

**Chem 111****10:10a section****Evening Exam #1**

This exam is composed of 20 questions, 6 of which require mathematics that might require a calculator. Go initially through the exam and answer the questions you can answer *quickly*. Then go back and try the ones that are more challenging to you and/or that require calculations.

*As discussed on the course syllabus, honesty and integrity are absolute essentials for this class. In fairness to others, dishonest behavior will be dealt with to the full extent of University regulations.*

$E = hv = \frac{hc}{\lambda}$ 1 mL = 1 cm <sup>3</sup>	<b>Some common ions:</b> PO <sub>4</sub> <sup>3-</sup> CN <sup>-</sup> CH <sub>3</sub> CO <sub>2</sub> <sup>-</sup> NO <sub>2</sub> <sup>-</sup> NO <sub>3</sub> <sup>-</sup> CO <sub>3</sub> <sup>2-</sup> SO <sub>3</sub> <sup>2-</sup> SO <sub>4</sub> <sup>2-</sup>	$h = 6.626 \times 10^{-34} \text{ J s}$ $c = \frac{2.998 \times 10^8 \text{ m}}{\text{s}}$ $N = \frac{6.022 \times 10^{23}}{\text{mol}}$
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1. What is the charge of ions formed from **F**?

- 1) +1                      2) +2                      3) -1                      4) -2                      5) -3

**(3) -1** (OWL question)

2. What is the charge of ions formed from **Be**?

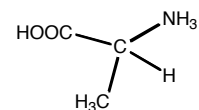
- 1) +1                      2) +2                      3) -1                      4) -2                      5) -3

**(2) +2** (OWL question)

3. The correct molecular formula for the molecule at right is:

- 1) C<sub>3</sub>O<sub>2</sub>NH<sub>8</sub>    2) C<sub>2</sub>ONH<sub>8</sub>    3) C<sub>3</sub>O<sub>2</sub>NH<sub>3</sub>    4) C<sub>3</sub>ONH<sub>3</sub>

**(1)**



4. Which of the following describes the compound **Ba(NO<sub>3</sub>)<sub>2</sub>**?

- 1) If the compound dissolved in water it would be a strong electrolyte.  
 2) The compound is ionic.  
 3) If the compound dissolved in water it would be a non-electrolyte.  
 4) The compound is molecular.  
 5) Both (1) and (2)

**(5)** (OWL question)

5.  $\text{K}_2\text{Cr}_2\text{O}_7$  is:

- 1) an element  
 2) an ionic compound  
 3) a nonionic compound  
 4) a homogeneous mixture  
 5) a heterogeneous mixture

(2) (OWL question)

6. What is the formula of the ionic compound expected to form between the elements **Cl** and **Mg**?

- 1)  $\text{MgCl}$       2)  $\text{Mg}_2\text{Cl}$       3)  $\text{Mg}_2\text{Cl}_3$       4)  $\text{Mg}_3\text{Cl}_2$       5)  $\text{MgCl}_2$

(5)  $\text{MgCl}_2 - \text{Mg}^{2+} + 2\text{Cl}^-$  (OWL question)

7. What is the formula of the compound formed between the ions  $\text{Co}^{3+}$  and  $\text{O}^{2-}$  ?

- 1)  $\text{CoO}$       2)  $\text{Co}_2\text{O}$       3)  $\text{Co}_2\text{O}_3$       4)  $\text{Co}_3\text{O}_2$       5)  $\text{CoO}_2$

(3)  $\text{Co}_2\text{O}_3 - 2\text{Co}^{3+} + 3\text{O}^{2-}$  (OWL question)

8. What is the formula of the compound formed between the ions  $\text{Co}^{2+}$  and  $\text{CN}^-$ ?

- 1)  $\text{CoCN}$       2)  $\text{Co}_2\text{CN}$       3)  $\text{Co}_2(\text{CN})_3$       4)  $\text{Co}_3(\text{CN})_2$       5)  $\text{Co}(\text{CN})_2$

(5)  $\text{Co}(\text{CN})_2 - \text{Co}^{2+} + 2\text{CN}^-$  (OWL question)

9. Which of the following is *not* an ionic compound?

- 1)  $\text{Ca}(\text{CH}_3\text{CO}_2)_2$     2)  $\text{NaCN}$       3)  $\text{CrO}$       4)  $\text{NO}_2$       5)  $\text{AgCl}$

(4)  $\text{NO}_2$  both N and O want to be negatively charged

10. What is the formula for the **hydrogen phosphate** ion ?

- 1)  $\text{H}_3\text{PO}_4$       2)  $\text{HPO}_4^{2-}$       3)  $\text{H}_2\text{PO}_4^-$       4)  $\text{H}_3\text{P}^-$       5)  $\text{HP}^{2-}$

(2)  $\text{HPO}_4^{2-}$  (OWL question)

11. What is the molar mass of **sulfur dioxide**?

- 1) 64 g/mol      2) 32 g/mol      3) 96 g/mol      4) 16 g/mol      5) 128 g/mol

(1)  $\text{SO}_2$   $1\left(32.07 \frac{\text{g}}{\text{mol}}\right) + 2\left(15.9994 \frac{\text{g}}{\text{mol}}\right) = 64.1 \frac{\text{g}}{\text{mol}}$  (OWL question)

12. Which of the following is a valid empirical formula?

- 1)  $\text{FeCl}_2$       2)  $\text{Fe}_2\text{Cl}_2$       3)  $\text{Fe}_4\text{Cl}_6$       4)  $\text{Fe}_6\text{Cl}_4$       5)  $\text{Fe}_4\text{Cl}_2$

(1)

13. A sample of cinnamaldehyde,  $C_9H_8O$ , contains 0.104 mol of the compound. What is the mass of this sample, in grams?

1) 3.02 g      2) 13.7 g      3) 27.4 g      4) 0.0730 g      5) 132 g

**First we need the molar mass of  $C_9H_8O$ :**

$$9(\text{molar mass of C}) + 8(\text{molar mass of H}) + 1(\text{molar mass of O}) =$$

$$9\left(12.011 \frac{\text{g}}{\text{mol}}\right) + 8\left(1.0079 \frac{\text{g}}{\text{mol}}\right) + 1\left(15.9994 \frac{\text{g}}{\text{mol}}\right) = 132.16 \frac{\text{g}}{\text{mol}}$$

**Use that to calculate the mass:**

$$(2) \quad (0.104 \text{ mol}) \left( \frac{132.16 \text{ g}}{\text{mol}} \right) = 13.7 \text{ g} \quad (\text{OWL question})$$

14. What is the (mass) percent composition of C in  $C_9H_8O$ ?

1) 9%      2) 50%      3) 61.2%      4) 81.8%      5) 30.6%

**Mass of C in 1 mol of the compound:**  $(9 \text{ mol})(12.01 \text{ g/mol}) = 108 \text{ g}$

**Mass of 1 mol of the compound:**

$$(1 \text{ mol}) \left[ 9\left(12.011 \frac{\text{g}}{\text{mol}}\right) + 8\left(1.0079 \frac{\text{g}}{\text{mol}}\right) + 1\left(15.9994 \frac{\text{g}}{\text{mol}}\right) \right] = 132.16 \text{ g}$$

$$(4) \text{ Percent composition: } \frac{108 \text{ g C}}{132 \text{ g } C_9H_8O} 100\% = 81.8\% \quad (\text{OWL question})$$

15. Ethylene glycol,  $C_2H_6O_2$ , is an ingredient in automobile antifreeze. Its density is  $1.11 \text{ g/cm}^3$  at  $20^\circ\text{C}$ . If you need exactly 500 mL of ethylene glycol, what mass of the compound, in grams, is required?

1) 555 g      2) 450 g      3) 1.80 g      4) 62.0 g      5) 68.6 g

$$(1) \quad 500 \text{ mL} \left( \frac{1 \text{ cm}^3}{1 \text{ mL}} \right) \left( \frac{1.11 \text{ g}}{\text{cm}^3} \right) = 555 \text{ g} \quad (\text{book question})$$

