Exam 4

# Part 1: Multiple Choice (2 points each)

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

1. Identify the instrument(s) used to detect radiation.
	1. Film-badge dosimeter
	2. Geiger-Müller counter
	3. Scintillation counter
	4. a and b
	5. all of the above
2. Define mass defect.
	1. The difference in mass between an atom and the sum of its separate components.
	2. An atom with too many neutrons.
	3. The difference in mass between a radioactive atom and a nonradactive atom.
	4. The energy released in a radioactive reaction.
	5. The energy absorbed in a radioactive reaction.
3. The following reaction represents what nuclear process? $+\rightarrow +$
	1. Nuclear fusion
	2. Alpha emission
	3. Beta emission
	4. Neutron emission
	5. Neutron capture
4. How many moles of aqueous ions will be produced from the dissolution of 1.0 moles of Na3[FeCl6] in water?
	1. 9.0 moles
	2. 4.0 moles
	3. 10.0 moles
	4. 2.0 moles
	5. 1.0 moles
5. Identify the structure that cis-trans isomerism can occur in.
	1. MA5B
	2. MAB
	3. MA3B3
	4. MA4B2
	5. MAB2
6. For an octahedral complex what metal d orbitals are directly towards the ligand?
	1. dxy, dxz
	2. dxy, dxz, dyz
	3. $d\_{z^{2}}, d\_{x^{2}-y^{2}}$
	4. $d\_{z^{2}}, d\_{xz}, d\_{yz}$
	5. none of the above
7. Name the following compound:
	1. 3-butyl-3-propyl-1-pentyne
	2. 3-butyl-3-propyl-4-pentyne
	3. 3-ethyl-3-propyl-1-heptyne
	4. 5-ethyl-5-propyl-6-heptyne
	5. 3-ethyl-3-butyl-1-hexne
8. Which of the following compounds exhibits geometric isomerism?
	1. CH2=CH-CH3
	2. CCl2=CBr2
	3. CH3CCl=CCl-CH3
	4. CBr2=CHBr
	5. all of the above
9. Choose the weak acid from the compounds below.
	1. CH3CH2NH2
	2. CH3CH2COOH
	3. CH3CH2OCH3
	4. CH3CH2I
	5. CH3SH
10. Which of the following is true regarding the state of a chemical as it is burning?
	1. Only liquids and gases can burn.
	2. Only liquids can burn.
	3. Only gases can burn.
	4. Solids, liquids, and gases can burn.
	5. When lighting a Bunsen burner turn on the gas first to avoid wasting matches.

# 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. Copper-64 is an unusual radionuclide in that it may undergo β decay, positron emission, or electron capture. What are the products of these decay processes (4 points)?
2. Fluorine-18 undergoes positron emission with a half-life of 1.10 × 102 minutes (10 points).
	1. Write the balanced decay reaction.
	2. If a patient is given a 248 mg dose for a PET scan, how long will it take for the amount of fluorine-18 to drop to 83 mg? (Assume that none of the fluorine is excreted from the body?
3. A person’s body generates about 0.20 µCi of radioactivity! Determine the total radioactivity emitted by 18 students in a lecture hall. (1 Ci = 3.7  1010 Bq and 1 Bq = 1 decay/s) (6 points)
4. Describe what is meant by the term "valley of stability" (4 points)?
5. Explain why the compounds of most of the first-row transition metals are colored (4 points).
6. For each species below complete the table (10 points):

|  |  |  |  |
| --- | --- | --- | --- |
|  | Name | Coordination Number of Central Atom | Geometry of Complex Ion |
| [Rh(NH3)5I]I2(Rh is rhodium) |  |  |  |
| [Au(CN)2]- |  |  |  |
| [Ni(H2O)2Cl2] (only one isomer) |  |  |  |

1. The drug Nipride, Na2[Fe(CN)5NO], is an inorganic complex used as a source of NO to lower blood pressure during surgery (10 points).
	1. The nitrosyl ligand in this complex is believe to be NO+ rather than neutral NO. What is the oxidation state of iron, and what is the systematic name for Na2[Fe(CN)5NO]?
	2. Draw a crystal field energy-level diagrams for [Fe(CN)5NO]2-, assign the electrons to orbitals, and predict the number of unpaired electrons.
	3. Is the complex paramagnetic or diamagnetic? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
	4. What is the hybridization on the central metal atom? \_\_\_\_\_\_
2. What is meant by the term "structural isomer"? Draw a structural isomer of

CH3-CH2-CH2-CH3 (4 points).

1. Determine the products of the following reaction (6 points):
	1. 
	2. CH3CH2CH2NH2 + HCl → ?
	3. CH3CH2COOH + CH3CH2CH2OH → ?
2. Identify each as a saturated or unsaturated hydrocarbon (5 points):
	1. Chlorobenzene \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
	2. Cyclobutene \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
	3. 3-methylhexane \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
	4. Propyne \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
	5. Ethanoic acid \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
3. 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? \_\_\_\_\_\_
	2. What functional group(s) is present in dodecental? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
	3. What types of isomerism are possible in dodecental? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
1. Draw a structure for each organic compound (12 points):
	1. 4,7-diethyl-2,2-dimethylnonane
	2. 3,3-dimethyl-1-pentyne
	3. Meta-dibromobenzene
	4. 2-butanol
	5. Triethylamine
	6. 4-heptanone