

Whoosh Bottle

(Requires adult supervision)

Great activity for outdoors during Halloween nights! This is a Chemistry class standard where a small amount of alcohol is poured into an empty 5 gallon polycarbonate water bottle. Some of the alcohol evaporates into fumes, which are confined by the bottle shape. A lit match is dropped into the bottle, and WHOOSH! the fumes catch on fire. The fire dances and swirls in the bottle, and accelerates out the opening. It's quick, but really quite satisfying!

MATERIALS

Whoosh Bottle (5 gallon water bottle)
Lid for Whoosh Bottle (or aluminum foil)
Isopropyl alcohol 70%
Book of matches
Barbeque tongs
Bucket of water
Fire extinguisher, if available
Waste container (old jar, plastic container, etc)

SAFETY (YYYlist this first)

1. Outdoors ONLY!
2. Clear the area of flammable material (leaves, patio furniture, etc)
3. Only one person doing the activity. Everyone else stands 10 feet away.
4. Safety glasses preferred for the person doing the activity.
5. Polycarbonate (thick, strong) plastic water delivery bottle, aka Whoosh Bottle. These can be purchased at Walmart. Don't use glass, in case it breaks from heat or pressure. Other plastic bottles may not be strong enough, or they may melt or ignite.
6. Create a safety station about 10' from the Whoosh Bottle, containing:
 - a. Bucket of water
 - b. Fire extinguisher, if you have one
 - c. Location for alcohol bottle, extra matches.
7. BEST, SAFEST PRACTICE: Use isopropyl (rubbing) alcohol, 70%. (Currently, it is the only type available retail at CVS & Walmart in Pioneer Valley. 90% isopropyl alcohol can be used, but 70% is safer. This is because 70% rubbing alcohol is 30% water, so less fumes (vapor) will evaporate from the liquid. This lower volatility means the "whoosh" reaction goes slower and less violently.
8. Ethanol could also be used. BUT NEVER use methanol. (Isopropyl and ethanol are lower volatility alcohols.)
9. Always recap the isopropyl alcohol and return it to the Safety Station before lighting the Whoosh Bottle.
10. NEVER put your face, hand, or other body part directly above the opening of the Whoosh Bottle.

WHOOSH BOTTLE PROCEDURE

1. Best bottle characteristics for "whoosh": Large volume (for containing alcohol vapor) and narrow neck.

2. Put two capfuls of 70% isopropyl rubbing alcohol into the Whoosh Bottle. (Recap the alcohol and return it to the Safety Station.)
3. Cap the Whoosh Bottle. (Use foil, if no cap.) Swish the alcohol in Whoosh Bottle, coating the sides. This makes more surface area for the alcohol.
4. Wait 1 minute, swishing occasionally. This allows some of the alcohol to evaporate, from liquid to vapor fumes. It allows the fumes to collect and fill the full volume of the bottle. Ambient air containing oxygen is also in the bottle, which is essential for combustion.
5. Lighting the fumes: Remember, no body parts above the Whoosh Bottle opening.
6. Lighting the fumes--paper match method: Clamp 2 matches at the end of the tongs. Light the matches with a third match. Maneuver the two lit matches over the Whoosh Bottle opening. Keep the tongs at arm's length. (Practice this once to get coordinated.) Release the tongs, dropping the matches into the Whoosh Bottle.
7. WHOOSH!
8. Cleanup: Pour the remaining liquid into an empty waste container (old jar). Cap it and place at Safety Station. Repeat Whoosh activity, beginning with Step #2.
9. DO NOT repeat Whoosh activity more than 2 or 3 times. The Whoosh Bottle will get hot, and there will be less oxygen in the bottle with repeated trials. After 3 times, fill Whoosh Bottle with water from a garden hose. Dump and drain. It is now cool and refilled with oxygen-containing air. You are ready for more Whoosh-ing.
10. When you're completely done, the remaining liquid (alcohol/water mix) in the waste container can be washed down a drain with lots of water.

DUDS: WHAT IF IT DOESN'T WHOOSH?

This can happen. If it is your first attempt, assume the Whoosh Bottle is still primed with alcohol fumes. It is possible that the matches blew out too soon after dropping into the bottle. (This is why we use 2 matches.) Try again. This also sometimes happens on the 2nd or 3rd repeat Whoosh. It could be that the oxygen has been used up from the earlier Whooshes. Wait for some air to enter the bottle, maybe fan some in. Then try again.

ONLINE RESOURCES

- (Best quick read)
<https://www.flinnsci.com/api/library/Download/bf2f0d16dd86411ea26eb0cb687dc593>
- <https://www.chemedx.org/blog/there-more-whoosh-bottle>
- <https://edu.rsc.org/resources/the-whoosh-bottle-demonstration/708.article>
- <https://uwaterloo.ca/chem13-news-magazine/march-2015/feature/whoosh-bottle-and-safety-discussion>