

POTIONS

Grades: 4-5

Team Size: 1-2 competitors

Event Duration: 45 minutes

Supervisor: Emily Briggs, Michael Briggs

Summary Description:

Each team will answer questions on general chemistry and conduct 2-3 experiments related to forensic science. Students will be asked questions related to the experiments and observations made.

Changes from Previous Year

$\frac{1}{3}$ of the total score will be based on the general test question (previously $\frac{2}{3}$).

$\frac{2}{3}$ of the total score will be based on experimental and analytical skills (previously $\frac{1}{3}$)

Concepts Covered

Lab safety, basic lab skills (weighing, measuring, transferring, filtering, etc.), fingerprinting, ink chromatography, general chemistry (phases of matter, elements, compounds, mixtures, Bohr atomic model, periodic table of elements, pH, acids & bases, use of metric system, chemical reactions).

Rules/Competition Format

Each team has 45 minutes for the competition. The competition will consist of two parts. In the first part, students will answer general questions pertaining to chemistry (~1/3 of total score). These questions will be presented in several formats including multiple choice, true/false, and fill in the blanks. In the second part, students will be evaluated on their experimental and analytical skills (~2/3 of total score). For this section, each team will be given equipment and materials and instructed to perform several small experiments or observations. It is highly recommended that teammates work together on both sections. Teams will be given a ten-minute and a five-minute warning.

Scoring

- For the first part of the competition, scoring will be based on the number of correct answers.
- For the second part, scoring will be based on adherence to lab safety rules, accuracy and interpretation of the experimental results, and how well the students cleaned up their bench space.
- Completion time will **NOT** be considered in scoring.
- Any student not wearing proper lab safety equipment and protective clothing during the event will automatically receive a point deduction. (Long pants, closed toe shoes, lab coats or long-sleeved shirts over their T-shirts, long hair pulled back, and gloves and goggles during the experimental portion)

Tie Break Criteria

- There will be several clearly marked tiebreaker questions, which will be graded only in the event of a tie between teams.

Materials Distributed by WESO

Chemistry Lab Kits: New chemistry lab kits were provided to all new and returning schools few years ago. Please make sure you locate your kit and make sure it is complete. A list of kit contents is below. Students will be expected to be familiar with all items in the kit. WESO supplied materials for the forensics science section of the event in 2019. For 2020, WESO will replenish some consumable items for all schools. All necessary supplies will be provided by WESO for the competition.

WESO POTIONS KIT CONTENTS		
	Description	Per school in 2015
1	Polypropylene Beakers, 250ml	2
2	Flask, Erlenmeyer, 250 ml	1
3	Polypropylene graduated cylinders, 50ml	2
4	Polypropylene graduated cylinders, 250ml	2
5	Weighing Dishes	100
6	Spatulas	50
7	Transfer pipets	25
8	Gloves, Small	1
9	Gloves, XS	1
10	pH indicator stick, 0-14	1 pack
11	Funnel	1
12	Glass rods	2
13	Filter paper	100 sheets
14	Plastic rack for 13mm diameter tube	1
15	Polypropylene tubes, 13 X 100mm	20
16	Safety goggles, small	4
17	50ml tubes with styrofoam rack, 25/rack	1
18	Container for storing	1

Additional Materials for forensics supplied in 2019		
	Description	Per School in 2019
1	Ink Pad	1
2	Chromatography Paper	50 strips
3	Iodine Solution	50 mL

Note: Popsicle sticks can be used as stirrers instead of glass rods and coffee filters instead of standard filter papers.

Additional Materials Useful for Practices

- The school is responsible for providing a balance for their coaching sessions.

Materials to be Brought to Competition

- Wear protective clothing (lab coats, long pants, close toed shoes, gloves, and safety goggles/glasses). Gloves will be supplied by WESO for the test. It is recommended that students

get their own safety goggles from the school kit that we have provided (if needed, WESO can provide too).

Study Guide

Students are expected to know the following:

Safety rules:

- Do not experiment on your own – always have an adult nearby.
- Read and follow all directions for your activity and use materials carefully.
- Read all warning labels on all materials being used.
- Wear protective clothing (lab coats, long pants, close toed shoes, gloves, and safety goggles/glasses).
- Long hair must be pulled back.
- When finished, clean up and dispose all materials properly.
- Wash your hands after the activity.
- Never taste or directly smell any reagents.
- Keep materials away from your eyes.
- Never use any lab containers for food storage.
- Never eat or drink while conducting an experiment.
- Never play around/near chemicals.

Basic chemistry facts: Covering the following concepts at the level comparable to how it is explained at www.chem4kids.com. Excellent quizzes on this site. Only cover topics listed below.

- Matter (or phases): properties of solids, liquids, gases
 - Do **NOT** need to know about plasmas and Bose-Einstein condensates
- Transitions between phases: melting/freezing, evaporation/condensation, sublimation
- Law of Conservation of matter/mass
- Structure of matter: compounds, molecules, atoms, electrons, protons, neutrons
- Elements, compounds, mixtures
 - Types of Mixtures (homogeneous, heterogeneous, colloids, emulsions)
- Solutes, solvents and solutions
- Basic elements: hydrogen, oxygen, nitrogen, carbon, aluminum, sodium, copper, chlorine, phosphorus, sulfur, helium, argon
 - General Characteristics: group classification, where you would commonly find the element, and physical state at room temperature.
- Draw Basic Bohr Model element when atomic number and atomic mass/weight is given
 - Nothing beyond the third period will be asked
- Periodic table of elements: organization and information represented, understand the rationale behind periods and groups (Do not memorize! Students will be given a table.)
- General Understanding of Metals, Nonmetals, and Metalloids in periodic table
- Acids and bases (**Brønsted-Lowry definition only**), pH scale
- Physical vs. Chemical Properties and Changes

Basic chemistry skills:

- Use of the metric system: liquids, weight
- Identification and appropriate use of glassware and all components of the Potions Kit provided to the school
- Weigh out powders using electronic balance.
- Measure liquid volumes using graduated cylinders.
- Pour liquids into narrow-mouthed containers (with and without using a funnel; practice with water).
- Use a pipet/dropper to measure and transfer small amounts of liquid.
- Filter solutions using funnel and paper filters.
- The only heat source to be used will be hot tap water.
- Estimate pH of liquids with pH indicator paper or empirically
- Ink Chromatography
- Fingerprinting (loops, whirls, and arches)
- Identify powders by examining their physical or chemical properties. (For example: using solubility, color and pH to distinguish starch from salt from baking soda).
- Identify liquids by examining their physical or chemical properties (viscosity, pH, color).
- Separation of mixtures and solutions based on physical properties. (For example: how would you separate sand, salt and water from a bucket of sea water)

5th Grade Only

- All topics above
- Chemical reactions (activation energy, reaction rates, and equilibrium)
 - Activation Energy, Reaction Rates (Conc, Temp, Pressure, etc.), Equilibrium, Reactants, and Products
- Chemical Bonding (ionic vs. covalent)
- Ions and Isotopes (what are they and how are they represented)
 - Cation and Anions
- Iodine Test
- Fingerprints
 - The difference between a plain arch and a tented arch

Additional Resources

Please use any material that you can find on the web/library that is appropriate for upper elementary to middle school. Some useful websites are listed below (activities are suitable for getting familiar with basic facts and chemistry techniques):

- <https://quizlet.com/74150354/lab-equipment-names-and-pictures-flash-cards/> (identification of labware and equipment – not all apply)
- <https://quizlet.com/24901733/lab-equipment-identification-and-functions-flash-cards/> (identification of labware and equipment – not all apply)

- <http://www.sciencegeek.net/Chemistry/taters/labequipment.htm> (identification of labware and equipment – not all apply)
- <http://www.slideshare.net/marglema9/biology-labequip> (identification of labware and equipment – not all apply)
- <http://www.uen.org/Lessonplan/preview.cgi?LPid=33067> (5 experiments of physical and chemical changes)
- <http://www.uen.org/Lessonplan/preview.cgi?LPid=16252> (Blobber – chemical changes)
- <http://www.uen.org/Lessonplan/preview?LPid=2176> (How to identify powders and liquids) (This is a great exercise but **do not have them taste the powders!**)
- <http://www.uen.org/Lessonplan/preview.cgi?LPid=631> (Changes in matter)
- <http://www.uen.org/Lessonplan/preview.cgi?LPid=2683> (Dissolving Salt – physical change)
- <http://www.uen.org/Lessonplan/preview.cgi?LPid=16250> (What a Reaction)
- <http://www.uen.org/Lessonplan/preview.cgi?LPid=639> (What's the Matter?)
- <http://www.uen.org/Lessonplan/preview.cgi?LPid=2686> (Chemical reactions: Borax & Glue. Cream)
- <http://scifun.chem.wisc.edu/homeexpts/Chemilum.html> (Chemiluminescence)
- <http://scifun.chem.wisc.edu/homeexpts/ACIDBASE.html> (Exploring Acids and Bases) (Be careful with ammonia!)
- <http://www.acs.org/content/acs/en/education/whatischemistry/adventures-in-chemistry.html> (3 experiments that are fun to watch and well explained)
- <https://www.shodor.org/ssep/lessons/ink.html> (Ink Chromatography)
- <https://www.childrensmuseum.org/blog/saturday-science-incredible-iodine> (Iodine Test for Starch)

Example Questions

- Which state of matter has no defined shape but has a defined volume?
 - a) solid
 - b) gas
 - c) liquid**
 - d) ice
- Match the following to the proper description: O₂ H₂O Na

○ represents a compound	H₂O
○ represents an atom	Na