Name Date

Cloze Activity

Section 2.3

Use with textbook pages 92–99.

Bioaccumulation

Vocabulary	
bioaccumulation	lead
biomagnification	mercury
bioremediation	parts per million
cadmium	PCBs
half-life	persistent organic pollutants
heavy metals	producers
keystone species	

Use the terms in the vocabulary box to fill in the blanks. Use each term only once.

1. _____ is the gradual build-up of synthetic and organic chemicals in living organisms.
2. _____ are species that can greatly affect population numbers and the health of an ecosystem.
3. _____ is the process in which chemicals not only accumulate but become more concentrated at each tropic level in a food pyramid.
4. Even small concentrations of chemicals in _____ and primary and secondary consumers can build up to cause problems in higher trophic levels.
5. _____ are synthetic chemicals that were widely used from the 1930s to the 1970s in industrial products.
6. _____ is the time it takes for the amount of a chemical to decrease by half.
7. _____ are carbon-containing compounds that remain in water and soil for many years.
8. Chemical accumulation is measured in _____
9. _____ are metallic elements with a high density that are toxic to organisms at low concentrations.
10. Three polluting heavy metals are_____, _____, and _____.
11. _____ is the use of living organisms to clean up chemical pollution naturally, only faster, through biodegradation.

PCBs and the Orca

Figure 2.54 A newborn orca calf has the same PCB level as its mother and then receives more through its mother's fat-rich milk.

The significance of bioaccumulation is seen in the way PCBs affect orcas (killer whales). **PCBs** (polychlorinated biphenyls) are synthetic chemicals that were widely used from the 1930s to the 1970s in industrial products such as heat exchange fluids, paints, plastics, and lubricants for electrical transformers. In 1977, they were banned in North America as concerns grew about their impact on the environment and human health. Many synthetic chemicals such as PCBs that bioaccumulate and biomagnify also have a long half-life. **Half-life** is the time it takes for the amount of a substance to decrease by half. PCBs stay in organisms and the environment a very long time, suppress the immune system, and probably cause cancer in humans. Aquatic ecosystems and species that feed on aquatic organisms are especially sensitive to the effect of PCBs.

Hardest hit of all are orcas (Figure 2.54). One study found that PCBs will interfere with the reproductive success of British Columbia's resident orcas until at least 2030. Even though these chemicals have been banned for decades, orcas retain high levels of PCBs, especially the calves.

Figure 2.55 shows how biomagnification occurs in an orca. Even if the PCBs enter the food chain at a relatively low level, by the time they get to the orca, they are highly concentrated in the blubber. When salmon stocks are low, magnification is increased, since blubber is then burned for energy. The PCBs are released into the orca's bloodstream where they interfere with immune function, making the orca more susceptible to disease.

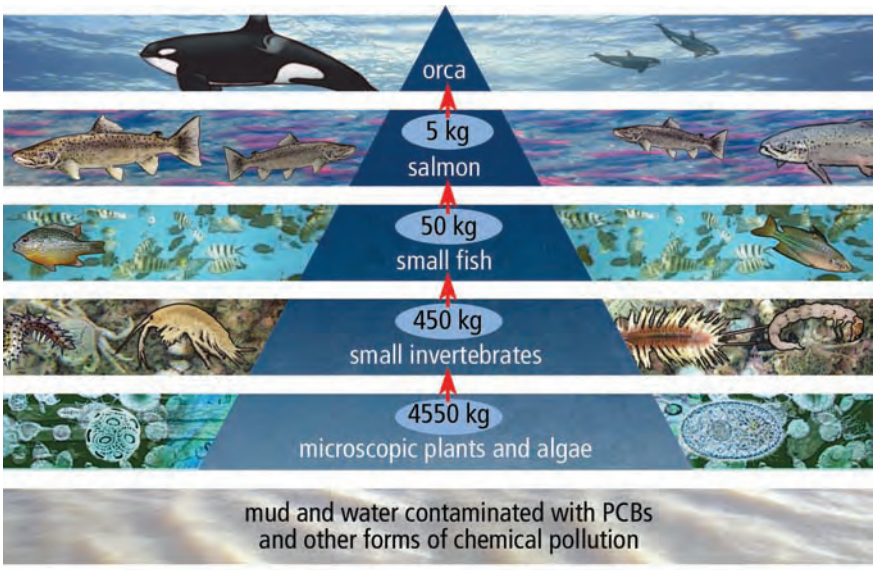

Figure 2.55 The PCB load of orcas is much higher than that of any other animal in the world. When an orca eats 5 kg of salmon, it is ingesting PCBs and other pollutants from about 4550 kg of microscopic plants and algae.

Use with textbook page 95.

PCBs and the orca

1. What are PCBs? What is their full chemical name?

_____

2. What were PCBs used for in the 1970s?

_____

_____

3. In North America, PCBs were banned in 1977. Explain why they are still having an effect on organisms today.

_____

_____

_____

4. Explain what happens to PCBs when they enter an orca's body.

_____

_____

5. How do orcas survive when salmon stocks are low? What effect does this have on their survival?

_____

_____

_____

6. Draw a diagram to illustrate how biomagnification occurs in orcas.

