 $66 + (13.7 \times \text{weight}) + (5 \times \text{height}) - (6.8 \times \text{age})$

For example:  
 A man aged 30 who is 80kg and 180 cm, the calculation is:  
 $66 + 1096 + 900 - 204 = 1858$  calories

**Female Resting Metabolic Rate**

The equation:  
 $655 + (9.6 \times \text{weight}) + (1.85 \times \text{height}) - (4.7 \times \text{age})$

For example:  
 A woman aged 30 who is 70kg and 168 cm, the calculation is:  
 $655 + 672 + 311 - 141 = 1497$  calories

**KEY WORDS:**

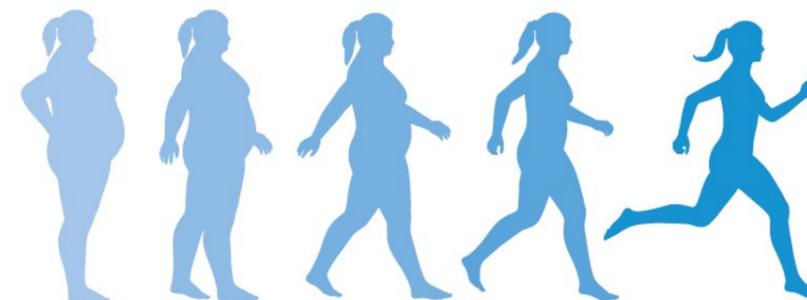
**ENERGY DENSE** A food that contains a lot of fat and/ or carbohydrate and has a high energy value.

**BMR** This stands for **BASAL METABOLIC RATE**. It is the amount of energy needed to keep us alive and the body working normally. **BMR varies according to age, sex, body size and PAL.**

**PAL** This stands for **PHYSICAL ACTIVITY LEVEL**. Physical activity reduces the risk of diet related diseases such as heart disease .

**ENERGY BALANCE** (see the image of the scales above)

- The amount of energy consumed in food must be used up by the BMR and PAL to be in **ENERGY BALANCE**.
- **Too much energy = WEIGHT GAIN**
- **Too little energy = WEIGHT LOSS.**



# OBESITY

## REASONS

no activity

endocrine diseases

hereditary predisposition

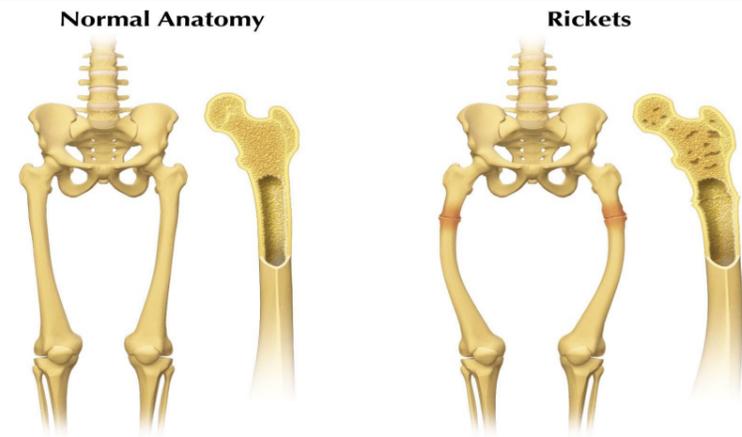
unhealthy food

netmeds.com  
India KI Pharmacy

You become obese if the body contains **too much stored fat**. It occurs over time when the body is not in **ENERGY BALANCE**. If you take in more energy from food than your body uses for BMR or PAL you will gradually become overweight.

Many processed foods and snack foods and fizzy drinks are **ENERGY DENSE** because they contain a **lot of hidden fat and sugar**.

The stored fat that builds up under the skin is called **ADIPOSE FAT** and the fat inside the body around the abdomen and intestines is called **VISCERAL FAT**.



**TOOTH DECAY**—Every time we eat or drink a sticky film called **plaque** builds up on the tooth enamel. Bacteria in the mouth feed off plaque and turn the sugars it contains into **ACIDS**. The acids stay on the teeth for about 45 minutes and gradually **ERODE** the tooth. If you are constantly snacking throughout the day this process will be ongoing.

### SKELETAL DISEASE (Rickets and osteoporosis)

The skeleton includes the bones and teeth.

**RICKETS**—is a bone disease that affects **CHILDREN**. It is caused by a **deficiency** of **VITAMIN D** in children. **REMEMBER**—without vitamin D the body cannot absorb calcium into the bones and teeth.

**OSTEOPOROSIS**—is a bone disease that affects **ELDERLY**. Osteoporosis literally means **porous bones**—Bones that become brittle and break very easily.



# CARDIOVASCULAR DISEASE

ATHEROSCLEROSIS

FAMILY HISTORY

RISK FACTORS

The **cardiovascular system** in the body is the **heart** and **blood vessels** (veins, arteries and capillaries).

The heart has its own blood supply that is brought to it by the **CORONARY ARTERIES**.

To work properly the coronary arteries need to be clear inside to allow the blood to flow, otherwise CVD happens.

**HIGH BLOOD PRESSURE** caused by a diet very high in salt can lead to CVD and CHD.

To prevent CVD a diet should be low in salt, low in energy dense foods, low in saturated fats and sugars and high in fibre. Exercise strengthens the heart muscles.

### How to Prevent Complications From Type 2 Diabetes

Ensure cholesterol levels are normal

Eat a balanced diet

Keep blood glucose within its recommended range

Maintain a healthy body weight

Take medication as prescribed

In order for all or body cells to produce energy during respiration, they need a continual supply of **GLUCOSE**.

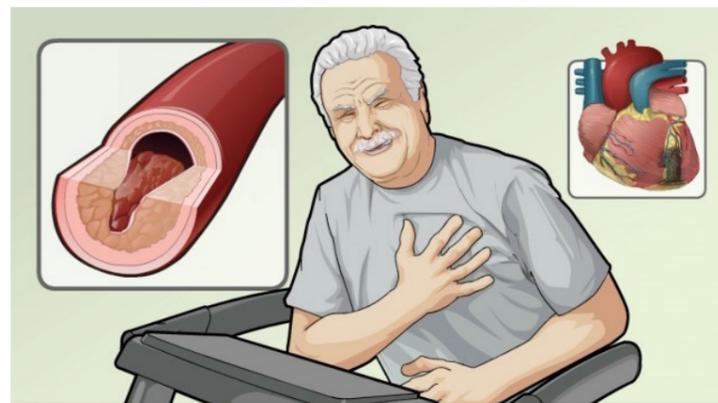
Glucose enters the bloodstream after it has been absorbed from the food we eat.

In order to get into the body cells, the glucose needs a hormone called **INSULIN** which is produced by the pancreas (just behind the stomach). Imagine that each body cell has a 'door' that needs to be 'unlocked' to allow the glucose in—the key that will unlock the door is insulin.

If there are no keys (ie no insulin) the doors cannot be unlocked and the glucose cannot enter the cells so it stays in the bloodstream (**this is TYPE 1 diabetes**).

If there are plenty of keys (i.e. enough insulin) but the **locks are damaged** again the glucose cannot enter the cells and stays in the bloodstream—this is **TYPE 2 diabetes** and can be prevented.

### CORONARY HEART DISEASE (CHD)



In CHD the coronary arteries become blocked by **fatty deposits** which prevent blood flowing properly.

These fatty deposits occur when a diet is too high in **saturated fat**. Saturated fat causes **cholesterol** to build up in the arteries **blocking the supply of blood to the heart**. This can result in a **heart attack**. The lining of the arteries also become less flexible, especially as people get older, which makes it harder for the heart to pump blood around them.

**ANTI-OXIDANT FOODS** (containing vitamins A, C and E) can help prevent CHD, as can **losing weight, cutting down on salt, taking regular exercise and stopping smoking**.

# ANEMIA

Red Blood Cells

White Blood Cells

Platelets

Normal

Anemia

### SYMPTOMS

Fatigue

Weakness

Pale or Yellowish Skin

Irregular Heartbeats

Shortness of Breath

Dizziness or Lightheadedness

Chest Pain

Cold Hands and Feet

Headache

**Anaemia** is a deficiency of iron in the blood. The body needs **iron** to make a substance called **haemoglobin** in **red blood cells**.

**Haemoglobin** picks up the **oxygen** we breathe in from the lungs and carries it to all body cells where it is used, with **glucose**, to produce **energy during respiration**.

**VITAMIN C** is needed to help the body **absorb iron** from food during digestion.

**A lack of vitamin C** means that the **body will lack iron** and the person will get **ANEMIA**. Symptoms are tiredness, pale skin, feeling cold and muscle weakness. To prevent it eat plenty of iron rich, and vitamin C rich foods.



To make the food safe to eat and kill the bacteria in **HIGH RISK FOODS**.

To develop and intensify the flavours in food.

To improve the texture and appearance of food.

To improve the shelf life of food.

To give people variety in their diet.

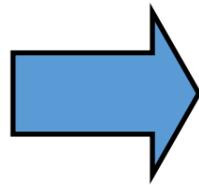
To make food easier to digest.

**THE MAIN HEAT TRANSFER METHODS ARE;**

**CONDUCTION**

**CONVECTION**

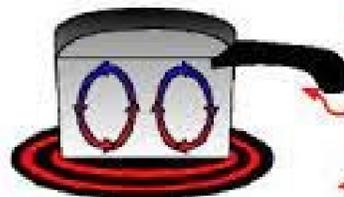
**RADIATION**



The heat from the stove transfers to the pan via **conduction**



The heat is transferred through the water via **convection**



The element transfers heat to the kitchen via **radiation**



A very popular exam question is this:

**How can you prepare fruits and vegetables to conserve their nutritional value?**

**WHEN PREPARING:**

Choose fruit and veg that are as fresh and undamaged as possible—as bruised means loss of vitamin C.

Chop fruit and veg just before serving as vitamin C will be lost (**ANTIOXIDANTS**)

**WHEN COOKING:**

Cook without water, or with a minimum amount of water, or else the water soluble vitamins are lost.

Use the cooking water for gravies, soups or stock to add the water sol vitamins back to the food.

**SERVE** straight away.

**KEY WORDS:**

**HEAT TRANSFER**—The way in which heat energy is passed into food.

**CONDUCTION**—Transferring heat through a solid object (pan base) into food.

**CONVECTION**—Transferring heat through a liquid or air into food.

**RADIATION**—Transferring heat by infra red waves that heat up what they come into contact with a solid object.

**PALATABILITY**—What makes a food acceptable and good to eat.

**SENSORY QUALITIES**—The characteristics of a food that give it a particular appearance, flavour, texture, mouthfeel, aroma and sound when eaten.



**SAUTEING:**

Frying food gently in a little oil to soften the food and develop the flavour = **CONDUCTION**. As this is a cooking method that does not use water, there is minimal loss of the water sol vitamins (C and the B-group) or of the fat soluble vitamins (A, D, E and K). The fat sol vitamins are in fact added as a little oil is used to fry.



**SHALLOW FRYING:**

Frying food in a shallow frying pan with oil = **CONDUCTION**.

This is a quick cooking method so there is minimal vitamin loss. No water is used so the water sol vitamins do not leech out. As the food is cooked in oil the fat sol vitamins (A, D, E and K) are added.



**STIR FRYING:**

Frying food for a very short time in a hot wok using very little oil = **CONDUCTION**.

This is a healthy cooking method as all of the fat and water sol vitamins are retained due to no water being used and fast cooking to prevent heat destroying the nutrients.



**ROASTING/BRAISING:**

Cooking food in oil or stock in the oven = **CONDUCTION & CONVECTION**.

Fat used in roasting adds to energy density. If stock is added the water sol vitamins are lost. Some loss of water sol vitamins due to long hot cooking time. Fat sol vitamins added if oil is used.



**BAKING:**

Cooking foods in a hot oven = **CONDUCTION & CONVECTION**.

Heat from cooking damages the B-group (water sol) vitamins. Starch is made more digestible through the cooking process.



**GRILLING:**

Cooking food by intense radiant heat on a metal grill rack underneath a heated grill element = **RADIATION**.

Vitamin C, B1 (thiamine) and B2 (riboflavin) are damaged by the intense heat. Fat melting out of the food makes the food healthier.



**MICROWAVING:**

Cooking food by electromagnetic waves called microwaves in a microwave oven = **RADIATION**.

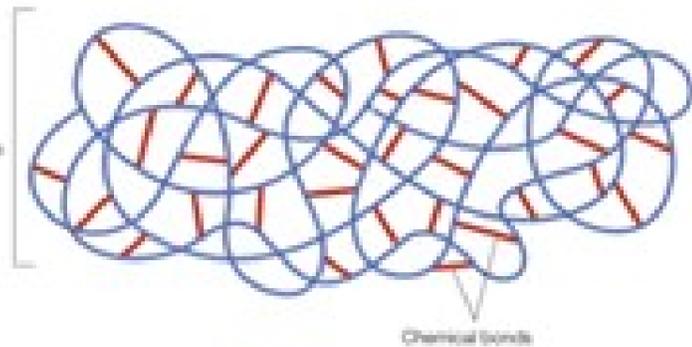
Less damage to the water sol vitamins (C and the B-Group) due to rapid cooking time.

# PROTEINS

PROTEIN MOLECULES ARE VERY BIG.

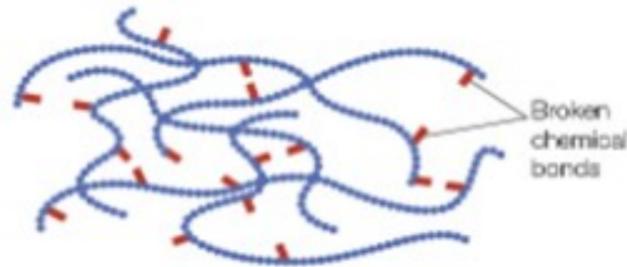
THEY ARE MADE UP OF AMINO ACIDS (AA)

The AA's are formed into bundles held together by **CHEMICAL BONDS**.



When the chemical bonds are broken the proteins **DENATURE**. Proteins denature by:

- ⇒ HEATING
- ⇒ MECHANICAL AGITATION (whisking)
- ⇒ ADDING ACIDS (such as lemon juice)
- ⇒ TRAPPED AIR BUBBLES (formed in meringue)



## FOOD SCIENCE KNOWLEDGE ORGANISER

### WHAT COAGULATION MEANS:

- As protein foods are cooked they change texture and become more solid (e.g. when you cook eggs or fish).
- Denatured protein molecules unfold and join up with other ones to form big groups—they **COAGULATE**.
- As they coagulate they trap water.

### Denaturation and coagulation in eggs...

The processes of denaturation and coagulation are easily observable in our use of eggs.



The yolks and the whites of an egg contain protein. The protein is 'viscous' (sticky, resists flow).



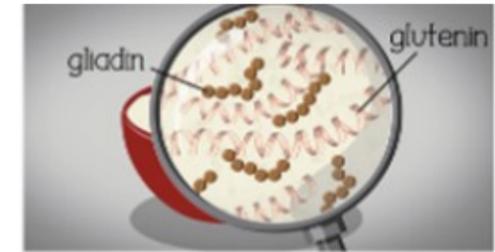
Adding salt or beating the eggs can cause the protein to denature, becoming 'looser'.



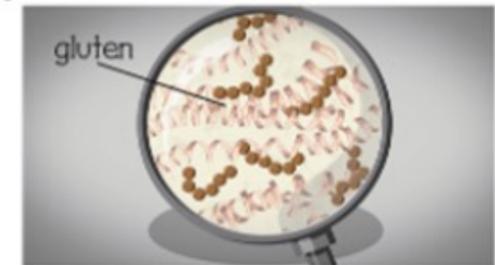
By applying heat during the cooking process, the protein in the eggs coagulates into soft clumps. The result is what we commonly call 'scrambled eggs'.



### GLUTEN IS A PROTEIN FOUND IN WHEAT FLOUR:



- When liquid is added to the flour, these proteins mix together to form a gluten network. This is usually just called gluten.



**Gluten** is an important protein for producing the right **TEXTURE** in baked products like bread.

Gluten makes doughs **stretchy and elastic** and enable to be shaped and **rise**.

Gluten **traps gas bubbles** that have been produced in the dough—e.g. the carbon dioxide gas produced by yeast in bread making.

**Gluten lets doughs rise** as the gas bubbles they contain expand during baking.

**Gluten then SETS** the baked product in the last stages of baking.

**EGG WHITE PROTEINS** can stretch and hold a large volume of air to produce a **FOAM**.

Air gets trapped in a **GAS-IN-LIQUID foam** by whisking e.g. as you can see here where the egg whites are being mixed to make a meringue.

The heat from the whisk beater causes the protein to **DENATURE**.

### Key terms

**Chemical bonds:** bonds that hold large protein molecules together in compact, folded bundles

**Denaturation:** the chemical bonds have broken and the protein molecule has unfolded and changed shape

**Coagulation:** the joining together of lots of denatured protein molecules, which changes the appearance and texture of the food

# CARBOHYDRATES

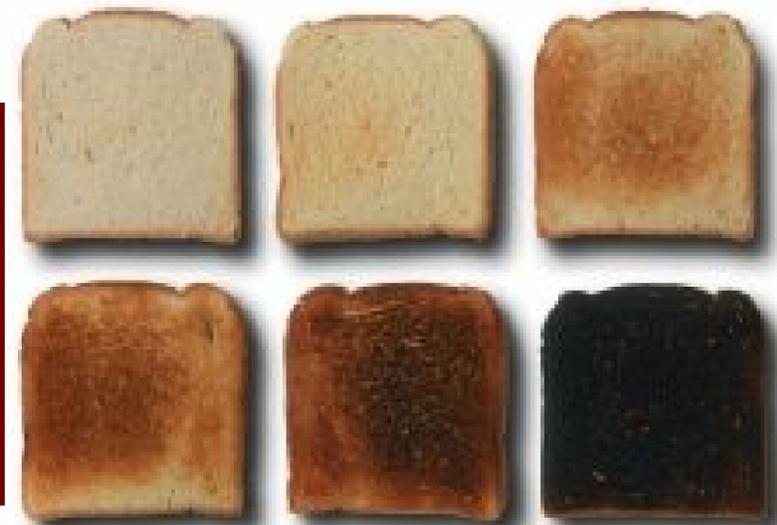
## FOOD SCIENCE KNOWLEDGE ORGANISER

Carbohydrates play an important role in cooking and can contribute towards making food **look, smell and taste more appealing!**

**Caramelisation**  
Caramelisation is the browning of sugar when heated in dry or moist heat. (Moist heat is any cooking which involves water!)  
This results in not only a darker colour, but also a sweeter, nuttier and buttery flavour. Foods which are high in sugar caramelize.



Dry heat (oven or grill) also causes starch to change colour, texture and flavor—this is called **DEXTRINIZATION**. The starch changes to **DEXTRIN**.



### SUGARS CAMELISE:

**SUCROSE** is the main sugar used in cooking..

When sucrose (sugar) is heated it **melts into a syrup that boils**.

The sucrose molecules break up and **water molecules are formed**.

The **water evaporates**, the syrup gets thicker and changes to a golden brown colour (**caramel**).

This process is called **CAMELISATION**.

### Gelatinisation

As the cooked sauce **cools down**, the starch molecules start to form longer chains and the water molecules stay trapped inside them, so the sauce gradually becomes a **solid gel**.



**Key terms**

**Gelatinisation:** the swelling of starch granules when they are cooked with a liquid to the point where they burst and release starch molecules

**Dextrinisation:** the breaking up of starch molecules into smaller groups of glucose molecules when they are exposed to dry heat

**Caramelisation:** the breaking up of sucrose (sugar) molecules when they are heated, which changes the colour, flavour and texture of the sugar as it turns into caramel



Starch is found in flour.

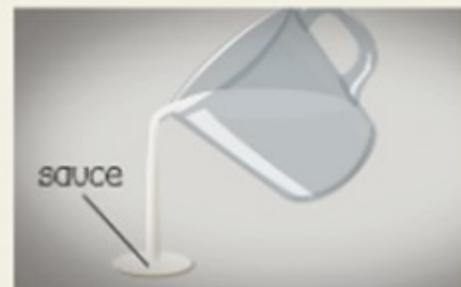
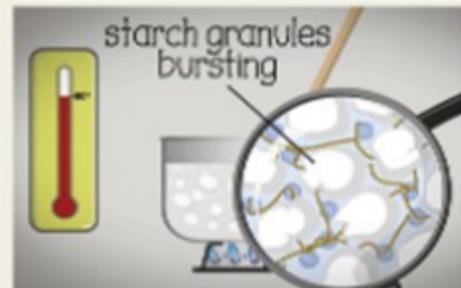
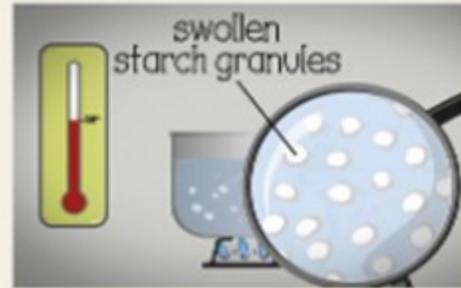
When starch is added to a liquid (milk) it sinks to the bottom.

How does starch react when heated in a liquid?

This is a process called **GELATINISATION—STARCHES GELATINISE:**

**Gelatinisation**

- When starch granules are put into water and then heated, at about **60°C** they start to absorb the water, which causes them to **swell up** and get bigger.
- In sauce making, this makes the sauce start to **thicken**, because there is less room for the swollen granules to move around.
- It is important to **stir the sauce regularly** as it is heating up, to prevent the starch granules from staying at the bottom of the liquid, where they would swell up, stick together and cause the sauce to have a **lumpy texture**.
- At about **80°C**, the starch granules are so swollen that they start to **burst** and release starch molecules into the surrounding liquid.
- These released starch molecules form a **3-dimensional (3D) network** that traps water molecules and stops them moving around so much.
  - At **boiling point (100°C)**, the sauce completely thickens.
  - The sauce should be heated for a few minutes to make sure all the starch is cooked.
  - The sauce is now ready to pour out and serve.
  - This whole process is known as **gelatinisation**.



# FOOD SCIENCE KNOWLEDGE ORGANISER



LO: To explore the function of fats and oils in baking.

## Exam question

1. Describe the processes which are taking place in the following two recipe steps.



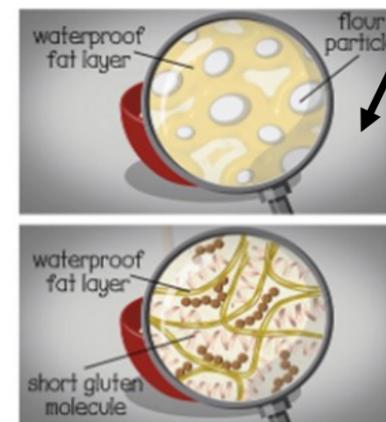
Rubbing in method when making short crust pastry for mince pies. [2 marks]

Answer: The butter is rubbed into the flour. This coats the flour grains with a waterproof barrier. This prevents gluten from developing as the proteins glutenin and gliadin cannot be mixed with moisture so stay short, giving a crumbly texture.



Creaming method when making sponge cake. [2 marks]

Answer: The butter and sugar are mixed together on their own. The sugar granules create pockets of air whereas the fat traps the air by encasing it in a bubble. The trapped air aerates the mixture and creates a light airy texture.



## Key terms

**Plasticity:** the ability of a fat to soften over a range of temperatures and be shaped and spread with light pressure

**Shortening:** the ability of fats to shorten the length of gluten molecules in pastry

**Aeration:** the ability of some fats to trap lots of air bubbles when beaten together with sugar

**Emulsification:** either keeping drops of oil or fat suspended in a liquid and preventing them from separating out; or keeping drops of water suspended in an oil or fat and preventing them from separating out

## Chemical structure of fats

This is the basic chemical structure of a fat/oil:

Fats are composed of the chemical elements: carbon, hydrogen and oxygen. Fat molecules are made of one unit of glycerol and three fatty acids, like this:



This molecule is called a triglyceride.

## Function and properties of fats

### Explanation

#### Plasticity

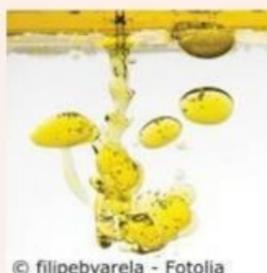
The ability of a solid fat to soften or melt over a range of temperatures



Plasticity describes the ability of a solid fat to soften over a range of temperatures. Plasticity affects the spreading, creaming and shortening ability of the fat. Fat chosen for shortening must have good plasticity – needs to spread over a large area of flour and coat it with a film of oil. Too hard – poor spreading. Liquid (oil) - will clump rather than make a coating.

#### Emulsification

When two unmixable/ immiscible liquids are forced together



An emulsion is a special type of liquid where tiny droplets of one liquid, like oil, spreads throughout the other, such as water. Emulsions should last and not separate out – sometimes if allowed to stand for some time oil or water will separate out from mixture. Formation of an emulsion depends on presence of an **emulsifier** – a substance that will allow two immiscible/unmixable substances to be held together.

## What function do these ingredients have in a pastry recipe?



Plain flour

Answer:

Has a lower gluten content than other flours so helps to keep the texture short. Also creates the structure of the pastry.



Fat

Answer:

Coats the flour grains in a waterproof barrier preventing gluten from developing. This keeps the texture short.



Water

Answer:

Binds the ingredients together.



Salt

Answer:

Adds flavour. IF you want stretchy flaky dough, this would also strengthen gluten.

# Raising Agents



Warmth  
Moisture  
Time  
pH  
Food

## Functional and chemical properties of food (Raising Agents)

### Mechanical:

Whisking (foam formation), beating, folding, sieving, creaming and rubbing in are all methods of incorporating air into a mixture.

### Biological:

Fermentation is the process where yeast produces CO<sub>2</sub> gas, which makes bread dough expand and rise. Fermentation only occurs when given the right conditions: Warmth, moisture, food and time.

### Chemical:

Bicarbonate of soda is used as a raising agent in cakes, scones and biscuits. Bicarbonate of soda (alkali) is mixed with cream of tartar (acid) which produces CO<sub>2</sub> gas, making the products expand and rise.

### Steam:

steam is produced when the water in any moist mixture reaches boiling point. It is used as a raising agent in batters (e.g. Yorkshire puddings, choux pastry and flaky or puff pastry).



- ⇒ Bicarbonate of soda is used for strong flavoured cakes such as parking, gingerbread etc.
- ⇒ Has a soapy aftertaste so the product it is being used in has to be strongly flavoured.
- ⇒ Produces large amount of carbon dioxide when mixed with a liquid.

