



basic education

Department:
Basic Education
REPUBLIC OF SOUTH AFRICA

NATIONAL SENIOR CERTIFICATE

GRADE 12

AGRICULTURAL TECHNOLOGY

NOVEMBER 2016

MEMORANDUM

MARKS: 200

This memorandum consists of 15 pages.

SECTION A**QUESTION 1**

1.1	1.1.1	C✓✓	(2)
	1.1.2	A✓✓	(2)
	1.1.3	D✓✓	(2)
	1.1.4	C✓✓	(2)
	1.1.5	B/C✓✓	(2)
	1.1.6	B✓✓	(2)
	1.1.7	B✓✓	(2)
	1.1.8	D✓✓	(2)
	1.1.9	D✓✓	(2)
	1.1.10	A✓✓	(2)
			(10 x 2) (20)
1.2	1.2.1	Biological/Bacteria✓✓	(2)
	1.2.2	area✓✓	(2)
	1.2.3	gear/speed/gear ratio ✓✓	(2)
	1.2.4	evaporation pan/tensiometer/moist meter✓✓	(2)
	1.2.5	Geothermal/geo✓✓	(2)
			(5 x 2) (10)
1.3	1.3.1	G or A✓✓	(2)
	1.3.2	A or G✓✓	(2)
	1.3.3	B✓✓	(2)
	1.3.4	C✓✓	(2)
	1.3.5	E✓✓	(2)
			(5 x 2) (10)
TOTAL SECTION A:			40

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

- 2.1 **Explanation of why a copper hammer should be used**
- When copper strikes against a hard surface, it will not generate sparks because it is soft.✓
 - Steel hammers can cause a spark because the steel is harder.✓ (2)
- 2.2 **THREE reasons for adding copper to metals to form an alloy**
- Increases resistance to corrosion✓
 - Increases conductivity✓
 - Increase conducting of electricity✓ and heat✓
 - Hygienic
 - Easy to alloy (Any 3) (3)
- 2.3 **Process used to soften tempered brass products for further working processes**
Annealing (only the word, not the process)✓ (1)
- 2.4 2.4.1 **Explanation of why metal cans must be coated with a thin tin layer**
- To prevent corrosion of steel✓
 - To prevent contamination of food (Any 1) (1)
- 2.4.2 **THREE important properties of tin**
- Silvery white✓
 - Soft✓
 - Malleable metal✓
 - Can be highly polished
 - Resists oxygen and water but dissolves in acids and bases(prevent rust)
 - When heated in air, tin forms tin oxide
 - Tin has a crystalline structure and when a tin bar is bent, a 'tin cry' is heard. (Any 3) (3)
- 2.5 **THREE elements added to steel when manufacturing stainless steel**
- Chromium✓
 - Manganese✓
 - Nickel✓ (3)
- 2.6 **THREE aspects to consider when one needs to improve the cohesion properties of an adhesive**
- Apply a thin base coat if the surface is very porous.✓
 - Apply only a thin layer of adhesive.✓
 - Apply adhesive to both surfaces.✓ (3)
- 2.7 **Substance added to harden resin when doing fibreglass repairs**
Catalyst/hardener/accelerator✓ (1)

- 2.8 2.8.1 **Reason for suitability of Vesconite for marine application**
- Water is an excellent lubricant for Vesconite.✓
 - Making it suitable for both dry and immersed applications.
 - Does not rust.
 - Saltwater does not corrode the material.
- (Any 1) (1)
- 2.8.2 **THREE reasons why machining Vesconite holds no health risk to the person working with it**
- Does not contain any asbestos/hazardous fibres✓
 - Does not contain any lead✓
 - Does not give off any poisonous gases/smoke when machined✓
 - Does not rust
- (Any 3) (3)
- 2.8.3 **THREE reasons for choosing Vesconite over white metal when manufacturing bushes**
- Higher design load limit than white metal✓
 - Higher metal fatigue strength✓
 - Two to three times better wear resistance capability✓
 - Machined without the use of a coolant
 - Does not shrink or expand
 - Does not wear
 - Will not damage the shaft
- (Any 3) (3)
- 2.9 2.9.1 **TWO preventative measures that can be followed to prevent lightning from damaging the energiser of an electric fence**
- Install lightning protectors.✓
 - Switch off all electricity during thunderstorms.✓
 - Disconnect the battery.
- (Any 2 reasonable answers) (2)
- 2.9.2 **Description of TWO methods that can be used to protect a permanent electric fence energiser system from theft**
- Install it high on a long pole out of reach of people.✓
 - Locked into a metal or concrete structure.✓
- (2)
- 2.9.3 **THREE design requirements prescribed for the warning signs that are used on an electric fence**
- The signs must be at least 100 mm x 200 mm.✓
 - The background colour of both sides must be yellow.✓
 - The inscription must be black and must read 'TAKE CARE – ELECTRIC FENCE'.✓
 - The inscription must be clear, inscribed on both sides and have a height of at least 25 mm.
 - At least two languages must be used on a sign.
- (Any 3) (3)

2.9.4 **TWO solutions to overcome the problem of reduced earthing efficiency in electric fences due to very dry soil**

- Increase the number of earth spikes.✓
- Run an earth return wire parallel to the fence line and connect it to earth spikes at regular intervals.✓

(2)

2.9.5 **TWO rules or regulations that an electric fence, which is erected next to a public road, must adhere to**

- Mount the electrified wires in such a way that people cannot inadvertently come into contact with them.✓
- Display warning signs to inform people that the property is protected by an electric fence.✓
- Electrical fences must never be erected parallel underneath overhead power lines because a higher current can be induced in the fence by the overhead power lines.
- Barbed wire is not allowed in the construction of an electric fence.
- 3–10 meters away from the road

(Any 2)

(2)

[35]

QUESTION 3: ENERGY

- 3.1 3.1.1 **Identification of parts A and B of the wind turbine**
- A Rotor/Propeller✓(nose cone, cone head)
- B Gear box✓(transmission, gear) (2)
- 3.1.2 **TWO problems associated with wind turbines used to generate electrical energy**
- The unreliability of the wind✓
 - Generates a lot less energy than fossil energy✓
 - Initial installation cost is high
 - Noise pollution
 - Protest and petitions against countryside invasion
 - Mechanical failure (Any 2) (2)
- 3.1.3 **Name and description of TWO devices installed on the wind turbine that ensures maximum efficiency of the turbine blades**
- Wind direction meter:✓ Orientates the rotor/propeller properly into the wind.✓ (2)
 - Wind speed meter:✓ Orientates the pitch of the blades to effectively harness the available wind power. (Turning faster or slower)✓
 - Gearbox. Installing an automatic gearbox/synchronised gearbox (Any 2) (2)
- 3.2 **TWO different systems that can be used to produce hot water in this situation**
- Solar/Sun hot water system✓
 - Electrical solar/sun panel system✓
 - To heat the water with a wood or coal fire under a container
 - Diesel/petrol/paraffin/gas engine generator (Any 2) (2)
- 3.3 **THREE economic factors that influence the production of biofuel**
- Fuel price✓
 - Certain food crops like maize are needed to make biofuel which may lead to an imbalance.✓
 - A huge quantity of water is required which may affect the local water resources.✓
 - The more land to produce crops for biofuel, the more habitats for animals and wild plants will be lost.
 - If biofuel generates more profit for farmers, they may grow crops for biofuel production instead of food production.
 - Lower food production will increase food prices and cause a rise in inflation. (Any 3) (3)

3.4 Description of how electricity is generated in the hydro-electric plant

- It needs a constant downward water flow.✓
- This is achieved by using rushing water that is obtained from dams.✓
- Water enters the intake pipes of the turbines which make them spin.✓
- The turbines are connected to generators that produce electricity.✓

(4)

3.5 THREE applications for photovoltaic cells on a farm

- Electric power for the farmhouse✓
- Water pumping✓
- Security systems✓
- Communication systems
- Electric gates
- Electric fences

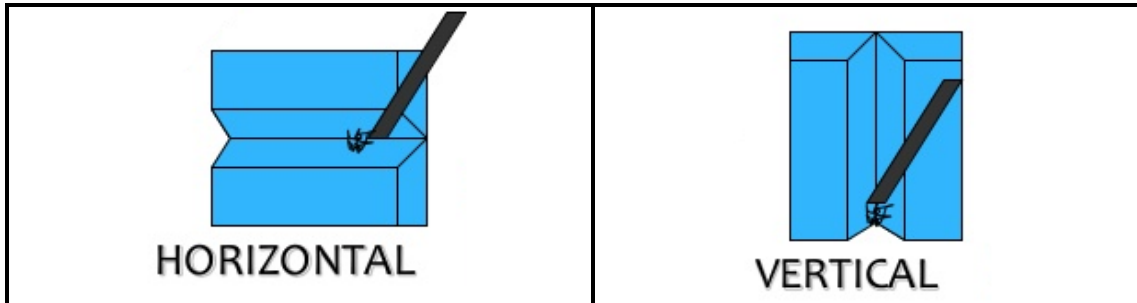
(Any 3 acceptable answers)

(3)
[20]

QUESTION 4: SKILLS AND CONSTRUCTION PROCESSES

- 4.1 4.1.1 **Explanation of what will happen when water enters the torch of the plasma cutter nozzle**
- Water entering the torch nozzle can cause internal arcing/a short circuit.✓
 - This arcing will damage the torch.✓
- (2)
- 4.1.2 **TWO reasons for using the welding helmet when doing plasma cutting**
- The visor blocks the ultraviolet rays.✓
 - It covers the whole face of the operator.✓
 - Protects face and eyes against heat.
 - Protects face and eyes against sparks.
- (Any 2) (2)
- 4.1.3 **Identification of nozzle used for plasma cutting**
C✓
- (1)
- 4.2 **TWO kinds of wear that the bucket of the front-end loader can be subjected to when working**
- Metal against metal friction✓
 - Serious jolts or shocks of metal against rock✓
 - Scraping plus jolts and shocks
 - Serious scraping
- (Any 2) (2)
- 4.3 4.3.1 **THREE ways of controlling distortion of the welded joint**
- Pre-setting✓
 - Welding of patch work✓
 - Clamping✓
 - Spot welding
 - Pre-heating
- (Any 3) (3)
- 4.3.2 **THREE factors that influence the amount of distortion of a welded joint**
- Amount of welding✓
 - Number of welding runs✓
 - Degree of resistance✓
 - Original state or condition of parts that must be welded
 - Welding procedure
 - Cooling process
 - Thickness of the metal
- (Any 3) (3)

4.4 **TWO labelled sketches to indicate the difference between a horizontal arc welding butt joint and a vertical up arc welding butt joint when the metal is 6mm thick**



Drawing correct: 1 mark
Indicated V-groove: 1 mark

Drawing correct: 1 mark
Indicated V-groove: 1 mark

(4)

4.5 **Description of the procedure that must be followed to cut a 10 mm steel plate when using the oxyacetylene apparatus**

- Set the flame to a cutting flame.✓
- First bring the material up to red hot.✓
- Oxygen is then fed with the lever on the cutting attachment.✓
- The steel actually ignites giving off 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.
- Safety regulations/measures

(Any 5) (5)

4.6 4.6.1 **The gauge that is used for MIG welding**
B✓

(1)

4.6.2 **Factors that must be considered when MIG welding is done on galvanised steel**

- Galvanising must be removed prior to the welding.✓
- The galvanising interrupts the welding arc making welding difficult.✓
- The gases created when welding galvanised steel are poisonous.
- Wear gas mask.

(Any 2) (2)

4.6.3 **THREE disadvantages of MIG welding.**

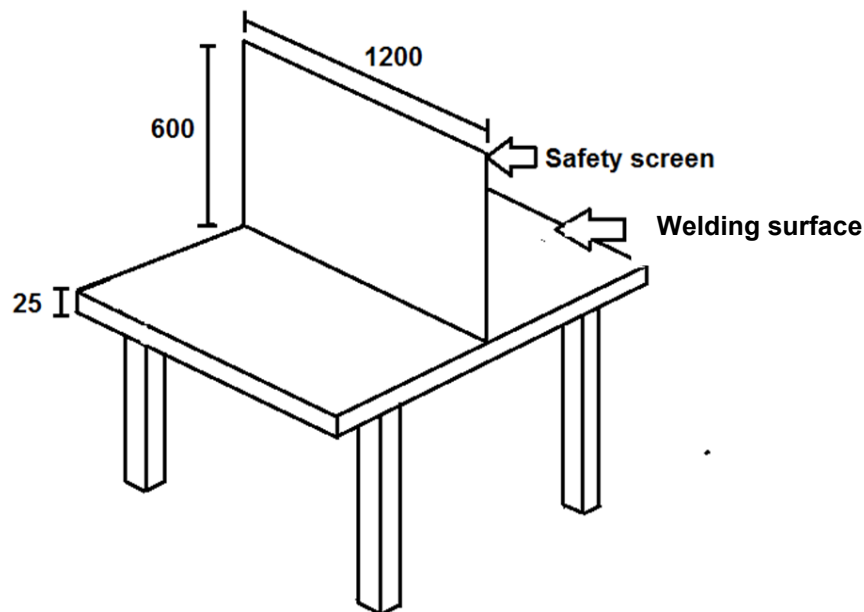
- MIG welding can only be used on thin to medium thick metals.✓
- The use of an inert gas cylinder makes this type of welding less portable.✓
- Produces a less controlled weld as compared to Tungsten Inert Gas Welding (TIG).✓
- Higher initial setup cost.
- Atmosphere surrounding the welding process has to be stable; therefore, this process is limited to draught-free conditions.
- Higher maintenance costs due to extra electronic components.
- The setting of plant variables requires a high skill level.
- Less efficient where high-duty cycle requirements are necessary.
- Radiation effects are more severe.

(Any 3) (3)

4.7 **Calculation of the number of welding rods needed to complete the job**

$$\begin{aligned} \text{Circumference of circle} &= \pi \times d \\ 3,14 \times 100 &= 314 \text{ mm} \checkmark \\ 314 / 105 &= 2,99 \text{ welding rods} \checkmark \\ &= 3 \text{ rods} \end{aligned}$$

(2)

4.8 **Drawing of a two-station arc welding table**

Design: 2 marks✓ (One station -1 mark)
 Dimensions: 1 mark✓
 Safety feature: 1 mark✓
 Labels: 1 mark✓

(5)

[35]

QUESTION 5: TOOLS, IMPLEMENTS AND EQUIPMENT

- 5.1 5.1.1 **Match the correct implement in COLUMN B with the tractor in COLUMN A.**
 (a) C✓
 (b) A✓
 (c) B✓ (3)
- 5.1.2 **FOUR reasons why tractor (c) is a better choice than tractor (a) for work in a vineyard**
 • Smaller financial expenditure✓
 • Cost effective✓
 • Less diesel will be used✓
 • Cheaper maintenance cost✓
 • Tractor fits well into narrow rows
 • Tractor does not compact the soil
 • The exhaust pipe must be below the tractor
 (Any 4) (4)
- 5.1.3 **FOUR technological advanced devices that tractor (a) must be equipped with to make it highly efficient for precision spraying on a commercial farm**
 • Variable Rate Technology (VRT) ✓
 • GPS✓
 • Four-wheel driving✓
 • Air conditioner✓
 • Power steering
 • Hydraulic or pneumatic couplings
 (Any 4) (4)
- 5.2 **Names of parts A, B and C in the transmission assembly**
 A – Flywheel✓
 B – Clutch plate✓
 C – Pressure plate✓ (3)
- 5.3 5.3.1 **Identification of the two types of baling machines A and B**
 A Round baler/Roller type✓
 B Rectangular baler/Ram or piston type✓ (square, big pack) (2)
- 5.3.2 **Description of how the bale density can be changed in baler B**
 By increasing or decreasing✓ the resistance to the hay moving through the baling chamber✓ (2)
- 5.3.3 **THREE reasons why a farmer will prefer baler B instead of baler A when baling hay**
 • Storage space optimally utilised✓
 • Bales stored easily✓
 • Continuous baling process✓
 • Transport space optimally utilised
 • Easier feeding/handling
 (Any 3) (3)

- 5.4 **Description of the process of harvesting maize with a combine harvester**
- The shears cut the plants.✓
 - Maize is fed by the pick-up wheel to the auger.✓
 - The auger feeds the material to the thresher chamber.✓
 - The hammers separate the material.✓
 - The blowers separate the light material from the heavy material.✓
 - The sieve separates the coarser material from the maize kernels.
 - The maize is then fed through the auger to the collecting bin. (Any 5) (5)
- 5.5 **THREE safety requirements when working with the hammer mill**
- Do not work on the machine while it is still in motion.✓
 - Ensure that there are no loose objects lying inside the machine when starting it.✓
 - Wear safety goggles/equipment.✓
 - Do not use the machine when the rotor is out of balance.✓
 - Driving mechanism must be screened off.
 - Use in a well-ventilated area.
 - Small pieces of scrap metal must be kept away from fodder because it can cause a spark, which can cause an explosion. (Any 3) (3)
- 5.6 **Identification of the TWO types of hydraulic cylinders**
- A Single-action cylinder✓
- B Double-action cylinder✓ (2)
- 5.7 **Explanation of why the drive shaft must be equipped with a sliding joint**
- During work the distance✓between the tractor and implement varies.✓ (2)
- 5.8 **TWO running expenses with regard to a tractor that the farmer must take into consideration when doing financial planning**
- Repairs✓
 - Lubricants✓(oil and grease)
 - Labour
 - Antifreeze
 - Tyres
 - Supervising expenses
 - Fuel (Any 2) (2)
- 5.9 5.9.1 **Determination of the gear ratio of the final drive**
- 1 : 2✓ (1)
- 5.9.2 **Explanation of why the final drive increases the torque**
- The drive gear is smaller✓than the driven gear. This means that the speed is reduced, thus increasing the torque.✓ (2)
- 5.9.3 **Calculation of the speed of the driven gear**
- $200/2 = 100$ ✓ r/min (2)
- [40]

QUESTION 6: WATER MANAGEMENT**6.1 THREE problems associated with irrigation in South Africa**

- Competition for surface water rights✓
- Depletion of underground aquifers✓
- Ground subsidence✓
- Under-irrigation increases soil salinity
- Over-irrigation wastes water
- Deep drainage may result in rising water tables
- Irrigation with saline or high-sodium water may damage soil structure/pollution
- Drought
- Price of water

(Any 3) (3)

6.2 6.2.1 Description of the construction of the centre pivot irrigation system

- The system consists of several segments of pipes (usually galvanised steel or aluminium) joined together.✓
- Supported by trusses.✓
- Mounted on wheeled towers.✓
- Sprinklers positioned along its length/Spacing of sprinklers.
- Wheels are driven by electric motors.

(Any 3) (3)

6.2.2 Function of a smart controller in the working of a centre- pivot irrigation system.

The smart controller is a controller that is capable of adjusting the watering time by itself✓ in response to current environmental conditions.✓

(2)

6.2.3 TWO data sources from where the smart controller gets its data

- Soil moisture sensors✓
- Rain sensor✓
- Satellites/weather stations
- Historic weather data

(Any 2) (2)

6.2.4 TWO disadvantages of the use of large centre-pivot irrigation systems

- The centre pivot cannot be used on uneven land.✓
- Water delivery at the edge of the land is so high that water tends to run off.✓
- (Even) Water delivery becomes problematic.

(Any 2) (2)

6.2.5 A reason why most centre-pivot irrigation systems have drop pipes with sprinkler heads that are placed a few centimetres above the crop

To limit evaporation✓(wind blows water away)

(1)

- 6.3 **Brief explanation of how a home fire suppression system works**
- The sprinkler head is attached to the ceiling, with the top of the head facing down.✓
 - Built into the sprinkler head is a heat/smoke-sensitive bulb or a two-part metal link that is held together with an alloy.✓
 - The bulb or metal lies across the top of the head and acts as a plug to keep the opening closed.✓
 - This breaks when heated, the alloy melts and water is released which extinguishes the fire. (Any 3) (3)
- 6.4 6.4.1 **The name of the micro-organism that breaks down the raw sewerage in a septic tank**
Bacteria✓ (1)
- 6.4.2 **Explanation of why the inlet pipe of a septic tanks ends into a T-fitting or baffle**
Preventing the effluent from flowing straight across from one pipe to the other✓(solids dropping down) (1)
- 6.4.3 **THREE aspects to remember in the maintenance of a septic tank**
- The septic tank is pumped out periodically.✓
 - The frequency of pumping out will depend primarily on the amount of waste water that goes through the system each day.✓
 - The frequency also depends on how careful you are about not throwing excess fats and other similar garbage down the drains.✓
 - The more solid waste thrown in the system, the quicker the tank will fill up.
 - Heavy flows of water also tend to make the tank fill up more quickly.
 - Do not use a garbage disposal in the system when you have a septic tank. (Any 3) (3)
- 6.5 **Brief explanation of the construction of a French drain system**
A French drain is basically a ditch dug around the foundation's perimeter filled with fine gravel to let the water flow away from the building structure.✓ (1)
- 6.6 6.6.1 **Working of the water purification system**
- The system uses three cartridges to filter the water.✓
 - They are connected to the incoming water pipes, and provide clean water for the entire house.✓
 - The first and second filters have very fine filament filters of 0,2 microns.✓
 - The third filter is a carbon filter. (Any 3) (3)

6.6.2 Calculation of the time that it will take to fill a tank with water

$$\text{Time} = \frac{\text{Content}}{\text{Flow rate}} \checkmark$$

$$= \frac{10\,000 \text{ l}}{50 \text{ l/min}} \checkmark$$

$$= 200 \text{ min} \checkmark \text{ or (3 hours 20 minutes } \checkmark)$$

(3)

6.7 Description of how data integration through a GIS works on a combine harvester

- Yield monitors are crop yield measuring devices installed on harvesting equipment. ✓
- The yield data from the monitor is recorded and stored at regular intervals along with positional data received from the GPS unit. ✓
- GIS software takes the yield data and produces yield maps.

(Any 2)

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