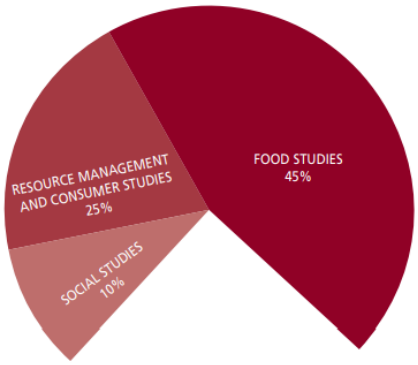
Course Outline

Syllabus Structure

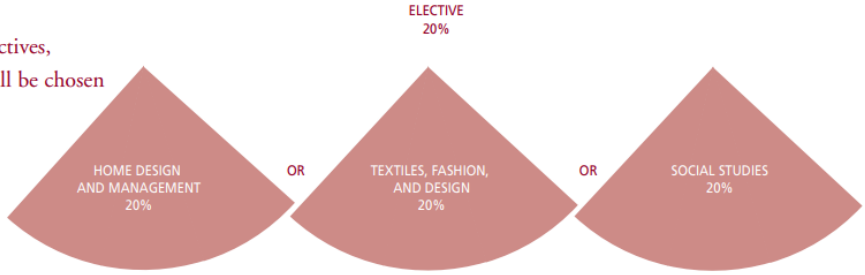
Core

The core consists of three areas:



Electives

There are **three** electives,
from which **one** will be chosen



Each elective is an extension of the content of the core.

Exam Layout – Two Components – Written Examination and Food Studies Coursework (Journal 20%)

WRITTEN EXAMINATION

Section A – 60 marks
Twelve questions, answer 10 questions.

Section B (core)

Section C
Answer one elective question:
1. Home Design and Management
2. Textiles, Fashion and Design
3. Social Studies

Answer part (a) and either part (b) or (c) in chosen elective.

Electives 1 and 3 = 80 marks
1(a), 3(a) = 50 marks
1(b) or (c) 3(b) or (c) = 30 marks each.

COURSEWORK: FOOD STUDIES

Candidates are required to present and record a record of any four assignments from five assignments issued by the SEC.

Protein

Elemental Composition

- Protein is made up of the four elements:

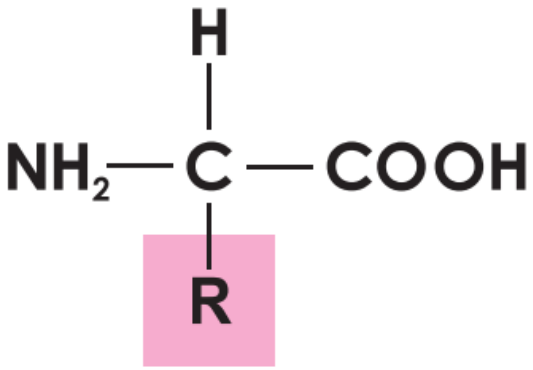
1. Carbon
2. Oxygen
3. Hydrogen
4. Nitrogen

- Protein is the ONLY nutrient to contain NITROGEN which is necessary for growth of new cells
- Also contain small amounts of sulphur (S), phosphorous (P) and iron (Fe)
- These elements are arranged into basic units called AMINO ACIDS

Chemical Structure of Protein

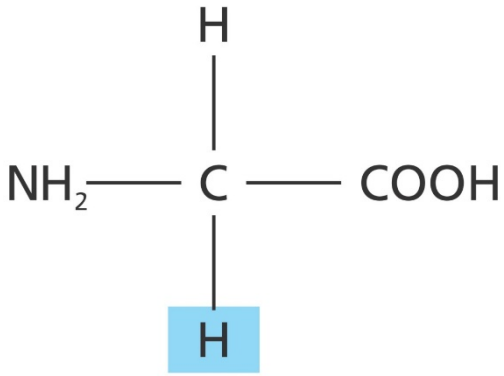
- Proteins are made up of chains of small molecules called amino acids.
- There are 20 different amino acids, but each has the same basic structure.
  - **C** = carbon atom
  - **H**= Hydrogen atom
  - **NH_2** = Amino group (basic)
  - **COOH** = Carboxyl group (acidic)
  - **R** = Variable group (changes for every amino acid)

The Structure of an Amino Acid



Examples of the structure Glycine (an example of an amino acid)

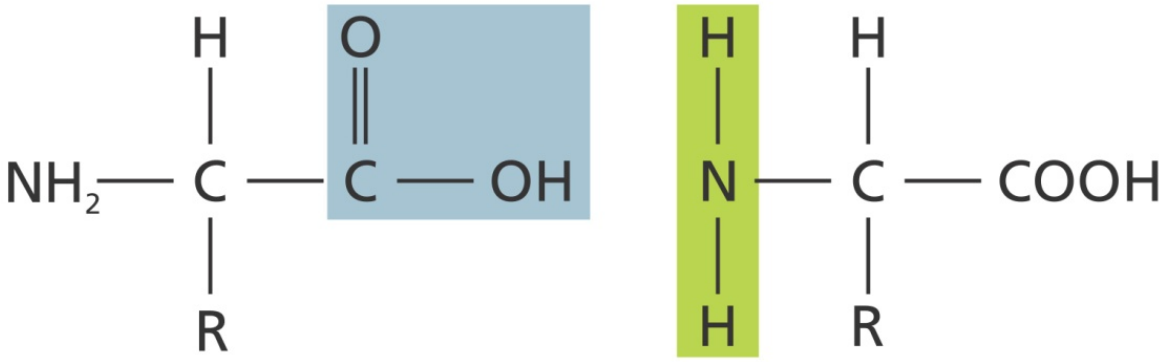
- The amino acid glycine: The R group = H (one hydrogen atom)



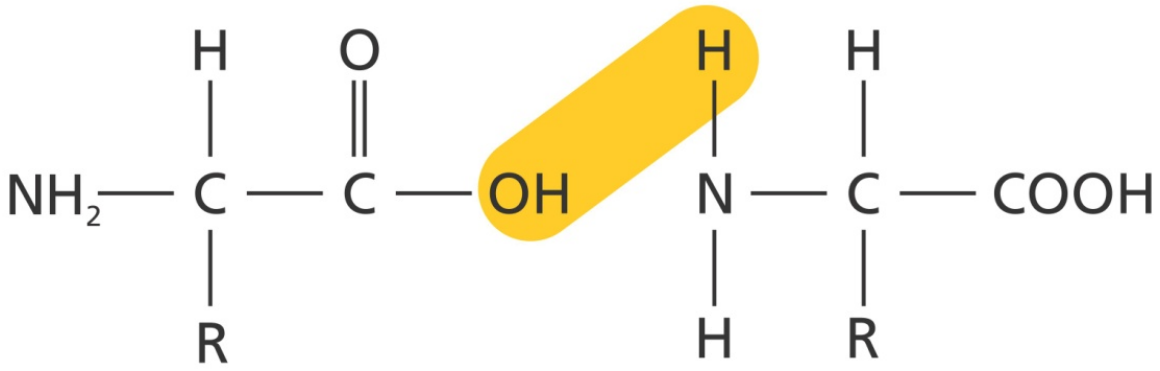
Formation of a Protein

- The bond that links one amino acid to another is called a peptide link or bond.
- When two amino acids join together they form a dipeptide
- When many amino acids join together they form a polypeptide chain
- Each time two amino acids link together, a water molecule is taken away. The linking process is therefore called condensation.
- The reverse of condensation is called hydrolysis – water molecules are added to protein chains and split the amino acids apart. This happens during protein digestion so it is easily absorbed into the bloodstream to keep the body nourished

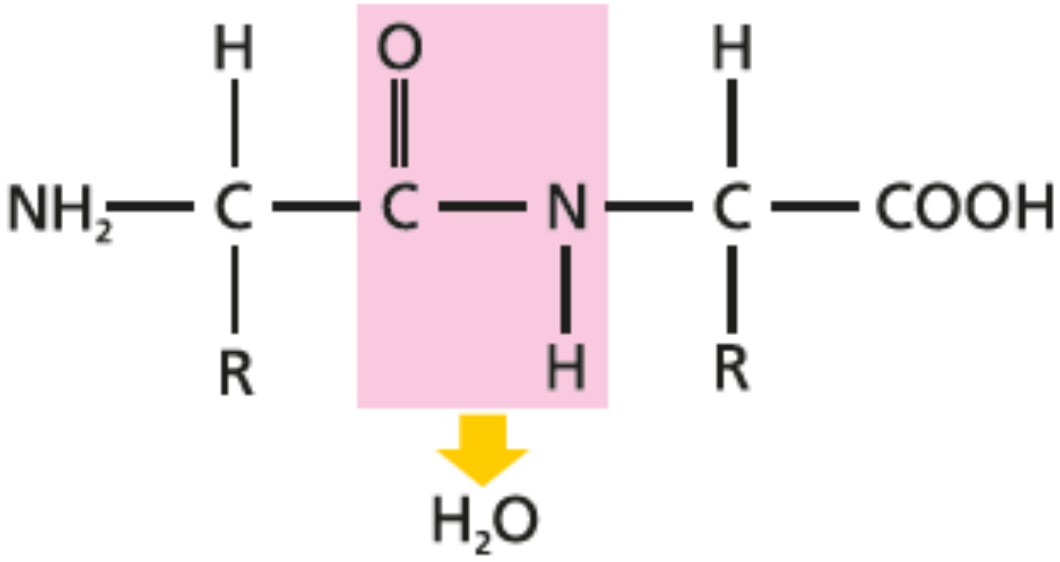
1. Acid COOH reacts with the basic NH2 of another amino acid.



2. The amino group (NH2) loses one H and the carboxyl group (COOH) loses an OH group.



3. The remaining CO and NH join together to make a dipeptide.



Essential Amino Acids	Non Essential Amino Acids
Cannot be made in the body … must be consumed from a food source	Can be made in the body **e.g. cysteine, asparagine, glutamine, glycine, proline and tyrosine**

Examples of Essential Amino Acids

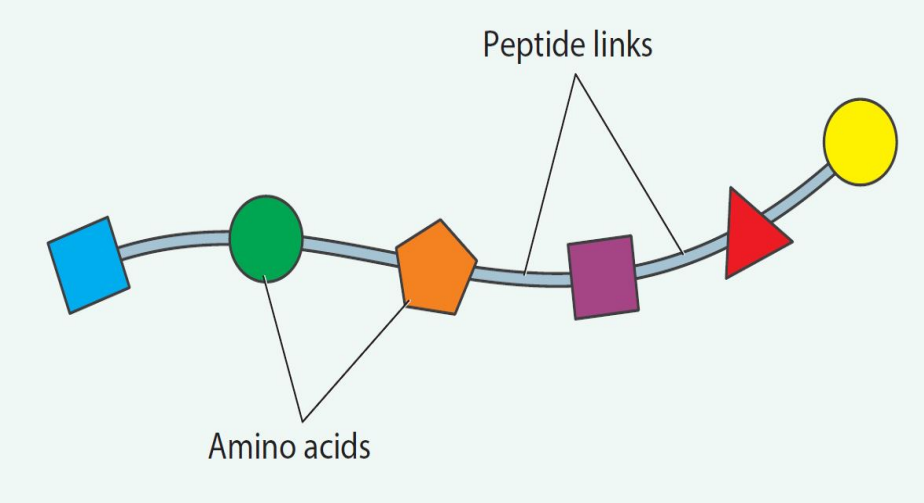
Memory Aid	Essential Amino Acids
Vincent's	Valine
Lovely	Lysine
Mother	Methionine
Took	Tryptophan
Him	Histidine (children)
To	Threonine
Limerick	Leucine
In	Isoleucine
A	Arginine (children)
Pram	Phenylalanine

Protein Structure:

1. **Primary Structure**

- Primary structure is the order or sequence of amino acids in protein chains (polypeptide chain).
- Amino acids can be arranged in many different combinations.

Example: Insulin, one of the simplest proteins, contains 51 amino acids.

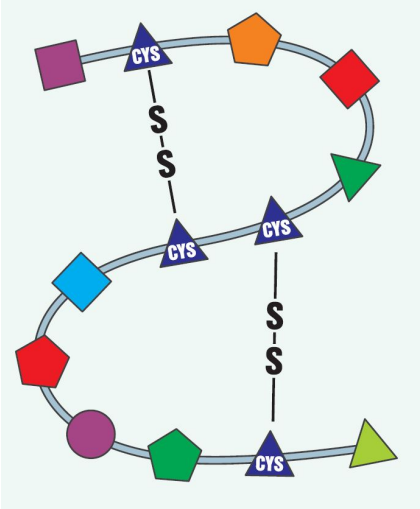


2. **Secondary Structure**

- Secondary structure involves the folding of the primary structure of proteins into definite shapes.
- Polypeptide chains either fold in on themselves or cross-link with another polypeptide chain.
- This causes the chains to form a spiral/helix/pleated shape, giving proteins their unique properties, e.g. gluten its elasticity.

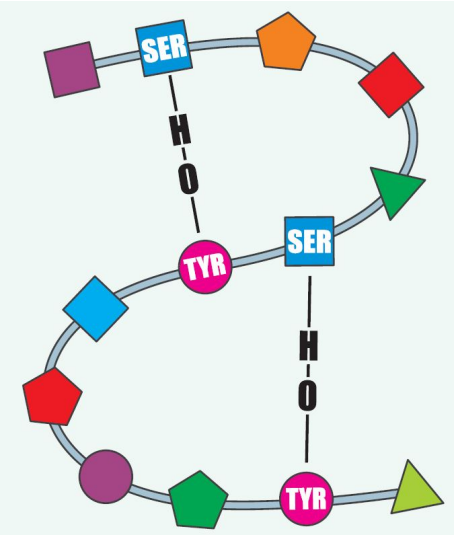
Disulphide Bonds

- Disulfide bonds occur when two sulfurs from two amino acids join together from either a single polypeptide chain or two different polypeptide chains.
- The amino acid cysteine contains sulfur. Two cysteine amino acids can form a disulfide bond.
- Insulin contains disulfide bond



Hydrogen Bonds

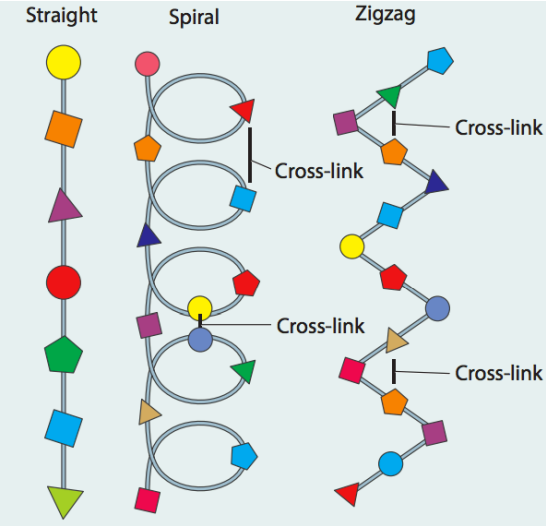
- Hydrogen bonds occur when a hydrogen (H) from the N-H group of one amino acid and an oxygen (O) from the C=O group of another amino acid join together from either a single polypeptide chain or two different polypeptide chains.
- The amino acids serine and tyrosine are capable of forming hydrogen bonds.
- Collagen contains hydrogen bonds.



3. **Tertiary Structure**
   - Involves the folding of the secondary structure of proteins into three-dimensional shapes.
   - Further cross-linking between amino acids forms definite shapes, which may be:
1. fibrous (elongated) or
2. globular (folded over itself to form a compressed unit).

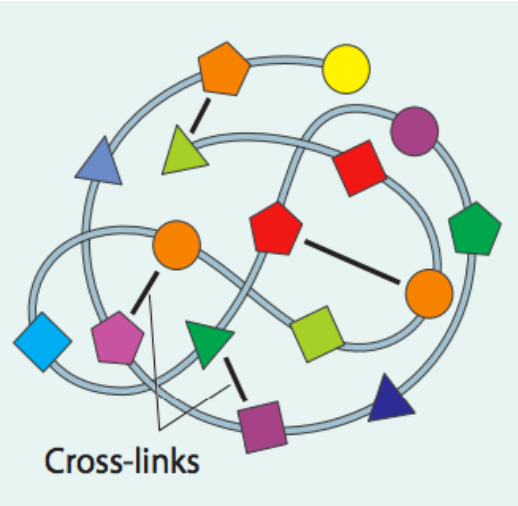
Fibrous

- Polypeptide chains are arranged in straight, spiral or zigzag two-dimensional shapes.
- Properties: Insoluble in water, not easily denatured
- Examples: Gluten (wheat), Elastin and collagen (meat connective tissue)



Globular

- Polypeptide chains are arranged in a globular shape.
- Properties: Soluble in water, easily denatured
- Examples: Ovalbumin (egg white), Lactalbumin (milk)



Classification of Proteins

Simple proteins			
Group	**Sub-group**	**Examples**	**Sources**
Animal	Fibrous	Elastin	Meat connective tissue
		Collagen	Meat connective tissue
	Globular	Ovalbumin	Egg white
		Lactalbumin	Milk
Plant	Glutenins	Glutenin	Wheat
		Oryzenin	Rice
	Prolamines	Gliadin	Wheat
		Zein	Maize

HL

Conjugated proteins Conjuated proteins form when proteins combine with a non-protein molecule.		
Group	**Examples**	**Sources**
Lipoproteins (lipid and protein)	Lecithin	Eggs
Phosphoproteins (phosphate and protein)	Caseinogen	Milk

Derived:

- Do not occur naturally but are obtained from simple or conjugated proteins by the action of enzyme and chemical agents, e.g. peptones convert to peptides during digestion
- Denatured chemicals: Acetic acid (vinegar) in marinade denatures the protein structure and tenderises the meat
- Enzymes: Rennet containing the enzyme rennin changes caseinogens to casein during cheese production

High Biological Value Proteins (HBV)

Food	Biological value	Proteins present
Eggs	100%	Ovalbumin, vitellin and livetin
Milk	95%	Caseinogen, lactalbumin and lactoglobulin
Meat	80–90%	Collagen, actin, elastin, myosin, globulin
Fish	80–90%	Collagen, actin, myosin
Cheese	84%	Casein
Soya beans	74%	Glycinin

Low Biological Value Proteins (LBV)

Food	Biological value	Proteins present
Rice	67%	Oryzenin
Wheat	53%	Gluten
Maize	40%	Zein
Meat bones	0%	Gelatine

Supplementary/Complementary Value of Protein

- LBV proteins are deficient in one or more essential amino acid
- Eating two LBV foods together can ensure all essential amino acids are obtained
- Particularly important for vegans and vegetarians
- E.G. Beans on toast
- Toast is high in methionine, low in lysine
- Beans are low in methionine, high in lysine

Biological Functions of Proteins

Structural proteins (used to build parts of the body)	• Production of cell membranes, muscle tissue and skin • Cell repair and replacement • Growth
Physiologically active proteins (assist with the normal functioning of the body)	Production of: • hormonal proteins: help to coordinate bodily activities, e.g. production of insulin • enzymes: speed up chemical reactions, e.g. pepsin speeds up the breakdown of proteins in food • antibodies (immunoglobulins): defend the body from harmful substances, e.g. viruses • blood proteins: move molecules around the body, e.g. haemoglobin transports oxygen through the blood • nucleoproteins (DNA): make up the hereditary material in chromosomes
Nutrient proteins (play a nutritional role within the body)	• Provide the body with essential amino acids • Excess can be used as a source of energy when carbohydrate and fat reserves are used

Properties of Proteins

- Denaturation (heat, chemicals, mechanical action, enzymes)
- Elasticity
- Maillard reaction
- Solubility
- Gel formation
- Foam formation
- **Memory Aid: Denatured Eggs Make Stiff Glossy Foams**

Denaturation

Denaturation is a change in the nature of the protein. The protein chain unfolds, causing a change to the structure.

- Denaturation is caused by:
  a) heat
  b) chemicals
  c) agitation/mechanical action
  d) enzymes
- It is often an irreversible process.

a) **Heat** – Most proteins coagulate/set when heated, e.g. egg white coagulates at 60°C; egg yolk coagulates at 68°C.
b) **Chemicals** – Acids, alkali, alcohol cause changes to the protein structure, e.g. a vinegar based marinade tenderises meat by denturating proteins
c) **Agitation** – This is also known as mechanical action. It involves whipping or whisking the protein. This results in the protein chain unfolding and partial coagulation. E.g. beating eggs to make meringue
d) **Enzymes** – Change the structure of the protein e.g. the enzyme rennin causes caseinogen in milk to coagulate during cheese making

Elasticity

- Certain proteins (often fibrous) have an elastic property, e.g. gluten, the protein found in flour, enables bread to rise during cooking

Maillard Reaction

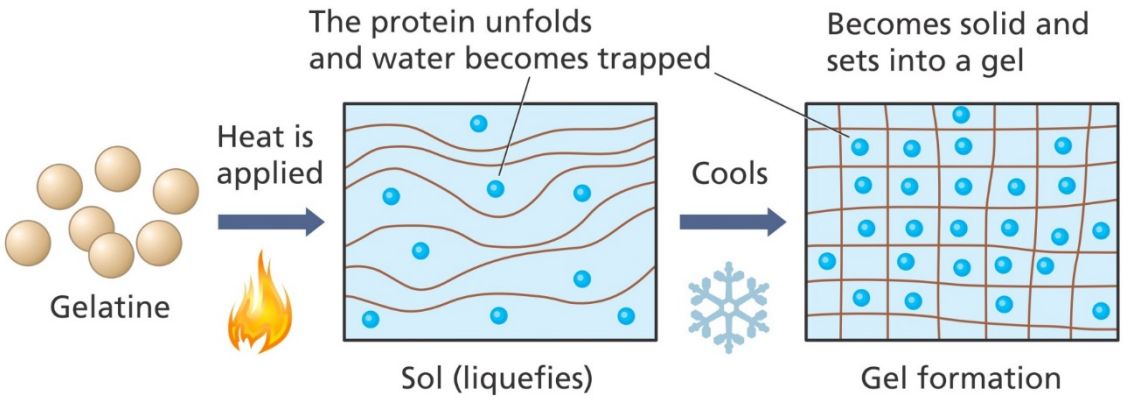
- The Maillard reaction is also known as non-enzymic browning. It occurs when food is roasted, baked or grilled. Examples include roast potatoes and toast.
  - Amino acid + carbohydrates + dry heat = brown colour.
  - E.g. Roast potatoes, roast meat, shortbread biscuits

Solubility

- Most proteins are insoluble in water except for collagen in meat and egg albumin
- *Culinary application:* Moist heat tenderises meat by converting collagen to gelatine e.g. beef during stewing

Gel Formation

- Collagen, when heated, forms gelatine. Gelatine can absorb large amounts of water and, when heated as protein chains uncoil and water becomes trapped, forms a sol. On cooling, a sol forms a gel. A gel is a semi-solid viscous solution. All gels have a three-dimensional protein matrix whereby water becomes trapped. This property is used in making cheesecakes and soufflés.



Foam Formation

- When egg white is whisked, air bubbles are formed as the protein chains unravel. The protein chains entrap the air, creating a foam. Whisking also produces heat, which slightly sets the egg white. This foam will collapse after a while, unless it is subjected to heat. This property is used to make meringues.

Effects of Dry and Moist Heat on Proteins

Dry and moist heat	• Coagulation, e.g. egg whites coagulate at 60°C and egg yolks at 68°C • Colour change, e.g. myoglobin (red pigment) in meat changes to haematin (brown pigment) • Overcooking causes proteins to become indigestible
Dry heat	Maillard reaction, e.g. roast beef
Moist heat	Tenderising meat: collagen in meat converts to gelatine, causing the fibres to tenderise, e.g. pulled pork

Recommended Daily Allowance(RDA)/Reference Intake (RI)

- The protein requirements of an individual depend on body weight and rate of growth.
- An adult needs approx.1g of protein per 1kg of body weight, children and adolescents need more as they are growing

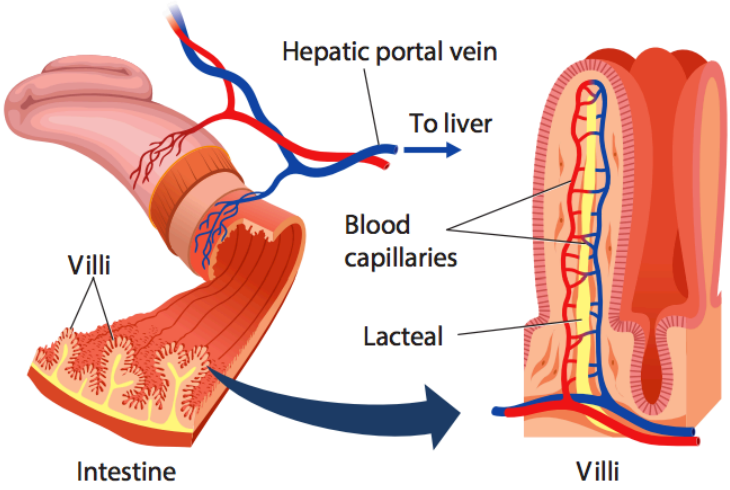
Group	RDA/RI (g)
Children	30–50 g
Adolescents	60–80 g
Adults and older people	50–75 g
Pregnant and lactating women	70–85 g

Digestion of Protein

Organ or gland	Secretion	Enzymes	Substrate	Product
Stomach	Gastric juice	Rennin Pepsin	Caseinogen Proteins	Casein Peptones
Pancreas	Pancreatic juice	Trypsin	Peptones	Peptides
Small intestine (ileum)	Intestinal juice	Pepidase	Peptides	Amino acids

Absorption and Utilisation of Proteins

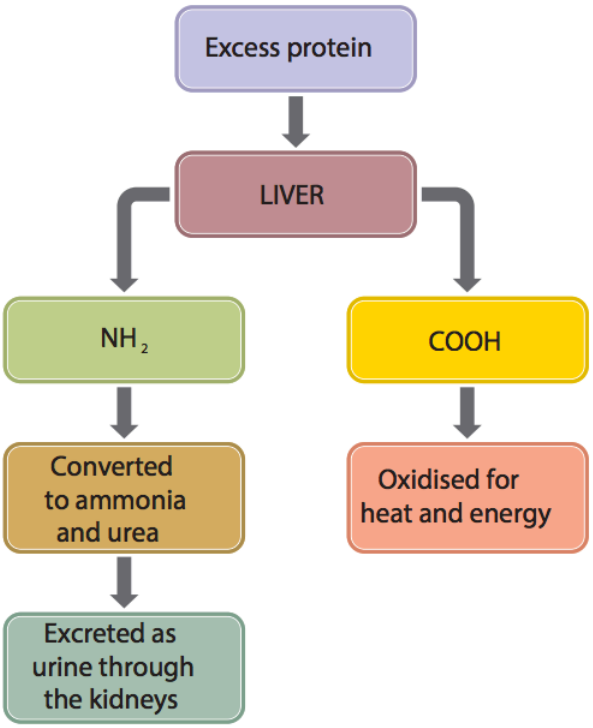
- After digestion the amino acids are ready to be absorbed by the small intestine.



▲ Villi and hepatic portal vein

Deamination

- Deamination is the process through which excess amino acids are broken down by the body in the liver for energy.



Energy Value of Protein

- **Energy value**
- 1 g of protein gives 4 kcal or 17 kJ energy

Exam Questions

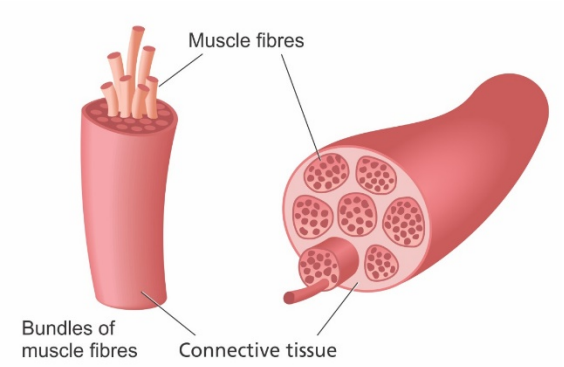
2020 Section B Q1 (b) and (c)
2014 Section B Q1 (d)
2011 Section B Q1 (b)
2006 Section B (c) and (d)

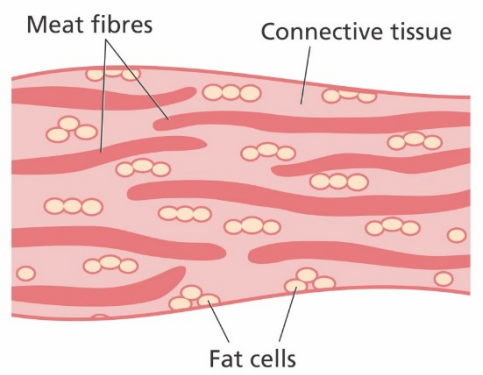
Meat

Classification of Meat

- Carcass: Beef, veal, mutton, lamb, pork, ham, bacon and reindeer.
- Poultry: Chicken, turkey, duck, goose and ostrich.
- Game: Deer (venison), rabbit, grouse, pheasant.
- Offal: Liver, kidney, heart, tongue, tripe, sweetbread, brain.

Structure of Meat





- Composed of bundles of tiny fibres containing

1. Water
2. Proteins **(actin and myosin)**
3. Minerals
4. Extractives

- Muscle fibres are like hollow tubes. Their size depends on the use the muscle gets – **shorter fibres mean more tender meat.**
- The walls of the muscle fibres are made up of connective tissue called **elastin.**

- Bundles of fibres are held together by **collagen**, which is another, tougher **connective tissue** that becomes tender when cooked.
- There are two types of fat cells: **invisible fat**, known as marbling, which is dispersed throughout the meat, and **visible fat**, which is found under the skin and around internal organs.

Nutritive Value:

Meat	Protein	Fat	Carbohydrates	Vitamins	Minerals	Water
Carcass	20-30%	10-30 %	0%	1.5% Niacin, B1, B2, B6, B12	Iron, potassium, phosphorous, sulphur, zinc	50-60%
Offal	20-25%	5-10 %	0% Traces of glycogen in liver	A, B group, C, D and K	Iron, potassium, phosphorous, sulphur, zinc	60-70%
Poultry	25-30%	2-5%	0%	Niacin, B1, B2, B6 and B12	Iron, calcium, zinc, phosphorous	65-75%

- **Protein**: Good source of high biological value (HBV) protein. The meat tissue contains myosin, actin and globulin. The connective tissue contains collagen and elastin.
- **Lipids**: Fat content varies depending on the

type of animal,
the cut of the meat,
the age of the animal and
the method of cooking used,
e.g. skinless chicken fillets would be low in fat, while pork and lamb have a much higher fat content. The saturated fat found in meat can be visible on the outside and can be trimmed off or invisible (dispersed through the meat) and melts when cooked.

- **Carbohydrates**: No carbohydrates in carcass meat so it needs to be served with food rich in carbohydrates, e.g. pasta, rice or potatoes. There are traces of glycogen in liver.
- **Vitamins**: Meat provides water-soluble B-group vitamins: thiamine (B1) riboflavin (B2), niacin, folic acid, pyridoxine (B6) and cobalamin (B12). There are small amounts of vitamins A and D in liver.
- **Minerals**: Red meat and offal are very good sources of easily absorbed haem iron. Small amounts of zinc, potassium, phosphorus, calcium and sulphur are also present in meat.
- **Water**: Meat contains a high proportion of water (between 50–70%). The water content varies; meat with a high fat content has less water than a leaner cut.

Dietetic Value

- **Popular, nutritious** … but can be **expensive**
- Protein, for **growth and repair**, important for children, adolescents and pregnant women.
- The **saturated fat content** means meat should be reduced in the diet of those with **high cholesterol** or **heart disease.**
- **Obese** people should choose **chicken**, turkey and lean meat to avoid fat.
- Good source of **haem iron,** especially for **teenage girls** and **pregnant women.**
- Good source of **B-group vitamins,** especially **B12** for red blood cells.
- Adds **variety** to diet – there are many types and cuts available.

Meat is not essential it can be replaced by fish, eggs, cheese, lentils, beans

Tough Meat Vs Tender Meat

- The toughness/tenderness of meat is determined by…

1. The **age** and **activity** of the animal prior to slaughter
2. The **treatment** (conditioning) of the animal prior to and after slaughter.

Factors which cause toughness in meat

- **Activity:** Tougher parts of meat are from the more active parts of the animal e.g. neck due to longer thicker fibres and more connective tissue
- **Age:** Younger animals are more tender than older animals. As animal ages, fibres get coarser and connective tissue harder
- **Treatment of animal prior to and after slaughter (conditioning):** Before slaughter animals should be rested to allow glycogen build up in muscle, after death glycogen breaks down into lactic acid which tenderises meat protein .. Should also be hung (21 days) to further tenderise the meat
- **Incorrect cooking method:** Using a dry quick method e.g. grilling on a tough cut of meat will make it even tougher

Methods of tenderising meat

- Meat tenderisers (contain proteolytic enzymes)
- Mechanical breakdown (e.g. meat mallet)
- Marinating
- Slow, moist cooking methods (e.g. stewing and casseroling)

Hanging meat

- After the animal is killed, its muscles stiffen (rigor mortis).
- When meat is hung, enzymes cause glycogen stored in the liver and muscle cells changes to lactic acid.
- The lactic acid tenderises the meat.
- It also helps preserve the meat, giving it a longer shelf life

Guidelines for buying meat

- Buy from a reputable shop with a good turnover

In the butchers …

- Surfaces and equipment must be clean and hygienic
- Assistants do not handle meat and money
- Hair must be covered and protective clothing worn
- Raw and cooked meat must be stored and handled separately
- Plastic gloves worn by assistants who handle meat
- The meat supplied is produced under the Bord Bia Quality Assurance Scheme
- If pre packed check use by/best before label

Guidelines for selecting meat

- Buy fresh meat in small quantities unless freezing
- Meat chosen should be a good bright colour and characteristic of that meat e.g. beef is a dark red
- Cuts must be firm and moist
- No excess juices should be running
- Odour free
- Poultry should be a good colour, no blemishes on skins, firm and plump
- Choose correct cut for cooking method
- Cheaper cuts can be as nutritious
- Frozen meat must be frozen solid with undamaged wrappers

Guidelines for storing meat

- Store meat quickly after purchase in a fridge (4 degrees)
- Remove plastic wrapping unless vacuum packed/pre packed
- Put on a clean plate and cover loosely (to prevent drying out).
- Store on bottom shelf of fridge to prevent dripping
- Store raw and cooked meat separately
- Use within two days; use offal and mince on the day of purchase.
- Follow instruction on prepacked meat
- If freezing, freeze on the day of purchase (never refreeze)
- Cured meat fat goes rancid, so store in a wrapper and use inside a week once opened

Methods of cooking meat

Guidelines for cooking carcass meat

- Choose an appropriate cooking method, e.g. frying or braising, suited to the type and cut of carcass meat.
- If baking or roasting carcass meat ensure the oven is preheated, so it will cook meat until it reaches a sufficiently high temperature to ensure all pathogenic bacteria are killed.
- Avoid overcooking carcass meat, as it becomes tough and difficult to digest.

Guidelines for preparing and cooking poultry

- If poultry is frozen, thaw in a fridge at 4°C before cooking.
- Remove giblets (offal), e.g. liver, heart, stomach and neck.
- Avoid stuffing the cavity - absorbs the juice from raw poultry – risk of bacteria/food poisoning if the poultry is not sufficiently cooked.
- Wash hands and equipment used
- Cook in a preheated oven until the centre of the carcass reaches a sufficiently high
- temperature, approximately 75°C, to ensure all pathogenic bacteria are killed.
- Cool leftovers quickly to avoid bacterial growth.
- Cover and store in the fridge and use within two days.

Effects of cooking on meat

- Protein coagulates at 40–50°C, causing meat to shrink.
- Fat melts, adding flavour to meat.
- Colour changes from red to brown due to the denaturation of myoglobin (red pigment) to haematin (brown pigment).
- Some B-group vitamins are lost, as they are not heat stable.
- Other vitamins and minerals are also lost, as they as dissolve into the cooking liquid.
- Bacteria are destroyed.
- Flavour develops, as extractives are released from the meat fibres.
- Collagen converts to gelatine, making meat more digestible as the fibres loosen and fall apart.
- Meat can become tough, rubbery and difficult to digest if overcooked

Meat Processing

Curing/salting	
Process	Meat can be cured using two processes: wet curing and dry curing. Wet curing involves injecting or soaking the meat in brine, made from water, salt (sodium chloride) and nitrates, and letting it rest for several days. Dry curing is a traditional method of curing meat, which involves coating the meat in plain crystal salt and letting it rest for a week or more. After each process, the meat may be smoked.
Effects	• Salt content is increased • Colour and flavour are changed • Microorganisms and enzymes are destroyed
Examples	• Bacon • Ham, e.g. prosciutto

Dry curing

Freezing	
Process	Meat is deboned and some fat is removed. It can then be frozen by commercial methods, e.g. blast freezing at -30°C, or by home freezing at -25°C.
Effects	• No effect on colour, flavour and texture • Microorganisms are inactivated • Some loss of B-group vitamins and extractives during drip loss when thawed • Freezer burn may occur if packaging is damaged • Rancidity of meat may occur if stored in the freezer for too long
Examples	• Pork • Beef • Lamb • Poultry products, e.g. chicken nuggets

Tip

The processing methods for meat can also be applied to fish.

Drying		
Process	Meat has its moisture removed. This can be completed by fluidised bed drying or accelerated freeze drying.	 Beef jerky
Effects	• Colour, flavour and texture are changed • Loss of B-group vitamins • Microorganisms and enzymes are destroyed	
Examples	• Beef jerky • Meat in packet soups	

Processed Meat Products

- Fresh sausages
- Cooked sausages (e.g. black/white pudding)
- Dried sausages (e.g. salami/pepperoni)
- Beef burgers
- Meat extractives (e.g. stock cubes)
- Pâté (e.g. chicken liver pâté)
- Cold cooked meat (e.g. corned beef)
- Gelatine (leaf or powdered)

Controlling Meat Quality in Ireland

The Department of Agriculture, Food and the Marine enforce food safety within the meat sector by:

- ensuring meat purchased is fresh, hygienic and free from disease by enforcing European Union legislation regarding the import of foods of animal origin from outside the European Union
- monitoring the use of antibiotics and growth promoters in animal production
- ensuring the maintenance of abattoirs and meat-processing factories throughout Ireland
- testing animals routinely for diseases (e.g. TB)
- ensuring the identification of livestock and traceability of meat.

Sustainable Beef and Lamb Assurance Scheme (SBLAS)

- If beef or lamb products bear the Bord Bia Quality Mark it tells the consumer that the products are quality assured, as they have been produced sustainably with the highest level of care and attention at primary production.
- To achieve this, the farmer must be a certified member of the Sustainable Bord Bia Assurance Scheme.

Lipids

Lipids refers to both fats and oils.

Fats = solid at room temperature e.g. butter.
Oils = liquid at room temperature e.g. olive oil

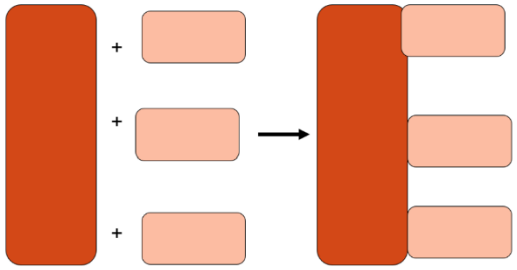
Elemental Composition

- Lipids are made up of three elements:

Carbon (C)
Hydrogen (H)
Oxygen (O)
(CHO)

Chemical Structure

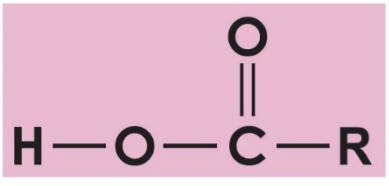
- Lipids are composed of **triglycerides.**
- A triglyceride contains **one glycerol molecule** and **three fatty acid molecules.**



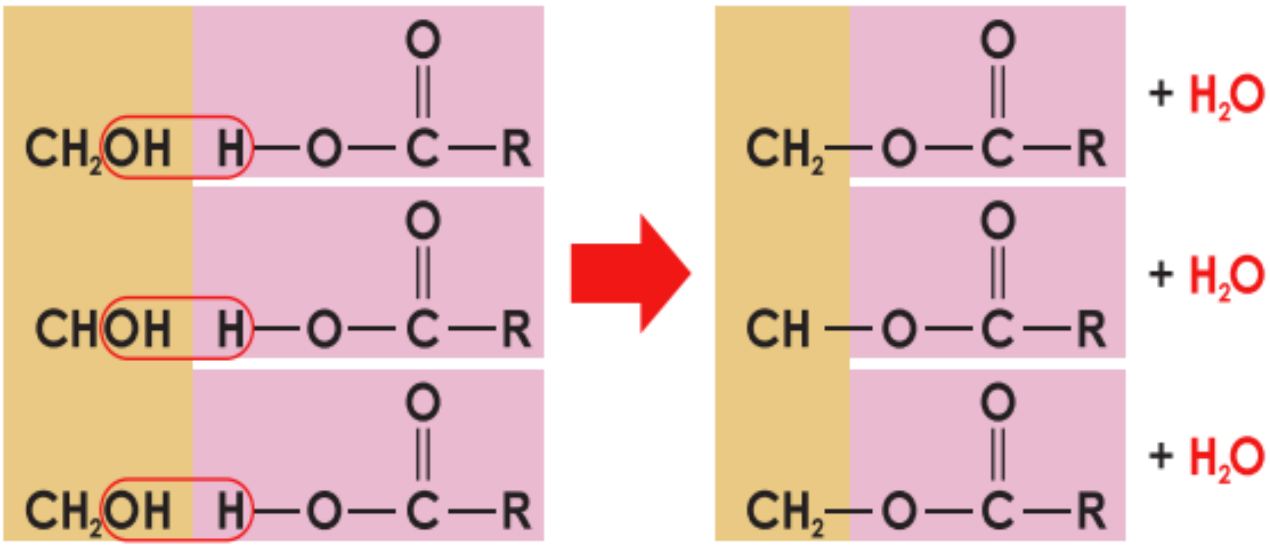
Glycerol + 3 Fatty Acids = Triglyceride

Glycerol molecule

Fatty Acid Molecule

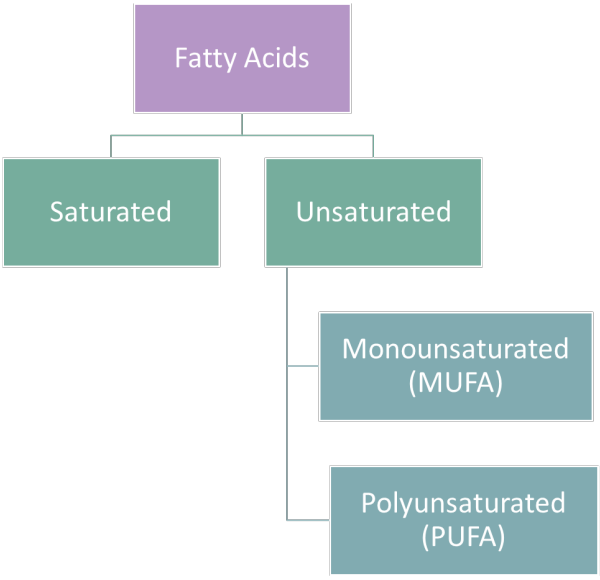


Triglyceride Formation



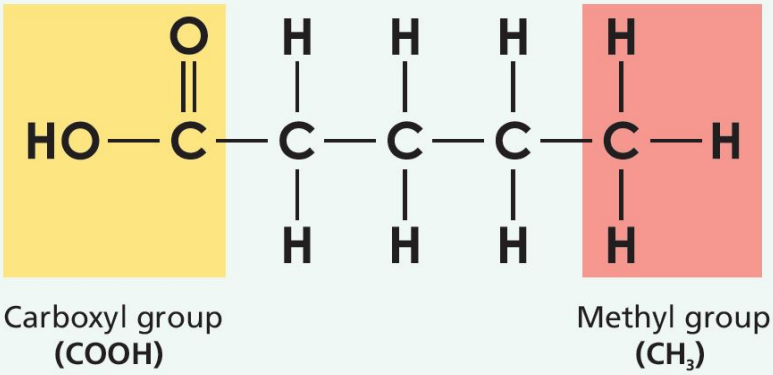
- A triglyceride is formed when **one glycerol molecule** joins with **three fatty acids** to produce a **triglyceride and water**
- Water is eliminated (**condensation reaction**)
- A glycerol molecule has three hydroxyl groups (OH).
- Every fatty acid has a carboxyl group (COOH) at the end.
- A hydroxyl group from the glycerol and a hydrogen atom from the end of the fatty acid break off and combine to form water (H2O) (condensation reaction)
- As a result, the fatty acid becomes bonded to the glycerol.
- This happen for each of three fatty acids, releasing three water molecules.

Fatty Acids


Fatty Acids
Saturated
Unsaturated
Monounsaturated (MUFA)
Polyunsaturated (PUFA)

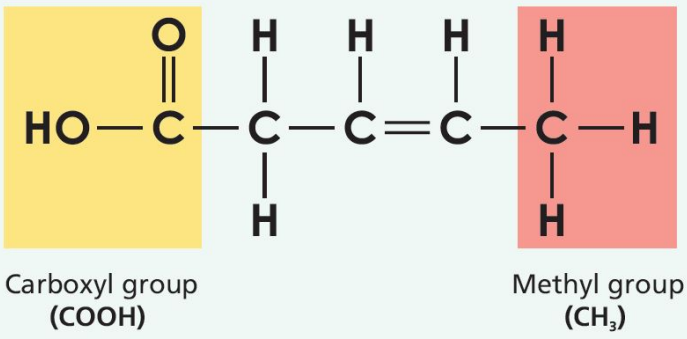
Saturated Fatty Acids

Structure	Consistency and melting point	Sources	Examples
• Each carbon atom is fully saturated with its full quota of hydrogen atoms • No double bonds occur between the carbon atoms	• Solid at room temperature (18°C) • High melting point	• Generally found in animal sources	• Butyric acid in butter • Stearic acid in meat
Chemical structure			



Monounstaurated Fatty Acids

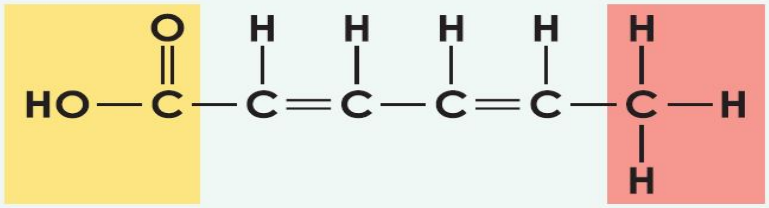
Structure	Consistency and melting point	Sources	Examples
• Each carbon atom is not fully saturated with a full quota of hydrogen atoms • There is one double bond between the carbon atoms	• Soft or liquid at room temperature (18°C) • Low melting point	• Generally found in plant and marine sources	• Oleic acid in olive oil
Chemical structure			



Polyunsaturated Fatty Acids

Structure	Consistency and melting point	Sources	Examples
• Each carbon atom is not fully saturated with a full quota of hydrogen atoms • There is more than one double bond between the carbon atoms	• Soft or liquid at room temperature (18°C) • Lowest melting point of all the fatty acids	• Generally found in plant and marine sources	• Alpha linolenic acid (three double bonds) in seed oil • Linoleic acid (two double bonds) in nuts • Linolenic acid (three double bonds) in seeds • Arachidonic acid (four double bonds) in oily fish **Remember It!** **ALLA** uses the first letter of each example.

Chemical structure



Distribution of saturated, monounsaturated and polyunsaturated fatty acids in food

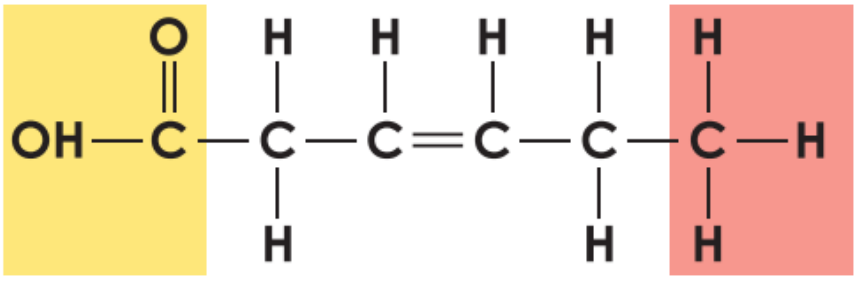
- Fats/oils are made up of a **combination of fatty acids** which determine consistency, colour, taste and texture of fat/oil. More hydrogen atoms = greater degree of saturation.

Essential fatty acids (EFAs) – sources and biological functions

- Can't be manufactured in the body and must be obtained from food.
- These include **linoleic acid** found in corn oil, **linolenic acid** found in vegetable oil, **arachidonic acid** found in animal fat.
- Linoleic acid is the most important as linolenic acid and arachidonic acid can be manufactured from linoleic acid.
- Sources: Nuts, seeds, olive oil, oily fish
- Biological functions of EFAs:
  - Aid cell formation
  - Reduce risk of heart disease by removing cholesterol from the blood and lowers low density lipoprotein which deposits cholesterol in the blood

Omega 3 Fatty Acids

- Omega-3 fatty acids have a double bond between the third and fourth carbon atoms along their hydrocarbon chain.



▲ Chemical structure of an omega-3 fatty acid

Omega-3 fatty acids – sources and biological functions

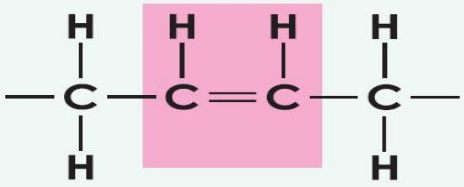
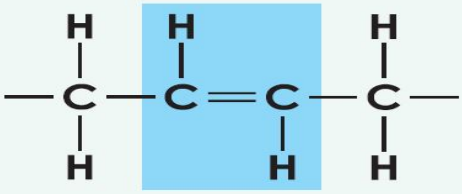
- **Omega-3 fatty acids** (PUFA) have a double bond between the 3rd and 4th carbon atoms of their hydrocarbon chain.
- **Sources:** oily fish, fish oils e.g. cod liver oil, seeds, nuts, fortified eggs with added omega-3
- **Biological functions:**
  - reduce risk of heart disease
  - prevent blood clots by increasing viscosity of blood
  - aid foetal brain development in pregnancy, help improve memory and cognitive functioning

Omega 3 Fatty Acids

- **EPA** = eicosapentaenoic acid.
- **DHA** = docosahexaenoic acid

These are long-chain omega-3 polyunsaturated fatty acids (O-3s) that are abundant in fish, shellfish

Cis and Trans Fatty Acids

	Cis fatty acids	Trans fatty acids
Chemical structure	The hydrogen atoms on either side of the double bond are both above or both below the carbon chain 	The hydrogen atoms on either side of the double bond are on opposite sides of the carbon chain 
Sources	Naturally occurring in foods such as olive oil and oily fish	Formed from cis fatty acids during: • the heating or frying of oils at high temperatures • industrial processing, e.g. the addition of hydrogen atoms to oil to produce margarine. Also present in foods that contain hydrogenated fats, e.g. pastries and crisps.
Health effects	Generally good for health as they raise HDL while lowering LDL, decreasing the risk of coronary heart disease	Generally bad for health as they lower HDL while raising LDL, increasing the risk of coronary heart disease

Classification of Lipids by Source

Animal	Plant	Marine
Mainly saturated	Mainly unsaturated	Mainly polyunsaturated
Meat, meat fats, butter, cream, cheese, egg yolks and milk	Vegetable oils, nuts and nut oils, seeds and seed oils, margarine, avocados, olives and soya beans	Oily fish and fish liver oils

Properties of Lipids

- Solubility
- Absorption of flavours
- Heating lipids (melting point, smoke point, flash point)
- Emulsions (water in oil / oil in water)
- Emulsifiers
- Hydrogenation
- Rancidity
- Plasticity

Hydrogenation

A process whereby hydrogen gas, in the presence of a nickel catalyst is forced through the double bond of an unsaturated oil, converting the unsaturated oil into a saturated solid fat.
Culinary Application: used in the production of margarine

Rancidity

- This is the spoilage or decomposition of lipids
- It results in an unpleasant odour and taste
- 2 types of rancidity:
- **1) Oxidative Rancidity:** (most common) occurs when oxygen in the air combines with the carbons in a double bond of the unsaturated fatty acid
- **2) Hydrolytic Rancidity:** occurs when enzymes or bacteria break down lipids into glycerol and fatty acids

Plasticity

- Describes how soft, pliable and malleable a fat is at a given temperature
- It is determined by the degree of saturation
- The more saturated fatty acids present, the more solid the lipid
- As a result butter is solid at room temperature compared to margarine which is soft and spreadable.
- *Culinary Application:* lipids with a low saturation level e.g. margarine, are used for creaming during cake making

Additional Notes on Properties

Additional Notes on Properties

Biological Functions of Lipids

- Supply body with heat / energy, helping to keep the body at 37 degrees C and providing energy for all activities
- Form protective layer around delicate organs e.g. kidneys
- Supply body with fat soluble vitamins: A, D, E and K
- Provide body with essential fatty acids that cannot be made in the body e.g. linoleic acid
- Excess lipids stored as adipose tissue under skin – insulates body and acts as energy reserve

Lipids – Recommended Dietary Allowance/Reference Intake (RDA/RI)

- Recommended Daily Allowance (RDA)/Reference intake (RI):
  - No more than **70g** per day.
  - Men no more than 30g saturated fat
  - Women no more than 20g saturated fat.

Energy Value of Lipids

- 1 g provides 9 kcal energy (37kJ)

Associated dietary disorders:

- Obesity
- Coronary heart disease
- High cholesterol
- Strokes

Digestion of Lipids

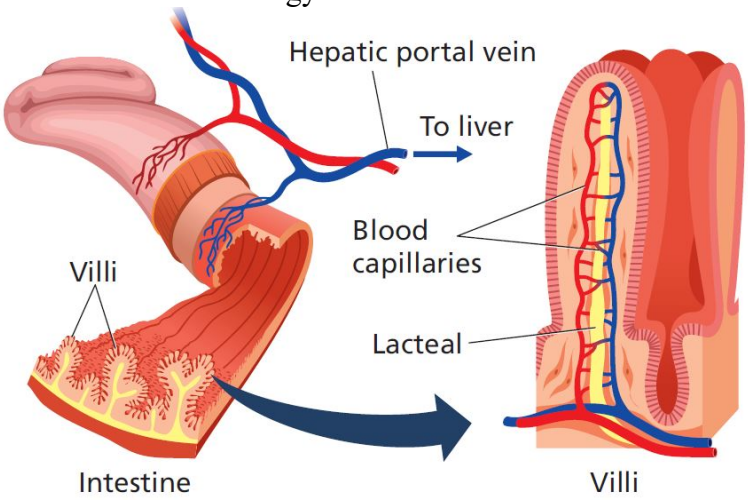
- During digestion water and enzymes break down lipids into one glycerol and 3 fatty acids - this process is called **hydrolysis**
- **Mouth:** Food is chewed into small pieces by the teeth
- **Stomach:** The heat from within the stomach causes some fat to melt
- **Liver:** Secretes bile into the duodenum (the first part of the small intestine) via the bile duct. This emulsifies large fat molecules to produce smaller molecules
- **Pancreas:** Secretes pancreatic juice into the duodenum. The pancreatic juice contains the enzyme lipase which begins to break down lipids into fatty acids and glycerol
- **Small Intestine:** The ileum (final section of the small intestine) secretes intestinal juice containing the enzyme lipase which continues to break down the lipids into fatty acids and glycerol

Fatty acids and glycerol are now ready to be absorbed and utilised by the body

Organ or gland	Secretion	Enzymes	Substrate	Product
Liver	Bile		Large fat molecules	Emulsified fat (small molecules)
Pancreas	Pancreatic juice	**Lipase**	Lipids	Fatty acids and glycerol
Small intestine (ileum)	Intestinal juice	**Lipase**	Lipids	Fatty acids and glycerol

Absorption and utilisation of lipids

- After digestion the fatty acids and glycerol are ready to be absorbed by the small intestine. They pass through the wall of the villi into lacteals, which form part of the lymphatic system.
- The lymphatic system transports the digested lipids to the thoracic duct, where they are deposited into bloodstream through the subclavian vein (near the left side of the neck).
- The subclavian vein transfers the fatty acids and glycerol to the liver.
- In the liver, digested lipids are oxidised to produce heat and energy and form cell membranes.
- Excess digested lipids are stored as adipose tissue under the skin to insulate the body and act as an energy reserve.



Questions
2008 Section B Q1
2013 Section B Q1
2018 Section B Q1

Milk

Types of cow's milk

- Whole milk
- Low-fat milk (semi-skimmed milk)
- Skimmed milk
- Buttermilk

Average nutritional composition of milk

Nutrient	Whole milk	Low-fat milk	Skimmed milk
Proteins	3.4%	3.4%	3.5%
Fat	4%	1%	0.3%
Carbohydrates	4.8%	4.5%	4.6%
Vitamins	A, B group, D	B group	B group
Minerals	Calcium, phosphorus, potassium, magnesium	Calcium, phosphorus, potassium, magnesium	Calcium, phosphorus, potassium, magnesium
Water	87%	89%	91%

Nutritional value of milk

Proteins	• An excellent source of easily digestible, high biological value (HBV) protein • The main proteins present are caseinogen, lactalbumin and lactoglobulin
Fat	• Saturated fat is present in small droplets dispersed throughout milk, making it easy to digest • The amount of fat present depends on the type of milk
Carbohydrates	• Contains carbohydrates in the form of the disaccharide lactose (sugar) • Lacks dietary fibre and starch
Vitamins	• A good source of vitamin A. Contains a small amount of vitamin D. Vitamins A and D are removed when fat is skimmed from milk. • A valuable source of B-group vitamins, particularly thiamine (B1), riboflavin (B2) and niacin (B3) • Lacks vitamin C, as the small amount present is lost during processing
Minerals	• An excellent source of calcium • Some phosphorus is present • Contains trace amounts of magnesium and potassium • Lacks iron
Water	• High water content

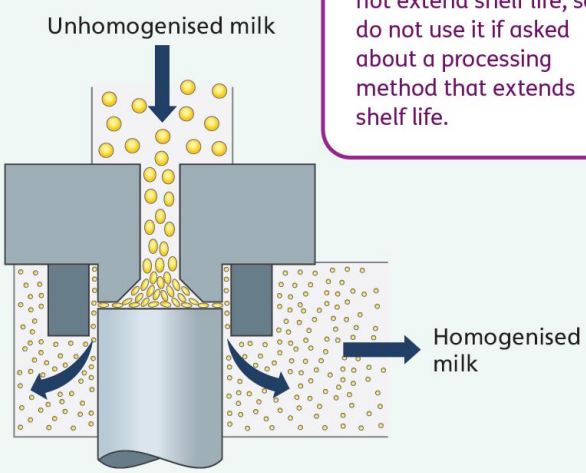
Dietetic value of milk

- Excellent source of easily digestible HBV protein
- Excellent source of calcium
- Individuals with high cholesterol or on calorie-controlled diets should choose low-fat or skimmed milk
- Available in a variety of types to suit varying tastes and dietary needs
- Versatile food suited to many different culinary uses
- Inexpensive
- Lacks starch, dietary fibre, iron and vitamin C, should be combined with foods rich in these to balance the diet.

Milk processing

Homogenisation

Process	Milk is heated to 60°C. It is then forced under pressure through a machine with tiny holes that break up the large fat globules and disperse them evenly throughout the milk.
Effects	Improves the texture and flavour of the milk (makes it creamier), as smaller fat globules are evenly dispersed throughout the milk and do not rise to the top as cream



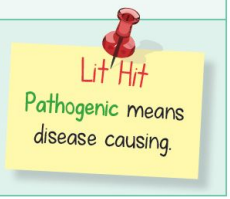
Tip

Homogenisation does not extend shelf life, so do not use it if asked about a processing method that extends shelf life.

Heat Treatments – Prolong/Extend Shelf Life of Milk

Pasteurisation

Process	Milk is heated to 72°C for 25 seconds, and then cooled quickly to 10°C
Effects	• **Pathogenic** bacteria are destroyed • Shelf life is extended (approximately 6–8 days) • Loss of vitamin C and vitamin B1 (thiamine) • No noticeable change in flavour



Sterilisation

Process	Milk is homogenised. It is then sealed into glass bottles and heated to 110°C for 30 minutes, then cooled.
Effects	• Pathogenic bacteria are destroyed • Shelf life is extended (approximately six weeks if unopened) • Loss of vitamin C and B-group vitamins • Flavour is slightly altered, as lactose becomes sweeter on heating

Ultra heat treated (UHT)

UHT milk is also known as long-life milk. It is used on aircraft and in hotel rooms.

Process	Milk is heated to 132°C for one to two seconds and then cooled quickly to 10°C. It is then packaged in sterile containers.
Effects	• Pathogenic bacteria are destroyed • Shelf life is extended (approximately six months if unopened) and it does not require refrigeration • Loss of vitamin C and B-group vitamins • Flavour is slightly altered, as lactose becomes sweeter on heating

Condensed milk

Sweetened, concentrated milk used for making caramel.

Process	Milk is homogenised, pasteurised and 15% sugar is added. It is then evaporated to one-third of its volume, cooled and sealed into cans.
Effects	• Pathogenic bacteria are destroyed • Shelf life is extended (approximately one year if unopened) • Loss of vitamin C and B-group vitamins • Flavour is altered, as lactose becomes sweeter on heating and sugar is added • Increased kilocalorie and carbohydrate content due to sugar added

Evaporated milk

Unsweetened, concentrated milk. Mainly used as a cream substitute.

Process	Milk is pasteurised, evaporated to half its volume then homogenised. It is then sealed into cans and sterilised at 115°C for 20 minutes.
Effects	• Pathogenic bacteria are destroyed • Shelf life is extended (approximately one year if unopened) • Loss of vitamin C and B-group vitamins • Flavour is slightly altered, as lactose becomes sweeter on heating

Dried milk

Go Figure 2'3

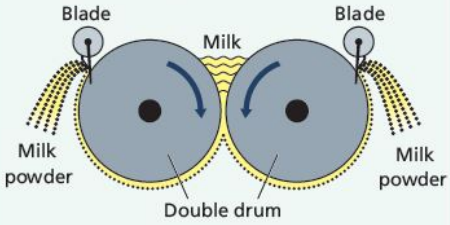
The value of exports for specialised nutritional powders e.g. infant milk formulas, has increased from less than €600m in 2010 to €1.1bn in 2018.

Process

Milk is homogenised and pasteurised. It is then evaporated to 60% of its volume and dried to form a powdered milk. This can be done by either roller drying or spray drying.

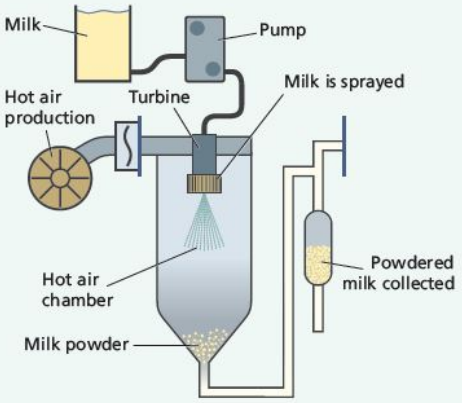
Roller drying

Milk is poured onto heated rotating metal rollers that dry the liquid milk to a powder. The milk powder is then scraped off the rollers, cooled and packaged in airtight containers.



Spray drying

Milk is sprayed into a hot air chamber (165°C) that instantly evaporates the water in the milk, forming a powder that falls to the bottom of the chamber. The milk powder is cooled and packaged in airtight containers.



Effects

Roller-dried milk does not reconstitute easily when stirred with water

Spray-dried milk reconstitutes easily when stirred with water

- Pathogenic bacteria are destroyed
- Some loss of B-group vitamins and amino acids
- Long shelf life due to water extraction (2–10 years)
- Does not taste the same as fresh milk

Guidelines for buying milk

- Buy milk from a retailer that has a strict food hygiene and safety policy.
- Check the use-by date.
- Buy milk in small amounts.
- Ensure packaging is properly sealed.
- Buy near the end of the shopping trip.

Guidelines for storing milk

- Store milk in a fridge at 4°C.
- Avoid mixing milks with different use-by dates.
- Keep milk covered and away from strong-smelling foods.
- Use within two to three days.

Spoilage of milk

- Occurs when naturally present lactic acid bacteria breaks down the lactose in milk, forming lactic acid.
- This causes milk to develop an unpleasant taste and to curdle.
- Milk may also spoil during food preparation or cooking due to
    - the addition of an acid, e.g. lemon juice,
    - enzymes, e.g. rennet in cheese-making or
    - heat, e.g. adding milk to very hot coffee.

Culinary uses of milk

- Drinks: e.g. milkshakes, lattes.
- Baking: e.g. scones, bread.
- Puddings and desserts: e.g. crème caramel.
- Sauces: e.g. custard, white sauce.
- Batters: e.g. Yorkshire puddings.
- Soups: e.g. cream of chicken soup, mushroom soup

Heating milk

Guidelines

- Keep a watchful eye on milk while heating - can quickly boil over.
- Avoid overheating, as it may curdle.

Effects:

- Protein coagulates, creating a skin on the surface of milk.
- Bacteria are destroyed.
- Flavour is slightly altered, as lactose becomes sweeter on heating.
- B-group vitamins and vitamin C are lost as they are not heat stable.

Controlling milk quality in Ireland

- The Department of Agriculture, Food and the Marine ensure that milk purchased is fresh, hygienic and free from disease by:
  - ensuring that dairy farms that supply milk to the public are registered with the Department of Agriculture, Food and the Marine
  - inspecting herds and milk-producing premises on dairy farms
  - testing cattle routinely for diseases such as tuberculosis (TB), as these are easily transmitted to humans from milk
  - testing milk routinely for bacterial contamination and residues of antibiotics
  - ensuring dairy farms observe strict codes of hygiene when transporting, processing and storing milk.

Fats, Spreads, Oils

Classification of fats and oils

- **Animal fats (saturated)**: e.g. cream, suet, lard, ghee, butter and dripping
- **Plant oils (mainly unsaturated)**: vegetable oils, e.g. olive and corn; nut oils, e.g. coconut and peanut; seed oils, e.g. rapeseed and sunflower seed; margarine.
- **Marine oils (polyunsaturated)**: e.g. cod liver oil and herring oil.

Average Composition of Fats and Oils

Nutrient	Butter	Cooking oil	Margarine	Low-fat dairy spread
Proteins	0.5%	0.2%	0.2%	0%
Fat	82%	99.9%	81.5%	40%
Carbohydrates	0.5%	0%	0%	0.5%
Vitamins	A, D	0%	A, D (fortified)	A, D
Minerals	Calcium	0%	Calcium	Calcium
Water	15%	0.1%	18%	58%

Nutritional Value of Fats and Oils

Proteins	• Butter and margarine contain trace amounts of high biological value (HBV) protein.
Fat	• The fat content present varies depending on the type of fat or oil, e.g. vegetable oil contains 99%, butter contains 82% and low-fat dairy spreads contain approximately 40%
Carbohydrates	• Lack carbohydrates, for this reason fats and oils are usually served with a carbohydrate-rich food, e.g. bread
Vitamins	• Butter and dairy spreads contain trace amounts of vitamins A and D • Margarine is fortified with vitamins A and D
Minerals	• Butter and margarine contain trace amounts of calcium
Water	• Water content varies depending on the fat content • The higher the water content the less fat present

Dietetic Value of Fats and Oils

- Plant and marine oils contain polyunsaturated fat - helps increase the production of high-density lipoproteins
- Delay hunger, make you feel fuller for longer
- Source of fat-soluble vitamins, especially A and D
- Help form protective layer surrounding delicate organs
- Help supply essential fatty acids, e.g. linoleic acid
- Provide heat and energy to the body
- Animal fats are a source of saturated fat

Manufacture of Vegetable Oil

1. Seed preparation
2. Oil extraction
3. Refined – degumming / centrifuging
4. Bleached
5. Filtered
6. Deodorisers added
7. Packaged and labelled

Manufacture of vegetable oil

1. **Seed preparation:** seeds (e.g. rapeseed) are prepared by being cleaned, ground and crushed through break rollers and heated.
2. **Oil extraction:** oil is removed from seeds by pressing or by the addition of a solvent.
3. **Refined:** oil undergoes a refining process to remove impurities. This includes:
   - **degumming:** the addition of hot water followed by centrifuging (rotating at a high speed), which causes impurities to fall to the bottom
   - **neutralising:** involves mixing oil with an alkali, which changes free fatty acids into insoluble compounds that can be easily removed from oil.
4. **Bleached:** oil is bleached with **Fuller's earth** to lighten the colour.
5. **Filtered:** oil is filtered to produce a clear liquid.
6. **Deodorisers added:** deodorisers are added to remove putrid odours.
7. **Packaged and labelled:** vegetable oil is packaged in containers of varying size, e.g. 500 ml or 1 litre, and materials, e.g. plastic or glass. The packaging is labelled with details including the type of oil, ingredients, storage instructions, allergy advice and nutritional information.

Lit Hit

Fuller's earth is any clay material that has the ability to absorb impurities or colouring bodies from fats.

Remember It!

Several Oils Require Bleaching and Filtering During Production.

Seed preparation, Oil extraction, Refined, Bleached, Filtered, Deodorisers added, Packaged and labelled.

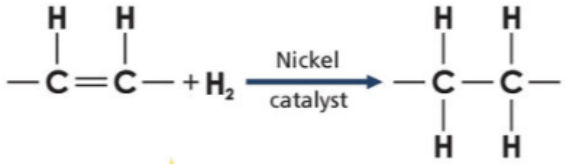
Manufacture of Margarine

Manufacture of margarine

1. **Oil extraction:** oils from various sources, e.g. olives and rapeseed, are extracted and refined to remove impurities. The oils chosen depend on the desired final properties, e.g. plasticity or low cholesterol.
2. **Hydrogenated:** oil is hydrogenated by forcing hydrogen gas through the double bond of an unsaturated oil in the presence of a nickel catalyst, converting it into a saturated, semi-solid fat. Different oils are blended together.
3. **Other ingredients added:** skimmed milk or water is added along with salt, colourings and flavourings. It is also fortified with vitamin A and D.
4. **Emulsification:** an emulsifying agent, e.g. lecithin, is added to prevent the fat and liquid in the margarine from separating.
5. **Churned:** a machine called a votator churns the oil and water-based ingredients together until they form an emulsion. Mixing is carried out until the desired consistency is reached.
6. **Weighed:** margarine is weighed into retail-size portions, e.g. 250 g or 500 g.
7. **Packaged and labelled:** margarine is packaged in varying materials, e.g. plastic or foil. The packaging is labelled with details including the type of margarine, ingredients, storage instructions, allergy advice and nutritional information.

Tip

Margarine is an example of an added-value food.



Vegetable oil

Margarine

Types of Margarine

Block margarine	Soft margarine
• Made mainly from vegetable oil, but can include marine and animal oils • Wrapped in waxed paper or foil • Generally has a high saturated fat content • Used for baking and frying	• Made mainly from vegetable oil, and is designed to spread straight from the fridge • Sold in plastic tubs • Generally has a high saturated fat content (slightly less than block margarine) • Used for baking and frying

Types of Dairy Spreads

Low-fat dairy spreads	Functional dairy spreads
• Contain approximately half the fat (38–40%) of butter and margarine • Ideal for calorie-controlled diets as they contain approximately 95 kcal per 25 g in comparison to 185 kcal in margarine or butter • Ideal for low-cholesterol diets as they are low in saturated fat and high in monounsaturated fatty acids • Not suitable for baking and frying due to their high water content 	• Scientifically proven to lower cholesterol levels in the body due to the presence of plant sterols (stanol ester) that prevent the absorption of cholesterol in the small intestine • Contain approximately 60% fat • Ideal for calorie-controlled diets, as they contain approximately 131 kcal per 25 g in comparison to 185 kcal in margarine or butter • Ideal for low-cholesterol diets as thet are low in saturated fat and high in polyunsaturated fatty acids • Suitable for baking and frying due to their lower water content 

Guidelines for storing Fats and Oils

- Store oils in a cool, dark cupboard and fats in a fridge at 4°C
- Keep covered, as fats and oils go rancid when exposed to air (oxidative rancidity).
- Store fats and oils away from strong-smelling foods, such as blue cheese, to prevent them absorbing odours.
- Use within the best before date as after this date they could be rancid.

Culinary Uses of Fats and Oils

- **Flavour:** fats and oils add flavour to food, e.g. potatoes and salads.
- **Frying:** oils are suitable for shallow- and deep-frying, due to their high boiling points.
- **Emulsions:** fats and oils create emulsions when mixed with water or vinegar, e.g. mayonnaise.
- **Aeration:** fats assist with the aeration of cakes, as they can entrap air, producing a well-risen end product.
- **Shortening:** fat gives a crumbly texture to pastry, cakes and biscuits by acting as a shortening agent.
- **Anti-staling:** fats and oils act as anti-staling agents, preventing baked goods, e.g. cakes, from drying out.

Guidelines for Cooking with Fats and Oils

- Avoid overheating fats and oils as they will start to decompose, causing them to reach smoke point and flash point.

Exam Questions
2008 Section B Q1
2011 Section B Q1
2017 Section B Q2

Carbohydrates

Photosynthesis

Equation for photosynthesis

$$\underset{\text{Carbon dioxide}}{6CO_2} + \underset{\text{Water}}{6H_2O} \xrightarrow[\text{Chlorophyll}]{\text{Light energy}} \underset{\text{Glucose}}{C_6H_{12}O_6} + \underset{\text{Oxygen}}{6O_2}$$

Elemental composition and classification of carbohydrates

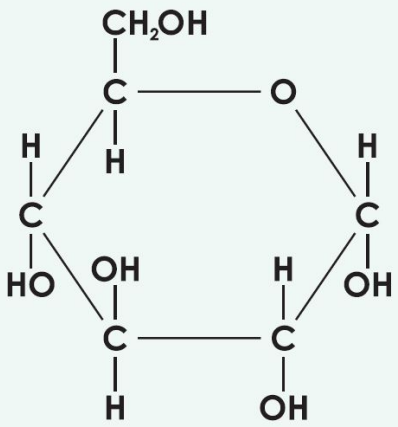
- Carbohydrates are made up of three elements: carbon (C), hydrogen (H) and oxygen (O).
- All carbohydrates are based on simple sugar units. Carbohydrates are classified into three main groups: **monosaccharides**, **disaccharides** and **polysaccharides**.

Monosaccharides

Structure	Chemical formula	Examples	Sources
A simple sugar that contains **one** single sugar unit. It is the smallest unit of a carbohydrate.	$C_6H_{12}O_6$	Glucose	Fruit
		Fructose	Fruit and honey
		Galactose	Digested milk

HL

Chemical structure

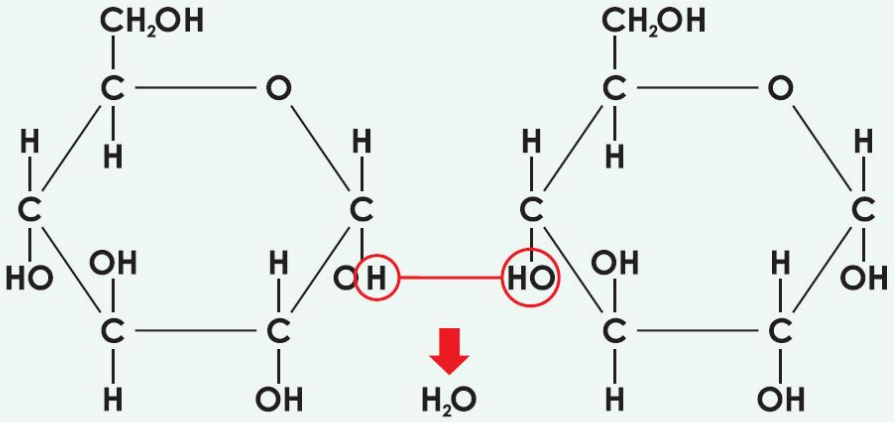


Disaccharides

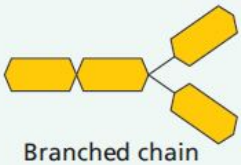
Structure	Chemical formula	Examples	Sources
Formed when **two** monosaccharides join, resulting in the loss of a water (H_20) molecule (condensation reaction)	$C_{12}H_{22}O_{11}$	Maltose (glucose + glucose)	Barley
		Sucrose (glucose + fructose)	Table sugar
		Lactose (glucose + galactose)	Milk

HL

Chemical structure



Polysaccharides

Structure	Chemical formula	Examples	Sources
Formed when **three or more** monosaccharides join together, resulting in the loss of a water (H_2O) molecule with each new link (condensation reaction). Chains can be straight or branched.  Straight chain  Branched chain	$(C_6H_{10}O_5)n$ (n refers to the number of monosaccharides joined together)	Starch	Cereals and potatoes
		Pectin	Fruit and nuts
		Glycogen	Meat
		Gums	Plants and seaweed
		Cellulose (dietary fibre)	Skins of fruit and vegetables

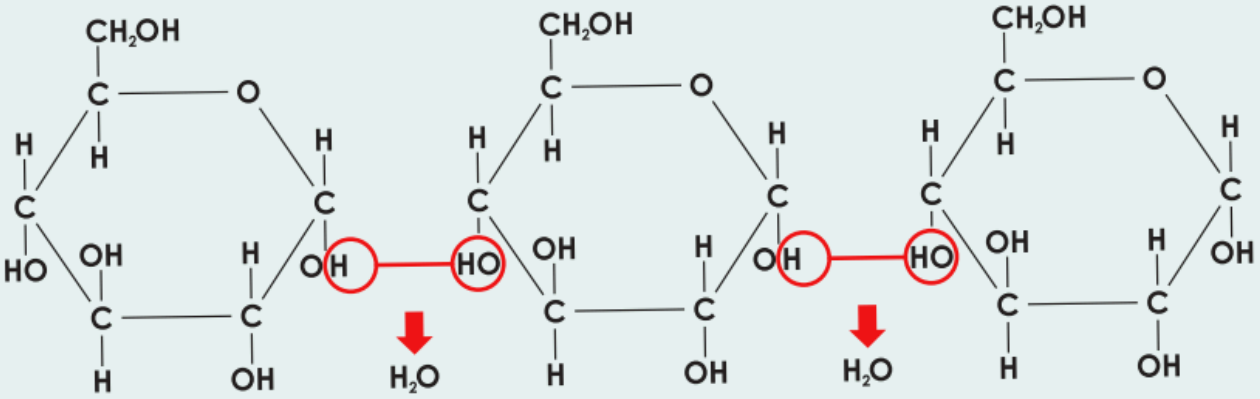
Remember It!

Starchy Potatoes Give Great Cellulose.

Starch, Pectin, Glycogen, Gums, Cellulose.

Polysaccharides – Chemical structure

Chemical structure



Write a brief note on (a) pectin, (b) starch,
(c) glycogen and (d) cellulose

(a) Pectin

- Pectin is a polysaccharide found in fruit and vegetables.
- It is involved in setting jams and jellies.
- The following shows the pectin change in the ripening of fruit:

Under-ripe to **ripe** to **over-ripe**
Protopectin to **pectin** to **pectic acid**
(pectose)

- For pectin extraction:
  1. Use fruit rich in pectin, e.g. blackcurrants and apples
  2. Heat needs to be applied to the fruit
  3. Add an acid, e.g. lemon juice changes protopectin to pectin.

(b) Starch

- Starch is a polypeptide chain made up of glucose units.

(c) Glycogen

- Glycogen is the carbohydrate that is stored in the liver of an animal or human.
- Glycogen is the **only** carbohydrate from an animal source and acts as an energy store.

(d) Cellulose

- Can absorb large amounts of water.
- Cannot be digested, but it adds bulk to the diet, i.e. gives a feeling of fullness.
- Aids the removal of waste from the body.
- Is insoluble in water.

Properties of sugar

1. Solubility

- Sugars are white crystalline compounds that are soluble in water.
- Solubility is increased by heating the water.
- A syrup is formed when sugar is heated.

2. Assists aeration

Sugar denatures egg protein, enabling aeration to occur, e.g. in the making of sponge cakes – the egg, when whisked with sugar, becomes aerated.

3. Crystallisation

- This occurs if more sugar is added than can be absorbed by a liquid.
- Crystal particles are formed when the mixture cools.
- Crystallisation is used in the confectionery and sweet industry.

4. Caramelisation

- When sugars are heated, they produce a range of brown substances know as a caramel.
- There are ten gradual changes in sugar between melting and caramelisation.
- These stages occur between 104–177°C.
- Eventually, the heat will cause carbonisation (burning).

5. The Maillard reaction

Sugar (carbohydrate) + amino acid + dry heat = browning of foods, e.g. roast potatoes.

6. Sweetness

Sugar has varying degrees of sweetness based on a point scale using the tasting method:

- Sucrose has a relative sweetness of 100
- Fructose has a relative sweetness of 170
- Lactose has a relative sweetness of 15.

7. Hydrolysis

- Hydrolysis is the chemical breakdown of a molecule by adding water to produce smaller molecules.
- This occurs when water is added to a disaccharide to produce two monosaccharides.
- Hydrolysis is the reverse of the condensation reaction.

8. Inversion

- The hydrolysis of **sucrose** is also known as the **inversion** of sucrose (mixture of glucose and fructose), known as '**invert sugar**'.
- Inversion may be brought about by either: (a) heating sucrose with an acid; or (b) adding the enzyme invertase or sucrose.
- Invert sugar is used in jam production.

Culinary uses of sugar

- Sweetener – desserts, drinks
- Preservative – jam, relish
- Caramelisation – caramel custard, crème brûlée
- Fermentation – yeast bread, wine-making
- Gel formation – sugar combines with pectin to form gel (jam-making)
- Colour – a sugar solution prevents discolouration of cut fruit

Properties of starch

- Solubility
- Flavour
- Hygroscopy
- Gelatinisation
- Hydrolysis
- Dextrinisation

1. Flavour
Starch (a white powder) is not sweet in flavour.

2. Solubility
Starch is insoluble in cold water.

3. Hygroscopic
This property relates to how starch absorbs moisture from the air, e.g. biscuits soften if they are not kept airtight.

4. Dextrinisation

- Dextrins are shorter chains of starch.
- On heating, dextrins form longer chains and become brown-coloured substances called pyrodextrins.
- An example of dextrinisation is toasting bread.

5. Hydrolysis

- Hydrolysis is a chemical breakdown of a molecule caused by adding water to produce smaller molecules.
- Disaccharides become monosaccharides partly due to hydrolysis.

6. Gelatinisation

- Gelatinisation is based on the principal that when starch is heated in the presence of water, starch grains swell, burst and absorb the liquid, resulting in the thickening of the liquid.
- As the temperature rises, this mixture becomes even more viscous, forming a sol. (A sol contains particles that do not fully dissolve but are evenly dispersed throughout the liquid.)
- On cooling, this becomes a gel.
- An example of this is using flour to thicken soups and sauces.

Culinary uses of starch

Thickener – sauces, soups, stews.
Hygroscopic – absorbs moisture to increase shelf of cakes, keeps baking powder dry.
Dextrinisation – browning, e.g. toast.

Properties of non-starch polysaccharides

- Cellulose/dietary fibre
- Gums
- Pectin

Cellulose:

- Can absorb large amounts of water
- Cannot be digested, however it adds bulk to the diet (gives a feeling of fullness)
- Aids the removal of waste from the body
- Is insoluble in water.

Effects of heat on carbohydrates

Dry heat	• Maillard reaction (sugar), e.g. roast beef • Caramelisation (sugar), e.g. crème caramel • Dextrinisation (starch), e.g. toast
Moist heat	• Syrup formation (sugar), e.g. syrup in canned peaches • Gelatinisation (starch), e.g. white sauce • Cellulose softens (non-starch polysaccharides), e.g. potatoes • Pectin extraction (non-starch polysaccharides), e.g. jam

Biological functions of carbohydrates

- Supply body with heat and energy
- Protein sparing function
- Cellulose/dietary fibre prevent constipation
- Excess carbohydrate stored in liver as glycogen

Carbohydrates – RDA/RI, Energy value and associated dietary disorders

- Recommended Daily Allowance (RDA)/Reference Intake (RI):
  - adults **260g per day** of which sugars only 90g and of which cellulose/dietary fibre should be 25-35g
- Energy value:
  - 1g carbohydrate = **4kcal** (17kj)
- Associated dietary disorders:
  - Too much sugar/starch can lead to obesity, type 2 diabetes, dental cavities. Too little cellulose/dietary fibre can lead to bowel disorders.

RI of fibre

- 25–30 g per day.

Digestion of carbohydrates

Organ or gland	Secretion	Enzymes	Substrate	Product
Salivary glands (mouth)	Saliva	Salivary amylase	Starch	Maltose
Pancreas	Pancreatic juice	Amylase	Starch	Maltose
Small intestine (ileum)	Intestinal juice	Maltase Sucrase Lactase	Maltose Sucrose Lactose	Glucose Glucose and fructose Glucose and galactose

Absorption and utilisation of carbohydrates

- After digestion the monosaccharides glucose, fructose and galactose are ready to be absorbed by the small intestine. They pass through the wall of the villi and into the bloodstream.
- Next the hepatic portal vein transports the monosaccharides to the liver via the bloodstream.
- In the liver, fructose and galactose are converted to glucose. The glucose is then:
  - oxidised to produce heat and energy
  - converted to glycogen and stored in the liver and muscles as a long-term energy reserve.
- Excess glucose is converted to fat and stored as adipose tissue under the skin, insulating the body and acting as an energy reserve.

Questions:
2017 Section B Q1 (b)
2012 Section B Q1 (b)

Fruit and Vegetables

Classification of Fruit

Citrus fruit: e.g. oranges, satsumas, clementines, lemons, grapefruits and limes.
Berry fruit: e.g. strawberries, cranberries, blackcurrants and gooseberries.
Hard fruit: e.g. apples and pears.
Stone fruit: e.g. plums, peaches, cherries, nectarines and avocados.
Dried fruit: e.g. raisins, sultanas, dates and prunes.
Other: e.g. pineapples, kiwis, grapes and melons

Average Nutritional Composition of Fruit

Nutrient	Citrus fruit	Berry fruit	Hard fruit	Dried fruit
Proteins	1%	0.5%	0.5%	2–4%
Fat	0%	0%	0%	0%
Carbohydrates	1%–9%	5–10%	10–12%	40–70%
Vitamins	A, B group, C	A, B group, C	A, C	A, B group
Minerals	Calcium, iron	Calcium, iron	Calcium, iron	Calcium, iron
Water	90–95%	90–95%	88–90%	15–20%

Nutritional Value of Fruit

Proteins	• Contains trace amounts of low biological value (LBV) protein
Fat	• Lacks fat, due to its high water content. Avocados are an exception, as they contain polyunsaturated fat.
Carbohydrates	• Contains sugar, starch, dietary fibre and pectin in varying amounts • Starch is generally found in unripe fruit, but it changes to sugar on ripening • Sugar is present in all fruit in the form of glucose, sucrose and fructose. Dried fruit has a higher percentage of sugar. • Dietary fibre is mainly present in the skins of fruit, making pears and apples an excellent source • Pectin is present in high amounts in certain fruits, e.g. blackberries and gooseberries

Vitamins	• Fruit, especially berry fruit and citrus fruit, contains an excellent source of vitamin C • Orange or red coloured fruits, e.g. peaches, are an excellent source of vitamin A (beta-carotene) • Contains varying amounts of B-group vitamins, e.g. berry and citrus fruit are a good source of niacin (B3) and folate and bananas are a good source of pyridoxine (B6) • Lacks vitamins D and B12 (cobalamin)
Minerals	• Contains a small amount of calcium • Dried fruits, e.g. prunes, are a good source of non-haem iron • Bananas contain potassium
Water	• High water content • Dried fruit contains much less water

Classification of Vegetables

- **Leafy green vegetables:** e.g. spinach, cabbage, kale, brussels sprouts
- **Flower vegetables:** e.g. broccoli, cauliflower, artichoke
- **Root vegetables:** e.g. beetroot, carrot, parsnip, celeriac
- **Tuber vegetables:** e.g. potato, radish.
- **Bulb vegetables:** e.g. onion, garlic.
- **Fruit vegetables:** e.g. pepper, chilli, courgette, aubergine, tomato.
- **Stem vegetables:** e.g. asparagus, celery.
- **Pulse vegetables:** e.g. peas, beans, lentils
- **Fungi:** e.g. mushrooms, truffles.

Average Nutritional Composition of Vegetables

Nutrient	Leafy green vegetables	Root vegetables	Fruit vegetables	Pulse vegetables
Proteins	3%	1%	1%	2–44%
Fat	0%	0%	0%	0-8%
Carbohydrates	2%	5–10%	2–5%	3-60%
Vitamins	A, B group, C	A, B group, C	A, B group, C	A, B group, C
Minerals	Calcium, iron	Calcium, iron	Calcium, iron	Calcium, iron
Water	90–95%	70–90%	90–95%	14–19%

Nutritional Value of Vegetables

Proteins	• Contain small amounts of LBV protein • Pulses have the highest LBV content • Soya beans are the exception as they contain high biological value (HBV) protein
Fat	• Lack fat, due to their high water content • Olives and soya beans are exceptions as they are a source of polyunsaturated fat
Carbohydrates	• Contain starch, dietary fibre and sugar in varying amounts • Pulse, root and tuber vegetables provide starch in high quantities • Dietary fibre is mainly present in the skins of vegetables, e.g. potatoes. Pulses are also an excellent source of dietary fibre • Carrots, tomatoes, peppers and onions contain small amounts of sugar

Vitamins	• Vitamin C is present in all vegetables, especially green leafy vegetables, tubers, pulses and fruit vegetables • Contain varying amounts of B-group vitamins, e.g. pulses are a good source of thiamine (B1), riboflavin (B2) and pyridoxine (B6); mushrooms are a good source of riboflavin (B2) and niacin (B3); and leafy green vegetables are a source of folate • Leafy green vegetables and orange- or red-coloured vegetables, e.g. carrots and peppers, are an excellent source of vitamin A (beta-carotene) • Lack vitamins D and B12 (cobalamin)
Minerals	• Contain a small amount of calcium, especially leafy green vegetables, root vegetables and pulses • Leafy green vegetables and pulses are a good source of non-haem iron
Water	• High water content

Dietetic Value of Fruit and Vegetables

- Valuable source of LBV protein
- Excellent source of dietary fibre
- Most fruit and vegetables contain no fat and are low in kilocalories
- Soya beans and avocados contain polyunsaturated fat
- Supply the antioxidants vitamin A (beta-carotene) and vitamin C
- Available in a variety of types and forms, e.g. fresh and processed
- Fruit and vegetables are a versatile food, can be eaten raw
- Some fruit and vegetables, e.g. bananas and carrots, are inexpensive - economical food

- Some fruits, e.g. pineapples, can be high in sugar – not suitable for diabetics
- Fruit and vegetables lack vitamin D and cobalamin (B12)

Guidelines for Buying Fruit and Vegetables

- Buy fruit and vegetables from a retailer that has a strict food hygiene and safety policy
- Buy fruit and vegetables that are fresh, brightly coloured and firm to the touch
- Buy medium-sized fruit and vegetables
- Buy fruit and vegetables in small amounts.
- Purchase fruit and vegetables loose or in netted packaging
- Choose fruit and vegetables that are in season – taste better/cheaper
- Buy locally produced fruit and vegetables where possible to reduce carbon emissions from air miles.

Guidelines for Storing Fruit and Vegetables

- Remove fruit and vegetables from plastic packaging to allow air circulation
- Remove any discoloured fruit and vegetables before storage
- Store fruit and vegetables in a cool, dry, dark place
- Minimise the amount of time fruit and vegetables are in storage

Guidelines for Preparing Fruit and Vegetables

- Prepare fruit and vegetables close to cooking/serving time
- Avoid soaking in water
- If possible, avoid peeling
- Use a sharp knife to chop fruit and vegetables as this minimises damage to the cell wall, reducing oxidation and maintaining vitamin C levels.

Culinary Uses of Fruit and Vegetables

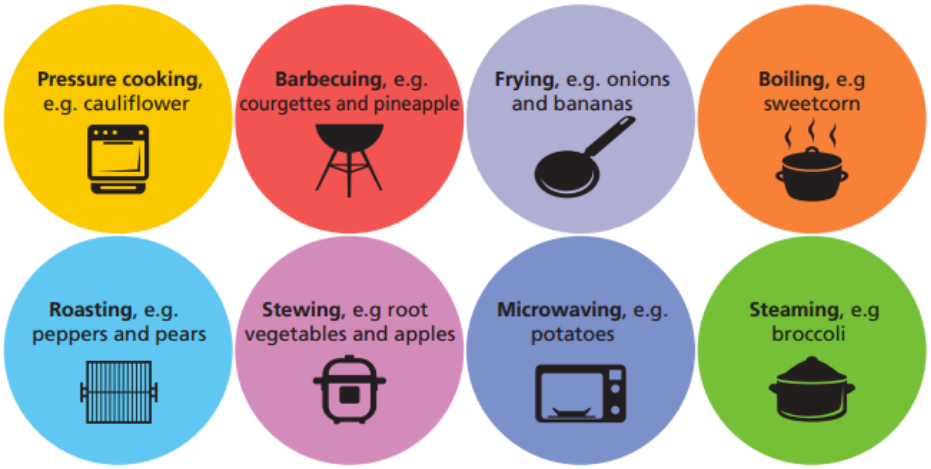
Fruit

- Drinks: e.g. juices, smoothies.
- Baking: e.g. apple crumble, pear tart.
- Desserts: e.g. pavlova, sponge cake.
- Sauces: e.g. strawberry sauce (coulis), cranberry sauce.

Vegetables

- Soups: e.g. winter vegetable soup, roasted red pepper soup.
- Salads: e.g. broccoli salad, coleslaw.
- Savoury dishes: e.g. roast vegetable lasagne, mushroom risotto.

Suitable Methods for Cooking Fruit and Vegetables



Guidelines for Cooking Fruit and Vegetables

- Eat fruit and vegetables raw where possible
- Cook fruit and vegetables quickly in the least amount of water possible
- Cover fruit and vegetables with a tightly fitted lid when boiling
- Avoid copper or brass saucepans – react with vitamin C
- Do not discard the water from boiling vegetables
- Avoid overcooking vegetables, ideally serve al dente.
- Do not add bicarbonate of soda to green vegetables to enhance colour

Effects of Cooking on Fruit and Vegetables

- Dry heat causes starch grains to swell, burst and become soft. Moist heat causes starch cells to absorb liquid, resulting in softening.
- Cellulose in the cell walls softens, making fruit and vegetables more digestible and easier to eat.
- Some vitamins, especially vitamin C, are lost, as they are not heat stable. Some minerals are lost, as they dissolve into the cooking liquid.
- Microorganisms and enzymes are destroyed.
- Overcooking vegetables causes them to lose their colour and texture, and dilutes their flavour.

Fruit and Vegetable Processing

Freezing	
Process	Fruit and vegetables can be frozen by commercial blast methods, e.g. freezing at –30°C, or by being blanched and then home frozen at –25°C.
Effect	• Colour and flavour remains unchanged • Change in texture due to blanching • Microorganisms are inactivated. Enzymes are destroyed if fruit and vegetables are blanched. • Some loss of B-group vitamins and vitamin C due to blanching and through drip loss when thawed
Examples	• Peas • Mixed berries • Frozen fruit and vegetable products, e.g. frozen fruit yoghurt and vegetable burgers

Canning	
Process	Fruit and vegetables are placed in sterile cans, sealed and heated to high temperatures. They may be canned in brine, spring water or a sauce, e.g. tomato sauce or sugar syrup.
Effect	• Microorganisms and enzymes are destroyed • Colour, flavour and texture are altered • Loss of B-group vitamins and vitamin C • Calorie, fat and sugar content can increase, depending on what liquid is used for canning the fruit or vegetables
Examples	• Kidney beans • Strawberries • Tomatoes • Pineapples

Drying	
Process	Fruit and vegetables have their moisture content removed. This can be completed by fluidised bed drying, accelerated freeze drying or sun drying.
Effect	• Colour, flavour and texture are altered • Microorganisms and enzymes are destroyed • Loss of B-group vitamins and vitamin C 
Examples	• Lentils • Tomatoes • Raisins • Banana chips • Kale crisps

Irradiation	
Process	Fruit and vegetables are exposed to low levels of radiation (gamma rays)
Effect	• No effect on colour, flavour and texture • Microorganisms and enzymes are destroyed • Slows down the ripening and sprouting of fruit and vegetables, so shelf life is extended • Some loss of B-group vitamins and vitamin C 
Examples	• Onions • Potatoes • Rhubarb • Peaches

Ripening and Decaying Fruit

- Enzymic action: unripe – ripe – overripe – decayed
- Unripe fruit has a high content of starch
- As fruit ripens:
  - starch is converted to sugar
  - colour changes
  - texture changes
  - insoluble protopectin changes to pectin
  - ethylene gas is produced by some fruits
- Once ripe, fruit will stay wholesome for a limited time period before decay sets in.

Grading Fruit and Vegetables

There are three general grades under EU legislation.
Class extra: superior quality. Shape, size and colour must be at an optimum level.
Class I: good quality. A slight defect in shape, size and colour is permitted.
Class II: reasonable quality. Some minor defects in shape, size and colour are permitted.

Organic Fruit and Vegetables

- Grown without the use of any artificial fertilisers, pesticides or preservatives.
- Tend to be more expensive.
- Producers must ensure farming practices meet EU regulations.
- Certification bodies, e.g. Irish Organic Farmers and Growers Association (IOFGA), carry out inspections and implement certification.
- By law, organic fruit or vegetables, sold in Ireland must display:
    - the European Union's Euro Leaf organic logo
    - a certification code from the certification organisation,
    - the place of farming
    - the words 'certified organic'

Types of Pulses and Nuts

Pulses

- Beans (oval or kidney shaped), e.g. soya, kidney
- Peas (round shaped), e.g. chickpeas and garden peas.
- Lentils (flat discs), e.g. red and yellow lentils.

Nuts

- Almonds
- Pistachio nuts
- Pecans
- Brazil nuts
- Cashew nuts
- Hazelnuts
- Macadamia nuts

Nutritional Value of Pulses

Proteins	• A source of LBV protein • Soya beans are the exception, as they contain HBV protein
Fat	• Lack fat • Soya beans are the exception, as they are a source of polyunsaturated fat
Carbohydrates	• Contain starch and dietary fibre
Vitamins	• A good source of B-group vitamins, particularly thiamine (B1), riboflavin (B2) and pyridoxine (B6) • Pulses contain vitamin C. If pulses have been processed, e.g. canned, vitamin C is lost.
Minerals	• A source of non-haem iron • Contain a small amount of calcium
Water	• Water content varies depending on the type of pulse, but it is generally quite low

Nutritional Value of Nuts

Proteins	• Contain small amounts of LBV protein
Fat	• High in polyunsaturated fat
Carbohydrates	• Dietary fibre is present
Vitamins	• Contain a small amount of B-group vitamins • Lack vitamin C
Minerals	• A source of non-haem iron • Contain calcium
Water	• Low water content

Dietetic Value of Nuts

- Source of LBV protein
- Good source of dietary fibre
- Nuts contain polyunsaturated fat
- Available in a variety of forms
- Versatile food

Culinary Uses of Pulses and Nuts

Pulses

- Soups: e.g. pea soup, red lentil soup.
- Savoury dishes: e.g. chilli con carne, tarka dahl.
- Dips: e.g. refried bean dip.

Nuts

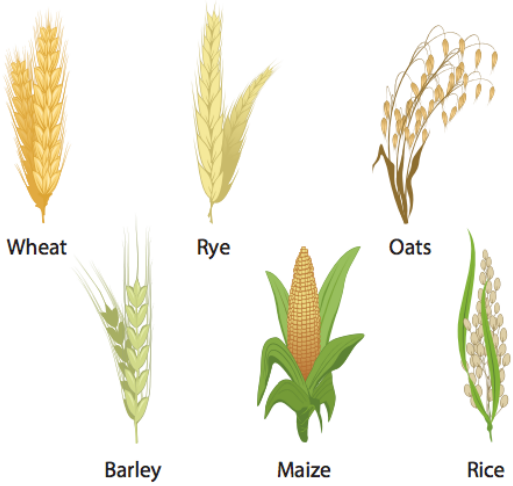
- Garnish: e.g. doughnuts, coffee cake.
- Salads: e.g. Waldorf salad.
- Savoury dishes: e.g. nut loaf, pilaf.
- Desserts: e.g. pecan pie, baklava.

Guidelines for Storing Pulses

- Store dried pulses in an airtight container out of direct sunlight.
- Store canned pulses in a cool cupboard.
- Use within the best before date.

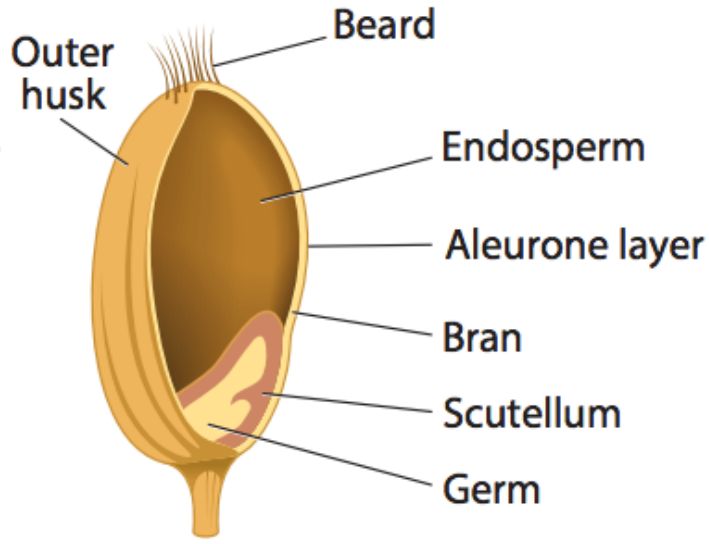
Cereals

Types of cereals



Structure of wheat grain

- Bran (13%)
- Endosperm (85%)
- Germ (2%)



▲ Structure of a wheat grain

Types of wheat

- Winter wheat: main wheat grown, less than 10% protein (gluten), grown in climates with milder winters, e.g. Ireland.
- Spring wheat: higher protein (gluten) content of 12–14%, grown in climates that have cold winters and hot summers, e.g. North America.

Average nutritional composition of wheat

Proteins	Fat	Carbohydrates	Vitamins	Minerals	Water
12%	2.5%	71%	B group, E	Calcium, iron, phosphorus	12%

Nutritional value of cereals

Proteins	• A source of low biological value (LBV) protein • The main protein in wheat and rye is gluten. The essential amino acids lysine, threonine and tryptophan are lacking in cereal grains. • Cereals should be eaten in combination with other LBV foods to ensure a full complement of essential amino acids
Fat	• The germ is a source of polyunsaturated fat that contains essential fatty acids, e.g. linoleic acid
Carbohydrates	• An excellent source of carbohydrates, particularly starch (64%) • The outer husk contains dietary fibre. This is removed during the refining process.
Vitamins	• A good source of B-group vitamins, particularly thiamine (B1), riboflavin (B2) and niacin (B3) • A small amount of vitamin E is found in the germ • Lacks vitamin C
Minerals	• A source of calcium, iron and phosphorus
Water	• The water content varies slightly between different grains, but it is generally low

Dietetic value of cereals

- Excellent source of starch.
- Outer husks of cereals provide an excellent source of dietary fibre
- Contain polyunsaturated fat
- Valuable source of LBV protein
- Versatile food
- Inexpensive - an economical food.
- Phytic acid in cereals can inhibit the absorption of calcium and iron
- Gluten cannot be digested by coeliacs

Guidelines for buying cereal products

- Buy from a retailer with a strict food hygiene and safety policy.
- Check the best before date.
- Ensure packaging is properly sealed

Guidelines for storing cereal products

- Store cereal products, in a cool, dry, well-ventilated space.
- Once opened, store cereal products in an airtight container. Label with the name of the cereal product and best before date.
- Use within the best before date.

Effects of cooking on cereals

- Moist heat causes starch grains to swell, burst and absorb the cooking liquid, e.g. roux sauce.
- Dry heat causes starch grains to swell, burst and absorb fat, e.g. pastry and popcorn.
- Cellulose and starch softens, making it easier to digest, e.g. wholegrain rice.
- Protein (gluten) coagulates in dry heat. This sets cakes and breads.
- Some B-group vitamins are lost, as they are not heat stable.
- Dextrinisation of starch and caramelisation of sugar causes browning on the surface of breads and cakes.

Wheat processing: Stage 1: wholemeal flour production

Preparation

1. Screened
2. Cleaned

Milling

1. Conditioned
2. Blended
3. Break rolled

Wheat processing: Stage 2: white flour production (refining process)

1. Sifted and purified
2. Reducing rollers
3. Air classified
4. Addition of additives
5. Packaged and labelled

Stage 1: wholemeal flour production

Preparation

1. **Screened:** sieves remove sticks, stones, dust, soil and dirt from the wheat grains.
2. **Cleaned:** wheat grains are **scoured** to remove the beard and washed.

> **Lit Hit**
> Scoured means cleaned by scrubbing.

Milling

1. **Conditioned:** wheat is often too dry for milling, so it is conditioned by adding water to make it easier to roll and mill.
2. **Blended:** different wheat types are blended. This blend is referred to as a grist.
3. **Break rolled:** wheat grains pass through rotating metal ridged rollers that peel them open, releasing the endosperm without breaking the outer bran layers into pieces. At this point wholemeal flour is produced.

Wheat flour

Remember It!

Starchy Cereals Can Be Beneficial.

Screened, Cleaned, Conditioned, Blended, Break rolled.

Stage 2: white flour production (refining process)

1. **Sifted and purified:** the opened wheat grains pass through a series of rotating sieves, starting with a coarse mesh sieve to separate the bran and germ from the rough endosperm (semolina). Air is blown through the grain to help separate the lighter particles (bran) from the heavier particles (rough endosperm). The bran and germ can now be packed and sold separately.
2. **Reducing rollers:** the remaining rough endosperm is ground by smooth steel-reducing rollers. This produces a fine flour.
3. **Air classified:** air is introduced to create a lighter flour.
4. **Addition of additives:** bleaching agents, e.g. calcium carbonate, are added to whiten the flour. Nutritive additives, e.g. calcium, are added to replace the nutrients lost during milling. Improvers, e.g. vitamin C, are added to improve the quality of the gluten in the flour.
5. **Packaged and labelled:** flour is weighed to retail size, e.g. 1 kg or 2 kg, and packaged in varying materials, e.g. paper or cardboard. The packaging is labelled with details including the type of flour, ingredients, storage instructions, allergy advice and nutritional information.

Remember It!

Successful Refining Always Alters Products.

Sifted and purified, Reducing rollers, Air classified, Addition of additives, Packaged and labelled.

Wheat products

- Flour
- Wholemeal bread
- Pasta
- Breakfast cereals

Types of flour

Type	Description	Extraction rate (% wholegrain used)	Uses
Stoneground flour	Made by rolling wheat grains though stone rollers instead of metal. Contains all the wheat grain (high dietary fibre content).	100%	• Bread • Scones
Wholemeal flour	Contains all the wheat grain (high dietary fibre content)	100%	• Bread • Scones
Wheatmeal (brown) flour	Some of the bran has been removed, reducing dietary fibre and B-group vitamin content	83%	• Bread • Scones • Pastry
White (plain/ cream) flour	The bran and germ are fully removed, reducing its B-group vitamin and dietary fibre content. Fortified with nutritive additives.	75%	• Bread • Scones • Pastry • Cakes • Biscuits
Self-raising flour	Similar to white flour, but has a raising agent of sodium bicarbonate and cream of tartar added	75%	• Cakes • Biscuits • Scones
Strong flour	Similar to white flour but has a higher gluten content	75%	• Yeast baking, e.g. bread and pizza

Types of rice

Type	Description	Uses
Short-grain rice	A short, plump rice grain that is sticky and moist when cooked	• Rice pudding
Medium-grain rice	A narrower grain than short-grain rice, which becomes sticky and moist when cooked	• Sushi • Risotto
Long-grain rice	A long and slender grain with all of the bran removed. It stays separate and fluffy after cooking.	• To accompany savoury dishes, e.g. stir-fries
Wholegrain (brown) rice	Similar to long-grain rice, except just some of the bran is removed. It takes a long time to cook.	
Pre-cooked/ instant rice	A rice grain that has been fully cooked and then dehydrated. It cooks quickly.	
Basmati rice	A long-grain aromatic rice grown in India and Pakistan	• To accompany savoury dishes, e.g. curries

Rice products

- Breakfast cereals, e.g. Rice Krispies
- Rice flour
- Rice pudding
- Rice paper
- Rice cakes

Oats, maize, rye and barley

Oat products	Maize products	Rye products	Barley products
• Porridge • Oat cakes • Flapjacks • Granola • Oat flour	• Cornflour • Sweetcorn • Breakfast cereals, e.g. cornflakes • Popcorn	• Rye flour • Rye bread • Rye crispbread	• Malt vinegar • Barley water • Barley flour

Questions:

Fruit and Vegetables
2019 Section B Q2
2012 Section B Q2
2008 Section B Q2