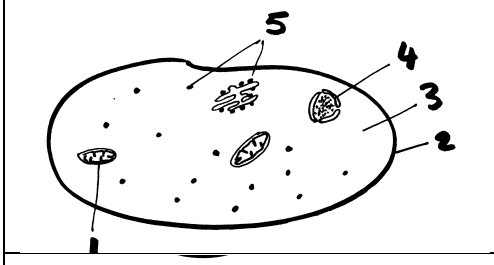
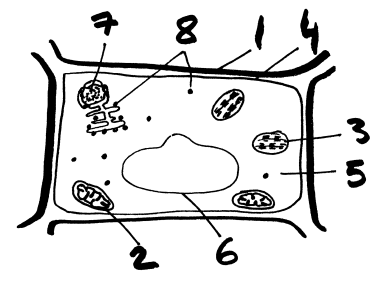
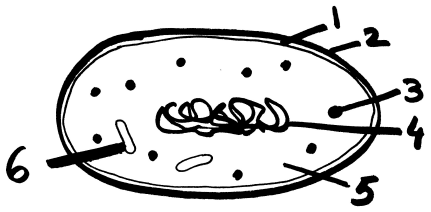
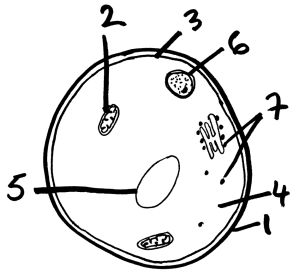
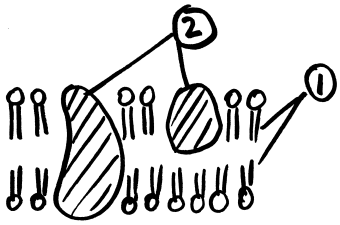
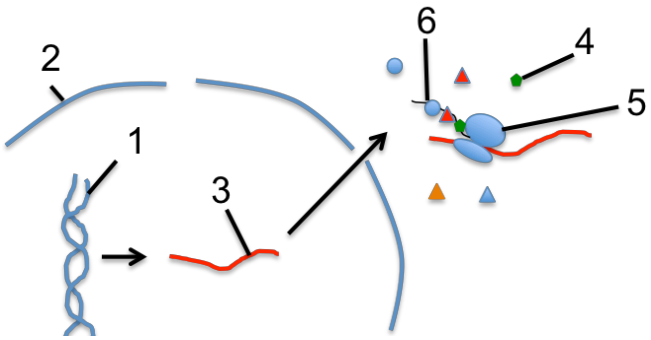
N5- Unit 1 – Cell Biology	
How do we improve the reliability of the results of an experiment?	Repeat the experiment AND work out an average.
Why do we repeat experiments?	To improve the reliability of the results
How do we improve the validity of an experiment?	By improving its design. For example, having all the reagents at the same temperature to start with, making sure that all conditions are the same (controlled variable) except for what is changed (independent/input variable).
Why do we use % or % change as a way to compare results?	To allow comparison between tissues which were different in their mass/ volume/ length at the start of the experiment.
Why do we use different pipettes/syringes/measuring cylinders when setting up an experiment with solutions of different concentrations?	To prevent cross-contamination between the solutions. If you have only one measuring cylinder, you need to start measuring the **least** concentrated solution first so that the cross contamination has a limited effect.
Unit 1 – CB1 - Cell structure	
1-Why do we use a microscope?	To magnify an object so it *appears* larger than it is.
2-More powerful lenses allow you to see more/less of the sample	Less but in greater detail.
3-Why do we use stains?	So that cell parts stand out.
4-Why do we use coverslips?	So that the sample does not dry out.
5-To convert 1 mm into 1 µm (micrometer)…	X 1000
6-To convert 1 µm into 1 mm	÷ 1000
7-To calculate the total power of the microscope	Multiply the power of the eyepiece lens and the power of the objective lens.
	Animal cell: 1-mitochondrion, 2-cell membrane, 3-cytoplasm, 4-nucleus, 5-ribosomes.
	Plant cell: 1-cell wall, 2-mitochondrion, 3-chloroplast, 4-cell membrane, 5-cytoplasm, 6-vacuole, 7-nucleus, 8-ribosomes.

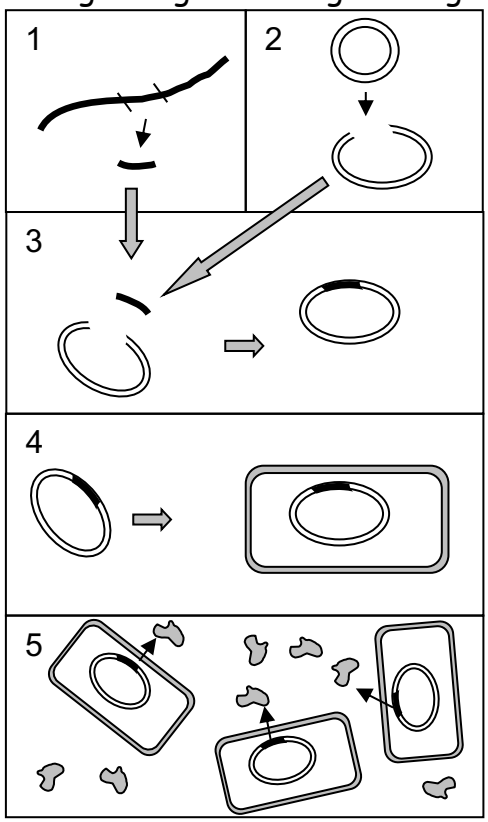
	Bacterial cell: 1-cell membrane, 2-cell wall, 3-ribosome, ~~4 nucleoid~~, 5-cytoplasm, 6-plasmid
	Fungal cell: 1-cell wall, 2-mitochondrion, 3-cell membrane, 4-cytoplasm, 5-vacuole, 6-nucleus, 7-ribosome.
8-Function of cell membrane	Controls the movement of substances into and out of the cell.
9-Function of cytoplasm	Where most chemical processes take place.
10-Function of nucleus	Contains genetic material which controls the activities of the cell.
11-Function of vacuole	Contains cell sap and can help keep cell structure rigid.
12-Function of ribosome	Where protein synthesis happens
13-Function of mitochondria	Where most of the energy is released by respiration
14-Function of cell wall	It strengthens and supports the cell.
15-Function of chloroplast	Contain the pigment chlorophyll. Photosynthesis happens here.
16-Function of plasmid	Small circular piece of DNA in bacteria.
17-Which cells need lots of mitochondria?	Cells with high energy needs such as muscle cells, nerve cells, sperm cells.
18-Similarity/ difference between plant and fungal cell	Similar structures except that only plant cell wall is made of cellulose and fungi have no chloroplasts.
19-Similarity/ difference between animal and fungal cell	Similar structures except that animal cells have neither cell walls nor vacuoles.
20-Similarity/ difference between plant and fungal cell	Similar structures expect that Fungal cells lack chloroplasts
21- What is characteristic of a bacterial cell compared to all other cells?	Absence of organelles and a different cell wall structure to plant and fungal cells
22- Which organelle is not always present in plants?	Chloroplasts are not always present in plant cells, e.g. in tissues not exposed to light such as roots cells.

Unit 1– CB2 - Transport across the cell membrane	
1-Composition of the cell membrane 	1- Phospholipids (in a bilayer). 2- Proteins. These can be on the inner or outer surface of the membrane or embedded within the membrane surface. These proteins can help **move molecules** into or out of the cell. They also act as receptors for hormones.
2-Property of the cell membrane	It is selectively permeable (only let molecules smaller than a certain size go through)
3-Fluid mosaic model	The molecules which form the cell membrane move constantly with respect to each other.
4-Characteristics of passive transport	Passive transport happens **down** a concentration gradient and does **not** require energy.
5-What causes passive transport?	Different concentrations of substances exist between cells and their environment.
6-Examples of passive transport.	Examples of passive transport are diffusion and osmosis.
7-Diffusion	Diffusion in cells is the movement of molecules down a concentration gradient, from an area of high concentration to an area of low concentration
8-Importance of diffusion	It is how gases (CO_2, O_2) and some other substances, e.g. water, glucose, urea and amino acids move in and out of cells. O_2 and glucose are needed by animal cells for respiration. Water and CO_2 are needed by plants for photosynthesis.
9-Osmosis	**Osmosis** is the movement of water molecules from a higher water concentration to a lower water concentration, down a concentration gradient through a selectively permeable membrane.
10-Effect of osmosis on animal cells	**Water loss: cells shrink.** **Water gain: cells burst.**
11-Effect of osmosis on plant cells	Water loss: cells plasmolysed (cell shrinks away from the cell wall, cell wall caves in) Water gain: cells turgid (swollen cell which does not burst due to the support of the cell wall).
12-In experiments, the diffusion of substances other than water is usually demonstrated by…	A reagent changing colour. E.g. starch changes Iodine form brown to black & Benedicts changes from blue to orange in presence of glucose.
13-In experiments, osmosis is usually demonstrated by…	A change in mass of a piece of potato or a model cell or the change of volume of a solution (visible on a graduated tube).
14-Define active transport	Transport against the concentration gradient, i.e. from lower to higher concentration.
15-Requirements for active transport	**Energy** for **membrane proteins** to move molecules and ions **against** the concentration gradient.
16-Examples of molecules and organisms using active transport	**Ions** such as sodium and potassium in nerve cells, or **molecules** such as iodine in seaweeds.

Unit 1-CB3-DNA and the production of proteins	
1-Describe the structure of a DNA molecule.	Double-stranded helix held by complementary base pairs.
2-What makes up the genetic code?	The four bases: adenine, cytosine, guanine and thymine (A, C, G and T)
3- Complementary rule of base pairing?	A-T and G-C.
4-What is determined by the base sequence?	The base sequence determines amino acid sequence in proteins.
5-What is a gene?	A section of DNA which codes for a protein.
6-How is the genetic code written?	3 bases (=triplet of bases) code for 1 amino acid.
Protein synthesis	
7-Structure of proteins is determined by…	The sequence of amino acids which is itself determined by the sequence of the DNA bases in a gene,
8-Where does protein synthesis take place?	At the ribosomes in the cytoplasm.
9-What does mRNA stand for?	Messenger RNA
10-What is the job of mRNA	What carries the sequence information from where it is stored (i.e. in the nucleus) to where it is needed (ribosome)
11-Comparison of DNA and mRNA	- mRNA is single stranded, DNA is double stranded. - mRNA is found both in the nucleus and the cytoplasm, DNA is only found in the nucleus (except during cell division)
12-Label the diagram.  	1- DNA 2- Nucleus/ Nuclear membrane 3- mRNA 4- Free amino-acid 5- Ribosome 6- Polypeptide
13-Describe protein synthesis	mRNA is synthesized from the DNA template in the nucleus. The single stranded mRNA travels out of the nucleus to the ribosome in the cytoplasm. The ribosome moves along the mRNA reading the code 3 bases at a time (triplets). For every triplet, it attaches the corresponding amino acid to the previous one forming a chain of amino acids called a polypeptide. After further modifications, the polypeptide folds to form a protein.

Unit 1 –CB4- Proteins and enzymes	
1-What is responsible for the variety of proteins shapes and functions	The sequence of amino acids
2-Give 5 examples of types of proteins and their function	Enzymes: speed up chemical reactions, e.g. catalase Hormones: carry chemical messages around the body (e.g. insulin) Antibodies: recognize molecules of invading organisms to defend the body against disease. Structural proteins: e.g. proteins in cell membrane. Receptors: participate in cell signaling, site of hormone binding on target tissues.
3-What conditions/factors/variables affect all proteins, including enzymes?	**Temperature** and **pH**
4- Describe a chemical reaction in general terms	**A substrate** is chemically altered into a **product**
5- Explain the meaning of the term "catalyst".	A catalyst is a substance which ***speeds up the rate (i.e. the speed) of a chemical reaction*** without being ***changed or used up***. (i.e. a catalyst is neither a substrate nor a product as it is unaffected by chemical reactions).
6-State what an enzyme is.	An enzyme is a **biological** catalyst made up by all living cells. It speeds up cellular reactions and is left unchanged.
7-Which part of the enzyme binds to the substrate?	The **active site**. The shape of the active site is complementary to that of its specific substrate.
8-Explain the word "specific" as applied to enzymes and their substrate	Each enzyme only works on one substrate because **the shape of the active site is only complementary to that of its specific substrate**. E.g. Amylase only breaks down starch. Enzymes and substrates have matching shapes like a "lock (Substrate) and key(enzyme)".
9-What is formed to facilitate an enzymatic reaction?	Formation of a temporary enzyme-substrate complex. For this complex to form, the enzyme needs to collide with the substrate.
10-What is the result of enzyme activity?	Formation of product(s)
11-Explain why enzymes are required for the functioning of living cells.	The cell processes necessary for life would happen too slowly without enzymes.
12-What are the 2 types of reactions that enzymes can get involved in?	Degradation and synthesis.

13-Give an example of an enzyme involved in a degradation reaction.	C-L-A-P - ***Catalase***: breaks down hydrogen peroxide into water and oxygen - ***Lipase***: breaks down fats into fatty acids and glycerol - ***Amylase***: It breaks down starch into maltose. - ***Pepsin***: breaks down proteins into polypeptides and amino acids.
14-Give an example of an enzyme involved in synthesis (building up)	***Potato phosphorylase***: in potatoes, joins molecules of Glucose-1-phosphate to form starch.
15-State what enzymes are made of?	Enzymes are ***proteins.***
16-Explain what is meant by enzyme activity	How fast the substrate is changed into the product.
17-How is enzyme activity measured?	By measuring the rate of product formation or that of substrate disappearance.
18-When is an enzyme most active?	In optimum conditions, i.e. optimum temperature and optimum pH.
19-Describe the effect of temperature on enzyme activity	At low temperatures, enzymes work slowly (Enzyme and substrate collisions do not happen often as molecules move slowly). As temperature increases, so does the frequency of collision (Enzymes and substrate move faster in warmer solution). Enzymes work the fastest at a temperature called the ***optimum temperature.*** Beyond that temperature, the shape of the enzyme and its active site change and they are less and less complementary. This slows down reaction rate. Above a certain temperature, an enzyme becomes ***denaturated***, i.e. shape of active site is irreversibly changed, it no longer fit that of its substrate, the reaction stops.
20-Describe the effect of a range of pH on the activity of an enzyme	Each enzyme has an optimum ***pH,*** i.e. a pH at which it works the fastest (faster rate of reaction). Enzyme may work at other pHs but the rate of the chemical reaction that they control is usually ***not as fast***.
21-Explain the term "optimum" as applied to the activity of enzymes	The conditions at which enzymes works the fastest are called ***optimum*** conditions: ***optimum pH*** and ***optimum temperature.***

Unit 1 –CB5- Genetic engineering	
1-State in general terms how human can engineer bacteria to make new substances	By transferring a gene from an organism (e.g. plant, human) to bacteria.
2-Stages in genetic engineering 	1-Identification of section of DNA that contains required gene to be transferred from the source chromosome 2- Extraction of required gene from organism (Gene is cut out by **enzymes).** 2- A **plasmid** extracted from a bacterial cell is **cut open** by **enzymes** 3- Gene is inserted into bacterial plasmid by an **enzyme**. 4- Plasmid is introduced back into **host bacteria** and forms a genetically modified (GM) organism 5- Bacteria allowed to multiply by being placed in growth medium. Production of desirable substance from information contained in the new gene. 6- Isolation of desired product from bacteria.
3-Which steps in genetic engineering require enzyme action?	- Extracting the gene of interest. - Cutting open the plasmid - Inserting the gene of interest in the plasmid.
4-State what is the advantage of genetic engineering for the production of substances from genes	Obtain large quantities in short time.
5-Give examples of products of genetic engineering used by humans	Insulin to help treat diabetes. Human growth hormone for children who do not make enough of their own.

Unit 1- CB6- Respiration	
1-What is respiration	A series of chemical reactions, controlled by enzymes which result in the release of the chemical energy stored in glucose. Respiration takes place in **all** living cells.
2-What is the useful product of respiration?	ATP, the energy provided by ATP can be used directly for cellular activities.
3-State at least 3 examples of cellular activities needing energy (and therefore ATP)	Cell division (mitosis) Muscle cell contraction Active transport Protein synthesis Transmission of electrical impulses along nerves.
4-Give an example of an energy transformation in a plant and in an animal.	Plants: light energy → chemical energy (starch) Animal: chemical energy (Fat) → heat energy
Respiration in presence of oxygen	
5-Name of respiration in the presence of oxygen	Aerobic respiration.
6-Describe aerobic respiration in terms of a word equation	glucose + oxygen → energy + carbon dioxide + water
7-Describe the stages in aerobic respiration with reference to their location, the name of the products and the yield in ATP.	Stage 1 • in the cytoplasm • glucose broken down in two molecules of pyruvate. • 2 ATPs produced. Stage 2 • in the mitochondrion • Pyruvate broken down into carbon dioxide and water • 36 ATPs produced
Respiration in absence of oxygen	
8-Name of respiration in the absence of oxygen	Fermentation (DO **NOT** SAY ANAEROBIC RESPIRATION).
9-Describe fermentation in animals in terms of a word equation	glucose → energy + lactate
10-Describe fermentation in plants and yeast cells in terms of a word equation	glucose → energy + carbon dioxide + alcohol

11-Describe the stages in fermentation with reference to their location and the name of the products and the yield in ATPs.	Stage 1 • in the cytoplasm • Glucose broken down in two molecules of pyruvate. • 2 ATPs produced. Stage 2 : • **still** in the cytoplasm • Plants and yeast cells: Pyruvate broken down into carbon dioxide and alcohol • Animal cells: Pyruvate broken down into lactate. • NO ATPs produced.
12-Compare aerobic respiration and fermentation in terms of location, total yield of ATPs.	Location: • aerobic respiration takes place in both the cytoplasm and the mitochondrion. • Fermentation takes place only in the cytoplasm. Total yield of ATPs per molecule of glucose: • aerobic respiration: 38ATPs • fermentation: 2ATPs
13-Which cells need lots of mitochondria?	Cells with high energy needs such as muscle cells, nerve cells, sperm cells.
14-State what is produced by respiration in addition to its chemical products.	***Heat energy***.
15-Explain what a control is.	***A repeat of an experiment to show that the effect observed is only due to the factor being investigated (e.g. activity of an enzyme).***
16- How can rate of respiration be measured in an experiment?	Use a Respirometer
17- What features do respirometers have?	-living (respiring) organism e.g. insect, germinating seeds, plant in the dark - method of measuring volume of Oxygen consumption e.g. glass tubing containing coloured liquid -method of absorbing Carbon dioxide produced e.g. soda lime
18 – How would you set up a control experiment for a respirometer?	- use exactly the same equipment but replace the living organism with glass beads of the same volume as the living organism