# Class Starters & Enders

## Making the Most of Instructional Time
## Five Minute Lessons

Class Starters and Enders help utilize the last minutes of class when a lesson ends but there is not enough time to start another, or for an interest approach at the beginning of class. Mini-lessons correlate to GPS in the programs areas below.

# $LD_{50}$: It's a Killer!

**Program Areas:** **Agriculture,** Biotechnology, Healthcare, Food Science, Culinary Arts, Family & Consumer Sciences

**Instructions:** Read the material and make notes of important points, answer questions, and be ready to discuss this topic.

Have you ever wondered how chemical companies determine which products are toxic enough to have the words CAUTION, WARNING or DANGER on their labels? To many people **acute toxicity**, **lethal dosage value**, **median lethal dose**, $LD_{50}$ or "Lethal Dose, 50%" may sound familiar. In **toxicology** the definition of each of these terms is simply the amount of a toxic substance needed to kill at least 50% of the population being tested. In most cases, the population being tested is rats, fish or cockroaches. Ultimately, the $LD_{50}$ of a substance is used to predict how much of the particular toxic material it would take to kill a human. By figuring out a product's $LD_{50,}$ companies can determine how hazardous the chemical is to humans.

The **Environmental Protections Agency** (EPA) categorizes $LD_{50}$ by three methods of entry. Oral $LD_{50}$ values are obtained when the population is fed a toxic substance. **Dermal** $LD_{50}$ is obtained when the chemical is applied to the skin. Last, the inhalation $LD_{50}$ is obtained by having the test population inhale the chemical. In a majority of chemicals, inhalation $LD_{50}$ is most toxic and dermal is the least toxic.



The skull and crossbones is the universal symbol used to warn of poisonous substances. The level of toxicity is based on the LD50.

At first glance, $LD_{50}$ can be confusing. It is measured in milligrams (mg) of the chemical per kilogram (kg) of body weight. If a product has an $LD_{50}$ of 130 mg/kg, it would take 130 mg of the chemical for every kilogram of body weight to kill 50% of the test subjects. For this reason, as the $LD_{50}$ number decreases, the product becomes more toxic. For example, a chemical with an $LD_{50}$ of 10 mg/kg is much more toxic than a chemical with an $LD_{50}$ of 130 mg/kg.

| Substance | $LD_{50}$ |
|---|---|
| Table Sugar | 29,700 mg/kg |
| Vitamin C | 11,900 mg/kg |
| Ethanol | 7,060 mg/kg |
| Table Salt | 3,000 mg/kg |
| Aspirin | 200 mg/kg |
| Caffeine | 192 mg/kg |
| Nicotine | 50 mg/kg |
| Venom of Inland taipan (Australian Snake) | 0.025 mg/kg |
| Toxin from Poison Dart Frog | 0.002-0.007 mg/kg (estimated) |
| Botulinum Toxin | 0.000001 mg/kg (estimated) |

**Math Connection:**

The $LD_{50}$ of caffeine is 192 mg/kg and an 8 oz. cup of coffee has 200 mg of caffeine. If Robert weighs 170 pounds, how many cups of coffee would it most likely take to kill Robert?

## Review

1. How do chemical companies determine if a product receives a CAUTION, WARNING or DANGER label?
2. What percent of the tested population is killed at $LD_{50}$?
3. What is the importance of knowing a chemical's $LD_{50}$?
4. What are the three methods of chemical entry into the body recognized by the EPA?
5. As $LD_{50}$ decreases the chemical becomes _____ toxic.
6. Which is most deadly, $LD_{50}$= 1,000 or $LD_{50}$= 14?

**Language Connection:**

Research/Define the following:
• Acute toxicity
• Lethal dosage value
• Median lethal dose
• Toxicology
• Environmental Protection Agency
• Dermal