2005 CLEARVIEW, OHIO, INVITATIONAL **ANSWER KEY**

SCHOOL NAME _____ TEAM NUMBER _____

PART I: **MULTIPLE CHOICE QUESTIONS:**

1. ___E___	5. ____B____	9. ___A___	13. __C___	17. ___A___
2. ___I____	6. ____D____	10. ___D___	14. __A___	18. ___C___
3. ___C___	7. ____J___	11. ___E__	15. __C___	19. ___A___
4. ___D___	8. ____E__	12. ___C__	16. __A___	20. ___D___

PART II: **LAB SIMULATION #1: COPPER RECYCLING**!

Q1. What substance is being oxidized? Cu

Q2. What substance is being reduced? HNO_3 or NO_3^{-1} or Nitrogen (N)

Q3. Write the balanced oxidation half reaction in acidic solution:
(use of (aq, s, l) consistently is Tie Breaker)

$Cu(s) \text{ ------> } Cu^{+2}(aq) + 2\ e^-$

Q4. Write the net ionic balanced reduction half reaction in acidic solution:

$NO_3^{-1}(aq) + e^{-1} + \ 2H^{+1}(aq) \text{----> } NO_2(g) + H_2O\ (l)$

Q5. Write the balanced overall net ionic equation for this reaction.

$Cu\ (s) + 4\ H^{+1} + 2\ NO_3^{-1}(aq) \text{ --> } Cu^{+2}(aq) + 2\ H_2O\ (l) + 2\ NO_2\ (g)$

Q6. Write the balanced net ionic equation for this reaction.

$Cu^{+2}(aq) + 2\ OH^{-1}(aq) \text{ --> } Cu(OH)_2(s)$

Q 7: What spectator ions was/were removed when the sample was washed?

Na^{+1} and NO_3^{-1}

Q 8: What does the term "decanted" mean? To pour off the liquid from a solid sample (the supernatant liquid)

Q. 9: What is the net ionic reaction for this step in the procedure?

$CuO(s) + H^{+}(aq) + HSO_4^{-1}(aq)$ -------> . $Cu^{+2}(aq) + SO_4^{-2}(aq) + H_2O(l)$ (TB #2)

[Reactions using $2H^{+}(aq) + SO_4^{-2}(aq)$ also accepted but will lose the TB]

Q.10: Write the balanced net ionic redox equation for the formation of the pure copper.

$Cu^{+2}(aq) + Zn(s)$ ---------> $Zn^{+2}(aq) + Cu(s)$

Q.11: Write the balanced net ionic equation for the redox reaction in the formation of the hydrogen gas. Note: it is the excess zinc that reacts with the acid for form H_2.

$Zn(s) + 2H^{+1}$ ---------> $Zn^{+2}(aq) + H_2(g)$

Q. 12: What is the percent yield of this copper recycling process?

$$\% \text{ yield} = \frac{\text{mass of recovered copper}}{\text{initial mass of copper}} \cdot 100\%$$ or 0.40g/ 0.50g x 100% = 80. % yield

PART III: **MOLECULAR MODEL PROBLEM #1**

1. DRAW YOUR MOLECULE HERE ---> trans-2-penten-1-ol

2. __B____ 5. ___D___

3. ___D___ 6. ___G___

4. ___A___ 7. ___B___

PART IV: **MOLECULAR MODELING PROBLEM #2**

Draw the Lewis Dot structure for the CNO^{-1} ion here and show resonance structures only if they exist.

2. hybridization is _____

PART V: **OXIDATION NUMBERS:**

1. ___+5____ 2.____-3____ 3. ___-3___ 4. ___0____ 5. ___+6____

PART VI: **CHEMICAL CELLS**

1. Write a balanced net ionic equation for the spontaneous reaction that occurs as the cell operates.

$$2\ Cr + 3\ Cu^{2+} \rightarrow 2\ Cr^{3+} + 3\ Cu$$

2. What is the oxidizing agent? ___ Cu^{2+} _____

3. What is the reducing agent? _____ Cr _____

4. What metal acts as the cathode? ____ Cu _____

5. What additional component is necessary to make the cell operate? salt bridge

6. What is the cell voltage produced? ____+1.08 v_____

7. ____B (decreases)_____ (multiple choice)

PART VII: **FUEL CELLS**

1. ___D____ 2. ____D_____ 3. ____A____ 4. ___B____