Successful Learners

Effective Contributors

Responsible Citizens

Literacy in Science Book 3

Confident Individuals

1 Read the passage below and answer the questions which follow it.

Some athletes use the effects of high altitude on the human body to increase the oxygen-carrying efficiency of their circulatory system.

At high altitudes, the oxygen concentration in the air is lower than it is at sea level. In response to lower oxygen concentration, an athlete's breathing quickly becomes deeper and more rapid. This helps to maintain the oxygen level in the blood. The athlete's heart rate also increases quickly so that more oxygen is delivered to the muscles. These changes to the body wear off as soon as the athlete returns to lower altitude.

However, other changes to the body caused by high altitude happen more slowly and last longer. Erythropoietin is a hormone that stimulates the bone marrow to make red blood cells. When there is a fall in the oxygen level in the body, more erythropoietin is produced. This causes an increase in both haemoglobin and red blood cell production, allowing the blood to carry a lot more oxygen.

Hard physical exercise at high altitudes is very difficult. Blood becomes thicker, the body dehydrates, appetite and food intake drops and the body tires more quickly. Many athletes use a high altitude training programme designed to maximise the benefits of increased oxygen-carrying efficiency while minimising the difficulties of hard physical exercise at high altitudes. A well-designed training programme includes periods of exercise at lower altitude combined with periods of rest and sleep at higher altitude.

(a) How does the oxygen concentration in the air at high altitudes compare with that at sea level?

(b) Give two changes to the body which happen **quickly** in response to the lower oxygen concentration in the air at high altitudes.

(c) What is erythropoietin?

(d) What does the body do to bring about the increase in haemoglobin and red blood cell production?

(e) Explain **fully** why a well-designed training programme **does** include sleeping but **not** exercising at high altitude.

2 Read the passage and then answer the questions.

Phosphorus is an element which is essential to both plants and animals. It is needed to form molecules of DNA, make cell membranes and release energy in cells. Animals also need phosphorus, along with calcium and vitamin D, to build up strong teeth and bones.

Like the elements carbon and nitrogen, phosphorus is recycled in the environment. Phosphorus is found in rocks. Erosion by rainfall and running water removes phosphorus from rocks. Plants absorb this phosphorus from water in the soil. When animals eat the plants, the phosphorus passes into their bodies. Decomposition of animal waste and dead organisms returns the phosphorus to the soil. The phosphorus can be absorbed again by other plants. However, most of the phosphorus is carried by rivers into the sea; it sinks to the seabed and is lost from the cycle until it forms rocks again.

Too much phosphorus can be an environmental pollutant. Phosphorus fertilisers are washed into rivers and lakes. As a result, the number of water plants increases sharply. This causes the oxygen level to fall and animals in the water cannot survive.

In humans, too much phosphorus can cause damage to the brain, bones, teeth and kidneys. In the past, some people working in factories who were exposed to high levels of phosphorus developed a disease called ‘Phossy Jaw’. The jaw bone absorbed so much phosphorus that it became swollen and crumbled away. Nowadays, the amount of phosphorus used in manufacturing processes is carefully controlled.

(a) Name the **three** substances animals need to build up strong teeth and bones.

(b) Name **two** elements which, like phosphorus, are recycled in the environment

(c) How is phosphorus removed from rocks?

(d) Explain why animals cannot survive in lakes which are polluted by too much phosphorus.

(e) Describe what happened to factory workers suffering from ‘Phossy Jaw’.

3 **Persistent Organic Pollutants**

Adapted from *The British Isles: A Natural History* by Alan Titchmarsh.

Insecticides such as DDT, aldrin and dieldrin are known as persistent organic pollutants (POPs). They do not break down easily and remain in the environment for a long time, causing great damage. They have had a devastating impact on Britain's bird population.

POPs become incorporated into the food chain. When birds eat insects or seeds treated with POPs, the insecticides enter their bodies and accumulate in body fat. Insect-eating fish also take in the insecticides, passing them on to fish-eating birds. Because the insecticides accumulate in animals' bodies, they become increasingly concentrated and toxic higher up the food chain. In birds' bodies, high levels of POPs disrupt hormone production and reproductive processes. Many birds of prey have been affected by eggshell thinning. This makes eggshells too fragile to protect chicks. British populations of eagles, peregrine falcons and sparrowhawks were almost wiped out by POPs in the 1960s and 1970s.

The POPs were banned in the 1990s and bird populations made a recovery. Peregrine falcon numbers quickly returned to their former levels in most parts of Britain. The white-tailed sea eagle, which had completely died out, has been reintroduced to Scotland and now has a stable population. Sparrowhawks had almost disappeared from eastern England, where insecticide use was highest, but they have now completely recovered, with 32 000 breeding pairs recorded.

(a) Name **three** persistent organic pollutants (POPs).

(b) Why do POPs remain in the environment for a long time?

(c) Why do POPs become increasingly concentrated and toxic higher up the food chain?

(d) Give **three** effects that POPs have on birds.

(e) When were POPs banned?

(c) Why had sparrowhawks almost disappeared from eastern England?