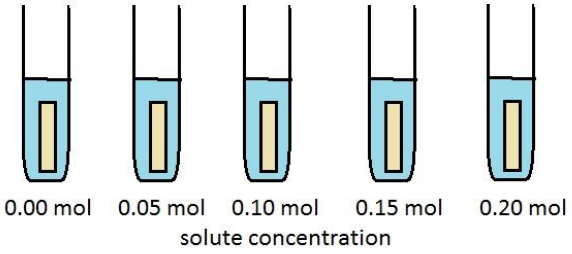
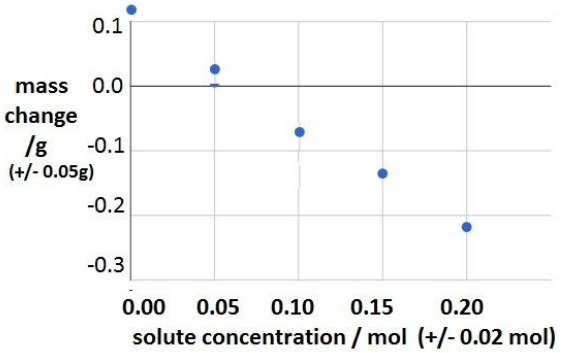
IB BIO SL PAPER 3 PRACTICE EXAM - SECTION A

Practical 2 - Estimation of osmolarity in tissues

In a simple experiment five cylinders of potato were soaked in five solute concentrations as shown below.
Use the graph to estimate the solute concentration of the cytoplasm of the potato cell cytoplasm.





How to do an estimate of the cytoplasm concentration.

1. **When the solution is the same as the cytoplasm concentration there will be no change in mass.**
2. **Draw a best fit line on the graph and estimate where it crosses the 0.0 mass change.**
3. **This is about 0.07 mol.**

Practical 2 - Estimation of osmolarity in tissues

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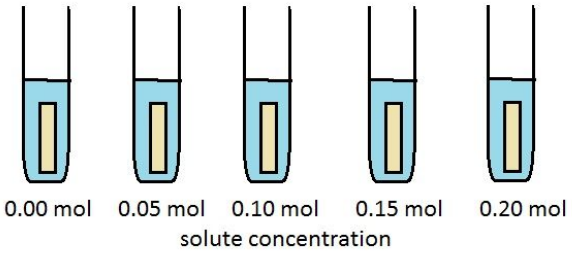

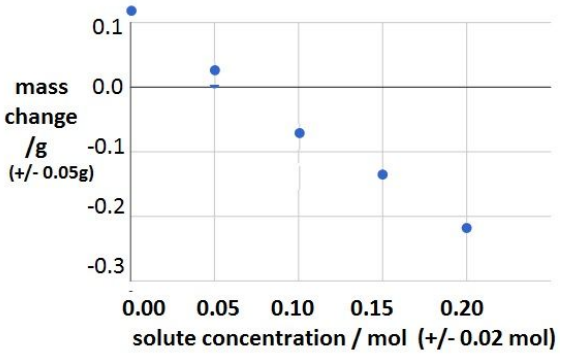

List the factors which must be controlled to make the experiment a reliable fair test.

Other factors which could affect the rate of osmosis could be:

- **temperature**
- **the time allowed for diffusion**
- **shape of the potato cylinders**
- **type of potato**
- **skin on the potato**

- **checking that all the salt has dissolved in the solution**

Practical 2 - Estimation of osmolarity in tissues

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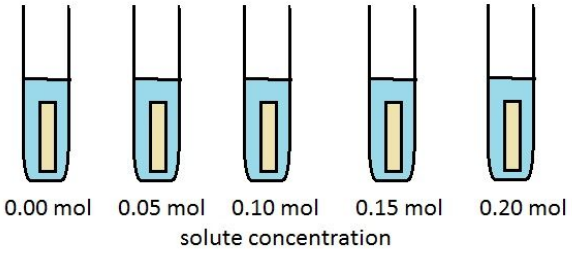
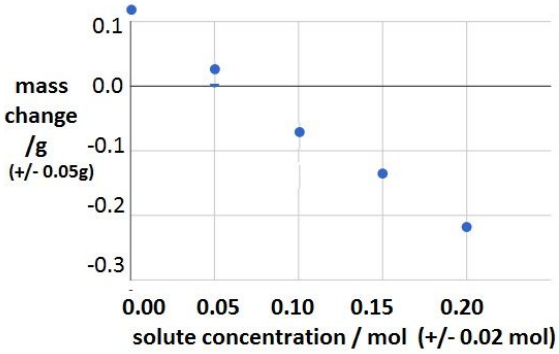




Explain what the figures +/-0.05g and +/-0.02mol indicate on the graph axes.

These values show the uncertainty or the measurement.

+/- 0.05g means that a reading of 0.1g could be as little as 0.05g or as much as 1.5g.

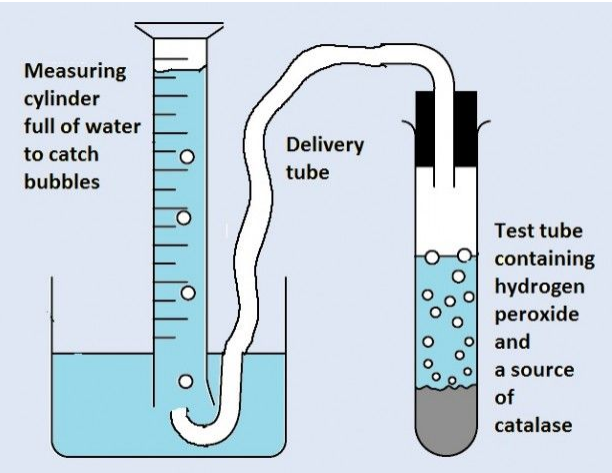
It is certain to be in between these values but we cannot know more precisely, because of the measuring equipment used.

The same logic can be applied to the concentration values.

Both of these 'uncertainties' are quite small, much smaller than the differences between concentrations shown on the graph, so we can infer that the data presented is quite reliable.

Practical 3 - Investigation of a factor affecting enzyme activity

This apparatus was used to investigate how pH can change the rate of an enzyme controlled reaction.
The source of catalase was a piece of liver. pH buffer solutions were added to the test tube.



Explain how you would set up an investigation of pH using buffer solutions.

1. How many different buffer solutions would you use, and which pH values?
In order to see any pattern in the results there needs to be a range of buffer solutions covering pH5 to pH9 at least. A wider range would be better. This experiment would have 5 different pH values tested, pH5,6,7,8, and 9.

2. How many repeats of each measurement would you need?

Each pH would need several repeats to check the reliability of the results. Three repeats would usually be sufficient.

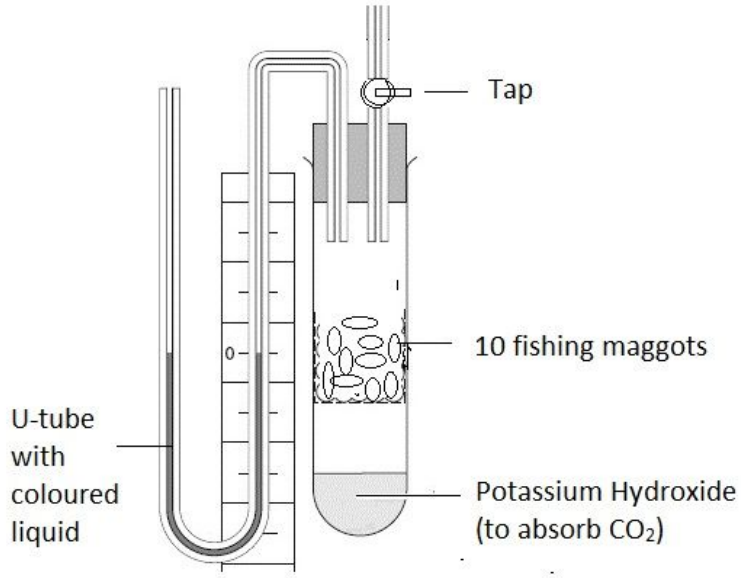
3. Why would a student need to consider the surface area, and the shape of the liver as well as its mass?

The enzymes from the liver will contact the hydrogen peroxide on its surface only. So although mass is important so will be shape as this will change the surface area if it is different.

Practical 3 - Investigation of a factor affecting enzyme activity.

This apparatus is used to test the rate of respiration with some insect larvae.

Respiration is a metabolic pathway controlled by enzymes, so the data gives us some information about the factors which affect enzymes.



In an experiment to test the affect of temperature on enzyme controlled reactions a student wants to do experiments at five different temperatures, 0°C, 20°C, 40°C, 60°C and 80°C.

The teacher stopped the experiment because it was breaking the IB guidelines on animal experiments.

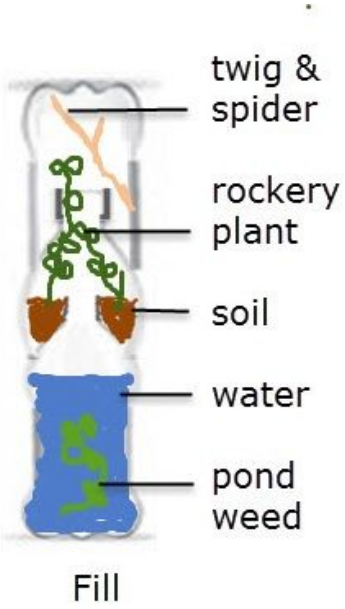
What is wrong with the plan? Explain why and suggest a better way to carry out the experiment.

The IB guidelines state that animals should not be subjected to conditions outside the range of conditions they experience in nature. It is very likely that 80°C, and 60°C will cause harm, or kill the maggots.

It would be better to test the maggots at 5 temperatures between 10°C and 40°C.

Practical 5 - Attempting to create a sealed microcosm

The diagram shows a simple mesocosm made by some students



Outline some of the practical difficulties you might encounter in the construction of such a mesocosm, and suggest some precautions which might be taken to avoid harm to students or the animals in the mesocosm.

There are lots of practical difficulties:

- **Cutting the bottles is a bit dangerous and you must hold the bottle in such a way that you cannot stab you hand with the scissors as you make the first cut into the bottle.**
- **The edges of the bottle must be the same size, and neatly cut to ensure a good seal.**
- **If you use a glue gun there is a need to be careful not to burn yourself.**
- **Putting the soil in without dropping too much into the water is tricky unless you have a long spoon / spatula.**
- **Care must be taken to ensure that there is enough photosynthesis to provide oxygen for the spider.**
- **Pond weed is a good idea as it is likely to survive well, given enough light.**

Practical 5 - Attempting to create a sealed microcosm

The photo shows a simple mesocosm made by some students

Suggest how this mesocosm could be used to investigate how the number of hours of light in a 24 hour period affects the balance of plants and animals in the mesocosm.

This is really a question about experiment design.

There would need to be five identical mesocosms each containing the same organisms.

Each mesocosm would be given a different lighting regime

(e.g. 4 ours / day, 8 hours /day, 12 hours /day, 16 hours and 20 hours.)

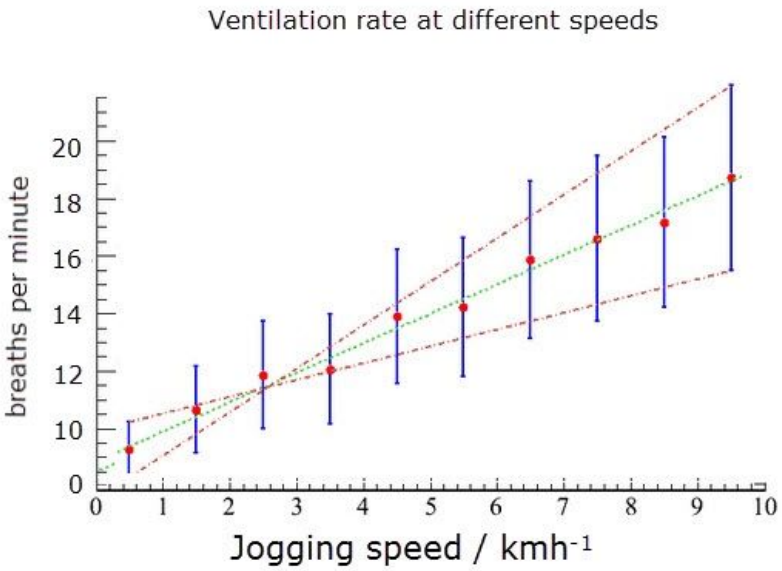
A measure of the number of animals, and plants after a period of several weeks would be recorded.

Measurements could be taken each week for a couple of months, or even longer.

For more reliable results more mesocosms would be needed so there could be repeats.

Practical 6 - Monitoring of ventilation at rest, after mild & vigorous exercise

This graph shows the results of an experiment to measure ventilation rates at different jogginG speeds.
The red dots show the average rate and the blue bars show the range of readings taken.



1. Describe how the ventilation rate changes as the jogging speed increases.

As the jogging speed increases the ventilation rate increases at a constant rate.

There is a positive correlation between jogging speed and ventilation rate.

2. Suggest what you would expect to happen to the volume of each breath as the jogging speed increased.

The depth of each breath would also increase (especially at slower jogging speeds)

There is a limit to the volume of a breath, the tidal volume of the lungs.