Answers to Workbook exercises Chapter 19

Exercise 19.1 Water hyacinth experiment

a 5 µm

b guard cell measures 12 mm in length = 12 000 µm

magnification = length in diagram ÷ real length

= 12 000 µm ÷ 5 µm

= ×2400

If the student has measured a different guard cell in the diagram, and arrived at a slightly different length value, the magnification value obtained will of course vary from that obtained here. Check that the method of calculation is correct.

c The leaves have many stomata on the upper surface. This is not usually found in land-living plants, where most stomata are on the lower surface to reduce the rate at which water vapour is lost through them – the lower surface is out of direct sunlight and therefore cooler, reducing the rate of evaporation and diffusion. The water hyacinth leaves are at the surface of the water, so they don't need to conserve water and having stomata on the upper surface allows them to absorb carbon dioxide easily from the air.

d The stomatal pores of the plants growing in polluted water are 1 µm smaller than those in clean water. The guard cells of the plants growing in polluted water are 2 µm shorter than those in clean water. The mean number of stomata on the upper surfaces of the leaves is the same in clean and polluted water. The mean number of stomata on the lower surfaces is a little higher in the plants grown in clean water than in those grown in polluted water.

Exercise 19.2 Big-horn sheep

a hair

b i nucleus

ii All of them. (All the body cells have a complete set of genes, but each type of cell only uses a particular number of them.)

c There has been selection against the sheep with the largest horns. Sheep with smaller horns are most likely to survive and reproduce. The alleles for smaller horns are therefore passed on to the next generations more often than the alleles for larger horns. Over time, more and more of the big-horn sheep population have small horns, and the mean horn length therefore deceases.

d i As the temperature rises, the sweat glands secrete more sweat onto the surface of the skin. The water in the sweat evaporates, taking heat with it and cooling the skin surface.

ii Vasoconstriction is the narrowing of the arterioles that supply blood to the skin capillaries. This reduces the amount of blood flowing close to the skin surface, and therefore reduces the rate of heat loss from the blood to the air (by radiation). Instead, the blood is diverted to flow through deeper vessels, separated from the air by adipose tissue, which insulates the body and decreases heat loss.

Exercise 19.3 Selective breeding for high milk yield

a i Value in 1990 = 11.0, value in 1965 = 7.2, so the change is an increase of 3.8 kg per cow.

ii Value in 1990 = 5.8, value in 1965 = 7.2, so the change is a decrease of 1.4 kg per cow.

b Only the cows that gave the highest milk yield would have been allowed to breed. They would be bred with bulls whose female family members also gave high milk yields. This would be done over several generations, each time only choosing the animals giving the highest milk yield to breed.

c We can only guess – there is no evidence to tell us why the milk yield fell. In this group of cows, all the cows were equally likely to breed, so perhaps it is just chance that the mean milk yield fell over time. However, perhaps there is a disadvantage in having a high milk yield – for example, perhaps these cows were less healthy in other respects so they are actually less likely to have offspring.

d **i** The selected line were the cows with high milk yields. The large amounts of milk in their udders may have increased the incidence of inflammation, and the heavy weight of milk they have to carry around may have increased the degree of lameness.

ii They would need more food, to supply the materials needed to produce the extra milk.