Materials Identification

- Methane (from gas jet), CH₄
- Oxygen (in air), O₂

Products of Reaction

- Carbon dioxide, CO₂
- Water vapor, H₂O

Type of Reaction

- Combustion

Chemical Equation

- CH₄ + 2 O₂ → CO₂ + 2 H₂O

Intended Procedure and Outcomes

Students measure an amount of methane gas from gas jet into a syringe, and then inject the gas through the hole at the bottom of the Pringles can into the can while the lid is capped. The methane is allowed to mix with the air in the can for a minute or so. Then the piezoelectric lighter is placed in the hole at the bottom of the can and lit. The chemical reaction occurs and the pressure buildup inside the can causes the cap to pop off. The can is lined with aluminum foil on the inside, so it should not be flammable.

Safety Rules to Enforce

The following safety rules, printed on the student handout, should be emphasized very clearly:

1. The can must be secured upright (cap at top) to a ring stand using a three-pronged clamp before lighting the lighter.
2. You are only allowed to place methane into the can using the syringe. Do not put the hose into the can.
3. Everyone should stand to the sides of the can (not in front of it) before lighting.
4. Any time you try to make the explosion by using the lighter, the cap must be ON the can, and the front of the lighter (where the flame occurs) must be inserted at least 1” INSIDE the hole in the Pringles can.

Other standard laboratory safety rules that students have followed all through their chemistry courses are also particularly pertinent:

- Tie back long hair.
- Roll up loose clothing so that it will not dangle near a flame.
- Wear goggles.
- Do not get close enough to a flame to get burned.
- Never leave a gas jet on.
Possible Problematic or Dangerous Outcomes, How to Avoid Them, and Safety Contingencies in Case They Occur

- **The cardboard on the outside of the Pringles can could catch fire if students light the outside of the can instead of starting the flame inside.**

  If the lighter is not placed inside the hole, it is possible to light the cardboard. Tell students this explicitly when drawing their attention to the safety rules for the activity at the beginning of the activity. While students are working, check to make sure they are inserting the front of the lighter into the hole in the can before they pull the trigger to light the explosion. Make sure students take care to step back when someone is clicking the lighter. (Most students do this intuitively.)

  In case this outcome occurs, have a safety blanket on hand to cover the fire and put it out.

- **The flame could shoot out of the top of the can if the students do not cap the can and if they fill the can completely with methane.**

  If the cap is not on the can, the flame inside the can could shoot up. If there is something flammable above the can (e.g., a wooden shelf, someone's hair, a notebook, clothing), it could catch fire. Although students will do this naturally, advise everyone in the group to stand back a bit while one person places the lighter into the hole and clicks it.

  In case this outcome occurs, have a safety blanket nearby to smother any object that catches fire.

- **The flame could shoot out the hole if the students fill the entire can with methane and light it.**

  It may be natural for some students to try to fill the entire can with methane. The safety rule about only using the syringe to place methane into the can should prevent students from placing a tube from the gas jet into the can and creating a tremendous excess of methane so that lots of methane escapes. If this occurs, however, methane is much less dense than air, and it will quickly rise in the room, so it is very unlikely that a lit can could cause a larger flame than just the methane that is in the can. What is more likely is that students will measure the exact volume of the can and will try to fill the entire can with methane, reasoning that the more methane there is, the bigger the explosion will be. In fact, oxygen is a necessary reactant, so if a student lights the lighter just outside the hole, the methane that is escaping from the hole will catch fire on contact with the oxygen in the air outside the can, creating a fire that shoots out of the hole. When this happens, the flame only lasts for one or two seconds and then dies. The rule about standing to the sides of the can when lighting should prevent anyone from being hurt by this.

  In case a shooting flame does occur and someone is in its way, make sure to have a safety blanket nearby to wrap the student (or cover the object) and extinguish any fire.