AQA Biology A-Level

Required Practical 9

Investigation into the effect of a named variable on the rate of respiration of cultures of single-celled organisms.

Yeast is a single celled organism that respires both **aerobically and anaerobically**. During respiration, **electrons** are transferred to synthesise **ATP.** Respiration can be measured using a **redox indicator dye** such as **methylene blue**, which accepts these electrons and undergoes a **colour change** from **blue to colourless.**

Equipment list

- Yeast and glucose in buffered solution
- Water bath
- Thermometer/temperature probe
- Test tubes
- Timer

Method

In this method the named variable is temperature

1. Set up a **water bath at 35°C.**
2. Add **5cm^3** of the yeast and glucose solution to three test tubes. Place test tubes in the water bath and leave them, for the solution to **equilibrate for 10 minutes**.
3. Add **2cm^3** of **methylene blue** to the test tubes and **start the timer**. Shake for 10 seconds and place test tube back in water bath. Record how long it takes for the methylene blue to turn **colourless for each test tube.**
4. Repeat the experiment using temperatures of **40°C, 50°C, 60°C and 70°C**.
5. **Find the mean** of the results for each temperature and use to calculate the **average rate of respiration**.

$$Rate\ of\ respiration = \frac{1}{mean\ time}$$

NB: the yeast and glucose solution should be **buffered** to maintain a **constant pH**.

Risk Assessment

Hazard	Risk	Safety Precaution	In emergency	Risk Level
DCPIP	Irritant to skin and eyes; may cause staining	Wear eye protection	Wash from skin/eyes immediately using cold water	Low
Biohazard	Allergies	Wash hands after use	Seek assistance	Low
Broken glass	Cuts from sharp object	Take care when handling glass objects; keep away from edge of desk	Elevate cuts; apply pressure; do not remove glass from wound; seek medical assistance	Low
Hot liquids	Scalding	Handle with care; use tongs to remove boiling tubes from water bath; wear eye protection	Run burn under cold water; seek medical assistance	Low

Graph

- Plot a graph of **rate of respiration** against **temperature.**

Conclusion

- Yeast has an optimum temperature range for respiration, which is shown by the peak on the graph. As the temperature moves away from the **optimum**, the rate of reaction will **decrease** as **enzyme action decreases,** and at high temperatures **denaturation** may occur.
- As enzymes are crucial to respiration, as their activity decreases, so does the rate of respiration. This means that the methylene blue will take **longer** to turn colourless when the temperature is **further from the optimum.**