

## ACTIVITY 1

## ▼ PRACTICAL: INVESTIGATING THE RATE OF ANAEROBIC RESPIRATION IN YEAST

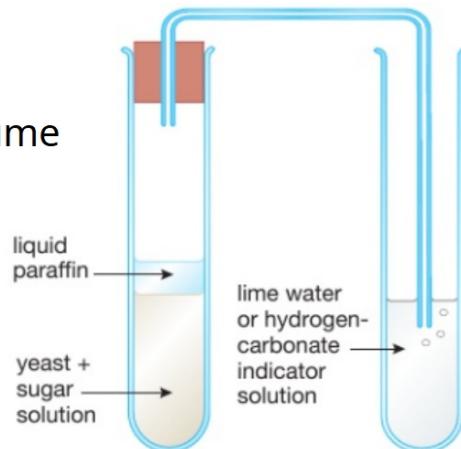
Some simple apparatus and materials can be used to investigate the rate of anaerobic respiration in yeast.

A small amount of water is gently boiled in a boiling tube to remove any air that is dissolved in the water. The water is allowed to cool, and a small amount of sugar (glucose or sucrose) is dissolved in the water. Finally, a little yeast is added and the mixture is stirred.

The apparatus is set up as shown in Figure 21.5.

A **gas syringe** measures the exact volume of  $\text{CO}_2$  produced to **improve results**

Note: when you measure the volume of gas (for example: oxygen or carbon dioxide produced during a reaction ) it must always be recorded in a set time period.



A thin layer of liquid paraffin is added to the surface of the mixture, using a pipette. The boiled water ensures that there is no oxygen in the mixture, and the layer of paraffin stops any oxygen diffusing in from the air. A control apparatus is set up. This is exactly the same as that shown in Figure 21.5, except that boiled (killed) yeast is used instead of living yeast.

Both sets of apparatus are left in a warm place for an hour or two. The mixture with living yeast will be seen to produce gas bubbles. The gas passes through the delivery tube and into the indicator in the second boiling tube.

If this tube contains limewater, it will turn cloudy (milky). If it contains hydrogen carbonate indicator, the indicator will change from orange to yellow. This shows that the gas is carbon dioxide. The time taken for the indicator to change colour is recorded and compared with the control (which will not change).

(If the bung is taken out of the first boiling tube and the liquid paraffin removed using a pipette, the tube will smell of alcohol.)

This method can be used to test predictions, such as:

- the type of sugar (glucose, sucrose, maltose etc.) affects the rate of respiration of the yeast
- the concentration of sugar affects the rate of respiration of the yeast
- how temperature affects the rate of respiration of the yeast.

The rate can be found by timing how quickly the indicator changes colour, or from the rate of production of bubbles of carbon dioxide. You could plan experiments to test these hypotheses.

## ■ how temperature affects the rate of respiration of the yeast.

C: change temperature.

O: same yeast species

M1: measure the **number/volume of bubbles of CO<sub>2</sub>**

M2: given in a **set time period**

(or timing how quickly indicator change colour)

S: mass of sugar / type of sugar/concentration of sugar

Note: The higher the temperature, the more bubbles of CO<sub>2</sub> are produced as the higher temp will be closer to optimum temp of enzyme in yeast.

If the temp is too high, the enzyme will be denatured causing CO<sub>2</sub> production to slow down & eventually stop

### Notes on activity 1:

- the type of sugar (glucose, sucrose, maltose etc.) affects the rate of respiration of the yeast

C: change type of sugar.

O: same yeast species

M1: measure the number/volume of bubbles of CO<sub>2</sub>

M2: given in a set time period

(or timing how quickly indicator change colour)

S: mass of sugar / temperature.

- the concentration of sugar affects the rate of respiration of the yeast

C: change concentration of sugar.

O: same yeast species

M1: measure the number/volume of bubbles of CO<sub>2</sub>

M2: given in a set time period

(or timing how quickly indicator change colour)

S: type of sugar/temperature.