Have all supplementary information easily accessible: equations, constants, data tables, periodic table, etc...

1. Name the following compound:
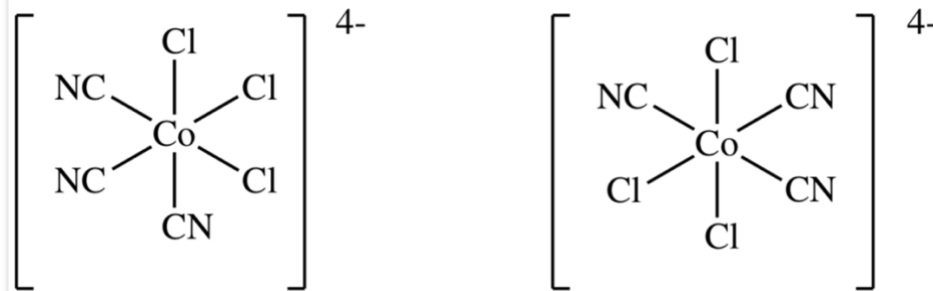
$[Co(NH_3)_6]Cl_2$

_____

hexaaminecobalt(II) chloride

_____

2. What is the formula for the pentaaquahydroxoiron(III) ion?

$[Fe(H_2O)_5OH]^{2+}$

3. The two compounds are ____mer/fac_____ isomers.

4.

> What is the resulting pH of a solution made by mixing 10.0 mL of an HCl(aq) solution having a pH of 1.00 with 10 mL of an HCl(aq) solution having a pH of 5.00?

For solution with pH = 1.00

$pH = 1.00$ thus $[H_3O^+] = 10^{-pH} = 10^{-1.00} = 0.100\,M = \dfrac{0.100\,moles}{L}$

$10.0\,mL\left(\dfrac{1\,L}{1000\,mL}\right)\left(\dfrac{0.100\,moles}{L}\right) = 0.00100\,moles$

For solution with pH = 5.00

$pH = 5.00$ thus $[H_3O^+] = 10^{-pH} = 10^{-5.00} = 0.0000100\,M = \dfrac{0.0000100\,moles}{L}$

$10.0\,mL\left(\dfrac{1\,L}{1000\,mL}\right)\left(\dfrac{0.0000100\,moles}{L}\right) = 0.000000100\,moles$

Total number of moles of $H_3O^+ = 0.00100\,moles + 0.0000000100\,moles \approx 0.00100\,moles$

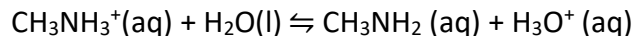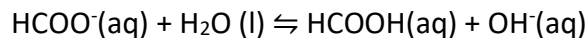$[H_3O^+]$ in mixed solution $= \dfrac{0.00100\,moles}{20.0\,mL}\left(\dfrac{1000\,mL}{L}\right) = 0.0500\,M$

$pH = -log(0.0500\,M) = 1.300$

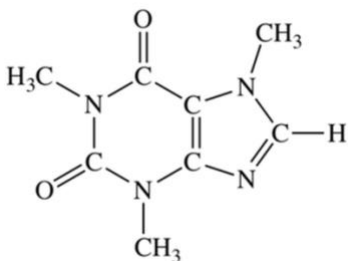5. Identify each of the following aqueous salt solutions as acidic, basic, or neutral.

KBr   LiHCOO CH_3NH_3Cl
Neutral.   Basic   acidic

If acidic or basic, write out the corresponding hydrolysis reaction with water.
$HCOO^-(aq) + H_2O (l) \leftrightharpoons HCOOH(aq) + OH^-(aq)$
$CH_3NH_3^+(aq) + H_2O(l) \leftrightharpoons CH_3NH_2 (aq) + H_3O^+ (aq)$

6. Consider the following compound.

    a) Is the compound a Bronsted-Lowry acid or a base?
    b) How many pi bonds are there? 4
    c) What is the molecular geometry around the top left nitrogen atom? Trigonal pyramid
    d) What is the molecular geometry around the bottom right nitrogen atom? bent
    e) Describe how the C=N double bond is formed. Short sentences will suffice (no sketch
    needed!). Hybridize both C and N.   sigma bond: $C(sp^2) - N(sp^2)$ pi bond: $C(2p) - N(2p)$

7. Draw the Lewis structure of the $[CNO]^{1-}$ ion, where the following formal charges are
observed: C (-2), N (+1), O (0)
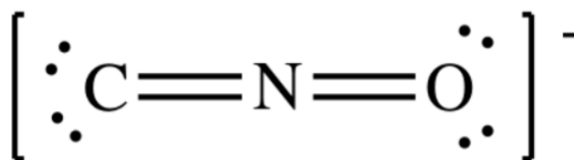
8.

An infant acetaminophen suspension contains 80 mg/0.80 mL suspension. The recommended does is 15 mg/kg body
weight. How many mL of this suspension should be given to an infant weighing 14 lbs?

14 lbs body wt x (0.454 kg / lbs) = 6.356 kg body wt

6.356 kg body wt x (15 mg/kg body wt) x (0.80 mL suspension / 80 mg) = 0.95 mL
suspension

9.

A combustion analysis of a 0.44g sample of an unknown compound yields 0.88 g CO_2 and 0.36 g H_2O. If the sample has a molar mass of 132 g/mol, what is the molecular formula of the sample?

$0.88 \text{ g } CO_2 \times \frac{1 \text{ mol } CO_2}{44.01 \text{ g } CO_2} \times \frac{1 \text{ mol C}}{1 \text{ mol } CO_2} = 0.020 \text{ mol C}$

$0.36 \text{ g } H_2O \times \frac{1 \text{ mol } H_2O}{18.02 \text{ g } CO_2} \times \frac{2 \text{ mol H}}{1 \text{ mol } H_2O} = 0.040 \text{ mol H}$

$0.020 \text{ mol C} \times \frac{12.01 \text{ g C}}{1 \text{ mol C}} = 0.24 \text{ g C}$

$0.040 \text{ mol H} \times \frac{1.01 \text{ g H}}{1 \text{ mol H}} = 0.040 \text{ g H}$

0.44 total grams $-$ 0.24 g C $-$ 0.04 g H $=$ 0.16 g

$0.16 \text{ g O} \times \frac{1 \text{ mol O}}{16.00 \text{ g O}} = 0.010 \text{ mol O}$

$\frac{0.02}{0.01} = 2 \text{ mol C}$

$\frac{0.04}{0.01} = 4 \text{ mol H}$

$\frac{0.01}{0.01} = 1 \text{ mol O}$

The molar mass of the empirical formula is 2 x 12.01 + 4 x 1.01 + 16.00 = 44.06 g/mol. 132/44.06 = 3, so the subscripts must be multiplied by 3.
So the formula is C6H12O3.

10.

Calculate the wavelength (in meters) of a 143 g baseball thrown at a speed of 95 miles per hour.

95 miles/hr x 1km/0.6214 miles x 10^3m/1km x 1 hr/3600 s = 42.4668311 m/s

$\lambda = h/mv = h/0.143$ kg x 42.4668311 m/s = 1.1 x 10^{-34} m

11. List all 4th period elements that are diamagnetic.   Ca, Zn, Kr

12. Arrange the following elements by atomic size, with the largest listed first from left to right.
Rb Ca Ge Si S F

13. Find the velocity (in m/s) of an electron emitted by a metal whose threshold frequency is 2.25 x 10^{14} s^{-1} when it is exposed to visible light of wavelength 5.00 x 10^{-7} m.

$\frac{1}{2} m_e v^2 = h\nu - \phi = hc/\lambda - h\nu$

$\frac{1}{2}$ x (9.101 x 10^{-31} kg)v^2 = h(c/5.00x10^{-7}m $-$ 2.25 x 10^{14} s^{-1})

v = 7.39 x 10^5 m/s

14. What is the atomic number of the yet undiscovered element where the 8s and 8p electron energy levels completely fill?

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[Rn]$7s^2 5f^{14} 6d^{10} 7p^6 8s^2 6f^{14} 7d^{10} 5g^{18} 8p^6$