AQA Trilogy-Biology key terms - Organisation

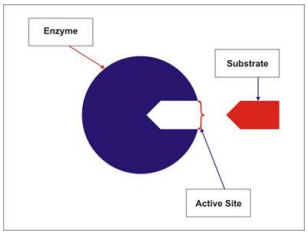
<table>
<tr><th colspan="2">Cells – Tissues – Organs and the digestive system</th></tr>
<tr><td>A tissue is a group of cells with a similar structure and function working together e.g.

Epithelial, glandular and muscular in the stomach

mesophyll and epidermal in plant leaves.</td><td>An organ system is a group of organs working together. E.g.

The digestive system is made up of a number of organs; Mouth, gullet, stomach, liver, pancreas, small and large intestines, rectum and anus.

In plants, the organs are the stem, leaves, roots.</td></tr>
<tr><td>An organ is a group of tissues working together e.g a leaf in a plant or the stomach in an animal.</td><td>The digestive system is made up of a number of organs; Mouth, gullet, stomach, liver, pancreas, small and large intestines, rectum and anus. They have specific roles e.g. the stomach digests food, it is made up of muscular, glandular (secretes enzymes) and epithelial tissue.</td></tr>
<tr><th colspan="2">Enzymes</th></tr>
<tr><td>Enzymes are biological catalysts. They are proteins (hence made by ribosomes) with an active site (substrate fits into this) that speed up chemical reactions involved in building, breaking down and changing large molecules. They are <u>not used up</u> in the reaction.

 
</td><td>Enzymes are specific to their substrates. They have a <u>specific shaped active site</u>, which only fits to 1 substrate.</td></tr>
<tr><td>Lock & Key model- can explain enzyme action

-Active site does not change (shape) - fixed
-is complementary to substrate (before binding);</td><td>- Amylase – breaks down carbohydrates (e.g. starch)-> glucose),

-Protease proteins ->Amino acids

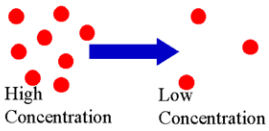
-Lipase fats-> fatty acids + glycerol. (In experiments, sometimes it refers to the pH being lower when fats are broken down, this is because fatty acids are acidic)

These products are used to build new carbohydrates, lipids and proteins. Glucose is also used in respiration</td></tr>
<tr><td>Where they are made → Amylase, protease and lipase are <u>all</u> made in the <u>small intestine</u> and <u>pancreas.</u> Amylase is also made in the salivary glands and protease is also made in the stomach.</td><td>Where they act → <u>all</u> act in <u>small intestine</u>. Amylase also acts in <u>mouth</u>. Protease also acts in <u>stomach</u>.</td></tr>
<tr><td>Increasing temperature increases rate of reaction to a point (gives particles <u>kinetic</u> energy-enzyme and substrate more likely to collide).
If temperature is too high (or pH too high or low)- enzyme is denatured. The active site changes shape so the <u>substrate can't fit</u> anymore.</td><td><u>Required practical</u> →Each enzyme has optimum pH. Change in pH can <u>denature</u> enzyme

If we increase the substrate concentration -
Increases rate of reaction to a point- until all <u>active sites</u> are full</td></tr>
<tr><td>Enzymes are denatured (change shape) by temperatures and pH that are outside of the optimum conditions – these are specific for each enzyme. Increase of temperature initially speeds up reactions as the substrates and active sites are more likely to collide, since particles have more kinetic energy.</td><td>Protease works best in the acidic conditions in the stomach. Bile made in the liver and stored in the gall bladder breaks lipids into smaller droplets (emulsifies) so there is a <u>larger surface area</u> for lipase to work on.</td></tr>
<tr><td><u>Required Enzyme practicals</u>

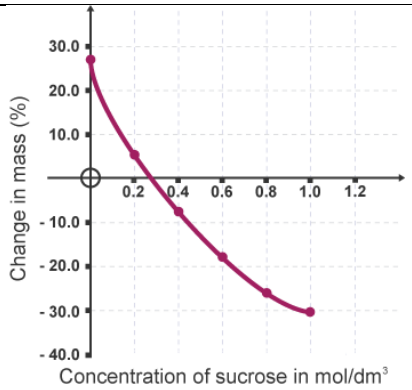
Independent variable – thing you purposefully <u>change</u> in an</td><td><u>Enzyme practicals</u>

<u>Optimum</u> means best. I.e. the optimum temperature is the</td></tr>
</table>

experiment. **Dependent variable**- thing you measure. **Control variable-** thing you keep the same to make it a fair test	temperature enzymes work best at. In industry, a lower temperature than the optimum might be chosen if there isn't much different in results, as it will be **cheaper** to use a lower temperature, as less energy is needed
Enzyme practicals A **water bath** can be used to control the temperature. If a water bath is used, the 2 substances should be put in the water bath for about 5 minutes before they are mixed. This **makes sure they are at the right temperature** when they react.	**Enzyme practicals** Can be surer of the optimum temp/pH if we **repeat** results. This makes them more **repeatable**. -We should also test **smaller intervals** (e.g. test 35°C, as well as just 30 and 40°C) (If a graph is drawn and the points are joined dot to dot, this is because the smaller intervals haven't been tested)- this makes it **more precise** **Accuracy**= how close values are to the true value (i.e. the result they should be)
Rates of reaction – enzymes (i.e. how quickly they happen) Work this out by finding the **gradient** of the line of best fit. Change in Y axis ÷ change in X axis. (Just like you do in the chemistry rates of reaction unit). Units = units on Y axis/units on X axis.	**Food tests- required practical** **Test** for **starch** -Add **iodine** solution -Turns blue/black
Transport systems	
Substances may move into and out of cells across the cell membranes via **diffusion**. **Diffusion** is the spreading out of the particles resulting in a **net** movement from an area of higher concentration to an area of lower concentration. It is the process by which gases (O_2/CO_2) are exchanged in cells and waste (urea) removed from cells into the blood plasma.  	Rate of diffusion can be increased by: -increased **temperature** (particles have more kinetic energy, so move more) -**larger surface area to volume ratio** (more space for particles to travel to) - a larger difference in concentration (**concentration gradient**),
Calculating surface area to volume ratio- 1. Calculate surface area (length x height x no. of sides) 2. Calculate volume (length x height x width) 3. Divide result for surface area by the volume	**Smaller organisms have a larger surface area to volume ratio**. Big animals have a small one. -Consequently single celled organisms (i.e. v small) can rely on diffusion alone to transport materials in and out of the cell -Bigger organisms must have a specialised transport system instead (as diffusion would be too slow)
Lungs, small intestine, roots and leaves are all adapted to maximise diffusion. Have **large surface area**s, **thin membranes** (short diffusion path) and in animals have a **good blood supply** (to keep concentration gradient)	**Water** may move across cell membranes via **osmosis**. **Osmosis** is the diffusion of **water** from a dilute solution to a concentrated solution through a **partially permeable membrane** Concentrated solutions have more sugar/salt (and thus less water). Water will move into these areas. The water moves from where there is lots of it, to less of it.
Required practical- Investigate the effect of a range of concentrations of salt or sugar solutions on the mass of plant tissue. 1. Use a potato borer to cut out several strips of potato	You may see a graph like this (based on the results of the required practical)

2. Measure their length and mass
3. Place each one in a different test tube. Each test tube should have a different concentration of salt/sugar in it
4. Leave overnight (or at least half an hour)
5. Remove potato chips and measure and re-weigh

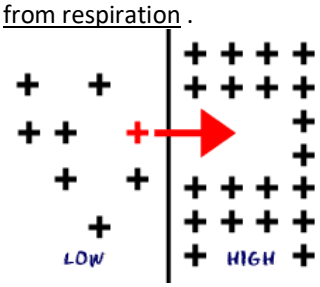
Work out percentage change in mass/length (change in mass/starting mass)



Where the line of best fit crosses the X axis is what the water potential of the potato cell is- no net movement of water by osmosis. Positive numbers show mass has increased (there is less sugar in solution, as there will be more water in the solution than the potato, so it will move into the potato **BY OSMOSIS**!.). Negative numbers show mass has decreased (when the sugar solution is high, there is less water in the solution (more in the potato), so it moves out of the potato **BY OSMOSIS)**. You must say by osmosis each time you mention water movement.

Other potential required practical questions: (higher tier)
-if you are asked to find the change in mass from a concentration of sugar/salt you haven't got results from, draw a **line of best fit** on a graph and read off it
-**Rate** means how quickly something happens (i.e. over time)
-Doesn't really matter if all the potato chips are exactly the same length if you have calculated % change, as **%s allow you to compare when you have different starting values.**
-Ideally you should **blot** the potato chips with paper towel before weighing them, to make sure the mass is only taking into account the water in the potato (and not the water that hasn't actually moved into the potato)
-Ideally you should use **bungs** on the tubes so water doesn't' evaporate. (both not using bungs or not blotting could be sources of error in an experiment)

Active transport moves substances from a more dilute solution to a more concentrated solution -**against a concentration gradient** (i.e. low to high concentration). This requires **energy** from respiration .



Cells that carry out active transport often have lots of **mitochondria** (to release energy for the process)

Used to absorb mineral ions into plant root hairs and sugar to be absorbed in the gut into the blood (so it can be used for respiration)

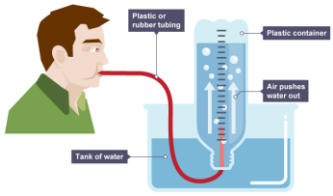
Osmosis & diffusion don't need energy (passive process)- active transport does (active process)
-Osmosis and diffusion go down a concentration gradient. Active transport goes against it
-Osmosis is the movement of water. Active transport and diffusion can be any other particles (e.g. ions)
-osmosis and active transport, substances move from a dilute to a more concentrated solution

You must give **like for like points** (i.e. compare on the same feature)

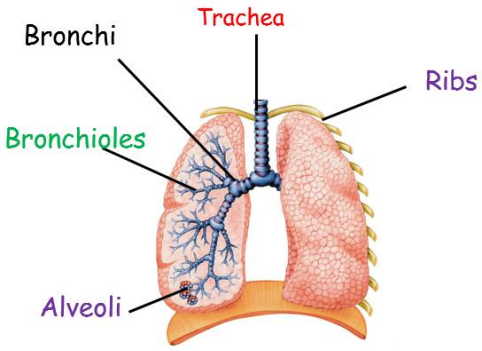
AQA Trilogy-Biology key terms - Organisation

The respiratory system

Equipment like the one below can be used to measure lung volume



Lung structure



Gas exchange happens in the **alveoli**. There are **many alveoli** (large surface area). They are surrounded by lots of blood **capillaries** to maintain concentration gradient of gases. **Thin walls**, so gases don't have far to travel. Ventilated to maintain concentration gradient.

Asthma is an allergy. People find it hard to breathe as the **bronchioles get narrower**, so **less air can pass through.**

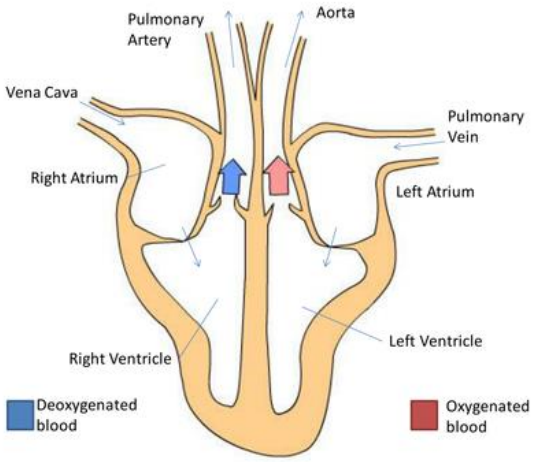
The heart and blood

Heart has **4** chambers – 2 atria (top) & 2 ventricles (bottom). Valves stop blood going backwards in heart.

Double pump system i.e.- blood from right hand side of heart goes to lungs. Then returns to heart after lungs and the left side pumps it to the body. This helps to **maintain pressure.**

Remember pictures are backwards

Heart structure



-**Aorta** (an artery) –Blood to body (oxy)
-**Pulmonary artery** – blood to lungs (de-oxy)
-**Pulmonary vein** – blood from lungs (oxy)
-**Vena cava** – blood from body (de-oxy)
Think **A** for away (arteries) & **pulmonary** to do with lungs

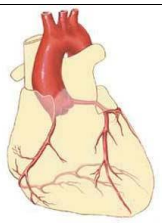
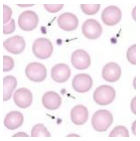
Resting heart rate is controlled by cells in the right atria that act as a **pacemaker**. If someone has an irregular heart rate it can be helped by using an artificial pacemaker (an electronic device), which makes sure the heart beats at regular intervrals.

Coronary arteries – arteries around the outside of heart – heart

Coronary heart disease

1. -layers of fatty material build up inside the coronary arteries, narrowing them.
2. This reduces the flow of blood through them
3. resulting in a lack of oxygen for the heart muscle.
4. The heart muscle cannot respire and therefore dies.

AQA Trilogy-Biology key terms - Organisation

 is muscle needing oxygen etc.	
Risk factors are linked to an increased rate of disease. For heart disease = lack of exercise, smoking, high blood pressure etc. With some risk factors, we know they **cause** a condition, with others, we just know there is a **correlation** (i.e. A link)	Heart conditions may cause chest pains, if the heart has to beat faster to allow enough oxygen to be supplied to cells/
Treatment for heart disease: -**Stents**- can be used to keep coronary arteries open so blood can reach heart muscle (+remain in place for a long time/-risks involved with the surgery e.g. blood clots or infections) -**Statins**- drugs to lower cholesterol (+decrease cholesterol, + slows down rate that fatty material is deposited on arteries, - may be other side effects of drug, - people may forget to take them)	Treatment for faulty heart valves (leaky or may not open properly -Can be replaced by **biological or mechanical valves**
Treatment for heart failure: -**heart transplant** from a donor -Artificial hearts can be used until a donor is found	You may be asked to **evaluate** the treatment methods. You need to give **good *and* bad points**. If data is provided, don't just repeat it back to the examiner, make a comment on it e.g. *cheaper* (rather than £20 vs £300), *better success rates, less side effects* etc.
Blood is carried around the body in 1 of 3 blood vessels: -**Arteries**- carry blood ***away*** from heart under high pressure. Have thick walls to **withstand pressure**. Elastic walls so they can **stretch.** Thick muscle to **maintain force on the blood.** -**Veins**- carry blood ***back*** to heart. Have valves to stop blood going backwards -**Capillaries**- tiny vessels branched off from the arteries. Where ***exchange*** happens. Very thin walls to help this happen (short diffusion path)	
Blood contains **white blood cells, red blood** and **platelets**. These are all found suspended in **plasma** (liquid part of blood)	**Red blood cell**- carry oxygen around body. Adapted by having no nucleus (so more space to carry oxygen) 
White blood cells – protects body against infection 	**Platelets**- help the blood to clot (stop body losing too much blood) 

AQA Trilogy-Biology key terms - Organisation

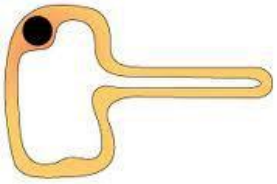
Plant tissues, organs and systems

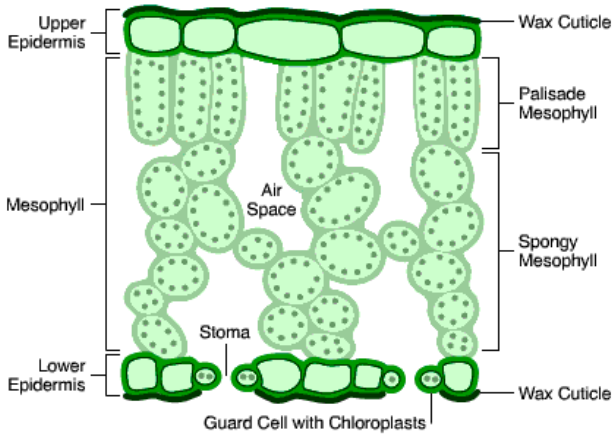
Plants don't have blood. They move substances via the xylem and phloem in the stem.

Xylem- **carries water** from roots to leaves. Made of dead, hollow cells, which allow a tube to carry the water. Strengthened by lignin. 1 direction.

Phloem- **carries dissolved sugars and minerals** from leaves to rest of plant (for use or storage)- this process is called translocation . Sugars can move in both directions. Made of elongated cells. Cell sap can move from 1 phloem to next through tiny pores in end walls.

Root hair cells- help absorb water (by osmosis) and minerals from the soil (by active transport). Have an elongated shape which allows a **large surface area.Lots of mitochondria** – where respiration happens, so more energy released for active transport of minerals





The leaf is a plant **organ** (as are stem and roots)

In leaves- Palisade layer- cells on upper surface of leaf with lots of chloroplasts for photosynthesis. Block shaped so can tightly fit onto top layer of leaf (more sunlight)

Spongy mesophyll layer- lots of air spaces to allow for gas exchange. Few chloroplasts as not needed.

Stomata- openings on bottom of plant (so less evaporation from sun)- let CO_2 into plant (and water out). Opening of these is controlled by **guard cells.**

Upper epidermis- very thin to let light through. Covered by a waxy cuticle to stop water loss.

Meristem tissue- in the tips of roots and shoots. Contains undifferentiated cells in zones where plant growth can take place.

Transpiration

-***Water*** enters the plant in the root hair cells, moves up through the xylem and **evaporates** out of the leaves through the stomata (tiny holes in leaf). Pulled by the transpiration stream.

-**Guard cells** can control water loss by helping to close stomata (so no water can leave), but they must also stay open sometimes to let CO_2 enter the plant for photosynthesis.

Plants usually have more stomata on the **bottom** of the leaf. This is so that they *are out of direct sunlight*, therefore it is **cooler** and **more humid**, so less evaporation of water happens.

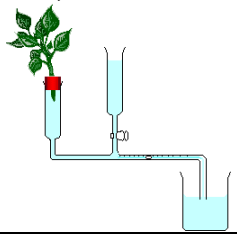
Transpiration is increased by:

1) Increased light (i.e. daytime) – The stomata open to allow CO_2 in for photosynthesis.
2) Increased temperature – The kinetic energy of the water molecules increases. Molecules move faster and evaporate quicker.
3) Increased air movement – Removing the moist air surrounding the leaf meaning there is a bigger concentration gradient.
4) Decreased air humidity – If there is less water in the air, there is a bigger concentration gradient between the plant and air (so diffusion happens faster)

If transpiration happens quicker, the plant will take up more water from its roots to try and replace the water lost.

Potometers can be used to measure **water uptake** (not truly transpiration rate – water is lost in respiration, used in photosynthesis, leaks in apparatus etc). Measures distance moved by an air bubble.

Setting up a potometer → must be airtight, cut shoot at slant underwater, insert apparatus under water, no air bubbles at start, note where bubble is at start.



AQA Trilogy-Biology key terms - Organisation

Higher only- **Calculating rate of transpiration with potometer** Πr^2 x distance air bubble moved/time	Counting stomata on a leaf -Mount a leaf on a slide and look at them under the microscope. Count the number of stomata. Turn over leaf and look at other side.