*This is the **Higher Separate** version — includes all Higher Tier content (marked ★) and all Separate Science content.*

Anaerobic respiration occurs when oxygen is insufficient. It releases much less energy than aerobic respiration but does not require oxygen.

- In animals and bacteria: glucose → lactic acid (+ small amount of energy).
- In yeast and plants: glucose → ethanol + carbon dioxide (+ small amount of energy). This is called FERMENTATION.
- Anaerobic respiration produces much less ATP than aerobic (2 ATP vs up to 38 ATP per glucose molecule).
- Lactic acid accumulates in muscles during intense exercise → causes fatigue and the burning sensation in muscles.
- Oxygen debt: after anaerobic exercise, extra oxygen is needed to break down lactic acid in the liver (converted back to glucose). This is why breathing rate stays elevated after exercise stops.
- Fermentation in yeast: used in beer/wine brewing (ethanol produced) and bread-making (CO■ causes dough to rise).
- Anaerobic respiration in muscles is a temporary measure — only sustainable for short periods.
- ★ **HT** The Cori cycle: lactic acid produced in muscles travels in blood to the liver, where it is converted back to glucose using oxygen — this requires the "oxygen debt" to be repaid.

Key Terms

Anaerobic respiration	Respiration without oxygen — produces lactic acid (animals) or ethanol + CO■ (yeast)
Fermentation	Anaerobic respiration in yeast or bacteria — produces ethanol and CO■
Lactic acid	Product of anaerobic respiration in animal muscle cells — causes fatigue
Oxygen debt	Extra O■ needed after anaerobic exercise to break down accumulated lactic acid

■ **Exam Tip:** Anaerobic in animals → LACTIC ACID. Anaerobic in yeast → ETHANOL + CO■. These are the two products you need to know. A common error is mixing them up — plants/yeast make ethanol, animals make lactic acid.