

CHEMISTRY LAB

DESCRIPTION: Students will work cooperatively to answer a series of questions or complete a task involving the science processes of chemistry focused in the areas of periodicity and oxidation/reduction. No reference materials allowed. If needed, calculators will be supplied. Do not bring a calculator!

Safety requirements: Students must bring and wear aprons or lab coats and OSHA approved chemical splash goggles with indirect vents. No open toed shoes will be allowed.

TEAM OF UP TO: 2

THE COMPETITION:

The competition will consist of a series of stations that include activities similar to those in first year high school courses. These stations could include hands-on activities, interpretation of experimental data (graphs, diagrams, photographs, etc.), and/or observation of an experiment set up and running. Contestants may not be rotated through stations. Supervisors are encouraged to use computer or calculator sensors/probes wherever possible or provide students with data sets collected by such sensors/probes following demonstration of the data collection. Data will be presented in a tabular and/or graphic format and students will be expected to interpret the data. Students should be aware that nomenclature, formula writing, and stoichiometry are essential tools of chemistry and may be included in the event at any time. Stoichiometry includes, for example, such abilities as mole conversions and percentage yield. For purposes of nomenclature and formula writing, students are expected to know the symbols and charges for the following ions by memory: nitrate, carbonate, phosphate, acetate, sulfate, ammonium, bicarbonate, and hydroxide. Students should know and be able to use the "ite" form of an ion, which is one less oxygen than the "ate" form, where this is applicable. Further, students should be able to use the periodic table to obtain the charge for mono atomic ions. For example, Na^+ , S^{2-} , etc.

1. The event will cover theory and application of areas in periodicity and oxidation/reduction. The following will be provided if needed: (a) periodic table (b) calculator (c) any constants needed (d) any polyatomic ions not included in the group to be memorized (e) Standard Reduction Potentials.

2. The lab portion may be run in microscale.

3. Cleanup should occur after all materials have been returned or a penalty may be given.

4. All measurements must be recorded with correct significant figures and units. All calculations must also include correct significant figures and units. Stations might include the following topics:

PERIODICITY: Students should understand the periodic nature of the elements. Knowledge about periodicity should be demonstrated conceptually (by predicting or explaining trends) or where possible experimentally (by collecting and/or accounting for data). Topics may include the following:

1. Physical properties (e.g. atomic and ionic radii, ionization energy, melting point, electro-negativity, etc.)

2. Electronic structure and bonding formation (e.g. ionic vs. covalent, charges on ions, etc.)

3. Chemical properties (e.g., precipitate formation (solubilities), reactions with acids, etc.)

OXIDATION/REDUCTION: Students must be able to write oxidation and reduction half reactions, assign oxidation numbers, balance redox reactions in neutral, acidic, and basic solutions, and calculate standard cell potentials using a table of standard reduction potentials. Tasks will be chosen from the following:

1. Use a sequence of redox reactions to construct an activity series.

2. Construct a simple voltaic cell and measure its potential.

3. Stoichiometry and electrochemical processes.

4. Construct simple electrolytic cells. At state and national levels, knowledge of fuel cells may be required.

5. At the state and national levels, knowledge and applications of the Nernst equation and common storage batteries may be required.

APPROXIMATE TIME: 50 minutes

SCORING: Points will be awarded for correct answers and/or proper technique. Time may be limited at each station, but time will not be used as a tiebreaker or for scoring. All ties will be broken by selected questions chosen by the supervisor. These questions may or may not be identified to the students.

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