

The Match Game: A Discovery of the Laboratory Equipment Used in High School Chemistry

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Most high school chemistry teachers will agree that it is in the laboratory that students learn the most chemistry. In fact, teachers will tell or demonstrate the story of Ira Remsen (1) to prove this point to their students. In this story, Remsen describes his desire to find out the meaning of the phrase "nitric acid acts upon copper" by pouring nitric acid found in a doctor's office over a copper coin. The resulting gases and colors intrigued him, as we hope laboratory activities in high school will intrigue our students. However, fear of the lab remains a big part of the anxiety that students feel as they enter a chemistry classroom for the first time. This fear of the unknown contributes to many students' prejudgment that they will not enjoy the year that they spend in the chemistry classroom. The lab can also be a source of anxiety for teachers. If students do not follow procedures carefully, or if they do not properly use lab equipment, accidents can occur.

In this laboratory exercise, designed as a simple game called the "Match Game", students learn the names of all lab equipment and glassware that they will encounter during the school year. The game leads into a student-based discussion during which they carefully think about proper uses for each piece of labware. Students are less anxious when they see lab equipment during the year, since they have already proven to themselves that its use is logical and safe.

Preparing the Match Game

The Match Game is inexpensive to prepare and easy to set up. The most difficult part of the preparation is initially deciding which equipment to use. If a laboratory curriculum has not been planned out for the year, the lists of supplies and glassware found at the front of laboratory manuals can be used for suggestions as to what to include. About 40–50 pieces of equipment should be included, depending on class level, class size, and personal safety concerns. The name of each piece of equipment chosen is written on an index card, for a set of 40–50 cards. One set of cards is prepared for each lab group. As many sets of cards as needed can be prepared on different colored index cards, so that they may be saved from year to year and quickly sorted into sets. Each set has the same names of lab equipment. A sample list of included equipment is shown in List 1. Before the laboratory period, all the equipment found on the index cards is collected and placed into a big bin or scattered on the tables where the students will be working. The set of cards is placed into the bin as well. A bin is prepared for each group of students. The total time required for successfully completing the Match Game as a teaching tool is about 70–90 minutes (preferably two consecutive class periods).

List 1. Lab Equipment and Glassware To Include in the Match Game

beaker	nichrome wire	graduated cylinder	graduated pipet
mortar and pestle	test-tube holders	gas collecting tube	pipet bulb
crucible and cover	clay triangle	thermometer	triple-beam balance
watch glass	scoopula	test-tube clamp	iron ring
evaporating dish	spatula	clamp holder	safety goggles
plastic wash bottle	rubber tubing	forceps	test tubes
dropper pipet	crucible tongs	buret	screw clamp
funnel	test-tube brush	double clamp	test-tube rack for small test tubes
rubber stoppers	triangular file	glass stirring rod	test-tube rack for large test tubes
ring stand	wire gauze	rubber policeman	spot plates
Erlenmeyer flask	gas burner	pinch clamp	beaker tongs

Playing the Match Game (30–40 minutes)

Each class is divided into cooperative groups of four to six students each, depending on class size. The directions given to the students are simple:

You will be divided into lab groups (teams) of no more than six people to a group. At each lab bench, there is a set of index cards. Your team color is the color of the index cards at your bench. Also at each table is a set of lab equipment and glassware. When the signal is given to begin, your team must match each piece of glassware or equipment to the index card that bears its name. When you think you have all the matches made, call me over and I will tell you if you are correct. The first team to correctly match all the items on the bench wins five points on the first quiz (which, incidentally, will be on the names of the equipment that you are studying today). After all the items are matched, we will discuss their uses in the chemical laboratory.

Students are verbally reminded that much of the equipment is breakable, and safety should always be on their minds. During the course of the game, the teacher can try to aid the students by telling them how many cards they have mismatched, or leading students to the correct answer by urging them to "play around" with the piece of equipment and guess what it may be used to accomplish. If a group finishes early, they are urged *not* to help the other groups (since students often just give out answers). After sufficient time (30–40 minutes), the game is ended, and the discussion begins.

Student-Based Discussion (40–50 minutes)

The discussion period is the most important part of this lab activity. It is rare in normal lab exercises that students *compare* pieces of lab equipment. For example, a side-by-side comparison of a beaker and a flask gives students the opportunity to think about the advantages and disadvantages of both, and for the remainder of the year they may choose the proper piece for their lab work. Also, if students have "played around" with the equipment during the game, and have *not* figured out its use, the postlab discussion often leads to that much-anticipated, "Ohhhhhhh!" Revealing how a piece of equipment is *actually* used leads to many happy squeals of, "I told you so!" and "That's what *we* did!" During this part of the exercise, pieces that are generally used together are discussed together, and the students get a glimpse of what is to be expected during the year. The different materials used to make lab equipment (glass, Pyrex, ceramic, etc.) can also be discussed. Safe handling of each piece is also a priority for discussion.

After the discussion, a handout showing drawings of all lab equipment discussed is provided so that each student can record the name and proper spelling of each item. When they are finished reviewing and recording, students have a study aid to add to their notes to help them study for the upcoming quiz. A summary and review of the discussion and names

is disguised as "cleanup". The teacher tells each group the order that each piece of lab equipment is to be placed back in the bin, and the group must work together to locate the piece and follow the directions as to how or where it should be placed into the bin. If done carefully, the lab activity is now set up for the next class!

Variations on the Match Game

For an honors class, the game can be made significantly more challenging by joining pieces that have separate cards (i.e., a stirring rod and a rubber policeman), separating sets that have one card (mortar and pestle), or by presenting more than one type of each object (i.e., plastic and ceramic spot plates with different well sizes). A teacher may choose to have students draw each piece of lab equipment themselves instead of providing a handout.

Student Response to the Match Game

When the game and its simple directions are first explained, students often believe that the whole idea is way beneath them, and that the task will be quick and easy to complete. They soon discover, however, that much of the equipment looks very odd (consider a pinch clamp or crucible tongs), and even the seemingly "easy ones" can quickly become confused (many students find it difficult to distinguish between a beaker and an Erlenmeyer flask). The students tend to work together, discussing how each piece might be used, and rearranging cards that have already been placed. Heated discussions between lab group members are common. Last year, I questioned students at the end of the school year to determine the level of satisfaction with this activity and how helpful it had been throughout the year. Generally, reaction to this exercise was very positive. Foremost, students had fun. One student said, "Can I still remember how I felt before and after the game? No. Can I still remember all the names of the lab equipment? Yes." He also thought that I should do the game with next year's class, because it was very helpful. An ESL student remembered that the game was, "hard and confusing," and that the "names were unfamiliar". He added that after the discussion, the lab "helped me to know the equipment better than just pictures in a book."

Conclusion

I have used this exercise as the introductory lab activity in my classroom for the past nine years, with little change to the procedure. It works extremely well in terms of building excitement, as well as teaching this very important information.

Literature Cited

1. Summerlin, Lee R.; Borgford, Christie L.; Ealy, Julie B. *Chemical Demonstrations, A Sourcebook for Teachers*, 2nd ed.; American Chemical Society: Washington, DC, 1988; Vol. 2, pp 4–5.