Aerobic Respiration

Standard Grade Biology

Investigating Cells
Respiration

- Respiration is the process of converting chemical energy stored in food into a usable form of energy.
- Respiration takes place in every living cell, all of the time in tiny organelles called mitochondria.
Respiration

- Respiration can be represented by the equation.

\[
glucose + oxygen \rightarrow \text{carbon dioxide} + \text{water} + \text{energy}
\]

- Oxygen is needed for this process to happen, it is called **aerobic respiration**.
Does food contain energy?
Results

- How many joules of energy were given out by the wotsit/puff?
- Energy content (joules/g)
- Energy (joule) = volume of water (ml) x temp rise of water (°C) x 4.2J

= energy given out by wotsit
weight of wotsit
Detecting carbon dioxide production
results

- Draw a diagram
- Label it
- Write a sentence conclusion explaining what the experiment shows, and how this relates to respiration.
Detecting Carbon Dioxide

• Answer the following questions in full sentences;
  – What is the effect of exhaled air on bicarbonate/indicator solution?
  – In comparing bicarbonate/indicator solution and limewater as tests for carbon dioxide, which is
    • More sensitive
    • More specific
  – Which of the two tests do you think is more suitable for detecting carbon dioxide production by small living organisms?
Do living things produce carbon dioxide?

![Diagram showing a series of containers: 1. Caustic potash, 2. Limewater, 3. Respiring Mouse, 4. Limewater. Air is drawn in at the left and out at the right.]
Do living things produce carbon dioxide?

- Caustic potash prevents carbon dioxide from the air entering the chain.
- Limewater stays clear, confirming that carbon dioxide has been removed.
- The mouse will breathe in oxygen, as it breathes out carbon dioxide will be released as a bi-product of respiration.
- The limewater will go cloudy, proving that living things produce carbon dioxide.
Do living things release energy from food?

- The energy in glucose is not totally converted into ATP; some is lost as heat energy, which can be detected.

- The experiment can be used to show that heat energy is released from germinating seeds during respiration.
Do living things release energy from food?

1. Peas killed by boiling
   - Cotton wool

2. Vacuum flask (Held in clamps)
   - Germinating peas
   - Cotton wool

Thermometer
Do living things release energy from food?

1. The temperature will stay the same.

2. The living cells in the germinating peas will release energy from food. Some of this energy escapes as heat energy; this will make the temperature in the flask rise.
Do living things need oxygen?

- The alkaline pyrogallol absorbs oxygen
- Make predictions on the results.
Respiration

- Energy released during respiration is used:
  - to build up larger molecules from smaller ones.
  - to enable muscles to contract.
  - to maintain a steady body temperature in colder surroundings.
Mitochondria

- Aerobic respiration takes place in the mitochondria
- They are tiny rod-shaped organelles
- They have a folded inner membrane which provides a large surface area for enzymes involved in respiration.
- Muscle cells contain lots of mitochondria
Aerobic Respiration in Yeast

SG Biology
Investigating Cells
Practical
Aerobic respiration in yeast

- Set up the experiment as shown in the diagram below.
Aerobic respiration in Yeast

- Methylene blue is a dye which will go colourless in the absence of oxygen.
- Label 2 test tubes A & B
- Place 2 cm$^3$ of 1% glucose solution to test tube A
- Place 2 cm$^3$ water to test tube B
- In tube A, add 30 mm (depth) yeast suspension.
- In tube B, add 30 mm yeast suspension.
- Place both tubes in a beaker of warm water ($40^0 C$)
Aerobic respiration in yeast

- After 5 minutes add 2cm³ methylene blue solution
- Shake both tubes well and return to water bath.

- Watch – how long does it take for the blue colour to disappear?
- Explain your results in terms of respiration.