

Human nutrition

IGCSE Biology 0610 · Topic 7 revision notes

Everything from the 5 lessons of this topic on a few pages: the key idea of each lesson, the diagram to remember, the points to learn and the traps examiners set. Read it, cover it, test yourself.

1. Diet

2. The digestive system

3. Physical digestion

4. Chemical digestion

5. Absorption

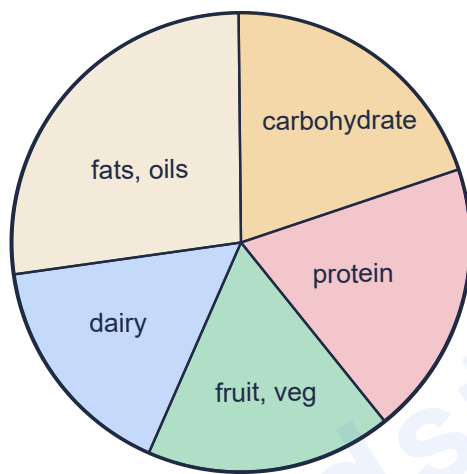
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1 Diet

Syllabus 7.1

A **balanced diet** contains all the nutrients (carbohydrates, fats and oils, proteins, vitamins, mineral ions, fibre and water) **in the correct proportions and amounts** to stay healthy, and supplies enough energy for the person's needs. **Scurvy** is caused by a lack of vitamin C; **rickets** is caused by a lack of vitamin D or calcium.

seven parts of a balanced diet



carbohydrate: energy

fats, oils: stored energy

protein: growth, repair

vitamin C: lack → scurvy

vitamin D: lack → rickets

calcium: bones, teeth

iron: haemoglobin

fibre: bulk, peristalsis

water: solvent, transport

Fig. 1: the main food groups on a plate and what each nutrient is for

Source, job, deficiency.

- ✓ **Balanced diet:** all the nutrients in the correct proportions and amounts.
- ✓ **Energy:** carbohydrates and fats;
growth and repair: proteins.
- ✓ **Scurvy** = lack of vitamin C; **rickets** = lack of vitamin D or calcium.
- ✓ **Fibre** is not digested: it adds bulk for peristalsis and prevents constipation.

Watch out!

A balanced diet is not just "eating healthy food" or "eating a bit of everything". You must say it contains all the nutrients in the correct proportions (amounts).

Rickets can be caused by a lack of vitamin D even when there is enough calcium in the diet, because vitamin D is needed to absorb the calcium. Name both possible causes.

2 The digestive system

Syllabus 7.2

Food passes along the **alimentary canal**: mouth, oesophagus, stomach, small intestine (duodenum then ileum) and large intestine (colon, rectum, anus). The **salivary glands, pancreas, liver and gall bladder** are associated organs that the food never passes through. Five processes happen on the way: **ingestion**, **digestion**, **absorption**, **assimilation** and **egestion**.

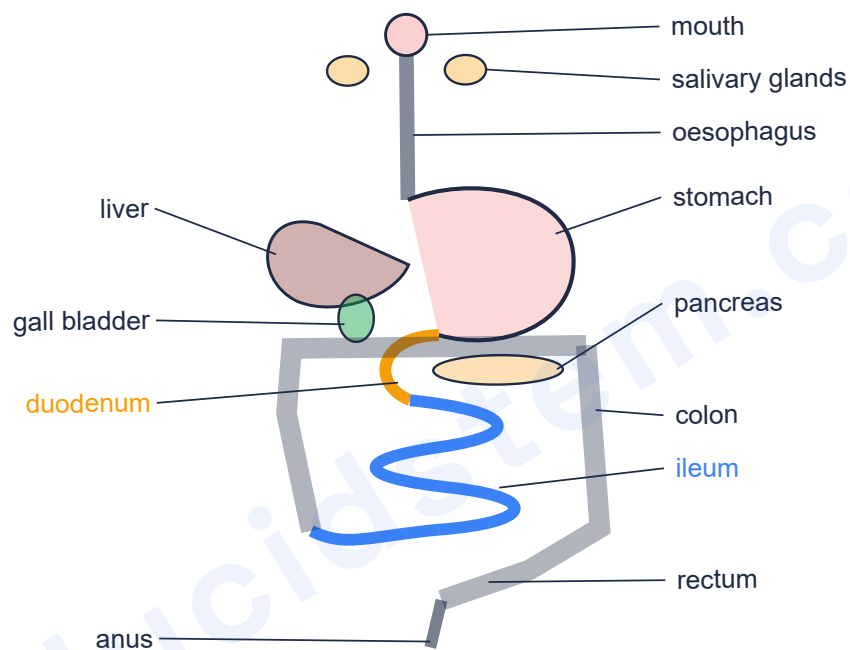


Fig. 1: the human digestive system; the duodenum (amber) and ileum (blue) make up the small intestine

Tube versus glands.

- ✓ **Alimentary canal:** mouth, oesophagus, stomach, duodenum, ileum, colon, rectum, anus.
- ✓ **Associated organs:** salivary glands, pancreas, liver, gall bladder; food does not pass through them.
- ✓ **Absorption** is into the blood; **assimilation** is uptake and use by cells.
- ✓ **Egestion** removes undigested food; it is not excretion.

Watch out!

The liver, pancreas, gall bladder and salivary glands are *not* part of the alimentary canal; food never passes through them. They secrete juices into it.

Egestion is *not* excretion. Faeces are mostly undigested food that never entered the body's cells; excretion removes waste products of metabolism, such as urea and carbon dioxide.

3 Physical digestion

Syllabus 7.3

Physical digestion is the breakdown of food into smaller pieces **without chemical change** to the food molecules. It **increases the surface area** of the food for the action of enzymes in chemical digestion. Teeth start it, the muscular stomach wall continues it by churning and (Extended) bile emulsifies fats into small droplets.

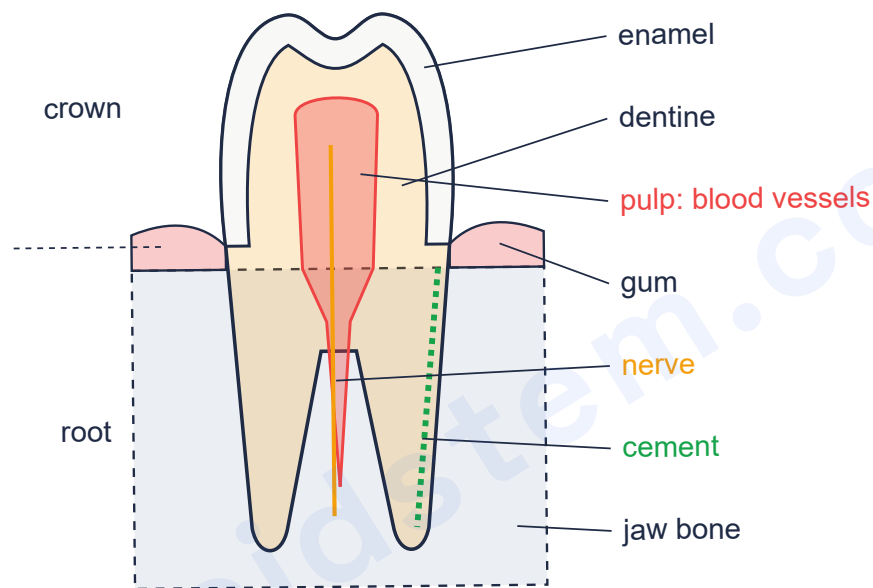


Fig. 1: section through a molar: enamel covers the crown, dentine forms most of the tooth, the pulp holds nerves and blood vessels, and cement fixes the root into the jaw bone

Same molecules, smaller pieces.

- ✓ **Physical digestion:** smaller pieces, no chemical change, larger surface area for enzymes.
- ✓ **Teeth:** incisors cut, canines tear, premolars and molars chew and grind.
- ✓ **Tooth layers:** enamel, dentine, pulp (nerves, blood vessels), cement; embedded in jaw bone and gum.
- ✓ **Extended:** bile emulsifies fat; it is not an enzyme.

Watch out!

Physical digestion does not produce smaller molecules. Only chemical digestion by enzymes breaks large molecules into small ones.

Bile contains no enzymes and does not digest fat. It emulsifies fat, a physical change that increases the surface area for lipase.

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4 Chemical digestion

Syllabus 7.4

Chemical digestion is the breakdown of **large insoluble molecules into small soluble molecules**, which can then be absorbed. **Amylase** breaks down starch to simple reducing sugars, **proteases** break down protein to amino acids and **lipase** breaks down fats and oils to fatty acids and glycerol. **Hydrochloric acid** in gastric juice kills harmful microorganisms in food and provides an acidic pH for the stomach protease.

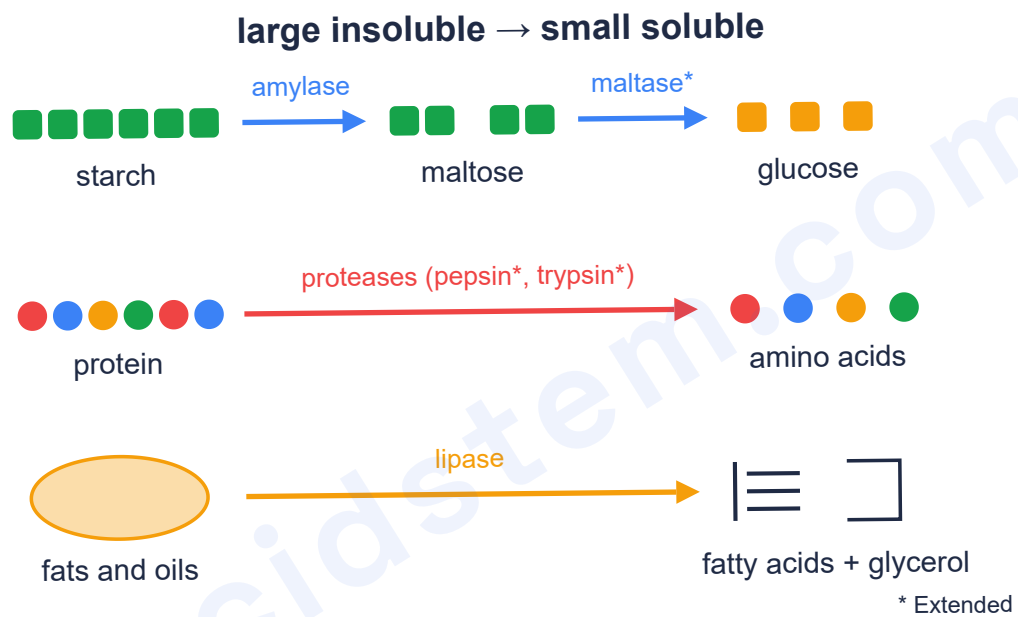


Fig. 1: the three groups of digestive enzymes and their products; starred names are Extended

Enzyme, substrate, product, place.

- ✓ **Amylase:** starch to simple reducing sugars (maltose); salivary glands and pancreas.
- ✓ **Proteases:** protein to amino acids; stomach and pancreas. **Lipase:** fats to fatty acids and glycerol; pancreas.
- ✓ **HCl:** kills microorganisms and gives the acidic optimum pH for the stomach protease.
- ✓ **Extended:** pepsin in acid, trypsin in alkali; maltase on the epithelium; alkaline bile neutralises acid.

Watch out!

Say "proteases break down protein to amino acids", not "to peptides" or "to glucose". And amylase produces simple reducing sugars (maltose), not glucose directly.

Hydrochloric acid is not an enzyme and does not digest protein itself. Its jobs are to kill microorganisms and to provide the optimum pH for the protease.

Pepsin and trypsin are both proteases, but each has a different optimum pH. Pepsin would be denatured or inactive in the alkaline duodenum, and trypsin in the acid stomach.

5 Absorption

Syllabus 7.5

The **small intestine** is the region where nutrients are absorbed. **Most water** is absorbed from the small intestine, but **some is also absorbed from the colon**. Extended: **villi and microvilli** greatly increase the internal surface area of the small intestine; each villus has a one-cell-thick epithelium, a network of **capillaries** that absorb glucose and amino acids, and a central **lacteal** that absorbs fatty acids and glycerol.

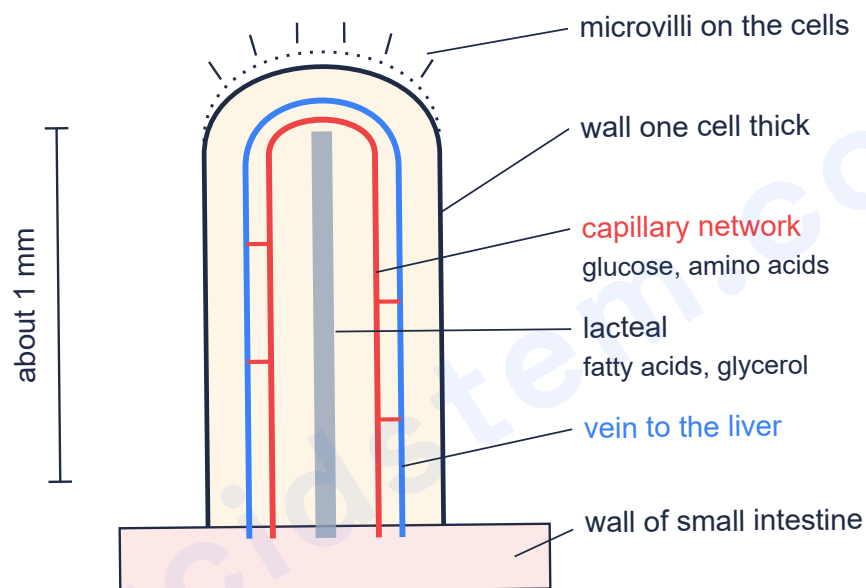


Fig. 1: a single villus; capillaries carry glucose and amino acids to the liver, and the lacteal takes fatty acids and glycerol into the lymph

Two routes out of a villus.

- ✓ **Nutrients:** absorbed in the small intestine.
- ✓ **Water:** most in the small intestine, some in the colon.
- ✓ **Extended:** villi and microvilli increase the internal surface area.
- ✓ **Extended:** capillaries take glucose and amino acids; the lacteal takes fatty acids and glycerol.

Watch out!

Most water is absorbed in the small intestine, not the colon. The colon only absorbs some of the water that remains.

Fatty acids and glycerol go into the lacteal, not the blood capillaries. Glucose and amino acids go into the capillaries. Keep the two routes separate.