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The electronic responses to this examination are due on Monday, 15 June 2015 at end of day (5:00 pm). Submit them to [shalloran@lifewest.edu](mailto:shalloran@lifewest.edu) OR to [smhbizness@gmail.com](mailto:smhbizness@gmail.com). You will be sent an acknowledgement receipt.

You are not allowed to consult with classmates or any individuals *other than* the instructor as you research, prepare and compose your responses to the questions posed in this examination. Lecture content (slides) and your oral presentations are on MOODLE for you to use in preparing answers, in addition to access to the LCCW library, reference books and course text books, and on-line resources. Please proofread and organize your work and assemble the exam before submitting it.

Some answers require you to include a citation of the sources you consult to formulate your response. Format your citation according to MLA or APA standards. (If you wish, you can use the built-in Word feature that formats your references: under the References tab, use Insert Citation and fill in the fields as much as possible. Later you will use Bibliography->Insert Bibliography at the point of the cursor. You might learn how to use Section Break too in order to insert bibliographies under separate answers. I have put in section breaks in this document between questions.)

By working the examination and submitting it for grading you are agreeing to work independently of all other individuals and you are certifying that all the responses and answers to the examination questions are your own work.

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Within group A through C, choose ONE of any of the choices answer.  
Choose between D or E, and within D, choose ONE of any of the choices

**A. Environmental Toxicants. Pick one from the three class of substances below and discuss exposure (places where it might be encountered), its toxicokinetics (ADME) and toxicodynamics (acute, chronic toxicity, effects on physiology and eliciting pathologies. You are allowed to focus on one compound in the class or discuss the toxicology of the class generally**

**1. Pesticides—Insecticides: organophosphates**

**a. Exposure**

- Insecticides, pesticides, nerve gases, ophthalmic agents, antihelmintics, herbicides
- One of the most common poisoning causes worldwide due to their common household use for pesticides, insecticides, and herbicides
- spread agriculturally in fruits in vegetables, used to control insects in public spaces such as parks

**b. Toxicokinetics**

- Absorption: inhalation, ingestion, dermal absorption, injection, transplacentally
- Distribution: stored in adipose tissue, may reach many different organs
- Metabolism: metabolized into oxones and other inactive metabolites
- Excretion: urinary, biliary/fecal, and milk in nursing mothers

**c. Toxicodynamics**

- Acute toxicity: most impactful in fetuses and young children (still developing brain & nervous system) – delayed learning rates, reduced physical coordination, and increased probability of behavioral problems and/or ADHD
- Chronic Toxicity: impaired memory & concentration, irritability, confusion, headaches, slurred speech, disorientation, depression, delayed reaction, nightmares, sleepwalking, drowsiness or insomnia; possible flu-like condition with headache, nausea, weakness, loss of appetite & malaise
- Effects on Physiology: Inhibits acetylcholinesterase (AChE), which then accumulates acetylcholine (ACh) – this leads to overstimulation of muscarinic and nicotinic receptors
- Eliciting Pathologies: excess ACh in the body – extremely important neurotransmitter for brain and nerve development and function

Katz, Kenneth D., MD, FAAEM, ABMT. "Organophosphate Toxicity ." *Organophosphate Toxicity*. MedScape, 27 Jan. 2015. Web. 14 June 2015.  
<<http://emedicine.medscape.com/article/167726-overview#a0104>>.

Laborde, Amalia, MD. "Pesticides." *Pesticides*. World Health Organization, July 2008. Web. 14 June 2015. <<http://www.who.int/ceh/capacity/Pesticides.pdf>>.

## **B. Food Toxicants.**

### **1. Sulfur dioxide (SO<sub>2</sub>) is added to wine during its production. Discuss what is known about acute and chronic toxicity and other toxicodynamic features. Can wine be produced without using it? Are there are alternatives?**

- a. Acute Toxicity: obstruction of airways, difficulty breathing, stomach pain, menstrual disorders, watery eyes, inhibition of thyroid function, loss of smell, headache, nausea, vomiting, fever, convulsions, and dizziness
- b. Chronic Toxicity: chronic bronchitis, emphysema, respiratory illness, aggravation of existing heart disease, respiratory disease, decreased fertility,
- c. Effects on Physiology: blocks nerve signals from pulmonary stretch receptors and negates the Hering-Breuer inflation reflex; regulates cardiac and blood vessel function; lowers rate of proliferation of endothelial smooth muscle
- d. Eliciting Pathologies: can contribute to cardiovascular diseases such as arterial hypertension, atherosclerosis, pulmonary arterial hypertension, stenosis of the heart vessels
- e. Wine production without SO<sub>2</sub>: Serves as an antibiotic and antioxidant, keeping wine from spoiling and oxidation; wine production without SO<sub>2</sub> causes premature oxidation
- f. Alternatives:
  - low electric current technology (LEC) – decreased survival time and increased death rates of apiculate yeasts; positive effect on grape juice fermentation
  - Dimethyl dicarbonate (DMDC) – effective against yeasts but not bacteria
  - lysozyme – effective against bacterial development
  - Ultrasound – high antiseptic and preservation effect
  - Ultraviolet radiation – inactivates yeasts & bacteria – more effective in whites than reds

- Pulsed electric fields – effective to destroy yeasts & bacteria

Alberto, Luiz. "The Use (or Not) of Sulfur Dioxide in Winemaking: Trick or Treat?" *The Wine Hub*. The Wine Hub, 9 Jan. 2013. Web. 14 June 2015.

<<http://thewinehub.com/home/2013/01/09/the-use-or-not-of-sulfur-dioxide-in-winemaking-trick-or-treat/>>.

Lustrato, G., G. Alfano, C. Belli, L. Grazia, M. Iorizzo, and G. Ranalli. "Scaling-up in Industrial Winemaking Using Low Electric Current as an Alternative to Sulfur Dioxide Addition." *Journal of Applied Microbiology* 101.3 (2006): 682-90. *Wiley Online Library*. 12 June 2006. Web. 14 June 2015. <<http://onlinelibrary.wiley.com/doi/10.1111/j.1365-2672.2006.02931.x/abstract;jsessionid=72ABADEAD4119EB3A3BD2A827ACED811.f04t01>>.

"Sulfur Dioxide." *Tox Town*. U.S. National Library of Medicine, 13 May 2015. Web. 14 June 2015. <[http://toxtown.nlm.nih.gov/text\\_version/chemicals.php?id=29](http://toxtown.nlm.nih.gov/text_version/chemicals.php?id=29)>.

Wang, Xin-Bao, Hong-Fang Jin, Chao-Shu Tang, and Jun-Bao Du. "The Biological Effect of Endogenous Sulfur Dioxide in the Cardiovascular System." *European Journal of Pharmacology* 670.1 (2011): 1-6. Print.

**C. Drug-Nutrient Interactions. Select any of the drugs or drug classes below and explain how it affects diet (nutrient absorption). Either suggest an alternative drug and/or explain how an individual can compensate for any effect on nutrition**

**1. Antacids**

a. Affects on Diet/Nutrient Absorption:

- alkaline ions directly neutralize stomach acid
- can cause diarrhea, constipation, kidney stones, osteoporosis
- delays gastric emptying because there is less acid to break down foods
- temporarily eliminates symptoms, but in actuality stops breakdown of foods

b. Alternative Drugs/how to compensate

- apple cider vinegar
- yogurt
- ginger
- peppermint
- wheat grass
- aloe vera juice
- papaya
- pineapple

c. How to compensate:

- Calcium – 500-1,200 mg daily
- Vitamin B12 – 100-200 micrograms daily
- Folic acid – 400 micrograms daily
- Vitamin C – 500 mg daily

Young-Balch, Robin. "Antacid and Reflux Drugs and Their Natural Alternatives." *AARP Prescription for Drug Alternatives*. By James F. Balch and Mark Stengler. N.p.: John Wiley & Sons, 2012. 47-58. Print.

**D. Personal Care Products. Select one of the product types and the named compound usually contained in it. Discuss any facts on acute and chronic toxicity through dermal exposure, and discuss alternatives to**

1. Antiperspirants: aluminum chlorohydrate
  - a. Acute Toxicity
    - none found
  - b. Chronic Toxicity
    - Breast Cancer (with underarm shaving and antiperspirant/deodorant use)
    - Alzheimer's Dx (less than 1%)
    - Kidney Dx (in persons with 30% or less kidney function)
  - c. Alternatives
    - Aluminum-free deodorant

Graves, Amy B., Emily White, Thomas D. Koepsell, Burton V. Reifler, Gerald Van Belle, and Eric B. Larson. "The Association between Aluminum-containing Products and Alzheimer's Disease." *Journal of Clinical Epidemiology* 43.1 (1990): 35-44. *Science Direct*. 25 June 2004. Web. 14 June 2015. <<http://www.sciencedirect.com/science/article/pii/089543569090053R>>.

Kalogria, Eleni, Athanasia Varvaresou, Spyridon Papageorgiou, Evaggelia Protopapa, Ioannis Tsaknis, Alexios Matikas, and Irene Panderi. "Pre-Column Derivatization HPLC Procedure for the Quantitation of Aluminium Chlorohydrate in Antiperspirant Creams Using Quercetin as Chromogenic Reagent." *Chromatographia*. Springer Berlin Heidelberg, 10 July 2014. Web. 14 June 2015. <<http://www.ncbi.nlm.nih.gov/pmc/articles/PMC4177567/>>.

McGrath, K. G. "An Earlier Age of Breast Cancer Diagnosis Related to More Frequent Use of Antiperspirants/deodorants and Underarm Shaving." *European Journal of Cancer Prevention* 12.6 (2003): 479-85. *Terra Naturals*. 30 July 2003. Web. 14 June 2015. <[http://terrannaturals.com/pdf/mcgrath\\_full.pdf](http://terrannaturals.com/pdf/mcgrath_full.pdf)>.