This memorandum consists of 17 pages.
**SECTION A**

**QUESTION 1**

1.1

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<tr>
<td>1.1.5</td>
<td>A, B, C ✓ ✓</td>
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<tr>
<td>1.1.6</td>
<td>A ✓ ✓</td>
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(10x2) (20)

1.2

<table>
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<tr>
<th>1.2.1</th>
<th>Nickel ✓ ✓</th>
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<tr>
<td>1.2.2</td>
<td>Anaerobic bacteria ✓ ✓</td>
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<td>1.2.3</td>
<td>Levelling box ✓ ✓</td>
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<tr>
<td>1.2.4</td>
<td>Global Positioning System (GPS) ✓ ✓</td>
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<tr>
<td>1.2.5</td>
<td>Generator ✓ ✓</td>
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(5x2) (10)

1.3

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<td>1.3.3</td>
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(5x2) (10)

**TOTAL SECTION A:** 40
SECTION B

QUESTION 2: MATERIALS AND STRUCTURES

2.1 2.1.1 Material added to copper:
   a) Zinc ✓
   b) Tin ✓ (2)

2.1.2 TWO methods to permanently join copper products.
   • Soft soldering ✓
   • Brazing ✓
   • Silver soldering (Any 2) (2)

2.1.3 A substance that can dissolve tin.
   • Acids ✓
   • Base (Any 1) (1)

2.2 2.2.1 TWO most important aspects when choosing an adhesive.
   • Type of material to be joined. ✓
   • Conditions under which this joint will be used. ✓ (2)

2.2.2 Preparation of diesel tank for adhesive.
   Clean the surface area around the crack with a cloth and sand it lightly until there are no more signs of dirt, rust or diesel fuel before applying the adhesive. ✓ (Any 1) (1)

2.3 2.3.1 Delamination ability (Vesconite)
   Delamination cannot occur because liquid cannot penetrate the bearing layers that can cause it to peel or break off, ✓ creating weaknesses and uneven surfaces. ✓ (2)

2.3.2 Friction ability
   Vesconite has a low static and dynamic friction ✓ which remains in tough working environments; whether dry or wet, lightly or heavily loaded. ✓ (2)

2.3.3 Corroding ability
   Vesconite is not subjected to rust, ✓ acid- and electrolytic corrosion. ✓ (2)
2.4 2.4.1 TWO methods of preventing lightning damage to the electric fence energizer.

- Install lightning protectors/arrestor.
- Switch off all electricity during thunderstorms.

2.4.2 The procedure when testing the earthing system of an electrical fence.

- Firstly short out the live fence line to ground, either with a metal stake or by laying the fence line on the ground for about 100 meters and at least 30 meters away from the energizer.
- Switch the energizer ON.
- Measure the voltage between the ground and the earth spike with a meter. If this is above 200 volts the earth installation is inefficient.
- Check the connections or increase the number of earth spikes.
- If you get a shock from the earth spike before you short the fence line, then there is a poor earth and possibly a fault on the fence line as well.
- Check for vegetation on the line or faulty insulators.

2.4.3 Description of the earth return system of an electric fence and TWO probable causes of a voltage drop in the electric fence loop.

- As with all energizers there must be a return path through the ground and earth spike back to the energizer in order to complete the loop.
  - Always bear in mind that all electrical circuits must form a complete loop from the positive (live) to the negative (earth) and is just as much part of the circuit as the fence line and the animal is the missing link that completes the loop.
  - Vegetation will also complete the loop causing the output voltage of the energizer to drop. Therefore it is very important to keep any growth on the line to a minimum to ensure the animal receives the maximum shock from the energizer.
  - Short circuit (defective energiser, cracked isolator, wires touching the ground/uprights and)

2.5 2.5.1 The correct type of fence wire for an electric fence.

- Steel wire

2.5.2 The prescribed minimum thickness of the wire used for an electric fence.

- 1.5 - 3 mm
2.5.3 **TWO methods to protect the bare electric wires of an electric fence from corrosion.**

- Tinning
- Galvanizing
- Electroplating

(Any 2)

(2)

2.6 **FOUR safety requirements for insulating material used on the ceiling.**

- Must not be harmful or dangerous to people when inhaled or touched.
- Should not burn easily.
- Rodents and insects must not be able to eat it or build their nests in it.
- Should be light.

(4)

2.7 **Four components in logical sequence of use.**

A) Solar panel
B) Solar regulator
C) Battery
D) Inverter DC-AC

(4)

[35]
QUESTION 3: ENERGY

3.1 Description of the function of the wind turbine parts:

3.1.1 Propeller blades
The blades are shaped like aeroplane wings to catch the wind and turn a large rotor.✓

3.1.2 Main shaft
The main shaft is connected to the rotor and transfers the turning motion from the rotor to the generator.✓

3.1.3 Gearbox
To regulate the speed of the generator.✓
Decrease or increase speed

3.1.4 Generator
The generator converts mechanical energy into direct current electrical energy.✓

3.2 TWO types of energy that sun rays consist of and a method that can be used to harness each.

- Light energy ✓ - Photo voltaic cells ✓
- Heat energy ✓ - Solar hot water panel/solar cooking systems ✓

3.2.2 TWO factors that determine the efficiency of a solar electric cell.

- The cell is defective.✓
- When the electrons release heat, the panel also becomes warm, interfering with other aspects of the solar cells.✓
- Number of solar panels determines the efficiency of the system.
- Expensive energy technologies produce more efficient than cheaper ones.
- Location/orientation of the cell.
- Obviously nearer the equator, you will receive a slightly better output.
- Solar panels should always be facing the direction of the sun/north.
- No objects blocking the sun’s rays. (Trees, mountains, buildings) ✓ (Any 2)

3.2.3 Device used to change the direct current of the solar cell into useful alternating current.

Inverter ✓

3.3 TWO problems with geothermal energy.

- Pumping too much cold water into the geothermal energy source, as this will cool the source. ✓ (Rock deep inside the earth)
- Escaping gasses from deep within the earth’s centre. ✓
3.4 **THREE disadvantages of biofuel.**

- Low energy output of the fuels.
- The production cost of the fuel is currently very high.
- Certain food crops like maize are needed to make them which may lead to an imbalance in the production of certain crops.
- There is a huge quantity of water required to grow the crops which may affect the local water resources.
- The more land to produce crops for bio-fuels, the more habitats will be lost for animals and wild plants.
- If bio-fuel becomes lucrative for farmers, they may grow crops for bio-fuel production instead of food production.
- Less food production will increase prices and cause a rise in inflation.

(Any 3) (3)

3.5 **Description of ethanol and methanol.**

**Ethanol**

Is made by fermenting and then distilling starch and sugar crops: maize, sorghum, potatoes, wheat, sugar-cane, cornstalks, fruit or vegetable waste.

(2)

**Methanol**

Is made from woody plant fibres, coal or natural gas. It is used primarily as a supplement to gasoline. It can be harvested from the methane gas in landfills in addition to fermented waste products such as sewage and manure.

(2) [20]
QUESTION 4: SKILLS AND CONSTRUCTION PROCESSES

4.1 THREE safety hazards

- Not a proper welding helmet,
- with no proper safety glasses, that should be placed over his face.
- He should wear safety clothes, leather apron and a fire retardant overall.
- He is not supposed to hold welding rods in his other hand while welding.
- He must look where he weld.

(Any 3) (3)

4.2 4.2.1 The type of metal that the cutting nozzle is manufactured from.

Copper

(1)

4.2.2 FOUR hints to ensure good quality welding joints when oxy-acetylene welding is done in the OVERHEAD welding position.

- A reduced melting pool is required, big enough to create the wanted penetration.
- Reduce the size of the welding flame.
- Use a slightly thicker welding rod.
- Increase the force of the welding flame a little bit as this will help to keep the molten metal positioned.

(4)

4.3 Welding defect that is caused during MIG-welding.

4.3.1 Porosity

4.3.2 Lack of penetration

4.3.3 Spatter

4.3.4 Undercutting

(4)

4.4 MIG-welding process from the moment the arc is struck until the torch trigger is released.

- The heat produced by the short circuit/weld arc, along with a non-reactive (hence inert) gas helps to melts the metal and allows them to mix together.
- Once the heat is removed, the metal begins to cool and solidify, and forms a new piece of fused metal.
- No slag is formed because of the absence of a flux.

(Any 5) (5)

4.5 TWO gasses that can be used as a MIG shielding gas.

- Argon
- Helium
- Carbon dioxide
- Argon and CO₂ mixture

(Any 2) (2)
4.6 4.6.1 A material list for the gate.

1) Square tubing 19 mm x 7 600 mm✓
2) Round bar rods of Ø 12 mm x 16 000 mm✓
3) 2 x Hinges✓
4) 1 x Lock✓

4.6.2 Total cost of the materials for the safety gate.

Square tubing: 7 600 mm x R 25.00=R 190.00✓
Round bar: 16 000 mm x R 6.00=R 96.00✓
Lock: 1 x R 80.00✓
Hinges: 2 x R 10.00 = R 20.00✓
Total cost: R 386.00✓
(Calculations must correlate if the learners design differs from given measurements.)

4.6.3 Neat sketch of the safety gate with the parts

Marks will be allocated for the following:

<table>
<thead>
<tr>
<th>Part</th>
<th>Marks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hinges</td>
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<td>Measurements</td>
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<td>Neatness</td>
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Sketch of the safety gate.
4.7 **Gas to be used.**

4.7.1 Air/Oxygen ✓

4.7.2 Argon or Hydrogen ✓ (Any 1)

4.7.3 Nitrogen ✓ (1) [35]
QUESTION 5: TOOLS, IMPLEMENTS AND EQUIPMENT

5.1  5.1.1  **Mechanism indicated by the arrow.**

Slip clutch ✓

5.1.2  **TWO reasons for installing the mechanism indicated by the arrow in the driveline of the cutting machine.**

- Prevent machine from further damage when blade mechanisms are obstructed. ✓
- Protect the machine from braking teeth or blades when a solid object is struck. ✓
- Protect the machine when breakages occur.
- Protect the machine when overloading of cutting mechanisms occurs. (Any 2)

5.1.3  **TWO procedures that must be followed when the cutting machine is stored for a long period.**

- Remove all grass from the machine. ✓
- Clean the cutting machine 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.
- Cover all unpainted areas with a thin layer of grease.
- Grease all grease nipples.
- Store cutting machine in a dry place and under cover. (Any 2)

5.2  5.2.1  **Bale forming mechanism of each baler.**

Baler A Vermeer has belts/chains. Baling chamber enlarges with the forming of the bale. ✓

Baler B Welger has rollers. Rollers roll the hay inside the baling chamber. The baling chamber stays the same size. (2)
5.2.2 **TWO safety precautions when baling is done against a slope or hillside.**

- Bales on a slope have the potential to roll down the hill, break through fences and cross highways. √
- Always orient the bale correctly before ejecting the bale from the bale chamber. √
- Sometimes this just means backing the baler at the right angle to eject the bale perpendicular to the slope.
- The objective is to make certain that the bale will come to rest securely on the hillside.
- Steep slopes may require that the bale be hauled to a flat location before ejection.

(Any 2) (2)

5.3 **The role of advanced technological devices, like computers and satellite.**

- Enable the tractor to drive by itself in a straight line with the aid of satellite navigation. √
- Computers help you to identify problems in the mechanics of the tractor that can prevent damage to tractor systems. √
- Computers analyse data from the mechanics and make corrections.
- GPS are used to determine exact coordinates.
- Computers analyse data from the environment.
- Computers analyse data from the drawn implements. (VRT Spreaders)
- Easier to make precise contours.

(Any 2) (2)

5.4 5.4.1 **Sources for reliable information on tractor oil.**

- Consult the workshop/operation manual. √
- Internet.
- Tractor sale agent/cooperation or service station.

(Any 1) (1)

5.4.2 **THREE advantages of the use of automatic transmission oil.**

- Not compressible. √
- Good lubrication qualities. √
- Remains liquid over a large temperature range. √
- Not volatile.
- Relatively cheap.
- Easily conductible in pipes.
- Flow through filters, pipes, oil pumps and cylinders with ease.
- Contains detergents that keep parts clean.

(Any 3) (3)
5.5 5.5.1 Parts A and B.

A  Top link ✓
B  Levelling box ✓ (2)

5.5.2 The working of part C.

- The driver of the tractor manoeuvres the control lever ✓
- that activates the hydraulic system that lifts the two arms and the attached implement ✓ (2)

5.6 5.6.1 TWO ways in which a tractor’s mass displacement can be positively counteracted, preventing the tractor from falling backwards.

- Decreasing the tow bar pulling force ✓
- Lowering the tow bar connection point on the tractor ✓
- Increase the wheel base of the tractor.
- Place weights on the nose of the tractor or the sides of the front wheels.

(Any 2) (2)

5.6.2 THREE factors that have an influence on the depth control system of a tractor when ploughing is done.

- Ploughing depth ✓
- Soil resistance ✓
- Forward speed of the tractor ✓ (3)

5.7 THREE requirements for the screens used to safeguard all moving parts of implements.

- Must appear neat ✓
- Safeguard the equipment / operator ✓
- Removed and installed easily ✓
- Must not become loose.
- Weight saving.
- Keep out all undesired matter.
- Strong enough.

(Any 3)

5.8 5.8.1 TWO main functions of a rear tractor differential.

- Changing direction of rotation ✓
- Speed reduction ✓
- Divide rotation equally between the rear wheels.

(Any 2) (2)

5.8.2 Explain the following statement: “A locked differential can provide a significant traction advantage over an open differential.”

- A locked differential forces both left and right wheels ✓
- on the same axle to rotate at the same speed under nearly all circumstances, without regard to traction differences experienced at both the wheels ✓ (2)
5.9 **A solution for jerky rotation of universal joint**

- Use two universal joints joined by an intermediate shaft.
- The second universal joint must be phased in relation to the first universal joint to cancel the changing angular velocity. (2)

5.10 **Farm workshop equipment A, B and C.**

- A - Air wrench or impact wrench.
- B - Bottle jack or hydraulic jack.
- C - Hydraulic press. (3)

5.11 **THREE advantages of the standardization of farm implements and tractor spares.**

- Any implement can be used on any make and model tractor.
- The same engine and spares can be used on a variety of tractors.
- Spares can be purchased from any agent instead of a specific one.
- Spares can be offered to the farmer relatively cheaply, because of mass production.
- A reduced quantity of spares needs to be kept in stock for maintenance and service purposes.
- When a farmer decides to purchase a new tractor, he will not have to take a special course on how to maintain it. (Any 3)

5.12 **Fault with a diesel tractor if black smoke is detected at the exhaust outlet.**

- Diesel mixture too rich.
- Faulty diesel pump (1)
QUESTION 6: WATER MANAGEMENT

6.1 The name of the irrigation method and provide ONE advantage of that type of irrigation system.

|   | "Hand Move" portable sprinkler system.✓ | • Not expensive.✓  
|   |                                       | • Light easy movable.  
|   |                                       | • Small area irrigation.  

(Any 1) (2)

|   | Pop up Sprinkler.✓ | • No pipes on the surface.✓  
|   |                   | • Even distribution of water.  
|   |                   | • Sprinkler heads are underground.  

(Any 1) (2)

|   | Centre pivot irrigation.✓ | • Minimum labourers needed.✓  
|   |                           | • Large area can be irrigated.  
|   |                           | • Fertilizer/pesticide application possible.  

(Any 1) (2)

6.2 The basic steps in selecting a suitable pump.

- Decide on the type of pump that best fits your needs, rotary, centrifugal, submersible, turbine, jet pump, etc.✓
- Estimate the flow rate (LPM) and pressure requirements.✓
- Research the available pump models and select a preliminary pump model that meets the requirements you established above.✓
- Create a first draft irrigation design. The irrigation should be designed for the flow and pressure the pump will produce.✓
- Once you have a first draft of your irrigation you may be able to fine tune your pump selection based on that design.✓
- Make your final pump selection.✓

(6)

6.3 TWO reasons why a farmer need to determine the water flow rate of a pipe delivery system.

- For correct calibration of the sprayers.✓
- Effective scheduling of irrigation.✓
- To prevent the over utilization of the water source.  

(Any 2)
6.4 **TWO preventative measures a farmer must keep in mind to prevent theft when installing electrical irrigation cables.**

- Install the electrical cable inside the water pipe.✓
- Install cables deeper underground than normal.✓
- Bury cables in concrete.
- CC TV systems/Cameras.
- Remote controlled alarms.
- Security guards.

(Any 2) (2)

6.5 **Computer software effectively regulates an irrigation system to ensure a better harvest.**

- It controls the amount of water supply.✓
- It controls the time, duration and tempo of water supply.✓
- It receives information from different monitors for instance rainfall/temperature/soil moist/wind speed, analyse it, and make alterations to the water supply.
- By managing liquid fertilizer supply.

(Any 2) (2)

6.6 **TWO devices to determine water evaporation in a field of maize.**

- Tensiometer✓
- Evaporation pan✓
- Neutron probe

(Any 2) (2)

6.7 6.7.1 **Unblocking irrigation sprayers without dismantling the whole system.**

- The tap at the end of the irrigation system is opened and all impurities in the pipe are flushed out.✓
- Unscrew the nozzle to remove blockages that is stuck.
- Making use of usable chemicals.

(Any 1) (1)

6.7.2 **Describe the internal construction of the sprinkler head of an irrigation sprayer and explain the reason for the design.**

The top of the sprinkler head is a circular shape with a series of fins or thin blades arranged in a circular pattern.✓

- When the sprinkler is activated, the water passes through the sprinkler head that changes the water flow from a steady stream to a circular arc shape.✓
- The water dispersion is designed to maximize the surface area that is reached by the water.✓

(3)
6.8 The drainage method that can be used in each of the following situations.

6.8.1 Septic tank / municipal system✓ (1)

6.8.2 French drain✓ (1)

6.8.3 • Drainage ditch✓
• Channel drain
• Storm water drain

(Any 1) (1)

6.9 Functioning of a septic tank.

• Solids are broken down by anaerobic bacteria in the first tank.✓
• Very little solids remain when the watery sewerage flows to the second tank.✓
• Only liquid sewage remains and drains away through the outlet pipe or stone trench.✓

(3)

[30]

TOTAL SECTION B: 160
GRAND TOTAL: 200