

PLUMBING GRADE 8

TERM 1

1. INTRODUCTION

What is Plumbing?

Plumbing is the manipulation of water through a network of pipes performing different functions in systems such as hot and cold water, filtration, sewerage water removal and the installation of geysers, solar water heaters & heat pumps.

Skilled tradesmen work with pipes, valves and fittings which deliver potable water to buildings and remove grey (basin shower & bath water) and black water (toilets, sewerage & factory water). When installing new systems or modernising old ones, plumbers take measurements and make drawings to show where pipes will connect with outside lines and where fixtures will be placed. They then measure, bend, cut and thread pipes according to the drawings. Pipes are joined by bolting, brazing, gluing, screwing or soldering them together. In some cases, plumbers also repair roof gutters. When doing repair or maintenance work, plumbers must locate the cause of problems and replace broken or worn out valves and clear pipes and waste traps.

Topics to be studied in Plumbing

1. Safety
2. Water cycle
3. Water supply
4. Tools & Equipment
5. Material
6. Fittings
7. Hot water cylinders (geysers) SANS10254
8. Valves
9. Connecting pipes
10. Freehand drawings
11. South African National standards (SANS)
12. Calculations System International-(SI) Units
13. Measuring
14. Solar hot water Heaters SANS10106
15. Heat pumps SANS 1352
16. Soldering
17. Flushing systems

18. Installations of Sanitary units and showers
19. Sewerage
20. Planning and preparation of plumbing works
21. Galvanized sheet metal work
22. Maintenance repairs and replacement of gutters and downpipes
23. Maintenance & repairs
24. Invoices and quotations

Specific Aims:

The learner is able to:

1. Comply with good housekeeping safety practices in the work area
2. Explain the Water cycle in different systems
3. Explain the Water supply in different systems
4. Demonstrate the safe use of suitable Tools & Equipment
5. Identify and select suitable material for different water systems
6. Identify and select suitable fittings for different water systems
7. Install a Hot water cylinder (geysers) SANS10254
8. Identify and select suitable valves for different water systems
9. Identify and select suitable connecting pipes for different water systems
10. Illustrate layout of water systems using suitable freehand drawings
11. Comply with various SANS when installing water systems
12. Complete calculations using System International-(SI) Units
13. Demonstrate and apply accurate measuring techniques
14. Install Solar hot water Heaters SANS10106
15. Install Heat pumps SANS 1352
16. Demonstrate soldering techniques
17. Explain and demonstrate flushing systems
18. Install sanitary units and showers
19. Explain and install sewerage systems
20. Plan and prepare for plumbing works
21. Demonstrate basic Galvanized sheet metal work
22. Maintain, repair and replace gutters and downpipes
23. Maintain and repairs water systems
24. Complete invoices and quotations

SAFETY



PERSONAL SAFETY



GOOD HOUSEKEEPING



WORKSHOP SAFETY

SAFETY



1.1 Personal safety

1.1.1 Personal safety is an individual ability to live their everyday life free from the threat or fear of psychological, emotional or physical harm from others.”

Safety first will not make you use any first aid kit, if the accident hasn't happened to you stay safe at all the time. Your carelessness will cost you a life.

Fingers, hands, eyes, head etc. must always be protected at all the time. Protective equipment should be comfortable to anybody wearing



Personal Safety Equipment (PPE)		
 <p style="text-align: center;">Apron</p>	 <p style="text-align: center;">Overall</p>	 <p style="text-align: center;">Safety glass/mask</p>
 <p style="text-align: center;">Nose mask</p>	 <p style="text-align: center;">Safety boots/Safety foot gear</p>	 <p style="text-align: center;">Safety gloves</p>

 <p>Safety helmet</p>	 <p>Safety goggles</p>	 <p>Ear protection</p>
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To provide safety for people is to wear your proper PPE (Personal Protective Equipment) at all the time. There are hazardous, fumes, objects that may cause an unplanned event that may lead to a person getting injured or losing a life.

1.1.2 Workshop safety

Workshop safety and good housekeeping.



Workshop safety is a number of various risk assessments of working practices which have to be observed and adhered to and enforced by the person using the workshop.

Good housekeeping is putting everything on its intended place time and space by making it easier to find and avoids any accidents.

Assessment

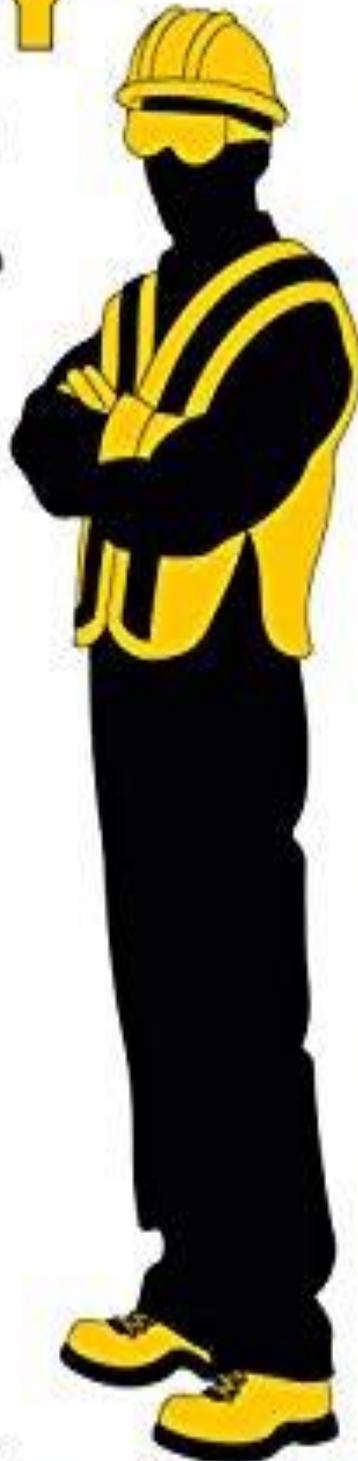


ACTIVITY: 1.1 Label Parts A-F

 <p>A</p>	 <p>B</p>	 <p>C</p>
 <p>D</p>	 <p>E</p>	 <p>F</p>

SAFETY RULES

- 1 You are responsible for your own safety and safety of others.
- 2 Wear personal protective equipment necessary for the job.
- 3 Always use equipment/tools/machinery safely and properly.
- 4 Lift properly using your legs and not your back.
- 5 Keep your work area clean.
- 6 Wear appropriate and safe work clothing and footwear.
- 7 Report any unsafe conditions.
- 8 Clean up spills immediately.
- 9 Report all injuries.
- 10 No alcohol or drugs to be used or allowed on company property.



1.1.3 Dangers in the workshop and workplace.

Workshop	Workplace
<ul style="list-style-type: none">• Not wearing personal protective equipment (PPE) in the workshop.• By not displaying safety rules and regulations in the workplace.• Working without the permission of the teacher/supervisor.• Do not play or full around in the workshop.• Placing of tools, materials, etc. on the walkways in the workshop.• Using the tools or machines for the wrong purpose.• Adjusting or touching moving machinery.• Working at a dangerous speed.• Pouring oil splits or other liquids that may cause slipping.	<ul style="list-style-type: none">• Not wearing personal protective equipment (PPE).• By not displaying safety rules and regulations in the workplace.• Not having first-aid kits at the workplace.• By operating faulty/malfunctioning machinery.• Pouring oil splits or other liquids that may cause slipping.• Working with defaulted tools & machineries.• Working at unsafe speed.

Assessment



ACTIVITY:

1.1 write down FIVE safety in the workshop.

MATERIALS:

PIPES USED IN PLUMBING.

PVC PIPES.

PVC is a common, strong but lightweight plastic used in construction. It is made softer and more flexible by the addition of plasticizers. If no plasticizers are added, it is known as uPVC (unplasticized polyvinyl chloride) or rigid PVC. Pvc pipes come in different sizes from 50mm-550 mm





The uses of PVC:

Economical, versatile **polyvinyl chloride (PVC, or vinyl)** is **used** in a variety of applications in the building and construction, health care, electronics, automobile and other sectors, in products ranging from piping and siding, blood bags and tubing, to wire and cable insulation, windshield system components and more.

COPPER PIPES:

There are two basic **types** of **copper tubing**, soft **copper** and rigid **copper**. **Copper tubing** is joined using flare connection, compression connection, pressed connection, or solder. **Copper** offers a high level of corrosion resistance but is becoming very costly.

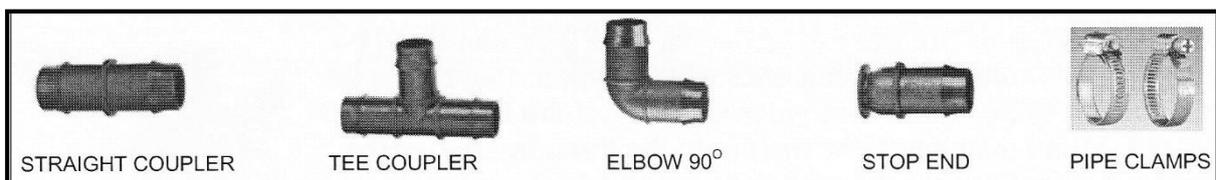
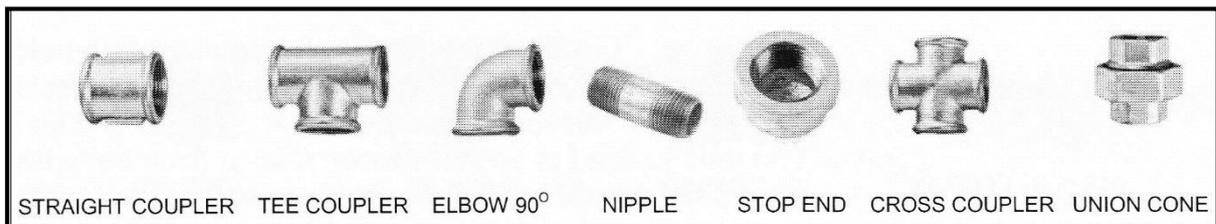


Copper pipes are commonly **used** in the construction industry for water supply lines and refrigerant lines in HVAC (heating, cooling, and air-conditioning) systems.

Copper pipes can be manufactured as soft or rigid **copper** and offer excellent corrosion-resistance and reliable connections.

GALVANIZED PIPES:

A **galvanized pipe consists** of a common steel **pipe** which is coated by a thin layer of another **metal** such as zinc to prevent rusting. Thus, for nearly all outdoor uses a **galvanized pipe** is usually preferred to other plastic **pipes** such as PVC or ABS **pipes**.



Galvanized pipe is **used** in outdoor and indoor **applications** due to its anti rusting components. The zinc coating slows the process of corrosion and can make the **pipe** last for decades (in the right environment). This makes it ideal for marine **applications** and for transporting hot and cold water alike.

Assessment



ACTIVITY:

2.1 Identify the following.

Part	Name
	2.1.1
	2.1.2
	22.3
	2.1.4
	2.1.5

PLASTIC FITTINGS:

PVC fittings includes solvent weld tees, elbows (both 45° and 90°), sockets, stubs, reducers, crosses and flanges.



Plastic pipework is **used for** the conveyance of drinking water, waste water, chemicals, heating fluid and cooling fluids, foodstuffs, ultra-pure liquids, slurries, gases, compressed air, irrigation, **plastic** pressure **pipe** systems, and vacuum system applications.

Brass fittings(Compression joints)

Brass itself is an alloy of copper that incorporates zinc as an alloying element; the ratio of **brass** to copper varies between types of **brass**. Of the **pipe** attachments available, common varieties include union tees, crosses, couplings, elbows (male or female).



Brass caps fit on the end of a pipe and, as their name suggests, are **used** to prevent flow in a certain area of the system. **Brass fittings** are also **used** in automotive **applications**, where they are **used** in air brakes, fuel line valves, and hose ends.

Assessment



ACTIVITY:

- 1) Name the types water pipes used for cold water.
- 2) Give the uses of brass fittings.
- 3) Describe the FOUR different types of fitting used to connect pipes.
- 4) Name the fitting used for PVC connections.

Enrichment



PVC Solvents and glues

To briefly explain, a solvent **cement** is a **glue** which **consists** of a small amount of **plastic** resin which is dissolved in a solvent. When a solvent **cement** is applied to the surface of the **PVC** pipe, the solvent contained within the **cement**, temporarily melts the surface of the **PVC**.

1 Contact glue:



The ultimate general-purpose Contact Adhesive that is a toolbox essential. Offers fast, flexible and permanent bonding - one of the best bonding agents for durability. It can be used for bonding almost anything but is especially useful for non-porous materials (e.g. glass, metal, hard plastics) that other adhesives can't glue together. Genkem Contact Adhesive offers good brushability for easy application in hard to

reach places. In its wet form, it will stick to a variety of surfaces, and in its tacky to dry form, it will only stick to itself. Once adhered, it is nearly impossible to rip apart.

SUITABLE FOR USE ON:

- Wood, processed boards, masonite, plywood, veneer, floor coverings, foam, canvas, leather, felt, cloth, linoleum, glass, metal, rubber, cork and some plastics.
- Ideal for hobby crafts, shoe repair, leather work, decorative work and general DIY projects

1.2 PVC adhesive:

Working with PVC conduit and its fittings is easy and with the right technique, you can have a strong holding bond between the conduit and the fitting by using this great tip on how to glue with PVC glue.

Unlike rigid metal conduit that has threaded fittings or EMT conduit that has setscrew fittings, PVC conduit has glued fittings that require some special twists and turns to make them secure and stay holding strong.

There are three plastic plumbing pipes that are put together with glue. They are ABS, PVC, and CPVC pipes. We don't really call it glue, but solvent-cement. None of the plumbing cements are interchangeable, each one is specific for its pipe.

Each pipe is joined with its own cement. One exception is transition cement, used to weld ABS pipe and PVC pipe together. This transition cement is green in colour so it's easy to recognize. The other exception is all-purpose cement which can be used to join any of the three pipes to each other.

APPLICATIONS & USES:

Excellent adhesion to rigid PVC plastics and ABS. Suitable for all close fitting PVC pipes:

- Low-pressure pipes: like swimming pool pipes, outlet pipes, cable conduits, PVC gutters, PVC and ABS connections, etc.
- High-pressure pipes: like irrigation pipes, drink-water pipes, gas pipes, sewage pipes, industrial pipes, etc.

Assessment



ACTIVITY:

- 1) Name the types of glues used for PVC pipes.
- 2) Contact adhesive can be used on which type of material?
- 3) Describe FOUR high pressure PVC pipes.
- 4) Name the fitting used for PVC connections.

PLUMMING TOOLS:

USE OF THE FOLLOWING TOOLS:

MONKEY WRENCH	SHIFTING SPANNER	PIPE STOCK AND DIE	WATER PUMP PLIERS	PLIERS
				
<p>USES:</p> <ul style="list-style-type: none"> - Tightening and loosening of pipes - Holding of pipes when valves, etc. are tightened 	<p>USES:</p> <ul style="list-style-type: none"> - Tightening and loosening of taps, pipe fittings. 	<p>USES:</p> <ul style="list-style-type: none"> - Cutting exterior thread on water pipes. 	<p>USES:</p> <ul style="list-style-type: none"> - For gripping and holding pipes, etc. 	<p>USES:</p> <p>To perform many functions like:</p> <ul style="list-style-type: none"> - Gripping - Cutting wire. - Bending - Pulling.
VICE GRIP	TIN SNIPS	HACK SAW	SOLDERING IRON	PIPE CUTTER
				
<p>USES:</p> <ul style="list-style-type: none"> - All purpose gripping tool 	<p>USES:</p> <ul style="list-style-type: none"> - Cutting straight cuts and curves in sheet metal 	<p>USES:</p> <ul style="list-style-type: none"> - To cut metal - To cut plastics 	<p>USES:</p> <ul style="list-style-type: none"> - Soldering work for joining of copper and brass pipes and fittings 	<p>USES:</p> <ul style="list-style-type: none"> - Cutting of pipes.
PLUMP BOB	BLOW TORCH	REAMER	<p>Enrichment</p> 	
				
<p>USES:</p> <ul style="list-style-type: none"> - To determine perpendicular level. 	<p>USES:</p> <ul style="list-style-type: none"> - To heat copper pipes when soldering 	<p>USES:</p> <ul style="list-style-type: none"> - To ream copper pipes 		

Assessment



ACTIVITY:

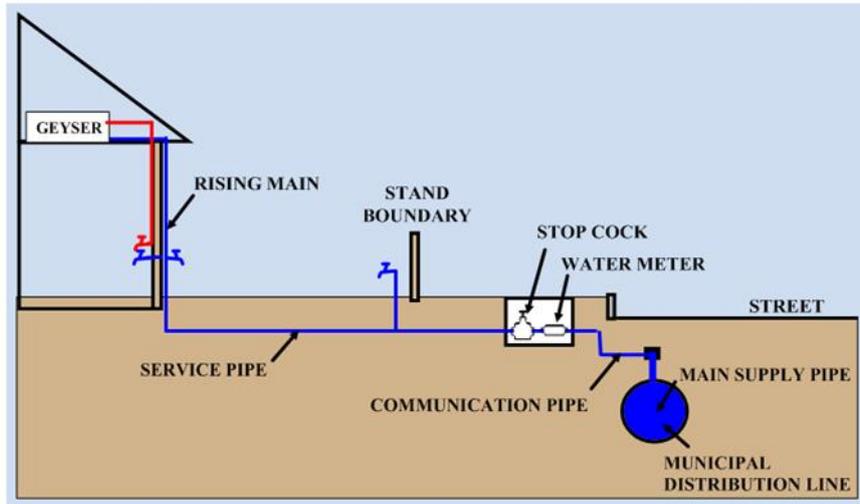
1. Identify FIVE (5) plumbing tools.
2. Name the uses of all plumbing tools listed above.

Enrichment



WATER SUPPLY:

Cold water supply of a dwelling in a municipal area:



MAIN SUPPLY PIPE:

Main water pipes usually run under the street roads and foot paths so that water supplies can be drawn off to individual points or dwellings. The municipality will connect a communication pipe from the main supply to a water meter box on the pavement with a stopcock or stop-valve with a short length of service pipe to a point just inside the property boundary.

SERVICE PIPE:

The pipe joining the main supply pipe from the stop cock with the rising main is called the service pipe and may be a copper, galvanized or polyethylene pipe. These pipes should be laid at least 450mm below the ground level.

RISING MAIN:

The rising main pipe connects the service pipe with the water installation inside the house.

Cold and Hot water supply

Water pipes should be 600mm below ground level to protect against frost and sharp objects and 500mm away from drains and have to be demarcated at all the following points:

- When they change direction
- At T-junctions
- At the end of the pipe

1.1 Types of water pipes

1.1.1 Copper pipe tubing

Copper tubing is specified to its outside diameter and available in 5,5m lengths.

Uses

- Externally: Outside, above or below ground.
- Internally: In the roof or plastered inside the wall.

1.1.2 Polyethylene piping (PVC)

Polyethylene is a thermoplastic material pipe. The thickness is specified to its outside diameter

Uses

- Externally: Below or above ground. It functions best if installed at 20°C. For exposed above the ground pipe work, proper anchorage and support is needed.
- **Red poly-cop PVC pipes are used for hot and cold installations.**

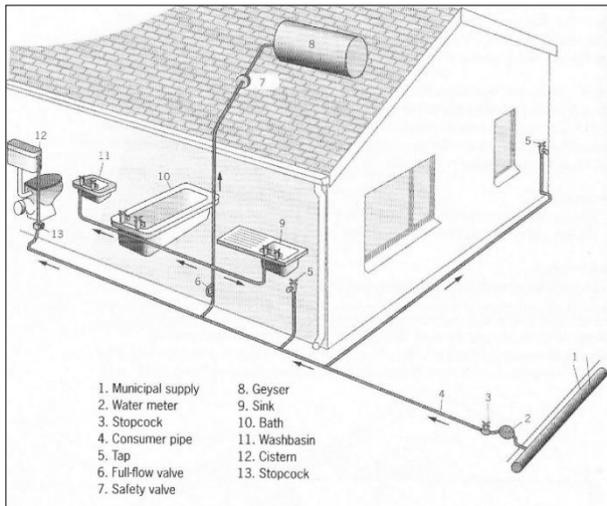
1.1.3 Galvanized steel pipes

Galvanized pipes are commonly used in domestic water installations and are available in 6m lengths

Uses

- Externally: Outside, above or below ground.
- Internally: In the roof or plastered inside the wall.

The figure below shows a domestic water supply system



Assessment



ACTIVITY:

1. Name THREE pipes used for cold water installation in a dwelling.
2. Describe the following:
 - a. Rising main
 - b. Main supply
 - c. Service pipe

Enrichment



FITTING AND JOINING OF PIPES

JOINING PVC PIPES:



Polycop pvc pipes used for cold water supply.



Brass Compression joint with lock ring and nut.



Brass T-piece compression fitting.

Enrichment



JOINING COPPER PIPES (Capillary)

Clean copper pipes and apply flux.



Heat pipes and fitting with blow torch



Add solder and applying heat at the correct temperature.



Solder continuously added to joint.

Enrichment



JOINING GALVANIZED PIPES:

By using the thread cutter, cut the screw thread on the pipe.



Pipe with screw thread can now be connected to any galvanized fitting.

Enrichment



How to connect different types of pipes for cold and hot water systems.



Assessment



ACTIVITY

1. Name the two ways of connecting copper pipes and explain the way the connection is done.
2. Describe how you will join galvanized pipes. connection is done.
3. Describe how you will join all the different pipes using the different fitting.



8: GEYSER (HOT WATER SUPPLY)

High pressure geyser

The cold water has to be heated before it flows to the taps of washbasins, baths, showers and washing machines.

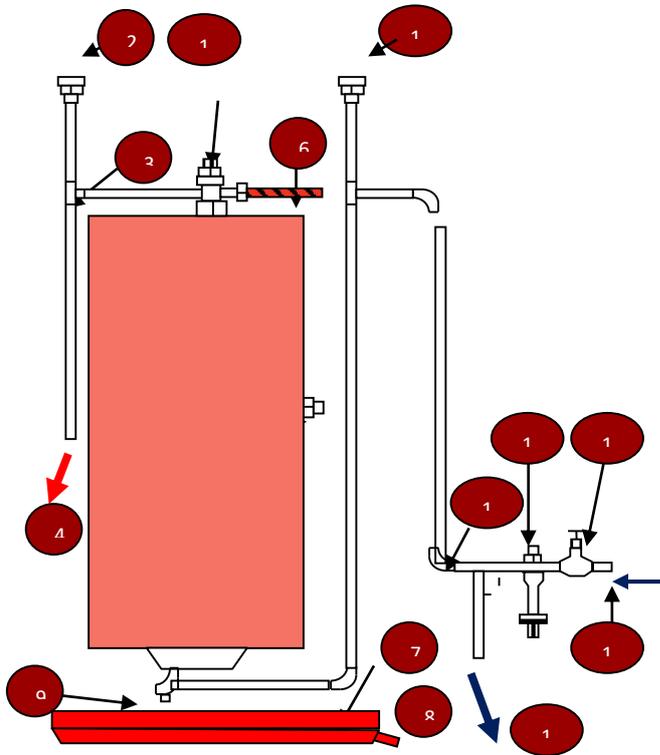
A geyser consists of the following

- A cylinder made of galvanized steel
- A round or square outer casting (galvanized metal)
- Insulation material made of polyester (middle layer)
- Thermostat, element and draining tap
- An inlet and outlet valve, as well as a safety and relief valve
- A shut off cock and pressure control valve that are fitted to the pipework just outside the geyser
- Emergency outlet (warning pipe) that leads water to the outside of the building
- The cylinder overflow pan on which the geyser rests

How the high pressure geyser works?

- Water flows into the cylinder through a pressure control valve
- The element mounted inside the cylinder heat the water
- The hot water pressure and the pressure of the water that is flowing into the cylinder are balanced
- A safety valve controls the pressure by releasing it if the pressure in the cylinder is too high
- The pressure in the cylinder allows water to flow to the taps
- When the water reaches the set temperature, the thermostat switches off the electricity. It is turned back on when the water gets too cold
- If the pressure in the cylinder drops lower than the pressure of the water that is flowing in, the vacuum breaker is opened to allow more water into the cylinder
- The vacuum valve protects the cylinder against cracking

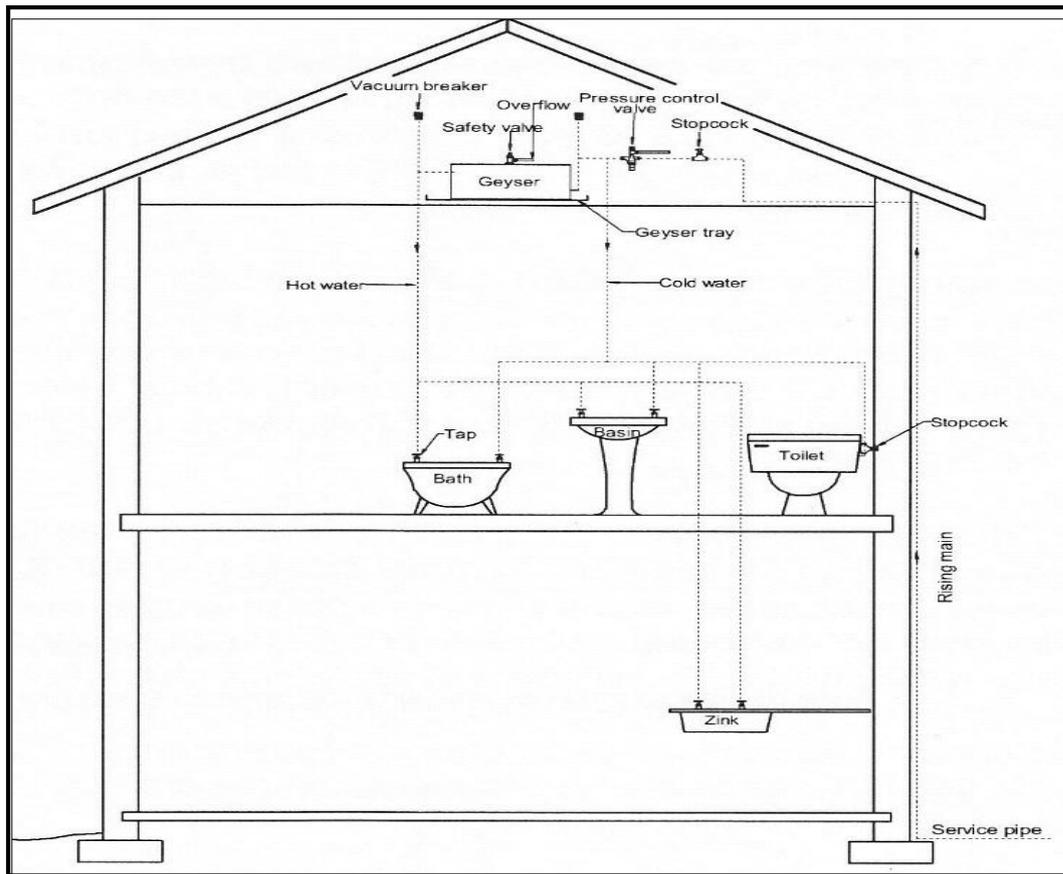
Horizontal geyser arrangement



300mm

1	Hot water cylinder WARM WATER TENK
2	Pressure release valve
3	T-piece connector
4	Hot water outlet
5	Alternative outlet (plugged)
6	Emergency outlet
7	Drip tray
8	Drip tray outlet pipe
9	Outlet valve / Drain cock
10	Cold water outlet
11	Pressure control valve
12	Stop cock
13	Elbow connector
14	Vacuum breaker
15	Main supply
16	Pressure safety valve

The figure below shows a typical system of water distribution for a normal dwelling



Assessment



ACTIVITY

1. Label the parts of the geysers in the figure below.
2. Explain the different parts the geysers consists of.

