

# Heavy metals in the environment

1A

Which of the following do you think are most responsible for environmental pollution by metals? Read Heavy metals in the environment and check your predictions.

- |  |   |
|--|---|
| <input type="checkbox"/> power stations                      | <input type="checkbox"/> diesel engines         |
| <input type="checkbox"/> by-products of industrial processes | <input type="checkbox"/> farm chemicals         |
| <input type="checkbox"/> industrial waste                    | <input type="checkbox"/> detergents             |
| <input type="checkbox"/> petrol engines                      | <input type="checkbox"/> human and animal waste |
| <input type="checkbox"/> other .....                         |   |

1B

What do you think should be done to prevent factories and farms from discharging chemicals into the environment?

- impose strict rules
- impose heavy fines
- check factories and farms regularly
- other .....

Heavy metals are chemical elements many of which are poisonous to humans. Because of their extensive use, their toxicity and their widespread distribution, the most hazardous ones are mercury, lead, cadmium and arsenic. Being totally non-degradable, that is, indestructible, they accumulate in the environment causing serious concern for human health.

Mercury is employed in many applications being a good liquid conductor of electricity. Liquid mercury is not highly toxic and most of that ingested is excreted but it is the most volatile of all metals and its vapour is very toxic. The main sources of atmospheric mercury are volcanoes, the burning of fossil fuels, the incineration of solid waste containing mercury. In air, most mercury is in the vapour (gaseous) state and it can travel long distances before being deposited on the Earth surface.

Lead is the most plentiful and the most widely used and dispersed of the four heavy metals of environmental concern. It is widely used in the building industry, in ammunition, and, combined with tin, it forms solder, used to make connections between solid metals. Lead becomes an environmental problem when it dissolves to yield the ionic form. Lead used in water pipes can dissolve in drinking water and therefore be absorbed by the body. Most environmental lead comes from vehicle exhausts and occurs mainly in inorganic form. It

is either inhaled or ingested with food where it is incorporated. Most ingested lead is initially present in the blood, when it accumulates, it enters the soft tissues, including the brain, and eventually it is deposited in bone, where it replaces calcium. Biochemically, lead interferes with the creation of haemoglobin and therefore it may cause anaemia. High lead levels also cause kidney dysfunction and permanent brain damage.

Most cadmium is produced as a by-product of zinc smelting. The main sources of cadmium in the environment are the burning of coal and the incineration of waste material containing cadmium. Cadmium is very toxic and it can be absorbed by the body from drinking water, air and food. The amount of cadmium which cannot be eliminated in the urine is stored in the liver and kidneys where it may cause disease.

In the past, arsenic compounds were mainly used as a poison and as a pesticide. Today, most arsenic in the environment still derives from pesticides but also from the combustion of coal.

Even though a trace amount of arsenic is essential to good human health and people get it from drinking water and from many foods, this heavy metal is known to be carcinogenic to humans. Organic forms of arsenic are less toxic than some inorganic forms since they are water-soluble acids that can be excreted.

(from: Bair-Cann, *Environmental Chemistry*, Freeman & Co.)

**2** Answer these questions about Heavy metals in the environment.

- a. What are heavy metals? • b. Which of them are the most hazardous ones? Why? • c. What are the main sources of atmospheric mercury? • d. Where is lead used? • e. How can lead be absorbed by the body? • f. What are the effects of lead poisoning? • g. What are the main sources of cadmium in the environment? • h. How can cadmium be absorbed by the body? • i. Where does arsenic in the environment derive from? • j. How do we get the arsenic essential for our health?

**3** Among the adjectives underlined in Heavy metals in the environment choose those matching the synonyms or definitions below. Tip: copy adjectives and synonyms/definitions in your indexed book.

- a. .... means abundant.  
 b. .... means causing illness or death if taken into the body.  
 c. .... means dangerous.  
 d. .... means found over a large area.  
 e. .... means important, grave.  
 f. .... means necessary.  
 g. .... means poisonous.  
 h. .... means unwanted matter which is thrown away.

**4** Choose the correct alternative in the following sentences.

- a. Heavy metals accumulate in the environment *caused by* / *causing* serious concern for human health.  
 b. Most *ingested* / *ingesting* mercury is excreted.  
 c. Lead is *absorbed by* / *absorbing* the body from food and water.  
 d. Water *contaminated by* / *contaminating* chemicals includes heavy metals.  
 e. Water may be *contaminated by* / *contaminating* human and animal wastes.