Edexcel IAL Biology A Level

Core Practical 16

Use a simple respirometer to determine the rate of respiration and RQ of a suitable material (such as germinating seeds or small invertebrates).

Independent variable: The main purpose of this experiment is to understand how to use a respirometer and how it works. If you only use one species of animal or seed there will be no independent variable. However, if you use multiple species then the independent variable is the species of organism being used.

Dependent variable: Distance moved by coloured fluid in the manometer.

Equipment list

- Sample seeds
- Sample animals - such as woodlice
- Soda lime or potassium hydroxide solution
- Spatula (if using soda lime)
- Funnel (if using potassium hydroxide solution)
- Pipette
- Ruler
- Marker pen
- Stopwatch
- Respirometer - consisting of:
    - Syringe with connecting tap
    - Bung
    - Test tube
    - Capillary tubing
    - Manometer
    - Coloured liquid
    - Scale
    - Gauze

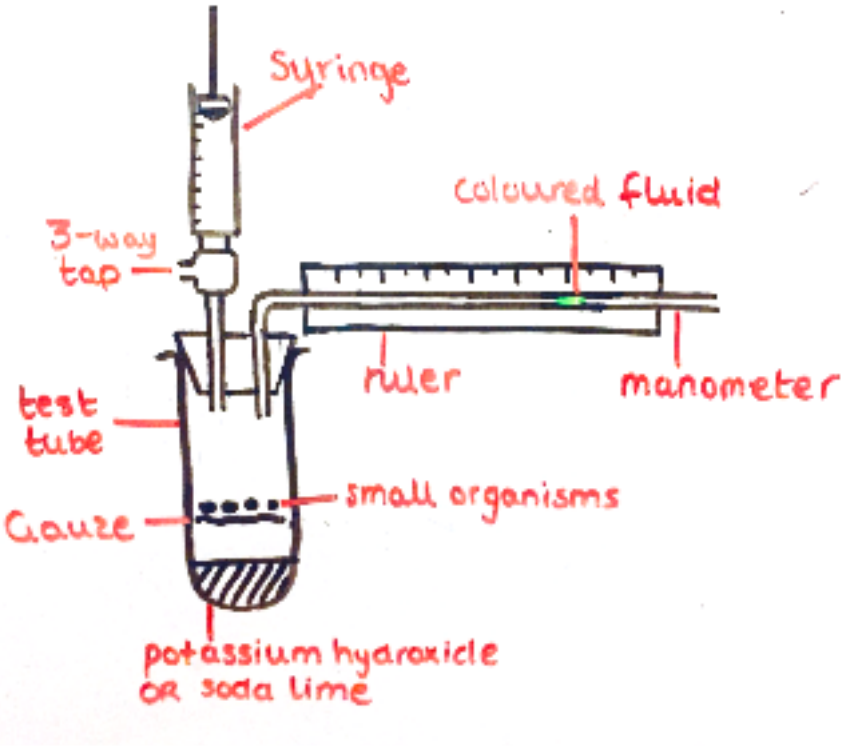
Method

1. Use either the pipette and funnel to add 5 cm^3 of potassium hydroxide solution to the test tube, or the spatula and weighing scales to add 5g of soda lime to the test tube.
2. Secure the gauze in place above the solution / powder in the test tube.
3. Select the first species of organism and place a known mass of them on to the gauze.
4. Set up the remainder of the respirometer as shown in the diagram below. If the manometer does not already have a drop of coloured fluid in it, one can be added using a dropping pipette.
5. Use the syringe to move the coloured fluid to the end of the manometer **furthest from the test tube** and mark its position with a pen, or record its distance from the end of the manometer by measuring with a ruler.
6. Close the 3-way tap to allow **no more gas exchange to occur** between the apparatus set up and the outside atmosphere and start the stopwatch immediately.
7. Measure the position of the coloured fluid from its starting point every minute for 5 minutes, recording the distance moved in a suitable table. As the organisms respire they take in oxygen, causing the pressure in the test tube to **decrease** which **draws in air** from the manometer tube; so the volume of oxygen taken in can be calculated if the **diameter of the**

tubing is known. Once calculated, the rate of oxygen uptake can be calculated per gram of organism and then compared between organisms.

8. Open the 3-way tap connection to the outside air and use the syringe to reset the capillary fluid.
9. Repeat steps 3-8 with any other organisms being investigated.

Respirometer set-up



Risk assessment

Risk	Hazard	Precaution
Animal and plant samples	Potential allergic reaction	Wear gloves when handling Wash hands after the practical
Glassware	Cuts from sharp objects	Take care when handling glass objects Keep away from edge of desk
Soda lime or potassium hydroxide	Corrosie, potential allergic reaction and could irritate skin	Avoid skin contact Be careful when handling Do not inhale Wash hands after

Results table

Time (minutes)	Distance moved by coloured fluid (cm)	Volume of oxygen taken in since start (cm^3)
0	0	0
1		
2		
3		
4		
5		

To calculate the volume of oxygen taken in since the start (cm^3) you calculate the volume of the manometer tube that has been filled with oxygen:

$V = \pi r^2 l$

Where r is the radius of the tube (half its diameter)
Where l is the distance moved from the start

E.g. If the fluid moved 1.5 cm in the first minute and the radius of the tube was 0.5mm then the volume produced would be:

$V = \pi \times (0.5)^2 \times 1.5$

$= 1.178\ cm^3$

The rate of oxygen uptake per minute can be calculated by **dividing the total volume of oxygen produced by the number of minutes since starting the stopwatch.**