The Robert Carre Trust

A Level Biology

Summer Transition work

Biology Summer work Name:

Write the definitions of the following words and prefixes,

1. Outline	
2. Analyse	
3. Describe	
4. Contrast	
5. Cytology	
6. Pathology	
7. Physiological	
8. Ecological	
9. Epidermis	
10. Erythrocyte	
11. Uni/mono	
12. Di	
13. Bi	
14. Semi/Hap	
15. Tri	
16. Quad	
17. Penta	
18. Haem	
19. Cyto	
20. Neuro	
21. Gastro	

Biology Summer work Name:

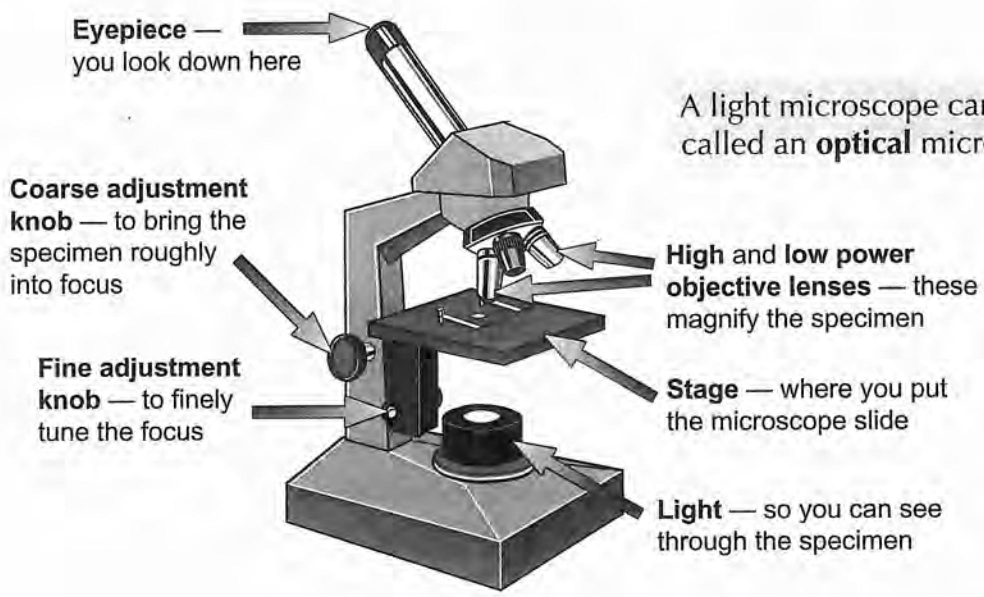
22. Zoo	
23. Troph	
24. Post	
25. Pre	
26. Endo	
27. Ecto	
28. Macro	
29. Meso	
30. Micro	
31. Monosaccharide	
32. Polysaccharide	
33. Starch	
34. Glycogen	
35. Cellulose	
36. Hydrolysis	
37. Condensation	
38. Glycosidic bond	
39. Peptide bond	
40. Fatty acid	

Microscopes

You Can See Cell Structure with a Light Microscope

A **light microscope** can magnify up to 1500 times and allows you to see individual animal and plant cells along with the organelles inside them.

1) If the cells have been **stained** you can see the dark-coloured **nucleus** surrounded by lighter-coloured **cytoplasm**.
2) Tiny **mitochondria** and the black line of the **cell membrane** are also visible.
3) In plant cells, the **cell wall**, **chloroplasts** and the **vacuole** can be seen.



A light microscope can also be called an **optical** microscope.

Electron Microscopes have a Greater Magnification

1) The detailed **ultrastructure** of cells was revealed in the 1950s when the **electron microscope** was invented.
2) An electron microscope can **magnify** objects more than 500 000 times and, more importantly, it allows **greater detail** to be seen than a light microscope. For example, it allows you to see the detailed **structures inside organelles** such as mitochondria and chloroplasts.
3) The image that's recorded is called an **electron micrograph**.

I put a slide on the stage and then slid straight off the edge...

1) Name three things visible with a light microscope in both animal and plant cells.
2) Which type of microscope must be used to show the detailed ultrastructure of a cell?
3) What is the image recorded by an electron microscope called?

Biology Summer work Name:

Microscopy

Define the following terms

Light Microscope:
....
....

Magnification: ....
....

Resolution: ....
....

Scanning Electron Microscope: ....
....

Specimen: ....
....

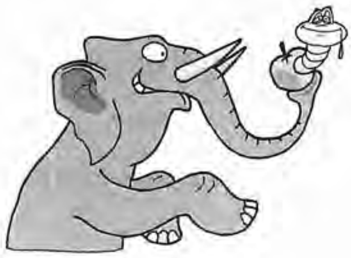
Transmission Electron Microscope: ....
....

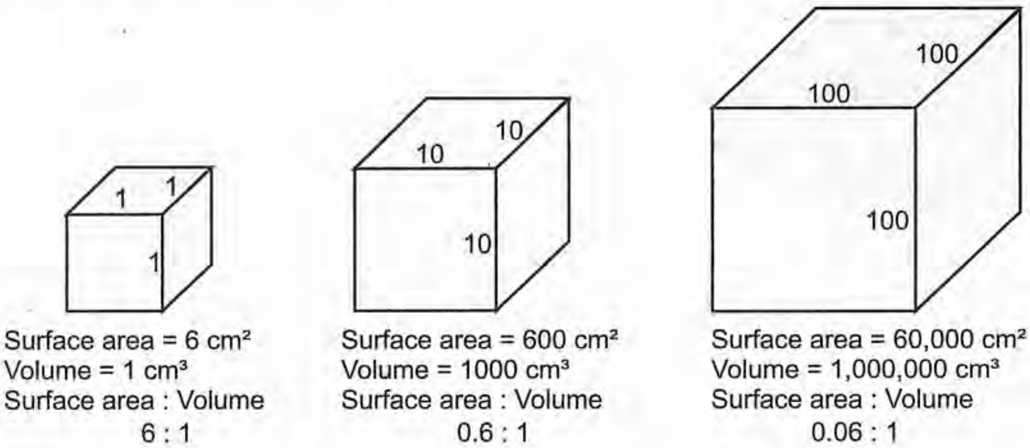
Wavelength: ....
....

Size and Surface Area to Volume Ratio

Small Objects have Relatively Large Surface Areas

1) Have you ever wondered **why** there are no large single-celled organisms or why big animals are made up of **millions** of tiny cells instead of a few large ones?
2) The main reason relates to the changes in the **surface area to volume ratio** of an object as it increases in size.
3) Look at the three cubes in the diagram below. The **smallest cube** has the **biggest** surface area to volume ratio and the **biggest cube** has the **smallest** surface area to volume ratio.





Surface Area is Important for Exchange

1) Cells or organisms need to **exchange materials** and **heat** with their environment.
2) **More** chemical reactions happen every second in organisms with a **larger volume** than in ones with smaller volumes.
3) Therefore **more** oxygen, nutrients, waste products and heat need to be exchanged across the membrane of cells of larger organisms.
4) With increasing volume this becomes an **ever-increasing problem**.

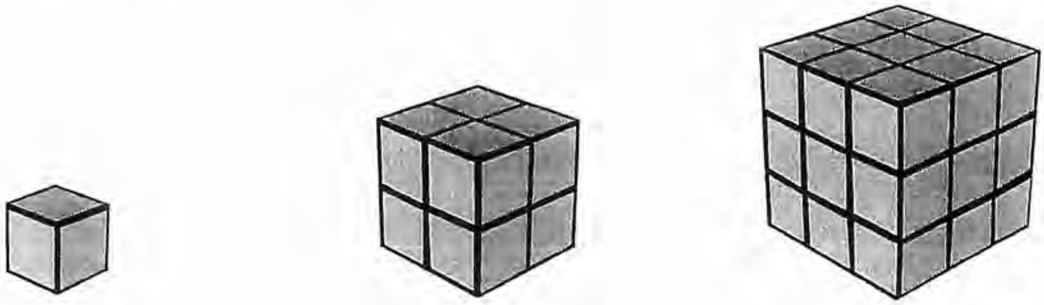
My surface area just keeps growing... so does my volume (it's the pies)...

1) Which has the bigger surface area to volume ratio, a small organism or a large organism?
2) An animal has a surface area of 7.5 cm^2 and a volume of 1 cm^3. What is its surface area to volume ratio?
3) Which animal has the greatest surface area to volume ratio — Animal A (9.8 : 1), Animal B (0.98 : 1)?
4) Give three materials that need to be exchanged across the membranes of organisms' cells.

Name...

Answer the questions:

1. Calculate the surface area, volume and surface area: volume ratio of each of the cubes below. Assume each small block has sides 1cm long. [9]



Cube1...

Cube 2 ....

Cube 3..

2. Giving two reasons, explain why the blocks above are not a good model for describing the problems with surface area: volume ratio in organisms. [4]

3. Give five examples of how organisms increase their surface area: volume ratio. [5]

Name………………………………………………………

MATHS SKILLS

Drawing Results Tables

A results table should always have the following:-

- ✓ Clear title
- ✓ Ruled grid lines, ENCLOSING ALL DATA, INCLUDING THE HEADINGS
- ✓ Headings at tops of columns
- ✓ The independent variable should be in the first column
- ✓ Headings should include <u>units</u>. DO NOT PUT UNITS IN THE BODY OF THE TABLE. (Units must not be mixed eg time is in minutes OR seconds but not both). Please note: the units for seconds is **s**, not sec.
- ✓ Same number of decimal places for each measurement. The number of places should reflect the accuracy and precision of your measurement. Do not round off data values; this might affect subsequent analysis of your data.
- ✓ Repeated readings; use a separate column for each
- ✓ Think about any additional columns you may need, and draw them in at the start. Additional columns may be used to show step by step calculations e.g. volume (cm^3), time (s), 1/time (1/s), rate (cm^3/s), etc.
- ✓ Calculated mean averages (Do not use a greater number of decimal places than you have in the raw data)

WORKED EXAMPLE: see table 1 below

Percentage Change

To calculate percentage change you need to use the following formula

$$\text{Percentage change} = \frac{\text{final value} - \text{initial value}}{\text{initial value}} \times 100$$

- Final mass – start mass, is the same as 'change in mass'.
- the answer should have either a + or a - sign to show whether the change is a gain or a loss compared to the original value

Name...

- the answer should have a % sign after it, or a % sign in the column heading, if it is part of a table of results

Why do we calculate percentage change?
In some experiments it is useful to calculate percentage change **when the initial values vary between samples**, and when you want to **compare** them; it is a way of eliminating the effect of this variation and allows you to make direct comparisons with these sorts of data.

WORKED EXAMPLE: Osmosis in potato cylinders.

- The student used a borer and ruler to cut potato cylinders of the same size for each concentration of sucrose solution and she measured their mass
- She put the cylinders into the different sucrose solutions for 1 hour and then re-measured their mass
- She recorded the initial and final mass for each cylinder in table 4

Sample answers below in italics and bold.

Table 1 showing the change in mass of potato cylinders in different concentrations of sucrose solution

Concentration of sucrose solution /M	Initial mass of potato cylinder /g	Final mass of potato cylinder /g	Change in mass /g	Percentage change in mass /%
1.0	5.7	4.3	*- 1.4*	*- 24.6*
0.75	5.9	5.1	*- 0.8*	*- 15.7*
0.5	6.1	5.8	*- 0.3*	*- 5.2*
0.25	5.6	6.5	*+ 0.9*	*+13.8*
0	5.8	7.1	*+ 1.3*	*+ 18.3*

Use the information in table 1 to do the following

(i) calculate the change in mass for each concentration (1 mark) *on table*

(ii) calculate the percentage change in mass at each concentration (2 marks) *on table*

(iii) why is it important to calculate the percentage change in mass in this experiment? (1mark)

the original values varied between the samples, therefore, calculating % change allowed me to compare the data.

Name..

(iv) the student decided that to check the reliability of her results. How did she do this and why? (3 marks)

- *she carried out repeat measurements.*
- *this would allow her to calculate a reliable mean*
- *and identify any anomalous results.*

Ratios

A ratio is a way to compare amounts of something. For instance, someone can look at a group of people, count them, and refer to the "ratio of women to men" in the group. Suppose there are thirty-five people, fifteen of whom are women. Then the ratio of women to men is **15 to 20**.

Notice that, in the expression "the ratio of women to men", "women" came first. This order is very important, and must be respected: whichever word came first, its number must come first. If the expression had been "the ratio of men to women", then the numbers would have been "20 to 15".

We would express the ratio of women to men as **"15 : 20"**

To write a ratio in its **simplest form** we divide both sides by their highest common factor.

For example, **15 : 20**, becomes **3 : 4.**

Now try these questions:

1. In a park, there were 10 geese and 45 ducks. Express the ratio of geese to ducks in its simplest form. (2 marks).

Name..

2. Collect a banana and follow the instructions below:

Cut a transverse (cross) section of the banana approximately half way along its length.

Do not remove the skin.

Calculate the ratio of the ***mean*** of the total width of the section to the ***mean*** width of the outer skin. You will need to record your results in an appropriate table, decide on a suitable number of repeats and show all your calculations. (5 marks).

3. Calculate the percentage increase in your pulse rate after exercise. Follow the instructions below. You will need to record your data in an appropriate table. (5 marks).

- ✓ Sit down and relax for 5 minutes.
- ✓ Then take your resting pulse rate by counting the number of pulses in 15 seconds.
- ✓ Repeat a further two times and calculate the mean.
- ✓ Exercise extensively until you think that your heart rate has risen significantly.
- ✓ Stop exercising and immediately take your pulse rate as before.
- ✓ Repeat the exercise and record the pulse rate a further two times and calculate the mean.
- ✓ Calculate your % increase in heart rate.

Biology Summer work Name:

Planning an Experiment

A Good Experiment Gives Precise and Valid Results

1) **Precise** results are **repeatable** (if the same person repeats the experiment using the same methods and equipment, they will get the same results) and **reproducible** (if someone different does the experiment, or a slightly different method or piece of equipment is used, the results will still be the same).
2) **Valid** results are **precise** and **answer the original question.** To get valid results you need to **control all the variables** to make sure you're only testing the thing you want to.

To Get Good Results You Need to Design Your Experiment Well

Here are some of the things you need to consider when thinking about **experimental design**:

1) **Only one variable should be changed** — Variables are **quantities** that have the **potential to change**, e.g. pH. In an experiment you usually **change one variable** and **measure its effect** on another variable.
   - The variable that you **change** is called the **independent variable.**
   - The variable that you **measure** is called the **dependent variable.**
2) **All the other variables should be controlled** — When you're investigating a variable you need to keep everything else that could affect it **constant**. This means you can be sure that **only** your **independent** variable is **affecting** the thing you're measuring (the dependent variable).
3) **Negative controls should be used** — Negative controls are used to **check** that only the independent variable is affecting the dependent variable. Negative controls **aren't expected** to have **any effect** on the experiment.
4) **Repeat the experiment at least three times** — Doing **repeats** and getting **similar results** each time shows that your data is **repeatable**. This makes it more likely that the same results could be **reproduced** by another scientist in an independent experiment. This makes your data **more precise**. Doing repeats also makes it easier to spot any **anomalous results** — unexpected results that don't fit in with the rest.

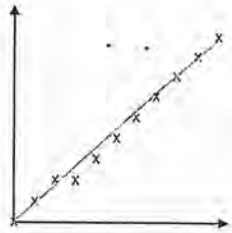
EXAMPLE: Investigating the effect of **temperature** on **enzyme activity.**

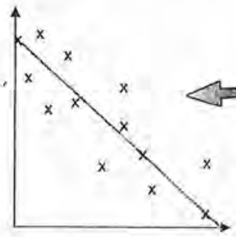
1) Temperature is the **independent** variable.
2) Enzyme activity is the **dependent** variable.
3) pH, volume, substrate concentration and enzyme concentration should all stay the **same.**
4) The experiment should be **repeated** at least three times at each temperature used.
5) A **negative control**, containing everything used except the enzyme, should be measured at each temperature. No enzyme activity should be seen with these controls.

Correlation and Cause

Lines of Best Fit Are Used to Show Trends

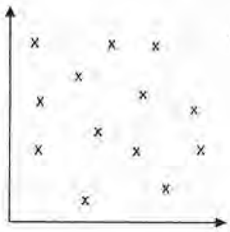
The line of best fit on this graph shows that as one variable **increases**, the other variable **also increases**. This is called a **positive correlation**. The data points are all quite close to the line of best fit, so you can say the correlation is **strong**. If they were more spread out, the correlation would be **weak**.





Variables can also be **negatively correlated** — this means one variable **increases** as the other one **decreases**. Look at the way the line of best fit **slopes** to work out what sort of correlation your graph shows.

Sometimes the graph won't show any clear trend and you won't be able to draw a line of best fit. In this case, you say there's **no correlation** between the variables.



Correlation Doesn't Always Mean Cause

1) Be careful what you **conclude** from an experiment — just because two variables are correlated, it doesn't necessarily mean that one **causes** the other.
2) In lab-based experiments, you can say that the independent variable causes the dependent variable to change — the increase in temperature **causes** an increase in the rate of the reaction. You can say this because everything else has **stayed the same** — nothing else could be causing the change.
3) Outside a lab, it can be much harder:

EXAMPLE:

Kate measured the level of air pollution and the incidence of TB, to see whether the two are related. Her results show a positive correlation between the variables — where the level of pollution is highest, the incidence of TB is also highest.

From Kate's results, you can't say that air pollution causes TB.

Neither can you say that TB causes air pollution.

It could be either way round... or one change might not cause the other at all — you just can't tell.