GOVERNMENT OF WESTERN AUSTRALIA

WorkSafe Western Australia

WorkSafe SmartMove

WorkSafe SmartMove Certificate

Plumbing and Gas Fitting
Study Guide

smartmove.safetyline.wa.gov.au

Disclaimer

Date published: 1 March 2022

Reference

Department of Local Government, Industry Regulation and Safety (LGIRS) (2025, July 1). *WorkSafe SmartMove Certificate*: *Plumbing and gas fitting industry module study guide* (3rd ed). Western Australian Government.

Contact

SmartMove Coordinator

Department of Local Government, Industry Regulation and Safety (LGIRS)

303 Sevenoaks Street

CANNINGTON WA 6107

Telephone: 1300 307 877

Email: smartmove@dmirs.wa.gov.au

Contents

Plumbing and Gas Fitting Industry

Learning outcomes

In this module you will:

1. Learn about common workplace hazards encountered in the plumbing and gas fitting industry
2. Understand how to prevent injuries from common workplace hazards
3. Identify existing and potential hazards in a workplace and learn how to report and record them
4. Learn how to eliminate workplace hazards and reduce risks

The plumbing and gas fitting industry includes activities such as assembling, installing, maintaining and repairing water supply, pipes, drainage, sewerage, and gas systems for residential and commercial properties. Work activities may involve both indoors and outdoors. Some activities may be dirty and unsanitary.

Job roles for young workers may include plumbers, roof plumbers or gas fitters.

The plumbing and gas fitting industry is one of the most dangerous for young and inexperienced workers to work in. Major hazards found in the plumbing and gas fitting industry are:

- working with machinery, equipment and tools
- falls
- manual tasks
- electricity
- noise
- hazardous substances
- hazardous working conditions

> ***Note:***
>
> *To become a plumber, you usually need to undertake an apprenticeship in plumbing and gas fitting.*
>
> *To work as a plumber in Western Australia, you need to hold a Plumbing Tradesperson's Licence or Plumbing Contractor's Licence from the Plumbers Licensing Board.*
>
> *Roof plumbers do not need to be licensed.*

Working with machinery, equipment and tools

In the plumbing and gas fitting industry, young workers work with or near a wide range of machinery, equipment and tools. The most common injuries to young workers are from:

- being hit or crushed by moving parts of machinery, equipment and tools (e.g. struck by their own hand tools)
- being hit or struck by ejecting objects (e.g. parts, components, products or waste items)
- being hit, trapped or crushed by powered mobile plant, equipment and vehicles (e.g. earth movers, bulldozers and loading trucks).

Machine guarding can prevent or reduce access to dangerous areas of the machine. A guard may be any shield, cover, casing, or physical barrier intended to prevent contact between a hazardous machine part and any part of an operator or operator's clothing.

A guard can perform several functions such as:

- protecting you from moving parts
- containing ejected parts from the machine
- preventing emissions escaping.

Powered tools and hand tools are also used to carry out everyday tasks in the plumbing and gas fitting industry. These tools may include wrenches, spanners, hacksaws, cutters, hammer, chisels, welding equipment and power tools. Many young workers injure themselves using tools.

Hand tools can be dangerous if they are not used correctly. A common cause of accidents with hand tools is from using the wrong tools for the job.

When working with or near power tools, the hazards you may be at risk from are being hit or cut by the tool and being hit from falling, flying, abrasive and splashing objects while using the tools. You must also be aware of the dangers involved with using electricity around water or wet areas. The most common injuries from power tools are cuts, abrasions and lacerations.

Let's have a look at how to stay safe

It is your employer's responsibility to:

- have safe work procedures in place and provide you with training and supervision in the proper use of machinery, equipment and tools.
- make sure you are provided with the appropriate tools for each task, and you should be instructed in how to use them safely.
- fit or choose machinery, equipment and tools with a guard to protect you from moving parts. Any guard removed during cleaning must be replaced by an authorised person before you use the machine. Power tools must be fitted with guards and safety switches.
- supervise you when first using machinery, equipment and tools and until you are competent. You may be buddied up with an experienced worker so skills, knowledge and experience can be shared.
- provide you with appropriate personal protective equipment (PPE).

To protect yourself, you should:

- not work alone with machinery unless it has an emergency stop mechanism (or a dead-man switch).
- reduce the risk of cuts by keeping cutting tools clean and sharp.
- wear PPE given to you and wear clothing that won't get caught in machinery or equipment. PPE may include safety glasses or goggles, earplugs or earmuffs, protective gloves, overalls or other close-fitting clothing. Safety shoes or boots with reinforced toe-caps will protect your feet if any heavy or sharp items are dropped.

Examples of potentially dangerous machinery and power tools

Powered mobile plant

Generally, powered mobile plant (PMP) is any machine that is self-propelled and controlled by an operator. This can include lift trucks, elevating work platforms, mobile cranes, integrated tool carriers, earthmoving machinery and tractors. PMP is associated with a number of accidents and injuries including the operator falling from the machine; people being crushed or run over; and people being entangled in and trapped between moving parts.

Your employer must provide adequate supervision, training and assessment of competency for workers on site who use mobile plant, including the application of safe operating procedures. You must follow safe operating procedures.

You should keep away from any mobile plant being operated. If you need to be in an area where plant is operating, you should:

- make visual contact with the operator before moving into the area
- wear a high visibility vest so that the operator can see you
- be aware of your surroundings by looking out for PMP using the area. Remember that operators cannot always see pedestrians
- not be distracted with:
    - talking or texting on a phone

- walking around listening to music through earphones
- day dreaming.

Power drills

A young plumber was using a power drill on a metal pipe. A small piece of steel flew from the pipe and lodged in his eye.

Power drills are used for drilling holes and driving screws into timber, metal, concrete or plastic. It's important to know that the power drill itself doesn't do the actual drilling. The drill bit goes through the wood, brick or other material you're using. Injuries caused by using power drills are common in young workers.

How can you avoid injuries when using power drills?

- Use the proper drill bit to perform the task effectively and safely – ask your supervisor or an experienced worker to help select the proper drill bit.
- Always keep drill bits sharp.
- Do not use bent drill bits.
- Follow the manufacturer's operating instructions.
- Don't use excessive force to drill into hard material – reduce drill speed if possible.
- When working with small pieces, clamp the material so it will not twist or spin – don't drill with one hand while holding the material with the other as the drill could slip and injure you.
- Wear appropriate PPE such as safety glasses or goggles.

Angle grinders

Angle grinders are hand-held tools with a rotating disc used for grinding and polishing work. Angle grinders are designed for grinding, not cutting. The most common angle grinder injuries are from metal particles lodging in the operator's eye. The most serious injuries are from kick-back, where the disc is thrust back violently towards the operator.

How can you avoid injuries when using angle grinders?

- Make sure the angle grinder is correctly fitted with a guard that is in good condition. Replace damaged guards before using.
- Follow the manufacturer's operating manual for safe use.
- Ensure that the angle grinder will not operate when unattended by checking it has an automatic cut off (constant pressure/dead-man) switch.
- Do not use grinding wheels that are cracked or those that vibrate excessively.
- Use both hands when holding the grinder.
- Keep the power cord away from the grinding wheel and the material being ground.
- Wear appropriate PPE such as safety glasses or goggles to protect against flying particles.

Chasing saws

Chasing saws are power tools used for cutting narrow grooves in brick, stone and concrete walls or floors so that pipe or electrical cables can be laid in the channel. Workers need to show caution when using chasers. If they are not operated as per the manufacturer's instructions or the *Concrete and masonry drilling and cutting code of practice*, they can cause severe injuries.

Never use a large chaser above shoulder height, as this is against the manufacturer's instructions for use and kickback could cause serious or fatal injuries.

Quiz – Equipment and tools

1. Guards are fitted to powered tools:
   a. To protect you from moving parts
   b. To keep the tools clean
   c. As a temporary part that should be removed before use
   d. None of the above

2. Which of the following is a safe practice when working with power tools?
   a. Never use a large wall chaser above shoulder height
   b. Use power tools fitted with guards and safety switches
   c. Follow manufacturer's manual for the safe use
   d. All of the above

3. Which of the following injuries can be caused when using power tools?
   a. Cuts
   b. Abrasions
   c. Lacerations
   d. All of the above

4. When vehicles or mobile plant operate nearby, you should:
   a. Be aware of your surroundings by looking out for other vehicles or mobile plant using the area
   b. Talk or text on a phone
   c. Walk around listening to music through earphones
   d. Day dream

Falls

Falls are the most common cause of work-related injuries among young workers in the plumbing and gas fitting industry.

Falls from height

A fall from height is a fall from one height or level to another. Many plumbing tasks are carried out at heights. These include working on roofs, installing or repairing gutters and downpipes and accessing roof cavities through manholes. A fall from height can be fatal.

Your employer must manage the risks of falls. It is best to avoid or limit the need to work at height. If it cannot be avoided, your employer must provide safe systems of work, including:

- providing fall injury prevention devices such as scaffolding, elevating work platforms (e.g. scissor lifts) or other types of safe working platforms to help workers access areas where there is risk of falling
- providing fall protection systems, such as fall-arrest devices (e.g. safety harness), safety nets and guard railing
- providing work position systems, such as travel restraints, which are designed to prevent workers from reaching an edge where they could fall

- providing ladders that are industrial-rated and well-maintained with no bent or broken parts and ensuring they are only used for light work or easy-to-reach places
- ensuring that tools and equipment provided for working at height are appropriate for the tasks and in good condition
- providing information, training, instruction and supervision for you to use equipment and tools safely.

> ***Note:***
>
> *You must follow safe systems of work and use equipment and tools provided to you to prevent falling from a height.*

Ladders

An apprentice plumber was standing on a ladder installing a pipe. The ladder slipped and the plumber fell against a wall, scraping their face. The ladder was not placed on a flat and stable surface.

Many falls occur from inappropriate use of ladders. Your employer must provide ladders that are suitable for the task and make sure they are looked after. Ladders are only to be used for light work or easy to reach places. You must be supervised when you first use ladders and until you are competent.

Before using a ladder, conduct safety checks. Check that the ladder:

- is industrial-rated (don't use a domestic ladder for commercial work)
- has no damage, including loose or missing parts
- is properly put up, secure and located on a firm footing
- extends at least 900 mm beyond the landing for the platform it is being used to access.

Make sure that you maintain 'three-point contact' when going up or down a ladder. This means two hands and one foot, or two feet and one hand should be in contact with the ladder at all times.

> ***Remember:***
>
> *Safety checks should be conducted prior to using a ladder, to make sure no damage or wear has occurred that could make it unsafe.*

Roof work

A roof plumber was working on the roof of a multi-story apartment building to repair a leak in the roof. While standing near the edge of the roof, he fell 9 meters and suffered fatal injuries. The edge of the roof did not have adequate edge protection. He did not use any kind of fall prevention system.

Roof plumbers install gutters, downpipes, flashings, rainwater tanks, and detect and fix leaking roofs. They may encounter hazards such as tripping and falling on a roof, and falling off of or through a roof, especially if it is fragile or damaged. Working on roofs is dangerous and requires additional precaution

Fragile roofs

All roofs should be treated as fragile until a competent person has confirmed they are not. The following roofing materials are likely to be fragile:

- old liner panels on built-up sheeted roofs
- non-reinforced fibre cement sheets
- corroded metal sheets
- glass (including wired glass)
- rotted chipboard
- polycarbonate sheeting (skylights)
- slates and tiles.

What can your employer do?

Your employer must manage the risks of roof work falls by providing safe systems of work such as:

- providing scaffolding or elevating work platforms so a worker can avoid standing on the roof itself
- providing a safety harness system with adequate anchorage points on roofs. Workers must be trained and supervised in the safe use of harnesses.
- ensuring the tools and equipment provided are appropriate for the task and in good condition.
- installing a non-corrosive safety mesh that is capable of preventing a worker falling through the roof. These should be fixed directly over the top of the fragile areas, or directly underneath the brittle or fragile areas
- maintaining secure barriers around the brittle or fragile areas.

What can you do to keep safe and minimise the risk of falling from a height?

- Use all PPE given to you correctly. Safety belts and harnesses should be checked and inspected each time before use, with particular attention being paid to buckles, rings, hooks, clips and webbing.
- Pay careful attention when working on roofs. Never stand on or walk across a roof made of fragile material.

Falls into openings or holes

An apprentice plumber was carrying three boxes of plumbing fixtures from a van when he stepped in a hole in the ground. He fell forward, sprained his ankle and required stitches to his forehead. The apprentice could not see the hole because the boxes he was carrying were obstructing his view.

A young plumber was working on the second floor of a house which was under construction. He stepped backwards and fell through an opening which had been made for a stairway. He broke his left knee and suffered multiple bruises.

Holes, penetrations and openings through which a person could fall should be made safe immediately after being formed. These include unguarded floor openings and open stairways.

Guardrails should be used to protect floor openings and open stairways. If a cover is used as a control measure for holes, it must be made of a material that is strong enough (e.g. embedded wire mesh) to prevent persons or objects falling through and should be securely fixed to prevent any dislodgement or accidental removal.

Covers for holes should be made clearly visible with the words DANGER. HOLE BENEATH written on them.

Slips, trips and falls

A plumber was walking along a corridor of his customer's house, when he stepped on a coupling that his apprentice had left on the floor. The coupling rolled and the plumber sprained his ankle trying to maintain his balance.

Slips and trips resulting in falls are described as falls on the same level. They are a common cause of injuries of young workers. These types of injuries can result in serious harm and lengthy time off work.

Slips, trips and falls may cause injuries including:

- broken bones when colliding with an object or hitting the ground
- cuts if it occurs near sharp objects
- sprains or strains.

What can you do to keep safe from slips, trips and falls?

- Wear suitable shoes with treads that are kept clean from mud and soil. Make sure that shoelaces are always tied.
- Remove any contaminants straight away. Contaminants, such as water, oil, or dust, can all make surfaces slippery causing shoes to have less grip.

- Clean up spillages straight away.
- Maintain good housekeeping. Keep work areas and walkways free of obstacles and clutter so that you or your workmate's do not trip over. Place, stack, or store materials and equipment neatly. Avoid stringing cords or cables across walkways and on rooftop surfaces.
- Ensure that you have enough light to work safely. Work areas that have ladders, stairs and walkways may be dimly lit. Ensure proper lighting is everywhere to prevent accidents. You may use portable task lighting.
- When moving or carrying objects, make sure you can see where you are going.
- Move slowly and carefully on smooth surfaces or on rooftop spaces. Mind your step and be aware of what is around you at all times.

Being hit by falling objects

Objects have the potential to fall onto or hit people. Loose objects such as hand or power tools, loose rocks and other debris can be accidentally dropped or knocked off high areas. Being hit by falling objects is a major cause of serious injuries.

What can you do to keep safe from being hit by falling objects?

- Follow safe work procedures.
- Report any hazards of objects falling to your employer promptly so risks can be managed before an incident occurs.
- Never place yourself or allow anyone else to be in the drop zone of a suspended load.
- Use suitable personal protective equipment (PPE) provided such as a hard hat when work is being performed overhead or when other work conditions call for it.
- When working with machines or power tools that can produce flying particles, wear safety glasses, goggles or face shields.
- Stack materials securely to prevent them from sliding, falling or collapsing.
- Secure all tools and materials to prevent them from falling on people below.

Quiz – Falls

5. Before using a ladder, safety checks should include ensuring that the ladder:
   a. Has no damage including loose or missing parts
   b. Is properly put up and secured
   c. Is industrial rated
   d. All of the above

6. What can you do to prevent slips, trips and falls at work?
   a. Ensure that you have enough light to work safely.
   b. Maintain workplaces to keep them in a clean and tidy condition.
   c. Wear suitable shoes with appropriate treads that are kept clean.
   d. All of the above

7. Which of the following statements is correct?
   a. All roofs should be treated as fragile until a competent person has confirmed they are not.
   b. Guardrails should be use to protect floor openings and open stairways.
   c. Roofs made of corroded metal sheets are fragile roofs.
   d. All of the above

8. Which of the following statements will minimise the risk of you being hit by falling objects? (Select **three** that apply)
   a. Never place yourself in the drop zone of a suspended load
   b. Wear a bucket hat for sun protection when work is being performed overhead
   c. When working with machines or power tools that can produce flying particles, wear safety glasses, goggles or face shields
   d. Stack materials securely to prevent them from sliding, falling or collapsing

Manual tasks

An apprentice plumber lifted a section of cast-iron soil pipe weighing about 50 kilograms while he was kneeling. As a result, he pulled a muscle and strained his back. He was frequently in pain and had limited range of motion for 4 weeks.

Manual tasks are any activities or sequence of activities that require a person to use their physical body (musculoskeletal system) to perform work. The most common injuries and health issues that can arise from performing manual tasks are musculoskeletal injuries.

Some examples of musculoskeletal injuries are:

- sprains and strains of muscles, ligaments and tendons (e.g. back strain)
- joint injuries
- disc protrusion or disc herniation of the back
- nerve injury or compression
- muscular and vascular disorders (e.g. carpal tunnel syndrome or repetitive strain injury)
- soft tissue injuries.

How does performing a manual task result in injury?

Plumbers and gas fitters are at risk of suffering injuries due to performing hazardous manual tasks involving:

- increased effort (force) such as repeated forceful arm, hand and finger movements when using hand tools such as power tools and hammers
- awkward postures on one part of the body such as squatting, kneeling and stopping for prolonged periods when installing plumbing fixtures
- lifting and carrying heavy and awkward objects such as loading and unloading heavy, bulky or large items from the back of work vehicle, and lifting and carrying long pipes
- working above should height for prolonged period.

What can your employer do to prevent injuries from performing manual tasks?

Your employer has a responsibility to provide and maintain a safe workplace. If you are about to perform tasks that may become hazardous, ask your employer or supervisor for assistance.

Your employer should provide you with *risk management and **task specific training for performing hazardous manual tasks at your workplace.

*Risk management refers to the steps required to manage workplace hazards described as SAMM – Spot the hazard, Assess the risk, Make the change, Monitor and follow-up.

**Task specific training is the practising of actual tasks that will be performed.

Task specific training should be provided:

- during induction to the task
- as part of your refresher training
- when work tasks are about to be changed or new ones introduced.

There are a variety of ways you can be trained. Methods include a buddy system, demonstrations, training by observation or at staff meetings, toolbox talks and practice sessions.

After the training, you should be able to:

- recognise the risks and their sources and, in discussion with your employer or supervisor, decide the best way to minimise them
- prepare the workplace layout and surroundings to perform manual tasks safely
- prepare loads, where applicable
- organise tasks and workflow to minimise the risk of injury
- use relevant mechanical aids and handling devices provided to you
- use tools or equipment provided to you.

Examples of how to load or unload a work vehicle safely

- Using vehicle loading cranes
- Using mechanically lowered/lifted tail gate
- Using ladder rollers on a roof rack
- Using ramps
- Using light weight tools and equipment where possible
- Using the best layout for loading equipment and tools to allow for easy access
- Asking your workmate to help with the load

> ***Remember:***
>
> *Young and new workers are at a greater risk of lifelong injuries due to performing hazardous manual tasks. Speak up if you think the task is too much for you.*

Quiz – Manual tasks

9. The most common health problems that can arise from hazardous manual tasks are:
    a. musculoskeletal injuries
    b. cold and flu
    c. toothache
    d. food allergies

10. When performing a manual task, which of the following actions may result in injury? (Select **four** that apply)
    a. Increased effort (force)
    b. Awkward posture
    c. Lifting and carrying heavy and awkward objects
    d. Working above shoulder height for prolonged periods
    e. Asking your work mate to help carry a heavy load

11. When should you receive specific task training to perform manual tasks?
    a. During induction to the task
    b. As part of your refresher training
    c. When work tasks are about to be changed or introduced
    d. All of the above

Electricity

An apprentice plumber was working in a trench to connect a building's firefighting system to the main water supply. He did not know that an 11,000 volt underground electrical main was located in the trench. The apprentice accidently drilled into the 11,000 volt main using a power drill and received flash burns to his left arm and left leg. He was not under direct supervision at the time of the incident.

Electric shocks happen when a person becomes part of an electrical circuit and the current flows through their body. Electricity passing through the body can cause convulsions (involuntary contractions of the muscles) and the heart to stop beating, as well as internal and external burns. It can also cause secondary injuries resulting from falls or collisions and fire hazards resulting from an electrical fault.

The most common causes of electrocution in plumbing and gas fitting are usually caused by:

- faulty electrical tools
- working with or near equipment that people think is switched off or isolated, but is actually on or 'live'
- contacting with overhead power lines, usually when using equipment
- a lack of experience, training or supervision
- the absence of or poorly maintained *residual current devices (RCDs)

A *residual current device (RCD) is a safety switch or life-saving device designed to prevent you from receiving an electric shock if you touch something live, such as a bare wire. If you are using portable electrical equipment and extension leads at work, there must be an RCD installed at the switchboard, built into a fixed socket or through a portable RCD outlet. The RCD must be regularly tested. This is a legal requirement.

> ***Note:***
>
> *Plumbers should be aware of and understand the potential for electric shock when working with metallic water services (metal pipelines). Metal pipes and water are often conductive. If there is a fault in the electrical supply system on the premises or in the street, electricity can still be earthed through the pipes or water leaks resulting in an electric shock.*
>
> *When installing, fixing and repairing metallic water services or maintaining or repairing machinery and equipment, an isolate and lockout procedure is required to safeguard the workers who carry out the task.*

Lockout procedures

Before commencing any plumbing work, especially those that are on or near metallic water services, and near live equipment, all sources of electricity need to be disconnected and isolation points secured to prevent them being accidently turned on.

1. Isolate

This means the electrical circuits must be shut down. This is done by switching off the isolator/circuit breaker and removing fuses or other components.

2. Secure (lock and tag)

Lock

This means the electrical circuits must be locked after they are shut down.

This is often done by putting a lock on an ON switch so the machine can't be turned on. There are a wide range of locks that can be used in this process. These can include:

- switches with a built-in lock
- chains
- jaws or hasps.

Note:

There should be one key only for each lock or set of locks, and this should be held by the person who put the lock on.

All people involved in carrying out the work must fit their own lock at the same isolation point(s).

Locks must be clearly labelled with a tag.

Locks must be removed upon completion of work or at the end of the shift. If the work will be continued by others, they must fit their own locks.

Tag

This means to attach an information tag to a power source or piece of equipment warning others not to operate it. A lockout tag:

- includes the name of the person working on the equipment, the time and date of the work and the equipment that's being isolated
- must be attached in a prominent position at each isolation point
- must be fitted and removed by the person who attached it, or by an 'authorised person'
- must be removed upon completion of the work or at the end of the shift. If the work will be continued by others, they must fit their own tags.

Note:

Two types of tags that are commonly used are danger tags and out of service tags.

3. Test

This means that all power sources need to be checked with proper test instruments to make sure everything is safe before going ahead with work.

All isolated electrical equipment also needs to be checked to ensure it has been de-energised. This should be done using proper test instruments (multimeters) to make sure everything is safe before going ahead with work.

Note:

Testing of power sources or de-energised equipment should only be carried out by an electrician or competent person.

Volt sticks are not a testing instrument. Correct electrical rated testers (multimeters) should be used to determine if equipment is energised

Roof work and electricity

An apprentice plumber inadvertently made contact with an overhead electrical cable when working on the roof of an awning for a commercial property. He received a severe electric shock.

Plumbers often work on roofs and sometimes in ceiling spaces. Conductive material, such as guttering, roof sheeting or metal battens, can become live if it comes in contact with overhead electrical cables, or if there is a fault with the electrical wiring in the area.

In Western Australia, WHS laws prohibit workers entering the roof spaces of **residential buildings* unless the electrical installation is de-energised. Prior to entering a roof space, a risk assessment must be undertaken by a competent person and all power must be isolated.

Residential buildings mean:

- a single dwelling (i.e. a detached house, terrace house, town house, villa unit)
- a boarding house, guest house, hostel, care home, residential part of a school, hotel or detention centre, or similar.
- a non-habitable building or structure including a private garage, carport, shed.

When working on roofs, check for electrical cables in the area you are working and be aware of safe working distances from overhead power lines.

When working in ceiling spaces you must ensure that someone is aware of where you are and that you maintain contact with them until the work is completed.

> ***Remember:***
>
> *Extreme care must be taken to avoid touching any live overhead power lines or supply cables, and to ensure that people are not exposed to the risk of contacting live wiring, cables or pipes.*

How can you keep safe working with or near electricity?

- Plan and discuss the job with your supervisor, including assessing any safety risks.
- Understand the lockout procedure. Do not operate or use power tools and equipment that is being locked and/or tagged.
- Use power tools and equipment properly – regularly inspect wiring, cords, plugs and tools for obvious external damage and look out for shorting, smoking or sparking fittings
- Report any breakdowns or faulty power tools or equipment to your employer. It is the responsibility of your employer to make sure they are in good working order.
- Ensure all available power is RCD protected.
- Use weatherproof outlets and fittings in areas exposed to wind and rain. Avoid using electrical equipment outdoors or in wet conditions.
- Wear suitable footwear and clothing when using electrical equipment.
- Be extra cautious when working on metal pipes and insulated gloves should be worn. If there is any sign of electricity, stop working immediately. Get an electrician to detect the source of the electricity and safely disconnect it prior to starting work.
- Be aware of the locations of all safety switches and what equipment they cover in case equipment needs to be switched off in an emergency. You may ask this question during your induction.

Quiz – Electricity

12. There are three specific steps in locking out machinery and equipment. These steps are:
    a. lock, look and tag
    b. lock, tag and test
    c. tag, do and test
    d. lock, test and try

13. When cleaning, maintaining or adjusting machinery and equipment, an isolate and lockout procedure is required to:
    a. Safeguard workers
    b. Safeguard machinery
    c. Identify hazardous energy
    d. Prepare safe work procedures

14. What safety precautions should you take when working on roofs and/ or in ceiling spaces? (Select **three** that apply)
    a. When working in ceiling spaces you must ensure that someone is aware of where you are and that you maintain the contact with them until the work is completed
    b. When working on roofs check for electrical cables in the area you are working
    c. You must maintain safe working distances from overhead power lines
    d. No need to take any safety precautions.

Noise

Noise can be a workplace hazard. Tasks in plumbing such as drilling and cutting materials or using powered equipment can produce high noise levels. The higher the dose of noise, the greater the risk to the worker's hearing.

The noise dose is dependent on three factors:

- Intensity/Loudness: measured by a noise level meter and described in decibels (dB)
- Frequency: the number of sound vibrations in one second measured in hertz (Hz)
- Duration: the length of time workers have been exposed to noise

In Western Australia, the law sets a workplace exposure standard averaged over eight hours to be 85 dB(A) (e.g. the sound levels of a front-end loader), or a peak noise level of 140 dB (e.g. the impact noise of sledgehammering). Any noise exposure above 140dB can create almost instant damage to hearing.

As a general rule, if you have to raise your voice to be heard by someone standing 1m away, the noise level is likely to be 85 dB(A) or more.

What can your employer do?

Where the exposure standard is exceeded, your employer must provide solutions to noise hazards such as:

- choosing quieter power tools and equipment
- keeping equipment in good working condition
- reducing machinery and equipment vibration, and muffling engine and compressed air noise
- using job rotation and alternating noisy tasks with quieter ones
- providing you with suitably fitting hearing protection (i.e. earplugs and earmuffs) to use along with all other control measures.

What can you do to protect your hearing?

To safeguard your hearing, you must wear the hearing protection that has been given to you. It might seem like there is nothing wrong with your hearing, but the damage is often done without you noticing it.

Hearing protectors, like earplugs and earmuffs, should be regularly cleaned, repaired and stored near noisy areas.

> ***Remember:***
>
> *The most important factor in the effectiveness of hearing protection is wearing it.*

Quiz – Noise

15. To prevent hearing loss at work, the law sets a workplace exposure standard averaged over eight hours to be _____dB(A)
    a. 85
    b. 95
    c. 140
    d. 200

16. The most important factor in the effectiveness of hearing protection devices is:
    a. style
    b. appearance
    c. colour
    d. wearing it

Hazardous substances

A hazardous substance can be any substance, liquid, solid, dust or gas that may cause harm. Plumbers and gasfitters may encounter or work with lead, sulphur dioxide, asbestos, silica, adhesives, solvents and dusts.

These substances can be harmful if you:

- get them on your skin
- eat or drink them by mistake
- breathe them in
- mix substances so they become deadly
- mistake one substance for another.

How can you keep safe from hazardous substances?

- Read the label - look for warning pictograms and signs. Always follow the safety warnings.
- Read the safety data sheet (SDS) for more information about a product and how to use it safely. Your employer must provide (or have available) safety information documents for any substances or products that are hazardous.
- Check the hazardous substance register at your workplace. It is a legal requirement that your employer keeps a current register of each hazardous substance that may be used or stored in the workplace.
- Keep an up-to-date SDS for each substance used in the workplace. As plumbing work takes place in many different locations, you will need to carry the SDS with you to the work site. It will include first aid instructions in case of a splash which results in eye injury or accidental swallowing of a chemical.
- Don't eat, drink or smoke when you are using or near hazardous substances or dangerous goods.
- Don’t keep food near hazardous substances or dangerous goods.
- Always use the PPE and clothing provided by your employer.
- Practice good housekeeping – declutter and avoid build-up of combustible materials like plastics, cardboard boxes and rags around any chemical storage.

Example of hazardous substances

Asbestos

In Australia, asbestos was once found in more than 3000 different products including in insulation of pipes, boilers, ducts, tanks and in building materials. Asbestos is known to cause cancer. Inhaling

asbestos fibres (dusts), even in a limited or short-term exposure, can be very harmful. Asbestos is now banned for use in new materials, but it is still commonly found in older materials. Plumbers are at risks of exposure to asbestos dusts when drilling and handling pumps, valves and gaskets that contain asbestos

Let's have a look at how to be safe from asbestos

- Make sure you follow safe work procedures.
- If you have any reason to believe that you are working on an asbestos product or material, stop work immediately. It is important to treat it as asbestos until a competent person tests and confirms that the project or material is not asbestos
- Know what to do and where to go if you are affected by asbestos. Check with your employer if you are unsure.
- Wear PPE and RPE (respiratory protective equipment) provided to you.

Silica dust

Silica (or silicon dioxide – SiO2) is a very common mineral used in building and construction (e.g. sand, concrete, bricks, tiles, mortar and engineered stone).

Plumbers may be required to perform tasks such as chasing gutters or cutting grooves in concrete, brickwork or other masonry surfaces to allow for the inclusion of cables, pipes or flashing. Many of these materials or products that require cutting, drilling or chasing contain silica.

Silica is especially dangerous to health when dust is generated, becomes airborne and is inhaled by a worker. Repeated exposure to silica dust can cause silicosis, which is scarring and stiffening of the lungs. The effects are irreversible and can be fatal.

Let's have a look at how to keep safe from silica dust

If you are working with material that may contain silica, your employer must provide you with information, training and instruction about the risks of exposure, the control measures at the workplace, and the correct use and maintenance of RPE (respiratory protective equipment). Your employer must provide you with health monitoring that is carried out or supervised by a registered medical practitioner to ensure your health is not affected by the work.

Always use PPE and RPE given to you, for example, safety goggles suitable for dust protection and masks that cover your nose and mouth. RPE must be suitable and comfortable, be tested for fit, and be well-maintained.

> ***Remember:***
>
> *Silica dust is harmful. If you are required to work with silica and be exposed to silica dust, talk to your employer about the control measures and how to work safely. You must be given RPE and PPE.*

Lead

Lead can be toxic to humans and may cause serious long-term health issues. Lead sheeting, flashing, PVC products, solder and a number of plumbing fittings can all contain lead. Lead can enter the body in a number of ways:

- by being inhaled as dust or fumes, which are often odourless,
- through ingestion or consumption of lead dust, which can settle on food, water, clothes or other objects and may have a metallic taste
- through contact with the skin. Handling lead or lead dust and then touching your eyes, nose or mouth could expose you.

Let's have a look at how to keep safe from lead

If you are working with material that may contain lead, your employer must develop a safe system of work for you to work safely, which may include:

- identifying lead hazards and assessing the risks of exposure
- using alternatives to lead, such as acrylic coated flashing, lead-free PVC, tin or silver solder
- providing appropriate PPE and RPE and protective clothing (e.g. respirators and face masks, and gloves).

> ***Note:***
>
> *You should change your clothes at the work site when the job is done to prevent lead dust being taken home on your clothes, body and inside your car.*
>
> *If you have been working with lead you must wash your hands carefully before eating. Food should not be consumed in workplaces where lead dust is present.*

Quiz – Hazardous substances

17. Select **three** correct actions you would take to keep yourself and others safe from hazardous substances.
    a. Read the product label
    b. Read the product SDS
    c. Follow safe work procedures
    d. Smell the substance

18. Lead is a hazardous substance because it is:
    a. Flammable
    b. Toxic
    c. Solid
    d. Corrosive

19. Long-term exposure to silica dust can cause _____.
    a. musculoskeletal injuries
    b. back pain
    c. silicosis
    d. toothache

20. Which statement is correct?
    a. Inhaling asbestos fibres is a major health hazard.
    b. Asbestos dust is very toxic to inhale and may cause cancer.
    c. Asbestos is banned in new materials, but can still be found in older materials.
    d. All of the above

Hazardous working conditions

Working in a confined space

A young plumber died while working in a deep trench when a water main adjacent to the trench burst filling the trench with water and mud. The plumber, who was inside a safety box, could not be saved from the high volume of water and mud in the trench and drowned.

A confined space is an enclosed or partially enclosed space that is not intended or designed primarily for human occupancy, is at normal atmospheric pressure during occupancy, and has restricted means for entry and exit. Examples of potential confined spaces are storage tanks and bins, boilers, sumps and pump hoppers, pipes, wells and excavation holes and trenches.

Why you are at risk?

Plumbers working in trenches, pits, tanks, beneath houses and in roof cavities must understand and plan for the significant hazards of confined spaces. Confined spaces can pose serious health and safety risks to workers. There is a risk of one or more of the following occurring:

Suffocation (Asphyxia)

Asphyxia is caused by a lack of oxygen in air resulting in deficiency of oxygen in the blood. Oxygen levels within a confined space could drop resulting in a high concentration of common gases (e.g. nitrogen, carbon dioxide, helium, and propane). These gases can displace oxygen in the air. Inhaling too much common gas can cause dizziness, disorientation, abnormal heart function, unconsciousness and can even be fatal.

When working in a confined space, there is also a risk of being engulfed by any liquid in which a person can drown including oil or water, or any solid including grain, sawdust, mud and sand that can flow and surround a person cutting off their air supply resulting in suffocation.

> ***Be aware:***
>
> *Most asphyxiant gases are colourless and odourless so their presence in high concentrations may not be noticed.*

Toxicity

Toxicity is the degree to which a toxic substance can damage an organism. In a confined space, a concentration of toxic gases or fumes (e.g. hydrogen sulphide in tanks of decomposing organic material) may cause impairment and loss of consciousness.

Flammability and Explosion

Flammable atmospheres in a confined space may result from the evaporation of a flammable residue, flammable materials used, a chemical reaction (e.g. the formation of methane in sewers), or from the presence of combustible dust (e.g. dust in flour silos). If an ignition source, such as a sparking welding torch or static on a person, is introduced into a space containing a flammable atmosphere, an explosion is likely to result.

Electrical shock or electrocution

Electrical hazards may cause electric shock, burns or electrocution, and can arise from cables, transformers, capacitors, relays, exposed terminals and wet surfaces where electrical circuits and electrically powered plant are used in a confined space.

Falls from height

There is a risk of falling when descending into or ascending out of a confined space.

What do you need to know?

When working in a confined space, your employer needs to provide additional measures to ensure you work safely, including:

- Conducting a risk assessment before work in a confined space begins. A competent person must carry out the risk assessment, which must be in writing and take account of the hazards involved. A safe work procedure must be developed following the risk assessment
- Providing you with an observer when working in a confined space. It is a legal requirement that a person must be on standby in the immediate vicinity outside the designated confined space.
- Providing means of communication between you and the observer. As the person on standby has to remain outside the confined space it is not always possible for them to keep the person/s working inside the confined space in sight at all times. Continuous communication with the worker/s inside the confined space must be maintained. Communications may be achieved using:
  - voice
  - radio (ensure it is safe to use if working in potentially flammable conditions)
  - mobile phone (not to be used if flammable gas or vapour is present which may cause explosion or fire)
  - hard wired communications.

Arranging for emergency response procedures including rescue, first aid and resuscitation. All necessary equipment that may be required in an emergency (such as harnesses, respirators and stretchers) must be available and serviceable.

> ***Note:***
>
> *You must follow the safe work procedures and use appropriate PPE given to you.*

Quiz – Working in a confined space

21. Confined spaces can pose serious safety and health risks to workers. There risks include: (Select **five** that apply)
    a. Suffocation
    b. Toxicity
    c. Electric shock
    d. Flammability and Explosion
    e. Hunger
    f. Fall from height

22. Do you need an observer when working in a confined space?
    a. Yes. You need an observer that always has sight of you when in a confined space
    b. No. An observer is not always needed when in a confined space
    c. Yes. An observer is needed that can maintain continuous communication with you
    d. No. As long as someone can contact you on a radio or mobile phone, you don't need an observer

Welding activities

A young plumber suffered flash burns to both eyes while working near arc welding operations. He was not wearing protective goggles at the time of the incident.

Plumbers often need to work with metal pipes, which sometimes requires them to carry out welding activities. Welding is the process of permanently joining two or more materials together, usually metals, by heat, pressure or both.

Welding can be dangerous and precautions need to be taken to avoid injuries from:

- electric shock
- fire and explosion
- heat and sparks on unprotected skin that can result in burns
- exposure to infrared light that can heat the lens of the eye causing eye irritation and vision damage
- exposure to intense ultraviolet radiation from a welding arc which may cause skin cancer, skin ageing and a weakened immune system
- exposure to toxic fumes from the material being welded or cut or from the electrodes, fluxes and gases.

When welding is done in a hazardous environment, welding is extremely dangerous. Hazardous environments include welding in, on or nearby:

- confined spaces
- surfaces that have been treated or painted
- containers that have previously contained flammable materials or residues
- parts connected to wheels with pressurised tyres
- flammable dusty atmospheres.

How can you keep safe?

- Follow safe work procedures.
- Make sure you are properly trained and supervised for all welding work.
- Recognise a hazardous environment for welding. You may need to take extra precautions or avoid welding in the hazardous environment altogether.
- Check the welding equipment for damage before each use and make sure it is in good condition.
- Wear PPE and protective clothing specially made for welding provided to you at all times. Examples of PPE and protective clothing for welding activities are:
    - *eye and face protection* – wear a helmet with filter lens and cover plate, and approved safety glasses with side shields (or goggles) under the helmet
    - *head and ear protection* – wear a fire-resistant welder's cap or other head covering under your helmet. If loud noise is present, wear approved earplugs or muffs to protect your hearing or prevent hearing loss
    - *foot protection* – wear leather, steel-toed, high-topped boots in good condition to protect your feet and ankles from injury. In heavy spark or slag areas, use fire-resistant boot protectors or leather spats strapped around your pant legs and boot tops to prevent injury and burns
    - *hand protection* – wear protective flame-resistant gloves, such as leather welder's gloves
    - *body protection* – wear oil-free protective clothing made of wool or heavy cotton. Do not wear synthetic (man-made) fabrics because they may burn easily, melt, stick to your skin and cause serious burns. Wear leather aprons, leggings, capes and sleeves as needed. Leather protects better than most materials.

Quiz – Welding activities

23. What is the risk associated with welding activities? (select **five** that apply)
    a. Electric shock and electrocution
    b. Fire and explosion.
    c. Burns
    d. Exposure to infrared light
    e. toothache
    f. Exposure to toxic fumes

24. What is one of the best materials for welders' protective clothing?
    a. Silk
    b. Synthetic
    c. Leather
    d. European cotton

25. Which of the following conditions is considered to be extremely dangerous for welding activities?
    a. Confined spaces.
    b. Surfaces that have been treated or painted.
    c. Parts connected to wheels with pressurised tyres.
    d. All of the above

Infection risks

Plumbing tasks may involve working with sewage pipes and septic tank waste, and laying pipes in contaminated soil. These can expose workers to infection risks such as leptospirosis (caused by a parasitic worm), hepatitis A, tetanus (caused by toxins produced by bacteria common in soil and sewage), skin infections, gastroenteritis, and sickness from bacteria and mould.

Human pathogens (bacteria or other disease-producing agents that cause disease in humans) from soil and raw sewage can enter the body through the nose or mouth, particularly if a person drinks contaminated water or by hand-to-mouth transmission. Exposure can also occur through open wounds or by inhaling in particles.

Sharps, needles or syringes are also a potential source of infection risk. Needle stick injuries, where the skin is accidently punctured by a used needle, expose workers to serious diseases such as tetanus, hepatitis B and C, and HIV. In public buildings, sewer pipe blockages could contain discarded syringes. Guttering is also a common location for sharps, and plumbers must be constantly aware of the potential for needle stick injuries when working in 'vulnerable' locations.

What can your employer do?

Your employer must make sure that:

- the possible risks of exposure to health hazards are evaluated before the job begins
- required hygiene practices are known and followed by workers, which include:
    - assume anything touched by sewage is contaminated
    - do not eat or drink in any sewage handling area
    - wash hands well with soap and clean (preferably hot) water before eating or drinking, and

after touching any surface or object that may be contaminated by sewage

- immediately wash and disinfect any wound that comes into contact with sewage
- change out of work clothes before leaving the work site
- wear appropriate PPE (e.g. rubber boots and gloves, overalls and goggles)

- you are provided with training on safe handling of needles and sharps, including what to do if a needle-stick injury occurs. First aid and emergency procedures should be documented and understood by workers
- a vaccination program may be provided for at risk workers where applicable.

> ***Note:***
>
> *Workers unable to see the cause of a blockage in pipes, gutters or downpipes should not feel around for objects with an unprotected hand, as a needle stick injury could easily occur.*

Quiz – Infection risks

26. A needle stick can place you at risk of:
    a. HIV
    b. Tetanus
    c. Hepatitis B and C
    d. All of the above

27. Which of the following present infection risks to plumbers? (Select four that apply)
    a. Bacteria in soil
    b. Contaminated water in pipes or trenches
    c. Human pathogens from raw sewage
    d. Discarded used syringes
    e. Working at height

Contact with hot objects or substances

Plumbers often work with or near hot substances such as molten lead, soldering irons, steam or hot water, and pipes carrying hot liquids. These could cause scald or burn injuries, primarily to hands, eyes and feet.

How can you keep safe?

Your employer should have a safe work procedure for working with hot objects or substances in place to ensure that the job can be done safety. You must follow the safe work procedure.

Where possible, hot water systems should be switched off and allowed to cool before work begins.

You should be given information, instruction or training on first aid and emergency procedures for burns.

You should not be working alone where there is any possibility of an incident such a steam burn.

Wear PPE such as appropriate gloves and goggles and other protective clothing when handling hot substances.

Quiz – Contact with hot substances

28. Hazards from working with or near hot substances such as molten lead, soldering irons, steam or hot water, and pipes carrying hot liquids include scald and/or burn injuries.

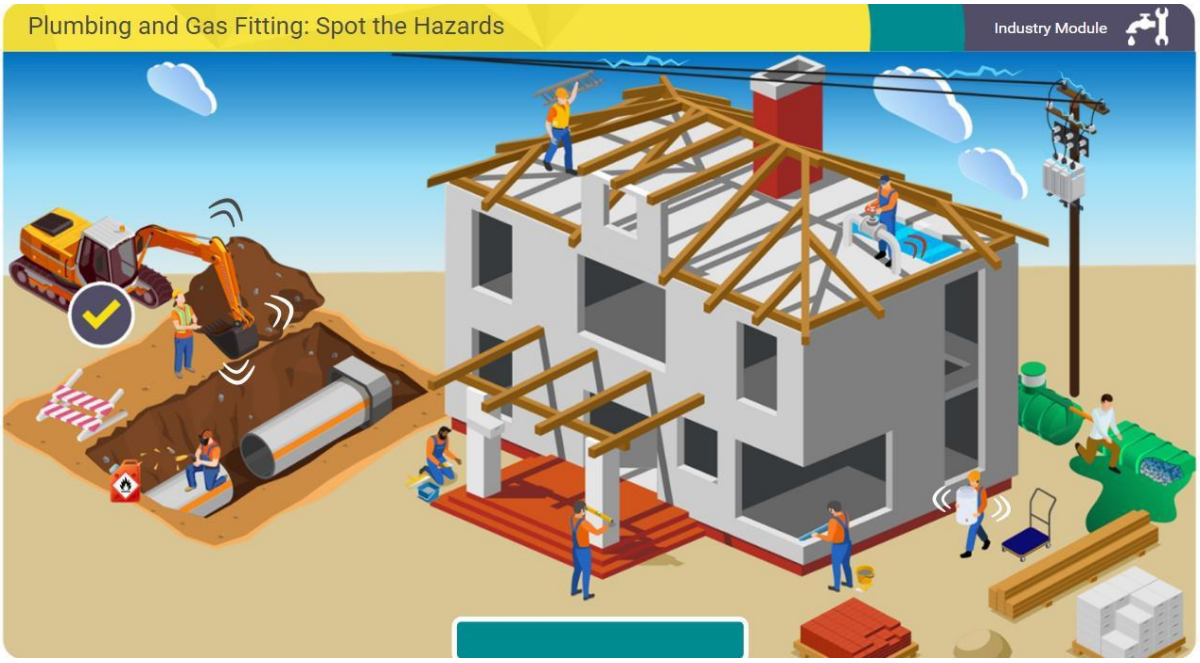
    a. True

    b. False

Spot the hazards

Albany Plumbing and Gas Engineering

There are 6 hazards in this area. Try to find them all.



Hazard notebook

Fill in the hazard notebook

#	Spot the hazard	Assess the risk	Make the change	Monitor and follow-up
1	A plumber standing too close to a moving PMP	Critical	Advise the person to move to a safer distance to avoid being hit by a moving part of PMP	Report it to the employer and suggest they conduct a risk assessment on the work process
2				
3				
4				
5				
6				

Plumbing and gas fitting industry – Knowledge quiz

1. Guards are fitted to powered tools:
   a. To protect you from moving parts
   b. To keep the tools clean
   c. As a temporary part that should be removed before use
   d. None of the above

2. Which of the following is a safe practice when working with power tools?
   a. Never use a large wall chaser above shoulder height
   b. Use power tools fitted with guards and safety switches
   c. Follow manufacturer's manual for the safe use
   d. All of the above

3. Which of the following injuries can be caused when using power tools?
   a. Cuts
   b. Abrasions
   c. Lacerations
   d. All of the above

4. When vehicles or mobile plant operate nearby, you should:
   a. Be aware of your surroundings by looking out for other vehicles or mobile plant using the area
   b. Talk or text on a phone
   c. Walk around listening to music through earphones
   d. Day dream

5. Before using a ladder, safety checks should include ensuring that the ladder:
   a. Has no damage including loose or missing parts
   b. Is properly put up and secured
   c. Is industrial rated
   d. All of the above

6. What can you do to prevent slips, trips and falls at work?
   a. Ensure that you have enough light to work safely.
   b. Maintain workplaces to keep them in a clean and tidy condition.
   c. Wear suitable shoes with appropriate treads that are kept clean.
   d. All of the above

7. Which of the following statements is correct?
   a. All roofs should be treated as fragile until a competent person has confirmed they are not.

b. Guardrails should be use to protect floor openings and open stairways.
c. Roofs made of corroded metal sheets are fragile roofs.
d. All of the above

8. Which of the following statements will minimise the risk of you being hit by falling objects? (Select **three** that apply)
   a. Never place yourself in the drop zone of a suspended load
   b. Wear a bucket hat for sun protection when work is being performed overhead
   c. When working with machines or power tools that can produce flying particles, wear safety glasses, goggles or face shields
   d. Stack materials securely to prevent them from sliding, falling or collapsing

9. The most common health problems that can arise from hazardous manual tasks are:
   a. musculoskeletal injuries
   b. cold and flu
   c. toothache
   d. food allergies

10. When performing a manual task, which of the following actions may result in injury? (Select **four** that apply)
    a. Increased effort (force)
    b. Awkward posture
    c. Lifting and carrying heavy and awkward objects
    d. Working above shoulder height for prolonged periods

11. When should you receive specific task training to perform manual tasks?
    a. During induction to the task
    b. As part of your refresher training
    c. When work tasks are about to be changed or introduced
    d. All of the above

12. There are three specific steps in locking out machinery and equipment. These steps are:
    a. lock, look and tag
    b. lock, tag and test
    c. tag, do and test
    d. lock, test and try

13. When cleaning, maintaining or adjusting machinery and equipment, an isolate and lockout procedure is required to:
    a. Safeguard workers
    b. Safeguard machinery

c. Identify hazardous energy
d. Prepare safe work procedures

14. What safety precautions should you take when working on roofs and/ or in ceiling spaces? (Select **three** that apply)
    a. When working in ceiling spaces you must ensure that someone is aware of where you are and that you maintain the contact with them until the work is completed
    b. When working on roofs check for electrical cables in the area you are working
    c. You must maintain safe working distances from overhead power lines
    d. No need to take any safety precautions.

15. To prevent hearing loss at work, the law sets a workplace exposure standard averaged over eight hours to be _____dB(A)
    a. 85
    b. 95
    c. 140
    d. 200

16. The most important factor in the effectiveness of hearing protection devices is:
    a. style
    b. appearance
    c. colour
    d. wearing it

17. Select **three** correct actions you would take to keep yourself and others safe from hazardous substances.
    a. Read the product label
    b. Read the product SDS
    c. Follow safe work procedures
    d. Smell the substance

18. Lead is a hazardous substance because it is:
    a. Flammable
    b. Toxic
    c. Solid
    d. Corrosive

19. Long-term exposure to silica dust can cause _____.
    a. musculoskeletal injuries
    b. back pain
    c. silicosis

d. toothache

20. Which statement is correct?
    a. Inhaling asbestos fibres is the major health hazard.
    b. Asbestos dust is very toxic to inhale and may cause cancer.
    c. Asbestos is banned in new materials, but can still be found in older materials.
    d. All of the above

21. Confined spaces can pose serious safety and health risks to workers. There risks include: (Select **five** that apply)
    a. Suffocation
    b. Toxicity
    c. Electric shock
    d. Flammability and Explosion
    e. Hunger
    f. Fall from height

22. Do you need an observer when working in a confined space?
    a. Yes. You need an observer that always has sight of you when in a confined space
    b. No. An observer is not always needed when in a confined space
    c. Yes. An observer is needed that can maintain continuous communication with you
    d. No. As long as someone can contact you on a radio or mobile phone, you don't need an observer

23. What is the risk associated with welding activities? (select **five** that apply)
    a. Electric shock and electrocution
    b. Fire and explosion
    c. Burns
    d. Exposure to infrared light
    e. toothache
    f. Exposure to toxic fumes

24. What is one of the best materials for welders' protective clothing?
    a. Silk
    b. Synthetic
    c. Leather
    d. European cotton

25. Which of the following conditions is considered to be extremely dangerous for welding activities?
    a. Confined spaces.
    b. Surfaces that have been treated or painted.
    c. Parts connected to wheels with pressurised tyres.
    d. All of the above

26. A needle stick can place you at risk of:
    a. HIV
    b. Tetanus
    c. Hepatitis B and C
    d. All of the above

27. Which of the following present infection risks to plumbers? (Select four that apply)
    a. Bacteria in soil
    b. Contaminated water in pipes or trenches
    c. Human pathogens from raw sewage
    d. Discarded used syringes
    e. Working at height

28. Hazards from working with or near hot substances such as molten lead, soldering irons, steam or hot water, and pipes carrying hot liquids include scald and/or burn injuries.
    a. True
    b. False