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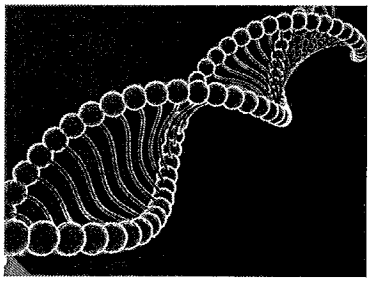


Additional Biology (Year 11) Revision Booklet

GCSE BIOLOGY REVISION

If you want to do well in your GCSE science exam you will need to know the biology section of the syllabus inside out.

SECTION B2.1

All living things are made up of cells. The structures of different types of cells are related to their functions.

To relate the structure of different types of cells to their function in a tissue or an organ.

Most human cells like most other animal cells have the following parts:
- a nucleus which controls the activities of the cell
- cytoplasm in which most of the chemical reactions take place
- a cell membrane which controls the passage of substances in and out of the cell
- mitochondria, which is where most energy is released inrespiration
- ribosomes, which is where protein synthesis occurs.

Plant cells also have a cell wall which strengthens the cell. Plant cells often have:
- chloroplasts which absorb light energy to make food
- a permanent vacuole filled with cell sap.

• The chemical reactions inside cells are controlled by enzymes.
• Cells may be specialised to carry out a particular function.

To get into or out of cells, dissolved substances have to cross the cell membranes.

Dissolved substances can move into and out of cells by diffusion and osmosis.

Diffusion is the spreading of the particles of a gas, or of any substance in solution, resulting in a net movement from a region where they are of a higher concentration.

The greater the difference in concentration, the faster the rate of diffusion.

Oxygen required for respiration passes through cell membranes by diffusion.

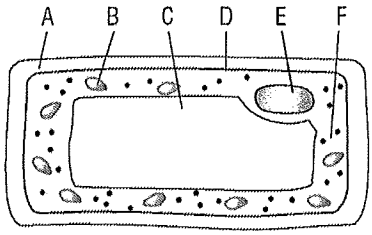
Water often moves across boundaries by osmosis. Osmosis is the diffusion of water from a dilute to a more concentrated solution through a partially permeable membrane that allows the passage of water molecules.

Differences in the concentrations of the solutions inside and outside a cell cause water to move into or out of the cell by osmosis.

Now try these exam style questions

Cells

1 The diagram is of a cell from the leaf of a plant.



(a) Name the structures **D**, **E** and **F**.

.....

.....

.....

(b) (i) What is the name of structure **A**?

.....

(ii) What material is structure **A** made of?

.....

(c) (i) What is the name of structure **C**?

.....

(ii) What is the liquid it contains called?

.....

(d) Structure **B** is a chloroplast. What is its function?

.....

.....

(e) Name two different structures that are found within the material labelled **F**.

.....

.....

(f) (i) A different type of plant cell is a root hair cell. What is the function of this type of cell?

.....

(ii) State one way in which a root hair cell differs from the leaf cell shown in the diagram.

.....

2 Look at the structures listed in the first column of the table below. Fill in the empty columns by putting a tick (✓) if you think it is present and a cross (×) if you think it is absent. .....(6)

Structure	**Animal cell**	**Plant cell**
Nucleus		
Cytoplasm		
Cell wall		
Cell membrane		
Chloroplast		
Permanent vacuole		

3 A student noticed that different trees give different amounts of shade on a sunny day. She decided to investigate three species of tree – oak, sycamore and ash. She thought that the more shading, the better the tree was at gathering light for photosynthesis. She would use a light meter to record the light levels. The student had many things to consider when deciding on a method.

(a) Should she take readings in direct sunlight as well as under the trees? Explain your answer.

.....

.....

.....

(b) Describe the weather that would be most appropriate when collecting the data.

.....

(c) Should the student collect data from one or more than one position? Explain your answer.

.....

(d) Explain why it would be necessary for the student to take as many readings as she could under the trees.

.....

(e) What type of independent variable has the student decided to use?

.....

(f) What type of dependent variable has she decided to use?

.....

(g) How should the student calculate the mean for each set of results?

.....

(h) Suggest how she should present her data.

.....

4 List **A** gives the names of different types of cells found in plants and animals. List **B** gives one special feature of each of these cells. Match each cell type with its feature by writing the relevant letter and number next to one another.

List A		**List B**	
A	Fat cell	**1**	Has a long tail with muscle-like proteins
B	Root hair cell	**2**	Can divide and change into many different types
C	Sperm cell	**3**	Contains chloroplasts
D	Leaf cell	**4**	Can expand up to 1000 times its original size
E	Stem cell	**5**	Contains a chemical called visual pigment
F	Cone cell (in eye)	**6**	Has extension to increase its surface area

SECTION B2.2

Green plants use light energy to make their own food. They obtain the raw materials they need to make this food from the air and the soil.

To interpret data showing how factors affect the rate of photosynthesis and evaluate the benefits of artificially manipulating the environment in which plants are grown.

Photosynthesis is summarised by the equation:

carbon dioxide + water (+ light energy) → glucose + oxygen

During photosynthesis:

- light energy is absorbed by a green substance called chlorophyll which is found in chloroplasts in some plant cells
- this energy is used by converting carbon dioxide and water into sugar (glucose)
- oxygen is released as a by-product.

The rate of photosynthesis may be limited by:
- low temperature
- shortage of carbon dioxide
- shortage of light.

Light, temperature and the availability of carbon dioxide interact and in practice any one of them may be the factor that limits photosynthesis.

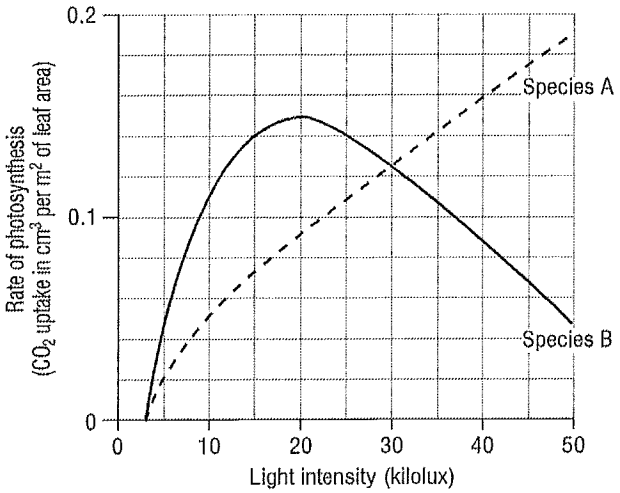
The glucose produced in photosynthesis may be converted into insoluble starch for storage. Plant cells use some of the glucose produced during photosynthesis for respiration.

Plant roots absorb mineral salts including nitrates needed for healthy growth. For healthy growth plants need mineral ions including:
- nitrate . for producing amino acids which are then used to form proteins
- magnesium . which is needed for chlorophyll production.

The symptoms shown by plants growing in conditions where mineral ions are deficient include:
- stunted growth if nitrate ions are deficient
- yellow leaves if magnesium ions are deficient.

Now try these exam style questions.

1 Jenny carried out an investigation to show the rate of photosynthesis in two species of plant at different light intensities.



This investigation had two independent variables.

(a) Name the categoric independent variable.

.....

(b) Name the continuous independent variable.

.....

(c) Describe the pattern shown by species **B**

.....

.....

(3)

The results for species **B** were as follows:

Light intensity (kilolux)	*CO_2 uptake (cm^3/m^2)*
5	0.04
10	0.12
20	0.15
30	0.125
40	0.09
50	0.04

(d) Jenny was not sure where the peak of the graph should be drawn. Which extra measurements should she take to be sure of this?

.....

(e) At what light intensity do both species photosynthesise at the same rate?

.....

(f) If species **A** has a total leaf area of 100 m^2, how many cm^3 of carbon dioxide will it take up at a light intensity of 10 kilolux? Show your working.

.....

.....

(g) Which species shows the best adaptation to shade conditions? Using the information in the graph give reasons for your answer.

.....

.....

(h) What is the name of the sugar produced during photosynthesis?

.....

(i) What is the name of the process by which this sugar is broken down to provide energy for the plant?

.....

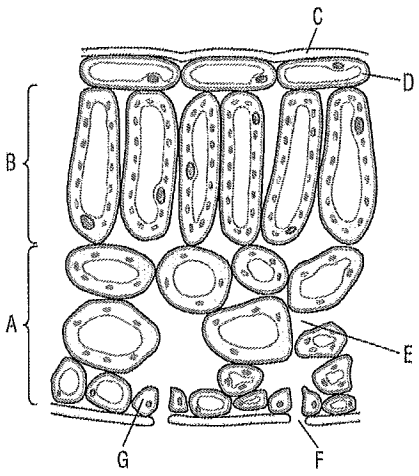
2 The diagram below represents a section through a plant leaf showing the arrangement of cells as seen under a microscope.

(a) Name the parts labelled **E**, **F** and **G**. (3)

E .....

F .....

G .....



(b) Give one function of the parts labelled

(i) **C**

.....

(ii) **G**

.....

(c) List the four letters that indicate structures that contain chloroplasts.

.....

.....

(d) The diagram shows only a small section through a leaf. State **FOUR** ways in which the **whole leaf** is adapted to carry out photosynthesis. In each case show how this feature helps the plant to carry out photosynthesis.

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.....

.....

3 Plants need to obtain mineral salts in order to survive.

(a) Name two mineral salts that are essential to plants and in each case give a reason why they are needed.

.....

.....

(b) How do plants obtain the minerals they need?

.....

.....

(c) If crops are grown for long periods on the same piece of land, they may use up some of the minerals in the soil. State two ways in which farmers can avoid these crops dying due to lack of minerals.

.....

SECTION B2.3

By observing the numbers and sizes of the organisms in food chains we can find out what happens to energy and biomass as it passes along the food chain.

To interpret pyramids of biomass and construct them from appropriate information

To evaluate the positive and negative effects of managing food production and distribution, and to be able to recognise that practical solutions to human needs may require compromise between competing priorities.

Radiation from the Sun is the source of energy for most communities of living organisms. Green plants capture a small part of the solar energy which reaches them.

This energy is stored in the substances which make up the cells of the plants.

The mass of living material (biomass) at each stage in a food chain is less than it was at the previous stage.

The biomass at each stage can be drawn to scale and shown as a pyramid of biomass.

At each stage in a food chain, less material and less energy are contained in the biomass of the organisms. This means that the efficiency of food production can be improved by reducing the number of stages in food chains.

The efficiency of food production can also be improved by restricting energy loss from food animals by limiting their movement and by controlling the temperature of their surroundings.

The amounts of material and energy contained in the biomass of organisms is reduced at each successive stage in a food chain because:
- some materials and energy are always lost in the organisms waste materials
- respiration supplies all the energy needs for living processes, including movement.

Much of this energy is eventually lost as heat to the surroundings.
- these losses are especially large in mammals and birds whose bodies must be kept at a constant temperature which is usually higher than that of their surroundings.

Many trees shed their leaves each year and most animals produce droppings at least once a day. All plants and animals also eventually die.

Microbes play an important part in decomposing this material so that it can be used again by plants. The same material is recycled over and over.

Living things remove materials from the environment for growth and other processes.

These materials are returned to the environment either in waste materials or when living things die and decay.

Materials decay because they are broken down (digested) by micro-organisms.

Microorganisms digest materials faster in warm, moist conditions. Many microorganisms are also more active when there is plenty of oxygen.

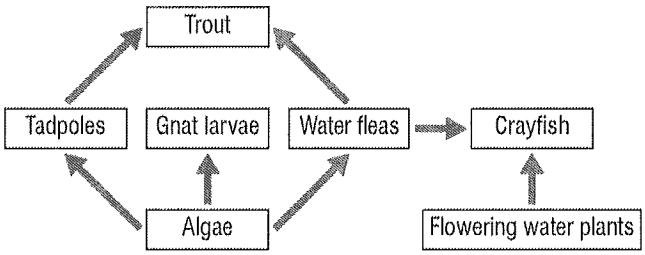
The decay process releases substances which plants need to grow.

In a stable community, the processes which remove materials are balanced by processes which return materials. The materials are constantly cycled.

The constant cycling of carbon is called the carbon cycle. In the carbon cycle:
- carbon dioxide is removed from the environment by green plants for photosynthesis. The carbon from the carbon dioxide is used to make carbohydrates, fats and proteins which make up the body of plants
- some of the carbon dioxide is returned to the atmosphere when green plants respire
- when green plants are eaten by animals and these animals are eaten by other animals, some of the carbon becomes part of the fats and proteins which make up their bodies
- when animals respire some of this carbon becomes carbon dioxide and is released into the atmosphere
- when plants and animals die, some animals and microorganisms feed on their bodies. Carbon is released into the atmosphere as carbon dioxide when these organisms respire
- by the time the microorganisms and detritus feeders have broken down the waste products and dead bodies of organisms in ecosystems and cycled the materials as plant nutrients, all the energy originally captured by green plants has been transferred.

Energy flows and Nutrients in the Environment

1 The diagram below shows a part of a food web for organisms in a lake.



(a) Which organisms feed on algae?

.....

(b) Which organisms are producers?

.....

(c) Which organism is both a primary consumer and a secondary consumer?

.....

(d) Draw and label a pyramid of biomass for the food chain below:

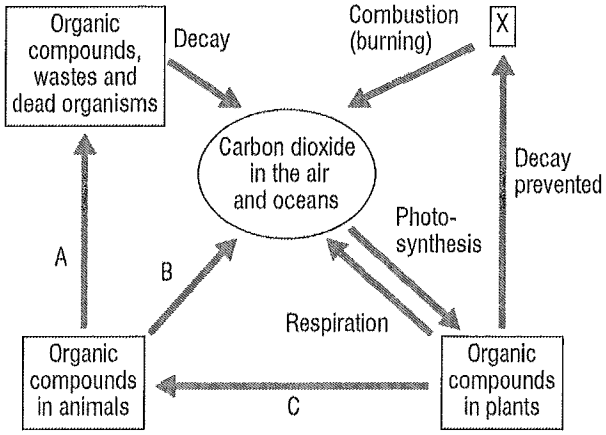
Algae → Tadpole → Trout

(e) If a disease suddenly killed all the water fleas explain how the population of the algae might be affected.

.....

.....

2 The diagram below is a version of the carbon cycle.



(a) Name the three processes indicated by the three arrows labelled with the letters **A**, **B** and **C**.....

.....

(b) In what form is the carbon in the box labelled **X**?

.....

(c) The organic compounds of plants and animals are mostly in the form of three groups of substances that make up the **majority** of the bodies of these organisms. What are the three groups of organic compounds?

.....

.....

.....

(d) The table shows the percentage of carbon cycled by some of the processes involved in the carbon cycle.

Process	*Percentage of total carbon cycled*
Photosynthesis	50
Respiration by animals	20
Respiration by plants	20
Respiration by microorganisms	5
Combustion/absorbed by oceans	5

(i) Draw a pie chart of these proportions.

(ii) If the total amount of carbon that is cycled in one year across the Earth is 165 gigatonnes, calculate how much carbon is cycled by the respiration of plants. Show your working.

.....

.....

(e) Respiration is an important process in recycling carbon. The word equation for respiration is shown below, with most words replaced by the letters **A**, **B**, **C** and **D**. Give the names of **A**, **B**, **C** and **D**.

.....

.....

.....

.....

A + **B** → **C** + **D** + energy

(f) The concentration of carbon dioxide in the atmosphere has increased over the past 200 years. Suggest one human activity that might have contributed to this increase.

.....

3 A factory which packaged shrimps produced tonnes of waste shrimp heads. It cost money to dump these in the local tip. The managers decided to investigate the decay of shrimp heads to see if they might be used as fertiliser. They used 80 shrimp heads in 4 sealed jars. Each jar had a different amount of water. They measured the length of the shrimp heads, left them for 60 days and then measured them again:

Amount of water (cm^3)	*% loss in length*
40	68
50	61
60	59
70	56

(a) Explain why they decided to measure the length of shrimp heads.

.....

(b) How many shrimp heads would they have put into each jar?

.....

(c) They predicted that the more water they added the greater the breakdown of the shrimp heads. Is their prediction supported? Explain your answer.

SECTION B2.4

Enzymes are biological catalysts that have many functions both inside and outside cells.

To evaluate the advantages and disadvantages of using enzymes in home and industry.

Catalysts increase the rate of chemical reactions. Biological catalysts are called enzymes.

Enzymes are protein molecules made up of long chains of amino acids. These long chains are folded to produce a special shape which enables other molecules to fit into the enzyme. This shape is vital for the enzymes function. High temperatures destroy this special shape.

Different enzymes work best at different pH values.

Enzymes inside living cells catalyse processes such as respiration, protein synthesis and photosynthesis.

During aerobic respiration (respiration which uses oxygen) chemical reactions occur which use glucose (a sugar) and oxygen. Energy is also released.

Most of the reactions in aerobic respiration take place inside mitochondria.

Aerobic respiration is summarised by the equation:

glucose + oxygen $\rightarrow$ carbon dioxide + water (+ energy)

The energy that is released during respiration is used:
- to build up larger molecules using smaller ones
- in animals, to enable muscles to contract
- in mammals and birds, to maintain a steady body temperature in colder surroundings
- in plants, to build up sugars, nitrates and other nutrients into amino acids which are then built up into proteins.

Enzymes inside living cells catalyse the reactions that build up amino acids and proteins.

Some enzymes work outside the body cells. The digestive enzymes are produced by specialised cells in glands and in the lining of the gut. The enzymes then pass out of the cells into the gut where they come into contact with food molecules.

They catalyse the breakdown of large molecules into smaller molecules:

- the enzyme amylase is produced in the salivary glands, the pancreas and the small intestine. This enzyme catalyses the breakdown of starch into sugars in the mouth and small intestine

- protease enzymes are produced by the stomach, the pancreas and the small intestine. These enzymes catalyse the breakdown of proteins into amino acids in the stomach and the small intestine

- lipase enzymes are produced by the pancreas and small intestine. These enzymes catalyse the breakdown of lipids (fats and oils) into fatty acids and glycerol in the small intestine

- the stomach also produces hydrochloric acid. The enzymes in the stomach work most effectively in these acid conditions

- the liver produces bile which is stored in the gall bladder before being released into the small intestine.

Bile neutralises the acid that was added to food in the stomach. This provides alkaline conditions in which enzymes in the small intestine work most effectively.

Some microorganisms produce enzymes which pass out of the cells. These enzymes have many uses in the home and in industry.

In the home, biological detergents may contain protein-digesting and fat-digesting enzymes (proteases and lipases).

In industry:
- proteases are used to .pre-digest. the protein in some baby foods

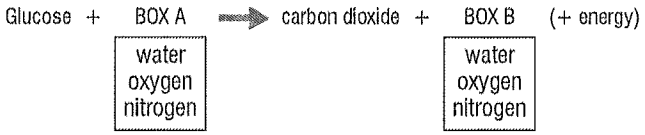
- carbohydrases are used to convert starch into sugar syrup

- isomerase is used to convert glucose syrup into fructose syrup, which is much sweeter and therefore can be used in smaller quantities in slimming foods.

NOW TRY THESE EXAM QUESTIONS

Enzymes

1 (a) In the summary of aerobic respiration shown below, choose a word from each of the boxes that best completes the equation.



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.....

(b) (i) State two ways in which the energy released during respiration is used in **all** animals.

.....

.....

(ii) How else might the energy released be used in mammals and birds only?

.....

(iii) Give a further use of the energy released that applies to plants rather than animals.

.....

2 **A**, **B**, **C**, **D** and **E** are the names of enzymes or groups of enzymes. The numbers **1**, **2**, **3**, **4** and **5** refer to the functions or uses of each of these enzymes. Match each letter with the appropriate number.

A	Lipase	**1**	Used in the manufacture of baby foods
B	Amylase	**2**	Group of enzymes that act on carbohydrates
C	Proteases	**3**	Its substrate is starch
D	Isomerase	**4**	Used in the production of slimming foods
E	Carbohydrases	**5**	The products of its catalytic action are glycerol and fatty acids

3 Amylase is an enzyme that catalyses the conversion of starch into sugar.

(a) To which of the following groups of food does starch belong?

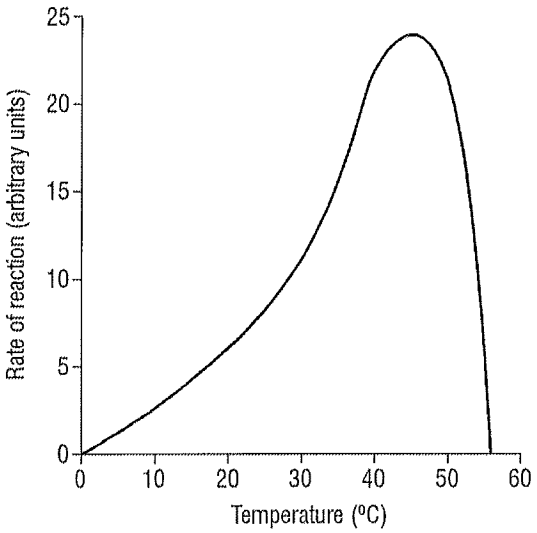
carbohydrates fats protein vitamins .....

(b) Give the names of the **three** organs in the human body that secrete the enzyme amylase.

.....

.....

.....



The graph above shows the effect of temperature on the activity of amylase.

(c) (i) At what temperature did the amylase work fastest?

.....

(ii) Why did the amylase not work above 56°C?

.....

(iii) State one other factor apart from temperature that will affect the rate of reaction of amylase.

.....

4 In the making of cheese, a commercially prepared form of an enzyme called rennin is used to make the protein in milk more solid. Rennin is an enzyme that is produced naturally in the stomachs of young mammals. The owner of a cheese-making factory wanted to use a different source of rennin. She needed to find out the best temperature to use for the new rennin. She planned to set up 20 test tubes. All would have 20 cm^3 of milk in them: half with the rennin added (A) and half to be left without rennin (B). One tube of each type would be left in a water bath until one of them clotted. When this happened, the time taken would be recorded.

(a) Construct a table that could be used by the owner.

(b) Fill in the table to show the range of temperatures she might use.

(c) Fill in the table to show the interval for the independent variable.

(d) Suggest how the owner might know when the milk is clotted.

.....

(e) Would you suggest that she repeats her results? Explain your answer.

.....

(f) Why do you think she used tubes A and B at each temperature?

.....

5 Bile is a greenish liquid that plays an important role in the digestion of food.

(a) In which organ is bile produced?

.....

(b) Where is bile stored in the body?

.....

(c) Into which region of the digestive system is bile released?

.....

(d) Describe how bile is involved in the digestion of fats.

.....

.....

.....

(e) What is the name of the enzyme that digests fats?

.....

(f) Name two places where this enzyme is produced in the body.

.....

SECTION B2.5

Humans need to remove waste products from their bodies to keep their internal environment relatively constant.

To evaluate the data from the experiments by Banting and Best which led to the discovery of insulin

To evaluate modern methods of treating diabetes.

Waste products which have to be removed from the body include:
- carbon dioxide produced by respiration. Most of this leaves the body via the lungs.
- urea produced in the liver by the breakdown of excess amino acids. This is removed by the kidneys in the urine, which is temporarily stored in the bladder.

Internal conditions which are controlled include the water content the body, the ion content of the body, temperature and blood sugar levels.

If the water or ion content of the body is wrong, too much water may move into or out of the cells and damage them. Water and ions enter the body when we eat or drink.

Sweating helps to cool the body. More water is lost when it is hot, and more water has to be taken as drink or in food to balance this loss.

Body temperature is monitored and controlled by the thermoregulatory centre in the brain. This centre has receptors sensitive to the temperature of blood flowing through the brain. Also temperature receptors in the skin send impulses to the centre giving information about skin temperature.

If the core body temperature is too high:
- blood vessels supplying the skin capillaries dilate so that more blood flows through the capillaries and more heat is lost
- sweat glands release more sweat which cools the body as it evaporates.

If the core body temperature is too low:
- blood vessels supplying the skin capillaries constrict to reduce the flow of blood through the capillaries
- muscles may shiver. Their contraction needs respiration which releases some energy as heat.

The blood glucose concentration of the body is monitored and controlled by the pancreas. The pancreas produces the hormone insulin which allows glucose to move from the blood into the cells.

Diabetes is a disease in which a persons blood glucose oncentration may rise to a fatally high level because the pancreas does not produce enough of the hormone insulin. Diabetes may be treated by careful attention to diet and by injecting insulin into the body.

Now try these exam style questions

Homeostasis

1 Complete the passage below by choosing the correct terms from the box and matching them with the numbers in the passage.

sweating	dilate	shivering
thermoregulatory	radiation	constrict

Body temperature is controlled by the ....**1**.... centre in the brain. On a hot day it causes blood vessels in the skin to ...**2**... and so lose heat by ....**3**.... Heat may also be lost by ...**4**... . On a cold day the blood vessels ....**5**.... to conserve heat. When cold, ...**6**.... may also occur to create some heat.

.....

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.....

.....

.....

.....

2 The table shows the daily water loss from a typical human being.

Water lost in	*Volume of water (cm^3 per day)*
Urine	1500
X	400
Evaporation from the skin	350
Faeces	150
Sweat	100

(a) One way in which water is lost from the body has been missed out and replaced by the letter **X**. What does **X** represent?

.....

(b) These figures were taken on a cool day with the person at rest. State two ways in which the figures would be different if the person had been exercising on a hot day.

.....

.....

(c) Apart from water, what other two substances are typically found in urine?

.....

.....

(d) Where is urine stored in the body?

.....

3 (a) What is the name of the hormone that causes the liver to remove glucose from the blood?

.....

(b) Where in the body is this hormone produced?

.....

(c) Two people drank a solution that contained 100 g of glucose. The blood sugar level of each person was measured over the next three hours. The results are shown in the table below.

(i) On a piece of graph paper, draw a line graph of the data in the table.

(ii) One of the two persons is diabetic. From the graph suggest which one and give two reasons for your answer.

.....

.....

Time in minutes	*Blood sugar level (mg/100 cm^3 blood)*	
	Person X	*Person Y*
0 (glucose drunk)	90	90
30	160	140
60	220	90
90	200	80
120	150	70
150	130	80
180	110	90

4 Read the following passage about diabetes.

Diabetes is a metabolic disorder in which there is an inability to control blood glucose levels due to the lack of the hormone insulin. Diabetes was a fatal disease until in 1921 Banting and Best succeeded in isolating insulin from the pancreases of pigs and cows, having first carried out experiments on dogs. Insulin is a small protein of 51 amino acids, the sequence of which was determined in the 1950s by Sanger. More recently the gene for human insulin has been isolated and the hormone can now be produced by bacteria as a result of genetic engineering. Diabetics must test their blood sugar levels regularly and inject insulin if they are to lead normal lives.

(a) Why do diabetics inject insulin rather than taking it by mouth?

.....

.....

(b) What would happen to the blood sugar level of a diabetic who failed to inject insulin?

.....

(c) Suggest one other symptom of diabetes other than changes to blood sugar.

.....

(d) Give three advantages of using genetically engineered insulin rather than extracting the hormone from animal pancreases.

.....

.....

.....

(e) Injecting insulin only *treats* diabetes. In future it may be possible to replace the damaged pancreas by transplantation.

(i) What would be the benefits to the person with diabetes of such treatment?

.....

.....

(ii) State the drawbacks of this treatment.

.....

SECTION B2.6

What sex human beings are, and whether or not they inherit certain diseases, show a very simple pattern of inheritance.

To explain why Mendel proposed the idea of separately inherited factors and why the importance of this discovery was not recognised until after his death

To interpret genetic diagrams

To make informed judgements about the social and ethical issues concerning the use of stem cells from embryos in medical research and treatments

To make informed judgements about the economic, social and ethical issues concerning embryo screening that they have studied or from information that is presented to them

To predict and/or explain the outcome of crosses between individuals for each possible combination of dominant and recessive alleles of the same gene

To construct genetic diagrams.

In body cells the chromosomes are normally found in pairs. Body cells divide by mitosis to produce additional cells during growth or to produce replacement cells.

Body cells have two sets of genetic information; sex cells (gametes) have only one set.

Cells in reproductive organs (testes and ovaries in humans) divide to form gametes.

The type of cell division in which a cell divides to form gametes is called meiosis.

When a cell divides to form gametes:
- copies of the chromosomes are made
- then the cell divides twice to form four gametes, each with a single set of chromosomes.

• When gametes join at fertilisation, a single body cell with new pairs of chromosomes is formed. A new individual then develops by this cell repeatedly dividing by mitosis.

Most types of animal cells differentiate at an early stage whereas many plant cells retain the ability to differentiate throughout life.

In mature animals, cell division is mainly restricted to repair and replacement.

Cells from human embryos and adult bone marrow, called stem cells, can be made to differentiate into many different types of cells eg nerve cells.

Treatment with these cells may help conditions such as paralysis.

The cells of the offspring produced by asexual reproduction are produced by mitosis from the parental cells. They contain the same genes as the parents.

Sexual reproduction gives rise to variation because, when gametes fuse, one of each pair of alleles comes from each parent.

In human body cells, one of the 23 pairs of chromosomes carries the genes which determine sex. In females the sex chromosomes are the same (XX) in males the sex chromosomes are different (XY).

Some characteristics are controlled by a single gene. Each gene may have different forms called alleles.

An allele which controls the development of a characteristic when it is present on only one of the chromosomes is a dominant allele.

An allele which controls the development of characteristics only if the dominant allele is not present is a recessive allele.

Chromosomes are made up of large molecules of DNA (deoxyribose nucleic acid). A gene is a small section of DNA.

Each gene codes for a particular combination of amino acids which make a specific protein.

Each person (apart from identical twins) has unique DNA. This can be used to identify individuals in a process known as DNA fingerprinting.

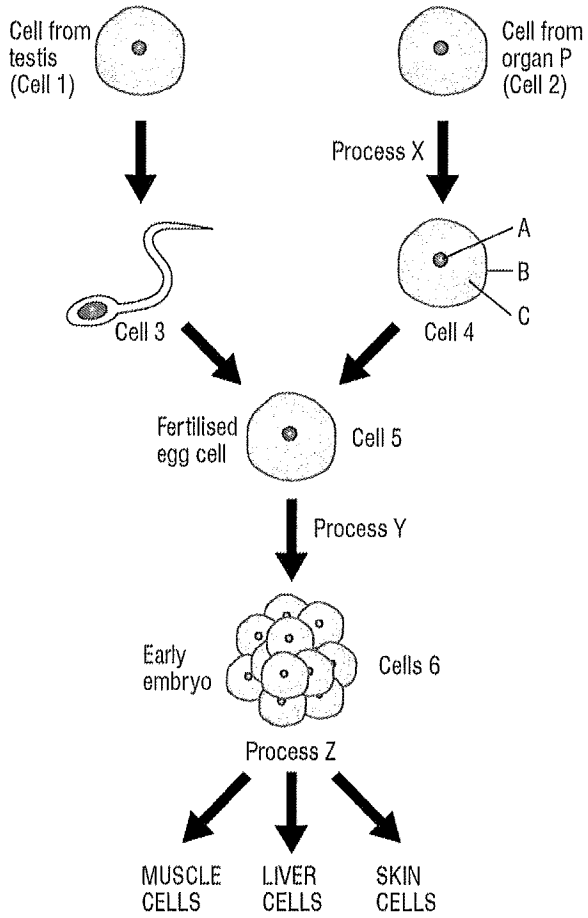
Some disorders are inherited:
- Huntington.s disease . a disorder of the nervous system is caused by a dominant allele of a gene and can therefore be passed on by only one parent who has the disorder
- cystic fibrosis is a disorder of cell membranes. Must be inherited from both parents. The parents may be carriers of the disorder without actually having the disorder themselves. It is caused by a recessive allele of a gene and can therefore be passed on by parents, neither of whom has the disorder.

Embryos can be screened for the alleles that cause these and other genetic disorders.

Now try these exam style questions

Inheritance

1 The diagram below is of stages in sexual reproduction in a mammal.



(a) What is the name of organ **P**?

.....

(b) Give the names of parts **A**, **B** and **C** in cell 4.

.....

.....

.....

(c) What is the name of cell 3?

.....

(d) What type of cell division takes place in processes **Y** and **Z**?

.....

(e) Which two of the cells labelled 1–6:

(i) are genetically identical to one another?

.....

(ii) are known as gametes?

.....

(f) Cells 6 will in due course change into a range of different cell types.

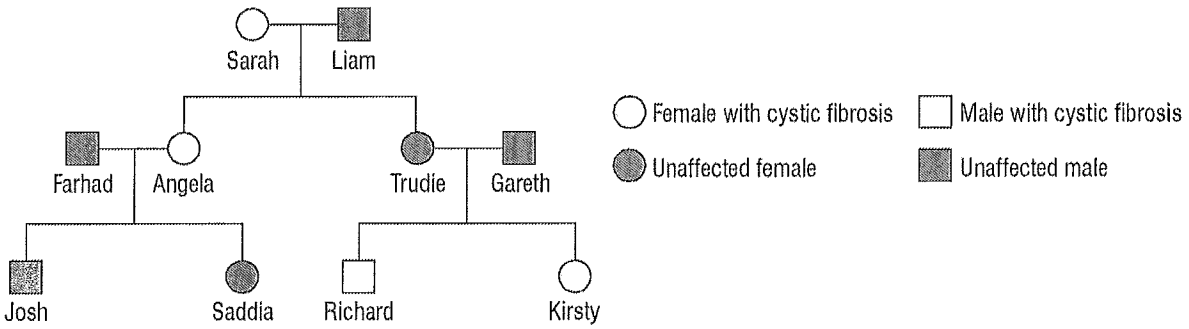
(i) What name is given to the type of cell, labelled as cells 6?

.....

(ii) What is the process called by which these cells change into different cell types?

.....

2 Cystic fibrosis is a condition in which people suffer from the accumulation of thick and sticky mucus in their lungs. The chart shows part of a family tree in which some members have cystic fibrosis.



(a) Using two pieces of evidence from the family tree, explain why cystic fibrosis appears to be controlled by a recessive gene.

.....

.....

(b) Trudie and Gareth want to have another child. What is the chance that this child will inherit cystic fibrosis? Explain, with the aid of a genetic diagram, how you reached your answer.....

.....

.....

.....

(c) The letters **A**, **B** and **C** show the three different possible combinations of alleles possessed by the members of this family tree

A dominant and dominant

B dominant and recessive

C recessive and recessive

For each of the individuals below, give the letter that represents the alleles they possess.

(i) Liam

.....

(ii) Angela

.....

(iii) Saddia

.....

(d) Explain how it is possible that Farhad and Angela could have a child with cystic fibrosis.

.....

.....

.....

GCSE ADDITIONAL BIOLOGY (B2) REVISION BOOKLET

AQA Science

Name: Date:

Summary questions

1 Look at this table showing how long different cells live for:

Type of cell	Life in days
Liver cell	250
Muscle cell	240
Red blood cell	100
Skin cell	18

a) What does this data tell you about how these cells are produced?

.....

..... (1)

Now read the following information:

- All nerve cells develop when a person is very young.
- Most people in Britain live in excess of 70 years.
- Older people have increasing problem with memory.
- Memory involves nerve cells in our brain.
- Nerve cells are never replaced.

b) Explain what this information tells you about how long nerve cells live.

.....

.....

.....

..... (2)

2 Read the following article:

In Japan, each child is presented with its own umbilical cord in a decorated box to remind it of the bond with its mother. At the end of the 20th century there was a nuclear accident in Japan. The two workers who were most affected had their bone marrow destroyed. One received a bone marrow transplant from his sister. His blood-cell levels improved quite fast. The other had no relatives with a tissue match. Blood stem cells were taken from his preserved umbilical cord and used to give him a chance of life.

a) What is a stem cell?

.....

..... (1)

b) What type of stem cells are named in this article?

....., ... (2)

c) There is one other type of stem cell – what is it?

..... (1)

d) What are the possible benefits of using stem cells in medicine?

.....

..... (2)

e) What are the problems with using stem cells?

.....

..... (1)

f) In the UK, children are not given their umbilical cords to keep. How might umbilical blood with its stem cells be stored in this country?

..... (1)

AQA Science

Name: Date:

Summary questions

3 a) Use straight lines to link each word related to photosynthesis to its description:

A contain chlorophyll	1 big surface area for light to fall on
B broad	2 allow carbon dioxide to enter leaf cells and oxygen to leave
C have veins	3 to absorb light energy
D have air spaces	4 supply leaf cells with water

(4)

b) What do we call leaves that only contain chlorophyll in some of their cells?

..... (1)

c) When testing a green leaf for starch the chlorophyll has to be removed.

i) Why is this necessary?

..... (1)

ii) How is this done?

..... (1)

Name: Date:

4 a) Underline the correct word from each of the pairs given.

Oxygen/ozone and **glycogen/glucose** react together in your body to produce **excretion/energy**. This process is **respiration/breathing**. Carbon **monoxide/dioxide** and **water/waste** are produced as by-products of respiration. (6)

b) Use this to help you complete the equation for aerobic respiration:

_____ + _____ → _____ + _____ + _____ (5)

c) Why is aerobic respiration so important?

.....

.....

..... (3)

d) What are the mitochondria and why are they so well adapted for their role in your cells?

.....

..... (2)

5 **A**, **B**, **C**, **D** and **E** are the names of enzymes or groups of enzymes. The numbers **1**, **2**, **3**, **4** and **5** refer to the functions or uses of each of these enzymes.

Match each letter with the appropriate number. (5)

A	Lipase	**1**	Used in the manufacture of baby foods
B	Amylase	**2**	Group of enzymes that act on carbohydrates
C	Proteases	**3**	Its substrate is starch
D	Isomerase	**4**	Used in the production of slimming foods
E	Carbohydrases	**5**	The products of its catalytic action are glycerol and fatty acids

6 Amylase is an enzyme that catalyses the conversion of starch into sugar.

(a) To which of the following groups of food does starch belong?

carbohydrates **fats** **protein** **vitamins**

..... (1)

.....

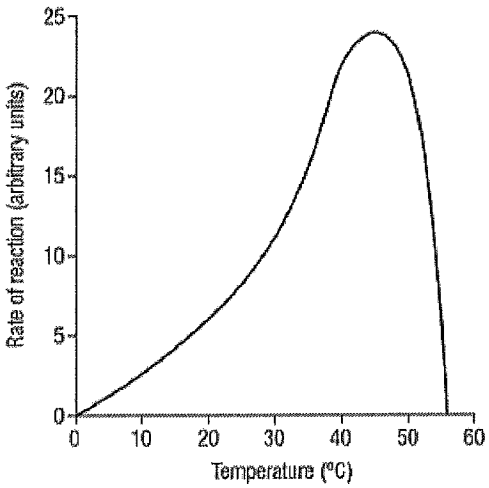
Continued ...

(b) Give the names of the three organs in the human body that secrete the enzyme amylase.

.....

.....

..... (3)



The graph above shows the effect of temperature on the activity of amylase.

(c) (i) At what temperature did the amylase work fastest?

..... (1)

(ii) Why did the amylase not work above 56°C?

..... (1)

(iii) State one other factor apart from temperature that will affect the rate of reaction of amylase.

..... (1)

AQA Science

B2.6 Inheritance
Summary sheet

Name: Class:

7 Cystic fibrosis is an example of an inherited disease caused by gene mutation, which affects about one child in 2000.

a) Which parts of the body are mainly affected by this condition?

..... (2)

b) What substance (produced in excess) affects these parts of the body? ..... (1)

c) The reproductive system is also affected by this condition. As a result, people suffering from cystic fibrosis are often ..... (1)

d) What are the main treatments for cystic fibrosis?

..... and ..... (2)

e) Enzyme treatment is also used. What is the purpose of these enzymes?

.....

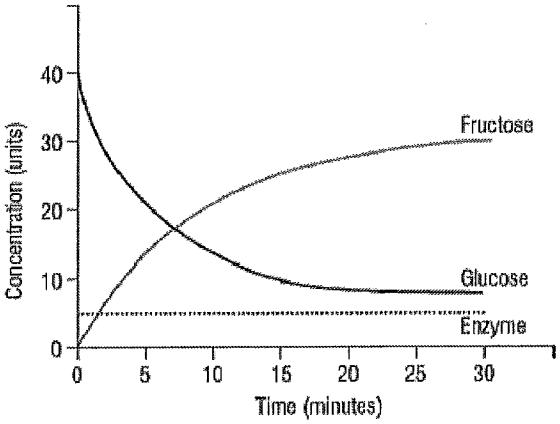
..... (1)

f) What kind of allele causes cystic fibrosis? ..... (1)

g) How do we describe the parents of cystic fibrosis sufferers? ..... (1)

Name: **Class:**

8 In an investigation, an enzyme was added to glucose syrup in test tube A. In another test tube (B) glucose was left without the enzyme. In a third test tube (C) the enzyme was left without the glucose. The concentrations of glucose, fructose and the enzyme were measured for thirty minutes. The results for test tube A are shown in the graph.



(a) Describe the changes in the concentration of fructose.

.....

..... *(2 marks)*

(b) (i) Explain why test tubes B and C were used.

..... *(1 mark)*

(ii) How should tubes B and C have been treated?

..... *(1 mark)*

(c) Fructose is often added to foods used by people on a slimming diet.

(i) Give **one** advantage of this for the company making the slimming food.

..... *(1 mark)*

(ii) Explain one advantage of this for a person on a slimming diet.

.....

..... *(2 marks)*

9 In 1868 a German scientist, Wunderlich, took the mouth temperature of 25,000 people a total of 1 million times. He concluded that the normal range for temperatures recorded from the mouth using a mercury thermometer was 36.25°C to 37.5°C. Mean temperature was 37°C.

In 2005 scientists in Baltimore measured the mouth temperature of 148 men and women aged 18–40 years. Measurements were taken 4 times daily for 3 days using an electronic digital thermometer. They found that the normal range was 37.2°C to 37.7°C, with a mean of 36.8°C.

(a) Which control variable was the same for both investigations?

..... *(1 mark)*

(b) How could supporters of Wunderlich argue that he had the most accurate technique?

..... *(1 mark)*

(c) How could supporters of the Baltimore team argue that they had the most accurate technique?

..... *(1 mark)*

(d) Why is it economically important to have an accurate measurement of the normal range for body temperatures?

..... *(1 mark)*

AQA Science

Answers to summary questions

Answers

1 a) These cells must be produced on a regular basis to replace those that die otherwise the organs listed would quickly break down. *1 mark*

b) Many nerve cells live for at least 70 years otherwise the human body could not function for that length of time. *1 mark*

But clearly some nerve cells die sooner (progressively throughout life in fact) and this explains the decrease in memory and other brain functions with age. *1 mark*

2 a) Stem cells are unspecialised cells that can differentiate (divide and change) into many different types of cells when they are needed. *1 mark*

b) Adult stem cells and umbilical cord stem cells. *2 marks*

c) Embryonic stem cells. *1 mark*

d) Make new cells, tissues or organs for people who have diseases or damage, e.g. new spinal nerves, treating Alzheimer's, etc. *1 mark* *1 for e.g*

e) Ethical issues, risk of side-effects such as cancer. *1 mark*

f) Frozen straight after birth. *1 mark*

Answers to summary questions

3 a) A–3; B–1; C–4; D–2. *4 marks*
b) Variegated. *1 mark*
c) i) To enable the colour of iodine reacting with any starch to be clearly seen. *1 mark*
ii) By boiling in ethanol. *1 mark*

AQA Science

Answers to summary questions

Answers

4 a) oxygen; glucose; energy; respiration; dioxide; water. *(6 marks)*
b) glucose + oxygen → energy + carbon dioxide + water. (5 marks)
c) It provides the energy needed for synthesis reactions, muscle contraction and maintaining body temperature. *(3 marks)*
d) The mitochondria are organelles that are the site of the reactions involved in aerobic respiration.

They have a large internal surface area and many enzymes. *(2 marks)*

5 **A** 5
B 3
C 1
D 4
E 2 *(1 mark each)*

6 a) Carbohydrates *(1 mark)*

b) Salivary glands
Pancreas
Small intestine *(1 mark each)*

c) i) 45°C *(1 mark)*
ii) It had become denatured. *(1 mark)*
iii) pH *(1 mark)*

AQA Science

Answers to summary questions

Answers

7 a) Lungs and digestive system. *(2 marks)*
b) Thick, sticky mucus. *(1 mark)*
c) Infertile. *(1 mark)*
d) Physiotherapy and antibiotics. *(2 marks)*
e) To thin the mucus in the digestive system so that is does not clog up the digestive system so easily. *(1 mark)*
f) Recessive. *(1 mark)*
g) Carriers. *(1 mark)*

AQA Science

Additional biology

8 (a) The concentration of fructose increases *(1 mark)*
then levels off/rate of increase slows *(1 mark)*

(b) (i) They acted as controls. *(1 mark)*
(ii) Exactly the same as tube A. *(1 mark)*

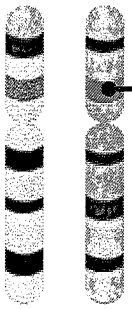
(c) (i) less sugar is used/cheaper than using glucose *(1 mark)*
(ii) food is just as sweet/fructose is sweeter *(1 mark)*
there is less sugar to convert to fat/less surplus energy *(1 mark)*

9 (a) Mouth temperature was used in both investigations for all those tested. *(1 mark)*

(b) He carried out the largest survey. *(1 mark)*

(c) E.g. tests carried out several times on the same people; used a digital thermometer which is less easy to misread; more recent thermometers are more likely to be more accurate. *(1 mark)*

(d) E.g. more accurate diagnosis of disease and therefore more appropriate treatment. *(1 mark)*



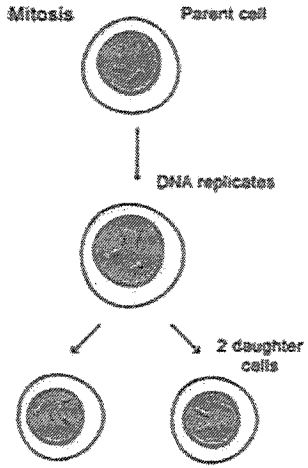
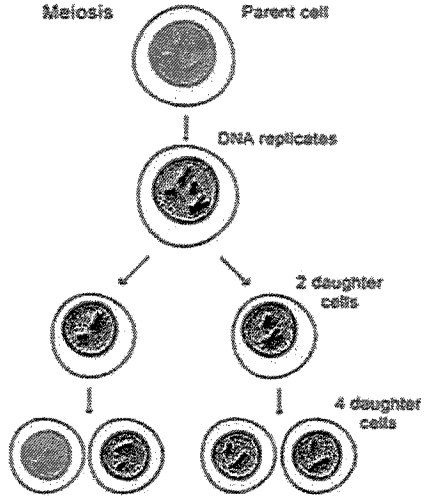
Different forms of the same gene are called **alleles**.

The characteristic controlled by a **dominant** allele develops if the allele is present on **one or both** chromosomes in a pair

The characteristic controlled by a **recessive** allele develops only if the allele is present on **both** chromosomes in a pair

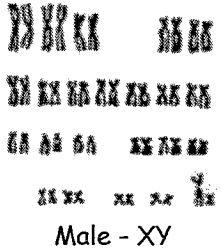
Gregor Mendel

I studied the inheritance of different characteristics in pea plants and found that when I bred red-flowered plants with white-flowered plants, all the offspring produced red flowers. If I bred these plants with each other, most of the offspring had red flowers, but some had white.

Mitosis	Meiosis
	
Leads to growth or repair	Leads to formation of gametes
Two identical daughter cells form	4 daughter cells form
Daughter cells identical to each other	Daughter cells different to each other
Daughter cells identical to parent	Daughter cells different to parent
Cells contain full set of information	Cells contain half the information
Cells divide once	Cells divide twice

Huntington's disease	Cystic fibrosis
Huntington's disease is an inherited disorder that affects the nervous system. It is caused by a **dominant** allele. This means it can be passed on by just one parent if they have the disorder.	Cystic fibrosis is an inherited disorder that affects the cell membranes, causing the production of thick and sticky mucus. It is caused by a **recessive** allele. This means that it must be inherited from both parents.

Female - XX



Male - XY

DNA

DNA molecules carry the genetic code that determines the characteristics of a living thing.

Genes

A gene is a short section of DNA that codes for a specific protein.

Chromosomes

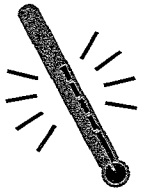
The cell's nucleus contains chromosomes made from long DNA molecules.

Gametes

Sex cells (sperm, egg, pollen)

Homeostasis – maintaining a constant internal environment.

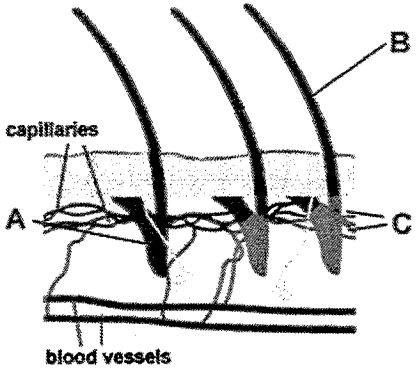
Waste product	Why produced?	How removed?
Carbon dioxide	Product of aerobic respiration	Via lungs when breathe out
Urea	Produced when excess amino acids broken down in liver	Via kidneys in urine

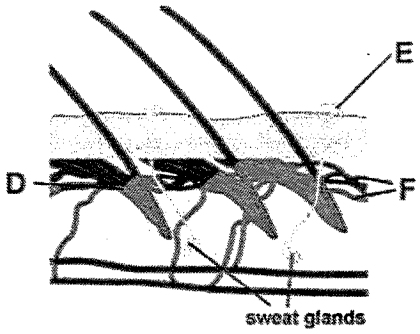


Controlling Body temperature

Human enzymes work best at 37°C, so the body's temperature is controlled. A part of the brain called the **thermoregulatory centre** monitors and controls body temperature. It gathers information as nerve impulses from **temperature receptors** in:

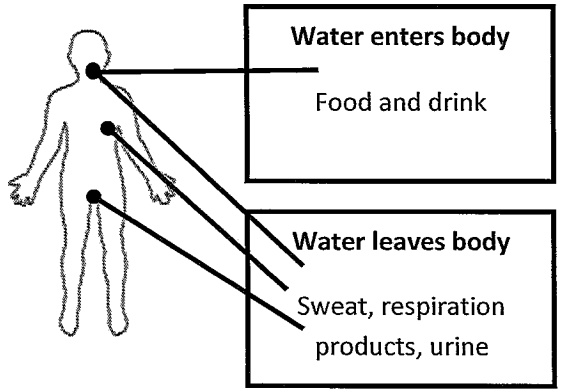
- the brain - these are sensitive to the temperature of the blood flowing there
- the skin - these are sensitive to skin temperature





Controlling Blood Glucose

The **pancreas** monitors and controls the concentration of glucose in the blood. It produces a hormone called **insulin**. Insulin causes glucose to move from the blood into cells. It lowers the blood glucose concentration if has become too high. This can happen after eating a meal



Diabetes

Diabetes is a disease where the concentration of glucose in the blood is not controlled properly by the body. In **type 1 diabetes**, the pancreas does not produce enough insulin. This can lead to high levels of glucose in the blood. which can be fatal.

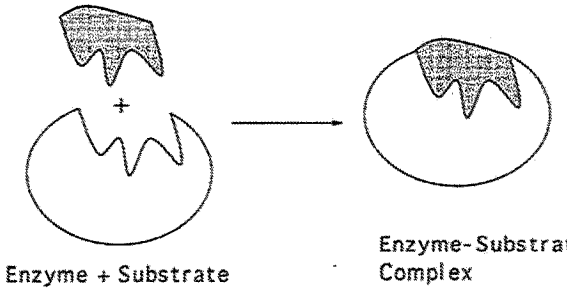
Charles Best and Frederick Banting

Too Hot

Hairs lie flat - do not trap a layer of insulating air
Vasodilation - blood capillaries allow blood to flow to surface of skin allowing radiation of heat.
Sweating - sweat evaporates from surface of skin

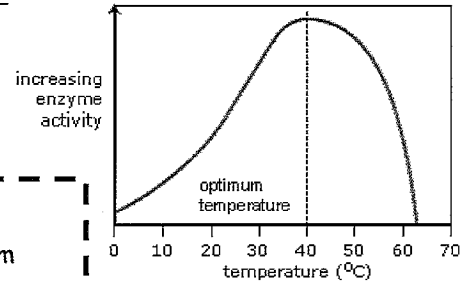
Too cold

Hairs stand on end - trap a layer of air (insulator).
Vasoconstriction - blood capillaries constrict blood flow reducing heat loss by radiation.
Shivering - repeated muscle contraction.



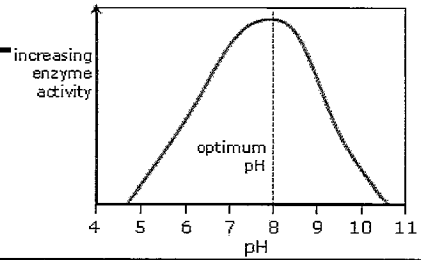
Temperature and enzymes

enzyme activity gradually increases with temperature until around 37°C, or body temperature. Then, as the temperature continues to rise, the rate of reaction falls rapidly, as heat energy denatures the enzyme.



pH and enzymes

Changes in pH alter an enzyme's shape. Different enzymes work best at different pH values.



Enzymes and respiration

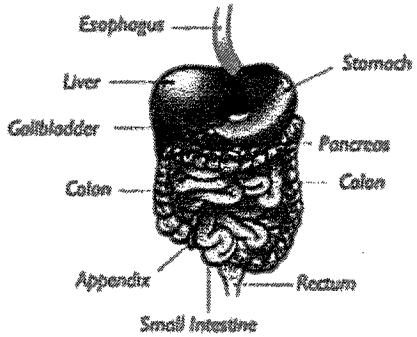
Respiration is a chemical process in which energy is released from food substances, such as glucose.

Aerobic respiration needs oxygen to work. Most of the chemical reactions happen in mitochondria

glucose + oxygen → carbon dioxide + water (+ energy)

The energy released by respiration is used to make large molecules from smaller ones. In plants, for example, sugars, nitrates and other nutrients are converted into amino acids. Amino acids can then join together to make proteins. The energy is also used:

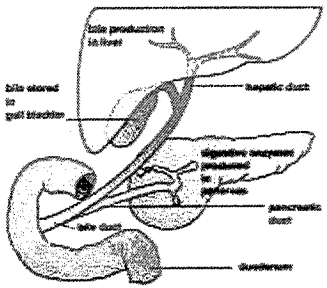
- to allow muscles to contract in animals
- to maintain a constant body temperature in birds and



The role of hydrochloric acid

Kills bacteria

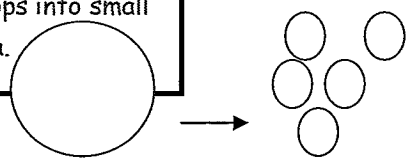
Provides optimum acidic pH for protease enzymes to work.



The role of bile

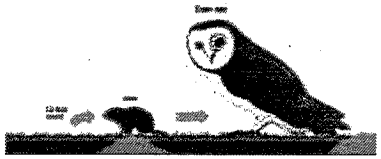
Neutralisation – alkaline substance neutralises stomach acid allowing optimum condition in S.I.

Emulsification – breaks large fat drops into small lipid droplets increasing surface area.



Enzyme	Produced	Reaction catalysed
1. Carbohydrase	S.I, pancreas, mouth	Carbohydrates → sugars
2. Protease	S.I, pancreas, stomach	Proteins → amino acids
3. Lipase	S.I, pancreas	Lipids → fatty acids + glycerol

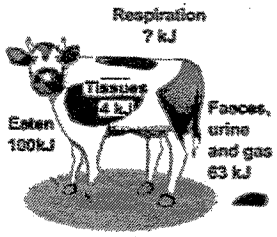
Food chains



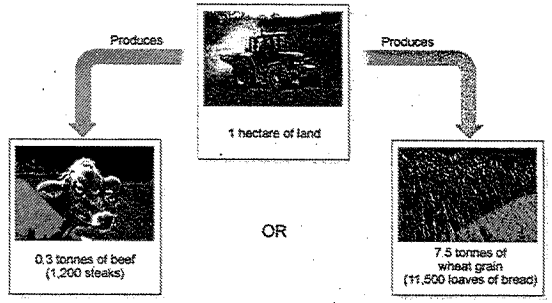
The Sun is the ultimate source of energy for most communities of living things. Green plants absorb some of the Sun's light energy to make their own food by photosynthesis. The other organisms in a food chain are consumers, because they all get their energy and biomass by consuming - eating - other

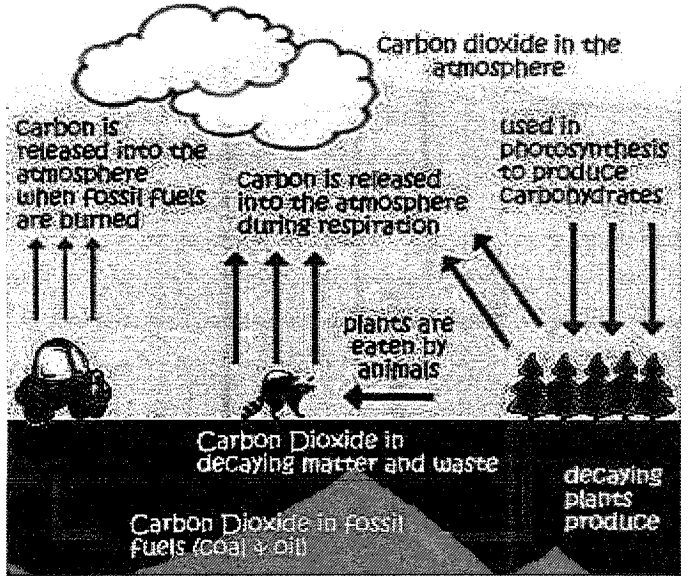
Food chains show the feeding relationships between living things. Pyramids of biomass reveal the mass of living material at each stage in a chain. The amount of material and energy decreases from one stage to the next. Food production is more efficient if the food chain is short, or if energy losses from animals are reduced.

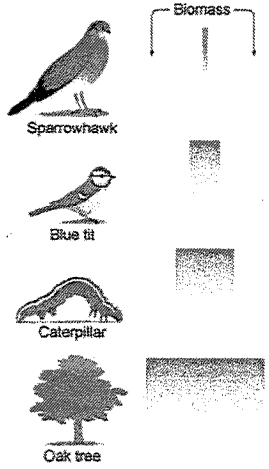
Producers	Green plants - they make food by photosynthesis.
Primary consumers	Usually eat plant material - they are herbivores. For example rabbits, caterpillars, cows and sheep.
Secondary consumers	Usually eat animal material - they are carnivores. For example cats, dogs and lions.
Predators	Kill for food. They are either secondary or tertiary consumers
Prey	The animals that predators feed on.
Scavengers	Feed on dead animals. For example, crows, vultures and hyenas are scavengers.
Decomposers	Feed on dead and decaying organisms, and on the undigested parts of plant and animal matter in faeces.



Efficiency of food production







Energy transfer

Energy is transferred along food chains from one stage to the next, but not all of the energy available to organisms at one stage can be absorbed by organisms at the next one. The amount of available energy decreases from one stage to the next as most of the available energy is used up:

- energy released by respiration is used for movement and other life processes, and is eventually lost as heat to the surroundings
- energy is lost in waste materials, such as faeces

All of the energy used in these ways returns to the environment, and is not available to the next stage.