Answers to Workbook exercises Chapter 11

Exercise 11.1 Effect of temperature on the rate of respiration

Look for the following points being made somewhere in the plan:

- temperature varied, over a stated range (say, 0–50 °C)
- how the temperature is varied (for example, placing in fridge, warm incubator, or standing in a water bath)
- important variables controlled – type and age of seeds, mass or number of seeds, length of time seeds are soaked before placing in a flask or other container, size and insulation of flask
- details of how the dependent variable – e.g. carbon dioxide concentration – will be measured
- outline results chart.

Exercise 11.2 The effect of animals and plants on the carbon dioxide concentration in water

a The results chart could look like this:

Tube	A	B	C	D
Contents	animal	plant	animal and plant	no animal or plant
Colour of indicator at start	orange	orange	orange	orange
Colour of indicator at end	yellow	deep red	orange	orange

Students might also want to include a row stating the conclusions that can be made.

b In tube A, the animal respired, giving out carbon dioxide.

In tube B, the plant photosynthesised (faster than it respired), taking in carbon dioxide.

In tube C, the carbon dioxide given out by the respiring animal was used by the photosynthesising plant, so there was no change in the carbon dioxide concentration in the water.

In tube D, neither photosynthesis nor respiration took place.

c Respiration would continue, but photosynthesis would not. The indicator would therefore go yellow in tubes A, B and C, and remain unchanged in D.

d During the day, aquatic plants take in carbon dioxide (and give out oxygen) which helps the animals in the tank. At night, the plants use oxygen and give out carbon dioxide, so this could mean less oxygen for animals for respiration, and a higher concentration of carbon dioxide in the water.

Exercise 11.3 A simple respirometer

a Towards the container. As the woodlice use oxygen, this reduces the volume of air around them. The carbon dioxide they give out is absorbed by the soda lime.

b Look for 'time / minutes' on the *x*-axis, and 'distance travelled / cm' on the *y*-axis; both axes fully labelled with units, and with suitable scales; points accurately plotted with crosses or encircled dots; two clean best-fit lines drawn and labelled.

c Distance travelled in 8 mins is 2.4 cm. So, mean distance travelled in 1 min = 0.3 cm

d It was probably because the soda lime took up the small amount of carbon dioxide already present in the air. It could also be caused by a change in temperature – if temperature fell, then the volume of gas would be decreased.

e Repeat the experiment twice more, and calculate mean rates of movement of the oil drop. Place more animals in the apparatus, so that they respire faster and it is easier to measure the distance moved by the drop. Use a longer tube so results can be collected over a longer period of time.

Exercise 11.4 Gas exchange surfaces in rats

a Look for:
- 'age / days' on the *x*-axis
- 'ratio of alveolar surface to body mass / cm^2 per gram' on *y*-axis
- both axes with suitable scales with equal intervals (not the intervals in the first column of the results chart)
- points accurately plotted as neat crosses or encircled dots
- two separate lines drawn
- a key or labelling to show which line is for females and which for males.

b The individual rats may have differed in size, so comparing the alveolar surface area for a small rat with that of a big rat would introduce another variable. The important feature is the ratio between surface area and mass or volume, as this gives information about how effectively the body cells (mass) can be provided with oxygen by the gas exchange surface.

c At 21 days, males have a higher ratio of surface area to body mass than females; the difference is 1.5 cm^2 per gram. However, from 33 days onwards, females always have a higher ratio than males. The greatest difference is at 95 days, when females have a ratio that is 4.0 cm^2 per gram higher than males.

d When pregnant, the female's alveolar surface has to supply the growing embryo with oxygen, as well her own cells. She therefore needs a larger surface area in order to obtain this extra oxygen. This could explain why the female rats' ratio of alveolar surface area to body mass is higher than the males' ratio at 60 days (when pregnancy can first occur) and 95 days. (However, it does not explain why the ratio is actually at its highest at age 21 days, and then falls to age 45 days. This pattern is the same for both males and females, so perhaps this is related to the rate of growth of the rats at those stages in their development.)