40
43
17
100

name Key

Scored grade (instructor use only!) 100

1. Write **balanced, net ionic chemical equations**, with appropriate **phase labels**, for the following reactions. In both cases, you may use as much scratch space as you need, but write your final answer **legibly** in the box.

a. [10 pts] The reaction of **aqueous silver nitrate and aqueous zinc bromide.

Ch 11 #7 $AgNO_3$ $ZnBr_2$

Undissoc: $2\,AgNO_{3(aq)} + ZnBr_{2(aq)} \rightarrow 2AgBr_{(s)} + Zn(NO_3)_{2(aq)}$

Dissoc/ionic: $2Ag^+_{(aq)} + 2NO_3^-{}_{(aq)} + Zn^{2+}_{(aq)} + 2Br^-_{(aq)} \rightarrow 2AgBr_{(s)} + Zn^{2+}_{(aq)} + 2NO_3^-{}_{(aq)}$

net ionic: $Ag^+_{(aq)} + Br^-_{(aq)} \rightarrow AgBr_{(s)}$ *(remember to give net ionic, balanced rxn, and include phase labels.)*

10

b. [10 pts] The reaction of **aqueous sodium hydroxide and aqueous chlorous acid.

Ch 12 #7 $NaOH$ ← strong base $HClO_2$ ← weak acid ← from chlorite ion ClO_2^-

undissoc: $NaOH_{(aq)} + HClO_{2(aq)} \rightarrow NaClO_{2(aq)} + H_2O_{(l)}$

dissoc/ionic: $Na^+_{(aq)} + OH^-_{(aq)} + HClO_{2(aq)} \rightarrow Na^+_{(aq)} + ClO_2^-{}_{(aq)} + H_2O_{(l)}$

net ionic: $OH^-_{(aq)} + HClO_{2(aq)} \rightarrow ClO_2^-{}_{(aq)} + H_2O_{(l)}$ *(remember to give net ionic, balanced rxn, and include phase labels.)*

-2 if dissoc. (treated as strong)

10

2. [2 pts each] Give the correct **oxidation number** for **sulfur** in each chemical species below.

$CaSO_4$ (+2 +6 −8 = 0) calcium sulfate +6

SCl_4 (+4 −1) sulfur tetrachloride +4

Ch 13 #2 $S_4O_3^{2-}$ (+1 −2; $S_4O_3^{2-}$) +1

S_8 0

H_2S (+1 −2) hydrogen sulfide −2

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3. [2 pts each]

**(a) give the formula of hydrofluoric acid: HF

Ch 12 #3

(b) give the formula of sodium hydrogen sulfite: $NaHSO_3$

(c) give the name of HNO_2: nitrous acid

Ch 12 #4

(d) give the name of H_3PO_4: phosphoric acid

(e) give an example of an amphoteric species: H_2O, HCO_3^-, HSO_3^-, HS^-, HPO_4^{2-}, others

10

40

name Key

Ch 14 #1

4. **(a) [5 pts] Balance the following redox reaction, occurring in aqueous solution. We'll grade the answer in the box, so make sure it's clearly legible.

(work space:) $\underline{2}\ H^+ + \underline{2}\ Cl^- + \underline{2}\ HNO_2 \rightarrow \underline{2}\ HClO + \underline{\ }\ N_2O + \underline{\ }\ H_2O$

(-1 → +1: 2e⁻; +3 → +1: 2 x 2 atoms = 4 e⁻)

① point per element
① point for charge balance

5

(final answer:) $\underline{2}\ H^+ + \underline{2}\ Cl^- + \underline{2}\ HNO_2 \rightarrow \underline{2}\ HClO + \underline{(1)}\ N_2O + \underline{(1)}\ H_2O$

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

4

the element reduced? N the reducing agent? Cl^-

**Ch 11 #4&5

5. (a) [6 pts] In the list below, circle all substances that are INSOLUBLE in aqueous solution.

6

K_3PO_4 (↑ soluble) $Al(OH)_3$ (rule 7) $CuCl$ (rule 3) CaC_2O_4 (rule 6) $AgBr$ (rule 3) MoO_3 (rule 6)

(b) [6 pts] In the list below, circle all substances that are strong electrolytes.

6

HF (weak acid) ammonia (weak base) $AgClO_4$ (soluble ionic) potassium hydroxide (soluble ionic) H_2O (molec.) CO_2 (molec.)

(c) [6 pts] In the list below, circle all substances that would react with acids to form gaseous products.

6

$K_2C_2O_4$ $CaCO_3$ (carbonate) $NaHSO_3$ (hydrogen sulfite) LiOH $(NH_4)_2SO_4$ ammonia

6. [2 pts each] **Clearly** label each statement as TRUE or FALSE. If we can't tell which you mean, it's wrong.

false **Only ionic compounds can dissociate in water. (Ch 10 #1) acids can also dissociate

false **A nonelectrolyte dissociates completely when dissolved in water. (Ch 10 #1) nonelectrolytes don't dissociate

16 True **If a reaction is done at stoichiometric amounts of all reactants, then no reactant is in excess. (Ch 8 #1)

true Strong acids are strong electrolytes.

false **H^+ is always a spectator ion in an acid/base reaction. (Ch 12 #1) ~~always~~ never

false H_2O is always a product in an acid/base reaction. e.g. $HCl + NH_3 \rightarrow NH_4^+ + Cl^-$

false CH_3OH is a strong base. molecular – doesn't dissoc.

true In a balanced reaction, the total charge must be the same in the reactants and products.

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Ch. 9 #4

name Key

**7. [5 pts] You need to prepare 150.0 mL of 2.7 M potassium nitrate. How many grams of potassium nitrate are needed? SHOW YOUR WORK below and write your final answer in the space.

KNO_3 39.10 + 14.01 + 48.00 = 101.11 g/mol

$150.0\,mL \times \frac{L}{1000\,mL} \times \frac{2.7\,mol}{L} \times \frac{101.11\,g}{mol} = 40.95\,g$

Answer: 41 g (2 s.f.)

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8. The following equation is balanced.

$$S_4N_4 + 4\ Ag_2O \rightarrow 4\ Ag_2S + 4\ NO$$

Ch. 8 #2

**(a) [5 pts] The reaction is conducted beginning with 26.37 g S_4N_4 and 69.23 g Ag_2O. How many grams of NO can be made? SHOW YOUR WORK below and write your final answer in the space.

$26.37\,g\ S_4N_4$ (excess) $\times \frac{mol\ S_4N_4}{184.32\,g} \times \frac{4\,mol\ NO}{1\,mol\ S_4N_4} \times \frac{30.01\,g\ NO}{mol} = 17.174\,g$

$69.23\,g\ Ag_2O$ (limiting) $\times \frac{mol\ Ag_2O}{231.8\,g} \times \frac{4\,mol\ NO}{4\,mol\ Ag_2O} \times \frac{30.01\,g\ NO}{mol\ NO} = 8.9629\,g$ ← less → max theor. yd.

Answer: 8.963 g NO (4 s.f.)

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(b) [4 pts] After the reaction described above, 6.90 g of NO are actually recovered. What is the percent yield in this experiment? SHOW YOUR WORK and write the answer in the space.

$\%yd = \frac{actual}{theor} \times 100 = \frac{6.90\,g}{8.963} \times 100 = 76.98\%$

Answer: 77.0 % (3 s.f.)

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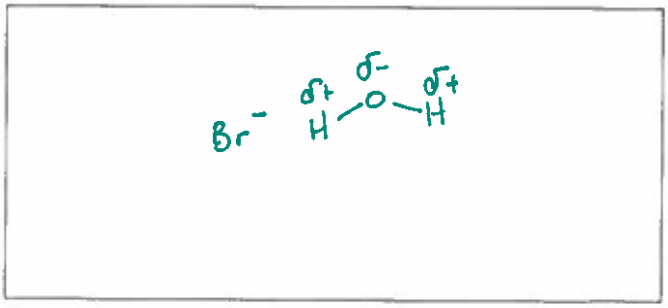
9. [3 pts] In the space provided, draw a simple sketch showing the interaction between an aqueous bromide ion and a water molecule. Represent relevant charges accurately.

Br^-



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