



education

Department:
Education
REPUBLIC OF SOUTH AFRICA

**NATIONAL
SENIOR CERTIFICATE**

GRADE 12

AGRICULTURAL TECHNOLOGY

NOVEMBER 2009

MEMORANDUM

MARKS: 200

This memorandum consists of 21 pages.

SECTION A

QUESTION 1

- 1.1 A ✓✓
- 1.2 B ✓✓
- 1.3 A ✓✓
- 1.4 C ✓✓
- 1.5 C ✓✓
- 1.6 A ✓✓
- 1.7 B ✓✓
- 1.8 A ✓✓
- 1.9 A ✓✓
- 1.10 B ✓✓
- 1.11 C ✓✓
- 1.12 A ✓✓
- 1.13 A ✓✓
- 1.14 B ✓✓
- 1.15 A ✓✓
- 1.16 B ✓✓
- 1.17 A ✓✓
- 1.18 C ✓✓
- 1.19 A ✓✓
- 1.20 C ✓✓

(20 x 2) (40)

TOTAL SECTION A: 40

SECTION B**QUESTION 2: MATERIALS AND STRUCTURES**

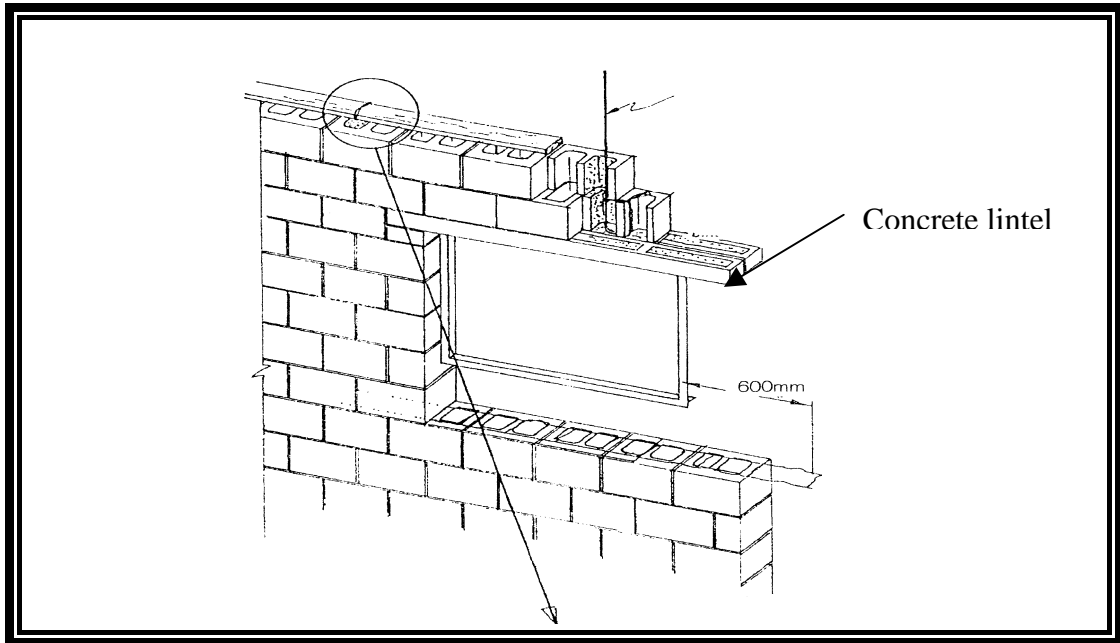
- 2.1 There are many environmental factors that should be considered when erecting buildings and other structures on the farm.
- 2.1.1 Identify the most important factor to consider when planning the foundations of these structures.
- The soil texture ✓ determines the width, thickness and reinforcement of the foundation. ✓ (2)
- 2.1.2 Name ONE insulation material that can be used in the roofs of buildings to keep the inside cool.
- Pink aerolite ✓
 - Foil sheets etc.
 - Shredded newspaper. (Any 1) (1)
- 2.2 Name TWO important procedures that should be followed before galvanised roof plates can be painted.
- Clean with hydrochloric acid. ✓
 - Paint with a prescribed undercoat. ✓ (2)
- 2.3 Security fences can be made from various types of wire. Name TWO of these types of wire.
- Bonnox ✓
 - Jackal-proof netting ✓
 - Wire mesh
 - Chicken mesh
 - Steel wire (Any 2) (2)
- 2.4 Adhesives play an important role in everyday repair jobs on the farm.
- 2.4.1 Name the TWO most important aspects to be considered when choosing an adhesive for a specific purpose.
- The type of material to be joined. ✓
 - The conditions under which the joint will be used. ✓ (2)
- 2.4.2 Describe the difference between the *cohesion* and *adhesion properties* of an adhesive.
- Cohesion:**
- Inherent strength of the adhesive. / Force between molecules of the same kind ✓

Adhesion:

- Ability of the molecules of an adhesive to stick to the molecules of other substances. ✓

(2)

2.5 Concrete lintels are always used over windows and wall openings (except in the case of face bricks) as you can see in the sketch below.



2.5.1 Explain the reason for using lintels over windows and wall openings.

- It has to carry the stress load of the bricks/wall ✓ and the roof above the window opening. ✓

(2)

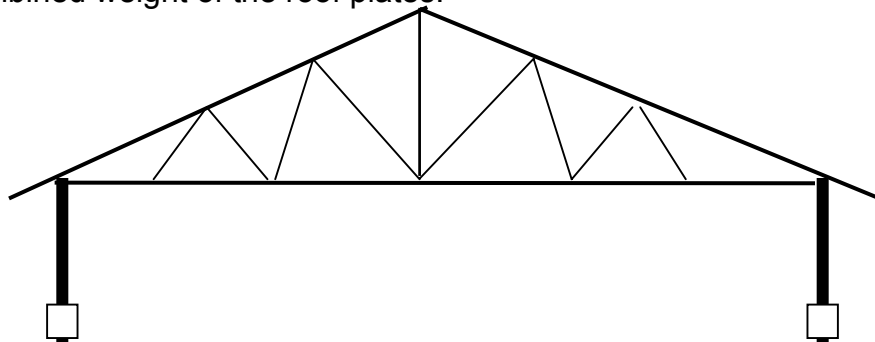
2.5.2 Layers of brick over windows must always be reinforced with brick force. How many layers of bricks above all window openings must be reinforced, according to the national building regulations?

- 3 layers ✓

(1)

2.5.3 The illustration below shows a roof construction without the triangular shapes of the roof trusses.

Redraw this roof construction and draw the support struts that must strengthen the construction to form a functional roof truss that can carry the combined weight of the roof plates.



(2)

2.5.4 Give TWO reasons for the use of pine wood in the manufacturing of roof trusses.

- Light in weight✓
- Strong✓
- Durable
- Relatively cheap
- Easy to work with

(Any 2)

(2)

2.6 Water supply to animals is essential and farmers should always make sure that enough fresh water is available at all times and that animals can drink without injuring themselves.

2.6.1 Name FOUR requirements that should be kept in mind when designing drinking troughs for animals.

- Should not be too high. ✓
- Should not be too deep. ✓
- Should not be too wide. ✓
- Should be built in such a way that the animals cannot get into it or fall into it when pushed. ✓
- Protection of valves.

(Any 4)

(4)

2.6.2 Design and sketch an effective water drinking facility for cattle. The topography of the area must be taken into account to make sure that the water pressure would be acceptable for cattle. Indicate the sizes of the pipes and volume of the troughs.

Water must be supplied to approximately 40 cattle.

Your free hand drawing must include the following:

- A VIEW that shows the position of the water tank, pipe lines and drinking troughs.
- Indicate the scale of the drawing.

Marks will be allocated for:

- Accuracy
- Scale
- Neatness

Any acceptable design must be considered.

Design and accuracy ✓✓✓

Tank: 1 000 to 5 000 litres ✓

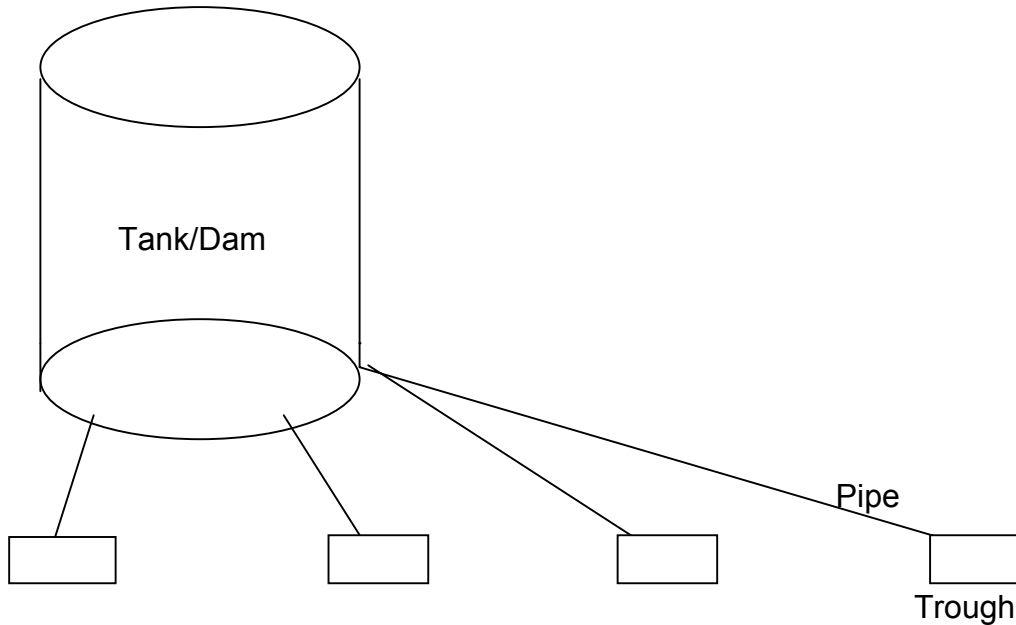
Drinking troughs contain 200 to 400 litres of water ✓

Thickness of pipes from tank to troughs: 25 mm to 75 mm. ✓

Neatness ✓✓

Scale ✓

Practicality and workability ✓



(10)

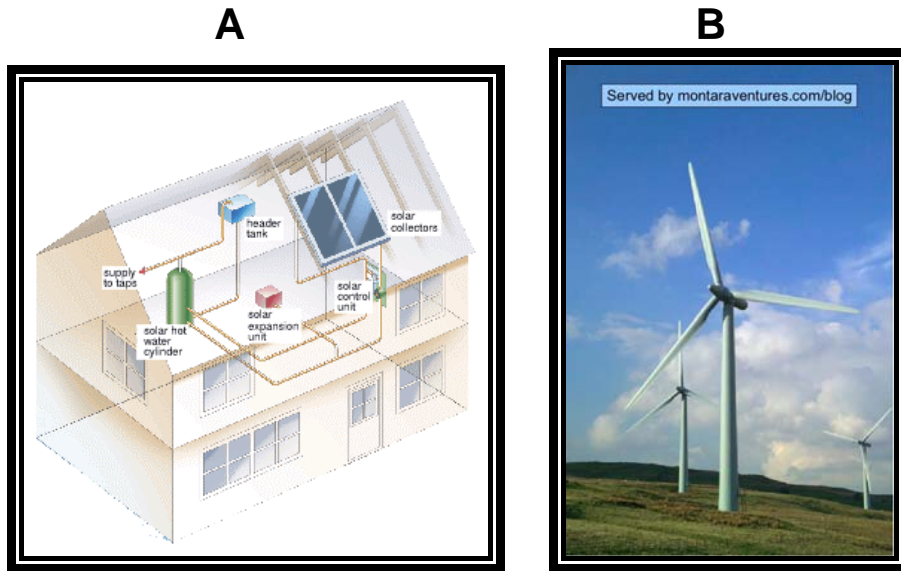
2.6.3 Explain why the concrete for building the water trough cannot be poured on a very cold day when the temperature drops to below freezing point.

The water inside the concrete mixture will freeze ✓ and expand ✓ causing small cracks and a weakened concrete mixture. ✓

(3)
[35]

QUESTION 3: ENERGY

3.1 The illustrations below show two different systems of producing electricity.



3.1.1 Identify the different energy sources labelled A and B that are shown above.

- A Solar/Sun energy ✓
- B Wind energy ✓

(2)

3.1.2 Which ONE of the methods indicated above will you erect on your farm to produce electricity if no local electricity is available? Elaborate on your answer by comparing the two systems in table form.

Will use method A or B because: ✓ (Motivate properly)

Solar/Sun	Wind
<ul style="list-style-type: none"> • Almost no maintenance needed. ✓ 	<ul style="list-style-type: none"> • High maintenance cost. ✓
<ul style="list-style-type: none"> • Sun energy is only available during day time but batteries can be used for storage of the energy to be used during night time. ✓ 	<ul style="list-style-type: none"> • Windless days may occur that cause the wind generator not to function. ✓
<ul style="list-style-type: none"> • Relatively cheap to erect. ✓ 	<ul style="list-style-type: none"> • Expensive to erect. ✓
<ul style="list-style-type: none"> • Can be installed any place on earth where the sun shines. 	<ul style="list-style-type: none"> • Can only be installed where moderate to strong winds prevail.
(Any 6)	

(7)

3.1.3 Name THREE factors that should be kept in mind when installing the system labelled A.

- Panels must be installed in such a way that it faces in the general direction of the sun's travelling lane. ✓ (north)
- No obstacles that can cast a shade over the panels. ✓
- Panels must be securely fixed on the roof to avoid it from being blown away by strong wind. ✓
- Panels must be resistant to forces of nature (frost, wind, heat, hail). ✓

(Any 3)

(3)

3.2 Complete the following statements by filling in the missing word(s). Write the word/s next to the question number (3.2.1 – 3.2.5) in the ANSWER BOOK.

3.2.1 The type of power station that uses water as an energy source is called a ... power station.

3.2.2 Geothermal systems use the ... of the earth to produce electricity.

3.2.3 ... are used to store excess electricity.

3.2.4 The mechanical part in the bio-electrical system that is used to convert turning energy into electric energy is called a ...

3.2.5 The device that is used in an electric power station to change direct current to alternating current, is called a ...

3.2.1 hydro-electric. ✓

3.2.2 heat energy ✓

3.2.3 batteries. ✓

3.2.4 generator. ✓

3.2.5 transformer ✓

(5)

3.3 The sign below is used to warn people against potential danger.



3.3.1 Against which type of dangerous situations do this sign warn people?

Electricity/Shock/High voltage ✓

(1)

3.3.2 What principles must be remembered when placing safety signs?

- Place on all gates, doors and fences to warn people of potential dangerous situations or places. ✓

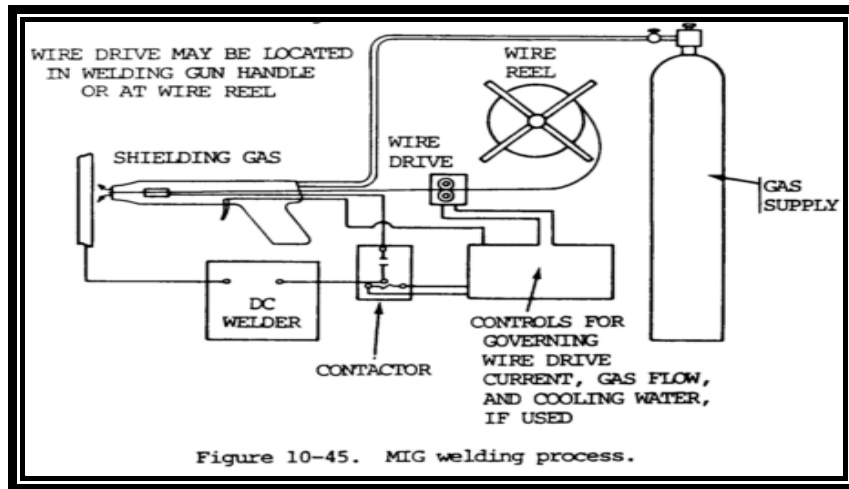
- Sign must be large and colourful so that people can notice it easily.
✓
- High enough to be out of reach of thieves, vandals and animals.

(Any 2)

(2)
[20]

QUESTION 4: SKILLS AND CONSTRUCTION PROCESSES

4.1 Study the sketch below of a welding machine that is used on the farm to construct or repair structures and equipment.



4.1.1 Identify this type of welding machine and state the type of gas that is used.

- MIG welder/Metal insert gas welder. ✓
- CO₂ gas/Carbon dioxide. ✓

(2)

4.1.2 Name any SIX advantages of this welding machine.

- High welding speed/Faster ✓
- Important savings in materials and weight ✓
- High mechanical properties of welding joints. ✓
- Neat and smooth seam surface ✓
- Guaranteed welding strength for root and layer welding. ✓
- Safety against cold shuts and cracks. ✓
- Welding in all positions, vertical up, down and overhead.
(Any correct answer can be accepted.)
- Excellent fusion and penetration.
- Operation requires less manual skills.
- Welding area is easier to see.
- No heavy slag to control or to chip away, compressed gas seals the weld pool.
- Potentially cheaper.
- Welds a wider range of thickness.
- Welding wire runs from a spool and does not need to be replaced regularly.

(Any 6)

(6)

4.1.3 Name THREE different metals that can be welded successfully with this welding machine.

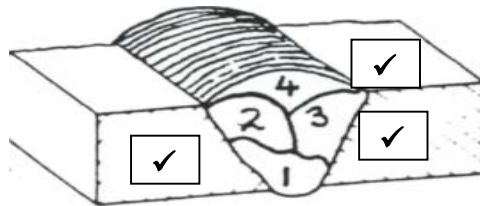
- High-alloy steel (stainless alloys) ✓
- Aluminium ✓
- Mild steel ✓

(3)

4.2 A welding operator should have extensive knowledge of the various welding techniques to be able to make a strong and neat welding joint.

4.2.1 Make a neat sketch of a butt-welding joint where four runs were made to build up the joint.

- Show the two pieces of metal with the four welding runs.
- Show the sequence of the runs (1 to 4).
- Correctness and neatness. ✓



(4)

4.2.2 Suggest THREE precautionary measures that should be taken to prevent undercutting and overlapping when doing arc welding.

- Increase the welding speed. ✓
- Change the angle of the electrode. ✓
- Decrease the amperage slightly. ✓

(3)

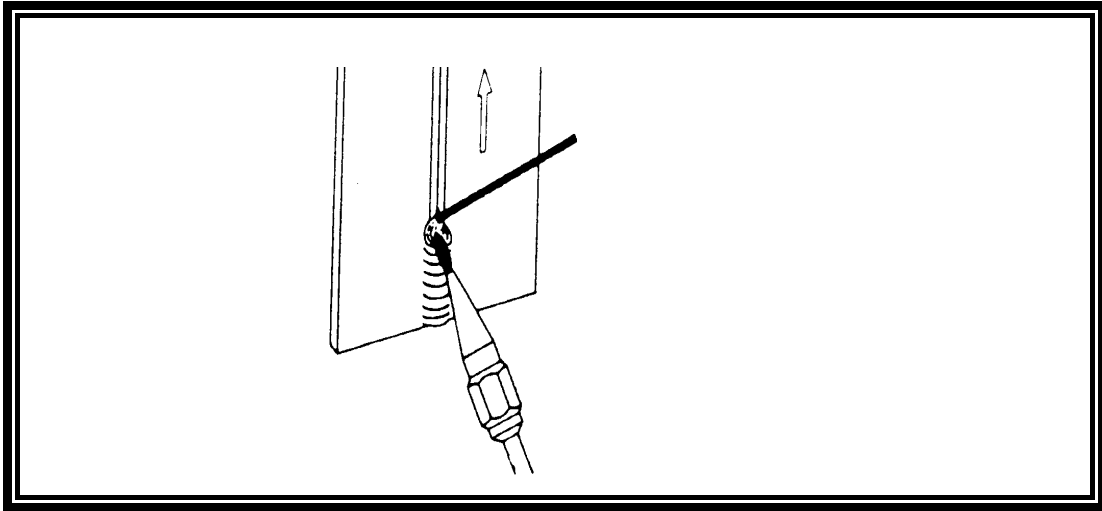
4.2.3 Name THREE advanced arc-welding methods, apart from the normal underhand welding, that can be used on the farm.

- Pipe welding ✓
- Overhead welding ✓
- Vertical up/down welding. ✓
- Welding of cast iron.
- Welding of aluminium.

(Any 3)

(3)

4.3 Vertical up welds are done where it is not possible for the work to be done in the normal underhand position, for example on the chassis of a trailer.



4.3.1 Where do you start when performing a vertical up weld?

- Start at the **bottom** of the joint and weld upwards. ✓

(1)

4.3.2 At what angle must the welding torch be held, with regard to the work piece, while doing a vertical up weld?

- 60° ✓

(1)

4.3.3 How can it be prevented that molten metal from the puddle runs down during vertical up welding?

- By regularly flicking the torch to the side (zigzag movement) ✓ and allowing the puddle to cool slightly.
- Decrease the force of the flame slightly. ✓

(2)

4.3.4 Why is it necessary to inspect the welding bead continuously while welding?

- To look for welding defects such as excess deposits or sagging of the welded metal. ✓

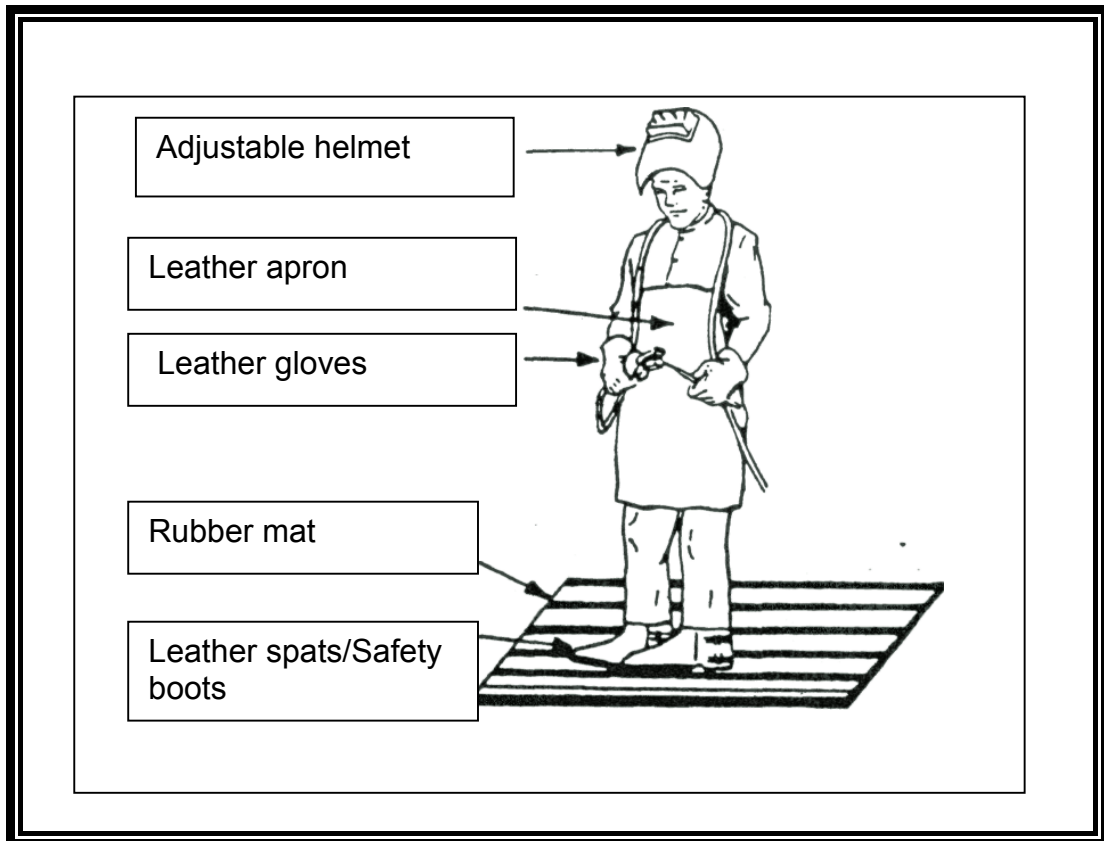
(1)

4.3.5 Indicate what should be checked after the welding is completed.

- Check the penetration on the underside of the work piece. ✓

(1)

4.4 The use of safety equipment in the welding workshop is very important. Study the sketch below and answer the questions that follow.



4.4.1 Name TWO functions of the adjustable welding helmet.

- Protects the eyes and skin against harmful ultraviolet rays. ✓
 - Protects the eyes and skin from warm flying sparks. ✓
- (2)

4.4.2 Name TWO serious effects that ultraviolet rays have on the human body.

- Burns the skin ✓
 - May cause cancer ✓
 - Can cause sterility.
- (Any 2) (2)

4.4.3 What purpose does the rubber mat serve?

Isolate the weld operator from the ground preventing an accidental electrical shock. ✓

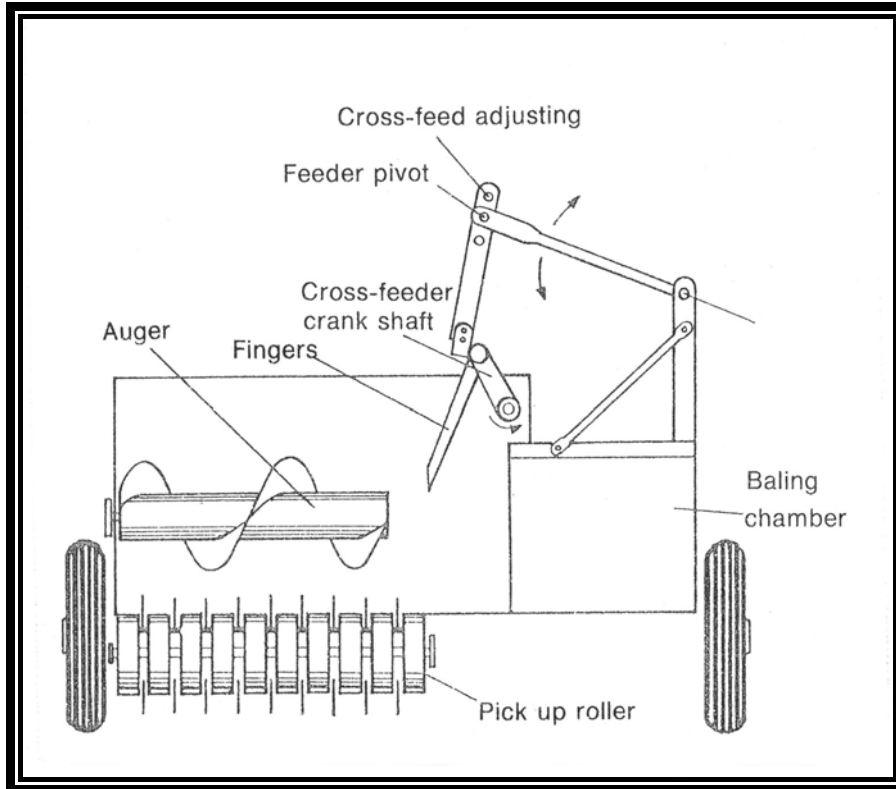
(1)

4.4.4 Name THREE precautionary measures that should be taken before welding commences.

- No inflammable materials nearby. ✓
 - Special welding screens should be in place. ✓
 - Good ventilation is essential. ✓
- (Any correct answer will be accepted.)**
- (3)
[35]

QUESTION 5: TOOLS, IMPLEMENTS AND EQUIPMENT

5.1 Study the illustration of a baling machine below and answer the questions that follow.



5.1.1 Describe the working of the ram type baler from the moment the hay is picked up to the moment that the hay enters the baling chamber.

- The pick-up wheel, which is spring-toothed, picks up the hay as the baler moves forward and puts it onto the combine plates where it comes into contact with the feeding auger. ✓
- The auger, that is floating, constantly rotates and feeds the hay to the packing arms. ✓
- The packing arms that move up and down to the hay, feed the hay to the baling chamber. ✓

(3)

5.1.2 Describe the function of the ratchet plate slip clutch of the baler.

- Prevents heavy objects from being taken into the baler. ✓
- Protects the pick-up if it is impeded by anything. ✓
- Protects the auger if it becomes overloaded. ✓

(3)

5.1.3 Explain what is meant by *timing of the bale mechanism* at the ram type baler.

It is the exact moment when the needles lift the binding rope ✓ so that the compressed hay can be bound. ✓

(2)

5.1.4 Name FIVE procedures to follow when the baler is stored for a long period at the end of the season.

- Remove all plant material from the baling chamber. ✓
- Clean the baler properly. ✓
- Drain and replace all oil. ✓
- Release the tension on all drive belts. ✓
- Remove all chains, clean and oil them, and replace them. ✓
- Dismantle all slip clutches, clean them and reassemble them but do not put the springs under tension.
- Reduce bale-chamber tension completely.
- Cover all unpainted areas with a thin layer of grease.
- Grease all grease nipples.
- Store the baler in a dry place under cover.

(Any correct answer will be accepted.)

(Any 5)

(5)

5.2 Name FOUR safety measures that should be followed when working with compressed air.

- Do not put the hose into your mouth, nose or ears. ✓
- Do not play or make jokes with compressed air/pneumatic equipment. ✓
- Do not use compressed air to blow dust from your clothes. ✓
- Hold the compressed-air nozzle firmly when you open the air valve. ✓
- Put large truck and tractor tires in a cage when inflating them for the first time.
- Use gloves/goggles when working with pneumatic equipment.

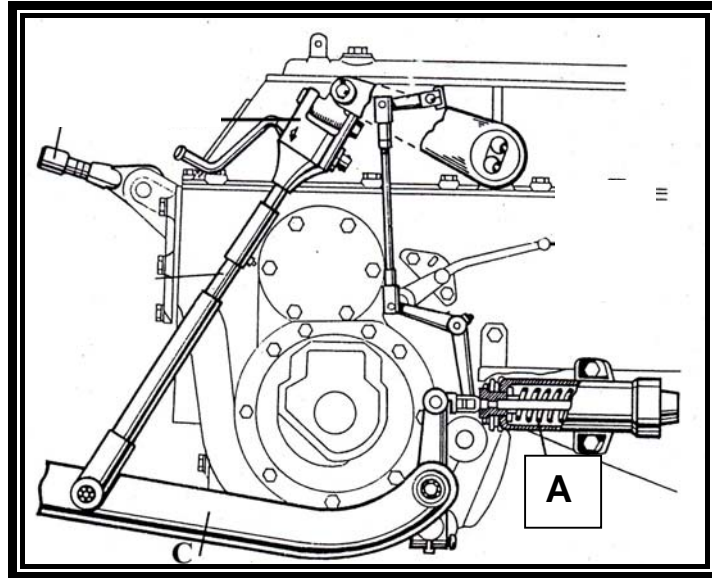
(Any correct answer will be accepted.)

(Any 4)

(4)

5.3 The illustration below shows the location of the sensitivity element in the three-point mechanism of a tractor.

Study the illustration carefully and answer the questions that follow.



5.3.1 Explain the function of the sensitivity element indicated by A.

Its function is to excite/activate the hydraulic system at a given moment ✓
e.g. when the plough penetrates too deeply ✓ or when it hits hard soil, so
the hydraulic system can make the necessary correction to overcome the
difficulty ✓

(3)

5.3.2 Name the THREE factors that have an influence on the depth control system of a tractor when busy ploughing.

- Ploughing depth. ✓
- Soil resistance. ✓
- Forward speed of the tractor. ✓

(3)

5.3.3 Name THREE ways in which the mass displacement of a tractor can be changed negatively.

- Increasing the tow bar pulling force. ✓
- Lifting the tow bar. ✓
- Decreasing the length of the wheel-base of the tractor. ✓

(3)

- 5.4 You want to drive a centrifugal pump for a centre pivot irrigation system with the aid of an electrical motor. The speed of the electrical motor is 2 400 r/min with a pulley radius of 200 mm. Calculate the diameter of the driven pulley if the speed of the centrifugal pump is 2 400 r/min, using the formula below. (Show ALL calculations.)

$$N_a \times D_a = N_g \times D_g.$$

N_a = Speed of driving pulley
 D_a = Diameter of driving pulley.
 N_g = Speed of driven pulley.
 D_g = Diameter of driven pulley.

$$N_a \times D_a = N_g \times D_g.$$

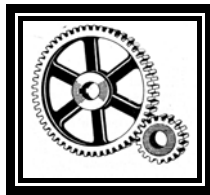
$$2\,400 \times 200 = 2\,400 \times D_g \checkmark$$

$$D_g = \frac{480\,000}{2\,400} \checkmark$$

$$D_g = 200 \text{ mm} \checkmark$$

(4)

- 5.5 The illustration below shows a gear that can be used in a windmill.



- 5.5.1 What type of metal is usually used for the manufacturing of gears? Motivate your answer.

- Cast iron. ✓
- Resistant against wear. ✓

(2)

- 5.5.2 Name the type of gear shown above.

Straight-cut gear ✓

(1)

- 5.5.3 Determine the speed ratio if the large gear has 51 teeth and the small gear has 17 teeth. (Show ALL calculations.)

$$\begin{aligned} \text{Ratio} &= \frac{\text{Large gear}}{\text{Small gear}} \\ &= \frac{51}{17} \checkmark \\ &= 3 \checkmark \end{aligned}$$

$$\text{Ratio} = 1:3 \checkmark$$

(3)

5.6 Name FOUR points that have to be inspected by the operator of a tractor before a job is undertaken.

- Fuel level✓
- Water level✓
- Oil level✓
- Tyre pressure✓
- Any liquid leaks. (Oil, water or fuel)
- Any repairs needed.

(Any answer that is correct.)

(Any 4)

(4)
[40]

QUESTION 6: WATER MANAGEMENT

6.1 Water is a national resource of South Africa that has to be protected because it is so scarce. It is predicted that South Africa will have a water crisis in 2020.

6.1.1 Briefly explain why it is necessary for farmers to do water scheduling in irrigation.

- To save water✓
 - To prevent over-irrigation✓
 - To prevent under-irrigation
- (Any 2) (2)

6.1.2 Before irrigation scheduling can take place, it is necessary to determine the evapotranspiration. Name any TWO pieces of equipment that can be used to determine the evaporation in a specific field.

- Tensio meter✓
 - Type A evaporation pan✓ (Alternative names also correct)
- (2)

6.2 A borehole should always have a casing. Name TWO types of material that can be used as a casing for a borehole.

- Metal ✓
 - Plastic✓
 - Cement
- (Any 2) (2)

6.3 Brick or concrete-lined canals can be used to convey water from a water source to irrigation lands. Which THREE factors will determine the rate of flow in these canals and what is usually used to extract water from the canal?

- Size of the canal✓
 - The slope of the canal✓
 - Siphons/Sluices are used to extract the water from the canals. ✓
- (3)

6.4 Water wells were dug many years ago to get access to underground water for animal and human consumption. This indigenous knowledge is still used today with great success.

6.4.1 Briefly describe ONE method of extracting water from a water well.

A bucket ✓with a rope can be used to extract the water✓, or a centrifugal pump with a foot valve, or a submersible pump can be used. (Any 2) (2)

6.4.2 What is the maximum depth of a well and why should it not be deeper?

- 4 to 5 metres ✓
 - It cannot be much deeper because the sides will calve in. ✓
- (2)

6.4.3 Give a reason why a well should always have a cover.

- To prevent animals from falling into the well. ✓
- To prevent people/children from falling into the well.
- To keep the water clean. (Any 1) (1)

6.5 The following drainage systems can be used to drain excess water from cultivated lands: a natural system, a herringbone system and a grid system.

For each of the following scenarios, choose one of the above-mentioned systems that would give the best results:

6.5.1 The system used where a piece of land has a clear depression down the middle

Herringbone ✓ (1)

6.5.2 The system used on level ground where the land mostly has a slight slope to one side

Grid system ✓ (1)

6.5.3 The system used if there are wet patches on the land

Natural system ✓ (1)

6.6 A farmer needs to know the amount of water that is delivered to his/her centre pivot irrigation system, to be able to irrigate his/her lands effectively. The method that he/she used to calculate the flow rate, was to use a water tank of known size that was filled with water. The time that it took to fill the tank was measured.

6.6.1 Calculate the flow rate of water in a pipe delivery system by using the data below: (Show ALL calculations.)

- It took 2 minutes to fill the tank.
- The content of the tank is 2 000 litres.

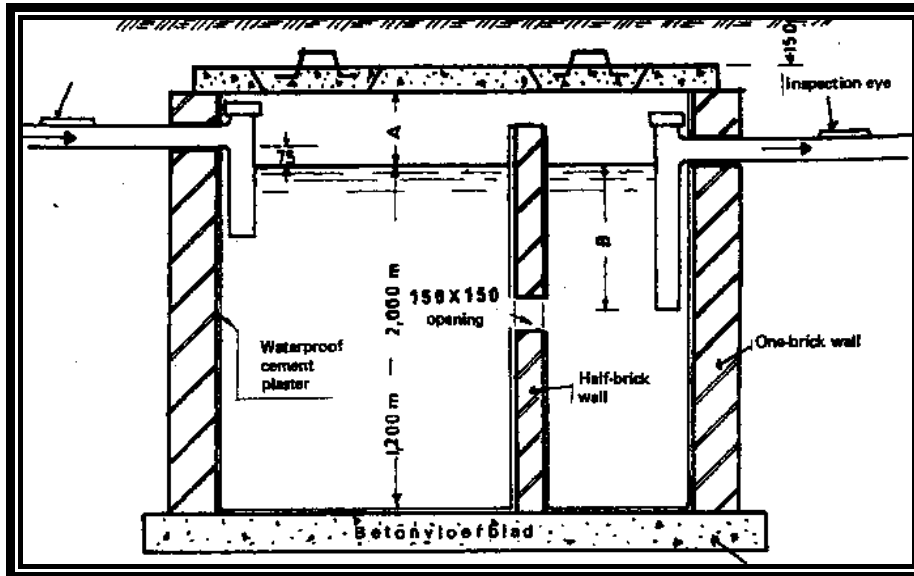
$$\begin{aligned}
 \text{Flow rate} &= \frac{\text{Content}}{\text{Time}} \checkmark \\
 &= \frac{2\,000}{2} \checkmark \\
 &= 1\,000 \text{ l/min} \checkmark \checkmark \quad (4)
 \end{aligned}$$

6.6.2 Give reasons why it is sometimes necessary for the farmer to determine the flow rate in a pipe delivery system.

- For correct calibrating of the sprayers. ✓
- Effective scheduling of irrigation. ✓
- To prevent the over-utilisation of the water source. (Any 2) (2)

- 6.7 The management of sewage is important on the farm, as it can be a health risk when these systems leak or overflow.

Study the diagram of a sewerage system below and answer the questions that follow.



- 6.7.1 Briefly discuss how the sewage in a septic tank is broken down.

- Sewage is broken down by anaerobic bacteria in the first tank. ✓
 - Very little solids remain when the sewerage flows to the second tank. ✓
 - Only liquid sewage remains and drains away through the outlet pipe. Seldom necessary to clean out the tank. ✓
- (3)

- 6.7.2 For a septic tank system to function properly, users should remember certain measures. Name TWO of these important measures.

- No disinfectants should be used. ✓
 - Use only toilet paper ✓
 - No cigarette butts, rags etc. should get into the tank. (Any 2)
- (2)

- 6.7.3 Name TWO precautionary measures that should be considered when choosing a location for building a septic tank.

- Do not build near boreholes, drinking water. ✓
 - A suitable distance away from the house and or traffic. ✓
- (2)
[30]

TOTAL SECTION B: 160

GRAND TOTAL: 200