

School Name: KEY
Students' Names: _____

Team Number: _____

Chemistry Lab Event Answer Sheet
2011 Battle at Valley Forge Invitational
Conestoga High School

1. Using the (3) lemons and provided materials, make (3) voltaic cells.
(5 points) Draw a diagram of one of the voltaic cells and label all of the parts.



(1 point) Measure the voltage of one of the voltaic cells. 1.1V

2. Arrange the (3) voltaic cells to give the greatest voltage.
(5 points) Draw a diagram of how they were arranged to get the greatest voltage.



(1 point) What was the voltage of your best arrangement? 3.3V

3. Given the following reduction potentials half reactions, write the oxidation and reduction half reactions for these voltaic cells.

| | |
|--|---------|
| $\text{Cu}^+ + e^- \rightarrow \text{Cu}$ | 0.52 V |
| $\text{Cu}^{2+} + 2e^- \rightarrow \text{Cu}$ | 0.34 V |
| $\text{Cu}^{2+} + e^- \rightarrow \text{Cu}^+$ | 0.16 V |
| $2\text{H}^+ + 2e^- \rightarrow \text{H}_2$ | 0.00 V |
| $\text{Zn}^{2+} + 2e^- \rightarrow \text{Zn}$ | -0.76 V |
| $2\text{H}_2\text{O} + 2e^- \rightarrow \text{H}_2 + 2\text{OH}^-$ | -0.83 V |
| $\text{H}_2 + 2e^- \rightarrow 2\text{H}^-$ | -2.23 V |

(3 points) Oxidation: $\text{Zn} \rightarrow 2e^- + \text{Zn}^{2+}$

(3 points) Reduction: $\text{Cu}^{2+} + 2e^- \rightarrow \text{Cu}$

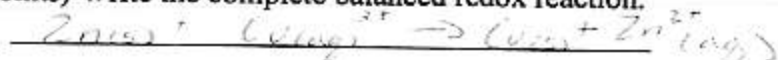
4. (2 points) Which is the anode and cathode of these voltaic cells?

Anode: Zn Cathode: Cu

5. (2 points) What are the oxidation numbers of the zinc ions and copper ions?

Zinc: +2 Copper: +2

6. (5 points) Write the complete balanced redox reaction.



Multiple Choice: Oxidation/Reduction (1 point each):

- | | | |
|--------------|--------------|--------------|
| 10. <u>A</u> | 18. <u>B</u> | 25. <u>C</u> |
| 11. <u>D</u> | 19. <u>D</u> | 26. <u>D</u> |
| 12. <u>E</u> | 20. <u>C</u> | 27. <u>E</u> |
| 13. <u>A</u> | 21. <u>B</u> | 28. <u>B</u> |
| 14. <u>E</u> | 22. <u>C</u> | 29. <u>E</u> |
| 15. <u>D</u> | 23. <u>B</u> | 30. <u>C</u> |
| 16. <u>A</u> | 24. <u>C</u> | 31. <u>C</u> |
| 17. <u>D</u> | | 32. <u>D</u> |

Aqueous Solutions 50 %

Multiple Choice: Aqueous Solutions (2 points each):

- | | | |
|-------------|--------------|--------------|
| 1. <u>C</u> | 8. <u>B</u> | 15. <u>A</u> |
| 2. <u>A</u> | 9. <u>B</u> | 16. <u>B</u> |
| 3. <u>A</u> | 10. <u>A</u> | 17. <u>C</u> |
| 4. <u>B</u> | 11. <u>C</u> | 18. <u>D</u> |
| 5. <u>B</u> | 12. <u>B</u> | 19. <u>C</u> |
| 6. <u>C</u> | 13. <u>D</u> | 20. <u>C</u> |
| 7. <u>B</u> | 14. <u>B</u> | |

Aqueous Solutions Short Answer (10 points):

Saturated - no more solute will dissolve
Unsaturated - more solute will dissolve
Supersaturated - has more solute than the solution would
have (theoretically) at a given temp and amount of solvent
To make a supersaturated solution, add solute to solvent
until no more will dissolve. Heat the solution. Add more
solute so it dissolves. Cool the solution. The solute will
remain in the solution.