Model Answers: Easy

1a

(a) The parts of the mitochondrion labelled A and B are as follows:

- **A** = the matrix; [1 mark]
- **B** = cristae; [1 mark]

[Total: 2 marks]

Mitochondria and chloroplasts contain their own DNA, it is different to the DNA in the nucleus and is similar to prokaryotic DNA in that it is circular and not associated with proteins.

1b

(b) The fully-completed Table 1 is as follows:

Stages of respiration	Location
Glycolysis	**(Cell) cytop**
Link Reaction	Mitochondri
Krebs cycle	Mitochondri
Oxidative phosphorylation / electron transport chain	Inner memb

[1 mark] for each correct missing cell

[Total: 3 marks]

Make sure you can identify the locations of the four key stages of respiration and remember that glycolysis is the only stage which occurs outside of the mitochondria.

1c

(c) An appropriate chemical equation to represent the production of ATP is:

- ADP + P_i ⟶ ATP; [1 mark]

[Total: 1 mark]

It is also acceptable to use PO_4^{3-} / Ⓟ for inorganic phosphate and because it does not specify the type of equation, you can also gain the marks for writing the word equation rather than the symbol equation. This equation is an important one to use whenever talking about the synthesis of ATP.

1d

(d) ATP is required for the following processes:

Any **two** of the following:

- Active transport **OR** Exocytosis; [1 mark]
- DNA synthesis **OR** Protein synthesis; [1 mark]
- Movement of organelles within cells **OR** Muscle contraction; [1 mark]
- Maintaining body temperature / Thermoregulation; [1 mark]

[Total: 2 marks]

Remember that reactions controlling thermoregulation are only relevant to 'warm blooded' organisms like mammals and birds.

2a

(a) The balanced chemical equation for respiration is:

- $C_6H_{12}O_6 + 6O_2 \rightarrow 6CO_2 + 6H_2O$

[1 mark] for correct reactants

[1 mark] for correct products

[Total: 2 marks]

You may choose to also include the energy produced in the reaction (2870 kJ) but it is not necessary.

2b

(b) The net ATP production from glycolysis is:

- Two / 2; [1 mark]

[Total: 1 mark]

In glycolysis there are 4 molecules of ATP produced per glucose molecule, but there are also 2 used in the process. This results in an overall production of 2 ATP molecules.

2c

(c) During phosphorylation,

Any **two** of the following:

- Two phosphate/Ⓟ / P_i groups; [1 mark]
- Are combined with a single 6-carbon glucose molecule; [1 mark]
- In the process, two ATP molecules are used; [1 mark]
- Fructose bisphosphate is produced/formed (this is an unstable molecule); [1 mark]

[Total: 2 marks]

2d

(d) During the oxidation of TP...

Any **two** of the following:

- A hydrogen is lost by the triose phosphate/TP molecule; [1 mark]
- This hydrogen is then picked up by the coenzyme NAD; [1 mark]
- Reduced NAD/NADH is produced; [1 mark]

[Total: 2 marks]

Remember, the following events can happen during oxidation:

- Addition of oxygen
- Loss of hydrogen
- Loss of electrons

The opposite is true of reduction.

3a

(a) Substances A and B in Fig. 1 are:

- Substance A = Pyruvate; [1 mark]
- Substance B = Ethanal; [1 mark]

[Total: 2 marks]

3b

(b) At point **X** the following has occurred:

- A reduction reaction **OR** ethanal has been reduced; [1 mark]
- Hydrogen has been gained by substance B/ethanal **OR** ethanal is the hydrogen acceptor; [1 mark]

[Total: 2 marks]

3c

(c) Lactate can be metabolised in two ways:

- Lactate can be oxidised to produce pyruvate (which enters the link reaction and Krebs cycle); [1 mark]
- The lactate can be stored as glycogen; [1 mark]

[Total: 2 marks]

3d

(d) The role of oxygen in the electron transport chain is:

- Oxygen is the terminal/final electron acceptor of the electron transport chain; [1 mark]
- Oxygen combines with hydrogen and electrons to form water / H_2O (a waste product); [1 mark]

[Total: 2 marks]

The idea of oxygen being the terminal electron acceptor in the electron transport chain is one that comes up frequently. Without oxygen, the electron transport chain would grind to a halt as there would be nowhere for the electrons to go once they reached the end of the chain.