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Department:
Basic Education
REPUBLIC OF SOUTH AFRICA

NATIONAL SENIOR CERTIFICATE

GRADE 12

AGRICULTURAL TECHNOLOGY

NOVEMBER 2022

MARKING GUIDELINES

MARKS: 200

These marking guidelines consist of 16 pages.

SECTION A**QUESTION 1**

- 1.1 1.1.1 C✓✓
1.1.2 A✓✓
1.1.3 A✓✓
1.1.4 D✓✓
1.1.5 C✓✓
1.1.6 D✓✓
1.1.7 B✓✓
1.1.8 D✓✓
1.1.9 C✓✓
1.1.10 A/D✓✓

(20)

- 1.2 1.2.1 Heat/steam/warmth/magma ✓✓
1.2.2 moveable✓✓
1.2.3 standardisation✓✓
1.2.4 more✓✓
1.2.5 Battery/Accumulator✓✓

(10)

- 1.3 1.3.1 G✓✓
1.3.2 D✓✓
1.3.3 F✓✓
1.3.4 B/H ✓✓
1.3.5 A ✓✓

(10)

TOTAL SECTION A: 40

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

2.1 The alloy metal that is specifically used to manufacture the products and a reason why the metal is used.

2.1.1 Wine tanks

Stainless steel.✓

- Resistant to air, water and many chemical acids and alkali.✓
- Resistant against corrosion.✓
- Can be welded well.✓

(Any 1) (2)

2.1.2 Fittings for hot-water copper pipes

Brass. ✓

- Strength ✓
- Machinability✓
- Wear resistance✓
- Hardness✓
- Corrosion resistance✓

(Any 1) (2)

2.1.3 Hammers that can be used in explosive atmosphere

Bronze✓

- Does not generate sparks✓
- Low friction ✓

(Any 1) (2)

2.2 ONE example where the following materials will be used on a farm.

2.2.1 High-tensile steel

- Tow bar✓
- Shafts✓
- Gears✓
- Crowbar✓

(Any 1) (1)

2.2.2 Cast iron

- Engine block✓
- Differential of the tractor✓
- Cast iron pots✓
- Tractor weights✓
- Brake drum✓
- Hubs for farm equipment✓

(Any 1) (1)

2.3 Description of the annealing process of copper.

Heat the metal to 500–550°C.✓ Then cool it in the air or sand.✓

(2)

- 2.4 2.4.1 **The TWO most important aspects that must be considered when an adhesive is chosen to repair the water trough.**
- Type of the material to be joined.✓
 - Conditions under which this joint will be used.✓ (2)
- 2.4.2 **Process of preparing the water trough before the adhesive is applied.**
- Clean the surface area around the crack✓ and sand it lightly until there are no more signs of dirt, clean before applying the adhesive.✓ (2)
- 2.4.3 **TWO methods used to join fibreglass parts.**
- Pop rivet✓
 - Bolt and nut✓
 - Screws✓ (2)
- 2.4.4 **TWO methods of colouring a fibreglass trough.**
- Painting✓
 - Dying✓ (2)
- 2.5 **The effect of extreme heat on the following material.**
- 2.5.1 **Bakelite**
- No effect.✓
 - Will become extremely hot.✓
 - Will discolour.✓ (Any 1) (1)
- 2.5.2 **Perspex**
- It will easily change shape when heated, because Perspex is not heat resistant.✓
 - It will burn.✓
 - It will melt✓ (Any 1) (1)
- 2.5.3 **Silicon**
- Silicon will melt. ✓
 - Will deform.✓ (Any 1) (1)
- 2.6 **Description of the friction ability of Vesconite.**
- Low static and dynamic friction✓
 - No friction in tough working environments whether dry or wet, lightly or heavily loaded.✓ (2)

- 2.7 2.7.1 **THREE design requirements prescribed for warning signs on electric fences.**
- The signs must be at least 100 mm x 200 mm.✓
 - The background color of both sides must be yellow.✓
 - The inscription must be black and must read 'BE AWARE–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 visible on the sign.✓ (Any 3) (3)
- 2.7.2 **TWO situations where an electrical fence can be used on a farm.**
- Protection✓
 - Temporary fences✓
 - Dangerous animals, e.g.lions✓
 - Around the farm perimeter (Any 2) (2)
- 2.7.3 **TWO alternative energy sources that can be used to provide energy for an electrical fence.**
- Wind✓
 - Solar✓
 - Hydro electric✓
 - Generator✓
 - Battery✓ (2)
- 2.8 **THREE components needed to create a fire.**
- Material that can burn✓
 - Oxygen✓
 - Any heat source✓ (lightning / friction, matches, lighter) (3)
- 2.9 **TWO reasons for using resin casting as an insulating material when joining THREE phase electrical wires.**
- Watertight✓
 - Non-conductor of electricity✓
 - Toughness✓
 - Prevents corrosion/ rust✓ (Any 2) (2)
- [35]**

QUESTION 3: ENERGY

3.1 3.1.1 **The energy source that makes use of a generator.**

Source C✓ (1)

3.1.2 **Description of the working principles of energy source B.**

- Cold water passes through glass tubes where it is heated by sun energy.✓
 - The heated water enters the geyser through a closed copper pipe network that runs through the geyser.✓
 - The hot water inside the copper pipes heats up the cold water inside the geyser.✓
 - The cooled water flows downwards back to the solar tubes where it is reheated.✓
- (Any 3) (3)

Alternative geyser system.

- The sun heats up the liquid in the glass tubes✓
- That heat up the element.✓
- The copper element heats up the water.✓

3.1.3 **The device that must be connected to energy source A to change the direct current to alternating current.**

Inverter✓ (1)

3.1.4 **Identify energy source C.**

Concentrated solar/Solar plant/Sun tower✓ (1)

3.2 **TWO disadvantages of a wind turbine's blades turning too fast.**

- The blades could be damaged.✓
 - The rotor experiences too much strain.✓
 - The structure could collapse.✓
 - Noise pollution.✓
 - Bird strikes
- (Any 2) (2)

3.3 **THREE geographical challenges that may arise during a survey for a geothermal energy power station.**

- Is the rock soft enough to drill through?✓
 - Do the rocks deep down contain sufficient heat?✓
 - Will this heat be sustainable for a significant amount of time?✓
 - Is the environment fit for a power plant?✓
 - Volcanic activities✓
 - Accessibility/Difficult to locate✓
 - Availability of water
- (Any 3) (3)

- 3.4 3.4.1 **An alternative racing fuel that can be used to supplement petroleum.**
- Methanol✓ (1)
- 3.4.2 **THREE materials used to manufacture the alternative fuel (Methanol).**
- Woody plant fibre✓
 - Methane gas in landfills✓
 - Coal✓
 - Natural gas✓
 - Fermented waste products such as sewage and manure✓ (Any 3) (3)
- 3.5 3.5.1 **THREE disadvantages associated with a hydroelectric power plant.**
- Limited plant locations✓
 - High initial costs✓
 - Carbon emission✓
 - Flood risk✓
 - Susceptible to earthquakes/tremors✓
 - Limited water resources✓
 - Affects marine life✓
 - High costs✓ (Any 3) (3)
- 3.5.2 **TWO reasons why hydroelectric power plants are limited in South Africa.**
- Water scarcity✓
 - Inadequate water flow✓
 - Non-sustainable water in rivers✓
 - Inadequate land gradient✓
 - High costs✓ (Any 2) (2)
- [20]**

QUESTION 4: SKILLS AND CONSTRUCTION PROCESSES**4.1 4.1.1 Parts A and B.**

A- Earth clamp/Clamp✓

B- Welding/gun/torch✓

(2)

4.1.2 The apparatus that can be attached for welding aluminium.

Push Pull torch✓

(1)

4.1.3 TWO gases that can be used with MIG welding.

- Argon✓
- Helium✓
- Mixture of Co₂ and Argon✓

(Any 2)

(2)

4.1.4 THREE different metals that can successfully be welded with the MIG-welding machine.

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

(3)

4.2 4.2.1 The material used for part A.

- Tungsten✓
- Copper mounted hafnium✓
- Zirconium✓

(Any 1)

(1)

4.2.2 Description of the plasma cutting process.

The process involves using a tungsten electrode, ✓ and high pressure plasma✓ (which is gas in an ionized state) to generate and carry an electrical arc between a copper nozzle and work piece.✓

The electrical arc performs the cutting, but the pressurized plasma helps to keep the cut cleared by removing the dross (metal impurities generated by the cutting).✓

(Any 3)

(3)

4.3 TWO types of metals that can be cut by using the oxy-acetylene.

- Mild steel✓
- Cast iron✓
- Stainless steel✓
- Any ferrous metals✓

(Any 2)

(2)

4.4 Description of the process of shutting down an oxy-acetylene flame and bleeding the system.

- Turn off the acetylene valve on the torch handle. This will extinguish the flame. ✓
- Turn off the oxygen valve on the torch handle. ✓
- Shut/close the main cylinder valves clockwise on the top of both gas cylinders. ✓
- Now open the two valves on the torch handle to 'bleed' the system. ✓
- Turn both the oxygen and acetylene regulator handles counter-clockwise until they are loose. ✓
- Close both valves on the torch handle. ✓
- Put the handle and tips away, and return the gas cylinders and their hoses to their proper storage area. ✓

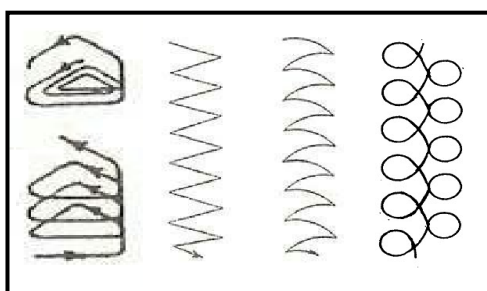
(Any 5) (5)

4.5 4.5.1 Description of the process of vertical up arc welding.

- A special electrode is used for vertical welding with an arc welder, makes the process easier as it 'freezes' more quickly. ✓
- Amperage can be reduced slightly from the normal down hand setting. ✓
- Tip of the electrode must be pointed upwards, so that the electrode forms an angle of up to 30° with the horizontal plane. ✓
- Arc must be kept short and the speed must be just sufficient to prevent the molten metal from the puddle to run down. ✓
- When welding up, very little lateral movements of the electrode must be made. ✓

(5)

4.5.2 Draw THREE different types of welding runs used for vertical welding.



(Any 3 drawings) ✓✓✓

(3)

4.6 4.6.1 Calculation of the volume of concrete needed.

Formula: Volume= Length x width x height

$$2\,500\text{ mm} \times 1\,200\text{ mm} \times 250\text{ mm} \checkmark = 750\,000\,000 \checkmark \text{ mm}^3 \checkmark$$

OR

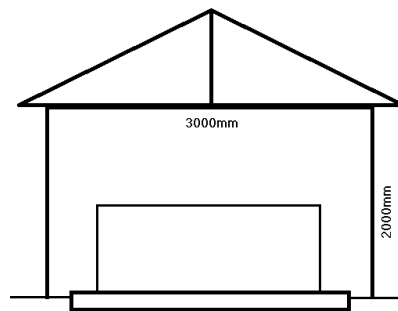
$$2,5\text{ m} \times 1,2\text{ m} \times 0,25\text{ m} \checkmark = 0,750 \checkmark \text{ m}^3 \checkmark$$

(3)

(Allocate full marks if only the final answer is given)

- 4.6.2 **Design and sketch of a shelter to protect the generator from weather conditions. Show at least TWO measurements.**

Roof and construction✓✓	(2)
Poles (Uprights)✓	(1)
Measurements✓	(1)
Neatness✓	(1)



(5)
[35]

QUESTION 5: TOOLS, IMPLEMENTS AND EQUIPMENT

5.1 5.1.1 **TWO measures the farmer can apply to ensure that the maize will be harvested on time.**

- Making use of contractors.✓
- Working longer hours.✓
- Making use of bigger harvesting machines.✓
- Harvest until the rain start. ✓

(Any 2) (2)

5.1.2 **An alternative method that can be used, other than the combine harvester and justification.**

Hand harvesting/You can continue to harvest by hand whilst it is raining/ Use a tractor drawn harvester.✓

Justification: Combine harvester will be stuck in the field when soil is wet.✓

(Any 1) (2)

5.2 5.2.1 **THREE aspects to bear in mind when buying a new baler.**

- Price✓
- Local maintenance services✓
- Parts locally available✓
- Driving power needed for operation✓
- Type of baler✓
- Ease of operation✓
- Type of binding technique✓

(Any 3) (3)

5.2.2 **THREE points to consider before buying a second-hand baler.**

- Reliability of the agent.✓
- Spare parts easily available.✓
- Well proven model.✓
- Guarantee from agent/seller.✓
- General wear and tear.✓

(Any 3) (3)

5.3 5.3.1 **Less space-consuming bale.**

A✓

(1)

5.3.2 **Justification for answer in QUESTION 5.3.1**

More bales can be stacked on a truck.✓
No gaps between the bales.✓
Bales are compact✓

(Any 1) (1)

5.3.3 The bale that can be wrapped.

(1)

A or B✓

5.3.4 A reason why baling process B can be used up until raining.

(1)

Water runs down the bale/ bale can be stored outside.✓

5.3.5 FIVE round-baler safety tips to young upcoming farmers.

- Familiarise yourself with the operator's manual.✓
- Adequate training must take place.✓
- Ensure all safety screens are in place.✓
- Be watchful when backing up as baler is bulky and reduces vision to the rear.✓
- Avoid sharp turning.✓
- Assure no one is near the rear gate when it is being raised and lowered.✓
- Keep everyone clear of the rear of the baler during unloading.✓
- Large round bales can roll after discharge when on hilly terrain.✓
- Before servicing, cleaning, or adjusting a round baler, disengage the tractor PTO.✓
- Block the gate before working under it. Use the safety lock system for the baler.✓
- Keep the PTO properly shielded.✓
- Never allow passengers to ride on the baler during operation or transport.✓
- Be extremely cautious when operating a baler on uneven or hilly terrain.✓
- Raise the pickup to clear humps and obstacles when passing over uneven terrain.✓

(Any 5) (5)

5.4 5.4.1 The type of belt best fitted on the pulley system and ONE reason for identifying it.

V-belts✓

AND

- Does not easily slip off.✓
- Draw tighter around pulleys.✓
- No lubrication needed.✓
- Lasts longer.✓

(Any 1) (2)

5.4.2 Changing the direction in which pulley A rotates.

By twisting the belts.✓

Switch the motor to the other side.✓

Change the polarity of the motor.✓

(Any 1) (1)

5.5 5.5.1 **The different types of gears, A and B.**

A- Straight cut gear/ Spur gear✓

B- Helical gear✓

(2)

5.5.2 **Calculation and ratio of gear connection.****Driver gear (128 teeth)****Driven gear (16 teeth)**

Driver gear

Driven gear

$$= 128 \div 16 \checkmark$$

$$= 8 : 1 \checkmark \checkmark$$

(3)

5.5.3 **ONE advantage and ONE disadvantage of each gearing system.**

GEAR	ADVANTAGE	DISADVANTAGE
Spur gear (A)	Easy to manufacture.✓ Cheaper to manufacture.✓ (Any 1)	Noisy.✓ Cannot use in synchronised gearbox.✓ Difficult to mesh.✓ Subject to wear.✓ (Any 1)
Helical gear (B)	Lasts longer.✓ Easy to mesh.✓ Less wear.✓ More contact point of teeth.✓ (Any 1)	Subjected to side thrust.✓ More expensive to manufacture.✓ (Any 1)

(4)

5.5.4 **The gear system to improve speed.**

A✓✓

(2)

5.6 5.6.1 **Cylinder types.**

A- Double (action) cylinder✓

B- Single (action) cylinder✓

(2)

5.6.2 **The cylinder best fitted on a front-end loader.**

A- Double action cylinder✓

(1)

5.6.3 **Explanation to support answer given in QUESTION 5.6.2.**

It enables the operator to set the control lever in a down✓and upward thrust position.✓

(2)

5.6.4 **TWO reasons to justify the use of transmission oil in a tractor hydraulic system.**

- Not compressible✓
- Good lubrication qualities✓
- Not volatile✓
- Relatively cheap✓

(Any 2)

(2)

[40]

QUESTION 6: WATER MANAGEMENT

6.1 Irrigation components and their function.

6.1.1 Irrigation timer/Irrigation controller/Smart controller✓ (1)

6.1.2 An irrigation timer controls the flow of water by turning on and off.✓
Used for scheduling irrigation.✓ (Any 1) (1)

6.1.3 Electronic valve/ Solenoid valve/ Irrigation valve✓ (1)

6.1.4 An irrigation valve regulates the one-directional flow of water in an irrigation system.✓ (1)

6.1.5 Sprinkler/sprayer✓ (1)

6.1.6 An irrigation sprinkler drops water onto the land, mimicking the effects of rain.✓ (1)

6.2 6.2.1 TWO reasons for determining the flow rate of the pump.

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

6.2.2 Calculation of the flow rate.

$$\begin{aligned}\text{Flow rate} &= \text{Content} \div \text{Time} \\ &= 10\,000 \div 8 \checkmark \\ &= 1\,250 \text{ Litres/minute} \checkmark\end{aligned}\quad (3)$$

6.3 Type of device suitable to send the location.

- GPS✓
 - Cell phone✓
 - Tablet
 - Tablet
- (Any 1) (1)

6.4 6.4.1 **The irrigation system, best suitable for a land against steep slopes with motivation.**

- B✓

AND

- Prevents run off water.✓
- Pivots mainly used on level surfaces.✓
- Does not cause soil erosion.✓

(Any 2) (3)

6.4.2 **Reasons for preferring irrigation system A.**

- Not necessary to remove system.✓
- Can work with implements on land.✓
- Animals cannot damage system.✓
- Less time consuming.✓
- Less labour intensive.✓
- Remote control/management.✓
- Variable rate irrigation.✓

.. (Any 2) (2)

6.5 6.5.1 **The design error of the septic tank.**

The outlet is higher than the inlet.✓

No partition wall.✓

There will be a backflow of waste water.✓

(Any 2) (2)

6.5.2 **The importance of installing a manhole in a septic tank.**

- General maintenance✓
- Removing of solids✓
- Inspection✓
- Adding bacteria✓
- Unclogging of in/outlet✓

(Any 4) (4)

6.5.3 **Suitable drainage system to be connected to the septic tanks outlet.**

French drain✓

Pebble/stone drain✓

Drainage field✓

(Any 1) (1)

6.6 **The main cause of blockages in a town's sewage system.**

- The disposal of non-degradable materials.✓
- The lack of maintenance.✓
- Missing manhole lids.✓
- Root obstructions.✓
- Too many people using the system.✓

(Any 1) (1)

6.7	6.7.1	The type of filter to connect with a water softener.		
		A✓		(1)
	6.7.2	The filter that is installed to a micro irrigation system.		
		F✓		(1)
	6.7.3	ONE example where the filter shown in C will be used.		
		Micro irrigation✓ Swimming pool✓	(Any 1)	(1)
	6.7.4	Correct statement.		
		Filtration always takes place from the outside ✓ to the inside ✓ of the filter.		(2)
				[30]
		TOTAL SECTION B:		160
		GRAND TOTAL:		200