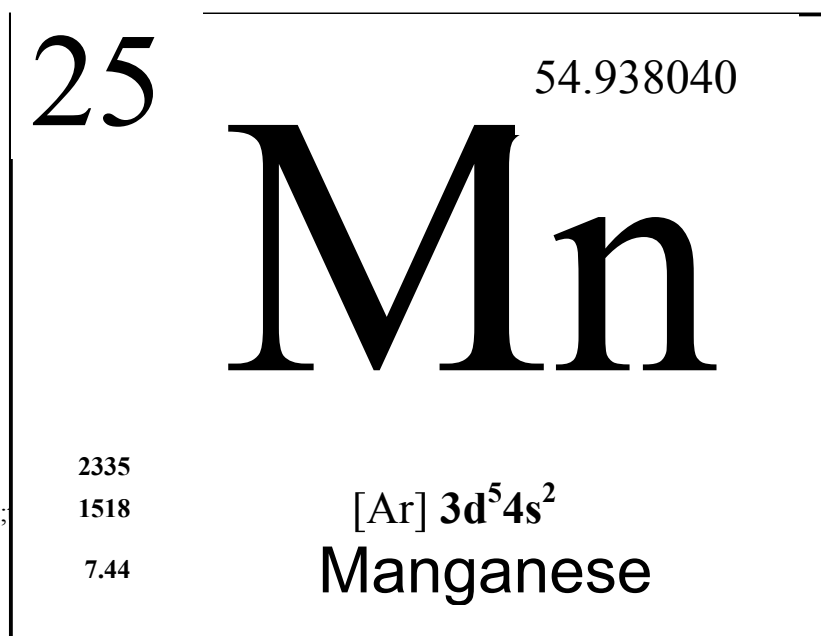


Creighton UNIVERSITY

Presents the
25rd Annual Chemistry Field Day



Hosted by the Chemistry Departments of
Creighton University and
University of Nebraska – Omaha
Saturday, March 29, 2008

Contents

Schedule	2
Introduction to Chemistry Field Day	3
Acknowledgments	6
Chem Survivor (College of Business Administration Room 216)	7
Quick Qual (Rigge Science Room 121)	15
Gameboard Gallimaufry (Business Administration Room 217)	18
Fax the Facts (Rigge Science Room 112)	21
Serial Dilution to A Better Solution (Rigge Science Room 219)	26
Equation Balancing Act! (Hixson-Lied Room 246)	29
Awards	31
Scoring	32

**Creighton University and
the University of Nebraska at Omaha
present the**

**Manganese Chemistry Field Day
(25th Annual)**

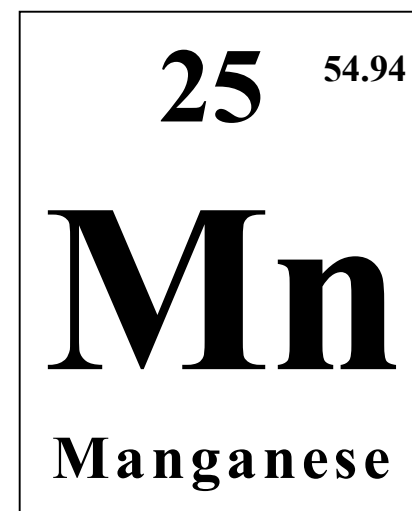
March 29, 2008
7:45 a.m. 2:45 p.m.
Creighton University
Department of Chemistry
Hixson-Lied and Rigge Science Buildings

Park and Enter: *Park in the student lot north of Burt Street and entrance off of Burt Street, near stoplights. Cross Burt (heading south) and enter Hixson-Lied Science Center.*

7:45 a.m. Registration, Doughnuts, Juice and Coffee
8:15 Welcoming Remarks (Rigge 120)
8:30 Event I
9:15 Event II
10:00 Event III
10:45 Event IV
11:30 Lunch (Pizza served first floor Hixson-Lied)
12:00 Event V
12:45 Event VI
1:30 Melodious Musichemical Manifestation Rigge 120
2:30 Awards Ceremony (Rigge 120)

**The 25th Annual
Chemistry Field Day: Manganese**

The chemistry faculty at Creighton University and the University of Nebraska at Omaha are proud to announce the Twenty-fifth Annual Chemistry Field Day — a day of fun and competition. This year's Chemistry Field Day is named for "Manganese", the 25th element and will be hosted in Creighton's Chemistry Department on Saturday, March 29, 2008 from 7:45 am to 2:45 p.m.



Your students are certain to enjoy themselves at the Chemistry Field Day — and will remember the day for a long time afterwards. Your students *do* appreciate the extra time and effort that it takes on your part. The Field Day is also rewarding for you as a teacher. The events are interesting and it is a pleasure to watch so many students having fun with chemistry and enjoying themselves. Over 30 teams will compete this year and we hope that your team is among those at the Manganese Field Day.

To assist you in promoting Field Day to your students, tour Field Day at our web site:

<http://chemistry.creighton.edu/Outreach/FieldDay.html>

The site includes dozens of pictures and descriptions of the six events.

This year we will feature our most popular events: **“Chem Survivor!”**, **“Gameboard Gallimaufry”**, **“Fax the Facts”**, **“Serial Dilution to A Better Solution”**, **“Equation Balancing Act”** and **“Quick Qual.”** A detailed description and rules for the six field day events is included in this booklet.

In order to make the participation fun for all, teams will be classified as either primary or advanced:

PRIMARY teams are those composed of three - five members, none of whom have completed the first year of high school chemistry.

ADVANCED teams have at least one team member that has completed a full year of high school chemistry.

First, second and third prizes will be awarded for both classes of teams.

All participants must be currently enrolled at the school that they represent. Chemistry teachers are encouraged to accompany their teams through the events.

First Time Field Day teams: If you have never brought a team to the Chemistry Field Day before, you may feel some hesitation. There is a lot to be learned about strategy — and the only way to develop this is to start bringing teams. Your students will enjoy the day even if they do not win — and the record books show that first time teachers and first time schools have won numerous Chemistry Field Day awards over the years.

There will be lots to do to make this Saturday outing a meaningful day for you and your students. Please plan to participate and make the day a success! There will be doughnuts, coffee and juice during registration (7:45 - 8:15) and pizza for lunch.

To register, go to the website above and click on “Register” right under the page title. You can update your team information if necessary — just return to the site. You will be given a PIN number for each team and you should jot that number down as you will need it to modify your team’s information. You will be asked choose an element team name (Sulfur, for example). If you register early, your team will have time to prepare posters, banners, T-shirts, or whatever! (Naturally, this extra effort is optional but it adds to the fun.)

Acknowledgments

All of the Field Day staff members, including chemistry faculty and staff members and students from Creighton University and the University of Nebraska at Omaha have volunteered their time. Also, the high school teachers are acknowledged for volunteering their Saturday in addition to the extra hours spent preparing their teams for the competition. Individuals working field day events are listed with the event. Organizers and facilitators include:

Creighton University Chemistry Department

Dr. Bruce Mattson, coordinator
Dr. Gary Michels, coordinator
Dr. HollyAnn Harris, Master of Ceremonies
Dr. Mark Freitag, scorer
Ms. Sharon Abboud, registration

University Nebraska at Omaha Chemistry Department

Dr. Ed Tisko, scorer, UNO coordinator
Dr. James Carroll, UNO coordinator
Ms. Michelle Battle, coordinator

We are grateful to the Creighton University Chemistry Players and their director, Dr. Gary Michels, for providing the entertaining production of Melodious Musichemical Manifestation.

Entrance fees do not cover all of the expenses for the Chemistry Field Day. We gratefully acknowledge the Omaha Section of the American Chemical Society for purchasing the awards and medallions given today.

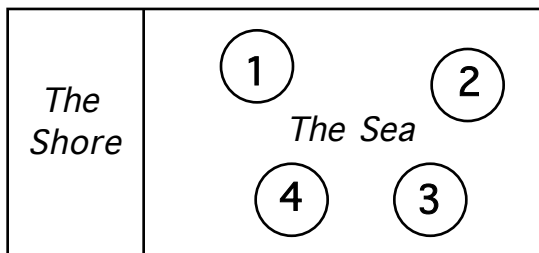
Thank You!

Chem Survivor!

Moderators: Drs. Steve and Erin Gross (CU)
Dr. Roger Hoburg (UNO)
College of Business Administration Room 216

Objective: To survive a number of chemistry intellectual and decision-making challenges in four different sets of circumstances.

Instructions: The room will be divided into two regions, the Sea and the Shore. Teachers and spectators are on Shore.



In the Sea there are four islands of challenges:

Island of Amazing Chemical Names: Answer questions to be guided through a maze.

Island of the Periodic Pillar: Where the Periodic Table and Jenga meet.

Island of Crossed Words: A crossword puzzle with a chemistry theme

The Formula for Staying Afloat: Load up On load it up with doubloons just fro knowing the formulas of substances.

Rules Island by Island.

Each island has its own Field Day Volunteer (FDV). The FDV may not communicate in any form (including verbal, gestures, facial expressions) any information, strategy or advice to the island survivors. The FDV does not speak except (a) when determining who stays on the island; (b) when selling a hint; (c) when delivering a message in a bottle (and then only speaks on Shore); (d) enforcing the rules. Island survivors may not ask questions of the FDV. FDVs assure game rules are obeyed.

Only three survivors can stay at each island. Before the surviving begins, the FDV will determine, by luck of the draw, who stays and who has to wait on shore. With each move to a new island, all participants (including those who may have been on shore) draw to see who stays on the new island.

Field Day Books may not be used on the islands. (They were ruined when the boat sank.)

Teams spend 6.02 minutes per island and then move to the next island as directed by the FDV.

Scoring. At each island teams can earn up to 25 points by successfully completing the survival challenge. (Fees for hints and message-in-a-bottle delivery are deducted). The four scores are added together at the end of the event for a total of 100 possible points.

Message in a Bottle. Each island has a bottle that can be used to send questions to shore for anyone to answer, including your teacher, but excluding Field Day personnel. Team members specify whom they want to receive the bottle. The FDV will deliver the bottle to the intended recipient on Shore. The FDV will return the bottle (with written answer) to the island. Sending a message costs 2 points each and there is a 3-message limit per island.

Get a Clue! Island survivors can buy a clue from the FDV for 1 point (rather useless information: "The palm tree is fake!"), 2 points (a good hint: "You made a mistake here (pointing)") or 3 points (BIG nudge!: "The answer is 'D'.").

Important WARNING! No Undo! Some decisions made by the survivors can never be undone. If the team makes a decision that results in catastrophic loss of points, our sincere condolences — but nothing more! Don't even ask! Hey! Every once in awhile, the boat flips!

Chem Survivor: The Formula for Staying Afloat

Instructions: An empty boat awaits you at this island — and the chance to load it up with doubloons before you leave the island! All you need to do is correctly identify the formula of a compound and one doubloon is yours — if you can load it on the boat without sinking it!

The Rules:

1. Field Day Manuals may not be used at this island. (Your team will discover that some ol' pirate nailed a periodic table to the tree on this island.)
2. The Field Day Volunteer (FDV) introduces the game and these rules.
3. The FDV determines what team member(s) must return to shore.
4. The FDV starts the game and the team has 6.02 minutes to work.
5. The Survivor answering the question and handling the doubloon is called "Skippy".
6. Members of the team take turns at being Skippy. Each Skippy is given one turn and then the role of Skippy passes in a clockwise direction around the island.
7. Skippy starts her/his turn by drawing a chemical name from the treasure chest.
8. Skippy always has first choice in providing the correct answer without the help of teammates. Skippy reads the formula privately without showing teammates. Skippy then writes the chemical formula on the paper provided and gives it to the FDV sitting at your table. If Skippy can answer it alone, he/she will be given two doubloons to load onto the boat.
9. If Skippy cannot provide the answer, he/she can ask the team to help. If the group of survivors can correctly write the formula, the team will earn one doubloon.
10. If no survivor on the island can identify the atomic symbol, the team can (a) send a message in a bottle to the team's survivor

on shore or (b) tell the FDV that they cannot answer the question (See "Wrong Answers/No Answer" to learn about the consequences of this.) "Messages in a bottle" can be sent for free from this island!

11. The FDV will ascertain the correctness of all answers. If the answer is correct, the FDV will hand one or two doubloons to Skippy and he/she must load them on the boat. If two doubloons are to be loaded, and the team thinks the second one will sink the boat, they elect to forfeit the second doubloon and end the game.
12. **WRONG ANSWER/NO ANSWER:** If the answer is incorrect or the team cannot provide the formula, the doubloon is thumb-flipped in the direction of the cup by the FDV. The FDV will rest her/his hand within the square on the game sheet and flip the doubloon towards the cup placed over the circle on the game sheet. If the boat sinks, the game is over! Let's hope the palm tree deflects some of these!
13. Play continues until the boat sinks or until the team decides to quit or until the time runs out.

Scoring.

1. Minimum score: 0 points; maximum score: 25 points.
2. Your team will receive one point for every doubloon safely loaded onto the boat. If the boat sinks, the doubloon that caused the sinking is not counted.
3. Your team will receive a 5 point bonus if the boat did not sink.

Chem Survivor: Island of Crossed Words

Instructions: A small chemistry-themed crossword puzzle greets you at this island. The three survivors work together to complete it within the allotted time.

The Rules:

1. Field Day Manuals may **not** be used at this island.
2. The Field Day Volunteer (FDV) introduces the game and these rules.
3. FDV explains that shore-based team members cannot speak or communicate in other ways with anyone (on shore or on the island) during this entire event. Penalty is 3-points charged against the team's final score.
4. The FDV determines by lottery what team member(s) must return to shore (with everyone's manuals).
5. The FDV starts the game and the team has 6.02 minutes to work.
6. The Survivors complete the puzzle to the best of their abilities. They may work together.
7. Island survivors can send a message in a bottle to the team's survivor(s) on shore. Note: Messages in a bottle are fee-paid from this island! Each message costs one point.
8. The FDV will ascertain the correctness of all answers after the island visit is over. Check the score-board!
9. It is forbidden for team members to talk to anyone other than their island-based survivors.
10. Play continues until the puzzle is complete or until the team decides to quit or until the time runs out.

Scoring.

11. Minimum score: 0 points; maximum score: 25 points.
12. Your team will receive two points for every correct word in the puzzle.
13. Your team will be charged 1 point if the for every erroneous word or word left blank.
14. Your team will be charged 1 point for every message sent in a bottle.
15. Puzzles perfectly completed are scored 25 points.

Chem Survivor: Those Amazing Names

Instructions: A chemistry maze greets you at this island. The three survivors work together to complete it within the allotted time.

The Rules:

1. Field Day Manuals may **not** be used at this island.
2. The Field Day Volunteer (FDV) introduces the game and these rules. The FDV will also go over the instructions on the maze clue sheet.
3. FDV explains that shore-based team members cannot speak or communicate in other ways with anyone (on shore or on the island) during this entire event. Penalty is 3-points charged against the team's final score.
4. The FDV determines by lottery what team member(s) must return to shore (with everyone's manuals).
5. The FDV starts the game and the team has 6.02 minutes to work.
6. The Survivors travel through the maze to the best of their abilities. They may work together.
7. Island survivors can send a message in a bottle to the team's survivor(s) on shore. Messages sent to shore from this island cost 2 points each and there is a 3-message limit.
8. Island survivors can buy a hint for a fee from the FDV. Prices: for 1 point: rather useless information, 2 pts: a pretty good hint (Exact words will be either "You are correct up until the question you are working on" or "You have made a mistake prior to the question you are working on.") or 3 pts for a BIG nudge — the correct answer for any single question specifically requested by the team. (Ask the FDV, using these words, "For 3 points, tell us the answer to Intersection #3", for example.
9. The FDV will ascertain the correctness of all answers after the island visit is over. Check the score-board!
10. It is forbidden for team members to talk to anyone other than their island-based survivors.
11. Play continues until the maze is complete or until the team decides to quit or until the time runs out.

Scoring.

12. Minimum score: 0 points; maximum score: 25 points.
13. Team will receive one point for each correct answer, ten points for correctly completing the puzzle (the highlighting matches our key), two points for trying.
14. Your team will be charged 1 - 3 points for information purchased from the FDV.
15. Your team will be charged 2 points for every message sent in a bottle.

Chem Survivor: Periodic Pillar

Instructions: A Jenga pillar of wood greets you at this island. Each piece of wood contains the name of an element (Atomic Numbers 1 – 92). Your team’s job is to push these pieces out, one at a time and identify the atomic symbol of the element written on the wooden piece. Points are earned by correctly identifying the atomic symbol of the element listed. Play continues until the team decides to quit, time runs out, or the pillar crashes!

The Rules:

1. Field Day Manuals may **not** be used at this island.
2. The Field Day Volunteer (FDV) introduces the game and these rules.
3. The FDV determines by lottery what team member(s) must return to shore (with everyone’s manuals).
4. The FDV starts the game and the team has 6.02 minutes to work.
5. The Survivor removing the piece of wood is called the “pillar prodder”. The prodder may use only one hand. The other one must not be on the table.
6. Members of the team take turns at pillar prodding. Each prodder removes only one piece and the role of prodder passes in a clockwise direction around the island. Only pieces below the square pillar cap can be removed.
7. The prodder always has first choice in providing the correct atomic symbol by writing the atomic symbol on the paper provided and give it to the FDV sitting at your table.

8. If the prodder cannot provide the element’s atomic symbol, other members of the team may help.
9. If no survivor on the island can identify the atomic symbol, the prodder can (a) send a message in a bottle to the team’s survivor on shore or (b) place the piece on top of the pillar. Note: Messages in a bottle can be sent for free from this island!
10. The FDV will ascertain the correctness of all answers. If the answer is correct, the FDV will keep the piece and it will count towards the team’s score. If the answer is incorrect, the piece must be placed on top of the pillar by the prodder.
11. It is forbidden for team members to touch the pillar. Touching the tower to support it, straighten or adjust it, or prevent it from collapsing is considered the same as causing the pillar to fall (see rules below).
12. Play continues until the pillar falls or until the team decides to quit or until the time runs out.

Scoring.

13. Minimum score: 0 points; maximum score: 25 points.
14. Your team will receive one point for every piece removed and correctly identified.
15. Your team will receive a 5 point bonus if the pillar did not fall.

Quick Qual

Moderators: Dr. Michael Anderson (CU)

Dr. Jodi Kreiling (UNO)

Room: Rigge Science Room 121

Objective: To correctly identify cations and anions in a series of solutions.

1. Each team will be given ten solutions, each of which contains a single pure salt. The anion will be one of the following: carbonate, sulfate, chloride, acetate, or iodide. The cation will be one of these: ammonium, sodium, potassium, barium, or lithium. Thus, there are 25 possible salts.

2. The identity of the salts will be determined from the following chemical tests. All of the necessary chemicals will be provided.

3. The maximum allowed working time is 30.00 minutes.

Test for Cations:

A. Test for metallic cations. Use the flame test to identify metallic cations:

Na⁺ yellow

K⁺ purple (faint)

Ba⁺² green

Li⁺ red

NH₄⁺ no color-See Test B

B. Test for ammonium: Add 1 mL of 6 M NaOH to about 1 mL of your unknown solution. A faint ammonia odor

should be detected if NH₄⁺ is the cation. Moistened litmus paper can also be used to check for the presence of ammonia (red litmus turns blue).

Test for Anions:

C. Test for Carbonate: Cautiously add 1 mL of 6 M HCl to 1 mL of your unknown. Odorless bubbles will be noted if carbonate is present.

D. Test for Sulfate: Add 1 mL of 6 M HCl to 1 mL of your unknown. Next add a few drops of 1 M BaCl₂. A white, finely divided precipitate indicates the presence of the sulfate ion.

E. Test for Iodide: Add 1 mL of starch solution to 1 mL of your unknown solution. Next add 1 mL of the dilute H₂O₂ solution. A blue color is indicative of the presence of iodide.

F. Test for Chloride: Add 1 mL of 6 M HNO₃ to 1 mL of your unknown solution. Next add a few drops of 0.1 M AgNO₃. A white precipitate confirms the presence of chloride.

G. Test for Acetate: Add 1 mL of 3 M H₂SO₄ to 1 mL of your unknown solution and stir. A vinegar odor is indicative of acetate. Moist litmus paper can also be used to check for the presence of acetic acid (blue litmus turns red).

3. Your score will be awarded as follows: From 110 points, your team score will be deducted (a) four points for every

incorrectly identified ion plus 1 point for every minute that it takes to complete the event (start time is receipt of solutions; finish time is submission of answer sheet). For example, if a team finishes in 22 minutes with three (out of 20) ions incorrectly identified, the team score will be $110 - 12 - 22 = 76$.

4. Safety glasses must be worn at all times!

5. General safety in handling of chemicals must be exercised at all times. The Quick Qual officials may disqualify an individual for conduct and safety violations.

Gameboard Gallimaufry

Moderators: Dr Mike Miller (CU)

Ms. Chris Fink (UNO)

Room: Business Administration 217

Objective: To correctly answer as much chemistry questions as possible in 25 minutes. Questions are selected from a large game board. Teams are not in direct competition with each other.

The Set-Up: Teams are situated in groups around a Jeopardy-like, game board. The board has six categories and five questions per category. The point value and difficulty of the questions increase down each category. The first question of each category is worth one point. The last question is worth five points. The questions are on cards. Questions may be multiple choice or require written responses. There are as many copies of each question as teams present. This allows more than one team to work on a question at the same time. The categories are revealed at the beginning of the event. Categories and questions are the same for all teams throughout the day.

The Play: A Field Day Volunteer (FDV) is assigned to each team. Each team must choose a leader for the event. When play begins, the leader shouts to the FDV the card they want to see by category and point value (i.e. "Solutions for 5, please!!!!"—The word please is explicitly required). The FDV delivers the appropriate card to the leader and records an "X" on a grid so that the team knows which questions they have received. After the team writes an answer to the question on the card, the leader hands it to the FDV. The leader may then request another card. Cards may be

selected in any order. A particular card may be selected only once. The FDV delivers the completed question to the scoring table, retrieves the next selection, and delivers it to the team leader. Play continues in this manner until the time runs out or until a team elects to quit. A completed card must be returned to the FDV before a new one is requested. The current question must be completed before a team elects to quit or when time expires. If a team clears the board (i.e. answers all questions before time has expired), they may proceed to the next level. There is a new board. The categories remain the same, but the point value is doubled.

Scoring: Questions are graded at the scoring table. A scorer rings a bell for a correct answer or a buzzer for an incorrect one. Points are awarded or taken away according to the value of the card. However, scores can never go less than zero during the play. The team scores are posted for viewing by all teams. At the end of the day, all team scores are scaled so that the day's best score is 100.

Special Rules and Considerations:

1. Interaction among team members to select and to answer questions is strongly encouraged. However, only a designated leader may communicate with the FDV to obtain new questions and return completed ones.
2. A team can work on only one question at a time. A question must be completed before a new one is selected.
3. Since 5-7 teams may be working simultaneously on the same questions, care should be taken to protect the

confidentiality of your answers. You must write your final answer on the card. Do not tell them to the FDV.

4. Only the periodic table found on the back cover, a pocket calculator, pens and pencils, and the provided scratch paper may be used. No other materials (texts, tables, notes, etc.) may be used. It's a good idea to bring one or two calculators to the event.

6. Your team can pick any question from the board at any time. There is no need to finish a category before starting a new one or to finish all questions of a point value before selecting ones of a higher value. Remember: The higher the point value the more difficult the question.

7. Your team can decide to stop anytime. However, you must answer your last question before you quit.

8. When time expires, you have 30 seconds to complete the answer to your last question.

Fax the Facts

Moderators: Dr. James Fletcher (CU)

Dr. Dana Richter-Egger (UNO)

Room: Rigge Science 112

Objective:

To effectively communicate chemical observations in writing between two groups of students on the same team in order to correctly match two sets of five identical solutions in the minimal amount of time.

Rules of Play:

1. Safety glasses must be worn during the entire competition.

2. All materials for the event will be provided except for pens and safety glasses. Students are not allowed to use the manual or notes.

3. Each Field Day Team is divided into two groups, called "Parties." Parties must be of similar size (5-person teams are divided into a 2-person and a 3-person party.) The selection of team members for each party is the responsibility of the team's chemistry teacher. The two parties are positioned across a large room from each other.

4. Each *team* is given two sets of solutions, with each *party* receiving only one of the two sets. The two sets are identical except for their labels. (One set may have labels such as A-1, A-2, A-3, A-4 and A-5 and the other set may have labels such as B-6, B-7, B-8, B-9 and B-0.) Each set consists of 5 dropper bottles. Each bottle holds approximately 25 mL solution.

5. Because the parties are widely separated, the party with the "A" set of solutions can only perform reactions between the various solutions within the "A" set. Similarly, the "B" solutions are reacted in various combinations by members of the other party. Reactions are performed by mixing drops on a special laminated sheet of paper, half of which is black and the other half white. One sheet of scratch paper is provided for recording results. Paper towels are provided for cleaning up the drops.

6. Observations are "faxed" between the two parties by filling out a "Fax Facts Form" which holds up to 30 characters and looks like:

Fax the Facts Form:

Only one letter per box is allowed. Unacceptable Fax Messages: Fax messages that exceed this in any way, including drawing more boxes or writing in the margins will not be delivered and the team will be assessed a 3-point penalty. An example of an acceptable fax message is:

Fax the Facts Form

A	1		+		A	4	->		
Y	E	L	L	O	W				
B	U	B	B	L	E	S			

7. ILLEGAL FAX MESSAGES: NO REFERENCE TO THE OTHER PARTY'S SOLUTIONS IS ALLOWED. (One party

could not send “OUR A1 SEEMS LIKE YOUR B3.” Failure to abide by this rule results in a 20 point penalty.)

8. No communication between parties, other than fax forms, is allowed. Hand signals, gestures, facial expressions, etc. are all illegal and will result in a severe penalty and possible disqualification.

9. Completed Fax Facts Forms are delivered by special Field Day Volunteers who will check the message before it is delivered.

10. The objective of each Party is to correctly match the two sets of solutions. (Thus, each team will submit two answers.) Answer forms look like:

A-1	A-2	A-3	A-4	A-5
B-	B-	B-	B-	B-

A typical completed form may look like:

A-1	A-2	A-3	A-4	A-5
B-6	B-9	B-7	B-8	B-0

11. A minimum of three faxes is necessary.

- Party A faxes data to Party B
- Party B faxes data to Party A
- First party done faxes “We’re done” to teammates.

12. The clock stops when the second party is finished.

13. Scoring. All teams start out with 120 points, the maximum possible. Negative scores are recorded as “0” on

the final Field Day Score Sheet. Deductions are made as follows:

Normal Deductions:

- 1 point deduction for each minute used to solve the puzzle (The event has a maximum time limit of 25 minutes) Both groups must submit their guess in order to “stop the clock.”
- 10 point deduction for each incorrect match.
- 2 point deduction for every fax sent.

Penalty Deductions:

- 10 point deduction for each time a safety glasses reminder has to be issued.
- 3 point deduction for every unacceptable fax messages (See Rule 5)
- 20 point deduction for illegal fax messages (See Rule 6)
- Points are deducted for talking loud enough for the other party to hear you. 5 points are deducted for the 1st warning; 10 for the 2nd; 20 for the 3rd, 40 for the 4th; and disqualification occurs for 5 offenses.
- Points are deducted for illegal communication between parties, such as hand signals, gestures, facial expressions, etc. 5 points are deducted for the 1st warning; 10 for the 2nd; 20 for the 3rd, 40 for the 4th; and disqualification occurs for 5 offenses.

A Note on Your Score: Example of excellent performance: Suppose both parties of a team correctly figured out the answer with the use of 5 fax messages and in a time period of 10 minutes and without any penalties. Their score would be $120 - 5 \times 2 - 10 \times 1 = 100$ points because they were

deducted 1 point per minute and 2 points per fax message sent. Example of good performance: Suppose one party of a team correctly figured out the answer and the other party switched two solutions around (deduct 20 points.) The parties used a total of 8 fax messages (deduct 16 points) and submitted the second answer in a time period of 12 minutes (deduct 12 points.) If there were no penalties, the team score would be 72 points.

Serial Dilution To A Better Solution

Moderators: Dr. David Dobberpuhl (CU)
Dr. Suellen Kador (UNO)
Room: Rigge Science 219

Necessary Materials: Goggles and calculator.

Objective: To quickly and accurately prepare a dilute solution of zinc ion (Zn^{2+}) from a much more concentrated solution and to learn about an instrumental method for measuring very low concentrations of metals in solution.

Preparing a solution of a known concentration is an essential skill to scientists. Included in this skill is the ability to make dilute solutions from more concentrated solutions that have been prepared previously. The concentration of the new, more dilute solution can be calculated using:

$$C_{conc.} V_{conc.} = C_{dil.} V_{dil.}$$

where "C" stands for concentration and "V" stands for volume.

One problem with making a dilute solution from a much more concentrated solution is that the required volume of the concentrated solution is often very small and almost impossible to measure accurately. For example, suppose you were asked to prepare 100.0 mL of a solution containing exactly 0.50 ppm Zn^{2+} from a 1000.0 ppm solution (*the "ppm" unit, like molarity, is a measure of concentration and stands for "parts-per-million"; for example, a 1 ppm Zn^{2+}*

solution contains exactly 1 gram of zinc per million grams of solution). Using the equation above, this would mean that you would need to transfer:

$$C_{conc.} V_{conc.} = C_{dil.} V_{dil.}$$

$$V_{conc.} = \frac{C_{dil.} V_{dil.}}{C_{conc.}}$$

$$V_{conc.} = \frac{(0.50 \text{ ppm})(100 \text{ mL})}{1000 \text{ ppm}}$$

$$V_{conc.} = 0.050 \text{ mL}$$

which corresponds to about one drop of the concentrated solution. Since this volume is almost impossible to measure accurately, scientists have found a better way to do this using "serial dilution." Serial dilution is a method where a solution of intermediate concentration is prepared from the more concentrated solution. This intermediate solution is then used to prepare the final dilute solution.

This event is designed to test your ability to accurately prepare a dilute solution from a more concentrated solution using serial dilution. At the beginning of the event, each team will be asked to prepare a solution of Zn^{2+} with a concentration between 0.50-1.50 ppm. To complete this task, each group will be provided with appropriate equipment (1-mL and 10-mL variable volume Mohr pipets; 50-mL, 100-mL, & 250-mL volumetric flasks; pipet bulb; distilled water; etc.) and a concentrated solution of about 1000.0 ppm Zn^{2+} . Each group has 30 minutes to prepare the assigned

concentration of Zn^{2+} using serial dilution. The concentration and volume of the intermediate solution are at the discretion of each team, but should be selected so as to permit preparation of the dilute solution with the supplied glassware. Once the dilute solution has been prepared, it should be submitted with your calculations to the Field Day Staff for evaluation.

Points will be awarded as follows: the percent error will be subtracted from 100 to create your raw score. For example, if your team was to prepare a 1.00 ppm solution and this solution measured 0.84 ppm, then your relative error would be $(1.00 - 0.84) \times 100\% = 16\%$. Your team then would receive $100 - 16 = 84$ points for the event. If your team submits the solution prior to the end of the thirty minute period, one extra point will be added to your score for each minute early. The Field Day Staff will deduct points for all safety violations, including not wearing goggles or using the pipets in a manner other than that demonstrated.

Equation Balancing Act

Moderator: Mr. Rob Doyle (CU)

Dr. Rich Lomneth (UNO)

Room Hixson-Lied 246

Objective: To correctly balance as many equations as possible in a 25 minute period. Balanced equations are submitted in a relay-style fashion.

1. This competitive event amounts to a good old fashioned equation balancing relay race! Team members will be seated at a team table located at one end of the room. The judges will be seated at the opposite end. After the team (or a team member) has balanced an equation and wishes to submit it for scoring, one member of the team then relays (runs) the result to the judges for scoring..

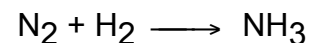
2. Scoring: If the equation is correctly balanced, the team will be awarded points equal to the value shown on the equation card. If the answer is wrong, a five point penalty is assessed. Right or wrong, the equation is not returned to the group. Running scores will be posted for all teams

3. Special Rules and Considerations:

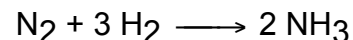
- Only one student from each team may be out of his/her seat at a time.
- Students may relay only one balanced equation per trip to the judging table.
- Students may not interfere with other teams or team members.

- Students may not leave the room.
- Judges may assess five point penalties for conduct infractions.
- Equations must be balanced with the smallest whole number coefficients.

For example, the following equation:



is correctly balanced as:



- Develop a team strategy prior to the event. Practice! Check all of your work carefully. Have another team member check balanced equations prior to submitting them for scoring.
- Calculators and the periodic table on the back of this manual may be used.

Awards

Overall Performance Awards and Distinguished Recognition Awards will be made according to the following plan:

Plaques and medallions will be awarded in these categories:

1st Place	Overall, Primary Team
2nd Plac	Overall, Primary Team
3rd Place	Overall, Primary Team
1st Place	Overall, Advanced Team
2nd Place	Overall, Advanced Team
3rd Place	Overall, Advanced Team

Plaques will be awarded in the categories:

Distinguished Recognition

Gameboard Gallimaufry
Fax the Facts
Chem Survivor
Serial Dilution
Quick Qual
Equation Balancing Act!

Awards are made following the scoring system described below here. Overall Performance Awards are determined first. Each team will receive a ranking for its performance in each event. The highest (best) score will be given a rank of 1.

EXAMPLE	score	rank
	99	1
	98	2
	95	3
	95	3
	95	3
	92	6 etc.

For each team a grand total will be obtained by summing the individual event rankings for all six events. The smallest sum of rankings will determine the winners. These totals are used to determine the 1st, 2nd and 3rd place primary and advanced teams.

Distinguished Recognition Event Awards are determined second using the individual event rankings as the criterion with the following qualifiers. Winners of overall awards are ineligible for these awards because they have won an overall award. Each team may win only one award. Awards will be granted in the order listed on the previous page. Once a team has won an event award, it will be judged ineligible for another. In case of a tie, the decision of the event judge or the team with the lowest overall grand total ranking will be used to select the one team to receive the award.

Scoring