Exam 1

Name: _________________________________________________________________

**Remember:**

- You can use notes on one side of one sheet of paper.

- A periodic table is provided.

- Turn the note sheet in with your quiz. Label it with your name.

- Significant figures will be included in points for each numerical problem.

- Point values for each question appear in parentheses in the margins. The total points for the exam is 100.

*My signature below means that I agree to uphold the Honor Principle in taking this exam.*

Signature: ____________________________________________________________________

*Please wait to start your quiz until everyone is seated and the instructor tells you to begin.*

*Good Luck!*

For graders’ use only: ___________
1. Vinegar is a dilute solution of the weak acid, acetic acid, CH₃COOH. In solution, acetic acid partially dissociates to form acetate ion, CH₃COO⁻ and H⁺ ion:

\[ \text{CH}_3\text{COOH} \rightleftharpoons \text{CH}_3\text{COO}^- + \text{H}^+ \]

Typically, vinegar is 3 to 5% acetic acid, by mass, with the remaining mass being the solvent. Vinegar has a density the same as water, 1.00 g/mL at 25 °C. To determine the concentration of acetic acid in a vinegar sample more accurately, it is titrated with NaOH solution. A 10.00 mL sample of Progresso Red Wine vinegar is titrated with 0.309 M NaOH solution. 19.57 mL of NaOH are required to reach the stoichiometric endpoint.

(4) Write the balanced chemical equation for the titration reaction and label the acid, base, and salt that appear.

(4) Write the net ionic equation for this reaction and list the spectator ions.

(4) What is the molarity of the Progresso Red Wine vinegar, according to the results of the titration?

(4) What is the mass % of acetic acid in the sample of Progresso Red Wine vinegar that was titrated? Is Progresso Red Wine Vinegar in the typical range?
1. CONTINUED…

(4) After the titration, the flask contains a solution of sodium acetate, Na\textsubscript{CH}_{3}\textsubscript{COO}. What is the concentration of this solution?

(4) If all the water were evaporated, what mass of Na\textsubscript{CH}_{3}\textsubscript{COO} would remain in the flask?

(4) What would you observe, if you measured the conduction of electricity through the solution before and after the titration? Circle the correct qualitative comparison between the conductivity before and after reaction.

- Conductivity is zero before and zero after titration
- Conductivity is low before and zero after titration
- Conductivity is high before and zero after titration
- Conductivity is zero before and low after titration
- Conductivity is low before and low after titration
- Conductivity is high before and low after titration
- Conductivity is zero before and high after titration
- Conductivity is low before and high after titration
- Conductivity is high before and high after titration

For graders’ use only: __________
2. Choose ONE of the following chemical equations. Balance the equation below. At the bottom of the page, fill in the information about species being oxidized, species being reduced, and oxidation numbers.

CHOOSE ONE!

\[
\text{NiS (s) + NO}_3^- (aq) + H_3O^+ (aq) \rightarrow Ni^{2+} (aq) + S (s) + NO (g)
\]

\[
\text{Mn}^{2+} (aq) + HBiO_3 (aq) + H_3O^+ (aq) \rightarrow MnO_4^- (aq) + Bi^{3+} (aq)
\]

\[
\text{N}_2\text{H}_4 (aq) + CO_3^{2-} (aq) \rightarrow N_2 (g) + CO (aq) + OH^- (aq)
\]

BALANCE YOUR CHOICE HERE

(15)

Species being oxidized: _________ oxidation # before reaction: _________

after reaction: _________

Species being reduced: _________ oxidation # before reaction: _________

after reaction: _________

For graders’ use only: _________
3. Circle the correct response for each item. There may be MORE THAN ONE correct choice, so look closely and evaluate each choice carefully.

(3 each)

The most electronegative atom

P    O    In    K    Ge

The most polar bond

H-H    H-F    F-F    O-F    H-I

The bond with the highest bond energy

N≡N    N-N    N=N

The species with S in the highest oxidation state

S_8    SO_4^{2-}    S^{2-}    SO_2

The substance with the greatest % oxygen, by mass

CO_2    H_2O    CaCO_3

The sample(s) with the greatest mass of hydrogen

10 g H_2O    10 moles H_2    10 moles H_2O    10 g H_2

The bond with the greatest ionic character

K-I    I-I    I-F    I-H

The ionic compound(s)

CH_4    NaHCO_3    H_2O    AgCl    PbCrO_4

Bond with the shortest bond length

C-C    C=O    C≡C

For graders’ use only: ___________
4. Draw Lewis structures, following the instructions for parts A and B. Show all important resonance structures and label each atom with its formal charge.

(15) Part A: Pick FIVE

$\text{I}_3^-$

$\text{CO}_2$

$\text{SO}_4^{2-}$

$\text{H}_3\text{O}^+$

$\text{XeF}_4$

$\text{BF}_3$
4. CONTINUED….Draw Lewis structures, following the instructions for parts A and B. Show all important resonance structures and label each atom with its formal charge.

(15) Part B: Pick THREE

\[ \text{CO}_3^{2-} \]

\[ \text{O}_3 \]

\[ \text{NO}_3^- \]

\[ \text{NCO}^- \]