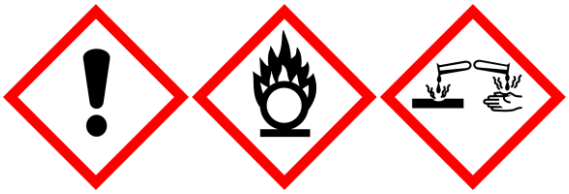
Demonstration (5th - 10th grade)	**Oxygen Synthesis**	**Time:** 10-15 min.

Safety:

safety glasses



Do not press the stopper too tightly into the test tube! Too much gas production can pop the stopper out and allow the gas to escape, but stoppers which are overly tight can cause the test tube to shatter under high pressure.
The needle tips should be trimmed off with wire cutters.

Instruments:

- 1 test tube (Duran 16/160)
- 1 soft rubber stopper
- 1 (pink) needle (1,2 / 40mm)
- 1 20ml syringe
- 1 pair wire cutters
- retort stand materials
- wooden splint

Chemicals:

- Hydrogen peroxide solution, H_2O_2 (30%; H: 318-319; P: 220-261-280-305+351+338-310)
- manganese dioxide powder, MnO_2 (H: 332-302; P: 221)

Preparation:

Remove the needle points with the wire cutters. Be careful not to crush the tube while doing this. The 20ml syringe should function smoothly and be lubricated using silicone oil.

Experiment:

- Fasten a test tube using the retort stand materials. Drill a hole in the rubber stopper with the needle. Affix the 20ml syringe to the needle.
- Pour hydrogen peroxide (H_2O_2) into the test tube to a depth of approximately 1 cm.
- Put a few small pieces of powdered manganese dioxide (MnO_2) into the test tube and seal it with the stopper. **Do not press the stopper into the test tube too tightly!**
- Catch the resulting gas in the syringe. **Make sure that the syringe plunger slides freely and easily.**

<u>Testing the captured gas:</u>

- Light a wooden splint and blow out the flame. Gently squeeze the gas over the glowing coal on the end of the splint.

Observations:	The syringe fills with a transparent gas. This gas makes a glowing coal burn visibly brighter and ignites the wooden splint.
Results:	The hydrogen peroxide decomposes into water and oxygen via a disproportionation reaction. The process is catalyzed by manganese dioxide: H_2O_2 (l) → O_2 (g) + H_2O (l) The presence of oxygen can be proven using the wooden splint test.
Disposal:	Pour the solution into the container for heavy metal waste.