Exam 2

Part I: Multiple Choice (2 points each)

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

Question 1. All electromagnetic radiation travels at the same \_\_\_\_\_\_\_.

1. frequency
2. color
3. velocity
4. energy
5. wavelength

Question 2. Which of the following pairs of elements are likely to form ionic compounds?

1. magnesium and chlorine
2. helium and oxygen
3. nitrogen and oxygen
4. chlorine and bromine
5. sodium and potassium

Question 3. Electrons in an atom may only have certain energy. Because of this, the energy of the electrons in an atom is said to be

1. high
2. equivalent
3. stepped
4. quantized
5. neutral

Question 4. The ionization energy of chlorine is lower than the ionization energy of \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.

1. sodium
2. fluorine
3. calcium
4. lithium
5. boron

Question 5. Which of the following is not true about the chemical formula HC2H3O2, which is also sometimes written CH3COOH?

1. Named acetic acid.
2. May be classified as a carboxylic acid.
3. Has a molar mass of 60.05 g/mol
4. a and c
5. all of the above

Question 6. In any balanced chemical equation, the number of atoms on both sides of the equation is\_\_\_\_.

1. doubled
2. decreased by one
3. increased by one
4. dependent on temperature
5. the same

Question 7. One mole of particles of any substances contains how many particles?

1. 6.022 x 1023
2. 1
3. 6.0022 x 10-23
4. 1.661 x 10-24
5. 0

Question 8. In an amine functional group, the central atom is \_\_\_\_\_\_\_\_.

1. sulfur
2. hydrogen
3. oxygen
4. chlorine
5. nitrogen

Question 9. What do the ions Ca2+, K+, S2-, and Br- have in common?

1. They have the same atomic radius.
2. They have the same electron configuration.
3. They have nothing in common.
4. They are all cations.
5. They are all anions.

Question 10. In the chemistry laboratory, you should never

1. taste the reagents.
2. put your scoopula in the reagent bottles.
3. move the reagent bottles from their designated area.
4. put chemicals directly on the balance pan.
5. all of the above

Part II: 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.

Question 1. Name the following compounds (10 points)

|  |  |  |  |
| --- | --- | --- | --- |
|  | Cation name | Anion name | Compound name |
| Ba(NO3)2 | Barium ion | Nitrate ion | Barium nitrate |
| Fe(OH)3 | Iron(III) ion | Hydroxide ion | Iron(III) hydroxideFerric hydroxide |
| Ag2S | Silver ion | Sulfide ion | Silver sulfide |
| P2S3 |  |  | Diphosphorus trisulfide |

Question 2. Give the correct formula for the following compounds (10 points)

|  |  |  |  |
| --- | --- | --- | --- |
|  | Cation formula | Anion formula | Compound formula |
| Ammonium chloride | NH4+ | Cl- | NH4Cl |
| Lead(IV) sulfatePlumbic sulfate | Pb4+ | SO42- | Pb(SO4)2 |
| Aluminum oxide | Al3+ | O2- | Al2O3 |
| Tetrasulfur octabromide |  |  | S4Br8 |

Question 3. How do chemists explain the lines of color that are seen in the atomic spectra of the elements (3 points)?

The lines of color are caused by the energy released as electrons drop from higher energy levels down to lower energy levels. This energy is released as light of a specific wavelength (color).

Question 4. Determine whether each of the following equations is balanced. If it is not balanced, balance it (6 points).

1. SF4 (g) + 2 F2 (g) 🡪 SF6 (g)

SF4 (g) + ~~2~~ F2 (g) 🡪 SF6 (g)

1. CO (g) + 2 H2 (g) 🡪 CH3OH (l)

balanced

1. 2 KMnO4 (s) 🡪 K2MnO4 (s) + MnO2 (s) + O2 (g)

balanced

1. Mg (s) + N2 (g) 🡪 Mg3N2 (s)

3 Mg (s) + N2 (g) 🡪 Mg3N2 (s)

Question 5. Arrange the following elements in order of increasing metallic character: Fr, Sb, In, S, Ba, Se (6 points).

 S < Se < Sb < In < Ba < Fr

Question 6. Complete the following statements regarding oxygen (14 points).

a. Write the complete electron configuration for an oxygen atom. Then identify the core and valance electrons in an oxygen atom.

O: 1s22s22p4

 core valence

 b. Write the shorthand electron configuration for an oxygen atom.

 O: [He]2s22p4

 c. Write the shorthand electron configuration for an oxide ion.

 O2- : [He]2s22p6

d. Write the electron dot formula for the oxygen atom and the oxide ion.

 

Question 7. Draw the three p orbitals (3 points)

 

Question 8. Identify the functional groups in each of the following organic compounds (alkane, alkene, alkyne, arene, ether, amine, aldehyde, ketone, alcohol, carboxylic acid, ester, or amide) (5 points).

* 1.  \_\_\_\_\_\_\_alcohol\_\_\_\_\_\_\_\_\_\_\_
	2.  \_\_\_\_\_\_\_ester\_\_\_\_\_\_\_\_\_\_\_
	3.  \_\_\_\_\_\_\_\_alkene\_\_\_\_\_\_\_\_\_\_
	4.  \_\_\_\_\_\_\_aldehyde\_\_\_\_\_\_\_\_\_\_\_
	5.  \_\_\_\_\_\_\_carboxylic acid\_\_\_\_\_\_\_\_\_\_\_

Question 9. Answer the following questions about vanillin a phenolic aldehyde with a molecular formula of C8H8O3. Synthetic vanillin is often used as a flavoring agent in food, beverages and pharmaceuticals instead of natural vanilla extract (15 points).

1. Calculate the molar mass of vanillin, C8H8O3.

C: 8(12.01 g/mol) = 96.08 g/mol

H: 8(1.008 g/mol) = 8.064 g/mol

O: 3(16.00 g/mol) = 48.00 g/mol

 152.144 g/mol ≈ 152.14 g/mol

1. Calculate the mass of 5.28 moles of vanillin.

$$5.28 mol C\_{8}H\_{8}O\_{3}×\frac{152.14 g C\_{8}H\_{8}O\_{3} }{1 mol C\_{8}H\_{8}O\_{3}}=803 g C\_{8}H\_{8}O\_{3}$$

1. Calculate the number of molecules of vanillin in 78.4 moles of vanillin.

$78.4 mol C\_{8}H\_{8}O\_{3}×\frac{6.022 ×10^{23}molecules C\_{8}H\_{8}O\_{3}}{1 mol C\_{8}H\_{8}O\_{3}}=4.72×10^{25} molecules C\_{8}H\_{8}O\_{3}$

1. Calculate the number of atoms of carbon in 102 molecules of vanillin.

$$102 molecules C\_{8}H\_{8}O\_{3}×\frac{8 atoms C}{1 molecule C\_{8}H\_{8}O\_{3}}=816 atoms C$$

1. Calculate the number of molecules of vanillin in a bottle of vanilla containing 37.0 mg of vanillin.

$$37.0 mg C\_{8}H\_{8}O\_{3}×\frac{1 g C\_{8}H\_{8}O\_{3}}{1000 mg C\_{8}H\_{8}O\_{3}}×\frac{1 mol C\_{8}H\_{8}O\_{3}}{152.14 g C\_{8}H\_{8}O\_{3}}×\frac{6.022 ×10^{23}molecules C\_{8}H\_{8}O\_{3}}{1 mol C\_{8}H\_{8}O\_{3}}=1.46×10^{20} molecules C\_{8}H\_{8}O\_{3}$$

Question 10. Ethyl butanoate is a compound that contributes to the flavor of pineapple. It has a molecular formula of C6H12O2 (8 points).

* 1. Find the percent carbon from ethyl butanoate’s molecular.



* 1. Determine the empirical formula of ethyl butanoate.

C6H12O2 = (C3H6O)2

Empirical formula is C3H6O