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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.

$E = h\nu = \dfrac{hc}{\lambda}$ $1 \text{ mL} = 1 \text{ cm}^3$	**Some common ions:** PO_4^{3-} CN^- $CH_3CO_2^-$ NO_2^- NO_3^- CO_3^{2-} SO_3^{2-} SO_4^{2-}	$h = 6.626 x 10^{-34} \, J \, s$ $c = \dfrac{2.998 x 10^8 \, m}{s}$ $N = \dfrac{6.022 x 10^{23}}{mol}$

1. What is the charge of ions formed from **F**?

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

    (3) -1   (OWL question)
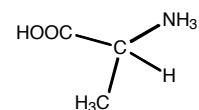
2. What is the charge of ions formed from **Be**?

    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) $C_3O_2NH_8$ 2) C_2ONH_8 3) $C_3O_2NH_3$ 4) C_3ONH_3

    (1)

4. Which of the following describes the compound **Ba(NO₃)₂**?

    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)

Name: _____

5. **$K_2Cr_2O_7$** is:

    1) an element   4) a homogeneous mixture

    2) an ionic compound   5) a heterogeneous mixture

    3) a nonionic compound

    (2)   (OWL question)

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

    1) $MgCl$ 2) Mg_2Cl 3) Mg_2Cl_3 4) Mg_3Cl_2 5) $MgCl_2$

    (5) $MgCl_2$ - Mg^{2+} + $2Cl^-$ (OWL question)

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

    1) CoO 2) Co_2O 3) Co_2O_3 4) Co_3O_2 5) CoO_2

    (3) Co_2O_3 - $2Co^{3+}$ + $3O^{2-}$ (OWL question)

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

    1) $CoCN$ 2) Co_2CN 3) $Co_2(CN)_3$ 4) $Co_3(CN)_2$ 5) $Co(CN)_2$

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

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

    1) $Ca(CH_3CO_2)_2$ 2) $NaCN$ 3) CrO 4) NO_2 5) $AgCl$

    (4) NO_2 both N and O want to be negatively charged

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

    1) H_3PO_4 2) HPO_4^{2-} 3) $H_2PO_4^-$ 4) H_3P^- 5) HP^{2-}

    (2) 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) SO_2 $1\left(32.07\,\dfrac{g}{mol}\right) + 2\left(15.9994\,\dfrac{g}{mol}\right) = 64.1\,\dfrac{g}{mol}$ (OWL question)

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

    1) $FeCl_2$ 2) Fe_2Cl_2 3) Fe_4Cl_6 4) Fe_6Cl_4 5) Fe_4Cl_2

    (1)

13. A sample of cinnamaldehyde, **C₉H₈O**, 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 C₉H₈O:

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

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

    Use that to calculate the mass:

    (2) $(0.104\,mol)\left(\dfrac{132.16g}{mol}\right) = 13.7g$ **(OWL question)**

14. What is the (mass) percent composition of **C** in **C₉H₈O**?

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

    Mass of C in 1 mol of the compound: $(9\,mol)(12.01g/mol) = 108g$

    Mass of 1 mol of the compound:

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

    (4) **Percent composition:** $\dfrac{108g\ C}{132g\ C_9H_8O}100\% = 81.8\%$ **(OWL**

    question)

15. Ethylene glycol, **C₂H₆O₂**, is an ingredient in automobile antifreeze. Its density is 1.11 g/cm³ at 20°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) $500mL\left(\dfrac{1cm^3}{1mL}\right)\left(\dfrac{1.11g}{cm^3}\right) = 555g$ **(book question)**

16. You've decided you don't like Chemistry after all and have decided to travel Europe instead. You're driving a rental car through France and see petrol selling at 0.61 euros per liter.

    How much does petrol cost in U.S. dollars per gallon?

    1) $2.77/gal   2) $0.69/gal   3) $2.44/gal   4) $3.15/gal   5) $4.72/gal

    (4) $$\left(\frac{0.61\,euro}{Liter}\right)\left(\frac{1.0\$}{0.88\,euro}\right)\left(\frac{4.546L}{gallon}\right) = \$3.15\Big/gallon$$

17. Which radiation below has the longest wavelength (don't use your calculator!)?

    1) blue light (6.8×10^{14} Hz)   4) microwaves (2.4×10^{9} Hz)
    2) green light (6.0×10^{14} Hz)   5) x-rays (5.0×10^{12} Hz)
    3) red light (4.5×10^{14} Hz)

    (4) It has the lowest frequency.   Remember that $\lambda = c\Big/\nu$

18. Which radiation below has the lowest energy (don't use your calculator!)?

    1) blue light (6.8×10^{14} Hz)   4) microwaves (2.4×10^{9} Hz)
    2) green light (6.0×10^{14} Hz)   5) x-rays (5.0×10^{12} Hz)
    3) red light (4.5×10^{14} Hz)

    (4) It has the lowest frequency.   Remember that $E = h\nu$

19. What is the wavelength of visible light with frequency 6.00×10^{14} Hz?

    1) 614 nm   2) 300 nm   3) 500 nm   4) 162 nm   5) 280 nm

    (3) $$\lambda = \left(\frac{2.9998 \times 10^{8}\,m}{s}\right)\left(\frac{1}{6.00 \times 10^{14}\,Hz}\right)\left(\frac{Hz}{1}\frac{s}{1}\right) = 5.00 \times 10^{-7}\,m$$

    $$= 5.00 \times 10^{-7}\,m\left(\frac{10^{9}\,nm}{m}\right) = 500\,nm$$

    (OWL question)

20. What is the catalog number for this class?

    1) 241   2) 111   3) 222   4) 3.14159   5) 68.6 g

    (2)