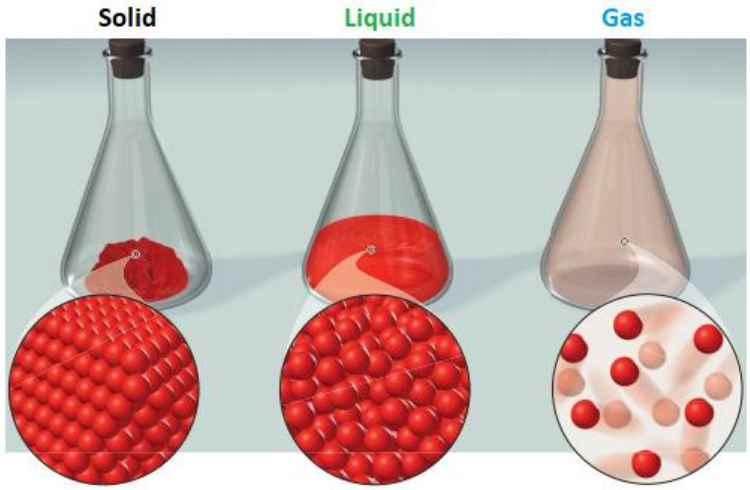
Chemical gases

What are gases and their characteristics ?

Gasses are one of the three fundamental states of matter, at regular room temperature and atmospheric pressure, the others being liquids and solids. The biggest and most noticeable difference between these states of matter is *the shape and volume*.

1. Gasses have ***no fixed shape or volume***, so they will completely fill whatever container they are in. This is because the atoms are spaced much further apart in gasses than liquids or solids, as shown in the picture.



2. Gasses are ***compressible.*** They are commonly stored in compressed cylinders until needed.
3. Gasses can be ***colourless***
4. Some gasses are ***odourless***, and others have ***distinctive odours*** though the odour limit can be above or below the toxic limit.
5. Gases ***form mixtures.*** They can be mixed with other matters like solid or liquid forming aerosols.

Information on the physical state of a chemical can be found in **Section 9** of **(M)SDS** (Material) Safety Data Sheet. Also, note the boiling point (b.p.) which is the temperature at which a chemical can change its state from a liquid to a gas. For example, hydrogen fluoride (HF) has a b.p of 19.5 °C (67.1 °F).

Where are gases used?

Gases are used in many kinds of applications such as medical, industrial and/or transport.

What are the associated health risks of exposure to gases?

There are very few common hazards associated with gasses because they will all chemically behave differently. However, there are some key factors to consider:

1. Is the gas toxic or not? Even if a gas is not toxic, a gastight material may still need to be considered depending on how it is handled. If it is toxic or corrosive on skin contact, a gastight material must always be considered.
2. Is the gas under standard conditions, or is it pressurized, or liquified? Then, an appropriate thermal protecting glove must be considered.
3. Is it diluted in water or a solution? Then, a material that can protect against such solution must be used.

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Further examples to elaborate:

1) **Air** is composed of different gases: oxygen, nitrogen, carbon dioxide, etc. Air is not toxic for human beings (they absolutely need oxygen to live), meaning that **no PPE** should be used in this case.

2) **Mustard gas** is classified as a chemical warfare agent and used in military applications. It is a blistering agent and toxic by inhalation. In this precise case, a glove does not provide an appropriate mean of protection when it is used alone. Instead, a full body protection suit with an isolating breathing device on it should be used to protect the user from this chemical.

3) **Hydrogen fluoride (HF)** is a very toxic chemical (see Hydrofluoric acid/Hydrogen fluoride FAQ). It can induce gangrene and even death. When pure (100% concentration), HF is a gas. If gaseous HF is used, then a whole suit of protection with an isolating breathing device on it should be used to completely avoid any contact and inhalation of this toxic chemical.

4) **Propane** corresponds to a gaseous compound often stored in pressurized bottles. This condition of storage, which increases the pressure, transforms propane into a liquid, which is called "liquefied gas". When this liquefied gas comes out of the pressurized bottles, the main risk will be the possible ***cold burns*** produced to the end-user's hands.

5) **Chlorine** is a gas in under normal use conditions – therefore, a glove doesn't represent a relevant way of protection against it when used alone. However, in the day-to-day life, many people use the term "chlorine" as a very generic word to describe the liquid solution usually used to disinfect swimming-pools.

What kind of hand protection is needed for gases?

Gloves alone do not provide appropriate protection against a pure gaseous compound. A glove can't prevent complete contact with the gas or protect against gas inhalation.

What kind of body protection is needed using gases?

For body protection materials, Ansell offers permeation data and estimates against gasses. AlphaTec® 4000 and up as well as AlphaTec® Light are usually tested against gasses. Although, AlphaTec® 3000 material and below or AlphaTec® Splash materials are not tested typically against gasses, there are instances when limited amounts of data are included when appropriate.
Our data is based on the fabric and not the model selected, therefore a fabric that may have excellent permeation times may not be suitable for a certain application. The decision for what PPE is required should be done by the onsite Health and Safety team with a good knowledge of conditions and a full health and safety report.

Only **Type 1** gastight suits are pressure tested to ensure they do not let gasses pass through the suit and we would always suggest considering one where protection from gasses is needed. Our gastight suits include the **AlphaTec® 6000**, **Light**, **Super**, **VPS**, **VPS Flash** and **EVO**.

Other models such as **PAPR** and **AIRline** may limit the amount of gas reaching the user. These models use positive pressure inside the suit which may stop gasses entering. Another model, namely **APOLLO**, which is an encapsulating designed model looking like a gastight, may also limit the amount of gasses

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reaching the user. However, it may not prevent all gasses reaching the user as this model is not designed as gastight suit, does not undergo pressure testing and is not certified as gastight.

Traditional model **coveralls** may **not be suitable** for protection from gasses. This is because gasses can enter the suit through neck, hand and foot openings and through the non-gastight zipper. They may be considered for small amounts of (non-hazardous) vapors as this may reduce the amounts of gas reaching the user but not sufficiently for large amounts of vapors and gasses. The decision to use a non-gastight suit for protection against gasses and vapors must be thoroughly considered.