

## Chemistry 100

### Study Guide for Exam 3 (Friday, November 7th)

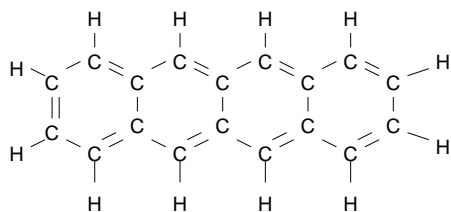
**Note: There will be no laboratory Friday after the exam.** The main topics to study for the exam, along with some previous exam questions are provided below.

#### Chapter 5

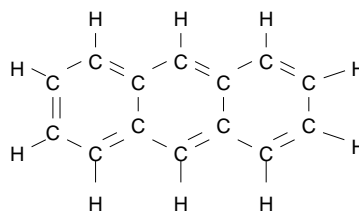
- electron configuration
- noble gas notation
- shells, subshells, orbitals
- black and white film, oxidation and reduction in this context
- free radicals, antioxidants (definitions, properties)
- UVA, UVB, sunscreens
- conjugation in organic compounds and absorption of light
- color and visible light absorption

#### Sample questions, Chapter 5

1. How many electrons are in the outer most shell of neon (Ne)?
2. What is the maximum number of electrons allowed in a p subshell?
3. Write out the full electron configuration of bromine (Br), with **and** without using the noble gas notation.
4. Write out the full electron configuration of a fluoride ion ( $F^-$ ), with **and** without using the noble gas notation.
5. What is the difference between UVA and UVB?
6. What is a free radical? Identify one chemical property of a free radical.
7. When silver bromide film is exposed to light,  $Ag^+$  ions are converted into silver metal. Is this oxidation or reduction?
8. AgBr is translucent. Why is it used in photography?
9. A green object is likely absorbing what color of visible light?
10. Which has more energy: a photon of red light or a photon of violet light?
11. Which has more energy: a photon of infrared light or a photon in the microwave range?
12. One of these molecules exists as a bright orange solid, the other molecule is a colorless solid. Which molecule is the highly colored one?

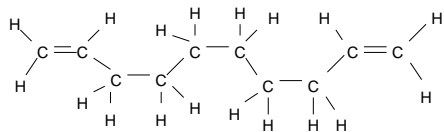
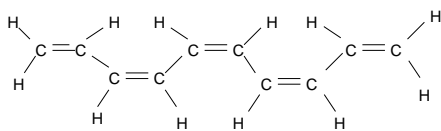


tetracene



anthracene

13. Which of the following molecules will absorb light of a longer wavelength?

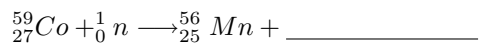


## Chapter 6

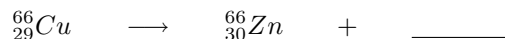
- isotopes, nuclear symbols, alpha and beta decay, nuclear equations
- half-lives
- primary sources of ionizing nuclear radiation exposure (natural and artificial)
- nuclear fission
- chain reaction
- power production from nuclear fission, composition of fuel pellets, fuel rods and control rods, role of coolant, how power is generated
- nuclear weapons, basic concepts, fuel composition
- physiological effects of radiation

Sample questions:

1. Pb-210 undergoes beta decay. Write a nuclear equation for this process.
2. U-234 undergoes alpha decay. Write a nuclear equation for this process.
3. Describe the process of nuclear fission using as much detail as possible. Include a description of initial and final materials, as well as energy released or absorbed.
4. Complete the following reaction:



5. Name two of the major natural sources of nuclear ionizing radiation humans experience on earth. These should be two of the four mentioned in class.
6. On average, which is the largest source of ionizing radiation exposure for someone in the U.S.?
7. Ionizing radiation is especially damaging to what kind of cells? (several answers possible)
8. Name two possible symptoms associated with a large, but non-lethal dose of ionizing radiation.
9. Complete the following nuclear equation:



10. Suppose that the radioactivity from Rn-222 in your basement was measured as 0.64 picoCuries. If no additional radon entered your basement, how much time would have to pass before the radiation level fell to 0.02 picoCuries? The half-life of Rn-222 is 3.8 days.
11. What is the isotopic concentration of natural uranium? Can this be used in power plants? Nuclear weapons?

**Chapter 7**

Chapter 7, sections 7.2 and 7.7 only. Material from lecture and in-class problems from 11/3 and 11/5.

- intermolecular forces: ion-dipole, dipole-dipole, hydrogen bonding, dipole-induced dipole, induced dipole-induced-dipole
- “like dissolves like”
- soap and detergents, how they remove grease and dirt from clothes
- hard water, hard water deposits, soap scum and effectiveness of detergents
- water softening

Sample questions:

1. Consider the molecules  $\text{CH}_2\text{Cl}_2$  and  $\text{CH}_2\text{F}_2$ . Both molecules are polar. Which would you expect to have the higher boiling point and why? (*hint: Consider electronegativity trends and types of interactions between molecules.*)
2. The compounds  $\text{C}_2\text{H}_6$  and  $\text{C}_8\text{H}_{18}$  are both nonpolar. The melting point of  $\text{C}_2\text{H}_6$  (ethane) is  $-172^\circ\text{C}$  and the melting point of  $\text{C}_8\text{H}_{18}$  (octane) is  $-57^\circ\text{C}$ . What accounts for this difference in melting points?
3. Why would  $\text{NH}_3$  have a higher boiling point ( $-33^\circ\text{C}$ ) than  $\text{PH}_3$  ( $-88^\circ\text{C}$ )?
4. Describe how soap works.
5. Which one of the following types of intermolecular force is the weakest: dipole-induced dipole, dipole-dipole, induced dipole-induced dipole, ion-dipole
6.  $\text{NH}_3$  is a polar molecule. Would you expect it to be soluble in water? Why or why not?