

Past-paper walk-through

Respiration ■ 12.2

eXercise

Questions in this set

- 9700/42 N25 Q1 ■ 9 marks
- 9700/44 N25 Q9 ■ 12 marks
- 9700/41 J25 Q1 ■ 11 marks
- 9700/41 J25 Q2 ■ 5 marks

Reading the mark scheme

- **B1** a mark that stands on its own – the point is either made or not.
- **M1** a *method* mark: the right approach, even if the number is wrong.
- **A1** an *answer* mark, and it usually needs its M mark first.
- **C1** a working mark on the way to the answer.
- **//** separates answers the examiner accepts equally.
- **ecf** = error carried forward: a later part is marked on your own earlier answer.
- **owtte** = “or words to that effect” – the wording need not match.

Question 1

9700/42 N25 ■ Q1 ■ 9 marks

Rice, *Oryza sativa*, is a crop plant that has adapted to grow in flooded fields.

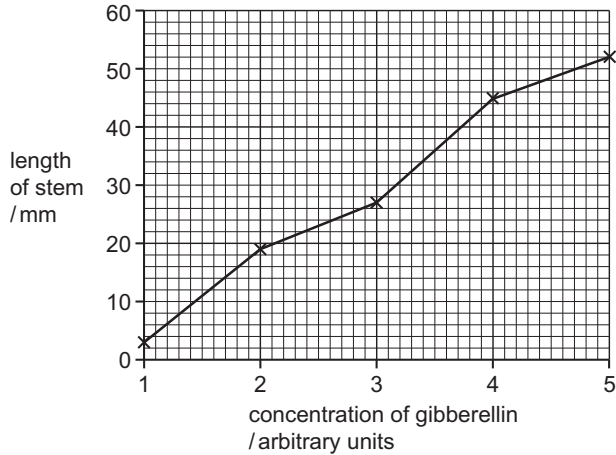
Fig. 1.1 outlines the effects on rice plants of growing in flooded fields.

Fig. 1.1

- (a) With reference to Fig. 1.1, name: [3]
- (b) Describe how root cells respond to a high concentration of substance B. [1]
- (c)(i) Describe the relationship shown in Fig. 1.2. [2]
- (c)(ii) ABA in rice plant cells inhibits the action of gibberellin.

With reference to Fig. 1.1 and Fig. 1.2, explain the importance of ethylene production for the growth of rice plants in flooded fields. [3]

Question 1



Solution 1

(a)

Mark scheme

- **A** oxygen ;
- **B** ethanol ;
- **C** aerenchyma ;

Solution 1

(b)

Mark scheme

- ref. to ethanol dehydrogenase (to break it down) ; **A** alcohol dehydrogenase

Solution 1

(c)(i) Mark scheme

as gibberellin concentration increases, the length of stem increases **or** positive correlation between concentration of gibberellin and length of stem ;

data quote – two concentrations and two lengths with units ;

conc gibberellin / au	length of stem / mm $\pm$ 0.5 mm
1	3
2	19
3	27
4	45
5	52

Solution 1

(c)(ii)

Mark scheme

any three from :

- 1 ethylene causes break down of ABA, so gibberellin, active / stimulated / functional ;
- 2 plants grow tall(er) / stems increase in length / stem elongation / increase in internodal length ;
- 3 (so) leaves / flowers, held above the water ;
- 4 (so) photosynthesis can occur / increased access to light / AW **or** (so) gas exchange / reproduction, can occur ;

Question 9

9700/44 N25 ■ Q9 ■ 12 marks

- 9 (a)** In aerobic conditions, pyruvate that has formed during glycolysis enters the mitochondrion and takes part in the link reaction.

Name the **two** coenzymes involved in the link reaction.

Question 9

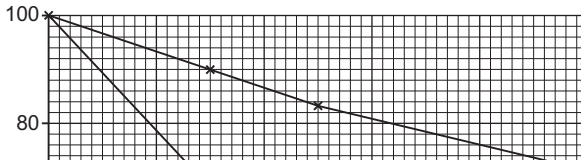
[2]

(b) Enzymes play an important role in the functioning of the Krebs cycle.

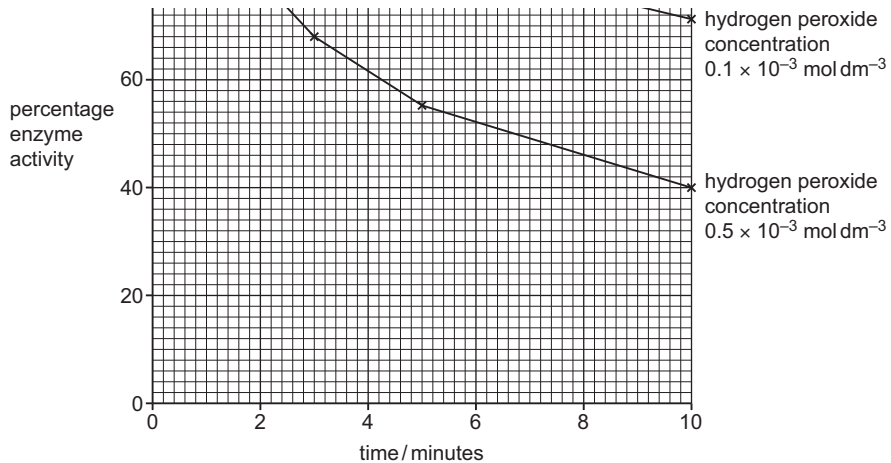
The enzymes in the Krebs cycle can be affected by the presence of hydrogen peroxide. Hydrogen peroxide is a product of some of the reactions that occur within the mitochondrion.

An investigation was carried out to measure the effect of two different concentrations of hydrogen peroxide on an enzyme of the Krebs cycle. The activity of the enzyme was measured over 10 minutes when exposed to the two different concentrations of hydrogen peroxide.

The results are shown in Fig. 9.1.



Question 9



Question 9

Fig. 9.1

Describe the effect shown in Fig. 9.1 of hydrogen peroxide concentration on the activity of the Krebs cycle enzyme.

Question 9

- (c) Reduced NAD and reduced FAD are produced during the Krebs cycle. They carry hydrogen to the inner mitochondrial membrane where oxidative phosphorylation occurs.

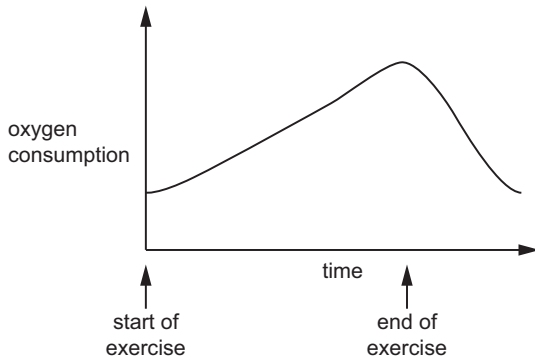
The first two steps in oxidative phosphorylation are:

1. Hydrogen atoms split into protons and electrons.
2. Electrons move along the electron transport chain, releasing energy.

Outline the steps that occur to complete oxidative phosphorylation.

Question 9

- (d) Fig. 9.2 shows the oxygen consumption of a person who is carrying out a fast-running exercise.



Question 9

1 / 1

Question 9

Fig. 9.2

Suggest why the oxygen consumption takes time to return to normal after exercise.

Question 9

[Total: 12]

Solution 9

(a)

Mark scheme

- 1
- NAD ;
- 2
- coenzyme A ;
- 2

Solution 9

(b) Mark scheme

- any three from:
 - 1
 - enzyme activity decreases over time at both concentrations (of hydrogen peroxide) ;
 - 2
 - activity decreases, more / faster / at a greater rate, at high(er) H_2O_2 concentration
 - or

Solution 9

- enzyme less active with, with high(er) H_2O_2 concentration ;
- 3
- paired data quote ;
- 4
- H_2O_2 , acts as an inhibitor / inhibits enzyme activity ;
- 3
- 9700/44
- October/November 2025

Solution 9

(c) Mark scheme

- any four from:
- 1
- energy is used to pump, protons / H^+ , into intermembrane space ;
- 2
- proton gradient (formed) ;
- 3
- protons diffuse through ATP synthase ;
- 4

Solution 9

- ATP produced from ADP and P_i ;
- 5
- oxygen accepts electrons to form water ;
- 6
- ref. to chemiosmosis ;
- 4

Solution 9

(d) Mark scheme

- any three from:
- 1
- respiration in anaerobic conditions ;
- 2
- produces lactate ;
- 3
- need oxygen, to oxidise lactic acid to CO_2 and H_2O /
- for breakdown of lactic acid in Krebs cycle plus oxidative phosphorylation /

Solution 9

- (for ETC) to make extra ATP ;
- 4
- ATP used for lactate $\rightarrow$ glucose / glycogen ;
- 5
- idea of re-paying oxygen debt ;
- 3
- 9700/44
- October/November 2025

Question 1

9700/41 J25 ■ Q1 ■ 11 marks

- 1 Organisms need a source of energy for many cellular processes. Respiration involves the release of energy from energy-rich molecules for the synthesis of ATP molecules. ATP is described as the energy currency of cells.
 - (a) Name **two** energy-rich molecules that enter the respiration pathway to synthesise ATP.

Question 1

(b) Fig. 1.1 shows a molecule of ATP.

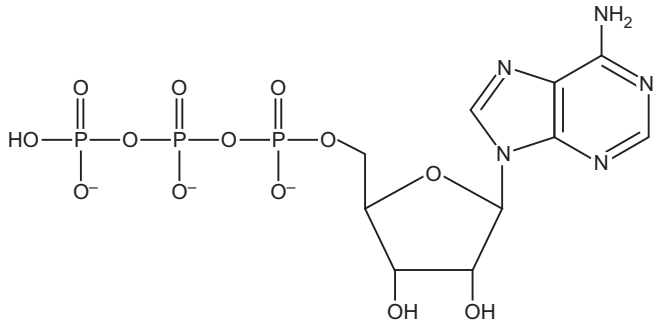


Fig. 1.1

Question 1

Explain the features of ATP that make it suitable to be the universal energy currency of cells.

Question 1

- (c) Identify the type of phosphorylation reaction to synthesise ATP that occurs during glycolysis and the Krebs cycle.

Question 1

- (d) (i) Pyruvate moves into the matrix of the mitochondrion only when a particular inorganic molecule is present.

Name the inorganic molecule that must be present in the cell for pyruvate to enter the matrix of the mitochondrion.

Question 1

- (ii) Explain how the presence of the inorganic molecule named in **(d)(i)** affects the ATP yield from respiration.

Question 1

[Total: 11]

Solution 1

(a) Mark scheme

- any two from:
- glucose (phosphate) ;
- fructose (phosphate / biphosphate) ;
- triose phosphate ;
- (named) fatty acid / keto-acid ;
- glycerol ;
- amino acid ;
- 2

Solution 1

(b) Mark scheme

- any four from:
- 1
- breaks down / hydrolyses to, ADP / AMP, and Pi ;
- 2
- releases, energy / 30.5 kJ mol^{-1} ;
- 3
- reversible reaction / high turnover / can be regenerated ;
- 4

Solution 1

- small / soluble, so can, diffuse / move (freely), in cell ;
- 5
- AVP ;
- 4

Solution 1

(c)

Mark scheme

- substrate-linked / substrate-level (phosphorylation) ;
- 1

Solution 1

(d)(i)

Mark scheme

- oxygen ;
- 1

Solution 1

(d)(ii) Mark scheme

- presence of oxygen:
- 1
- (ATP yield) increases / is higher ;
- plus any two from:
- 2
- oxygen acts as final, electron / proton, acceptor ;
- 3
- oxidative phosphorylation / chemiosmosis (occurs) ;

Solution 1

- 4
- energy from, reduced NAD / reduced FAD / electron transport chain ;
- 5
- proton gradient / $H^+ \rightarrow$ into intermembrane space ;
- 6
- ATP made in Krebs cycle ;
- 3
- 9700/41
- May/June 2025

Question 2

9700/41 J25 ■ Q2 ■ 5 marks

- 2 A respirometer can be used to investigate how temperature affects the rate of respiration of woodlice.

Woodlice are small invertebrate animals. Fig. 2.1 shows a single woodlouse.



Fig. 2.1

Fig. 2.2 shows a simple respirometer.

sodium
hydroxide
pellets
|

boiling tube
|

drop of
liquid
|

Question 2

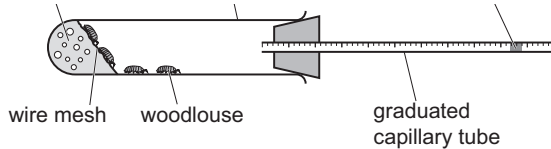


Fig. 2.2

- (a) Explain how the experimental set-up in Fig. 2.2 allows the rate of respiration of woodlice to be determined.

Question 2

- (b) A student determined the rate of respiration of woodlice at a temperature of 5 °C and at a temperature of 20 °C.

Predict **and** explain how the rate of respiration of woodlice differs at 5 °C compared to 20 °C.

Question 2

[Total: 5]

Solution 2

(a) Mark scheme

- any four from:
- 1
- sodium hydroxide absorbs, carbon dioxide / CO_2 , released by, woodlice / respiration ;
- 2
- oxygen / O_2 , taken in reduces pressure (in boiling tube) ;
- 3
- drop of liquid moves towards, boiling tube / bung / woodlice / left ;

Solution 2

- 4
- measure, distance / length, moved by drop, in set time ;
- 5
- rate = distance divided by time ;
- 6
- detail of calculation of volume of O₂ used ;
- 4

Solution 2

(b) Mark scheme

- rate at 5 °C:
- lower / slower
- and
- less / lower, kinetic energy
- or
- fewer enzyme-substrate, collisions / complexes
- or

Solution 2

- fewer, enzyme-catalysed / respiration / glycolysis / link reaction / Krebs cycle, reactions ;
- 1