B2 Revision Mind Maps
### 2.1 Cell organisation and simple cell transport

<table>
<thead>
<tr>
<th>Animal cell</th>
<th>Bacterial cell</th>
<th>Plant cell</th>
</tr>
</thead>
<tbody>
<tr>
<td>Membrane</td>
<td>Cytoplasm genes (no nucleus)</td>
<td>Membrane</td>
</tr>
<tr>
<td>Nucleus</td>
<td>Membrane cell wall</td>
<td>Nucleus</td>
</tr>
<tr>
<td>Mitochondria</td>
<td></td>
<td>Mitochondria</td>
</tr>
<tr>
<td>Ribosomes</td>
<td></td>
<td>Ribosomes</td>
</tr>
<tr>
<td>Cytoplasm</td>
<td></td>
<td>Cytoplasm</td>
</tr>
<tr>
<td>Nucleus</td>
<td></td>
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</tr>
<tr>
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<td></td>
<td>Cytoplasm</td>
</tr>
</tbody>
</table>

**Animal Tissue**

- **Muscular tissue** –
- **Glandular tissue** –
- **Epithelial tissue** –

**Plant cell**

- Membrane
- Nucleus
- Mitochondria
- Ribosomes
- Cytoplasm
- Wall
- Chloroplast
- Vacuole

### How does the stomach function as an organ?

- Muscular tissue,
- Glandular tissue,
- Epithelial tissue,

### How are cells specialised?

- Red blood cell - Larger m________ to carry more o________
- Root hair cell - F________ like to increase s a_______
- Sperm cell – head contains e_______ and middle part has m__________

### Diffusion

**Examples**
Animal cell

Membrane – controls what goes in and out of the cell.
Nucleus – controls all the activities of the cell
Mitochondria – where respiration takes place to release energy.
Ribosomes – site of protein synthesis
Cytoplasm – where chemical reactions happen

Animal Tissue

Muscular tissue – allows movement by contraction
Glandular tissue – secrete chemical / hormones/ enzymes
Epithelial tissue – lining to cover parts of the body

Plant cell

Membrane
Nucleus
Mitochondria
Ribosomes
Cytoplasm
Wall – strengthens the cell to withstand high water / turgor pressure
Chloroplast – site of photosynthesis
Vacuole – holds cell sap

Bacterial cell

2.1 Cell organisation and simple cell transport

Yeast cell

How does the stomach function as an organ?

- muscular tissue, to churn the contents
- glandular tissue, to produce digestive juices
- epithelial tissue, to cover the outside and the inside of the stomach.

How are cells specialised?

Red blood cell - Larger membrane to carry more oxygen
Root hair cell - Finger like to increase surface area
Sperm cell – head contains enzymes and middle part has mitochondria

Plant organs: leaves, stems, roots

Plant tissues:

Epidermal tissue - which cover the plant
Mesophyll tissue - which carries out photosynthesis
Xylem – transport water up the stem
Phloem – transports glucose all over plant

Diffusion

Movement of dissolved particles, liquids and gases from an area of high concentration to an area of low concentration.

Examples

Glands releasing hormones into the blood, oxygen moving from air sac onto red blood cell, carbon dioxide from blood plasma to air sac, carbon dioxide from atmosphere in through stomata of leaf.
Name four types of organism whose cells have a cell wall and explain the function of this.

Give the functions of the following:
- Nucleus
- Cytoplasm
- Mitochondrion
- Cell membrane
- Ribosomes.

What is diffusion?

What type of cell is it?

What is unusual about the genetic material in a bacterial cell?

Give 3 things that can speed up the rate of diffusion.

What type of cell is it?

Identify the cells below.

What type of cell is it?

Give 3 special features of a sperm cell and explain how it helps the sperm function.

What is the function of root hair cells and how are they adapted?

Which organelle would you expect muscle cells to have lots of and why?

Beta cells in the pancreas make lots of insulin, which is a protein. What cell part would you expect to see in high numbers?

What key process takes place in chloroplasts? Write an equation.
Name four types of organism whose cells have a cell wall and explain the function of this.

- **Plant**
  - **Algae**
  - **Bacteria**
  - **Fungi**

**Strengthen cell**

**Give the functions of the following:**

- **Nucleus** contains DNA: controls activities of cell
- **Cytoplasm** cellular reactions take place here
- **Mitochondrion** releases energy during aerobic respiration
- **Cell membrane** controls passage of substances in and out of cell
- **Ribosomes** Site of protein synthesis

**Give the key process that takes place in chloroplasts. Write an equation.**

**Photosynthesis**

\[ 	ext{Water} + \text{carbon dioxide} \rightarrow \text{glucose} + \text{oxygen} \]

**What is diffusion?**

- **The net movement of particles of a liquid or solute from an area of high concentration to an area of lower concentration**

**Give 3 things that can speed up the rate of diffusion.**

- **Bigger diffusion gradient**
- **Larger surface area**
- **Shorter diffusion distance**

**What is unusual about the genetic material in a bacterial cell?**

- Not inside a nucleus

**Identify the cells below.**

- **Bacterium**
- **Yeast cell**

**What type of cell is it?**

- **Animal**
- **Plant**

**What is the function of root hair cells and how are they adapted?**

- To absorb water and nutrients.
  - **Large surface area** - speeds up absorption

**Give 3 special features of a sperm cell and explain how it helps the sperm function.**

- **Lots of mitochondria** - release energy so can swim to egg cell
- **Long tail** - to swim to egg
- **Acrosome containing enzymes** - digest egg membrane

**What is the function of root hair cells and how are they adapted?**

- **To absorb water and nutrients.**
  - **Large surface area** - speeds up absorption

**Which organelle would you expect muscle cells to have lots of and why?**

- **Mitochondria**
  - **Need energy for contraction**

**Beta cells in the pancreas make lots of insulin, which is a protein. What organelle would you expect to see in high numbers?**

- **Ribosomes**

**Beta cells in the pancreas make lots of insulin, which is a protein.**

- **What organelle would you expect to see in high numbers?**
  - **Ribosomes**
What is the name given to a group of organs working together to perform a particular function?

What are the key features of tissues or organs designed to act as exchange surfaces?

Give a definition of a tissue.

What is an organ?

What does it mean if a cell is differentiated?

What is an organ?

Where will you find epithelial tissue? What are some of its functions?

Give the name and functions of the tissues in the leaf.

Label the diagram to give the names of the tissues that make up the stomach and give the function of each.

Name 2 substances produced by glandular tissue, and 2 organs in which you might find it.

What is the job of muscle tissue?

Add labels to the diagram to give the names of the plant organs.

http://www.kathimitchell.com/paclass.htm

http://www.buzzle.com/articles/digestive-system-for-kids.html

http://www.turbosquid.com/FullPreview/Index.cfm/ID/547654

http://www.turbosquid.com/FullPreview/Index.cfm/ID/547654
What is the name given to a group of organs working together to perform a particular function?
Organ system

Give a definition of a tissue.
A group of cells with similar structure and function that work together to perform a particular job

What are the key features of tissues or organs designed to act as exchange surfaces?
- Large surface area
- Thin walls
- Permeable surface
- Good blood supply

What is an organ?
A part of an animal or plant made up of several tissues working together to do a specific job.

What are the key features of tissues or organs designed to act as exchange surfaces?
- Large surface area
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What are the key features of tissues or organs designed to act as exchange surfaces?
- Large surface area
- Thin walls
- Permeable surface
- Good blood supply

Give the name and functions of the tissues in the leaf.
- Palisade mesophyll layer: carries out photosynthesis
- Xylem and phloem: transport water and sugars
- Epidermis: protects plant

Name 2 substances produced by glandular tissue, and 2 organs in which you might find it.
- Enzymes, Hormones
- Stomach / Pancreas / Small intestine

What is the job of muscle tissue?
Contracts to bring about movement.

What does it mean if a cell is differentiated?
It is specialized for a particular job.

What is the name given to a group of organs working together to perform a particular function?
Organ system

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What is the job of muscle tissue?
Contracts to bring about movement.

What does it mean if a cell is differentiated?
It is specialized for a particular job.

Where will you find epithelial tissue? What are some of its functions?
Lining body surfaces - protection or exchange
Write a word equation for photosynthesis.

Name the two reactants in photosynthesis and state where each comes from.

Where is chlorophyll found?

What is the function of chlorophyll?

State three things that can limit the rate of photosynthesis.

Look at the graph below. Describe and explain the effect of increasing light intensity at 0.03% CO₂.

What is meant by a limiting factor?

What is the function of cellulose?

State four uses of glucose in plants.

Explain the results obtained in the experiment below.

Why might a farmer put a paraffin heater in a greenhouse?

What must be added to glucose to make proteins and where does this come from?
2.3 Photosynthesis

**Write a word equation for photosynthesis.**

Carbon + Water $\xrightarrow{\text{Light}}$ Glucose + Oxygen

**State three things that can limit the rate of photosynthesis.**
- shortage of light
- low temperature
- shortage of carbon dioxide.

**Look at the graph below.**
Describe and explain the effect of increasing light intensity at 0.03% CO$_2$.

Rate of photosynthesis increases up to 5 a.u.
Until 5 a.u. light is a limiting factor for photosynthesis
Above 5 a.u. carbon dioxide is a limiting factor.

**What is meant by a limiting factor?**
An environmental condition that when in short supply slows down the rate of photosynthesis.

**What is the function of cellulose?**
It strengthens the cell wall.

**State four uses of glucose in plants.**
- Respiration
- To produce fat or oil for storage
- To produce cellulose
- To produce proteins

**Where is chlorophyll found?**
In chloroplasts in plants and algal cells.

**What is the function of chlorophyll?**
Absorbs light energy which is used to convert carbon dioxide and water to glucose and oxygen.

**Name the substance that glucose can be converted to for storage and describe how you can test for the presence of this substance.**
Starch
Test with iodine: changes from brown to blue-black if starch is present.

**What is the substance that glucose can be converted to for storage and describe how you can test for the presence of this substance.**
Starch
Test with iodine: changes from brown to blue-black if starch is present.

**Explain the results obtained in the experiment below.**

There is no chlorophyll in the white bits of the leaf.
Without chlorophyll photosynthesis cannot take place
So no glucose is made
So no starch is made
So the iodine does not turn blue-black.

**What must be added to glucose to make proteins and where does this come from?**
Nitrates from the soil.

**Why might a farmer put a paraffin heater in a greenhouse?**
To increase carbon dioxide concentration and increase the rate of photosynthesis.

**State three things that can limit the rate of photosynthesis.**
- shortage of light
- low temperature
- shortage of carbon dioxide.
Write down the equation for photosynthesis.

Explain why chlorophyll is needed in photosynthesis.

Describe the shape of the light intensity graph.

What are the three limiting factors in plants?

What is the glucose used for from photosynthesis?

How do plants produce proteins for growth?

Explain this result:

What are the limiting factors on this graph?

How could you increase the rate of photosynthesis in a greenhouse?

What are the limiting factors on this graph?

What are the limiting factors on this graph?

How could you increase the rate of photosynthesis in a greenhouse?
Write down the equation for photosynthesis.

\[ \text{Carbon} + \text{water} \rightarrow \text{glucose} + \text{oxygen} \]

Explain why chlorophyll is needed in photosynthesis.
Chlorophyll absorbs the light energy needed to convert carbon dioxide and water into glucose (chemical energy).

Describe the shape of the light intensity graph.
As the light intensity increases the rate of photosynthesis increases up to a peak point. After this point any further increase in light intensity does not increase the rate of photosynthesis.

Explain the shape of the light intensity graph.
When the line is diagonal at the start light intensity is limiting the rate of photosynthesis. At the peak point light is no longer limiting photosynthesis, something else is e.g. temperature or carbon dioxide.

What are the three limiting factors in plants?
Light intensity, carbon dioxide concentration, temperature

What are the three limiting factors in plants?

What is the glucose used for from photosynthesis?
1. to release immediate energy through respiration in all plant cells
2. store as insoluble starch
3. to make proteins for growth
4. to make cellulose fibres to strengthen the cell wall
5. to produce fat/oils for storage in seeds

What is the glucose used for from photosynthesis?

How do plants produce proteins for growth?
To produce proteins, plants also use nitrate ions that are absorbed from the soil to make amino acids that are then joined to make proteins.

How could you increase the rate of photosynthesis in a greenhouse?
Light bulbs
Parrafin heater

How could you increase the rate of photosynthesis in a greenhouse?

On the slope = carbon dioxide.
On the flat = temperature or light intensity

How could you increase the rate of photosynthesis in a greenhouse?

On the slope = light intensity
On the flat = temperature or carbon dioxide concentration

How could you increase the rate of photosynthesis in a greenhouse?

On the slope up and down = temperature.
On the peak = carbon dioxide concentration or light intensity

How could you increase the rate of photosynthesis in a greenhouse?

On the slope = carbon dioxide.
On the flat = temperature or light intensity

How could you increase the rate of photosynthesis in a greenhouse?

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On the slope up and down = temperature.
On the peak = carbon dioxide concentration or light intensity

How could you increase the rate of photosynthesis in a greenhouse?

On the slope = carbon dioxide.
On the flat = temperature or light intensity

Explain this result:
The green chlorophyll is needed to absorb the light energy to convert carbon dioxide and water into glucose which is stored as Starch in these green parts of the leaf

Explain this result:

Explain this result:

Explain this result:
Describe how you would carry out random sampling to compare the abundance of daisies in 2 different fields.

Give two problems with using a count of nests to estimate bird population.

Describe how you could use a quadrat to investigate how the species of plants change with distance from a river.

Describe how you could investigate how leaf size changes with height on a bush.

Explain what it means if your results are:
Reproducible:

Repeatable:

Why is it important to have a large sample size?

Look at the table of results on the left. Calculate the
a. Mean
b. Median
c. Mode

If the mean number of clover plants per m² quadrat is 6 and a field has a total area of 1200m² how many clover plants would you expect to find in the whole field?

### Physical Factor | Why does it affect the distribution of living organisms?
---|---
Temperature |  |
Nutrient availability |  |
Light intensity |  |
Oxygen availability |  |
Carbon dioxide availability |  |
Water availability |  |

<table>
<thead>
<tr>
<th>Quadrat number</th>
<th>Number of daisies</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>12</td>
</tr>
<tr>
<td>2</td>
<td>10</td>
</tr>
<tr>
<td>3</td>
<td>8</td>
</tr>
<tr>
<td>4</td>
<td>12</td>
</tr>
<tr>
<td>5</td>
<td>11</td>
</tr>
</tbody>
</table>
Describe how you would carry out random sampling to compare the abundance of daisies in 2 different fields:
• Mark out an area in the first field using two tape measures
• Used a random number generator to generate coordinates
• Place the quadrat at each coordinate and count the number of daisies in the quadrat
• Repeat several times in that field
• Calculate a mean number of daisies per quadrat
• Repeat all the steps above in the other field taking the same number of samples

Explain what it means if your results are:
Reproducible: the same results are repeated by someone else doing your experiment or by using a different method

Repeatable: you repeat the experiment with the same equipment and get the same results

Give two problems with using a count of nests to estimate bird population.
Nests may be old / disused
Young birds may have not made their own nest yet

Describe how you could use a quadrat to investigate how the species of plants change with distance from a river.
• Use a tape measure to create a line transect
• Place quadrats at regular intervals
• Count the number of species in each quadrat

Describe how you could investigate how leaf size changes with height on a bush.
• Use systematic sampling e.g. measure every 5th leaf
• Draw round the leaf on graph paper
• Add together the number of squares covered by the leaf, including half squares

Describe how you could investigate how the species of plants change with distance from a river.
• Use a tape measure to create a line transect
• Place quadrats at regular intervals
• Count the number of species in each quadrat

Why is it important to have a large sample size?
It allows you to identify anomalies.

2.4 Organisms and their environment

<table>
<thead>
<tr>
<th>Physical Factor</th>
<th>Why does it affect the distribution of living organisms?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Temperature</td>
<td>needs to be suitable for enzymatic reactions (different organisms have different ideal temperatures)</td>
</tr>
<tr>
<td>Nutrient availability</td>
<td>organisms need nutrients to synthesize new materials and grow</td>
</tr>
<tr>
<td>Light intensity</td>
<td>plants and algae need light for photosynthesis</td>
</tr>
<tr>
<td>Oxygen availability</td>
<td>needed by all organisms for respiration</td>
</tr>
<tr>
<td>Carbon dioxide availability</td>
<td>needed by plants and algae for photosynthesis</td>
</tr>
<tr>
<td>Water availability</td>
<td>needed for photosynthesis or to keep animals hydrated (not often a limiting factor though)</td>
</tr>
</tbody>
</table>

Look at the table of results on the left. Calculate the
a. Mean 11
b. Median 11
c. Mode 12

<table>
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</tr>
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</tr>
</tbody>
</table>

If the mean number of clover plants per m² quadrat is 6 and a field has a total area of 1200 m² how many clover plants would you expect to find in the whole field?

6 x 1200 = 7200
Describe a method to carry out random sampling of weeds using a quadrat.

Suggest why the red squirrel is rarely seen today except in particular niches of the UK.

What is the advantage of using a transect technique rather than just random quadrat sampling?

What are the arguments for the death and decline of the bee population?

What is the impact of bee decline on food production?

What can we do to raise the population of bees?

How has white nose syndrome affected bats?

How are butterflies again in decline in 2012?

How is the brown tree snake impacting on the biodiversity in Guam?

How does the acacia bullthorn plant work in a mutual relationship with ants?

Data was collected by two groups of students. Calculate the means, medians and modes for each sample.

<table>
<thead>
<tr>
<th>Sample 1</th>
<th>Sample 2</th>
</tr>
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<tbody>
<tr>
<td>12</td>
<td>14</td>
</tr>
<tr>
<td>16</td>
<td>13</td>
</tr>
<tr>
<td>14</td>
<td>15</td>
</tr>
<tr>
<td>16</td>
<td>14</td>
</tr>
</tbody>
</table>

Mean  
Median  
Mode

Is the data reproducible? Explain why.

What physical factors may affect organism numbers?

Why did the rabbit population in Australia increase?

What mechanisms are used to control the rabbit population in Australia?

How is seaweed designed to survive the changing tide?
Describe a method to carry out random sampling of weeds using a quadrat.
Split field into equal sized fractions. Give each fraction a number. Use a random number generator program to choose which areas to sample.

Suggest why the red squirrel is rarely seen today except in particular niches of the UK.
Introduction of grey squirrels from America that were bigger, stronger and carried a virus that infects and kills the red squirrel, and had a more varied diet. Red squirrels are now really only found today in pine forest plantations in northern England and Scotland.

How has white nose syndrome affected bats?
The white fungus lives on bats faces. Infection awakens hibernating bats, forcing them to use up fat reserves.

Why are butterflies again in decline in 2012?
• Heavy rain and wind damages the butterflies wings.
• Changing flowering times has reduced food availability.

How is the brown tree snake impacting on the biodiversity in Guam?
The snake ate all the native small birds that were not used to having predators, and then the snake changed its diet to other small mammals. Poisoned mouse bombs are being used to try and control the snake numbers.

What physical factors may affect organism numbers?
Temperature
Nutrients
Light
Water
Oxygen
Carbon dioxide

What are the arguments for the death and decline of the bee population?
Colony collapse disorder
Mobile phone masts interrupting bees navigation
Bees simply not returning

What is the impact of bee decline on food production?
Huge reduction in pollination of flowers for oil seed rape and fruit trees – reduced yield.

What can we do to raise the population of bees?
Place bee boxes in gardens and on farm land

How does the acacia bullthorn plant work in a mutual relationship with ants?
The plant provides a protective home and sugars for the ants. The ants deter hungry predators from eating the plant.

Data was collected by two groups of students. Calculate the means, medians and modes for each sample.

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<td>14</td>
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<td></td>
<td></td>
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<tr>
<td>Mode</td>
<td></td>
<td></td>
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</tbody>
</table>

Is the data reproducible? Explain why.
Yes the data collects is similar for both groups.

Why did the rabbit population in Australia increase?
People released rabbits for hunting, and those kept for rearing escaped destroying farm land.

What mechanisms are used to control the rabbit population in Australia?
Electric fences

How is seaweed designed to survive the changing tide?
Slime coat to prevent drying out, swim bladder to lift up when tide is out, holdfast attached to rock to withstand changing tide.
What is an enzyme and what is its function?

Describe the structure of a protein.

What type of organism do we use to produce enzymes for industry and why?

What is meant by enzyme specificity and why are enzymes specific?

Add labels to the following diagram of an enzyme-substrate complex.

What is the name of the enzyme used to convert glucose to fructose?

Look at the graph on the left which shows how temperature affects an enzyme-controlled reaction.

a. Describe the effect of temperature on the rate of reaction.

b) Explain the shape of the graph.

What is the name given to the part of the enzyme that enables it to recognize a substrate?

Why are biological washing powders more 'environmentally friendly'?

Which enzymes are contained in washing powders?

Why is fructose used instead of glucose in slimming foods?

Give four functions of proteins in living organisms.

What are carbohydrases used for in industry?

Give two factors that affect the rate of an enzyme controlled reaction.

Give two disadvantages of using enzymes in industry.
Why is the average human body temperature 37°C?

State where bile is produced? Stored? Acts?

Why does the stomach produce hydrochloric acid?

What type of enzyme is used in the manufacture of baby foods and why?

What type of cells produce digestive enzymes?

What is the function of digestive enzymes?

Complete the table below to show where the following enzymes are made and where they act.

<table>
<thead>
<tr>
<th>Enzyme</th>
<th>Where it is made</th>
<th>Where it acts</th>
</tr>
</thead>
<tbody>
<tr>
<td>Amylase</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Protease</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lipase</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Complete the table below to show the functions of the different digestive enzymes.

<table>
<thead>
<tr>
<th>Enzyme</th>
<th>Substrate</th>
<th>Product</th>
<th>Use of product</th>
</tr>
</thead>
<tbody>
<tr>
<td>Amylase</td>
<td></td>
<td></td>
<td></td>
</tr>
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Milk fat is a type of lipid. What would you expect to happen to the pH of the liquid as it's digested and why?

Some people suffer from gallstones, which may block their bile duct. Explain the following symptoms:

Pale faeces:

Jaundice:

Complete the table below to show why can't amylase break down protein?

Why can't amylase break down protein?

Why are the two functions of bile?

What type of cells produce digestive enzymes?
2.5 Proteins - Functions and uses

What is an enzyme and what is its function?
Biological catalyst - speeds up the rate of a reaction

Describe the structure of a protein.
Long chain of amino acids
Folded to produce a specific 3D structure

What is meant by enzyme specificity and why are enzymes specific?
Each enzyme only catalyses one type of reaction.
Each enzyme has a different shape active site

Give two factors that affect the rate of an enzyme controlled reaction.
- Temperature
- pH

What type of organism do we use to produce enzymes for industry and why?
Microorganisms
They reproduce rapidly so produce lots of enzyme
They are cheap and easy to handle

Give four functions of proteins in living organisms
- Hormones
- Enzymes (catalysts)
- Antibodies
- Structural components of tissues

What is the name given to the part of the enzyme that enables it to recognize a substrate?
Active site

Add labels to the following diagram of an enzyme-substrate complex.

- Enzyme
- Substrate
- Active site

What is the name of the enzyme used to convert glucose to fructose?
Isomerase

Look at the graph on the left which shows how temperature affects an enzyme-controlled reaction.
a. Describe the effect of temperature on the rate of reaction.
   - Rate increases up to 40°C
   - Rate is at a maximum at 40°C
   - Above 40°C rate rapidly falls
b) Explain the shape of the graph.
   - Between 0 and 40°C increasing temperature increases the kinetic energy of molecules so the enzyme and substrate collide more often and with more force
   - Above 40°C the enzyme is denatured so can no longer catalyse the reaction

Why are biological washing powders more 'environmentally friendly'?
Allow you to wash clothes at a lower temperature
Use less energy and therefore less fuel so produce less pollution

Which enzymes are contained in washing powders?
Proteases
Lipases

Why is fructose used instead of glucose in slimming foods?
Fructose is sweeter than glucose
So less is needed

What are carbohydrases used for in industry?
To convert starch to sugar syrup

Give 2 disadvantages of using enzymes in industry.
Most enzymes are expensive to extract
Some people are allergic to certain enzymes

What is the name of the enzyme used to convert glucose to fructose?
Isomerase

Give two factors that affect the rate of an enzyme controlled reaction.

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Give four functions of proteins in living organisms
- Hormones
- Enzymes (catalysts)
- Antibodies
- Structural components of tissues

What is the name given to the part of the enzyme that enables it to recognize a substrate?
Active site

Add labels to the following diagram of an enzyme-substrate complex.

- Enzyme
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Give 2 disadvantages of using enzymes in industry.
Most enzymes are expensive to extract
Some people are allergic to certain enzymes
What is the function of digestive enzymes?
To break large insoluble food molecules into small soluble molecules that can be absorbed.

Why is the average human body temperature 37°C?
Optimum temperature for most enzymes

State where bile is Produced? Liver
Stored? Gall bladder
Acts? Small intestine

Why does the stomach produce hydrochloric acid?
Stomach enzymes work best in acidic conditions.

What type of cells produce digestive enzymes?
Specialised cells in glands and the lining of the gut

Complete the table below to show where the following enzymes are made and where they act.

<table>
<thead>
<tr>
<th>Enzyme</th>
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<tr>
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<td>Salivary glands, pancreas, small intestine</td>
<td>Mouth, small intestine</td>
</tr>
<tr>
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<td>Stomach, pancreas, small intestine</td>
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Some people suffer from gallstones, which may block their bile duct. Explain the following symptoms:
Pale faeces: bile can’t get into the small intestines
Jaundice: Bile pigment is deposited in the skin

What are the two functions of bile?
• Neutralises the stomach acid to produce alkaline conditions so that enzymes in the small intestine are not denatured
• Emulsifies (breaks up) fats so they have a larger surface area on which enzymes can work, meaning they are digested more rapidly

Complete the table below to show the functions of the different digestive enzymes.

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<td>Amino acids</td>
<td>Used to synthesise other proteins</td>
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<td>Cell membranes, making hormones, insulation, energy store</td>
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Milk fat is a type of lipid. What would you expect to happen to the pH of the liquid as it’s digested and why?
Become more acidic. Fatty acids produced

Why can’t amylase break down protein?
The shape of the active site in amylase is not complementary to the shape of a protein molecule.

What type of enzyme is used in the manufacture of baby foods and why?
Proteases to predigest the protein in the food.

Why is the stomach temperature 37°C?
Optimum temperature for most enzymes

What type of cells produce digestive enzymes?
Specialised cells in glands and the lining of the gut

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What do plants use the energy from respiration for?

Give two changes that happen in the body when you exercise.

Why do athletes 'carb load' before a big race?

The graph above shows how Fred's heart rate changed during a 1500m race. 0 minutes is when he started the race and 4 minutes is when he finished. Describe and explain the shape of the graph.

What type of molecules control the rate of reactions inside cells?

What is meant by an oxygen debt?

What part of the cell do most stages of aerobic respiration take place in?

Why do muscle cells have lots of mitochondria?

What is the product of anaerobic respiration?

Why does anaerobic respiration release so much less energy than aerobic respiration?

Why do birds and mammals have a higher rate of respiration than reptiles and fish?

Why do muscle cells have lots of mitochondria?

What happens to muscles when they are subject to long periods of vigorous activity and why?

What is fermentation?

Write an equation for aerobic respiration.

Write a word equation for aerobic respiration.

What do birds and mammals have a higher rate of respiration than reptiles and fish?
What do plants use the energy from respiration for?
To build up sugars, nitrates and other nutrients into amino acids which are then built up into proteins.

What type of molecules control the rate of reactions inside cells?
Enzymes

Write a word equation for aerobic respiration.
Glucose + Oxygen → Water + Carbon (+ Energy) dioxide

What part of the cell do most stages of aerobic respiration take place in?
Mitochondria

Why does anaerobic respiration release so much less energy than aerobic respiration?
Anaerobic respiration is the incomplete breakdown of glucose,

What is the product of anaerobic respiration?
Lactic acid

What is meant by an oxygen debt?
The amount of oxygen required to oxidise lactic acid to carbon dioxide and water

What type of molecules control the rate of reactions inside cells?
Enzymes

When does anaerobic respiration take place?
When there is insufficient oxygen supply.

Why do birds and mammals have a higher rate of respiration than reptiles and fish?
They use energy from respiration to maintain a steady body temperature

What do plants use the energy from respiration for?
To build up sugars, nitrates and other nutrients into amino acids which are then built up into proteins.

Give two changes that happen in the body when you exercise.
• Heart rate increases
• Rate and depth of breathing increases

Why do athletes 'carb load' before a big race?
To increase stores of glycogen in their muscles
Can be converted back to glucose to be used for respiration during the race

Graph to show how heart rate changes with exercise

Why do muscle cells have lots of mitochondria?
They need to respire lots to produce enough energy for contraction

What happens to muscles when they are subject to long periods of vigorous activity and why?
They become fatigued as the build up of lactic acid stops enzymes working

The graph above shows how Fred's heart rate changed during a 1500m race, 0 minutes is when he started the race and 4 minutes is when he finished. Describe and explain the shape of the graph.
Between 0 and 4 minutes heart rate rises to supply the muscles with more oxygen and glucose and remove carbon dioxide more rapidly.
Heart rate remains high after finishing the race to supply oxygen to recover the oxygen debt and blood to remove the lactic acid.

What is fermentation?
Anaerobic respiration in yeast.

Write an equation.
Glucose → Carbon dioxide + ethanol
According to the most widely accepted model to be classified as living there are 7 key life processes

Mr. S. G. R. E. N.

Describe the changes in the body that take place when you exercise.
- H.r. increases
- Rate and d. of breathing i.
- Arteries supplying muscles w./ dilate.
- Arteries going to the s. dilate / widen
- Glycogen in muscles is broken down into g.
- Increase in s. at the skin

Write a word equation for aerobic respiration.

Respiration allows e to be released (NOT made) from the sugar g.

2.6 Aerobic & Anaerobic respiration

Explain the changes that happen when you exercise.
- Faster transport / supply of to m. cells
- Faster removal of from cells
- Increased rate of of oxygen and carbon dioxide at the lungs
- Faster rate of in cells releasing e. faster.
- Faster release of h. from the body preventing e. from denaturing

Why might aerobic respiration stop?

Word equation for anaerobic respiration.

Why is anaerobic respiration not as useful to cells as aerobic respiration?
- is made (which causes muscle fatigue) and is released into the b.,
- energy is released as the breakdown of glucose is i.,
- an o. builds up

What happens to the lactic acid?
It must be oxidised (repay the oxygen debt) into and w.

Where does respiration take place?

On which structures in the cell does respiration happen?

Where are these structures found within the cell?

Chemical reactions take place in the cytoplasm. What controls all chemical reactions?

Explain simply why it is important for all cells to regulate their temperature.

Is there any difference in respiration between plants and animals?

How is the energy released used?
to build l. molecules from s. ones e.g. glycogen from .molecules in animals, to enable .to c.
in mammals and birds (w. blooded), to maintain a . body t. in colder surroundings
in plants, to build up sugars, n. and other nutrients into a. acids which are then built up into p.
According to the most widely accepted model to be classified as living, there are 7 key life processes:

- Movement
- Respiration
- Sensitivity
- Growth
- Reproduction
- Excretion
- Nutrition

Respiration allows energy to be released (NOT made) from the sugar glucose.

### 2.6 Aerobic & Anaerobic Respiration

**Write a word equation for aerobic respiration.**

\[
\text{Glucose} + \text{oxygen} \rightarrow \text{carbon dioxide} + \text{water} + (\text{energy})
\]

**Describe the changes in the body that take place when you exercise.**

- Heart rate increases
- Rate and depth of breathing increases
- Arteries supplying muscles widen/dilate.
- Arteries going to the skin dilate/widen
- Glycogen in muscles is broken down into glucose.
- Increase in sweating at the skin
- Muscles contract/respire faster

**Explain the changes that happen when you exercise.**

- Faster transport/supply of glucose and oxygen to muscle cells
- Faster removal of carbon dioxide and lactic acid from cells
- Increased rate of diffusion of oxygen and carbon dioxide at the lungs
- Faster rate of respiration in cells releasing energy faster
- Faster release of heat from the body preventing enzymes from denaturing

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**Word equation for anaerobic respiration.**

\[
\text{Glucose} \rightarrow \text{lactic acid} + (\text{energy})
\]

**Explain why aerobic respiration is not as useful to cells as anaerobic respiration.**

- Lactic acid is made (which causes muscle fatigue) and released into the blood.
- Less energy is released as the glucose is not fully broken down.
- An oxygen debt builds up

**What happens to the lactic acid?**

It must be oxidised (repay the oxygen debt) into carbon dioxide and water.

**Where does respiration take place?**

In all living cells

**On which structures in the cell does respiration happen?**

Mitochondria

**Where are these structures found within the cell?**

In the cytoplasm

**Chemical reactions take place in the cytoplasm.**

What controls all chemical reactions?

Enzymes

**Explain simply why it is important for all cells to regulate their temperature.**

The enzymes would denature, respiration would stop happening and the cell dies.

**Is there any difference in respiration between plants and animals?**

No. It happens day and night in all cells

**How is the energy released used?**

- To build larger molecules from smaller ones e.g. glycogen from glucose in animals, to enable muscles to contract
- In mammals and birds (warm blooded), 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.
2.7a Cell division and Inheritance

Why do we need two types of cell division?
Mitosis – repair/growth of tissue (replacement of c….)
Meiosis – ensures variation in offspring

Compare mitosis and meiosis
Mitosis (nearly all cells) – chromosomes duplicate, cell splits into two cells, both have the same number of chromosomes at the end as the original parent cell.
Meiosis (produces gametes) Testes/ovaries cells chromosomes duplicate, cell undergoes two divisions to produce four cells with half the number of chromosomes of other body cells.

Why was Henry VIII wrong when he blamed his wives for giving him girls instead of boys?
- Woman
- Man

Why do we need two types of cell division?
Mitosis – repair/growth of tissue (replacement of c….)
Meiosis – ensures variation in offspring

Why is fertilisation important?
Ensures variation in offspring, through parents (reproduction) both passing on genetic information bringing differing combinations of genes / ancestry.
Higher chance of survival against predators

Why are plants better designed for survival than animals?
Plants retain stem cells throughout its lifetime, meaning new limbs/shoots can be formed

What are stem cells
Cells that have not yet specialised by the process of differentiation

What are the main animal sources of stem cells?
Embryonic – as they can become any cell in the body. The others are limited.
Explain why cystic fibrosis appears to be caused by a recessive allele.
- It skips the .... and generation.
- It is hidden in some people (such as ....) such as ..., ..., who appear normal.

Evaluate the ethical, social uses of stem cells.
E.... are l...... balls of cells – who should we be to decide their fate as spare parts?
At such an early stage of development the embryo has no spine / brain – scientifically acceptable to manipulate these cells.
Treat conditions such as pneumonia and diabetes, improving future lives.

What shape is the DNA that makes up a chromosome?

What is the difference between a gene and an allele?
What is embryo screening?

2.7b Inheritance and screening

Who was Mendel?

Why did Mendel propose the idea of separately inherited factors (genes)?
Mendel proposed the idea because the ratio of peas implied the idea of separately inherited factors. He classified the characteristics of peas and recognized that there is always a certain ratio. i.e. : or : or :
He also recognized that features could generations which implied a certain inheritance.

Who was Mendel?

Why was Mendel's work not accepted in his life-time?
- He was a monastic not a scientist.
- Technology / methods were not advanced enough to see the genes of inheritance.
- His theory defied current religious beliefs about God and creation.

When carrying out a genetic cross to work out the F2 what combination of alleles must you have for the P1?

Show how using a genetic cross pink pea flowers may skip a generation.

P1 phenotypes white x pink
P1 genotypes
Gametes
F1 genotypes (cross)
F1 phenotypes
P2 phenotypes
P2 genotypes
Gametes
F2 genotypes (cross)
F2 phenotypes

How does a gene code for a feature? How does cystic fibrosis arise? (Higher)
Each gene codes for a particular code of amino acids which make a specific protein. If a different amino acid is substituted a different protein is made which might cause more mucus to be released at the cell membrane.

Explain how polydactyl syndrome is inherited.
Explain how cystic fibrosis is inherited.

Compare the terms genotype and phenotype.

Compare a DNA fingerprint, with a fingerprint.

Compare the terms homozygous and heterozygous.
Compare mitosis and meiosis
Mitosis (nearly all cells)– chromosomes duplicate, cell splits once into two cells, both have the same number of chromosomes at the end as the original parent cell.

Meiosis – (produces gametes.) Testes / ovaries cells chromosomes duplicate, cell undergoes two divisions to produce 4 cells with half the number of chromosomes of other body cells.

Why was Henry VIII wrong when he blamed his wives for giving him girls instead of boys?
- The Y sex chromosome carried by the man is the deciding factor.

Why do we need two types of cell division?
Mitosis – repair / growth of tissues (replacement of cells)
Meiosis – ensures variation in offspring

Why is fertilisation important?
Ensures variation in offspring, through 2 parents (sexual reproduction) both passing on genetic information bringing differing combinations of genes / alleles.
Higher chance of survival against pathogens.

2.7a Cell division and Inheritance

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Plants retain stem cells throughout its lifetime, meaning new limb/shoots can be regenerated.

What are stem cells?
Cells that have not yet specialised by the process of differentiation

What are the main animal sources of stem cells?
- Embryonic (IVF unused embryos)
- Umbilical cord
- Adult stem cells (e.g. bone marrow)

Which is the best source?
Embryonic – as they can become any cell in the body. The others are limited.

Evaluate the ethical, social uses of stem cells.
Embryos are living balls of cells – who should we be to decide their fate as spare parts?
At such an early stage of development the embryo has no spine / brain – scientifically acceptable to manipulate these cells.
Treat conditions such as paralysis / diabetes, improved family lives.

What shape is the DNA that makes up a chromosome?
Double helix

What is the difference between a gene and an allele?
A gene is a short section of chromosome DNA that codes for 1 feature e.g. eye colour, alleles are the variants of the gene, e.g. brown, blue, green.

Why were the Y and Z chromosomes (both) once thought to be the sex chromosome?
- The Y chromosome is the deciding factor.
- The Z chromosome is also present.

Compare the terms dominant and recessive
Dominant alleles only need to be inherited from 1 parent to be seen, recessive alleles must be inherited from both parents to be seen.

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A gene is a short section of chromosome DNA that codes for 1 feature e.g. eye colour, alleles are the variants of the gene, e.g. brown, blue, green.

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- It skips the 2nd and 4th generations.
- It is hidden in some people (carriers) such as 2, 4, 5 who appear normal.
### Embryo Screening

What is embryo screening?
Taking a cell from an embryo (IVF) and looking for a genetic disorder.

### 2.7b Inheritance and Screening

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Monk - founder of genetics. Studied the pea plant |
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Mendel proposed the idea because the ratio of peas implied the idea of separately inherited factors. He classified the characteristics of peas and recognized that there is always a certain ratio, i.e. 1:1 or 3:1 or 1:0. He also recognized that features could skip generations which implied separate factors of inheritance. |
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AA and aa (homozygous dom and rec) |
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| **Compare the terms homozygous and heterozygous**
Homozygous is either two dominant (AA) or two recessive alleles (aa).
Heterozygous is a combination of a dominant and a recessive allele (Aa) for a gene |
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Genotype is the code used (combination of alleles e.g. Aa). Phenotype is what is displayed in the environment e.g. white flowers. |
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What are gametes and where do they form?

Why was the importance of Mendel's discoveries not appreciated until after his death?

Define the following terms:
- Homozygous
- Heterozygous

What is the shape of a DNA molecule?

What is an allele?

What is the function of mitosis?

What is the principle behind DNA fingerprinting?

What is the difference between the genetic material in body cells and gametes?

Where is genetic information found in the cell?

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Why are offspring produced by sexual reproduction genetically different to their parents?

Why is it easier to clone plants than animals?

Why is it easier to clone plants than animals?

Complete the table to compare mitosis and meiosis.

<table>
<thead>
<tr>
<th></th>
<th>Mitosis</th>
<th>Meiosis</th>
</tr>
</thead>
<tbody>
<tr>
<td>Type of cell formed</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rounds of division</td>
<td></td>
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<tr>
<td>Number of daughter cells</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Genetic makeup of daughter cells</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

What is the shape of a DNA molecule?

What is the principle behind DNA fingerprinting?

What is a gene?

What is an allele?

What did Mendel use for his experiments?

Distinguish between the terms genotype and phenotype using an example for each.

Add labels to the diagram to show the processes taking place.

Zygote  →  Embryo

What is the difference between the genetic material in body cells and gametes?
What is meant by a 'carrier' of a genetic disease?

State whether the following disorders are dominant or recessive?
- Polydactyl
- Cystic fibrosis

What are the features of polydactyl?

How many parents must possess the cystic fibrosis gene in order to have a child with the disease?

What is cystic fibrosis a disorder of?

How many polydactyl alleles do you need in order to have the disease?

What are stem cells and where are they found?

Give 2 advantages and 2 disadvantages of finding out whether your unborn child has a genetic disease.

What is the name given to the technique that involves checking whether an unborn child has a genetic disease?

Draw a genetic diagram to show why there is an equal chance of a couple having a boy and a girl.


Look at the genetic pedigree above. Explain how Carla can inherit the disease when neither of her parents have it.
What is the function of mitosis?
- Growth of new cells
- Repair of worn out or damaged cells
- To create cells that can differentiate

What is the principle behind DNA fingerprinting?
- Every individual except for identical twins has different DNA

Why was the importance of Mendel’s discoveries not appreciated until after his death?
- No one knew about chromosomes or genes at the time
- Mendel was not a well respected scientist and his work was not published in respected journals

Define the following terms:
- **Homozygous**: an individual for whom both alleles for a particular gene are the same
- **Heterozygous**: an individual for whom both alleles for a particular gene are different

What is the shape of a DNA molecule?
- **Double helix**

What is an allele?
- An alternative version of a gene

What are gametes and where do they form?
- Sex cells - testes (sperm) and ovaries (ova)

Where is genetic information found in the cell?
- On chromosomes in the nucleus

What is the difference between the genetic material in body cells and gametes?
- Body cells have 2 sets of chromosomes, gametes have only one set.

Complete the table to compare mitosis and meiosis.

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<th>Meiosis</th>
</tr>
</thead>
<tbody>
<tr>
<td>Type of cell formed</td>
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<td>Gamete</td>
</tr>
<tr>
<td>Rounds of division</td>
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<tr>
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<td>4</td>
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<tr>
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<td>Identical to parent cell</td>
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What is the function of mitosis?
- Growth of new cells
- Repair of worn out or damaged cells
- To create cells that can differentiate

Why are offspring produced by sexual reproduction genetically different to their parents?
- Offspring inherit one of each pair of alleles from each parent.

Define the following terms:
- **Homozygous**: an individual for whom both alleles for a particular gene are the same
- **Heterozygous**: an individual for whom both alleles for a particular gene are different

Why is it easier to clone plants than animals?
- Most plant cells retain the ability to differentiate throughout life whereas most animal cells become specialised during formation of the embryo.

Add labels to the diagram to show the processes taking place.

- **Fertilisation**
- **Mitosis**
- **Zygote**
- **Embryo**

What did Mendel use for his experiments?
- Pea plants

Distinguish between the terms genotype and phenotype using an example for each.
- **Genotype**: combination of alleles of an individual e.g. Bb
- **Phenotype**: observable characteristics of an organism e.g. brown eyes
What is meant by a 'carrier' of a genetic disease?
A heterozygote – has one normal allele and one faulty allele for a recessive disease

What is cystic fibrosis a disorder of?
Cell membranes

What is the difference between a dominant allele and a recessive allele?
A dominant allele controls the development of a characteristic when it is present on only one of the chromosomes in a pair.
A recessive allele controls the development of characteristics only if the dominant allele is not present is a recessive allele.

Draw a genetic diagram to show why there is an equal chance of a couple having a boy and a girl.

<table>
<thead>
<tr>
<th>Mum (XX)</th>
<th>Dad (XY)</th>
</tr>
</thead>
<tbody>
<tr>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>X</td>
<td>XX</td>
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<td>X</td>
<td>XX</td>
</tr>
<tr>
<td>Y</td>
<td>XY</td>
</tr>
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<td></td>
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What is the name given to the technique that involves checking whether an unborn child has a genetic disease?
Embryo screening

What are stem cells and where are they found?
Undifferentiated cells that can specialise to form any other type of cell
Found in the embryo, cord blood and adult bone marrow

Give 2 advantages and 2 disadvantages of finding out whether your unborn child has a genetic disease.

- **Advantages**
  - can make an informed decision about abortion; can prepare mentally and financially for having a child with a disease; can prevent suffering
  - can lead to destruction of the foetus which is against some religions; procedure can harm mother or baby

- **Disadvantages**
  - premature delivery could be damaging for baby
  - can only be carried out in the first trimester of pregnancy
2.8 Speciation

• Why are fossils important for studying evolution?

What conditions are needed for decay to occur?

Give two reasons why the fossil record is incomplete.

What does it mean if a species has become extinct?

Describe 3 ways in which fossils can form.

What does it mean if 2 populations of a species become isolated?

Give 5 reasons why a species may become extinct.

What is the theory of evolution?

Give a definition of a species.

Lemurs and monkeys have a common primate ancestor. Explain how they became separate species.

Give 2 ways in which populations of a species can become geographically isolated.

Why has the introduction of grey squirrels led to red squirrels becoming endangered?

Why are scientists unsure about how animals evolved even if there is good fossil evidence?
### 2.8 Speciation

**What is a fossil?**
The remains of an organism from millions of years ago preserved in rock.

**What conditions are needed for decay to occur?**
- Oxygen
- Moisture
- Warmth

**What does it mean if a species has become extinct?**
All organisms of the species have died out.

**Give 5 reasons why a species may become extinct.**
- Changes to the environment over geological time
- **New** predators
- **New** diseases
- **New**, more successful, competitors
- A single catastrophic event, e.g., massive volcanic eruptions or collisions with asteroids

**Describe 3 ways in which fossils can form.**
- From the hard parts of animals that do not decay easily
- From parts of organisms that have not decayed because one or more of the conditions needed for decay are absent
- When parts of the organism are replaced by other materials as they decay
- As preserved traces of organisms, e.g., footprints, burrows and rootlet traces.

**What does it mean if 2 populations of a species become isolated?**
They become physically separated.

**What is the theory of evolution?**
New species develop from old species by the process of gradual change over millions of years.

**Give a definition of a species.**
A group of organisms with similar characteristics that can reproduce to give fertile offspring.

**Lemurs and monkeys have a common primate ancestor. Explain how they became separate species.**
- Two populations of the primate ancestor became geographically isolated
- Within each population, there was genetic variation
- In the two different environments, there were differing selection pressures
- In each population, the alleles that gave a survival advantage were selected for
- Eventually, the populations became so different that interbreeding was no longer possible

**Give 2 ways in which populations of a species can become geographically isolated.**
- Land mass breaks off / formation of an island
- Flooding / Formation of a new mountain range

**Why has the introduction of grey squirrels led to red squirrels becoming endangered?**
- Grey squirrels are a **new** competitor
- Greys are better adapted to the environment, e.g., less timid / eat wider variety of food etc

**Why are scientists unsure about how animals evolved even if there is good fossil evidence?**
No scientists around millions of years ago to document changes.