

BIOLOGY

The Building Blocks of Life

Introduction

Atoms can bond with each other to form molecules. Molecules are needed to form structures called organelles. Different organelles help to form a cell which is the basic unit of living matter. Each organelle has a particular function(s) however the organelles often work together to ensure the survival of the cell.

1. Follow the link below to remind yourself about animal and plant cells, the organelles found within them and microscopes.

<https://www.bbc.co.uk/bitesize/guides/zcrhcj6/revision/1>

2. Animal and plant cells contain the following organelles, living parts. Fill in the sentences with the appropriate biological term from the box, each word is used once:

ribosomes	DNA	mitochondria	muscle	catalyse	sap
light	oxygen	chlorophyll	leaves	osmosis	glucose
proteins	swollen	chromosomes	enzymes	glucose	cellulose
carbon dioxide	glycogen granules	photosynthesis	supports	partially permeable	starch grains

Nucleus

The nucleus contains thread-like structures called _____ which are made of very long double helix molecules called _____ and protein. When a cell divides these structures coil up tightly and become visible especially if they have been stained. When a cell is not dividing, the DNA is loosely coiled and appear as dense granular patches called chromatin.

The nucleus controls the cell's activities because the DNA contains instructions for making _____. Some of these molecules help to make the structure of the cell whilst some are _____ which speed up or _____ chemical reactions inside the cell. The DNA can copy itself or replicate so its instructions can be passed on to new cells.

Inside the nucleus is a darkly stained area called the nucleolus. This contains DNA and is responsible for making tiny round organelles called _____. The latter are important because this is where proteins are made inside a cell. The nucleus is surrounded by the nuclear envelope. It contains gaps or pores to allow materials to enter and leave the nucleus.

Cytoplasm

The cytoplasm is a watery environment with many organelles suspended in it. One such organelle called the _____ is the site of aerobic respiration. Also present are energy storage materials such as _____ in animal cells. Such stores are prominent in those animal cells which actively respire such as _____ cells. Plant cells also contain carbohydrate energy stores called _____.

Plasma Membrane (Cell Membrane- as it was known at GCSE!!!!)

The plasma membrane is a flexible boundary which isolates the cell contents from the surroundings . It exerts control over what can enter and leave the cell. Thus it is described as being _____ . Raw materials such as _____ and _____ pass into the cell for aerobic respiration. This reaction produces a waste substance called _____ which diffuses out of the cell.

Plant Cells also have the additional structures:

Vacuole

The vacuole is surrounded by a membrane called the tonoplast. It contains a substance called _____ which is a mixture of sugars, acids, mineral ions and water. It supports the plant cell. If the water concentration is lower compared to the fluid surrounding the cell ,then water molecules will move in by _____ so the cell appears _____ under the microscope.

Cell Wall

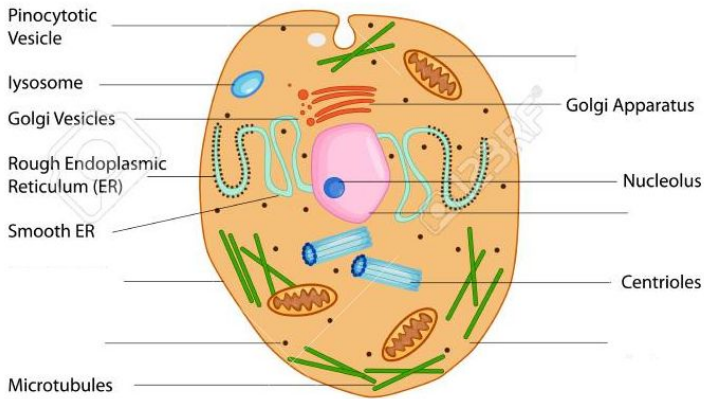
The cell wall is the non- living part of the cell which consists of fibres of a substance called _____. The fibres are irregularly arranged so allowing the cell wall to be fully permeable to molecules. Like the vacuole, it also _____ the plant cell.

Chloroplasts

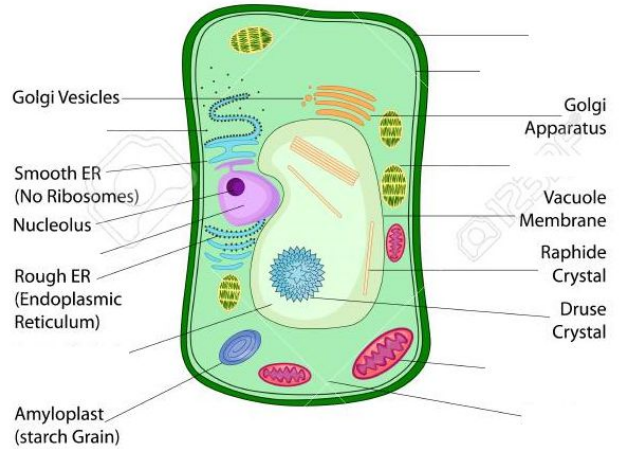
Different plant species have chloroplasts with different shapes and sizes. It contains a pigment called _____ which absorbs _____ energy for _____. This energy is used to convert carbon dioxide and water to a carbohydrate called _____. Chloroplasts are only found in those parts of the plant which are exposed to light such as the _____.

3. Diagrams of an animal and plant cell, complete the diagram by adding labels, use the key terms from the sentences above:

Animal Cell



Plant Cell



Cells contain a wide range of organelles, each with a different function, essential to the life of the cell and the organism.

4. Use the following website to fill in the details for each organelle in the table: <http://astarbiology.com/ocr/cell-structure/>

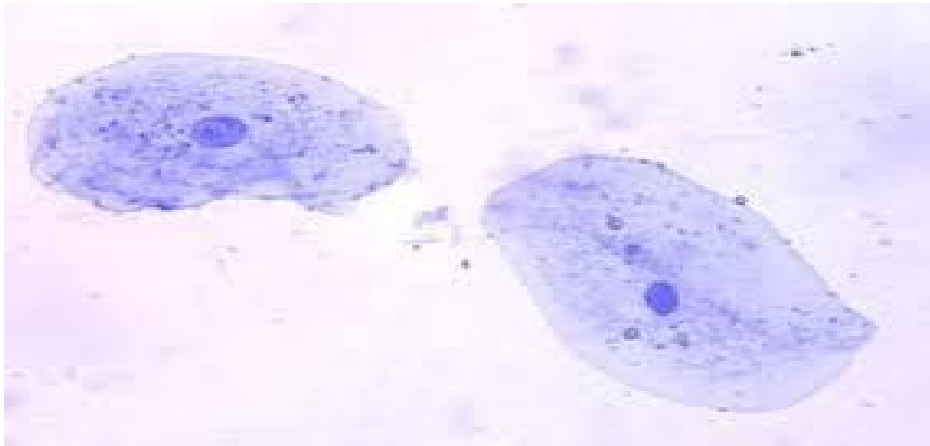
Name of Organelle	Description	Function
Mitochondria		
Ribosomes		
Rough Endoplasmic Reticulum		
Smooth Endoplasmic Reticulum		
Golgi Body (Apparatus)		
Lysosome		
Nucleolus		
Centrioles		
Plasma Membrane		

Microscopy

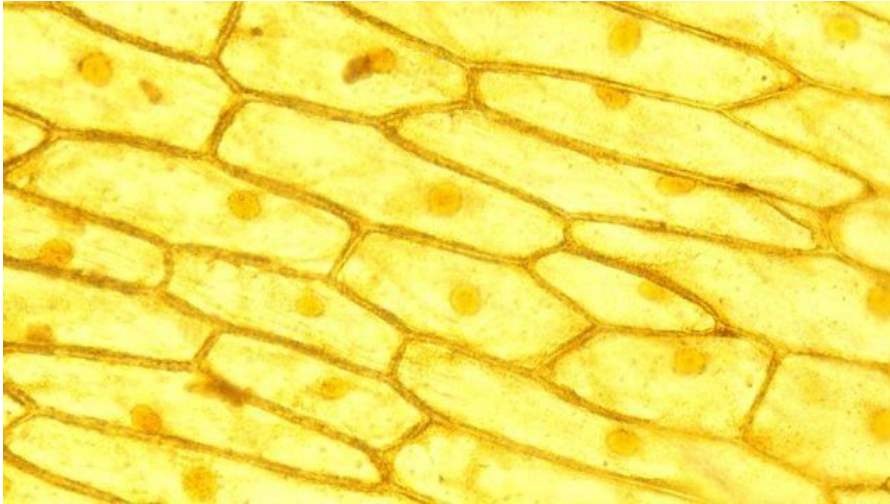
Microscopes are used to examine specimens such as cells which are too small to be seen with the human eye. Stains have to be often used to enable certain structures to be seen. Two types of microscope exist: light microscopes (used at GCSE in school) and electron microscopes.

5. Drawing diagrams of cells from light microscope viewing, an animal cheek cell and an onion skin cell.

- When drawing cells as seen under a microscope, the cells must be drawn using a sharp pencil and lines should be smooth and continuous-not jagged!!! Labelling should be done using pencil and a ruler. There should be no shading.
- Below is a photomicrograph of cheek cells as seen under a light microscope. Draw and label **one** of the cells in the box underneath. Write a description underneath each label to say how it looks. Give your drawing a title.



- Below is a photomicrograph of some onion cells. Draw three adjacent cells in the box underneath. Label each structure once on any cell on the diagram. Write a description, underneath each label, to say how it looks. Give your drawing a title.



A large, empty rectangular box with a black border, intended for drawing and labeling three adjacent onion cells.

Movement of Substances into a Cell

Substances can move in and out of cells in a variety of ways including diffusion, osmosis and active transport.

6. Write a definition for diffusion, osmosis and active transport:

Diffusion-

Osmosis -

Active transport-

CHEMISTRY

Task 1 Fundamental Particles

Atoms are the basic building blocks of matter. They are not the smallest of particles, and within Chemistry, we are interested in electrons, protons and neutrons.

Using a periodic table (<https://www.ptable.com/>), draw the *electronic configuration*, as well as identifying *how many sub-atomic particles* there are for the following atoms and their corresponding ions:

Hydrogen

Oxygen

Calcium

Hydrogen ion, H⁺

Oxygen ion O²⁻

Calcium ion Ca²⁺

Task 2 - Dot cross diagrams

You would have covered ionic and covalent bonding in your GCSE. Using your knowledge, draw the dot cross diagrams for the following compounds, showing only outer electrons. You will need to decide what type of bonding is present within these compounds, before you start remember **ionic compounds** contain ions and must contain **both a metal and a non-metal**; **covalent molecules** share electrons and contain **non-metals**.

Chlorine gas

Sodium chloride

Magnesium oxide

Water

Carbon dioxide

Calcium chloride

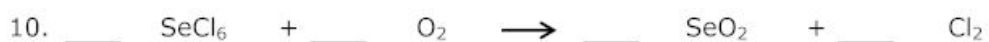
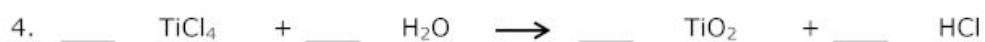
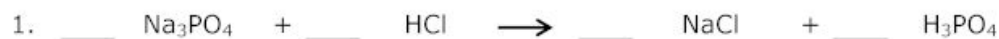
Methane CH₄

Nitrogen gas

Task 3 - Balancing equations

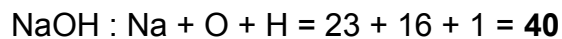
Look at the following equations – some need balancing, others do not. Balance the equations that need it.

Balance the following chemical equations.



Task 4 - Relative formula mass

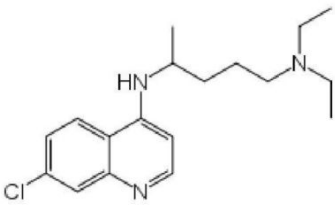
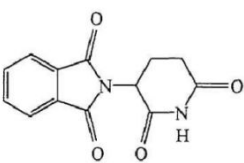
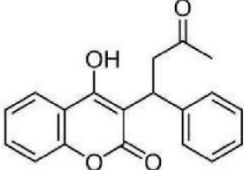
Use a Periodic Table (<https://www.ptable.com/>) to work out the relative formula mass of the following compounds



Task 5 – Research

Choose one (or more) of the following medicines/drugs and find out:

1. Common brand names
2. Class of drug
3. Brief history of discovery
4. State the chemical functional group found in the compound
5. Uses
6. List any side effects

Chloroquine	Thalidomide	Warfarin
		

PHYSICS

Task 1 Symbols and Prefixes

It is really important in the Physics section of the course that you remember the prefixes, symbols and units. Your first task is to make some flash cards of these and try to learn them off by heart.

Prefix	Symbol	Power of ten
Nano	n	$\times 10^{-9}$
Micro	μ	$\times 10^{-6}$
Milli	m	$\times 10^{-3}$
Centi	c	$\times 10^{-2}$
Kilo	k	$\times 10^3$
Mega	M	$\times 10^6$
Giga	G	$\times 10^9$

Quantity	Symbol	Unit
Velocity	v	ms^{-1}
Acceleration	a	ms^{-2}
Time	t	S
Force	F	N
Resistance	R	Ω
Potential difference	V	V
Current	I	A
Energy	E or W	J
Pressure	P	Pa
Momentum	p	kgms^{-1}
Power	P	W
Density	ρ	kgm^{-3}
Charge	Q	C

Task 2 Solve the following:

1. How many metres in 2.4 km?
2. How many joules in 8.1 MJ?
3. Convert 326 GW into W.
4. Convert 54 600 mm into m.
5. How many grams in 240 kg?
6. Convert 0.18 nm into m.
7. Convert 632 nm into m. Express in standard form.
8. Convert 1002 mV into V. Express in standard form.
9. How many eV in 0.511 MeV? Express in standard form.
10. How many m in 11 km? Express in standard form.

Task 3 Research

One of the joys of science at key stage five is the increase in the quantity and significance of practical work alongside research. Having a strong set of practical and research skills is essential to all scientists irrelevant of how much practical work they do on a day-to-day basis. Fill in the table below to give the details of what are some of the most important scientific investigations of the last 150 years.

Year of investigation	Scientists involved	Description of experiment and details of discovery
1898	Marie and Pierre Curie	
1911	Ernest Rutherford	
1950-1952	Rosalind Franklin and Maurice Wilkins	
2015	The Laser Interferometer Gravitational-Wave Observatory (LIGO)	

Task 4 - Significant Figures and Standard Form

Significant Figures

You need to be able to quote answers to the correct number of significant figures.

1) Write the following numbers to the quoted number of significant figures.

- | | |
|-----------------------------|------------------------------|
| a) 345789 4 sig figs | d) 6 3 sig figs |
| b) 297300 3 sig figs | e) 0.001563 3 sig figs |
| c) 0.07896 3 sig figs | f) 0.01 4 sig figs |

Standard Form

You need to be able to work with numbers in standard form.

3) Write the following numbers in non standard form.

- | | |
|---------------------------------|--------------------------------|
| a) 1.5×10^{-3} | d) 0.0534×10^4 |
| b) 0.046×10^{-2} | e) 10.3×10^5 |
| c) 3.575×10^5 | f) 8.35×10^{-3} |

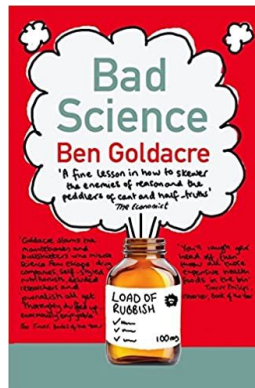
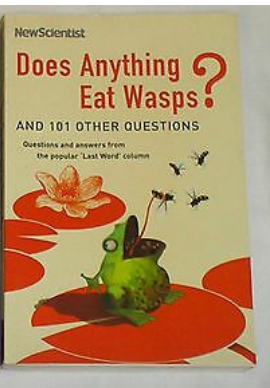
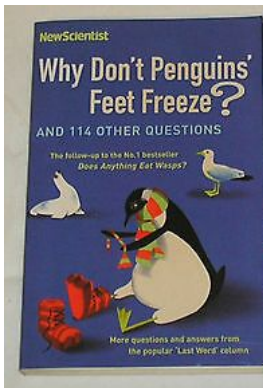
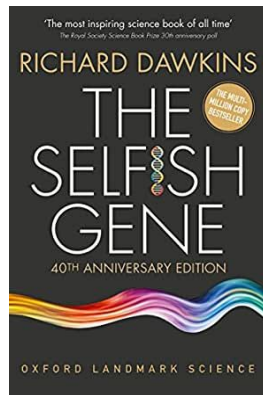
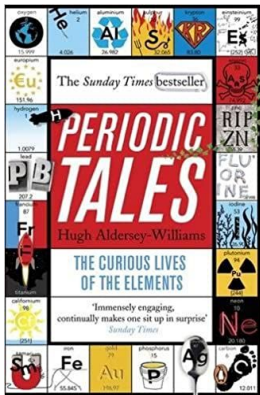
4) Write the following numbers in standard form.

- | | |
|---------------------|-------------------|
| a) 0.000167 | d) 34500..... |
| b) 0.0524..... | e) 0.62..... |
| c) 0.000000015..... | f) 87000000 |

General Science Interest.

Part of being a scientist is having an interest in the world around you. Below are a selection of books, films and websites that you might want to look at over the next few months.

Books



Films



Websites

<https://physicsworld.com/> physics magazine

<https://www.youtube.com/user/crashcourse> lots of videos on different subjects

<https://www.futurelearn.com/> free online courses

<https://www.rsc.org/> chemistry videos and articles

<https://www.nature.com/> biology and the natural world

<https://ed.ted.com/> talks about allsorts

<https://www.mooc.org/> free online courses