



basic education

Department:
Basic Education
REPUBLIC OF SOUTH AFRICA

**NATIONAL
SENIOR CERTIFICATE**

GRADE 12

AGRICULTURAL TECHNOLOGY

FEBRUARY/MARCH 2016

MEMORANDUM

MARKS: 200

This memorandum consists of 15 pages.

SECTION A**QUESTION 1**

| | | | |
|-------------------------|--------|------------------------------------|-------------|
| 1.1 | 1.1.1 | A✓✓ | (2) |
| | 1.1.2 | C✓✓ | (2) |
| | 1.1.3 | D✓✓ | (2) |
| | 1.1.4 | C✓✓ | (2) |
| | 1.1.5 | B✓✓ | (2) |
| | 1.1.6 | A✓✓ | (2) |
| | 1.1.7 | B✓✓ | (2) |
| | 1.1.8 | C✓✓ | (2) |
| | 1.1.9 | B✓✓ | (2) |
| | 1.1.10 | C✓✓ | (2) |
| | | | (10x2) (20) |
| 1.2 | 1.2.1 | Gravity/Too high welding current✓✓ | (2) |
| | 1.2.2 | Oxygen ✓✓ | (2) |
| | 1.2.3 | Alternator/generator✓✓ | (2) |
| | 1.2.4 | Bacteria✓✓ | (2) |
| | 1.2.5 | Timing✓✓ | (2) |
| | | | (5x2) (10) |
| 1.3 | 1.3.1 | F✓✓ | (2) |
| | 1.3.2 | A✓✓ | (2) |
| | 1.3.3 | C✓✓ | (2) |
| | 1.3.4 | B✓✓ | (2) |
| | 1.3.5 | E✓✓ | (2) |
| | | | (5x2) (10) |
| TOTAL SECTION A: | | | 40 |

SECTION B**QUESTION 2: MATERIALS AND STRUCTURES**2.1 2.1.1 **THREE alloy elements in stainless steel**

- Chromium✓
 - Manganese✓
 - Nickel✓
- (3)

2.1.2 **Alloy element**

Chromium✓ (1)

2.1.3 **TWO alloy elements used to produce brass**

- Copper✓
 - Zinc✓
- (2)

2.2 2.2 **Type of material that can be used to manufacture the following products:**

| PRODUCT | MATERIAL | | |
|---------------------------------------|----------|---|-----|
| Hot-water pipes for a milking parlour | 2.2.1 | Copper✓ Galvanised steel Stainless steel PVC plastic (Any 1) | (1) |
| Plumbing fittings | 2.2.2 | Brass✓ Galvanised steel PVC plastic (Any 1) | (1) |
| Cans for processed food | 2.2.3 | Tin✓ | (1) |
| Fishing rods | 2.2.4 | Glass fibre✓ Bamboo Composite materials (Any1) | (1) |
| Non-metal bushes | 2.2.5 | Vesconite✓ | (1) |
| Coating for non-stick pans | 2.2.6 | Teflon✓ | (1) |

2.3 2.3.1 Requirements that are prescribed for warning signs

- Firmly clamp to the fence wires at intervals of approximately 10 meters to 50 meters as recommended, but not exceeding 90 meters.✓
- The size of the warning signs shall be at least 100 mm x 200 mm.✓
- The background colour of both sides shall be yellow.✓
- The inscription shall be black and shall read 'TAKE CARE - ELECTRIC FENCE'.✓
- The inscription shall be clearly, inscribed on both sides and have a height of at least 25 mm.

(Any 4) (4)

2.3.2 TWO aspects that must be checked daily

- Regularly check the fence line for vegetation growing over the fence line or fallen branches.✓
- Check for damaged or broken wires✓
- Check for damaged isolators or loose connections.

(Any 2) (2)

2.3.3 FOUR components of the electric system used to control animals

- Insulators✓
- Grounding spikes✓
- Energizer✓
- Battery✓
- Battery charger (solar/wind 220v)
- Fence wire (Shock wire) covered with thin insulation material
- Uprights
- Wire tensioners – Spring and wire strainer tensioners
- Gate handles

(Any 4) (4)

2.4 2.4.1 FIVE characteristics of fibreglass

- Lightness✓
- Water tight✓
- Non-conductive of electricity✓
- Can be formed into any shape✓
- Easy to colour✓
- Colour fast
- Can be sawn, drilled, and filled
- Toughness
- Brittle when struck
- Easy repaired when break

(Any 5) (5)

2.4.2 ONE reason why the catalyst and accelerator of fibreglass should be stored separately

They can cause an explosive mixture✓

(1)

2.5 TWO aspects that must be considered when selecting an adhesive

- Type of material to be joined.✓
- Conditions under which this joint will be used.✓ (2)

2.6 Example of a hazardous chemical liquid in the battery of a tractor

Battery acid/Sulphuric acid✓ (1)

2.7 THREE components needed for a fire to burn.

- Material that can burn✓
- Oxygen✓
- Heat✓ (3)

2.8 Process used to relieve the internal stress in the brass fitting caused by overheating, without losing the properties of the brass fitting

- Annealing✓
 - Stress relieving
- (Any 1) (1)
[35]

QUESTION 3: ENERGY**3.1 3.1.1 TWO types of energy that apply to wind energy systems**

- Mechanical energy/rotational energy✓
 - Electrical energy✓
- (2)

3.1.2 How can rotor of wind turbine be protected from rotating too fast?

Changing the pitch of the blades will slow the fan down.✓ (1)

3.1.3 Explanation of *integration* – alternative energy sources

When two or more alternative energy systems are combined, it is called integration.✓ (1)

3.1.4 Process of producing electricity from solar energy

- Solar panels are made of a semi-conductive material; the most common material is silicon.✓
 - Semi-conductive material contains electrons which are stable ✓
 - When photons (contained within the sun's rays) hit the solar cells; the electrons absorb this solar energy, transforming them into conduction electrons.✓
 - When the energy of these photons is great enough, the electrons are able to become free, and carry an electric charge through a circuit to the destination.✓
- (4)

3.1.5 THREE reasons leading to a solar panel panel not functioning to its full potential

- 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 natural energy technologies produce more efficient than cheaper ones.✓
- Solar cells should always be facing the direction of the sun, and have no objects blocking the sun's rays.

(Any 3) (3)

3.1.6 Component connected to a solar panel system to allow generated energy to be stored and used when sunlight is not available

Battery✓ (1)

3.1.7 TWO advantages of solar energy

- Solar power technology is limitless.✓
- Solar power technology is completely clean, with no residues, waste or by-products of any kind.✓
- Environmentally friendly energy source.
- Solar is also extremely portable because of improved technology.
- Solar power can create more energy than is necessary for a single family needs.
- Extra power from solar panels can be fed back into the power grid, providing free energy throughout an entire community.
- Not dependant of power from the national network.

(Any 2) (2)

3.2 3.2.1 Explanation: what will happen to a geothermal energy source when you pump too much cold water into the source

The rocks will cool too much, resulting that the geothermal heat source cools down too much.✓

(1)

3.2.2 THREE factors when looking for a suitable location for extraction of geothermal energy

- The rock must be soft enough to drill through.✓
- The deep down rocks must contain enough heat.✓
- The heat source must be sustainable for a significant amount of time.✓
- The environment must be ready for a power plant.

(Any 3) (3)

3.3 TWO plants suitable for the process of transesterification

- Soya✓
- Canola✓
- Sunflower seed
- Algae

(Any 2) (2)

[20]

QUESTION 4: SKILLS AND CONSTRUCTION PROCESSES**4.1 Applicable accident-preventing safety regulation for each**

- 4.1.1
- Do not step over revolving Power Take Off (PTO) shafts.✓
 - The PTO shaft must be covered with a safety screen.
- (Any 1) (1)
- 4.1.2 Do not overload electrical wall sockets.✓ (1)
- 4.1.3
- Do not touch electrical fences.✓
 - Do not try to pull someone away from an electrical fence with your bare hands.
- (Any 1) (1)
- 4.1.4 Prevents that tractors tip over by not driving against steep slopes.✓ (1)

4.2 Plasma cutting process

- The process involves using a tungsten electrode✓ and high pressure plasma gas (which is gas in an ionized state) to generate and carry an electrical arc✓ between a copper nozzle and work piece.✓
 - It is the electrical arc that performs the cutting,✓ but the pressurised plasma helps to keep the cut clear by removing the metal impurities.✓
- (5)

4.3 4.3.1 Parts 1, 2, 3, 4 and 5

1. Gun/Pistol✓ (1)
2. Sprout✓ (1)
3. Filling wire guide✓ (1)
4. Copper contact tip✓ (1)
5. Filler wire✓ (1)

4.3.2 THREE different metals that can successfully be welded with this type of welding machine

- High carbon alloy steel (stainless alloys)✓
 - Aluminium✓
 - Mild steel✓
- (3)

4.3.3 THREE advantages of the MIG welding machine

- Higher welding speeds.✓
- Greater deposition rates.✓
- Less post weld cleaning.(e.g. no slag to chip off)✓
- Better weld pool visibility.
- No stub end losses or wasted man hours caused by changing electrodes.
- Low skill factor required to operate MIG welding torch.
- Positional welding offers no problems when compared to other.
- Use dip or pulsed mode of transfer.
- The process is easily automated.
- No fluxes required in most cases.
- Ultra low hydrogen process.

(Any 3) (3)

4.4 Oxy-acetylene cutting process when a 20 mm thick mild steel plate is cut

- Light the flame and adjust it to a carburising flame.✓
- First bring the material up to a red hot colour.✓
- Oxygen is then fed with the lever on the cutting attachment.✓
- The steel actually ignites giving more heat to keep the process going.✓
- The steel turns into a liquid.✓
- The iron liquid is cleared from the cut by pressure from the oxygen stream.✓

(6)

4.5 4.5.1 Arc welding procedure when welding a butt weld

- Make sure that the pieces to be welded are of the correct measurements and ready for welding.✓
- Ensure that the work pieces are prepared properly.(Root gaps)✓
- Grind a v-groove on both sides.✓
- Tack the prepared pieces together.✓
- Make sure of the correct setting of ampere.✓
- Keep electrode with correct angle to the work piece.✓
- Strike an arc and run the arc along the joint to form the bead.✓

(7)

4.5.2 TWO types of shrinking that can occur in a butt-welding joint

- Longitudinal shrinking✓
- Angular shrinking✓
- Angular shrinking longitudinally
- Lateral shrinking

(Any 2) (2)

[35]

QUESTION 5: TOOLS, IMPLEMENTS AND EQUIPMENT**5.1 Safety mechanism shown by arrow A**

Shear bolt/Shear pin✓ (1)

5.2 5.2.1 Component that is used on the tractors three point mechanism that prevents the implement from swinging sideways when in use

Stabilising chains✓ (1)

5.2.2 Mechanism to be adjusted to set the horizontal levelness of the implement

The top link✓ (1)

5.2.3 Component on the tractor where the cross-angle of the implement can be adjusted in relation to the tractor

Levelling box✓ (1)

5.2.4 THREE maintenance procedures to follow when the hay rake is stored for a long period

- Lubricate/grease all moving components.✓
- Check all bearings.✓
- Replace all broken rake teeth.✓
- Check bolt tension.
- Inspect chassis and frame for damage.
- Paint all unpainted areas.
- Store the rake in a dry place under cover

(Any 3) (3)

5.3 TWO types of baling machines and identify the type of bales

- Ram or piston type✓ - Makes rectangular bales✓
 - Roller type✓ - Makes cylindrical bales✓
- (4)

5.4 5.4.1 Components labelled A, B and C

A. Removable warning lights/Brake lights✓ (1)

B. Safety emblem/triangle✓ (1)

C. Reflectors/indicators/reverse lights✓ (1)

5.4.2 THREE circumstances under which it is advisable not to drive on a public road with an abnormally wide load on the trailer

- After daylight hours (at night)✓
- In poor visibility.✓
- In bad weather (rainy or windy)✓
- Hours with high vehicle traffic (peak hours)

(Any 3) (3)

5.5 THREE mechanical problems during the use of a combine harvester

- Loss of maize kernels due to blowers that are set incorrectly.✓
- Thresher set too fast and breaks the kernels.✓
- Engine overheats due to cooling system that breaks/malfunctions✓

(Any 3) (3)

5.6 THREE major causes of metal fatigue on a hammer mill

- Vibration/Excessive speeds/Unbalanced hammers or rotors✓
- Wear✓
- Rust✓

(3)

5.7 Component on a tractor that activates the hydraulic control valve of a power lift system

The operator's control lever.✓

(1)

**5.8 5.8.1 Calculation of the diameter of the drive pulley – ALL calculations
Use the formula: $N_a \times D_a = N_g \times D_g$**

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

$$25 \times D_a = 100 \times 100$$

$$25 \times D_a = 10\,000✓$$

$$D_a = 10\,000/25✓$$

$$D_a = 400 \text{ mm}✓$$

(3)

5.8.2 Turning direction of the driven pulley if the V-belt is crossed

Anti-clockwise✓

(1)

5.8.3 THREE disadvantages of using V-belts in drive systems

- V-belts are more difficult to install than flat belts.✓
- V-belts are not normally manufactured in very long lengths.✓
- V-belts cannot be joined.✓
- When the pulley, over which a V-belt runs, is situated between two bearings, one of them needs to be removed before the V-belt can be put over the pulley.
- V-belts are much more dangerous than flat belts.

(Any 3) (3)

5.9 THREE factors before buying a new tractor

- Driving power. (Kw)✓
- Local availability of parts and service.✓
- Rigidity of construction.✓
- Simplicity of control mechanisms.
- Driver comfort.
- Versatility.
- Proven reliability and durability.

(Any 3) (3)

5.10 TWO advantages of mechanisation in agriculture

- Increased profits/Increased productivity.✓
- Cheaper production.✓
- More effective production.
- Reduced work load on labourers.

(Any 2) (2)

5.11 Each tool: pneumatic or hydraulic

- A. Pneumatic✓
- B. Hydraulic✓
- C. Pneumatic✓
- D. Hydraulic✓

(4)
[40]

QUESTION 6: WATER MANAGEMENT

- 6.1 6.1.1 **ONE impurity in the water that can make this irrigation method inefficient**
- High lime content water.✓
 - Dirt that blocks the holes.
 - Coarse fertiliser.
- (Any 1) (1)
- 6.1.2 **Possible solution to overcome the problem**
- Use a sand filter or a decalcifier to remove impurities from the water.✓ (1)
- 6.2 6.2.1 **TWO methods to be used to produce high water pressure in the irrigation system**
- More effective pump system/booster pump✓
 - Gravity✓
 - Thicker delivery pipes
 - Smaller spray nozzles
- (Any 2) (2)
- 6.2.2 **Importance of high water pressure for the effective working of a centre-pivot irrigation system**
- It needs enough pressure to obtain an even coverage of water over the system.✓
 - Sprayers must have enough pressure to attain the effective range of spraying.✓
 - Sprayers must form a mist for even distribution.
 - The wheel drive mechanisms on certain models needs water pressure to move.
- (Any 2) (2)
- 6.2.3 **ONE example of the use of solar energy in an irrigation system**
- Solar driven pumps.✓
 - Electric operated water regulating system.
- (Any 1) (1)

- 6.3 6.3.1 **Amount of water that will be delivered in 5 minutes by one sprayer**
- 100 litres x 5 min ÷ 2✓
= 250 litres✓ (2)
- 6.3.2 **Amount of water that 1 m² of soil will receive in 5 minutes if each sprayer covers 5 m² of land**
- 500 litres ÷ 10 m²✓ = 50 litres✓ (2)
- 6.3.3 **TWO reasons for a farmer to determine the flow rate of a pipe delivery system**
- For the correct sprayer calibration.✓
 - For effective irrigation scheduling.✓
 - To prevent over utilisation of the water source.
- (Any 2) (2)
- 6.4 **TWO methods to be used to measure the water content of soil**
- Feel method✓
 - Tensiometer✓
 - Neutron probe
 - Gravimetric
- (Any 2) (2)
- 6.5 6.5.1 **TWO reasons for the outlet opening in the septic tank being lower than the inlet opening**
- If the outlet is the same height as the inlet the grease and oil in the tank will block the home drainage.✓
 - So that only liquid waste or solids that have been liquefied by the BACTERIAL ACTION going on at the bottom of the septic tank are discharged out into the drainage field while the grease, oil, scum float on top.✓ (2)
- 6.5.2 **Reason for not allowing water from the kitchen sink to enter the septic tank**
- The grease, oil and scum are not easily decomposable.✓
 - The detergents and soap kill the bacteria.✓ (2)
- 6.5.3 **TWO drainage commonly used for disposal of kitchen waste water**
- French drain✓
 - Channel drain✓ (2)
- 6.5.4 **What happens with solid waste at the bottom of the septic tank**
- The solids that have settled at the bottom are broken down by bacteria ✓ and form sludge.✓ (2)

6.5.5 TWO aspects when deciding where to build a septic tank

- Do not build near boreholes, drinking water installations.✓
- A suitable distance away from the house.✓
- Not near traffic.
- Not near where people eat, wash or work regularly.

(Any 2) (2)

6.6 Whole-house water purification system

- This system uses three paper elements to filter the water.✓
- They are connected to the main water inlet pipe.✓
- Reverse osmosis are incorporated into the system.✓
- This type of filter usually contains also a water softener unit.

(Any 3) (3)

6.7 TWO materials to be used to manufacture the sprinkler head

- Brass✓
- Plastic✓
- Galvanised iron or steel

(Any 2) (2)
[30]**TOTAL SECTION B: 160**
GRAND TOTAL: 200