Sample GNC Lesson Slides
Extracted from Element 10: Fire

10.1 Fire principles

10.2 Preventing fire and fire spread

10.3 Fire alarms and firefighting

10.4 Fire evacuation

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Fire safety enforcement

- Enforced and regulated by local fire and rescue service authorities
- HSE/HSENI enforce fire legislation for construction projects.

Specific legislation also in place for:

- Designing and constructing buildings (Building Regulations)
- Higher hazard workplaces with risks from dangerous substances capable of forming an explosive atmosphere (DSEAR and HSE guidance L138).

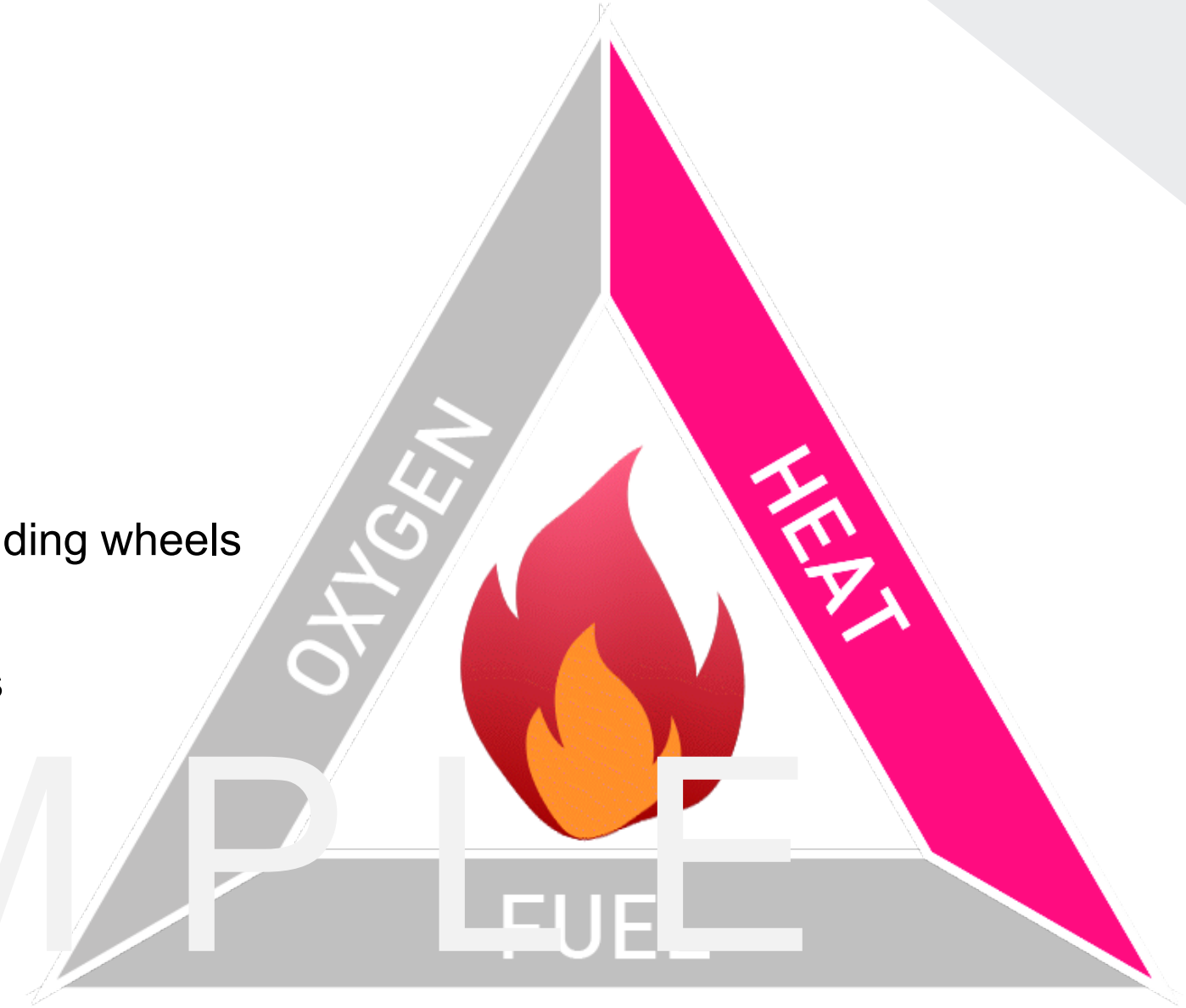
UK fire safety legislation

1. Regulatory Reform (Fire Safety) Order 2005 (England and Wales)
2. Fire and Rescue Services (Northern Ireland) Order 2006
3. Fire Safety Regulations (Northern Ireland) 2010
4. Fire (Scotland) Act 2005
5. Fire Safety (Scotland) Regulations 2006

Heat

Sources of ignition

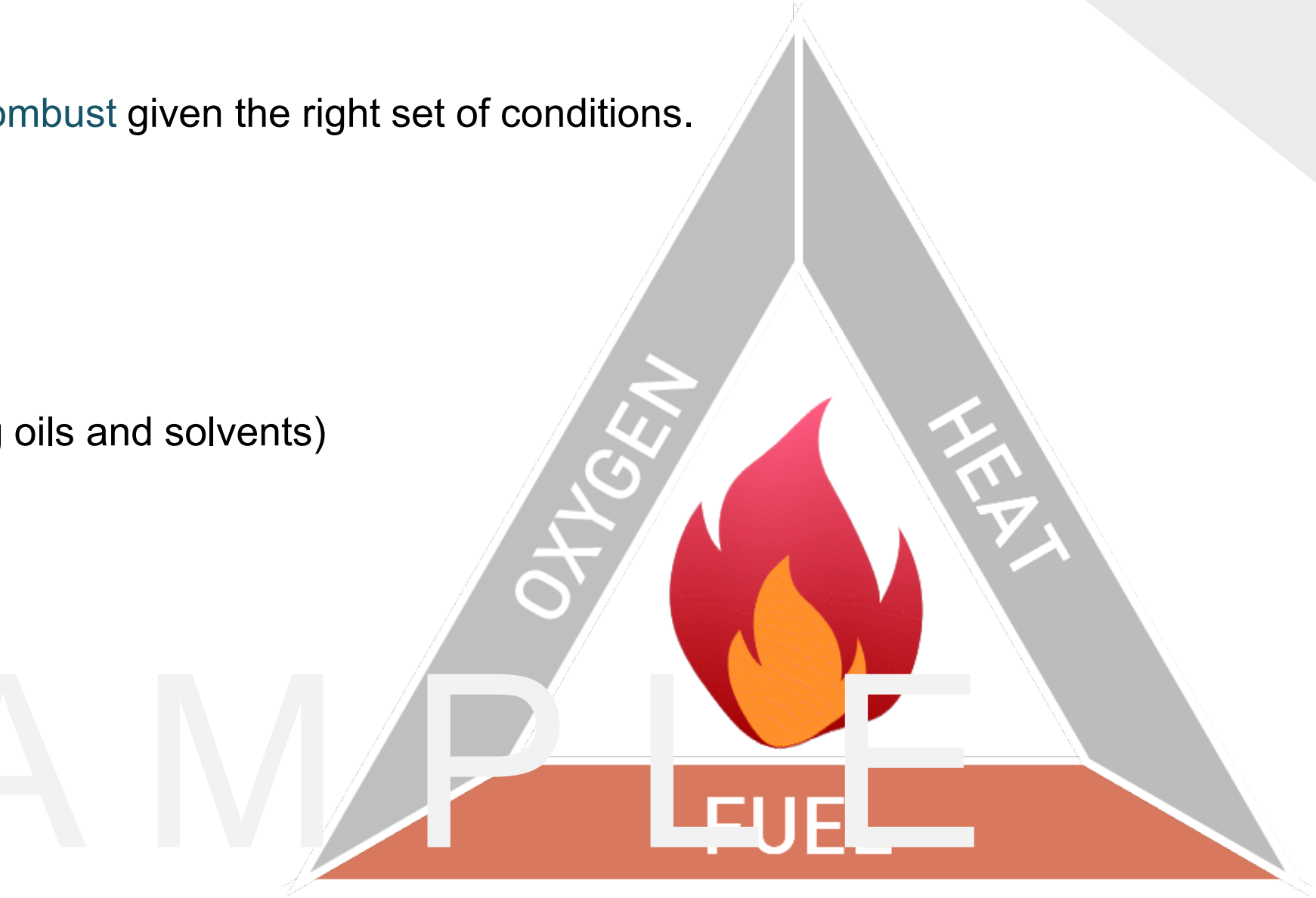
- Friction - from worn parts of machinery
- Hot surfaces
- Faulty electric supplies
- Faulty electrical equipment
- Static electricity
- Tools that can cause sparks by friction - grinding wheels
- Open flames - welding activities
- Smoking materials - matches and cigarettes
- Lightning strikes
- Radiant heat from the sun
- Faulty heating systems



Fuel

Fuel is any material that will combust given the right set of conditions.

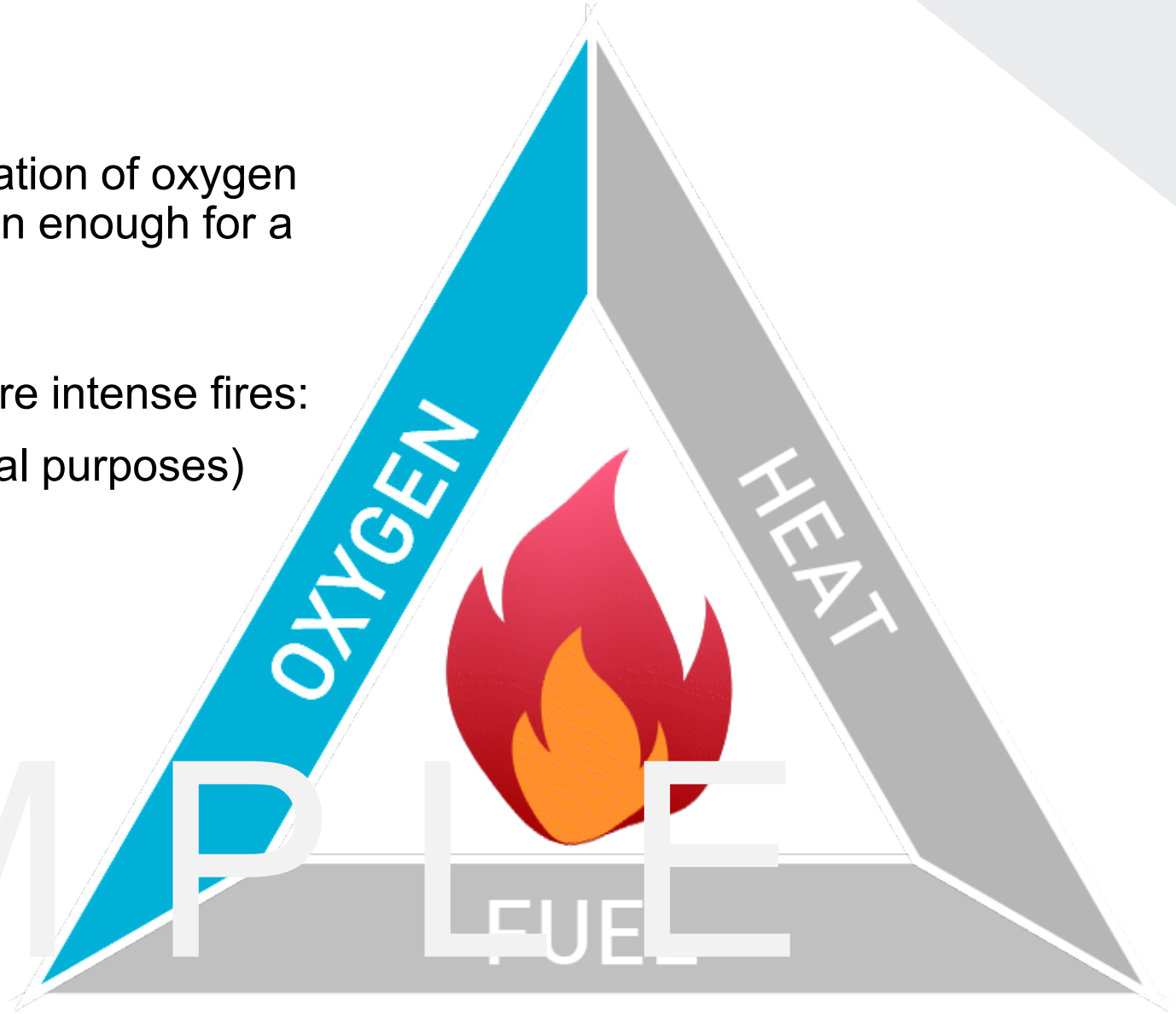
- Wood
- Paper and cardboard
- Fabrics
- Flammable liquids (including oils and solvents)
- Flammable gases
- Flammable metals
- Foam
- Rubber and plastics



Oxygen
Sources of oxygen

- The air that surrounds us. The usual concentration of oxygen in the air we breathe is 21% which is more than enough for a fire to start and continue to burn.

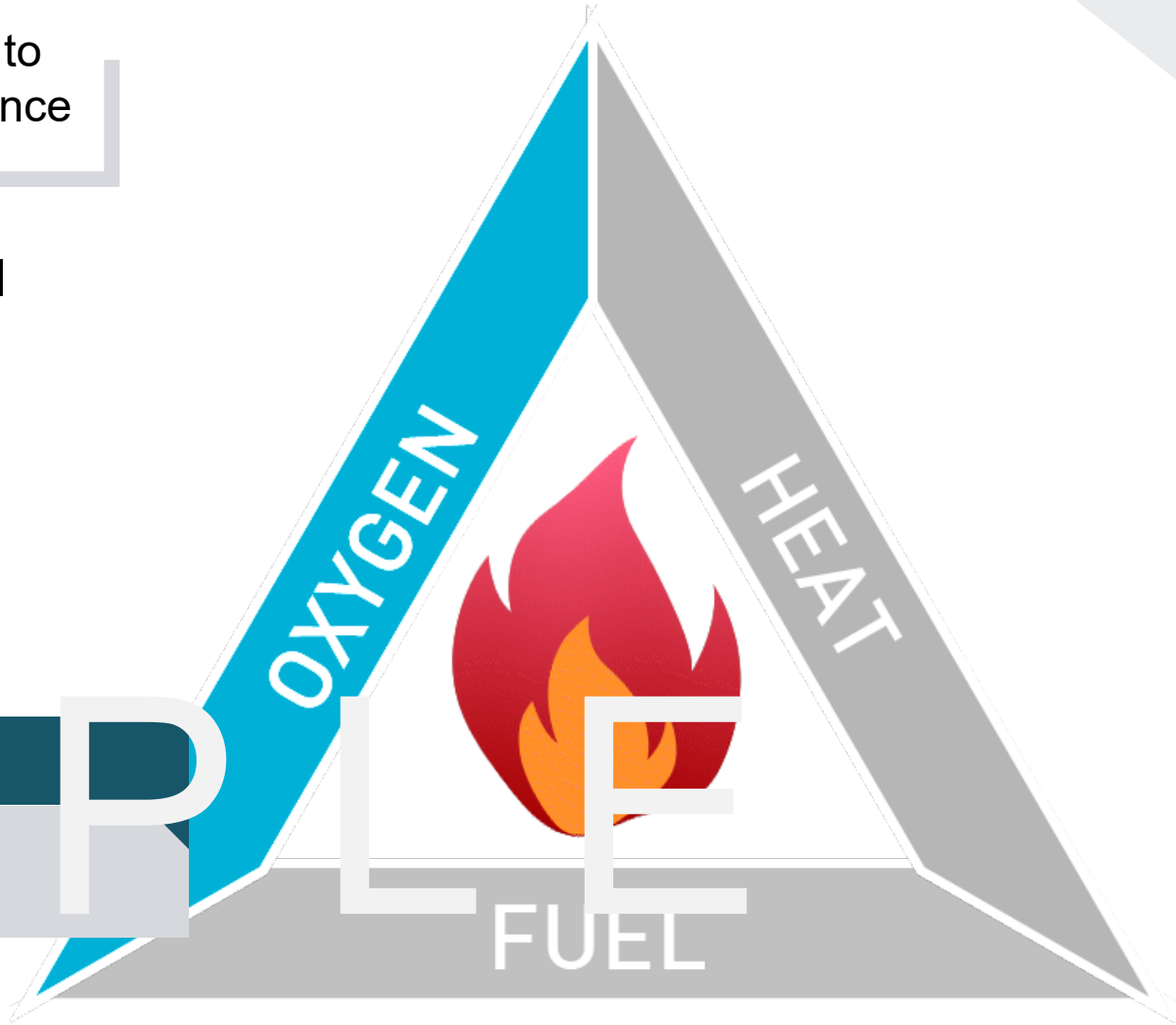
- Other sources of oxygen which will lead to more intense fires:
  - Oxygen bottles (used for welding or medical purposes)
  - Ventilation systems
  - Air-conditioning systems



Oxygen
Oxidising materials

Oxidising materials | chemicals that can easily decompose to release oxygen or an oxidising substance

- The oxygen is chemically bound in a material until it is freed by heat and/or a chemical reaction
- Can add to a fire and cause it to spread
- Should always be kept away from sources of fuel
- Can ignite sources of fuel without the presence of an ignition source



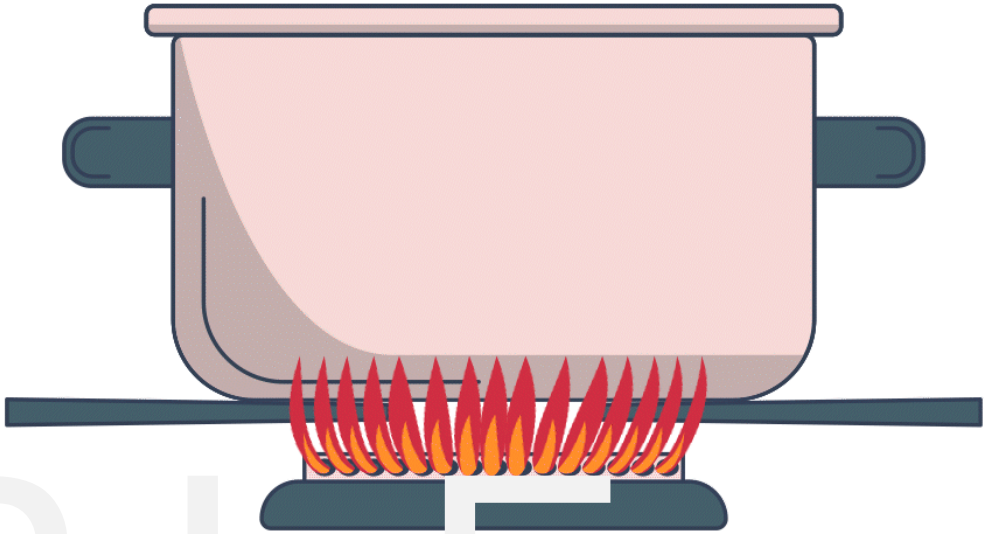
EXAMPLES

- Hydrogen peroxide (used in hair dressing salons)
- Sodium chlorate (used in weed killers)

Principles of heat transmission and fire spread

Conduction

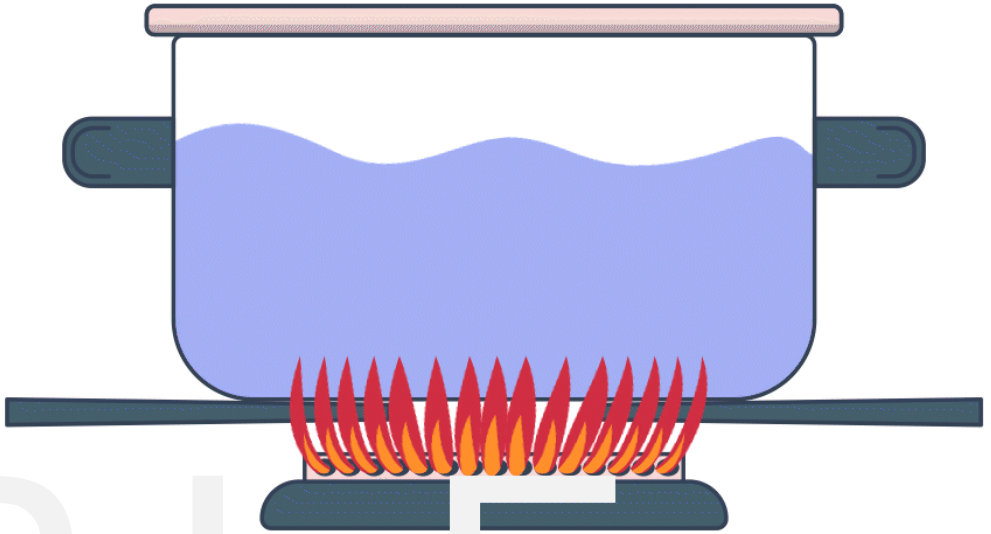
- The most common form of heat transfer
- The transfer of heat in a static material
- Materials differ greatly in their heat-conducting ability
- Metals are usually good heat conductors while building materials (e.g. brick and stone) are poor conductors



Principles of heat transmission and fire spread

Convection

- Heat is transferred through movement of a heated fluid such as air or water
- As the water is heated, its density decreases and it rises, being replaced by cooler fluid that is drawn in from below
- Hot air can travel both vertically and horizontally through gaps in the building fabric, along air vents and roof spaces, spreading the fire to other parts of the building



Common causes and consequences of fire

People

Making mistakes

Lapses of concentration

Being careless

Arson

Work activities

Working with open flames (e.g. welding equipment)

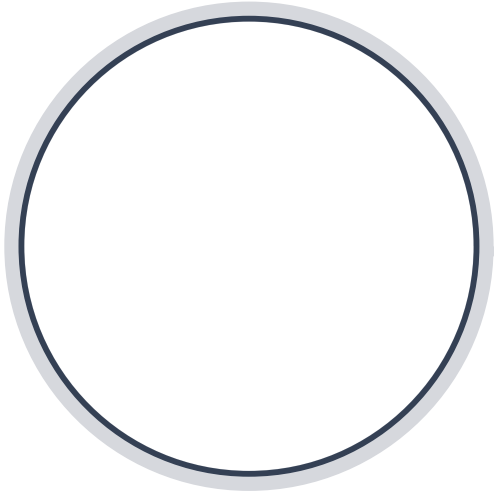
Hot work activities or activities involving open flames or excessive heat

Equipment/ electrical faults

Using faulty equipment

Overloading circuits

Poorly maintained equipment



Other conditions

Static electricity

Natural conditions (rays of sunlight or lightning)

Consequences of a fire

Personal injury

Small fire - Minor/superficial burns
Major fire - Major injuries/multiple deaths

Emergency workers are also at risk when responding to the fire.

Financial consequences

Can take years for an organisation to recover from a catastrophic fire. Some may be unable to recover.

Reputational impact

An organisation's reputation can be harmed if it is found to be cutting corners on fire protection.

E.g. If fire run-off w[illegible]used to control a fire caus[illegible]s widespread environmental damag[illegible]

Property damage

Ranges from minor smoke damage to total loss of the building; damaged/destroyed stock.

Seriousness of damage depends on design of building, degree of fire protection, alertness of workers and effecti[illegible]eness of detection and alarm syst[illegible]ms

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Common fire-detection and alarm systems

Detection and alarm systems identify an outbreak of fire or smouldering materials in its early stages - by sensing heat, flames or smoke.

Heat detectors

- Monitor the ambient air temperature and will sound an alarm when there is a change.
- Rate-of-rise (ROR) detectors sound an alarm when sudden rapid temperature rise is detected
- Fixed temperature heat detectors monitor ambient air temperatures against a pre-set level.

Flame detectors

Beams of ultraviolet/infrared light are transmitted across a protected area.

If flames interrupt the beam, this is detected by a receiving unit and the alarm is sounded or suppression unit activated.

Smoke detectors

Early warning devices that sound an alarm when smoke is detected. They are very sensitive and often give false alarms.

- Ionisation detectors
- Light scatter detectors
- Obscuration detectors

Fire alarms

- A fire alarm can be raised manually or, most commonly, electronically.
- The alarm must be easily recognisable by all workers, with a distinctive sound.
- A fire alarm must be distinguishable from other types of alarm, such as intruder alarms.

- **Manual alarms** such as bells, whistles, loud hailers, horns etc may be the most suitable for small, low-risk premises.
- **Audible alarms** are most commonly used. Additional systems may be required in a noisy environment or for people with hearing difficulties.
- Must be able to be heard, or seen, in all parts of premises.
- Some systems will link directly to smoke, flame or heat detectors that will automatically set off the alarm.

Portable firefighting equipment

- Fires are classified by their fuel type.
- There are various portable extinguishing media that can be used to put out each type of fire.
- The simplest methods are those used to smother fires, such as a fire blanket or sand.
- The most common portable firefighting method is the fire extinguisher.

Types of extinguisher

Foam

Wet chemical

Water

Powder

Carbon dioxide

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Means of escape

- Allows you to turn away from a fire and walk to a place of safety.
- Should lead directly to an outside open space away from the building.
- Should not include mechanical/other aids, e.g. chutes, ladders, harnesses, lifts (except for evacuating workers with mobility problems).

Consider:

Building construction | Travel distances | Stairs and passageways | Fire doors | Final exit doors | Emergency lighting | Directional and exit signage | Assembly points

Allow all people to escape to a place of safety without external assistance

Provisions to limit the ingress of smoke to the escape routes, to restrict the spread of fire and remove smoke

Adequate lighting and exits that are suitably signed

Protected from the effects of fire and smoke

Sufficient in number for the expected capacity of users and suitable location

Role and appointment of fire marshals

Workers take on this role as well as their day-to-day duties.

Known as fire wardens, incident officers, responsible persons

Appointed to assist with an evacuation.

Each fire marshal is allocated an area of the building that they will check once the fire alarm is sounded.

May also be asked to supervise workers at the assembly point.

Will check that everyone leaves the area, then reports to a coordinator. This information may be passed on to the emergency services.

They may also look out for potential fire hazards, so that proactive measures can be taken to deal with problems before they become emergencies.

Arrangements should be put in place to ensure coverage for sickness absence and holidays.

Fire drills

Aim

To make sure that all workers understand how to react in a fire or when the fire alarm sounds.

Regular fire drills will help to ensure that workers are familiar with escape routes, emergency procedures and firefighting equipment.

Provide feedback to all workers to let them know how effective the evacuation was and to highlight any problem areas.

A fire drill also tests arrangements for the evacuation of any disabled persons.

A record should be kept whenever a fire drill is performed.

Help ensure that the emergency evacuation plans work in practice.

Low-risk premises
minimum annual drill

Higher-risk buildings
more frequent drills

A roll call should be taken during a fire evacuation.