

Stages of respiration

**Write the overall equation for aerobic respiration of glucose.**

Stages of respiration

**Where does the carbon dioxide from respiration come from?**

Stages of respiration

**Why is respiration a stepped process?**

Stages of respiration

**Define substrate-level phosphorylation.**

Stages of respiration

**Glycolysis: ATP used, made and net?**

Stages of respiration

**What are the products of glycolysis per glucose?**

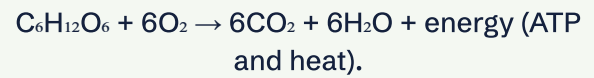
Stages of respiration

**What is formed when pyruvate is decarboxylated and dehydrogenated in the link reaction?**

Stages of respiration

**Products of one turn of the Krebs cycle?**

From the carbon in the substrate, removed by decarboxylation.



ATP formed by direct transfer of a phosphate group from a substrate molecule to ADP, without the electron transport chain.

Each step is catalysed by its own intracellular enzyme, so energy is released in small amounts, more is captured as ATP and each step can be controlled.

2 pyruvate, 2 reduced NAD and a net gain of 2 ATP.

2 ATP used, 4 made, net gain of 2 ATP per glucose.

2 CO<sub>2</sub>, 3 reduced NAD, 1 reduced FAD and 1 ATP.

Acetyl CoA (the acetyl group joined to coenzyme A), CO<sub>2</sub> and reduced NAD.

Stages of respiration

**Which stages of aerobic respiration take place in the mitochondria?**

Stages of respiration

**Where is the electron transport chain?**

Stages of respiration

**Define chemiosmosis.**

Stages of respiration

**What is the role of oxygen in oxidative phosphorylation?**

Stages of respiration

**Why is pyruvate converted to lactate in anaerobic conditions?**

Stages of respiration

**What happens to lactate after anaerobic respiration?**

Respiratory quotient and respiration practicals

**Define respiratory quotient (RQ).**

Respiratory quotient and respiration practicals

**Typical RQ values for carbohydrate, protein and lipid?**

On the inner mitochondrial membrane (cristae).

The link reaction, the Krebs cycle and oxidative phosphorylation. Glycolysis occurs in the cytoplasm.

Final electron acceptor: combines with electrons and protons to form water.

Flow of protons down their gradient across a membrane through ATP synthase, providing energy to make ATP.

It is carried to the liver, converted to pyruvate and respired aerobically or converted to glycogen.

To oxidise reduced NAD so that NAD is regenerated and glycolysis can continue.

Carbohydrate about 1.0, protein about 0.9, lipid about 0.7.

The volume of carbon dioxide produced divided by the volume of oxygen consumed in a given time.

Respiratory quotient and respiration practicals

**What might an RQ above 1.0 suggest?**

Respiratory quotient and respiration practicals

**Why does a redox indicator such as methylene blue decolourise in yeast?**

Respiratory quotient and respiration practicals

**In Core practical 15, what is measured as the dependent variable?**

Respiratory quotient and respiration practicals

**What does potassium hydroxide do in a respirometer?**

Respiratory quotient and respiration practicals

**How is the volume of oxygen consumed found from a respirometer capillary?**

Respiratory quotient and respiration practicals

**Why is a control tube used in a respirometer?**

Muscles and movement

**What is the function of tendons?**

Muscles and movement

**What is the function of ligaments?**

It accepts hydrogen from dehydrogenase enzymes in place of NAD, so it is reduced and loses its colour.

More CO<sub>2</sub> than O<sub>2</sub> is exchanged, so some anaerobic respiration may be occurring.

It absorbs CO<sub>2</sub>, so fluid movement shows the volume of O<sub>2</sub> consumed.

The time taken for the redox indicator to lose its colour.

To allow for temperature and pressure changes in the apparatus that are not due to respiration.

Volume =  $\pi r^2 \times$  distance moved by the fluid.

They join bone to bone at a joint, stabilising it.

They attach muscle to bone and transmit the force of contraction to the bone.

Muscles and movement

**Define flexor and extensor.**

Muscles and movement

**Why do muscles work in antagonistic pairs?**

Muscles and movement

**Name the cell surface membrane and cytoplasm of a muscle fibre.**

Muscles and movement

**What is a sarcomere?**

Muscles and movement

**Which part of the sarcomere contains only myosin?**

Muscles and movement

**What does the sarcoplasmic reticulum store?**

Muscles and movement

**Why are slow twitch fibres resistant to fatigue?**

Muscles and movement

**Why are fast twitch fibres suited to sprinting?**

Muscles can only pull, so one muscle is needed to move a joint each way; when one contracts, the other relaxes.

A flexor bends a joint when it contracts; an extensor straightens a joint when it contracts.

The repeating contractile unit of a myofibril, from one Z line to the next.

Sarcolemma (membrane) and sarcoplasm (cytoplasm).

Calcium ions ( $\text{Ca}^{2+}$ ), released when the muscle is stimulated.

The H zone (the A band is where the myosin filaments lie in full).

Large glycogen stores and anaerobic glycolysis give rapid ATP; they contract quickly and forcefully.

They respire aerobically, with many mitochondria, much myoglobin and a dense capillary supply, so little lactate builds up.

Muscles and movement

**What does tropomyosin do in a relaxed muscle?**

Muscles and movement

**What does calcium do in muscle contraction?**

Muscles and movement

**What are the two uses of ATP at the myosin head?**

Muscles and movement

**What happens to the I band, H zone and A band when a muscle contracts?**

The heart, ventilation and exercise

**What does myogenic mean?**

The heart, ventilation and exercise

**What is the role of the sinoatrial node?**

The heart, ventilation and exercise

**Why does the AVN delay the wave of excitation?**

The heart, ventilation and exercise

**Put in order: AVN, SAN, Purkyne fibres, bundle of His.**

It binds to troponin, which moves tropomyosin and exposes the myosin-binding sites.

It covers the myosin-binding sites on actin, so cross-bridges cannot form.

I band and H zone get shorter; the A band stays the same length.

Binding causes the head to detach from actin; hydrolysis by ATPase provides energy to re-set the head.

It is the pacemaker: it initiates the wave of excitation that spreads across the atria.

Cardiac muscle contracts and relaxes rhythmically without nervous stimulation.

SAN, AVN, bundle of His, Purkyne fibres.

So the atria finish contracting and the ventricles fill before the ventricles contract.

The heart, ventilation and exercise

**What do the P wave, QRS complex and T wave show?**

The heart, ventilation and exercise

**Name four abnormal heart rhythms an ECG can show.**

The heart, ventilation and exercise

**Cardiac output equation?**

The heart, ventilation and exercise

**Where are the cardiovascular control centre and ventilation centre?**

The heart, ventilation and exercise

**What do chemoreceptors detect in exercise?**

The heart, ventilation and exercise

**Which nerve decreases heart rate and which increases it?**

The heart, ventilation and exercise

**Where is adrenaline made and what is its role?**

The heart, ventilation and exercise

**Effect of adrenaline on the liver?**

Tachycardia, bradycardia, ectopic heartbeat and atrial fibrillation.

P: atrial depolarisation; QRS: ventricular depolarisation; T: ventricular repolarisation.

In the medulla oblongata of the brain.

Cardiac output = stroke volume  $\times$  heart rate.

The vagus (parasympathetic) decreases it; the sympathetic nerve increases it.

A rise in CO<sub>2</sub> concentration and a fall in blood pH.

It stimulates the conversion of glycogen to glucose, raising blood glucose.

In the adrenal glands; it prepares the body for fight or flight.

The heart, ventilation and exercise

**Respiratory minute ventilation equation?**

The heart, ventilation and exercise

**How is oxygen consumption found from a spirometer trace?**

The heart, ventilation and exercise

**What is tidal volume?**

Homeostasis, hormones and the kidney

**Define negative feedback.**

Homeostasis, hormones and the kidney

**Define positive feedback.**

Homeostasis, hormones and the kidney

**Why does negative feedback keep a factor within narrow limits?**

Homeostasis, hormones and the kidney

**Define homeostasis.**

Homeostasis, hormones and the kidney

**Role of the hypothalamus in thermoregulation?**

From the gradient of the trace, because soda lime removes the CO<sub>2</sub> so the falling volume is oxygen used.

Minute ventilation = tidal volume × breathing rate (dm<sup>3</sup> min<sup>-1</sup>).

A change in a factor is detected and the response reverses it, returning the factor to its set point.

The volume of air breathed in (or out) in one breath. It is about 0.5 dm<sup>3</sup> at rest and increases during exercise.

Any change in either direction is detected and corrected by effectors that act in opposite ways.

The response increases the change away from the starting point, e.g. oxytocin in labour.

Its thermoreceptors detect blood temperature, and it coordinates responses by effectors.

Maintenance of a stable internal environment within narrow limits, a state of dynamic equilibrium.

Homeostasis, hormones and the kidney

**How does vasodilation reduce body temperature?**

Homeostasis, hormones and the kidney

**What is a transcription factor?**

Homeostasis, hormones and the kidney

**Why can steroid hormones enter cells but peptide hormones cannot?**

Homeostasis, hormones and the kidney

**Which parts of the nephron are in the cortex?**

Homeostasis, hormones and the kidney

**Why is the afferent arteriole wider than the efferent arteriole?**

Homeostasis, hormones and the kidney

**What is deamination?**

Homeostasis, hormones and the kidney

**Name the three layers filtrate crosses in ultrafiltration.**

Homeostasis, hormones and the kidney

**What is in glomerular filtrate?**

A protein that binds to a specific DNA sequence and switches transcription of a gene on or off.

More blood flows through skin capillaries near the surface, so more heat is lost by radiation.

The glomerulus, Bowman's capsule, proximal convoluted tubule and distal convoluted tubule.

Steroids are lipid-soluble and diffuse through the phospholipid bilayer; peptides are water-soluble.

Removal of the amino group from an excess amino acid in the liver, forming ammonia (then urea) and a keto acid.

To create a high hydrostatic pressure in the glomerulus for ultrafiltration.

Water, glucose, amino acids, urea and ions; no blood cells or large proteins.

Capillary endothelium (with fenestrations), basement membrane and podocytes of the Bowman's capsule.

Homeostasis, hormones and the kidney

**How is glucose reabsorbed in the proximal tubule?**

Homeostasis, hormones and the kidney

**What is the role of the ascending limb of the loop of Henle?**

Homeostasis, hormones and the kidney

**Why is the loop of Henle a countercurrent multiplier?**

Homeostasis, hormones and the kidney

**Where are osmoreceptors and where is ADH released?**

Homeostasis, hormones and the kidney

**How does ADH increase water reabsorption?**

It is impermeable to water and actively pumps  $\text{Na}^+$  and  $\text{Cl}^-$  into the medulla, lowering its water potential.

By sodium-glucose co-transport (using the sodium gradient set up by active transport), then facilitated diffusion into the blood.

Osmoreceptors are in the hypothalamus; ADH is released from the posterior pituitary gland.

Fluid flows in opposite directions in the two limbs, and a small gradient at each level is multiplied into a steep gradient.

It causes aquaporins to be inserted in the collecting duct membrane, so it is more permeable to water.