

AGRICULTURAL TECHNOLOGY GRADE 11

SKILLS AND CONSTRUCTION Tools, Equipment, implements & mechanised systems irrigation and water supply

CHAPTER 1

SKILLS AND CONSTRUCTION

WELDING

ARC WELDING

1. Describe the process of arc welding.

Electric welding is a process of fusion in which electrical energy in the form of an arc is used to supply the necessary heat for the metals to fuse.

2. Name the TWO types of electric current that can be used to weld with.

a) Alternating current.	(AC) Transformer welders. Suitable for all ferrous metals.
	gives a smoother finish, and transformer is cheaper.
b) Direct current.	(DC) Generator welders. Welds non-ferrous metals.
c) Inverter welder	(DC) Transformer welder: Transform AC to DC. Suitable for ferrous and
	non - ferrous metals.

3. Name NINE hazards of arc welding.

- a) Never work with a welder of which the power supply is not connected to the earth leakage circuit breaker.
- b) Never weld when standing in water.
- c) Electrode holder must be thoroughly insulated.
- d) Keep flammable materials away from flying sparks.
- e) A helmet with clear glass must be worn to protect the eyes from flying slag.
- f) A visor with dark filter glasses that fits over the clear glasses must be worn to protect the user against ultraviolet rays when welding.
- g) It is extremely dangerous to look at flame with uncovered eyes when welding. It can lead to painful arc eyes or even blindness.
- h) Caution must be taken when welding any drums. Explosive gasses or substances can lead to explosions.
- i) Certain metals such as copper, manganese steel and galvanized metals emit poisonous vapours when welded.

4. Study the sketch below of a machine that is used on all farms where electricity is available to manufacture or repair articles. Answer the questions that follow:



- 1 Label the sketch from A to D.
 - A Crocodile clamp/Earth clamp.
 - B Electrode.
 - C Rheostat.
 - D Transformer.
- 2 Discuss the function of the part labelled C. To set the welding current by increasing or decreasing the amperage of the welding machine, when thicker or thinner metals are welded.
- Name the device that is used to hold the welding rod in position when welding, and provide one reason why this device must be thoroughly insulated.
 Electrode holder.
 To prevent the user from sustaining an electric shock when welding.

5. Describe an electrode/welding rod shortly.

- a) An electrode is a filler rod by means of which a joint is made.
- b) Consists of a metal rod covered with an insulating material called flux.
- c) The purpose of the coating is to: a) Stabilize the current.
 - b) Melt away impurities.
 - c) Help to form slag.
 - d) Help speed up the welding process.

6. What is the purpose of the slag that is formed on the welding run?

- a) Protects the molten metal against pollution by the air.
- b) Prevents the weld from cooling too fast.

- c) Brings about an even weld.(Slag must be removed after welding with a chipping hammer)
- 7. Tabulate the different defects that can occur on electrodes and give the effect of each defect.

Defect	Effect
A. Tip of electrode covered with insulating material.	No arc can be struck.
B. Colour code absent or indistinct.	Difficult to select correct rod for a specific metal
C. Rod coating absent.	 Current cannot be stabilized. Impurities on the surface of the metal cannot be melted away. Slag cannot be formed. Melting time is retarded. An even weld not possible. Protecting arc cannot be obtained.

8. Name TWO effects that poor storing conditions can have on electrodes.

- a) Rusting of electrode.
- b) Damaging of the coating.

9. Describe each of the following shortly:

a) Arc.

Flame or spark that is formed between the tip of the electrode and the metal that has to be welded.

- b) Shielded arc. Blue gas that forms around the arc when welding.
- c) Welding bead. Puddle of melted metal that forms directly below the electrode when an arc is struck.
- d) Penetration.

When the metal that is being welded is melted and the welding rod penetrates the welded object.

- e) Slag. Covering formed over the welded area during welding.
- f) Flux. Covers the welding rod.
- g) Tag weld.

Welding the ends of two pieces that has to be welded to prevent them from moving apart when you start welding.

h) Bead.

A series of weld pods is called a bead.

i) Chipping hammer. Remove slag from weld after welding.

10. Describe shortly the process of striking an arc.

- a) Make sure the earth cable clamp makes thorough contact with the welding table/work piece.
- b) Use a electrode with the correct diameter that corresponds to the thickness of the work piece.
- c) Adjust the amperage of the welding machine according to the table.
- d) Cover your eyes with a welding helmet.
- e) Start the weld by making a scratching movement with the welding rod.
- f) A crackling noise is a sign that the weld runs smoothly.
- g) Make a zigzag movement with the electrode.
- h) When the electrode gets stuck, bend the electrode back and lift it up.
- i) Finish the weld and remove the slag with a chipping hammer.

11. Draw a sketch of the arc.



- A. Coating.
- B. Nucleus of electrode.
- C. Molten metal.
- D. Molten flux.
- E. Shielding gas.
- F. Solidified flux.
- G. Electric arc.
- H. Molten puddle.

12. Name TEN welding defects.

- a) Insufficient fusion.
- b) Welding crater.
- c) Undercutting.
- d) Slag inclusion.
- e) Insufficient penetration.
- f) Gas pockets.
- g) Porosity.
- h) Adhesion.
- i) Concave weld.
- j) Unequal leg length.

WELDING SYMBOLS



GAS WELDING

OXY-ACETYLENE WELDING

13. Tabulate the difference between acetylene and oxygen equipment.

		Oxygen equipment	Acetylene equipment
1.	Composition	Oxygen/Nitrogen	Carbon/Hydrogen
2.	Colour	Black	Maroon
3.	Thread	Right hand thread	Left hand thread
4.	Content pressure	220kg/cm2	43kg/cm2

14. What is the burning temperature of

3100°C to 6000°C.

15. Label the drawing of the Oxygen and Acetylene bottles.



Oxygen

A. Escape valve.

- B. Steel casting.
- C. Gas. (Oxygen)

Acetylene

- A. Escape valve.
- B. Steel casting.
- C. Protective covering.
- D. Gauze wire filter.
- E. Porous upper layer.
- F. Porous mass with dissolved acetylene.

16. What is the function of the pressure regulator?

Lower the high pressure of the gas in the cylinder to the lower pressure needed for welding.

17. Name the two pressure gauges found on the regulators.

Cylinder pressure gauge. Supply gauge.

18. Can you use oil on any of the parts of the acetylene set?

No. Oil and grease can cause an explosive mixture if combined with acetylene.

19. How can leakages be traced on the acetylene welding set.

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20. What must the working pressure be of Acetylene and Oxygen?

60 Kpa.

21. Label the sketch of the Welding and Cutting torch.



22. What is the function of the high pressure welding torch?

Serves as a mixing apparatus in order to allow equal volumes of oxygen and acetylene to leave the welding torch nozzle.

23. Describe the mounting of the apparatus.

- a) Prop up both cylinders and fasten them to prevent them from toppling.
- b) Open both cylinders instantaneously to clean the openings of dust.
- c) Ensure that there is no oil/grease on apparatus.
- d) Connect high pressure rubber tubing to the pressure regulator.
- e) Turn both cylinders valves open for a instant to clean dust from rubber tubing.
- f) Connect the other ends to the torch.
- g) Fit the required size nozzle to the torch.

24. Describe the lightning and adjustment of the flame.

- a) Ensure that there are no flammable materials around.
- b) Ensure that the work piece are correctly set up, and that the correct filler rod, flux, welding goggles and lighter are at hand.
- c) Turn the cylinder valves open by one full turn.
- d) Set the pressure regulators at the correct pressure. 60 kpa.

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- e) Turn the acetylene valve slightly openf) Adjust the acetylene until the flame stops smoking.
- g) Turn the oxygen until the blue inner cone of the flame is clearly visible.

25. Describe how you would turn off the apparatus after you have finished a job.

- a) Turn off the acetylene supply first and then the oxygen.
- b) Close the cylinder outlet valves.
- c) Open the torch valves to release the pressure in the pipes.
- d) Loosen the pressure regulator screws.

26. Label the following diagram of the oxy-acetylene flame.



Which part of the flame is the hottest?

- B. Is the hottest part of the flame.
- 27. Name, draw and give the function of the three types of oxy-acetylene flames.



- A. Neutral flame. General welding. Thicker metal plates.
- B. Carburizing flame. To weld aluminium.
- C. Oxidising flame.

Used for welding brass and for brazing. Thinner metal plates.

28. Draw, name and describe the three methods of acetylene welding.

- a. Leftward welding technique. Used to weld mild steel sheet up to 5mm
- b. Rightward welding technique. Used to weld mild steel sheet thicker than 5mm.
- c. Vertical welding.
 Welding starts at the lower end of the weld, and then moves upwards to the end of the work piece.
- 29. What is meant with brazing? Oxy-acetylene welding, with bronze rods. Bronze work needs a flux when brazing/welding.
- 30. What device is used to keep flames from going back into the pipes and cylinders of the oxy-acetylene set, preventing an explosion?

Flash back arrester.

31. The illustration below shows a flame of the oxy-acetylene welding set with the different temperatures shown on the graph. Analyse the illustration and answer the questions that follow.



- 1 Identify the hottest part of the flame and indicate this temperature B 1600 °C or 2912 F.
- 2 Where will you position the work piece in relation to the flame if you look at the graph in the picture?

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Just in front of the white flame. At point B.

- 3 Is this flame used for cutting or welding? Welding. 4
 - Identify this type of flame and give two uses.
 - Neutral flame. a) Welding of mild steel.
 - b) Welding of copper.

OXY ACETYLENE CUTTING

1. Describe the cutting process.

- a) First bring the material up to red hot.
- b) Oxygen is then fed with the lever on the cutting attachment.
- c) The steel actually ignites giving off more heat to keep the process going.
- d) The steel turns into a liquid.
- e) The iron liquid is cleared from the cut by pressure from the oxygen stream.

2. Sketch of a cutting tip.



Sketch of the cutting nozzle. 3.



Sketch of the oxy acetylene cutting and welding apparatus. 4.



MIG/MAG WELDING (MIG = Metal Insert Gas)(MAG = Metal Active Gas)

1. Describe shortly what MIG welding is about.

It is an arc welding process in which individual consumable electrodes (standard welding rods) are replaced by continuously fed wire, and an insert gas shield replaces electrode flux.

2. Name the three types of gasses used in MIG welding?

Argon, helium and carbon dioxide CO_2 . CO_2 or a CO_2 /argon mix can be used for welding mild steel.

3. What type of current does this process use?

Direct current DC.

4. Name the advantages of MAG welding above normal arc welding.

- a) Excellent fusion and penetration.
- b) Faster.
- c) Operation requires less manual skills.
- d) Welding area is easier to see.
- e) No heavy slag to control or to chip away, compressed gas seals the weld pool.
- f) Potentially cheaper.
- g) Welds a wider range of thickness.
- h) Welding wire runs from a spool and need not to be replaced regularly.
- 5. Sketch of the MAG welding process.



6. In which direction must you work with MAG welding?

Pushing in the direction of travel with an 80° angle is the best but you can also pull the gun

7. Sketch of a MAG nozzle.





WELDING PRINCIPLES

1. Describe the process of overhead welding.

Gas welding

- a) Requires a reduced melting pool, big enough to create the wanted penetration.
- b) Done by reducing the size of the flame.
- c) Or using a slightly thicker welding rod.
- d) Force of the flame will help to keep the molten metal positioned.

Arc welding

- a) Use an arc as short as possible.
- b) Weld a number of runs without any lateral movement.
- c) When molten metal starts dripping, the amperage should be reduced slightly.
- d) Move electrode slightly faster.
- e) Hold electrode in same position as in relation to base metal.

2. Describe the process of vertical welding.

Arc welding

a) Welding downward in a vertical position may prove a problem, because the molten metal of the puddle will tend to run down

- b) Special electrode is used for vertical process easier as it "freezes" more quickly.
- c) Amperage can be reduced slightly from the normal down hand setting.
- d) Tip of the electrode must be pointed upwards, so that the electrode forms an angle of up to 30° with the horizontal plane.
- e) Arc must be kept short and the speed must be just sufficient to prevent the molten metal from the puddle to run down.
- f) When welding down very few lateral movements of the electrode must be made.

3. Name the different types of welding runs used for vertical welding.

- a) Figure 8 shape.
- b) U-shape.
- c) Zigzag shape.
- d) Triangle shape.

4. What must be kept in mind when welding pipes?

When welding a pipe the welding plane continuously changes as the welder welds a run.

5. Name the three pipe welding positions.

- a) Horizontal fixed position.
- b) Horizontal movable position.
- c) Vertical position.

6. What must be remembered when welding galvanized metal?

The galvanizing makes welding difficult so it is recommended that the galvanizing is removed prior to welding.

7. Name the different pipe-welding positions.

- a) Closed butt join, roll position.
- b) Open butt join, roll position.
- c) Chamfered join, roll position.
- d) Chamfered join, fixed position.

8. Describe the procedure that you would follow to weld a cast iron pot/part.

- a) Use a pure nickel welding rod.
- b) Amperage must be as low as possible.
- c) Arc must be a little longer than when welding mild steel.
- d) Make sure that all rust, grease, dirt and/or any other substances which can weaken the join has been removed before starting with the process of joining.
- e) Remember to remove the surface layer of the metal where the join is to be made.
- f) Cover the suspect area with white chalk. Vaseline in the cracks will color the chalk gray or show a wet line.
- g) Mark the line by means of a prick-punch and hammer to prevent the line from disappearing when grinding out the V-groove.
- h) It is very important that the casting is kept as cool as possible during the welding process.

- can help to prevent it from forming new
- i) Pre-heating of a casting to be welded cracks.
- j) Casting should be allowed to cool down slowly after welding.
- k) A casting should never be submerged in water to cool it down.
- I) While a run is allowed to cool down it can be lightly tapped with a small hammer. This action helps to relieve the tension around the weld.

9. Name a few points to consider when welding is done.

- a) Gravity can cause metal to drip or run down.
- b) Keep puddle small.
- c) Prevent over-penetration, burning through.
- d) Electrode size plays a role in penetration.
- e) Current plays a dominant role in the welding process.
- f) Surface area must be cleaned thoroughly.

10. Describe what is meant by hard-facing

- a) It is the process by means of which worn parts can be built up by padding with a wear resistant metal.
- b) The type of hard-facing and type of electrode used, are determined by the service requirements of the parts concerned.

11 Name the kinds of wear that parts can be subjected to.

- a) Metal against metal friction.
- b) Serious jolts or shocks of metal against rock.
- c) Scraping plus jolts and shocks.
- d) Serious scraping.

12. Describe the process of hard-facing.

- a) Area to be covered must be free of corrosion, grease or foreign substances by grinding it away.
- b) Do not work at too high amperage.
- c) Use a longer arc.

13. Give the definition of shrinking of welding joins.

When metal is heated it expands and when it cools down it shrinks. The shrinking of welded metal, as well as weld runs, causes distortion of sheets when they cool down. Shrinking takes place in all directions simultaneously and therefore causes various types of distortion.

14. Name and sketch the four types of shrinking.



- a) Longitudinal shrinking.
- b) Angular shrinking longitudinally.
- c) Angular shrinking.
- d) Lateral shrinking.

15. Name the factors that influence shrinking.

- a) Amount of welding.
- b) Number of welding runs.
- c) Degree of resistance.
- d) Original state or condition of parts that must be welded.
- e) Welding procedure.

16. Name the welding defects sketch each one and give the causes of each.

a) Insufficient penetration -

causes

- a) Torch flame too small or amperage too low
- b) Wrong welding technique
- b) Improper join preparation



b) Welding crater - causes

- 18
- a) Too big a flame or too high an arc current
- b) Incorrect welding technique
- c) Too thin electrode or rod



c) Undercutting

causes

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- a) Too high an amperage/current or too a high flame
- b) Wrong angle of electrode
- c) Wrong angle of torch



Fig. 2.27 Undercutting

d) Inclusion of slag

causes

- a) The arc current is too low
- b) Slag is not removed completely after each weld
- c) Wrong angle of electrode
- d) Faulty preparation of join



Fig. 2.28 Slag inclusion

- e) Insufficient penetration -
- causes
- a) Too small root gap
- b) Arc current too low or torch flame too small
- c) Electrode or rod too heavy



f) Gas holes

- causes
 - a) Dirty metal
 - b) Base metal is melted too fast
 - c) Welding metal is cooled down too quickly



g) Porosity

causes

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- a) Too high an arc current or too big a torch flame
- b) Too sudden removal of arc or torch causes the melted
- c) Metal to be attacked by atmospheric gases
- d) Incorrect electrode or rod



Fig. 2.31 Ponosity

h) Adhesion

causes

- a) Incorrect welding technique
- b) Incorrect electrode or rod



i) Concave welds

causes

- a) Too little welding material put down
- b) Too big a torch flame or too high an arc current



Fig. 2.33 Concave we

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j) Unequal leg lengths

causes

- a) Incorrect angle of electrode
- b) Incorrect angle of torch nipple.



17. Name four ways of controlling distortion of welding runs.

- a) Pre-setting.
- b) Welding of patch work.
- c) Clamping.
- d) Spot welding.

CORROSION

1. What is corrosion?

Corrosion is the slow process of metal deterioration. This process takes place when pure metals are exposed to oxygen and water or when other corroding substances like acids or alkaline combine with it, or when it takes place electrolytically.

2. Name and describe the three types of corrosion.

a) Oxidation

Oxidation takes place when oxygen and water in the air combine with a metal.

b) Electrolysis

This process takes place when two different metals touch.

c) Corrosion through acids

Acids may also be present in the air and because they are in a vapour form they work in or on metals e.g. hydrochloric acid vapour.

3. Name the different methods of preventing corrosion.

- a) Oil.
- b) Grease.
- c) Lacquer or varnish.
- d) Paint.
- e) Electroplating.

4. Describe how metal is finished off by polishing it.

- a) See that the surface is clean.
- b) Warm the metal slightly.
- c) Apply a layer of polish.
- d) Allow it to dry.
- e) Rub in the polish with a clean cloth.
- f) Finishing will take place in due course.
- g) Polish has a translucent quality.
- h) The polish protects the metal against corrosion.

5. Name the procedures to follow when applying enamels and varnish.

- a) The surface of the metal should be clean.
- b) Ascertain whether the metal has been finished off.
- c) Use a clean cloth or paper to handle the metal.
- d) Warm metal slightly so that the varnish will flow well
- e) Use a good clean brush and apply small quantities at a time.
- f) Never paint over any area twice.
- g) Allow the article to dry in a warm clean room.
- h) If necessary give a second application only after the first is dry.
- i) Determine the paint base.
- j) Turpentine base use turpentine for cleaning the brush. Water base – use water.

CHAPTER 2

FARM MACHINES

PLANTERS

1. Thorough knowledge of the calibrating, setting and working of the planter is critical for a successful harvest. To ensure that the planter is in working order, maintenance has to be done on implements.



1 Name four tasks that a person should perform when maintaining a planter.

a) Lubrication.

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- b) Check all bearings, chains and gears.
- c) Check all safety clutches.
- d) Sharpen all blades.
- e) Check tyre pressure.
- f) Check bolt tension.
- g) Inspect chassis and tyres for damage.

Name the procedures that have to be followed when the planter is stored after the planting season.

- a) Clean the planter properly.
- b) Fix broken or damaged parts immediately.
- c) Release the tension on all drive belts.
- d) Remove all chains, clean and oil them, and replace them.
- e) Dismantle all slip clutches, clean them and reassemble them but do not put the springs under tension.
- f) Paint or cover all unpainted areas with a thin layer of grease.
- g) Grease all grease nipples.
- h) Store planter in a dry place under cover.

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SPRAYERS

When applying pesticides to the crops one must be very cautious not to contaminate the environment.



- 1 Name the precautionary measures the worker has to keep in mind when spraying crops with pesticides.
 - a) Make sure the calibration of the sprayer is correctly set for the specific type of pesticide.
 - b) Use gloves when working with poisons.
 - c) Where a mask when working with or near the place where the pesticides are to be applied.
 - d) Discard empty containers safely.
 - e) One must wash immediately in case of accidental contact with poisons.
 - f) Get a doctor's advice if poisons are swallowed.

Name three tasks that a person should perform after the spraying job is finished.

- a) Cleaning must be done at a place where the poison will not affect human, animal or plant life.
- b) Run clean water through the whole system.
- c) Check for blockages on the tank, sprayers, nozzles and pipes.

CHAPTER 3

IRRIGATION AND WATER SUPPLY

IRRIGATION SYSTEMS

1. Name five irrigation methods that can be used on maize:

- a) Centre pivot irrigation.
- b) Flood irrigation.
- c) Canon sprayers.
- d) Quick coupling irrigation pipes.
- e) Roll set irrigation.

2. When will sprinkler irrigation be preferred toflood irrigation?

- * When water supply is weak.
- * Surface gradient (steep) leads to erosion.
- * Infiltration tempo not constant.
- * Drainage problems.
- * No high costs of levelling of land.

3. Sprinkler irrigation consists of four primary parts. List these primary parts.

- Engine/electrical motor.
- Pump.
- •___Pipes.
- Sprinklers.

4. Two types of sprinkler irrigation systems are illustrated below:



1 Write the name of the irrigation method shown in B.



Centre pivot.

- 2 Under what conditions will the system, numbered as B, be a better option than the system numbered as A.?
 - * Time saving.
 - * Bigger surfaces/larger land.
 - * Not enough labourers.
- 3 If macro irrigation systems are not managed effectively it will have a negative effect on the environment. Name THREE of these negative effects.
 - * Waste water over utilization of natural resources.
 - * Soil erosion.
 - * Increase salinity in soil.
- 4 Name FIVE advantages of the irrigation system shown above.
 - a) Minimum labour cost.
 - b) Low pump cost.
 - c) Low maintenance cost.
 - d) Durable.
 - e) High second-hand value.
- 5 Name a way of protecting the metal parts of the irrigation system against corrosion (rust). Galvanising.
- 6 How can theft of electrical cable be prevented? By installing the cable inside the water pipe.
- 7 Identify the device installed at the pump station, to prevent blockages of sprayers. Sand filter.
- 5. Sprinklers forms part of the irrigation system.



- 1 What is the function of the sprinkler head in the photo? Distribute water evenly, in this case over large areas.
- 2 Name two effective materials used to manufacture the sprinkler head indicated in the picture.
 - a) Metal; Brass; galvanised iron.
 - b) Plastic.

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3 Name an advantage of each material used in the previous question that makes it suitable for the sprinkler head. Metal does not wear out easily, plastic and choice of metals are not corrosive.

6. Give the correct solution for each of the following scenarios. Justify your answer with a reason in each case.

- 1 This pump is used to pump water from rivers or dams and is not a submersible pump. Centrifugal pump. Are used in shallow water reservoirs.
- This device can be used to switch a pump on or off over a great distance.
 Cellphone/Two way radio. Use a transmitter and a receiver to do the switching.
- 3 The metal from which quick coupling spray irrigation pipes are manufactured. Aluminium. Lightness.
- 4 The type of metal that can be used to manufacture sprayers for irrigation purposes. Brass, PVC. Corrosion resistant.
- A qualified person needs to connect electrical wiring to Eskom's distribution network.
 Electrician. Very dangerous job. Person without knowledge can be killed by the high current.

7. Choose from the list below a concept or word, which best suits, the description given

Stone drain, septic tank, fishbone drain, sieve, open drain.

- 1 Ditches are dug at regular intervals to a suitable depth to remove free water from waterlogged soil. Open drain.
- 2 The bottom of the trench is loosely packed with large stones, covered with smaller stones and finally with soil. Stone drain.
- 3 This wastewater management system uses biological principles to break down the waste. Septic tank.

- 4 The lateral drain runs into the main drain at an angle of about 45°. Fishbone drain.
- 5 The opening of the drain should be covered with this. Sieve.





- 1 What is the system in A called? Drip irrigation.
- 2 Give an example where system B can be used effectively. Horticulture, greenhouses, orchards, etc.
- 3 Explain in short the difference between micro- and macro-irrigation in relation to water distribution.
 - * Micro irrigation concentrates the moisture at root area.
 - * Macro irrigation keeps the whole field/surface wet.
- 9. The photo below shows a worker handling an aluminium pipe. Use the information shown in the photo and describe safety measures, regarding electricity, when working in irrigation fields.



- * Water and metal conduct electricity:
- * Do not work in wetlands with electricity.
- * Be careful not to touch transmission lines with metal pipes, as you are the shortest route to earth and could be electrocuted.

PUMPS

1. Name four criteria that can be considered in the choice of an appropriate pump.

- * Purpose of pump or purpose of use.
- * Required delivery; quantity of water needed.
- * Water quality havsan effect on material of pump
- * Type of power source available.
- * Mobility of pump to be used in different locations.
- * Simplicity of design for easy/cheaper repairs.
- * Maintenance required.
- * Self-installation.
- 2. The major types of water pumps available on the market are listed below:
 - A. Centrifugal pumps.
 - B. Rotary pumps.
 - C. Submersible pumps.
 - D. Jet pumps.

Choose from the list the pump that matches the description of the questions, by writing only the symbol that represents the pump.

A pump that is maintenance free and can be submerged motor and all.

C (Electrical submersible pumps).

A pump that is used in very deep water holes and works with a shaft.

B (Rotary pumps).

A pump that forces water through the pipes with vanes on the impeller and is movable.

A (Centrifugal pumps).

ELECTRICAL SUBMERSIBLE PUMP

1. Which type of pump can be submerged motor and all?

Electrical submersible pump.

2. Describe the construction of the electrical submersible pump.

- a) Pump consists of a number of drivers also known as stages that are mounted on top of one another.
- b) The larger and the greater the number of stages, the more water is pumped at the same speed.
- c) Each stage consists of a turbine and swirl.

- increase the water speed by means of
- d) The purpose of the turbine is to centrifugal force and then bring it back into the swirl. e) This last action transforms the speed into pressure before being taken to the next turbine.
- f) These stages are rigged inside a pipe that in turn is rigged to a pipe through witch the water is pumped.
- g) Below these stages a watertight motor is connected.
- h) As soon as the power is switched on the motor turns the stages that perform the pump action.
- Water is pumped through the motor to cool it. i)

3. Name the advantages of the electrical submersible pump.

- a) Easy to install.
- b) No maintenance needed.
- c) Can be pulled out of a borehole quickly.
- d) Lasts a lifetime.
- e) Delivers as much water as any other pump.
- f) Water at a very high pressure can be supplied.

4. Name the disadvantages of the electrical submersible pump.

- a) If motor is not 100% watertight it can be damaged.
- b) Pump can only be driven by electricity.

5. Sketch of the electrical submersible pump.



JET PUMP

1. Where can this pump be used?

- a) Deep boreholes.
- b) Wells.
- c) Open streams.

2. What can you use with this pump when water has to be pumped beyond the capabilities of the pump?

Injector.

3. Describe the working of this pump.

a) At the bottom end of the suction pipe a foot valve is mounted, to prevent water in the pump to flow back during rest periods.

Just above the foot valve a venturie is build into the suction pipe.

- b) Inside the venturie an injector is installed.
- c) As soon as the pump is switched on, a part of the water with which the pump has been filled beforehand, is pumped back to the injector.
- d) The extra amount of water that is now injected into the suction pipe creates an increased suction in the venturie.
- e) This increased suction force, together with an increased flow rate in the suction pipe, created by the injector, results in the pump working effectively.
- f) Care should be taken to ensure that the whole system is filled with water and be free of air.
- g) All joints must be airtight.

4. Name the advantages of this type of pump.

- a) No rods are required.
- b) Water can be drawn from great depths using the injector.
- c) Simple construction.
- d) Almost no maintenance necessary.
- e) It is a high-pressure pump.

5. Sketch of the jet pump.



ROTARY PUMP

1. Where are these pumps used?

Very deep boreholes.

2. What is the function of the pump head?

Transfer power from the engine to the pump.

3. What is the function of the sieve or grid?

Keep out coarse objects or stones that can damage the element.

4. What is the function of the non-return valve?

Keep the water from flowing backwards into the pipe.

5. Describe the working of the rotary pump.

- a) The movement of the pulley on the pump head is transferred to the rotor or worm by means of a shaft.
- b) The rotor is spiral-shaped and revolves inside the rubber stator.
- c) The revolving motion of the spiral forces the water upwards, delivering a constant stream of water.
- d) The water thrust upwards is replaced by water sucked through the foot valve.

6. Name the advantages of the rotary pump.

- a) The supply of the rotary pump is in Increase or decrease pump speed for more or less water.
- b) Pressure height is not related to pump speed.
- c) Parts that can wear is restricted to the minimum.
- d) Flexible stainless steel shaft eliminates a number of working parts.
- e) Drive unit is mounted at ground level that makes repair easier.
- f) Any power unit can drive rotor.

7. Name the disadvantages of the rotary pump.

- a) The pump has to be driven from the surface with a shaft.
- b) Direction of revolution must always be maintained to prevent the shafts from becoming unscrewed.

8. Sketch of the rotary pump.



CENTRIFUGAL PUMP

1. Describe the working of the centrifugal pump.

- a) The impeller rotates fast in the direction indicated by the arrow.
- b) The vanes of the impeller force the water outwards through the outlet pipe.
- c) Water moving outwards is replaced by water sucked into the pump via the foot valve and suction pipe connected to the inlet.
- d) This action is possible because there is no air that can be compressed inside the system.

2. Where can this pump be used?

- a) Irrigation pumps in rivers.
- b) Pumping from streams.
- c) Pumping from dams.
- d) Pumping from wells.

3. Name NINE aspects that should be considered before deciding on which type of pump to use.

- a) Purpose.
- b) Required delivery.
- c) Water quality.
- d) Availability of driving power.
- e) Mobility of the pump.
- f) Simplicity of construction.
- g) Attention required.
- h) Cost and availability of parts.
- i) Do-it-yourself installing.

4. Sketch of the centrifugal pump.



- 1. Key 2. Drive shaft
- 3. Oil seal
- 4. Oil seal
- 5. Cir clip
- 6. Ball bearing
- 7. Grease nipple
- 8. Ball bearing
- 9. Oil seal
- 10. Water swinger
- 11. Flange
- 12. Packing flange
- 13. Graphite packing
- 14. Bearing housing
- 15. Impeller
- 16. Flat washer
- 17. Lock bolt
- 18. Nut
- 19. Spring washer
- 20. Stud
- 21. Bleeding nipple
- 22. Casing

Name FOUR safety measures when working with electrical pumps and motors. 5

- a) Ensure that overload protector/earth leakage protector is functional.
- b) Electrical connections must be covered or well insulated.
- c) Earth wires must be connected and in working order.
- d) Belts, pulleys and couplings must be safely covered.

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WIND MILL



- 1. You must erect a pump on your farm to pump water from a borehole. The borehole is 100m deep and there is no electricity available. Answer the questions by using the information given in the paragraph.
 - Give the name of the pump that you will use in the scenario given above. Supply a reason for your answer. Wind mil/Sun electricity pump. No electricity available.
 - 2 To prevent the water from flowing back into the pipes, when the pump is not working, the pump will need some type of device. What is this device called and where can you install it. Non-return valve. You can install it at the bottom of the suction pipe beneath the water level or at the top of the suction pipe above ground level.
 - 3 If a farmer does not have the knowledge to solve the problem as stated in this scenario, he can utilise some sources of information that can help him solve this problem. Name TWO sources of information that the farmer can consult to help him solve the problem himself?
 - a) Printed media.
 - b) Internet.
 - 4 Communication plays a prominent role in the every day operation of the farm. The farmer cannot make an informed decision without communication between him and his

workers. The farmer also needs to communicate with the outside world to stay in touch with modern trends and daily market fluctuations. Name any TWO methods the farmer can use to communicate with his workers if he is not with them.

- * Two-way radios.
- * Cellphones.
- * Telephones.
- * Internet.

POWER HEAD

2. The sketch below shows a device that is driven by an engine.



1 What is this device called and what is its function? Power head.

Function is to pump water.

- 2 Name the type of drive that is used between the device and the engine. Belt drive or flat-belt drive.
- 3 The arrow A indicates the turning direction of the drive belt.

Will the turning direction of the gear indicated by the letter B be clockwise or anticlockwise? Clock wise.

PIPES GALVANIZED PIPES

1. Name 2 uses of galvanized pipes.

- a) Hot or cold water supply.
- b) Erection of tank stands, straining posts or verandas.

2. Name seven advantages of galvanized pipes.

- a) Longer lifespan.
- b) Cannot be constricted by roots.

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- c) Robust.
- d) Need no paint.
- e) Cannot be damaged by digging.
- f) Easily joined.
- g) Resist high pressures.

3. Name the disadvantages of galvanized pipes.

- a) Heavy and do not handle easily.
- b) Need a lot of labour to install.
- c) Large number of leaks represents potential leaks.
- d) Difficult to weld.
- e) Relatively expensive.

CONCRETE PIPES

1. Uses of concrete pipes.

- a) Carry water over long distances.
- b) Under roads for drainage.
- c) Used as wire posts (Filled with concrete)

2. Advantages of concrete pipes.

- a) Withstand high pressure.
- b) Never rust or corrode.
- c) Long lifespan.
- d) Cannot be compressed by tree roots or traffic.
- e) Need no protective covering.
- f) Cannot be damaged by digging

3. Disadvantages of concrete pipes.

- a) Very heavy.
- b) Difficult to work with.
- c) Hard and brittle, and crack easily.
- d) Only available in short lengths.
- e) Large number of joints means potential leaks.

PLASTIC PIPES (PVC)



1. Uses of PVC pipes.

a) Used for installing of water supplies over long distances.

2. Advantages of PVC pipes.

- a) Light.
- b) Few joints necessary.
- c) Long lengths laid in short times.
- d) Lay easily around sharp bends.
- e) Easily joined to galvanized pipes.
- f) Cuts and joins with ease.
- g) Relatively cheap.
- h) Very resistant to rust and corrosion.

3. Disadvantages of PVC pipes.

- a) Destroyed by veld fires.
- b) Easily damaged by digging.
- c) Blockages caused by roots entering leaks.
- d) Plant roots growing near the pipe may flatten the pipe.
- e) May be flattened by vehicles.

4. Method of laying the pipe underneath the soil.

- a) Burry deep enough so that implements cannot damage it.
- b) Burry in sand.
- c) Joints must be watertight.

COPPER PIPES

- 1. Uses of copper pipes.
 - a) Water supplies in and around the house.
 - b) Gas, oil or fuel are to be transported under low pressure.
 - c) Used in confined spaces.

2. Advantages of copper pipes.

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- a) Does not rust.
- b) Can withstand high temperatures.
- c) Can expand and contract without cracking.

3. Disadvantages of copper pipes.

- a) Expensive.
- b) Might not be readily available.
- c) Where they are installed where they are visible they must be painted.

ALUMINIUM PIPES

1. Name one use of aluminium pipes. Spray irrigation.

2. Advantages of aluminium pipes.

- a) Very light.
- b) Handle easily.
- c) Coupling is simple.
- d) Do not corrode or rust easily.
- e) Can withstand high pressure.

3. Disadvantages of aluminium pipes.

- a) Easily damaged by vehicles.
- b) Do not weld easily.
- c) Relatively expensive.
- d) Cannot cut thread.
- e) Cannot be joined easily to other pipes.

4. Give a short description and use of the following:

- a) Plug. Used to close the end of a pipe.
- b) Nipple.
 Short piece of piping with outside thread at both ends.
 Used where different systems/pipes are joined in a limited space.
- c) Another name for inside thread. Female thread.
- d) Socket.
 Short piece of piping with threads on the inside.
 Used to join two pipes of the same thickness.
- e) Reducing socket. Used when pipes of different diameters are to be joined.
- f) Hemp, Thread tape. Used as a sealing agent when joining two pipes by screwing them together.
- g) Another name for outside thread.

Male thread.

WATER SUPPLY FOR ANIMALS



- 1. Name the points that should be kept in mind when installing drinking water for animals.
 - a) Pressure high enough to satisfy needs.
 - b) Prevent spillage.
 - c) Joints watertight.
 - d) Removal of spillage water.
 - e) Protect all valves.

2. Name four requirements for troughs.

- a) Not be too high.
- b) " deep.
- c) " wide.
- d) Build in such a way that animals cannot get their feet into it.

3. What device is used to give water to pigs?

- Nipple.

4. Make a neat sketch of the automatic water supplier for chickens.

