Toxicology Lab: LD-50 AND MSDS

BACKGROUND
We handle many materials daily that are toxic. We are often unaware of the degree to which they are toxic. For a variety of reasons, different animals respond differently to the same toxin. Some animals may be very sensitive to a toxin, whereas others are relatively resistant to its effects. Because species of animals vary, it is important to understand that what is toxic to brine shrimp may not necessarily be toxic to other kinds of animals to the same extent.

Many household items that we deal with on a regular basis are toxic materials, but we don’t usually think of them as being toxic. It can be instructive to examine several such materials to determine their toxicity.

The commonly used term to describe acute ingestion toxicity is LD$_{50}$. LD means Lethal Dose (deadly amount) and the subscript 50 means that the dose was acutely lethal to 50% of the animals to whom the chemical was administered under controlled laboratory conditions. The test animals (usually mice or rats) are given specific amounts of the chemical in either one oral dose or by a single injection and are then observed for 14 days.

Since LD$_{50}$ values are measured from zero up, the lower the LD$_{50}$ the more acutely toxic the chemical. Therefore, a chemical with an oral LD$_{50}$ of 500 would be much less toxic than a chemical with an LD$_{50}$ of 5. LD$_{50}$ values are expressed as milligrams per kilogram (mg/kg), which means mg of chemical per kg of body weight of the animal. Mg/kg is the same as ppm. For example, if the oral LD$_{50}$ of the insecticide parathion is 4, a dose of 4 parts of parathion for every million parts of body weight would be lethal to at least half of the test animals.

An MSDS (Material Safety Data Sheet) is a document (for each chemical) with information on all the physical and chemical properties for that chemical, as well as information on reactions and safe disposal of the chemical waste.

The following information can usually be found in a MSDS:
· Identity of the organization responsible for creating the sheet and the date of issue
· The material's identity, including its chemical and common names
· Hazardous ingredients
· Exposure limits
· Physical and chemical hazards and characteristics
· Health hazards
· Emergency and first aid procedures
· Spill and disposal procedures
· Precautions and safety equipment
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PART 1.
Using your OWN MASS in kg, figure out how many total g would be required to kill 50% of perfect duplicates of yourself. Be careful about units! For your reference, a penny weighs around 3000 mg or 3 g. You don't need to show work for all of these problems, but write out ONE complete example of your conversion to LD₅₀/person below the table so that I know how you did it. Remember, everyone's answers will be slightly different.

PART 2.
Find a Material Safety Data Sheet (MSDS) for an ingredient in some household substance you have (e.g. toothpaste, shampoo, mouthwash, junk food additives, etc.). Don't use any of the ones already listed below. Fill out the attached worksheet and be prepared to share your results with the class. Search for MSDS's at one of the following websites:
http://siri.uvm.edu/msds
http://www.msdsonline.com/ (click “free search”)

<table>
<thead>
<tr>
<th>Substance (source or product)</th>
<th>LD₅₀</th>
<th>LD₅₀ for you</th>
</tr>
</thead>
<tbody>
<tr>
<td>disodium EDTA</td>
<td>2000. mg/kg</td>
<td></td>
</tr>
<tr>
<td>benzaldehyde (Cherry Flavor)*</td>
<td>4.8 mg/kg</td>
<td></td>
</tr>
<tr>
<td>Tetrahydrocannabinol (THC from marijuana)*</td>
<td>110 mg/kg</td>
<td></td>
</tr>
<tr>
<td>Ethyl acetate (Cherry Flavor)*</td>
<td>6100 mg/kg</td>
<td></td>
</tr>
<tr>
<td>propylene glycol (Cherry Flavor)</td>
<td>20 g/kg</td>
<td></td>
</tr>
<tr>
<td>Caffeine (Mountain Dew)*</td>
<td>0.13 g/kg</td>
<td></td>
</tr>
<tr>
<td>malic acid (sour candy)*</td>
<td>1.6 g/kg</td>
<td></td>
</tr>
<tr>
<td>Methanol (wood alcohol)*</td>
<td>5628 mg/kg</td>
<td></td>
</tr>
<tr>
<td>Nicotine (through mouth)*</td>
<td>190 mg/kg</td>
<td></td>
</tr>
<tr>
<td>Botulinum toxin (bacteria)*</td>
<td>3 x 10⁻⁸ mg/kg</td>
<td></td>
</tr>
<tr>
<td>potassium nitrate (fertilizer)</td>
<td>190 mg/kg</td>
<td></td>
</tr>
<tr>
<td>sodium fluoride (toothpaste)</td>
<td>52 mg/kg</td>
<td></td>
</tr>
<tr>
<td>parathion (pesticide)</td>
<td>6.0 mg/kg</td>
<td></td>
</tr>
<tr>
<td>Vx (nerve gas)</td>
<td>2 x 10⁻² mg/kg</td>
<td></td>
</tr>
<tr>
<td>tetrodotoxin (poison from puffer fish)</td>
<td>334 x 10⁻⁶ g/kg</td>
<td></td>
</tr>
<tr>
<td>diazinon (ant killer dust)</td>
<td>0.076 g/kg</td>
<td></td>
</tr>
<tr>
<td>amphetamine sulfate</td>
<td>32 mg/kg</td>
<td></td>
</tr>
<tr>
<td>ephedrine</td>
<td>0.600 g/kg</td>
<td></td>
</tr>
<tr>
<td>gamma hydroxybutyrate (date rape drug)</td>
<td>2.0 g/kg</td>
<td></td>
</tr>
</tbody>
</table>

Showing your work for ONE problem:

* natural substances
MSDS WORKSHEET

The product name for the material on this MSDS: _____________________
The formula for this material: _____________________

POTENTIAL HEALTH EFFECTS:
1. What are the routes of exposure for this material?
   _____________________________________________________________
2. Health effects of INHALATION: ________________________________
3. Health effects of EYE CONTACT: ______________________________
4. Health effects of SKIN CONTACT: _____________________________
5. Health effects of INGESTION: _________________________________
6. Is this material a cancer-causing agent: ________________________
7. What are the target organs of this material, if any? ______________

FIRST AID MEASURES
8. INHALATION: ______________________________________________
9. EYE CONTACT: _____________________________________________
10. SKIN CONTACT: ____________________________________________
11. INGESTION: ______________________________________________

PERSONAL PROTECTION MEASURES
12. RESPIRATORS _____ SAFETY GLASSES _____ GLOVES _____

REACTIVITY DATA
13. What materials is this product incompatible with? ______________
14. What are the steps to be taken in case material is released or spilled?
   _____________________________________________________________
15. What precautions should be taken in handling and storing this material?
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