



Name: \_\_\_\_\_ Group: \_\_\_\_\_ Date: \_\_\_\_\_

2. What is the main function of the peripheral nervous system?

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3. Since when have the human health effects of heavy metals been a concern?

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4. Name three properties common to mercury and lead.

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## PLANNING YOUR RESEARCH

5. Check the metal that you will research.

☐ Lead

☐ Mercury

6. Where will you conduct your research?

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## CONDUCTING YOUR RESEARCH

7. Through which channels can the human body absorb heavy metals?

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**8.** Complete the table below based on the choice you indicated in the preceding questions.

**Heavy metal:**

[illegible]

**9. Which people are most affected by exposure to heavy metals?**

**10.** Why do heavy metals affect some people more than others?

Name: \_\_\_\_\_ Group: \_\_\_\_\_ Date: \_\_\_\_\_

## REFLECTING ON YOUR APPROACH

- 11.** Name two ways you can minimize your risk of exposure to the heavy metal you chose.

Metal chosen: \_\_\_\_\_

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- 12.** What other information would help you to better understand how heavy metals affect the human organism?

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# APPENDIX

## 1. LEAD

### Effects of lead on human health

#### The issue

Lead occurs naturally in the environment and has many industrial uses. However, even small amounts of lead can be hazardous to your health.

#### Background

Everyone is exposed to trace amounts of lead through air, soil, household dust, food, drinking water and various consumer products. The amount of lead in the environment increased during the industrial revolution and again significantly in the 1920s with the introduction of leaded gasoline. However, since the early 1970s, lead exposure in Canada has decreased substantially, mainly because leaded gasoline and lead-based paint were phased out and the use of lead solder in food cans was virtually eliminated.

#### Health risks of lead exposure

Short-term exposure to high levels of lead can cause vomiting, diarrhea, convulsions, coma or even death. Severe cases of lead poisoning are rare in Canada.

However, ongoing exposure to even very small amounts of lead can be harmful, especially to infants and young children. Lead taken in by pregnant women can also pose a danger to the health of unborn children. You may not notice the symptoms of long-term lead exposure but they are still serious. Anemia is common and lead can also damage the brain and nervous system. Other symptoms are appetite loss, abdominal pain, constipation, fatigue, sleeplessness, irritability and headache. If you are continually exposed to lead, as in an industrial setting, it can affect your kidneys.

Lead exposure is most serious for young children because their growing bodies absorb lead more easily than the bodies of adults and they are more susceptible to its harmful effects. Even low level lead exposure may harm the intellectual development, behaviour, size and hearing of infants. During pregnancy, especially in the last trimester, lead can cross the placenta and affect the unborn child. Female workers exposed to high levels of lead have more miscarriages and stillbirths.

If you are concerned about lead exposure, your doctor can conduct a simple blood test to measure your blood lead level. Your doctor will recommend corrective action if the amount is over 10 micrograms per decilitre.



## 1. LEAD (*continued*)

### Sources of lead exposure

#### Food

Traces of lead are found in almost all food. Airborne lead falls onto crops or soil and is absorbed by plants. Lead solder used in making cans can also contaminate food. However, in Canada food manufacturers have eliminated the use of lead-soldered cans. Infants can also absorb lead from their mother's body through breast milk.

#### Air

Lead is released into air through industrial emissions, smelters and refineries. With the introduction of unleaded gasoline in Canada in 1975, lead concentrations in the air have declined significantly, falling 76 percent between 1973 and 1985. Leaded gasoline in cars was banned in Canada in 1990. Since then levels of lead in the air of most Canadian cities have dropped below detectable limits.

#### Dust and soil

Dust and soil can be significant lead exposure sources, especially for young children. Lead in soil can come from the air or from erosion of lead-bearing rocks, and may be carried indoors as dust. Lead dust can also come from within the home, especially older homes that used lead-based paints or lead solder. Lead dust is especially dangerous for babies and young children, because they tend to put things in their mouth and their breathing zone is closer to floor level where lead dust tends to collect.

#### Drinking water

In most of Canada, the amount of lead in natural water supplies is very low. However, lead can enter the water supply from lead solder in plumbing, lead service connections or lead pipes in your home. Homes built before 1950 often have leaded distribution lines and service connections.

In newer homes, lead may leach from solder for several years until the pipes form a protective oxide layer. Lead is more likely to be found in soft or very acidic water and in very old or very new homes. The *National Plumbing Code of Canada* does not permit the use of lead solder in new drinking water plumbing or in repairs to existing drinking water systems. Several provinces also limit the amount of lead solder in drinking water supply lines. ...

Lead levels in tap water increase as water stands in pipes. Drinking fountains may have higher levels of lead than water from nearby taps because the water usually sits for a longer time. They may also have more soldered joints.

#### Paint

Most indoor and outdoor paints produced before 1950 contained substantial amounts of lead. If you strip or sand old paint that contains lead, you could breathe in lead particles. In 1976, the amount of lead that could be added to interior paints was limited by law, but exterior paints could still contain higher amounts of lead, provided they carry a warning label. Under the Surface Coating Materials Regulations, which came into effect in 2005, the lead limit was further reduced. Paint manufacturers could no longer add lead to their paint. Canadian manufacturers of interior and exterior consumer paints had already been keeping to this limit voluntarily since 1991. ...



## 1. LEAD (*continued*)

### Other sources of lead

- Inexpensive horizontal PVC (polyvinylchloride) mini-blinds made in Asia or Mexico may contain lead. Health Canada recommends that if you have children six years of age or under, you should remove these blinds from your home. They should also be removed from schools and child-care centres.
- Workers in smelters, refineries and other industries may be exposed to high levels of lead. Lead dust may be inhaled. It can also cling to skin, hair, clothing and vehicles and be carried to the home, exposing workers' families. Most provincial governments require that lead-exposed workers be monitored for blood lead levels. [...]
- Lead can enter food, especially acidic food such as fruit juice, from lead-based glazes on glassware and ceramics. Canadian regulations limit the amount of lead that may leach from glazes on glass and ceramic products sold in Canada if they are intended for use in preparing, serving or storing food. However, glazed ceramic or glass dishes bought in other countries may contain enough lead to be a hazard to your health.
- Lead fumes can be released when waste oil, coloured newsprint, battery casings or wood coated with lead paint are burned. Candles that contain lead in their wick may also release harmful levels of lead vapour when burned. Using lead solder in a hobby, such as in making stained glass, lead shot or lead fishing weights, may expose you or your family to harmful lead vapours. The vapours may settle on nearby surfaces as lead dust.

Source: Health Canada online. *Healthy Living*. Last date modified November 20, 2008, accessed August 20, 2009.



## 2. MERCURY

### Mercury and human health

#### The issue

Although mercury is released naturally from rocks, soil and volcanoes, human activities have boosted levels in the atmosphere. Canadians can be exposed to mercury from many sources, including food and the use of dental amalgam fillings.

#### Background

Mercury is used in and released from a variety of industrial processes and commercial products. Since the 1970s environmental concerns have resulted in a reduction in the use and processing of mercury around the world.

Mercury exists in three different forms:

- Elemental mercury: this silvery, shiny, volatile liquid gives off a colourless, odourless vapour at room temperature.
- Inorganic mercury: compounds formed when elemental mercury combines with other elements such as sulphur, chlorine or oxygen to create compounds known as mercury salts.
- Organic mercury: compounds such as methyl mercury that are formed when elemental mercury combines with carbon.

Mercury is a global contaminant because it is toxic, does not break down in the environment and can build up in living things. In its vapour form, mercury can be carried long distances on wind currents, staying in the atmosphere for long periods of time.

Mercury can change from one form to another in the environment. For example, some types of bacteria and fungi can change mercury into its most toxic form: methyl mercury. Methyl mercury tends to accumulate to some degree in all fish, but especially in predatory fish such as shark, swordfish, certain species of tuna (which are generally sold fresh or frozen), escolar, marlin and orange roughy as well as in marine mammals. Predatory freshwater fish such as pike, bass and walleye may also have elevated methyl mercury levels. Since fish is also an excellent source of high-quality protein and omega-3 fatty acids and is low in saturated fat, the benefits and risks of eating fish must be considered carefully.

#### Sources of mercury

Mercury comes from a range of natural sources such as volcanoes, soils, undersea vents, mercury-rich geological zones and forest fires as well as from freshwater lakes, rivers and the oceans. However, human activity has increased the amount of mercury in the environment in several ways, including through a variety of combustion and industrial processes such as coal-fired power generation, metal mining and smelting and waste incineration.

Mercury is also leached from flooded soil at new hydroelectric dam sites, or from any flooded area. This process can add to mercury levels in freshwater aquatic food chains in those areas.

Products such as button batteries, fluorescent tube lights, fever thermometers, thermostats, switches and relays, barometers and dental fillings may contain mercury; however, mercury-free alternatives exist in most cases. Highly diluted quantities of mercury are used in some homeopathic medicines. However, when prepared according to regulated manufacturing practices, mercury in homeopathic medicines is considered safe. Mercury is also used in various traditional medicines from around the world. Disposing of these products can cause mercury to leach from landfills or be emitted from burning waste, adding to the amount of mercury in the environment.





## 2. MERCURY *(continued)*

Because mercury is toxic and has an impact on human and environmental health, even small mercury spills should be considered hazardous and cleaned up with caution. Liquid elemental mercury, commonly found in household thermometers, thermostats and barometers, quickly forms a poisonous, colourless and odourless vapour when spilled. If inhaled, this vapour is rapidly absorbed through the lungs. Children are especially at risk because mercury vapours, which are heavier than air, often linger near the floor where children crawl and play. Your local public health office can give you information on how to clean up small mercury spills.

### Health effects of mercury exposure

The health effects of mercury exposure depend on its chemical form (elemental, inorganic or organic), the route of exposure (inhalation, ingestion or skin contact) and the level of exposure. Vapour from liquid elemental mercury and methyl mercury are more easily absorbed than inorganic mercury salts and can therefore cause more harm. You should try to reduce your exposure to all forms of mercury whenever possible.

### Elemental mercury

The health effects of elemental mercury depend on the length and type of exposure. For example, if you were to accidentally swallow liquid elemental mercury from a broken fever thermometer, little mercury would be absorbed. However, if you were to inhale the vapour from that mercury spill, it would be more easily absorbed into your body, potentially causing health problems. At higher concentrations, mercury vapour can cause damage to the mouth, respiratory tract and lungs and can lead to death from respiratory failure. Long-term exposure to low concentrations causes symptoms similar to those of methyl mercury.

### Inorganic mercury compounds

Inorganic mercury can cause kidney failure and gastrointestinal damage. Mercury salts are irritating and can cause blisters and ulcers on the lips and tongue. Rashes, excessive sweating, irritability, muscle twitching, weakness and high blood pressure are other symptoms of elevated exposures.

### Organic mercury compounds (methyl mercury)

Mercury can change from one form to another in the environment. Methyl mercury tends to accumulate to some degree in all fish, but especially in the predatory fish noted above. Methyl mercury is absorbed through the digestive tract and distributed throughout the body. It readily enters the brain, where it may remain for a long period of time. In a pregnant woman, it can also cross the placenta into the fetus, building up in the fetal brain and other tissues. Methyl mercury can also be passed to the infant through breast milk.

A child's developing nervous system is particularly sensitive to methyl mercury. Depending on the level of exposure, the effects can include a decrease in I.Q., delays in walking and talking, lack of coordination, blindness and seizures. In adults, extreme exposure can lead to health effects such as personality changes, tremors, changes in vision, deafness, loss of muscle coordination and sensation, memory loss, intellectual impairment and even death.



## 2. MERCURY *(continued)*

### The risks of mercury poisoning

In general, Canadians are not at risk from mercury poisoning. However, people exposed to elevated levels of mercury may experience health problems ranging from rashes to birth defects, even death in cases of extreme poisoning.

People who consume large amounts of fish, marine mammals and wild game as part of their daily diet increase their risk. The developing fetus and children of women who have consumed large amounts of fish and marine mammals during pregnancy are the most susceptible to health problems. Children, who tend to put things in their mouth, may increase their intake of mercury through soil and contaminated objects.

In regions such as the Arctic, the traditional diet may include large quantities of fish and/or marine mammals at certain times of the year. However, this traditional diet has many nutritional and socio-cultural benefits, which must be weighed against the potential risks.

If you are concerned about mercury exposure, samples of hair, blood and urine can be taken to a doctor's office or health clinic and tested.

### Minimizing your risk

Elemental mercury from dental fillings does not generally pose a health risk. There is, however, a fairly small number of people who are hypersensitive to mercury. While Health Canada does not recommend that you replace existing mercury dental fillings, it does suggest that when the fillings need to be repaired, you may want to consider using a product that does not contain mercury.

Pregnant women, people allergic to mercury and those with impaired kidney function should avoid mercury fillings. Whenever possible, amalgam fillings should not be removed when you are pregnant because the removal may expose you to mercury vapour. When appropriate, the primary teeth of children should be filled with non-mercury materials.

Predatory fish such as shark, swordfish, fresh and frozen tuna, escolar, marlin and orange roughy have higher levels of mercury and should be consumed only occasionally. Follow Health Canada's fish consumption advice in order to enjoy the health benefits of eating fish while controlling exposure to mercury. Certain groups (young children, women who are or may become pregnant) should also limit their consumption of canned albacore (white) tuna.

Source: Health Canada online, *Healthy Living*. Last date modified March 2, 2009, accessed August 20, 2009.