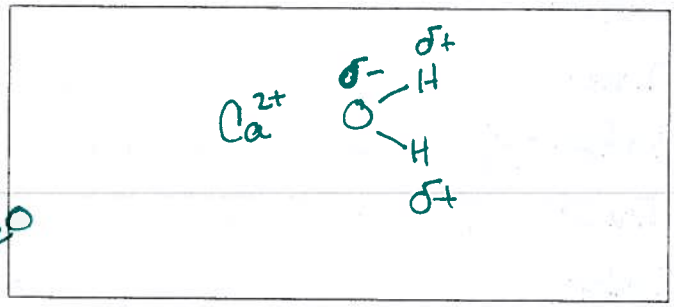
name Key

University of Louisville **Chem 201 Exam 2** **Dr. Hoyt** **Fall 2013**

Scored grade (instructor use only!) 75

1. [3 pts] In the space provided, draw a simple sketch showing the interaction between an aqueous calcium ion and a water molecule. Represent charges accurately.



-1: wrong charge on Ca^{2+}
ionic charge on O or H
wrong struct/formula for H_2O
wrong charge dist
+...+ or −...−
attraction represented as covalent bond

2. [2 pts each] Give the correct **oxidation number** for each requested atom.

**S in H_2S_3 $-2/3$ (+1 −⅔ / +2 −2)

C in methane -4 (CH_4, −4 +1)

**Se in $CaSeO_3$ $+4$ (Ca^{2+} SeO_3^{2-}, +4 −2 2− / +4 −3)

3. Complete each reaction and write the **balanced net ionic** equations in the boxes provided.

**a. [10 pts] ammonia (aq) + hydrofluoric acid (aq) → ???

$NH_3(aq) + HF(aq) \rightarrow NH_4^+(aq) + F^-(aq)$

reminder: net ionic?

**b. [10 pts] mercury(II) perchlorate (aq) + potassium sulfide (aq) → ???

(8) $Hg(ClO_4)_2 + K_2S \rightarrow HgS + 2KClO_4$

$Hg^{2+} + S^{2-} \rightarrow HgS$

reminder: net ionic?

4. **(a) [5 pts] Balance the following redox reaction, occuring in aqueous solution. We'll grade the answer in the box.

(work space:)

$2e^- \times 2 = 4e^-$

$\underline{2}\ HNO_2 + \underline{2}\ H^+ + \underline{2}\ Cl^- \rightarrow \underline{\ }\ N_2O + \underline{\ }\ H_2O + \underline{2}\ HClO$

(+3, −1, +1, +1)

$2e^- \times 2 = 4e^-$

(1) point each element, (1) point charge balance

(final answer:)

$\underline{2}\ HNO_2 + \underline{2}\ H^+ + \underline{2}\ Cl^- \rightarrow \underline{\ }\ N_2O + \underline{\ }\ H_2O + \underline{2}\ HClO$

(b) [2 pts each] In the above reaction, what is:

the element oxidized? Cl (1) Cl^-

the oxidizing agent? HNO_2 (1) N

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5. [26 pts] **Clearly** indicate whether each statement is TRUE or FALSE.

False **H_2O never appears in a net ionic equation.

True Strong acids are molecular compounds, but they dissociate completely in aqueous solutions.

False ~~All~~ ionic compounds are strong electrolytes. only if soluble

True **In a redox reaction, the oxidant is reduced. true

False In a solution of Na_2SO_4, most of the Na_2SO_4 ~~molecules~~ remain intact; ~~only a small fraction are dissociated.~~ all ions are dissociated

True In a solution of Na_2SO_4, there are twice as many cations as anions. $Na_2SO_4 \rightarrow 2Na^+ + SO_4^{2-}$

True In a solution of HClO, most of the molecules remain intact; only a small fraction are dissociated. → weak acid

True The name of HClO is hypochlorous acid. from hypochlorite ion

false HClO is composed of H^+, Cl^- and O^{2-} ions. molecular; and even when dissociated, forms H^+ and ClO^-

true **A limiting reagent is used up completely during a reaction.

false CO_2 is always a product in a combustion reaction. only if reactant contains C

false Oxidation numbers must be integers. can have fractional values

False The ~~product~~ that is produced in the smallest amount is the limiting reactant. Reactant used up first

6. [6 pts] Circle the compounds below that are **soluble in water.

K_3PO_4 $Al(OH)_3$ CaC_2O_4 NH_4HS $CuClO_4$ HBr

K^+ compounds NH_4^+ compounds ClO_4^- compounds acids

**7. [5 pts] $S_4N_4 + 4\,AgO \rightarrow 4\,AgS + 4\,NO$ → $\frac{14.01}{16.00}$ g/mol

The equation above is balanced. The reaction is conducted beginning with 26.37 g S_4N_4 (molar mass 184.3 g) and 69.23 g AgO (molar mass 123.9 g). How many grams of NO can be made? SHOW YOUR WORK below and write your answer in the space provided.

$26.37\,g\,S_4N_4 \times \frac{mol}{184.3\,g} \times \frac{4\,mol\,NO}{1\,mol\,S_4N_4} \times \frac{30.01\,g\,NO}{mol\,NO} = 17.18\,g$

$69.23\,g\,AgO \times \frac{mol}{123.9\,g} \times \frac{4\,mol\,NO}{4\,mol\,AgO} \times \frac{30.01\,g\,NO}{mol\,NO} = 16.77\,g$

answer: 16.77 g NO (4 s.f.)