

Substance	Hazard	Comment
Hydrogen Gas	 EXTREMELY FLAMMABLE  GAS UNDER PRESSURE	<p>DANGER: extremely flammable gas; contains gas under pressure, may explode if heated (cylinders and canisters).</p> <p>It forms explosive mixtures with air and oxygen.</p> <p>Mixtures with air between 4% and 74% hydrogen by volume are explosive.</p> <p>Explosive mixtures will ignite below 500 °C and well below this temperature in the presence of catalysts such as transition metals and their oxides.</p> <p>The explosion with oxygen produces a very loud noise which can damage hearing.</p> <p>Mixtures of hydrogen and oxygen can arise when recharging a car battery (or model cells in schools); ensure good ventilation, avoid sparks and naked flames.</p>

Typical control measures to reduce risk

- If preparing the gas in test-tube reactions, use the smallest possible amounts.
- Wear eye protection and stand well back.
- Use safety screens for all but test-tube amounts of the gas; ensure good laboratory ventilation.
- If preparing the gas on anything larger than a test-tube scale, make sure the apparatus has the smallest possible volume, so that only a little air has to be flushed out. If lighting the gas at a jet, test a sample to make sure that all the air has been flushed out and light from a distance.
- If possible, use a gas cylinder rather than generate your own hydrogen, because the cylinder produces a more rapid flow which flushes air more quickly from the apparatus.
- When carrying out reduction reactions, for example with metal oxides, consider alternative reducing agents such as methane or ammonia gas.

Assessing the risks

- What are the details of the activity to be undertaken? What are the hazards?
- What is the chance of something going wrong?
eg could the hydrogen be ignited accidentally? How easy is it to make sure that all the air has been flushed out?
- How serious would it be if something did go wrong?
Note: there are occasional reports of pupils being taken to hospital (for treatment to cuts or for splashes of chemicals) because of damage to apparatus in hydrogen explosions.
- How can the risk(s) be controlled for this activity?
eg can it be done safely? Does the procedure need to be altered? Should goggles or safety spectacles be worn?

Emergency action

In all emergency situations, alert the responsible adult immediately. Be aware that actions may include the following:

- Gas escape Open all the windows. Make sure there are no naked flames.
- Explosion If there are cuts from flying glass, apply pressure using a clean pad of cloth. Do not attempt to remove large pieces of embedded glass etc. If there is arterial bleeding, the casualty should be laid down and the injured limb raised up. Call 999/111.