

STEM Sims™

Knowledge Wheel

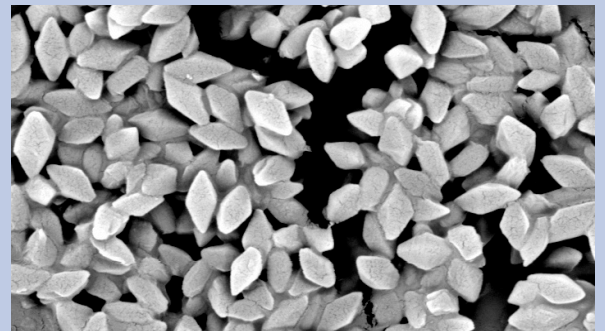


Knowledge Wheel

**Do you need an idea for a scientific study?
Try out one of our ideas or make one of your own.**

Start learning right now about working safely in a laboratory. Take the following brief quiz to see how much you already know about this lab safety. See the bottom of page 4 to check your answers.

1. What is the smallest dosage of Polonium-210 that can be fatal to humans?
 - a. 1 gram
 - b. 1/100 of a gram
 - c. 1/100,000 of a gram
 - d. 1/100,000,000 of a gram
2. Which snake typically delivers the deadliest bite?
 - a. brown snake
 - b. tiger snake
 - c. inland taipan
 - d. death adder
3. Botulinum toxin produced by the *Clostridium botulinum* bacteria is one of the deadliest toxins known to humans. During the past couple of years, doctors have intentionally injected this toxin into about 6 million patients each year.
 - a. true
 - b. false
4. Which species is the most frequently reported laboratory-associated bacterial infection?
 - a. *N. meningitidis*
 - b. *Brucella*
 - c. *Bacillus anthracis*
 - d. hepatitis B
5. Infections due to working with intestinal protozoa are relatively uncommon in clinical diagnostic laboratories.
 - a. true
 - b. false



How Many Drinks?

Handling toxic materials is just one dangerous task faced by those working in laboratories. Page 4 of this brochure presents information on something called LD_{50} , which is related to the toxicity of various substances. *Please carefully read the content on page 4 before completing the calculations and questions below.*

The LD_{50} for water taken orally is 90 mL/kg. Yes, even water can be fatal if consumed in large enough quantities too quickly. How many bottles of water would be deadly to an average person if the water was consumed in a relatively short period of time?

1) Convert your weight in pounds to kilograms using the following formula:

Your weight in pounds times 0.454 = your weight in kilograms

2) Calculate the water lethal dose (in mL) for a person your size.

The LD_{50} for water times your weight in kilograms = the lethal amount of water for you

3) Determine the number of 500-mL water bottles that would be lethal if consumed by a person your size.

Lethal amount of water in mL/500 mL per bottle = the number of bottles



Botulin is one of the most deadly toxins known to humans. The LD_{50} for botulin taken orally is estimated to be 0.000001 mg/kg. How many average-sized people could be killed with one teaspoon full of botulin?

4) Calculate the botulin lethal dose (in mg) for a person your size (use your mass in kg from question #1 above).

The LD_{50} for botulin times your weight in kilograms = the botulin lethal amount (mg)

5) One teaspoon of botulin has a mass of about 6,000 mg. How many people could be killed with this mass of botulin? Assume one-half of the people who took the toxin died.

Mass of one teaspoon botulin (mg)/botulin lethal dose (mg) = number of people expected to die

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Too Much of a Good Thing

What if you were asked, which is more potentially dangerous to ingest, table salt or trichloroethylene, which is a common solvent? Would you have guessed that table salt is over two times deadlier than ingesting the same amount of trichloroethylene? Most people would not. Scientists use a rating scale to describe how deadly substances are if ingested. This scale, called LD_{50} , states the amount of a substance that would kill one-half of a population after 14-days if the people were exposed to the substance.

The good news about LD_{50} is that the data collected does not involve any testing on humans. Instead, rats are typically the subjects of the tests. However, this creates a problem in that the biology and physiology of rats is not identical to humans, so test results are sometimes not easily generalized to humans. In fact, one major difference between humans and rats is that rats, unlike humans, do *not* have the ability to vomit substances from their digestive system. The ability to expel distasteful substances can drastically change the effects of some ingested substances.

The method of application of the substance also affects the substance's LD_{50} . For instance, injecting a substance directly into the blood stream of a person usually results in a smaller LD_{50} as compared to absorbing the substance through the skin. For instance, the LD_{50} for ingested aspirin is about 35 - 350 mg/kg for an adult, while significantly more aspirin could be placed on a person's skin with few to no effects.



Please visit the following webpages for more helpful information:

STEMsims.com

Answers: (1) Answers will vary, (2) Answers will vary, (3) About 18 bottles, (4) Answers will vary, (5) Roughly, 43,000,000 people would die.

Page 2 Answers: (1) d, (2) c, (3) a (Botox injections), (4) b, (5) a. Page 3 How Many Drinks Answers: (1) Answers will vary, (2) Answers will vary, (3) About 18 bottles, (4) Answers will vary, (5) Roughly, 43,000,000 people would die.

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