



**Fire Safety**  
**Module 2**

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Health & Safety  
**Essentials**

Registered charity number 207890

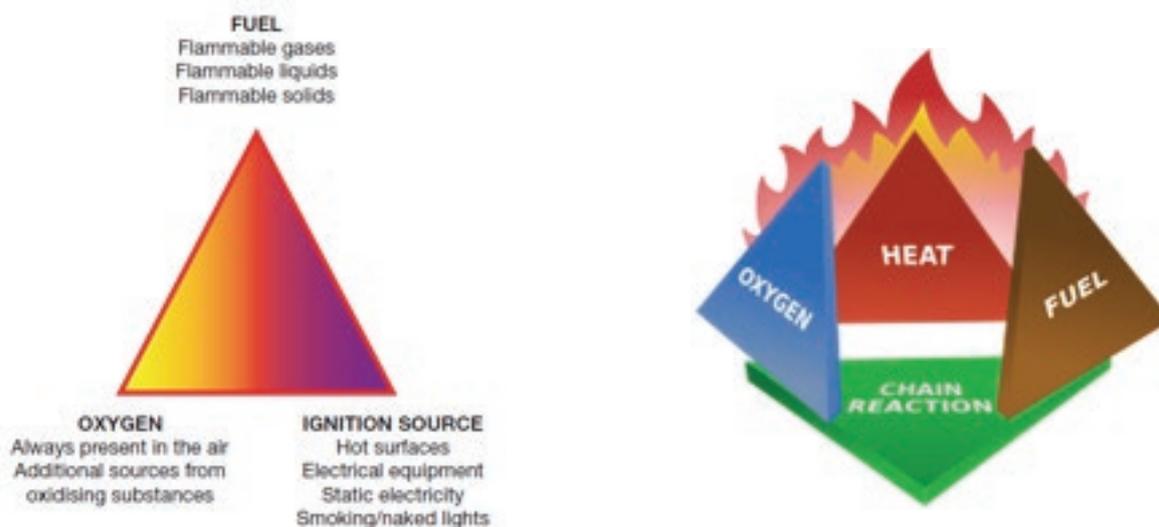
# An overview

## Combustion and fire

Combustion is the self-sustaining thermal oxidation of a fuel to produce heat and often visible light. Fire is really the visual indication that a rapid combustion process is occurring.

The simple view is that for a fire to occur there must be a fuel, heat or ignition source and oxygen but this is actually a description of the combustion process rather than the visible fire. Additionally, this isn't strictly always the case as some fuels contain usable oxygen within their structure and don't require an external source.

The 'Fire Triangle' is traditionally used to pictorially represent the components needed for 'fire' to occur but more recently the 'Fire Tetrahedron' is being used to represent the flaming condition of a fire.



The representation is that an uninhibited chemical chain reaction is taking place, often by thermal degradation to produce a gas/vapour that is able to burn with a visible flame in air.

This fourth component of fire in the pictorial representation allows for the explanation that some fire extinguishers don't remove fuel, oxygen or heat in quenching the fire; they actually 'interfere' with the chemical process.

## Fire safety risk management

Regulatory Reform (Fire Safety) Order (2005) requires that fire risk management is a structured and systematic process that identifies, implements and maintains the most appropriate measures to reduce risk from fires.

To achieve this, a comprehensive fire safety risk assessment is required and a competent person should complete this activity with the help of the occupiers of the building.

## Fire safety risk assessment overview - a five stage process

There is a wide range of issues to be considered and the following 5-step process is similar to that given in the HSE's Guidance document '5 Steps to Risk Assessment'.

- 1 Identify Fire Hazards
- 2 Identify People at Risk
- 3 Assess the Risk and Develop Control Measures
- 4 Record, Plan, Inform, Instruct and Train
- 5 Review

### Common terms

In everyday speech, the terms related to fire and combustion are often confused and misused so it is worth reviewing what the words are intended to convey; -

**Combustible** means capable of combustion so that under the right conditions the material could take part in a combustion process or fire.

**Flammable** is specific to substances that can be ignited at 55°C or below. The intention is to show that they present an increased fire risk without their needing to be heated to decomposition.

**Highly flammable** is the assigned descriptor for materials that can be ignited below 21°C. This means they can be ignited at room temperatures and so present a significant risk.

**Extremely flammable** liquids and gases have with a Flash Point lower than 0°C and a boiling point of 35°C or less.

**Flash Point** is the minimum temperature at which sufficient vapour is being produced for a fire to be ignited, but not sustained.

**Fire Point** is the temperature at which fuel will produce sufficient vapours to be ignited and then continue to burn. This normally means there is sufficient radiation from the flame to produce a steady stream of vapour to sustain the fire.

**Autoignition temperature** is the minimum temperature at which a vapour-air mixture will spontaneously ignite without the necessity of an ignition source.

**Lower explosion limit** (flammable limit) is the lowest percentage of vapour or gas in air which supports combustion. Below this limit the mixture is too 'lean' to support combustion.

**Upper explosion limit** (flammable limit) is the highest percentage of vapour or gas in air which support combustion. Above this limit the mixture is too 'rich' to support combustion.

**Fire Loading** is a term used to describe the amount of combustible material available to burn in the fire and so indicate the potential scale of the damage.

**Explosion** is the term most often used to represent a sudden release of energy and increase in volume of gases generated. Some definitions claim a pressure wave travelling at the speed of sound is required for an explosion to have occurred but this is also referred to as a detonation.

There is often a debate about the gases produced in a fire and whether they are toxic or not but this isn't particularly useful. Unplanned combustion processes by their very nature produce a mixture of materials including fine particulates and it is reasonable to assume that carbon monoxide and nitrogen oxides are produced in air so it should be assumed the gases are harmful.



## Fire protection concepts

**Passive Fire Protection** attempts to contain fires and limit/slow their spread throughout a building through the use of structural features such as fire resistant walls, doors and floors. It is an inherent quality of the building construction and so it does not require anything or anybody to do anything. As such, it is failsafe by always being 'on' and will operate as long as it is being maintained to the required standard. The primary design feature is to limit the spread of fire heat and smoke and thus reduce risk to people and limit the damage.

**Active Fire Protection** includes those features which require something to trigger the response. Typically, this would be features such as automatic fire detection & alarm systems, fire suppression and sprinkler systems and other engineering features such as auto-closing ventilation in fume cupboards and air-con vents. Active fire protection is inherently less reliable than passive protection in that it requires a trigger to turn it 'on' and this doesn't always happen.

## Learning assessment 1

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Fill in the blanks in the following sentences:

1. The four components of the 'Fire Tetrahedron' are: \_\_\_\_\_, \_\_\_\_\_, \_\_\_\_\_ and \_\_\_\_\_.
2. The Five Steps to Fire Risk Assessment are:
  1. Identify Fire H \_\_\_\_\_.
  2. Identify P \_\_\_\_\_ at Risk
  3. Assess the Risk and Develop C \_\_\_\_\_ M \_\_\_\_\_.
  4. Record, Plan, Inform, I \_\_\_\_\_ and T \_\_\_\_\_.
  5. R \_\_\_\_\_.
3. Flammable is specific to substances that can be ignited at \_\_\_\_\_°C or below.
4. Highly flammable is the assigned descriptor for materials that can be ignited below \_\_\_\_\_°C.
5. \_\_\_\_\_ liquids and gases have with a Flash Point lower than 0°C and a boiling point of 35°C or less.
6. \_\_\_\_\_ is the minimum temperature at which sufficient vapour is being produced above a liquid for a fire to be ignited, but not sustained.

