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Teacher's Guide
 Chemicals & Human Health Website
www.biology.arizona.edu/chh

Toxicology Activity

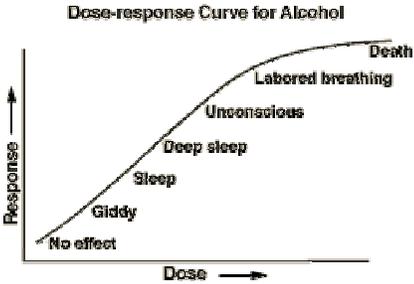
1. Pre-test - Have the students answer the questions on the worksheet prior to visiting the website. This is just to get them thinking and exposed to the questions. Don't grade the pre-questions.
2. Have the students go to the Chemicals and Human Health website and click on the Toxicology Problem Set. www.biology.arizona.edu/chh
3. Have the students find the correct answer to the questions as they go through the Lung Toxicology Problem Set.
4. Answers & scoring rubric below.

| Pre-Questions (circle the answer you think is correct) | Correct Answer (write in the correct answer from website) | # Points | Explain (explain the correct answer) |
|--|---|---|--|
| Which statement is the most correct? A. Chemicals manufactured by humans are more dangerous to human health than naturally occurring chemicals. B. Both natural and human-made chemicals are potentially toxic to humans. C. Naturally occurring chemicals are more poisonous to humans than synthetic chemicals. | B | 1 – for correct answer in the second column 2 – one for each example | Give an example of each <u>Natural toxic substance:</u> <i>Botulin, snake venom, radon, lead (lead naturally occurs in the environment)</i> <i>If students list Vitamin D or table salt (sodium chloride) as examples they need to explain that these are toxic only in high doses.</i> <u>Man-made toxic substance:</u> <i>DDT, some pesticides, lead-based paint (adding lead to paint)</i> |
| One of the items below is a hazardous substance. Four are sources of a hazardous substances. Which one is a hazardous substance? A. clogged furnace B. cigarette C. a dog D. paint applied before 1978 E. dust mite parts | E | 1 – for correct answer 4 – one for each correct explanation | <u>What is the a common health effect of this hazard?</u> <i>Allergies</i> <u>What is the source for this hazard?</u> <i>Dust mites</i> <u>List 2 additional examples of a hazard and its source:</u> |

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| | | | <p><i>animal dander - fur-bearing animals, such as dogs or cats</i> <i>carbon monoxide - broken appliances that incompletely burn natural gas or oil, such as furnaces or stoves</i></p> <p><i>lead - paint applied before 1978, batteries, water pipes</i></p> <p><i>mercury - thermometers, filling in teeth, batteries</i></p> <p><i>mold spores - molds which are found especially in damp places like showers</i></p> <p><i>tobacco smoke - lighted cigarettes or cigars</i></p> |
| <p>Which of the following is NOT a possible route of entry for a hazard?</p> <p>A. ingestion B. absorption C. exposure D. inhalation</p> | <p>C</p> | <p>1 – for correct answer</p> <p>5 – one for each primary route of entry, two for the correct explanation</p> | <p><u>Describe the primary ways a hazard can enter the body:</u></p> <p><i>Ingestion – eating the substance</i> <i>Inhalation – breathing the substance</i> <i>Absorption – through the skin</i></p> <p><u>Which route of entry may result in more of the toxicant in the blood and why?</u></p> <p><i>Inhalation – large surface area &/or poor chemical barrier</i></p> |
| <p>When DDT, a pesticide, enters the human body, it is _____.</p> <p>A. water soluble and is easily excreted in urine.</p> <p>B. stored in the bones.</p> <p>C. not toxic, but is processed by enzymes and becomes a different compound which is toxic.</p> <p>D. fat soluble and can be stored in fat tissue.</p> | <p>D</p> | <p>1 – for correct answer</p> <p>3 – one point for each correct explanation</p> | <p><u>Define solubility:</u></p> <p><i>Solubility means whether it can dissolve in water or lipids.</i></p> <p><u>What type of chemical is more easily eliminated from the body, water-soluble or fat-soluble?</u></p> <p><i>Water-soluble</i></p> <p><u>Based on your answer above, is DDT easily eliminated from our bodies? Why?</u></p> <p><i>No, because it is fat soluble and is stored in our body.</i></p> |
| <p>Who took the largest dosage of aspirin?</p> <p>A. an adult woman who weighs 125 lbs. and took 300 mg of aspirin</p> <p>B. a teenage boy who weighs 135</p> | <p>D</p> | <p>1 – for correct answer</p> <p>5 – one point for correct definition, one point for</p> | <p><u>Define dose:</u></p> <p><i>The amount of a chemical that enters a person's body.</i></p> <p><u>Calculate the dose for each person/animal in the question (show your calculations and include units):</u></p> |

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| <p>lbs. and took 600 mg of aspirin</p> <p>C. a baby who weighs 20 lbs. and took 100 mg of aspirin</p> <p>D. a chihuahua who weighs 5 lbs. and took 50 mg of aspirin</p> | | <p>each calculation</p> | <p>woman: $300 \text{ mg}/125 \text{ lbs.} = 2.4 \text{ mg/lb}$ boy: $600 \text{ mg}/135 \text{ lbs.} = 4.4 \text{ mg/lb}$ baby: $100 \text{ mg}/20 \text{ lbs.} = 5.0 \text{ mg/lb}$ chihuahua: $50 \text{ mg}/5 \text{ lbs.} = 10 \text{ mg/lb}$</p> |
| <p>Which will NOT help you determine the dose of a hazardous gas received by a person?</p> <p>A. their respiration rate</p> <p>B. their length of exposure to the gas</p> <p>C. the source of the gas</p> <p>D. their frequency of exposure to the gas</p> <p>E. the concentration of the gas</p> <p>F. the gas's chemical and biological properties</p> | <p>C</p> | <p>1 – for correct answer</p> <p>4 – one point for each correct explanation</p> | <p><u>Will the dose be higher or lower if:</u></p> <p><u>a person breathes more rapidly?</u></p> <p><i>Higher</i></p> <p><u>a person is exposed once?</u></p> <p><i>Lower</i></p> <p><u>a person is exposed over years?</u></p> <p><i>Higher</i></p> <p><u>the gas is easily absorbed?</u></p> <p><i>Higher</i></p> |
| <p>Most hazardous substances exhibit a "dose-response relationship." What does this mean?</p> <p>A. The harm caused by the hazard increases as the amount of hazard entering the body (dose) increases.</p> <p>B. It does not matter how big a dose you receive, you will always have same amount of harm/sickness.</p> <p>C. Exposure to the hazard always results in harm.</p> <p>D. Fifty percent of the people will die when exposed to 0.1 mg/kg.</p> | <p>A</p> | <p>1 – for correct answer</p> <p>4 – one point for each correctly labeled axis, one point for health effects labels, one point for the title</p> | <p><u>Draw a dose-response curve:</u></p>  |
| <p>A family home has a clogged furnace that is producing carbon monoxide, a hazardous gas. Which family member is likely to be harmed the most?</p> <p>A. Billy, the son who is in 1st grade</p> | <p>B</p> | <p>1 – for correct answer</p> <p>2 – one point for each correct explanation</p> | <p><u>Give 2 reasons for your answer:</u></p> <ol style="list-style-type: none"> <i>Baby Shea is in the house all day (long exposure time)</i> <i>Baby Shea is the smallest and will receive a comparatively larger dose.</i> <i>Children, in general, are more susceptible to hazardous substances</i> |

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| <p>B. Baby Shea, who is going to be in preschool next year</p> <p>C. Karla, the nanny who cares for the toddler every weekday morning</p> <p>D. Ms. Nguyen, the mother who works at home.</p> <p>E. Mr. Nguyen, the father who works at the University</p> | | | <p><i>(they are still growing & developing).</i></p> |
| <p>All of the people listed below live in the same house. Who is most likely to experience toxic effects from the second-hand smoke?</p> <p>A. the grandmother, who is very fit</p> <p>B. the mother, who smokes</p> <p>C. the father, who smokes</p> <p>D. the teenage daughter, who has asthma</p> <p>E. the son, who is in 5th grade</p> | <p>D</p> | <p>1 – for correct answer</p> <p>1 – one point for the correct explanation</p> | <p><u>Explain your answer:</u></p> <p><i>A person's health status can affect their response to a hazard. For example someone with asthma, whose lungs are already experiencing illness, may be more sensitive to hazardous gases and particles in the air.</i></p> |
| <p>There are several ways to control or reduce your exposure to a hazard. Opening a window in a room full of people who are smoking is an example of controlling your exposure to environmental tobacco smoke by _____.</p> <p>A. treating the symptoms of the hazard</p> <p>B. diluting the hazard</p> <p>C. distancing yourself from the hazard</p> <p>D. removing the hazard</p> | <p>B</p> | <p>1 – for correct answer</p> <p>3 – one point for the correct explanation, one point for each example</p> | <p><u>Explain your answer:</u></p> <p><i>By opening the window, fresh air will come in the window and reduce the concentration of cigarette smoke in the room. This dilutes the hazard and reduces your exposure.</i></p> <p><u>Give 2 additional examples of how to control or reduce exposure to a hazard:</u></p> <p><i>You could wear protective gear such as a gas mask.</i></p> <p><i>Distance yourself from the source of the hazard.</i></p> <p><i>Remove the source.</i></p> |
| <p>Which environmental health scientist would determine ways to prevent and reduce exposure to second hand smoke?</p> <p>A. a toxicologist</p> | <p>C</p> | <p>1 – for correct answer</p> <p>1 – one point for answering</p> | <p>Do any of the careers described in this question interest you? Why or why not?</p> |

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| B. an epidemiologist C. an industrial hygienist D. an occupational and environmental medicine physician E. a pharmacologist | | the question | |
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Total 45 points

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Chemicals & Human Health
 Toxicology Problem Set: Student Sheet

Directions

1. Answer the pre-questions (circle the answer in the Pre-Questions column).
2. Go to the website www.biology.arizona.edu/chh and click on the link to the Toxicology Problem Set.
3. Write the correct answer in the column labeled Correct Answer. All of the answers can be found in the Toxicology Problem Set.
4. Explain the correct answer.

| Pre-Questions (circle the answer you think is correct) | Correct Answer (write the letter of the correct answer from the website) | Explain (explain the correct answer) |
|---|---|--|
| <p>Which statement is the most correct?</p> <p>A. Chemicals manufactured by humans are more dangerous to human health than naturally occurring chemicals.</p> <p>B. Both natural and human-made chemicals are potentially toxic to humans.</p> <p>C. Naturally occurring chemicals are more poisonous to humans than synthetic chemicals.</p> | | <p>Give an example of each</p> <p>Natural toxic substance:</p> <p>Man-made toxic substance:</p> |
| <p>One of the items below is a hazardous substance. Four are sources of a hazardous substances. Which one is a hazardous substance?</p> <p>A. clogged furnace</p> <p>B. cigarette</p> <p>C. a dog</p> <p>D. paint applied before 1978</p> <p>E. dust mite parts</p> | | <p>What is a common health effect of this hazard?</p> <p>What is the source for this hazard?</p> <p>List 2 additional examples of a hazard and its source:</p> |
| <p>Which of the following is NOT a possible route of entry for a hazard?</p> <p>A. ingestion</p> <p>B. absorption</p> <p>C. exposure</p> <p>D. inhalation</p> | | <p>Describe the primary ways a hazard can enter the body:</p> <p>Which route of entry may result in more of the toxicant in the blood and why?</p> |

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| <p>When DDT, a pesticide, enters the human body, it is _____.</p> <p>A. water soluble and is easily excreted in urine.</p> <p>B. stored in the bones.</p> <p>C. not toxic, but is processed by enzymes and becomes a different compound which is toxic.</p> <p>D. fat soluble and can be stored in fat tissue.</p> | | <p>Define solubility:</p> <p>What type of chemical is more easily eliminated from the body, water-soluble or fat-soluble?</p> <p>Based on your answer above, is DDT easily eliminated from our bodies? Why?</p> |
| <p>Who took the largest dosage of aspirin?</p> <p>A. an adult woman who weighs 125 lbs. and took 300 mg of aspirin</p> <p>B. a teenage boy who weighs 135 lbs. and took 600 mg of aspirin</p> <p>C. a baby who weighs 20 lbs. and took 100 mg of aspirin</p> <p>D. a chihuahua who weighs 5 lbs. and took 50 mg of aspirin</p> | | <p>Define dose:</p> <p>Calculate the dose for each person/animal in the question (show your calculations and include units):</p> |
| <p>Which will NOT help you determine the dose of a hazardous gas received by a person?</p> <p>A. their respiration rate</p> <p>B. their length of exposure to the gas</p> <p>C. the source of the gas</p> <p>D. their frequency of exposure to the gas</p> <p>E. the concentration of the gas</p> <p>F. the gas's chemical and biological properties</p> | | <p>Will the dose be higher or lower if:</p> <p>a person breathes more rapidly?</p> <p>a person is exposed once?</p> <p>a person is exposed over years?</p> <p>the gas is easily absorbed?</p> |

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| <p>Most hazardous substances exhibit a "dose-response relationship." What does this mean?</p> <p>A. The harm caused by the hazard increases as the amount of hazard entering the body (dose) increases.</p> <p>B. It does not matter how big a dose you receive, you will always have same amount of harm/sickness.</p> <p>C. Exposure to the hazard always results in harm.</p> <p>D. Fifty percent of the people will die when exposed to 0.1 mg/kg.</p> | | <p>Draw a dose-response curve:</p> |
| <p>A family home has a clogged furnace that is producing carbon monoxide, a hazardous gas. Which family member is likely to be harmed the most?</p> <p>A. Billy, the son who is in 1st grade</p> <p>B. Baby Shea, who is going to be in preschool next year</p> <p>C. Karla, the nanny who cares for the toddler every weekday morning</p> <p>D. Ms. Nguyen, the mother who works at home.</p> <p>E. Mr. Nguyen, the father who works at the University</p> | | <p>Give 2 reasons for your answer:.</p> |
| <p>All of the people listed below live in the same house. Who is most likely to experience toxic effects from the second-hand smoke?</p> <p>A. the grandmother, who is very fit</p> <p>B. the mother, who smokes</p> <p>C. the father, who smokes</p> <p>D. the teenage daughter, who has asthma</p> <p>E. the son, who is in 5th grade</p> | | <p>Explain your answer:</p> |

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| <p>There are several ways to control or reduce your exposure to a hazard. Opening a window in a room full of people who are smoking is an example of controlling your exposure to environmental tobacco smoke by _____.</p> <p>A. treating the symptoms of the hazard</p> <p>B. diluting the hazard</p> <p>C. distancing yourself from the hazard</p> <p>D. removing the hazard</p> | | <p>Explain your answer:</p> <p>Give 2 additional examples of how to control or reduce exposure to a hazard:</p> |
| <p>Which environmental health scientist would determine ways to prevent and reduce exposure to second hand smoke?</p> <p>A. a toxicologist</p> <p>B. an epidemiologist</p> <p>C. an industrial hygienist</p> <p>D. an occupational and environmental medicine physician</p> <p>E. a pharmacologist</p> | | <p>Do any of the careers described in this question interest you? Why or why not?</p> |