Solutions

Each answer shows the steps, then the **result**.

2.1

- glycolysis – cytoplasm; Krebs cycle – mitochondrial matrix; oxidative phosphorylation – inner mitochondrial membrane

2.2

- 2 (a net gain of 2 ATP)

2.3

- glucose is phosphorylated using 2 ATP, forming fructose 1,6-bisphosphate
- this splits into two triose phosphate molecules
- each triose phosphate is oxidised to pyruvate, giving reduced NAD and a net gain of 2 ATP per glucose

3.1 D

- In oxidative phosphorylation oxygen is the final electron acceptor

3.2 B

- In mammals, anaerobic respiration converts pyruvate to lactate

3.3

(a)

- pyruvate enters the mitochondrial matrix; it loses a CO_2 (decarboxylation) and is oxidised to a 2C acetyl group, reducing NAD; the acetyl group joins coenzyme A to form acetyl coenzyme A

(b)

- cristae give a large surface area for more electron carriers and ATP synthase, so more ATP is made

3.4

(a)

- energetic electrons pass along the electron transport chain, releasing energy; this pumps protons across the inner membrane into the intermembrane space; the protons flow back into the matrix through ATP synthase; this flow provides energy to make ATP (chemiosmosis)

(b)

- anaerobic respiration uses only glycolysis, without the link reaction, Krebs cycle and oxidative phosphorylation that release most of the ATP

3.5

(a)

- the seeds take in oxygen for aerobic respiration
- the carbon dioxide they release is absorbed by the potassium hydroxide, so the gas volume and pressure in the tube fall

(b)

- volume $= \pi r^2 h = \pi \times 0.50^2 \times 24 = 18.8$ mm^3
- rate $= 18.8/10 =$ **1.9** mm^3 min^{-1}

(c)

- a control: any movement it shows is caused by changes in temperature or pressure, not respiration, so it can be subtracted

(d)

- the respiratory enzymes have more kinetic energy, so there are more enzyme-substrate collisions per second

3.6

- dehydrogenase enzymes remove hydrogen from respiratory substrates
- DCPIP accepts the hydrogen in place of NAD and is reduced, which makes it colourless

3.7 A

- aerenchyma has large air spaces that let oxygen diffuse from the shoots down to the roots