Biology 1: Cell Biology

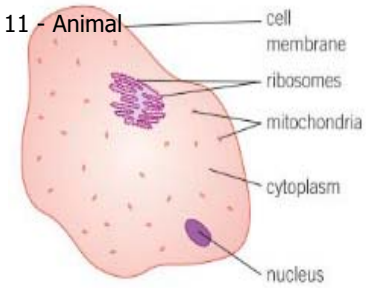
Section 1: Cell Structure

Cell Structure	Function	Eukaryotic (Nucleus) Animal Cells	Eukaryotic (Nucleus) Plant Cells	Prokaryotic (No Nucleus) Bacterial Cells
1 Nucleus	Contains **genetic material** controlling functions of cell	Y	Y	
2 Cell membrane	Controls what **enters** and **leaves** the cell	Y	Y	Y
3 Cytoplasm	Gel in which cells' **chemical reactions** occur	Y	Y	Y
4 Mitochondria	Provides **energy** from **aerobic respiration**	Y	Y	
5 Ribosome	**Synthesises** (makes) **proteins**	Y	Y	Y
6 Chloroplast	Contain chlorophyll for **photosynthesis**		Y	
7 Permanent vacuole	Contains **cell sap** to keep cell rigid and support plant		Y	
8 Cell wall	**Strengthens** and **supports** cell (made of **cellulose** in plants and algae but not in bacteria)		Y	Y
9 DNA loop	A loop of **DNA**, not enclosed within a nucleus.			Y
10 Plasmid	**Small ring of DNA**, sometimes with **genes** enabling antibiotic resistance.			Y
	Relative sizes	10-30μm	10-100μm	1-2μm

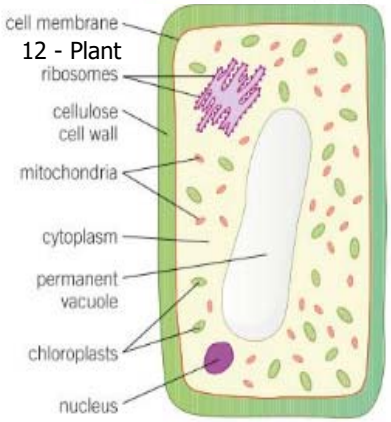
Section 2: Cell specialisation and differentiation

Type	Differentiation	Specialised Cell	How structure relates to function
ANIMAL CELLS	Cells differentiate in **early stage** of animal's development. Once mature, cell division only for **repair** & **replacement**	14 Sperm cell	**Acrosome** contains **enzyme** to break into egg; many **mitochondria** to provide **energy** for **tail** to swim to egg
		15 Nerve cell	**Long axon** to transmit electrical impulses over distance. To connect to other cells there are **dendrites** & **neurotransmitters** produced with energy supplied by mitochondria
		16 Muscle cell	Many mitochondria provide **energy** for **protein fibres** that can **contract** allowing movement**.** Store **glycogen** (chemical energy)
PLANT CELLS	Many plant cells can **differentiate** throughout life (ie **acquire different sub-cellular structures to carry out a particular function**)	17 Root hair cell	Root hair **increases surface area** for water & mineral uptake; permanent vacuole accelerates osmosis, mitochondria provide energy for active transport of minerals
		18 Xylem cell	**Hollow** to allow water & minerals to move up plant. **Lignin** in cell walls strengthen to withstand water pressure and support stem
		19 Phloem cell	Cell walls between phloem cells **sieve-like** to allow dissolved food made by photosynthesis up & down plant. **Companion cells** provides energy as few mitochondria.

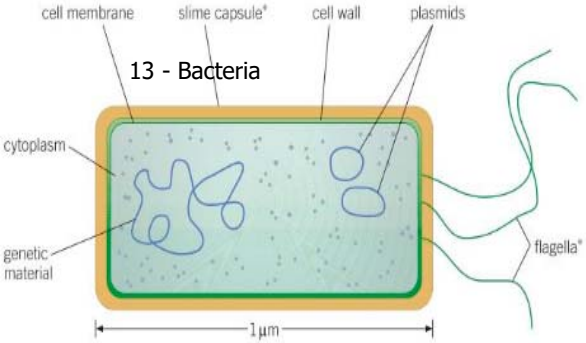
11 - Animal



12 - Plant

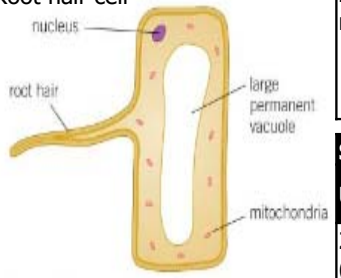


13 - Bacteria

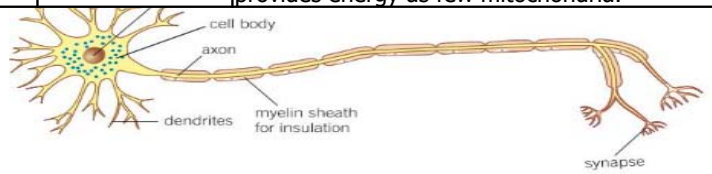


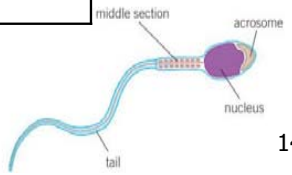
*not always present

17 – Root hair cell



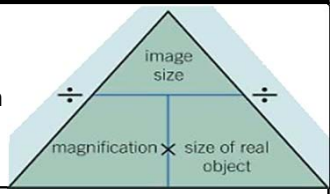
15 – Nerve cell





14– Sperm cell

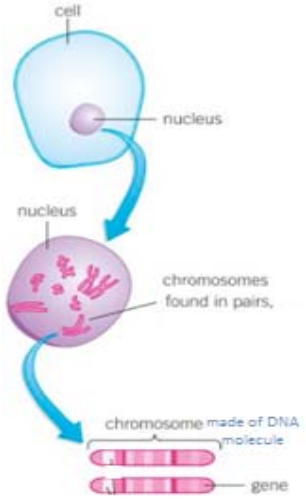
Section 3: Microscopy

20 Magnification	How much bigger an object looks 
21 Resolving Power	Minimum distance between two objects where you can still see them as separate
22 Light microscope	Invented in 17th century with lower magnification and resolving power.
23 Electron microscope	Invented in 1930s with much higher magnification and resolution. Allowed study of cells in finer detail and **exploration of subcellular structures**

Section 4: Orders of Magnitude

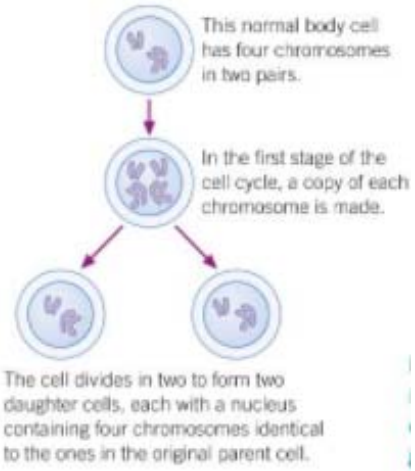
Unit Prefix	Size in metres	Standard Form	Context
24 Centimetre (cm)	0.01m	10^{-2}m	
25 Millimetre (mm)	0.001m	10^{-3}m	
26 Micrometre (μm)	0.000001m	10^{-6}m	**Cell size**
27 Nanometre (nm)	0.000000001m	10^{-9}m	

28 – Chromosomes



Section 5: Mitosis and the Cell Cycle		
29	Mitosis (**cell division**) is important in the growth & development of multicellular organisms	
30	Stage 1 (longest)	Number of **sub-cellular structures** (e.g. **ribosomes** and **mitochondria**) **increase. DNA replicates** creating two copies of each chromosome
31	Stage 2	One set of **chromosomes** is **pulled** to each end of the cell and then the **nucleus divides**
32	Stage 3	**Cytoplasm** and **cell membranes divide** to form two **identical** cells

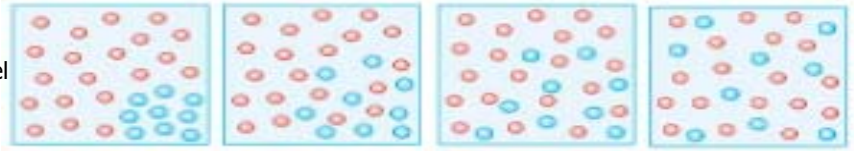
30 – 32 Stages of cell cycle



Section 6: Stem Cells			
Stem Cells	**Type**	**Properties**	**Uses**
33 **Undifferentiated** cell of an organism which is capable of giving rise to many more cells of same type, or other specialised cells can arise from differentiation	34 **Embryonic** stem cell	These are in a ball of cells that divide from fertilised egg. Can divide into **most types** of human cell.	Can be **cloned** and researchers are trying to differentiate into insulin producing cells to helps **diabetes** or spinal nerve cells to help **paralysis**
	35 Adult stem cell	Can divide into a **limited number of cells** e.g. bone marrow stem cells can form blood cells.	
	36 Meristem	Can differentiate (divide) into **any type** of **plant** cell throughout plant's life	**Clone** rare species to **prevent extinction**. **Crops** with **special features** can be cloned eg disease resistance
Pros and Cons of Using Embryonic Stem Cells			
37 Pros	**Treatment** of above conditions. **Therapeutic cloning** can produce embryo cells with the same genes as the patient's cells so they are not **rejected**		
38 Cons	**Ethical** and **religious** objections as often come from aborted/unused embryos. Can **transfer viruses** held within cells.		

Section 7: Transport Across Cell Membranes: Diffusion				
Definition	**Uses**	**Factors Affecting Rate**	**Factor Explanation**	**Specialisation of multicellular organisms to allow fast enough diffusion**
39 **Spreading** out of particles (gas/solution) resulting in a **net movement** from an area of **higher concentration** to an area of **lower concentration**	**Oxygen** and **carbon dioxide** in **gas exchange** (leaves & alveoli). **Urea** from **cells** into **blood plasma** for excretion in kidney	40 Difference in concentrations (**concentration gradient**)	The greater the difference in concentrations, the faster the rate of diffusion down gradient	43 **Large exchange surface areas** eg small intestine & lung in mammals, gills in fish, roots and leaves in plants
		41 **Temperature**	Particles move more quickly at higher temperatures, so rate of diffusion increases	44 **Thin membrane** to provide a **short diffusion path**
		42 **Surface area** of membrane	The greater the surface area the quicker the rate of diffusion (single cell organisms have large enough surface area to volume ratio to keep sufficient transport Multicellular don't)	45 **Ventilation** (in animals for gas exchange – maintains a steep concentration gradient)
				46 **Efficient blood supply as a transport system** (in animals – maintains a concentration gradient)

39 – Diffusion Model



42 – Surface area to volume ratio

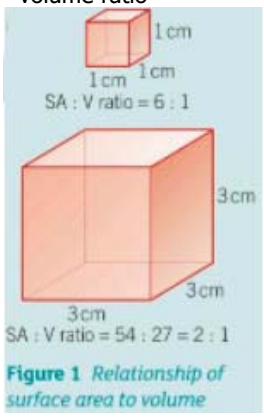


Figure 1 *Relationship of surface area to volume*

Section 8: Transport Across Cell Membranes: Osmosis		
Transport	**Definition**	**Uses**
47 Osmosis	Diffusion of water from a dilute solution to a concentrated solution through a partially permeable membrane.	Movement of water into and out of cells.

Section 9: Transport Across Cell Membranes: Active transport		
Transport	**Definition**	**Uses**
48 Active Transport	The movement of substances from a more dilute solution to a more concentrated solution (against a concentration gradient). Requires energy from respiration.	**Absorption** of **mineral ions** (low concentration) from soil into **plant roots**. **Absorption** of **sugar molecules** from lower concentrations in the **gut** into the **blood** which has a higher sugar concentration.