Exam 4

# Part 1: Multiple Choice (2 points each)

## Directions: Please circle the *best* answer for each of the following questions.

1. The radioactive decay of \_\_\_\_\_ is the single greatest source of human exposure to radiation.
   1. radon
   2. uranium
   3. ozone
   4. carbon
   5. thorium
2. The formula for an alkene is:
   1. CnH2n+2
   2. CnH2n
   3. CnH2n-2
   4. CnH2n-4
   5. CnH2n+4
3. Which compound is ethanol?
   1. C2H6
   2. C2H5OH
   3. CH3CO2H
   4. CH3CO2CH3
   5. CH3OCH3
4. What are the products of a hydrocarbon combustion?
   1. oxygen and carbon
   2. carbon and water
   3. oxygen and hydrogen
   4. carbon, oxygen and hydrogen
   5. carbon dioxide and water
5. Which nucleus is stable?
   1. Tin-118
   2. Po-212
   3. Cs-137
   4. P-30
   5. none of the above
6. The combination of two light nuclei to form a heavier nuclei is called \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.
   1. radioactive cleavage
   2. nuclear fusion
   3. nuclear fission
   4. radioactive merge
   5. half-life
7. Which of the following names are correct?
   1. 1,2-dimethylhexane
   2. 1-methylnonane
   3. 4,5-diethylpentane
   4. 2-methyl-3-propylhexane
   5. all of the above
8. Nuclides below the valley of stability can become more stable through which of the following processes?
   1. Neutron bombardment
   2. Electron capture
   3. Gamma emission
   4. Positron emission
   5. Beta emission
9. Give the maximum age that can be estimated from radiocarbon dating.
   1. 100,000 years
   2. 1,000,000 years
   3. 50,000 years
   4. 5,000 years
   5. 10,000 years
10. Incidents in the laboratory can be virtually eliminated if
    1. scientists take only known risks.
    2. scientists eliminate all possible hazards in a laboratory while still performing necessary experiments.
    3. risk assessment and risk management processes are carefully considered in all activities in the laboratory.
    4. scientists take only unknown risks.
    5. all of the above

# Part 2: Short Answer

## Directions: Answer each of the following questions. Be sure to use complete sentences where appropriate. For full credit be sure to show all of your work.

1. Explain why different kinds of radiation produce different effects in biological tissue, even though the amount of radiation exposure may be the same (4 points).

Different types of radiation have different ionizing power (gamma rays < beta particles ~ positrons < alpha particles) and different penetrating power (alpha particles < beta particles ~ positrons < gamma ray).

1. Are the following isotopes more likely to undergo fusion or fission (6 points)?
2. Hydrogen-1 \_\_\_\_\_\_\_\_\_\_fusion\_\_\_\_\_
3. Plutonium-241 \_\_\_\_\_\_\_\_\_\_fission\_\_\_\_\_
4. Helium-3 \_\_\_\_\_\_\_\_\_\_fusion\_\_\_\_\_
5. Hydrogen-3 \_\_\_\_\_\_\_\_\_\_fusion\_\_\_\_\_
6. Uranium-233 \_\_\_\_\_\_\_\_\_\_fission\_\_\_\_\_
7. Plutonium-239 \_\_\_\_\_\_\_\_\_\_fission\_\_\_\_\_
8. Bismuth-210 is a beta emitter with a half-life of 5.0 days (10 points).
9. Write the balanced nuclear reaction.
10. If a sample contains 1.2 g of Bi-210 (atomic mass = 209.984105 amu), how many beta emissions would occur in 13.5 days?

1.2 g – 0.18 g = 1.0 g Bi-210 decayed

1. If a person’s body intercepts 5.5% of those emissions, to what dose of radiation (in Ci) is the person exposed?
2. A 85.0 kg person is exposed to 169 rad of radiation. How many joules of radiation did this person absorb (5 points)?
3. PET studies require fluorine-18, which is produced in a cyclotron and decays with a half-life of 1.83 hours. Fluorine-18 decays by electron capture (6 points).
4. Write the balanced nuclear equation.
5. Assuming that fluorine-18 can be transported at 59.0 miles/hour, how close must the hospital be to the cyclotron if 68% of the fluorine-18 produced is to make it to the hospital?

Or

1. The mass of neutral is equal to 14.003074 atomic mass units. A single hydrogen atom (one proton plus one electron) has a mass of 1.007825 amu. A single neutron has a mass of 1.008665 amu. Recall that 1 MeV = 1.60 x 10-13 J and 1 amu = 1.6605 x 10-27 kg (12 points).
2. Calculate the mass defect of the nitrogen nucleus.
3. Calculate the binding energy of the nitrogen nucleus in MeV.

1. Calculate the binding energy per nucleon, MeV/nucleon.
2. An organic compound has a percent composition of 62.04% C, 10.41% H, and 27.55% O (12 points).
3. Determine the empirical formula.

The empirical formula is C3H6O.

1. Draw and name the two carbonyl containing compound(s). Straight-chain structures only.



1. Identify the structure(s) as aldehyde, ketone, carboxylic acid, or ester.
2. Why are there so many more carbon compounds than the number of compounds made up of all the rest of the elements combined (4 points)?

Carbon has the ability to form 4 bonds and is able to form a huge number of unique compounds with many other elements.

1. Salsa has antibacterial properties because it contains dodecental, a compound found in the cilantro used to make salsa (5 points).



* 1. How many carbon atoms are in dodecental? \_\_\_\_12
  2. What functional group(s) is present in dodecental? \_Alkene and aldehyde
  3. What types of isomerism are possible in dodecental?

Cis-trans isomerism and structural isomerism

1. Answer the following questions about the reaction of 2-pentyne and hydrogen gas (10 points).
2. Write the balanced chemical reaction.



1. What is the minimum amount of hydrogen gas, in grams, required to completely hydrogenate 13.6 kg of 2-pentyne?
2. Name or draw the following compounds (6 points):
3.  2-methyl-3-hexyne
4.  4-ethyl-3,3-dimethylheptane
5. 1-ethyl-3-methylcyclohexane 