Student answer A

(b)* Explain the effect that body size has on metabolic rate of these two mammals.

(6)

Aerobic respiration releases heat.

Aerobic respiration also requires oxygen.

Mouse lose heat faster as it has high sa:volume ratio

∴ it has a higher metabolic rate.

(small body size ⇒ high sa:vol ratio)

Examiner comments

This candidate has correctly related body size to surface area : volume ratio, heat loss and metabolic rate, linking ideas with lines of reasoning. This justifies a level 2 response and a mark of 4 (just). For level 3, candidates are expected to relate these principles to the relative demand for oxygen and to apply this to the dissociation curves for the two mammals.

Mark awarded = 4

Student answer B

(b)* Explain the effect that body size has on metabolic rate of these two mammals.

(6)

Elephant has very large body size, needs more O_2, so at lower partial pressures, it has a greater saturation of O_2 in blood, as needs more O_2 to travel around the body as larger, less dissociation needed as small SA to Volume ratio so lower metabolic rate. Mice are a lot smaller therefore use less energy to move, so at lower pressures don't need as high a saturation of O_2 in the blood, so dissociates quicker or have higher metabolic rate as need to generate more body heat as have a larger SA to volume ratio.

Examiner comments

This answer is not well expressed and lacks overall coherence. It does, however, include some relevant information on the relative surface area and volume ratios and metabolic rate. This is a level 1 answer, with some basic information and some attempt to link knowledge and understanding.

Mark awarded = 2.

Student answer C

*(b) Explain the effect that body size has on the metabolic rate of these two mammals.

(6)

A smaller mammal like a mouse has a higher metabolic rate than an elephant. This is because it has a larger surface area to volume ratio. This means that it will lose heat faster and need to have a higher rate to release produce heat energy. This heat comes from the breakdown of glucose in respiration. So the mouse will need to get oxygen more efficiently.

Examiner comments

This is a well-developed answer with a sustained line of reasoning, putting it into level 3. If the answer had included an explanation of how the mouse obtains oxygen 'more efficiently', with reference to the dissociation curves, a mark of 6 would be justified.

Mark awarded = 5.

Student answers for part c)

Student answer A

(c) The student carrying out the investigation wrote a further hypothesis:

'The limpets lower on the shore have a longer time to feed and will grow bigger.'

Design a laboratory experiment to test this hypothesis.

(5)

Set up five sea water tanks containing the same number of young limpets and rocks with enough algae. The limpets should be the same size or measure their area or mass. Each tank will have the seawater in it for a different length of time each day e.g. 24 hours, 12 hours, 6 hours, 3 hours, 1 hour. The tanks will be kept going in the same conditions of temperature and oxygen concentration for a number of weeks and then the limpets will be measured again. The change in area or mass is then plotted against time of feeding and the correlation coefficient calculated.

(Total for Question 13 = 13 marks)

Examiner comments

This answer includes several points relating to experimental design. However, it is important to note that most of the points on the mark scheme need to be qualified with a justification to gain credit. To illustrate this, the first sentence of this answer refers to setting up five tanks of sea water. This is the first part of mark point 2, but it is expected that candidates will justify this in terms of ensuring reliability. There are also references to supplying algae, using limpets of the same size and maintaining the same temperature for the experiment. All of these points need to be qualified, to be given credit.

The answer states that 'each tank will have the sea water in it for a different length of time each day, e.g. 24 hours, 12 hours, 6 hours, 3 hours, 1 hour.' This is acceptable for mark point 5 (withdrawal of water from tanks for different periods of time). The last sentence includes a reference to calculating a correlation coefficient, but this needs to be clearly related to the collection of quantitative data for the dependent variable.

Mark awarded = 1

Student answers

(b) Analyse the data to explain the changes in the T helper cell count from initial HIV infection until death.

(5)

From 2–6 weeks, the number of T helper cells decreases from around 900 → 500 due to the rapid increase in viral RNA. The viral RNA concentration drops as the number of T helper cells slowly increase. From 12 weeks → 12 years the amount of viral RNA slowly increases, causing the number of T helpers to slowly drop until death.

Examiner comments

This candidate has correctly indicated that (overall) the amount of viral RNA increases and the T helper cell numbers decrease. This gains mark point 1.

For mark point 2, there must be a clear link between the amount of viral RNA and the T helper cell count (note the word 'therefore' in the mark scheme) and a stated time reference, between week 6 and week 12.

Mark awarded = 1.

(b) Analyse the data to explain the changes in the T helper cell count from initial HIV infection until death.

(5)

The number of T helper cell decreases as the weeks increases from 1020 cells mm^{-3} in week 0 to 50 cells mm^{-3} in week 12 HIV is a virus and it first infect a host cell (T helper cell) which the virus ~~in fect~~ injects its viral RNA and it is transcribe to cDNA by reverse transcriptase and the viral cDNA is added to the normal T helper cell DNA and cause mutation. More HIV ~~virus~~ is produce and it burst out the T helper cell ~~because~~ and infect other T helper cell and repeat the whole process, therefore the number of T helper cell decreases overtime. As viral RNA increases, more HIV is replicated and the rate of virus replication is higher than that of T helper cell replication, so causing T helper cell to decrease count

Examiner comments

This answer includes mark points 4, 5 and 6. The last sentence just makes mark point 1, 'as the viral RNA increases..... so causing T helper cell count to decrease' as this is within the context of the overall changes.

Mark awarded = 4.