ANSWER KEY

Lethal Dose—How Much is too much?

Purpose: In this activity you will compare the toxicity of various substances.

I. Background information:
1. a. What does Lethal Dose \( 50 (LD_{50}) \) mean? b. How is \( LD_{50} \) determined?
   a. \( LD_{50} \) is the amount required to kill 50% of the test population
   b. \( LD_{50} \) is determined by testing substances on laboratory animals such as rats.

2. In what units are Lethal Doses (or \( LD_{50} \)) expressed?
   Mg/kg of body mass

3. What are some of the ethical concerns regarding research for lethal doses?
   Issues with animal testing

II. Determining Lethal Doses:
To use \( LD_{50} \), you will need to convert measurements of body weight from pounds \( \rightarrow \) kilograms (1 kg = 2.2 lbs) do the following calculations:

   \[ 132 \text{ lbs} \times 1 \text{ kg/2.2 lbs} = 60.0 \text{ kg} \]
   \[ 22 \text{ lbs} \times 1\text{ kg/2.2 lbs.} = 10. \text{ kg} \]

<table>
<thead>
<tr>
<th></th>
<th>The ( LD_{50} ) for acetaminophen (Tylenol)= 2402 mg/kg (rat, oral).</th>
<th>The ( LD_{50} ) for aspirin = 200mg/kg (rat, oral).</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. How many mg of &quot;medicine&quot; would be lethal to a 132-lb adult?</td>
<td>60. kg \times 2402 \text{ mg/kg} = 144,120 mg</td>
<td>12,000 mg</td>
</tr>
<tr>
<td>2. How many 500mg tablets of &quot;medicine&quot; would be lethal for an adult?</td>
<td>144,120 mg \times 1 \text{ tablet/500mg} = 288 tablets</td>
<td>24 tablet</td>
</tr>
<tr>
<td>3. How many mg of &quot;medicine&quot; would be lethal to a 22-lb child?</td>
<td>10. kg \times 2402 \text{ mg/kg} = 24,020 mg</td>
<td>2,000 mg</td>
</tr>
<tr>
<td>4. How many 500mg tablets would be lethal for a child?</td>
<td>24,020 mg \times 1 \text{ tablet/500mg} = 48 tablets</td>
<td>4 tablet</td>
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</table>

Acetaminophen versus aspirin:
5. a. Which is more toxic, acetaminophen or aspirin? b. How great is the difference in their toxicities? Explain.
   Aspirin is about 12 times more toxic than Tylenol (the \( LD_{50} \) for aspirin is about 1/12th the \( LD_{50} \) of Tylenol).
Part II: Comparing Lethal Doses  (Use Table of Lethal Doses).

1. What substance in the table is the most toxic when ingested? Explain.
   Arsenic is the most toxic in the table with the lowest LD_{50} (15mg/kg).

2. Rank the substances as best you can based on their lethal doses for ingestion (1 = most toxic...etc).
   1= Arsenic (15mg/kg), Caffeine (140mg/kg), Aspirin & Lorcher mushroom (200mg/kg), Lead (450mg/kg), Vitamin A (2000mg/kg), Table salt (3g/1kg), Alcohol (7060mg/kg), Sugar (30g/kg)

   Vitamin A is good for you (and a necessary for normal body function).

4. Are there any substances in the world that are non-toxic? Explain.
   Anything can be toxic if you consume too much of it.

Part III: Summarizing

1. How is dosage related to toxicity?
   Dosage determines how much should be taken at a time. The dosage should always be much lower than the toxicity level.

2. Besides dosage, what other factors should be considered when determining the toxicity of a substance on a person?
   The overall health of an individual, if an individual’s organs are functioning normally, their metabolic rate and tolerance (for some substances).

3. How many Flintstone vitamin tablets would be a lethal dose of vitamin A for a 22 Lb child? Each Flintstone vitamin tablet contains 0.9 mg of vitamin A & Vitamin A- LD_{50} 2000 mg/kg. (show work)
   10. kg x 2000 mg/1kg x 1 tablet/0.9 mg = 22,222 tablets

Part IV: At Home

1. Find at least 3 products at home with labels that warn of toxicity. For each product give the following:

<table>
<thead>
<tr>
<th>Product Name</th>
<th>Active Ingredient &amp; % comp.</th>
<th>How does the label advise you to avoid harmful exposure to the product?</th>
<th>What does the label tell you to do if a dangerous exposure does occur?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Answers will vary</td>
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2. Put this phone number in your home in a location everyone in your family can quickly & easily find (if it’s not already there). Poison Control phone number: 1-800-222-1222
   Parent Signature that this number is posted: