Week 1 Revision

Science (Biology)

Year 10

Name: _____

Tutor: _____

Key Science Vocabulary

Accuracy
A measurement result is considered accurate if it is judged to be close to the true value.

Calibration
Marking a scale on a measuring instrument. This involves establishing the relationship between indications of a measuring instrument and standard or reference quantity values, which must be applied. For example, placing a thermometer in melting ice to see whether it reads zero, in order to check if it has been calibrated correctly.

Data
Information, either qualitative or quantitative, that has been collected.

Error
See also uncertainty.

Measurement error
The difference between a measured value and the true value.

Anomalies
These are values in a set of results which are judged not to be part of the variation caused by random uncertainty.

Random error
These cause readings to be spread about the true value, due to results varying in an unpredictable way from one measurement to the next. Random errors are present when any measurement is made, and cannot be corrected. The effect of random errors can be reduced by making more measurements and calculating a new mean.

Systematic error
These cause readings to differ from the true value by a consistent amount each time a measurement is made. Sources of systematic error can include the environment, methods of observation or instruments used. Systematic errors cannot be dealt with by simple repeats. If a systematic error is suspected, the data collection should be repeated using a different technique or a different set of equipment, and the results compared.

Zero error
Any indication that a measuring system gives a false reading when the true value of a measured quantity is zero, eg the needle on an ammeter failing to return to zero when no current flows. A zero error may result in a systematic uncertainty.

Evidence
Data which has been shown to be valid.

Fair test
A fair test is one in which only the independent variable has been allowed to affect the dependent variable.

Hypothesis
A proposal intended to explain certain facts or observations.

Interval
The quantity between readings, eg a set of 11 readings equally spaced over a distance of 1 metre would give an interval of 10 centimetres.

Precision
Precise measurements are ones in which there is very little spread about the mean value. Precision depends only on the extent of random errors – it gives no indication of how close results are to the true value.

Prediction
A prediction is a statement suggesting what will happen in the future, based on observation, experience or a hypothesis.

Range
The maximum and minimum values of the independent or dependent variables; important in ensuring that any pattern is detected. For example a range of distances may be quoted as either: 'From 10 cm to 50 cm' or 'From 50 cm to 10 cm'.

Repeatable
A measurement is repeatable if the original experimenter repeats the investigation using same method and equipment and obtains the same results. Previously known as reliable.

Reproducible
A measurement is reproducible if the investigation is repeated by another person, or by using different equipment or techniques, and the same results are obtained. Previously known as reliable.

Resolution
This is the smallest change in the quantity being measured (input) of a measuring instrument that gives a perceptible change in the reading.

Sketch graph
A line graph, not necessarily on a grid, that shows the general shape of the relationship between two variables. It will not have any points plotted and although the axes should be labelled they may not be scaled.

True value
This is the value that would be obtained in an ideal measurement.

Uncertainty
The interval within which the true value can be expected to lie. Whenever a measurement is made, there will always be some uncertainty or doubt about the result obtained. Uncertainty can be expressed in terms of spread of values obtained. For example, a length of 56 cm ±2 cm would mean the true value could be anywhere between 54 cm and 58 cm.

Validity

Suitability of the investigative procedure to answer the question being asked. For example, an investigation to find out if the rate of a chemical reaction depended upon the concentration of one of the reactants would not be a valid procedure if the temperature of the reactants was not controlled.

Valid conclusion

A conclusion supported by valid data, obtained from an appropriate experimental design and based on sound reasoning.

Variables

These are physical, chemical or biological quantities or characteristics.

Categoric

Categoric variables have values that are labels, eg names of plants or types of material.

Continuous

Continuous variables can have values (called a quantity) that can be given a magnitude either by counting (as in the case of the number of shrimp) or by measurement (eg light intensity, flow rate etc). Previously known as discrete variable.

Control

Control variable is one which may, in addition to the independent variable, affect the outcome of the investigation and therefore has to be kept constant or at least monitored.

Dependent

Dependent variable is the variable of which the value is measured for each and every change in the independent variable.

Independent

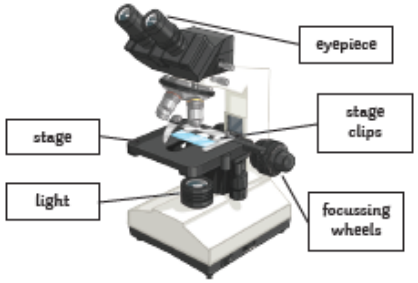
Independent variable is the variable for which values are changed or selected by the investigator.

Cell Biology Knowledge Organiser – Foundation and Higher

Required Practical

Microscopy Required Practical

- Includes preparing a slide, using a light microscope, drawing any observations – use a pencil and label important observations.



Osmosis and Potato Practical

- Independent variable – concentration.
- Dependent variable – change in mass.
- Control variable – volume of solution, temperature, time, surface area of the potato.

The potato in the sugar solution will lose water and so will have less mass at the end; the potato in the pure water solution will gain water.

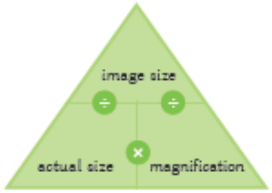
Specialised Cells

When a cell changes to become a specialised cell, it is called differentiation.

Specialised Cell	Function	Adaptation
sperm	To get the male DNA to the female DNA.	Streamlined head, long tail, lots of mitochondria to provide energy.
nerve	To send electrical impulses around the body.	Long to cover more distance. Has branched connections to connect in a network.
muscle	To contract quickly.	Long and contain lots of mitochondria for energy.
root hair	To absorb water from the soil.	A large surface area to absorb more water.
phloem	Transports substances around the plant.	Pores to allow cell sap to flow. Cells are long and joined end-to-end.
xylem	Transports water through the plant.	Hollow in the centre. Tubes are joined end-to-end.

Equations and Maths

Equation



Maths Skills

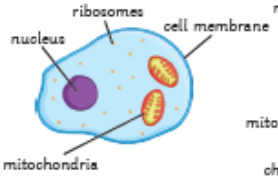
Conversions:
Micrometres to millimetres: divide by 1000.

Standard Form:
$0.003 = 3 \times 10^{-3}$

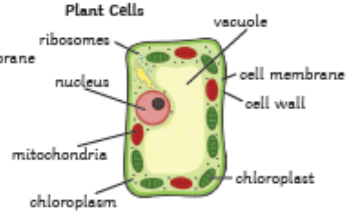
$5.6 \times 10^{-5} = 0.0056$

Prokaryotic and Eukaryotic Cells

Animal Cells



Plant Cells

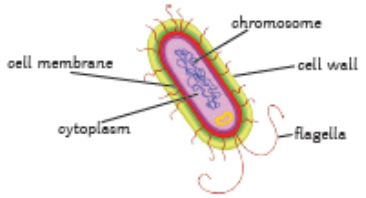


Plant and animal cells have similarities and differences:

	Animal	Plant
nucleus	✓	✓
cytoplasm	✓	✓
chloroplast	X	✓
cell membrane	✓	✓
permanent vacuole	X	✓
mitochondria	✓	✓
ribosomes	✓	✓
cell wall	X	✓

Bacterial Cells

Bacterial cells do not have a true nucleus, they just have a single strand of DNA that floats in the cytoplasm. They contain a plasmid.



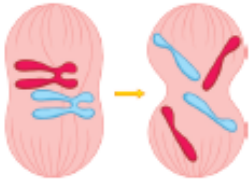
Cell Biology Knowledge Organiser - Foundation and Higher

Chromosomes and Mitosis

In the nucleus of a human cell there are 23 pairs of **chromosomes**. Chromosomes contain a double helix of **DNA**. Chromosomes have a large number of genes.

The **cell cycle** makes new cells.

Mitosis: DNA has to be **copied/replicated** before the cell carries out mitosis.



Key Vocabulary

active transport
alveoli
chromosome
diffusion
eukaryotic
gas exchange
mitosis
multicellular
osmosis
prokaryotic
undifferentiated
replicated
specialised
villi

Stem Cells

Embryonic stem cells are **undifferentiated** cells, they have the potential to turn into any kind of cell.

Adult stem cells are found in the bone marrow, they can only turn into some types of cells e.g. blood cells.

Uses of stem cells:

- Replacing faulty blood cells;
- making insulin producing cells;
- making nerve cells.

Some people are against stem cell research.

For Stem Cell Research	Against Stem Cell Research
Curing patients with stem cells - more important than the rights of embryos.	Embryos are human life.
They are just using unwanted embryos from fertility clinics, which would normally be destroyed.	Scientists should find other sources of stem cells.

Stem Cells in Plants

In plants, stem cells are found in the **meristem**. These stem cells are able to produce clones of the plant. They can be used to grow crops with specific features for a farmer, e.g. **disease resistant**.

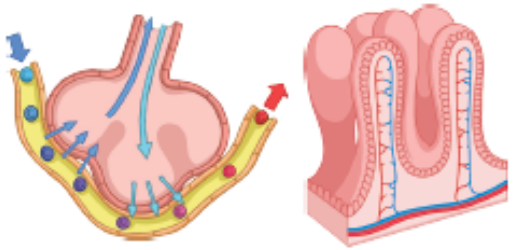
Exchange – Humans

Multicellular organisms have a large surface are to volume ratio so that all the substances can be exchanged.

Gas exchange: Lungs

The alveoli are where gas exchange takes place.

They have a large surface area, moist lining, thin walls and a good blood supply.

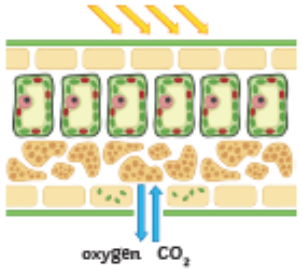


Villi: Small Intestine

Millions of villi line the small intestine increasing the surface area to absorb more digested food.

They are a single layer of cells with a good blood supply.

Exchange in Plants



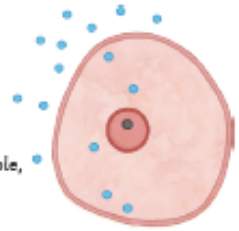
The surface of the leaf is flattened to increase the surface area for more gas exchange by diffusion.

Oxygen and water vapour diffuse out of the stomata. Guard cells open and close the stomata, controlling water loss.

Key Processes

Diffusion is the spreading out of particles from an area of higher concentration to an area of lower concentration.

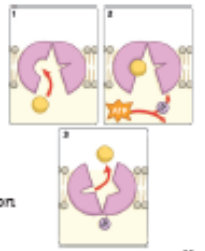
Cell membranes are semi-permeable, only small molecules can get through.



Cell Diffusion

Osmosis is the movement of water molecules across a partially permeable membrane from a region of higher concentration to a region of lower concentration.

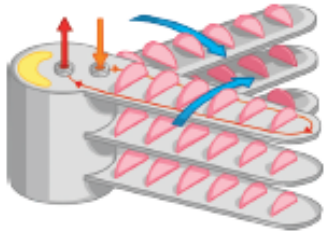
Active transport is the movement of substances against the concentration gradient. This process requires energy from respiration.



Active Transport in Cells

Exchange in Fish

Fish have a large surface area for gas exchange. These are called **gills**. Water enters the fish through the mouth and goes out through the gills. The oxygen is transported from the water to the blood by **diffusion**. Carbon dioxide diffuses from the blood to the water. Each gill has **gill filaments** which give the gills a large surface area. **Lamellae** cover each gill filament to further increase the surface area for more gas exchange. They have a **thin surface layer** and **capillaries** for good blood supply which helps with diffusion.



Cell biology

1) Summarise as much information from the knowledge organiser in the box below. Focus on key words and definitions rather than copying the text word for word.

2) Complete 5 self-quiz questions using the information you have summarised above in the box below.

Question	Answer

3) Complete both exam questions below and self-mark using the mark scheme

Foundation tier

Q1.

The table below shows the concentration of some substances outside a cell and inside a cell.

	Concentration in arbitrary units	
Substance	**Outside the cell**	**Inside the cell**
Chloride ions	116	4
Potassium ions	4	120
Sodium ions	145	12

(a) Complete the sentences.

Choose answers from the box.

Use information from the table above.

active transport	**diffusion**	**osmosis**

Chloride ions move into the cell by _____.

Potassium ions move into the cell by _____.

(2)

(b) Why do sodium ions move **into** the cell?

Use information from the table above.

_____

_____

(1)

(c) Calculate how many times greater the potassium ion concentration is inside the cell compared with outside the cell.

_____

_____

Number of times greater = _____

(1)

(d) Name the process that releases energy in cells.

_____

(1)

(e) Which process needs energy to move a substance into a cell?

Tick (✓) **one** box.

Active transport ☐

Diffusion ☐

Osmosis ☐

(1)

(f) Give **two** factors that affect the rate of diffusion.

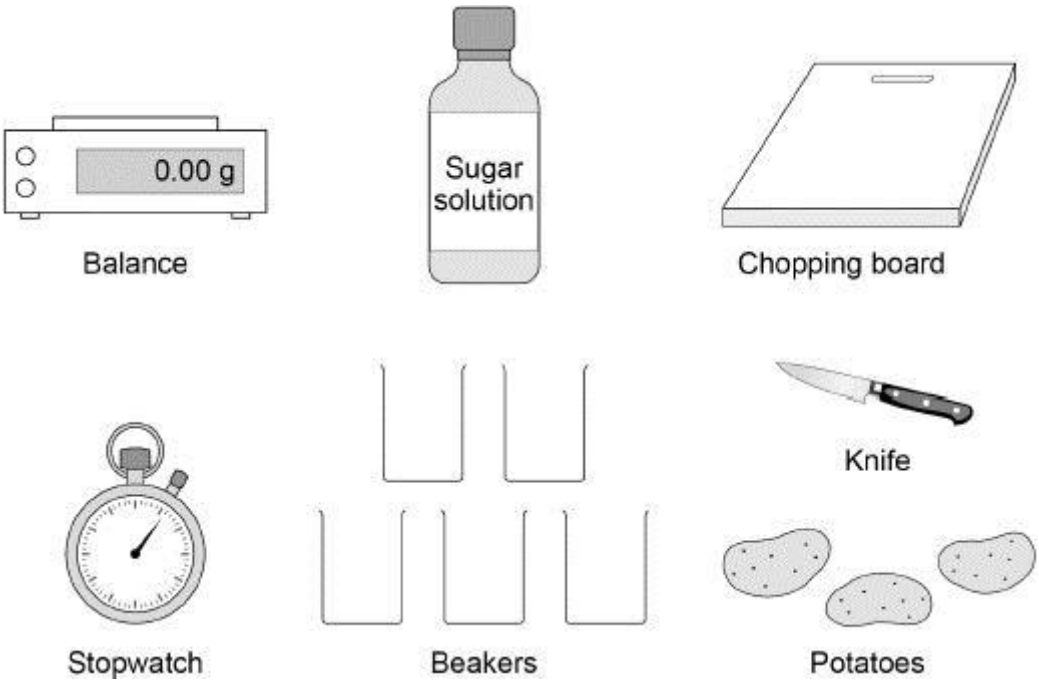
1. _____

2. _____

(2)

(g) Students investigated the change in mass of potato pieces in different concentrations of sugar solution.

The diagram below shows some of the equipment used.



Describe a method to investigate the effect of different concentrations of sugar solution on the change in mass of potato pieces.

_____

_____

_____

_____

_____

(6)

(Total 14 marks)

Mark schemes

Q1.

(a) diffusion

must be in this order

1

active transport

1

(b) (sodium ion) concentration is higher outside (the cell)

allow (sodium ion) concentration is lower inside the cell
allow there are more (sodium ions) outside (the cell)
allow there are fewer / less (sodium ions) inside (the cell)
allow (sodium ions) move from high concentration to low concentration
ignore diffusion unqualified

1

(c) 30

*allow 30 × **or** × 30 **or** 30 times*

1

(d) respiration

ignore aerobic / anaerobic

1

(e) active transport

1

(f) any **two** from:

- temperature
- surface area (of membrane)
- concentration (gradient)

2

(g) **Level 3:** The method would lead to the production of a valid outcome. All key steps are identified and logically sequenced.

5–6

Level 2: The method would not necessarily lead to a valid outcome. Most steps are identified, but the plan is not fully logically sequenced.

3–4

Level 1: The method would not lead to a valid outcome. Some relevant steps are identified, but links are not made clear.

1–2

No relevant content

0

Indicative content

- at least 5 concentrations
- remove peel
- cut pieces of potato

- to same mass / size
- measure / record initial mass of potato pieces
- leave in solutions
- for known time (at least 15 minutes if given)
- dry pieces
- measure / record final mass of potato pieces

- calculate change in mass
- calculate percentage change in mass

- control surface area / size / shape / length
- control temperature
- control type of potato

- repeat and calculate a mean (for each concentration)

[14]

Higher tier:

Q1.

Cells are the basic units of all forms of life.

(a) Describe **four** differences between a bacterial cell and a plant cell.

1. _____

_____

2. _____

_____

3. _____

_____

4. _____

_____

(4)

(b) Gonorrhoea is a bacterial disease.

A new vaccine is being developed against gonorrhoea.

Describe how a vaccine would work to prevent gonorrhoea.

_____

_____

_____

_____

_____

_____

_____

_____

(4)

Another disease caused by bacteria is salmonella food poisoning.

In the UK, chickens are vaccinated against *Salmonella* bacteria to reduce the number of cases of food poisoning in humans.

(c) Explain how vaccinating chickens reduces the number of cases of salmonella food poisoning.

_____

_____

_____

_____

(2)

(d) Give **one** way that the spread of salmonella food poisoning from one human to another is controlled.

Do **not** refer to vaccination in your answer.

_____

_____

(1)

(e) The number of cases of salmonella food poisoning is usually higher in summer than in winter.

Suggest **one** reason why.

_____

_____

(1)

(Total 12 marks)

Mark schemes

Q1.

(a) any **four** from:

- bacterial cell is smaller (than a plant cell)

  allow converse statements 'it' refers to bacteria

- bacterial cell does **not** have chloroplasts (plant cell does)

  ignore chlorophyll

- bacterial cell does **not** have its DNA / genetic material inside a nucleus (plant cell does)

  *allow bacterial cell does **not** have a nucleus (plant cell does)*

  allow bacterial cell has DNA / genetic material in a ring / loop (plant cell does not)

  allow bacterial cell has DNA / genetic material free in cytoplasm

- bacterial cell (may) have plasmids (plant cell does not)

- bacterial cell does **not** have mitochondria (plant cell does)

- cell wall in bacterial cells is **not** made of cellulose (cell wall in plant cells is)

- bacterial cell does **not** have a large / permanent vacuole (plant cell does)

- bacterial cell has smaller ribosomes (than plant cells)

  *do **not** accept idea that bacterial cells do not have ribosomes*

  allow bacterial cell (may) have a flagellum (plant cells do not)

  allow bacterial cell (may) have a slime capsule (plant cell does not)

4

(b) any **four** from:

- dead / inactive / weakened form of pathogen / bacterium / microorganism is introduced / injected

  allow introduce / inject antigen(s) from the pathogen

  allow dead / inactive / weakened form of Gonorrhoea (bacteria) introduced / injected

  *do **not** accept inject Gonorrhoea disease*

- white blood cells stimulated to produce antibodies

  *do **not** accept incorrect white blood cell, eg phagocyte*

- reference to memory cells made or remain

- on re-exposure specific / correct antibodies are made (very) quickly

  allow on re-exposure specific / correct antibodies are produced in large quantities

- bacteria / pathogens / microorganisms killed and do not produce a large enough population to cause the disease

  allow bacteria / pathogens / microorganisms killed and do not produce a large enough population to produce toxins

4

(c) fewer bacteria / pathogens in chicken / eggs / food

ignore references to immunity unqualified

allow fewer chickens / eggs will carry the bacteria / pathogens ignore chickens do not get disease / infected

1

(so) fewer bacteria are ingested (by humans)

allow idea of fewer bacteria being passed on to humans in food

or

fewer bacteria / pathogens ingested (by humans) (1)

(so) fewer toxins produced (1)

allow idea of fewer bacteria being passed on to humans in food (1)

1

(d) wash hands before preparing food

ignore wash hands unqualified

allow good food hygiene

wash hands after using the toilet

allow clean areas where a person has been ill

allow do not shake hands (with someone who has food poisoning)

1

(e) warmer weather so bacteria reproduce / increase faster

ignore bacteria are killed at low temperatures

allow food not cooked properly on barbeques

1

[12]