

NAME \_\_\_\_\_

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

**Polyaromatic hydrocarbons (PAHs):** Short for polycyclic aromatic hydrocarbons, PAHs describe chemicals that are often found together in groups of two or more. PAHs are found naturally in the environment but they can also be man-made. In their purest form, PAHs are solid and range in appearance from colorless to white or pale yellow-green. PAHs are created when products like coal, oil, gas, and garbage are burned but the burning process is not complete. Although PAHs can exist in over 100 different combinations, the National Waste Minimization Program defines this group using the Toxic Release Inventory reporting category for polycyclic aromatic compounds. PAHs are a concern because they are persistent. Because they do not burn very easily, they can stay in the environment for long periods of time. Individual PAHs vary in behavior. Some can turn into a vapor in the air very easily. Most do not break down easily in the water. Most PAHs are used to conduct research. However, some PAHs are used to make dyes, plastics, and pesticides. Some are even used in medicines. One of the most common ways PAHs can enter the body is through breathing contaminated air. PAHs get into your lungs when you breathe them. If you live near a hazardous waste site where PAHs are disposed, you are likely to

breathe PAHs. If you eat or drink food and water contaminated with PAHs, you could be exposed. Exposure to PAHs can also occur if your skin contacts PAH-contaminated soil or products like heavy oils, coal tar, roofing tar, or creosote. Creosote is an oily liquid found in coal tar and is used to preserve wood. Once in your body, PAHs can spread and target fat tissues. Target organs include the kidneys and liver. However, PAHs will leave your body through urine and feces in a matter of days. You can be exposed to PAHs in the environment, in your home, and in the workplace. Because PAHs exist naturally in the environment and are man-made, you can be exposed in a number of ways. Fumes from vehicle exhaust, coal, coal tar, asphalt, wildfires, agricultural burning and hazardous waste sites are all sources of exposure. You could be exposed to PAHs by breathing cigarette and tobacco smoke, eating foods grown in contaminated soil, or by eating meat or other food that you grilled. Grilling and charring food actually increases the amount of PAHs in the food. If you work in a plant that makes coal tar, asphalt and aluminum, or that burns trash, you can be exposed to PAHs. You can also be exposed if you work in a facility that uses petroleum or coal, or where wood, corn, and oil are burned. A number of PAHs have caused tumors in laboratory animals that were exposed to PAHs through their food, from breathing contaminated air, and when it was applied to their skin. When pregnant mice ate high doses of a PAH (benzo(a)pyrene) they experienced reproductive problems. In addition, the offspring of the pregnant mice showed birth defects and a decrease in their body weight. Other effects include damage to the body fluids, and the immune system. However, these effects have not been seen in humans. There is a test that can measure the presence of PAH in your urine. This test can only tell you if you have been exposed; but it can't reveal how harmful the effects of the exposure will be. This test would have to be performed in a laboratory that has special equipment to detect the PAHs. Another test currently being developed will be able to measure PAHs in your body tissue and blood. Most exposures to PAHs happen every day at very low levels in the air we breathe and the foods we eat. Treatment for a short-term exposure is unlikely. There is no information available from studies on humans to tell what effects can result from being exposed to individual PAHs at certain levels. However, breathing PAHs and skin contact seem to be associated with cancer in humans. Animal studies showed that mice exposed to 308 parts per million (ppm) of PAHs (specifically benzo (a) pyrene) in food for 10 days (short term exposure) caused birth defects. Mice exposed to 923 ppm of benzo (a) pyrene in food for months caused problems in the liver and blood.

<http://www.epa.gov/osw/hazard/wastemin/minimize/factshts/pahs.pdf>

1. Pesticides—Insecticides: organophosphates
2. Polychlorinated Biphenyls (PCBs)

B. Food Toxicants.

1. Heterocyclic amines (HCAs) can form when meat is cooked often at charring temperatures. Find one compound in this class, discuss how it is formed in cooking and sources of exposure, and discuss effects of chronic toxicity, either in humans or animal studies
2. 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 alternatives

3. Food Coloring Dyes. FD&C Blue No. 1, Red No. 40, Yellow No. 5, and Yellow No. 6 are common additives to food. Pick TWO of these and discuss what is known about the effect on health and name one alternative to using the dye, comparing financial costs and effect on health.

Red No. 40 is also known as Allura Red AC Dye. It is a coloring agent of chemicals and substances that impact color including soluble dyes and insoluble pigments. They are used in inks, paints, and as indicators and reagents. As a food coloring agent, is it natural or synthetic dye used to color agents in processed foods. Rats were fed a diet containing 5.19% of Allura Red. It was observed that 0.1% and 29% of the intact dye was excreted in the urine and feces respectively. In later studies, rats and dogs were pretreated daily with nonradioactive Allura Red. Subsequently, the animals were dosed with the <sup>35</sup>S labelled compound and studied for up to 72 hours for excretion and distribution patterns of the color. Both species showed limited absorption of the compound with the major route of excretion being via the feces. In the dog 92-95% of the recovered radioactivity appeared in the feces within 72 hours while in the rat 76-92% of the recovered radioactivity appeared in the feces within this time period. Urinary recoveries of the color in rats and dogs, respectively varied between 5.7 and 19.8% and 2.7 and 3.6%. After sacrifice, significant retention of radioactivity was located in the intestinal contents of both species and in the washed intestines of the rats. This was thought to be due to adhesion of the compound to the intestinal wall, since the total carcass and viscera of these animals contained <0.4% of the administered dose. Several metabolites, possibly resulting from azo-reduction in the gastrointestinal tract (two identified as aromatic amines, p-cresidine sulfonic acid being the major one), were also found in the feces and urine. Finally, significant retention in the washed intestines of rat was observed, probably due to adhesion to the intestinal wall. Cresidinesulfonic acid was found to be the major metabolite of Allura Red in the urine of these two species, whereas the parent compound was not measurable. In addition, two other unidentifiable metabolites were found in the urine of the rats. In the rat fecal extracts, cresidinesulfonic acid was a major metabolite along with two unknowns and the parent compound. The dog fecal sample revealed an identical metabolite pattern as seen in the rat, and in addition, a third unknown was discovered. One of the urinary unknowns demonstrated an R<sub>f</sub> value which was identical to that of the one of the fecal unknowns suggesting that they were one and the same. The other unknowns exhibited distinctive R<sub>f</sub> values which indicated that these metabolites were different. It has been postulated that azo reduction by gut flora of the dye will yield the two components of the parent compound: 2-methoxy-5-methyl-aniline-4-sulfonic acid (cresidine-4-sulfonic acid) and 1-amino-2-naphthol-6-sulfonic acid. It appears that negligible quantities of intact Red are absorbed and excreted in the urine, and that the major portion of the color is excreted as metabolites in the feces. Allowable tolerances of these residues of FD&C Red No. 40 are exempted from the requirement of a tolerance when used as a dye, coloring agent (limits: not to exceed 0.002% by weight of pesticide formulation) in accordance with good agricultural practices as inert (or occasionally active) ingredients in pesticide formulations applied to growing crops or to raw agricultural commodities after harvest. FD&C Red No. 40 is exempted from the requirement of a tolerance when used as a dye, coloring agent (limits: for seed treatment use only; not to exceed 2% by weight of the pesticide formulation) in accordance with good agricultural practice as inert (or occasionally active) ingredients in pesticide formulations applied to growing crops only. FDA requires all batches of this color additive when used in

foods shall meet the specifications, uses and restrictions, and labeling regulations contained in 21 CFR Part 74 and be certified in accordance with regulations in 21 CFR Part 80. All batches of this color additive when used in drugs shall meet the specifications, uses and restrictions, and labeling regulations contained in 21 CFR Part 74 and be certified in accordance with regulations in 21 CFR Part 80. All batches of this color additive when used in cosmetics shall meet the specifications, uses and restrictions, and labeling regulations contained in 21 CFR Part 74 and be certified in accordance with regulations in 21 CFR Part 80. In an interaction study, the color and its alumina lake were applied to the subjects volar forearms (200 subjects) as an aqueous solution for 10 alternate days, for 24-hr periods, followed by a 14-day rest period. Challenge batches were then applied under occlusion to fresh skin sites on the subjects scapular backs for 24 hours. The color did not produce either irritation or allergic responses during the induction phase nor contact dermatitis in the challenge period. Allura Red and its lake were evaluated on sites under occlusion for five 48-hr, alternate-day periods. These sites had been previously irradiated for 5 min with Xenon light which had been filtered through a window-glass equivalent to limit the exposure to non-erythema-producing, long-wave radiation. A 10-day rest period followed this induction exposure, and then the color was applied to fresh skin sites, irradiated for 5 min with Xenon and subsequently removed and the sites were evaluated. Allura Red was shown not to produce photosensitization on the 25 subjects studied.

<http://pubchem.ncbi.nlm.nih.gov/compound/6093299>

Yellow No. 5 is also known as Tartrazine. It is a yellow colored food coloring, Tartrazine has E number 102 and is a very popular synthetic food dye. It is, also known as lemon yellow azo dye, a common food coloring that is used in a number of countries across the world. The color is also used with Brilliant Blue FCF and E142 Green S to produce different shades of blue and green. Apart from being a yellow 5 food coloring agent (FD&C yellow no 5 lake), tartrazine also finds uses in many other applications like medicinal capsules and syrups, cold, stored beverages, pudding, ice creams and other bakery products. Among other industries using tartrazine – the lemon yellow azo dye in cosmetics like soaps, shampoos, creams, etc. Tartrazine is a useful synthetic yellow food coloring. It finds use beyond the food industry as well. Tartrazine uses in the food industry are numerous though. The uses of tartrazine across the various industries. Confectionery products like cakes, cake mixes, puddings, pastries, jams, jellies, custards commonly use tartrazine yellow food coloring. Packed and canned foods like breakfast cereals, chips, packaged drinks and snacks like pies and puddings, candies and carbonated beverages also contain tartrazine. Pickles, rice, soups, cereals, yogurt, noodles, ice creams are some other foods that have tartrazine coloring content. It is found in cosmetics and beauty products like shampoos, conditioners, soaps, creams, moisturizers, hand sanitizers, etc. It is also used as synthetic yellow dye in medications like syrups, capsules, vitamins, etc. Even though tartrazine is used in so many commonly sold food products, it is not free of ill effects. Tartrazine causes a number of allergies, side effects and intolerance reaction. People with asthma and aspirin intolerances are majorly prone to the tartrazine allergies and harmful reactions. Symptoms that mark tartrazine allergies are indigestion, anxiety, migraine, clinical depression, weakness, patches on skin, sleeping disorders, vision disorders, etc. Tartrazine yellow 5 dye has also been responsible for hyperactivity in kids and associated with cases of thyroid cancer. Although tartrazine is mostly harmful, but sensitivity to its intolerance reactions might vary from individual to individual.

<http://www.foodadditivesworld.com/articles/tartrazine.html>

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. Laxatives: Usually used in constipation to eliminate the bowels. Excessive use can lead to dependency as well as kidney damage, damage to the large intestines which can cause bloating, diarrhea, constipation, and with straining the bowels it can result in hemorrhoids. Excessive use can lead to potentially fatal fluid and electrolyte imbalances as well as intestinal paralysis, IBS(irritable bowel syndrome), pancreatitis, renal failure, diarrhea and other problems. Chronic use causes the colonic tissues to get worn out over time and not be able to expel feces due to long-term stimulation. A common finding is a brown pigments deposited in the intestinal tissue known as melanosis coli. Some safe and effective ways to eliminate the bowels include; chiropractic adjustments to the pelvis, concentrating on the sacrum, dietary fiber like green leafy vegetables (kale, swiss chard, etc.), fruits, bran, nuts, beans, saline solutions, and exercise.
2. Antacids
3. Anticonvulsants

**You can do either D or E below**

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. Lipstick: lead acetate
2. Antiperspirants: aluminum chlorohydrate
3. Shaving Lotion: find a toxicant in the shaving lotion and discuss it

E. Sexual dysfunction therapy. A medication for hypoactive sexual arousal disorder recently was in the news. This medication, flibanserin, is being called a “female Viagra.”

- (a) Discuss the effect of the drug both at clinical and molecular level
- (b) Discuss alternative therapies, including those in chiropractic medicine

Flibanserin is classified as a 5-HT serotonin receptor agonist and a dopamine D4 receptor partial agonist. It is a Non-Hormonal agent that in essence increases dopamine and noradrenalin while reducing Serotonin in the brain. The benefits of it being Non-Hormonal are that it will not have the problems associated with other hormonal treatments such as negative altered mood. Side effects that were reported by some of the users were usually low to moderate. These were dizziness, anxiety, fatigue, dry mouth, insomnia, nausea. Not everyone who partook in the study had any of these but there were more occasions of these being reported compared to the placebo group and due to the fact that this compound is fairly new, there have not been nor could there have been any long term studies on side effects. Alternative therapies can include chiropractic adjustments to areas of the spine that are directly related to the reproductive system, which is the

sacral area. Over all, spinal adjustments along with eating healthy and thinking healthy, can help improve sexual desire as well as many other things. Acupuncture, massage, herbal supplements like ginseng can also help boost the sex drive.