



basic education

Department:
Basic Education
REPUBLIC OF SOUTH AFRICA

**NATIONAL
SENIOR CERTIFICATE**

GRADE 12

AGRICULTURAL TECHNOLOGY

NOVEMBER 2014

MEMORANDUM

MARKS: 200

This memorandum consists of 17 pages.

SECTION A**QUESTION 1**

1.1	1.1.1	D✓✓	(2)
	1.1.2	A✓✓	(2)
	1.1.3	C✓✓	(2)
	1.1.4	B✓✓	(2)
	1.1.5	A✓✓	(2)
	1.1.6	B✓✓	(2)
	1.1.7	C✓✓	(2)
	1.1.8	C✓✓	(2)
	1.1.9	C✓✓	(2)
	1.1.10	A✓✓	(2)
			(20)
1.2	1.2.1	Irrigation valve/Non-return valve/One-way valve✓✓	(2)
	1.2.2	Galvanized steel / Zinc✓✓	(2)
	1.2.3	Single-phase✓✓	(2)
	1.2.4	Sunflower (plant oils)✓✓	(2)
	1.2.5	Dry powder (Powder)✓✓	(2)
			(10)
1.3	1.3.1	F✓✓	(2)
	1.3.2	A✓✓	(2)
	1.3.3	G✓✓	(2)
	1.3.4	B✓✓	(2)
	1.3.5	D✓✓	(2)
			(10)
		TOTAL SECTION A:	40

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

2.1 2.1.1 **THREE main alloy elements found in stainless steel.**

- Chromium✓
- Manganese✓
- Nickel✓

(3)

2.1.2 **TWO influences of EACH of the three alloy elements.**

Chromium

- Increases resistance against corrosion.✓
- Promotes the hardening of steel.✓
- Improves strength.
- Improves resistance to the formation of scale.
- Improves tensile strength.
- Decreases magnetism.
- Most chromium steels can be welded.

(Any 2)

Manganese

- It combats corrosion.✓
- Gives steel a coarser structure.✓
- Changes the band structure, at the same time causing a reduction in striking strength.
- Increases tensile strength.
- Reduces the critical cooling tempo and by doing so improves hardening.
- Increases resistance against wear.
- It reduces magnetism.

(Any 2)

Nickel

- It improves the toughness and the hardening ability.✓
- One of nickel's greatest advantages is that it gives steel a fair amount of toughness at low temperatures.✓
- Used with chromium, nickel helps to increase the hardening ability.
- Steel which is alloyed with chromium and nickel is resistant to air, water and many chemical acids and alkali.

(Any 2)

(6)

2.2 **Precautionary measures to take to prevent cracks and brittleness.**

Preheating✓ of the whole part / area that must be soldered.✓

(2)

2.3 THREE applications of bronze products.

- Bearings✓
- Electrical connectors✓
- Springs✓
- Taps
- Pipe connectors
- Hammers

(Any 3) (3)

2.4 TWO properties of copper.

- Copper is an excellent conductor of electricity.✓
- Copper is an excellent conductor of heat.✓
- Ductile and easily joined by soldering.
- It resists corrosion.

(Any 2) (2)

2.5 2.5.1 Adhesive to stick the posters to the wall.

Prestik✓

(1)

2.5.2 Difference between cohesion and adhesion.*Cohesion*

Inherent✓ strength of the adhesive.✓

Adhesion

Ability of the molecules of an adhesive to cling✓ to the molecules of other substances.✓

(4)

2.6 THREE precautionary measures to be followed when working with fibreglass.

- Catalyst and accelerator should always be stored separately.✓
- Remove all resin catalyst and accelerator from skin.✓
- Wear gloves if skin is sensitive.✓
- Use acetone in well-ventilated room.
- Handle resin castings carefully – they are brittle.
- Glass fibre matting has small pieces of fibre that can penetrate the skin.
- Do not breathe in glass fibre or get it in your eyes.
(Can lead to blindness)

(Any 3) (3)

2.7 2.7.1 FIVE safety regulations applicable to electric fences.

- Must cause no electrical hazards to persons, animals or their surroundings.✓
- Constructions, which are likely to lead to entanglement of animals or persons, must be avoided.✓
- May not be supplied from more than one energiser.✓
- The gap between two separate electric fences with different energizers must be at least 2 m.✓
- If this gap is to be closed, this should be affected by means of an electrically non-conductive material.✓
- Barbed or razor wire may not be electrified.
- Parts of an electric fence, along a public path or highway, must be identified by warning plates that are firmly attached.
- The energiser earth electrode must penetrate the ground to a depth of at least 1 m.
- Leads that run inside buildings must be insulated to the earth structural parts of the building.
- Leads that run underground shall be run in a conduit of insulating material.
- Care must be taken to avoid damage to the connecting leads due to the effects of animal hooves or tractor wheels sinking into the ground.
- Connecting leads must not be installed in the same conduit as the mains supply wiring, communication cables or data cables.
- Connecting leads and electric fence wires may not cross above overhead power or communication lines.
- If connecting leads and electric fences are installed near an overhead power line the clearances must be:
 - **Power Line Voltage:** Under 1 000 volts – **Clearance:** 3 m
 - **Power Line Voltage:** 1 000–33 000 volts – **Clearance:** 4 m
 - **Power Line Voltage:** Over 33 000 volts – **Clearance:** 8 m
- Leads and electric fence wires near an overhead power line may not exceed a height of 2 m above ground.
- This height applies to either side of the orthogonal projection of the outermost conductors of the power line, for a distance of 2 m for power lines not exceeding 1 000 V and 15 m for power lines exceeding 1 000 V.
- A distance of 10 m must be maintained between the energiser earth spike and any other earthing system.
- Electric fences intended for deterring animals – current need only be supplied from low output energisers to obtain satisfactory and safe performance.
- No electric fence wire intended for deterring birds from roosting on buildings must be connected to the earth spike.
- Where an electric animal fence crosses a public pathway, a non-electrified gate must be incorporated in the electric fence.
- Switch off the power while working on fence (Any 5)

(5)

2.7.2 Ways of increasing the earthing efficiency of an electric fence.

- Increasing the number of earth spikes.✓
- Run an earth return wire in parallel✓ to the fence line and connecting it to earth spikes at regular intervals.✓ (3)

2.7.3 The main purpose of the conductor wire of an electric fence.

To carry the electric fence charge ✓ throughout the length of the fence.✓ (2)

2.7.4 ONE type of wire that is not allowed to be electrified.

Barbed wire or razor wire.✓ (Any 1) (1)
[35]

QUESTION 3: ENERGY**3.1 Type of solar system that can be used to heat water in a dairy, alternatively to Photo voltaic panels.**

Solar hot water panels.✓ (1)

3.2 3.2.1 THREE factors that can influence the efficiency of the solar cells.

- The cell is not working to its full potential.✓
- 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 efficiency than cheaper ones.
- Location of the solar cell.
- Nearer the equator, you will receive a slightly better output with a given cell, but solar cells should always be facing the direction of the sun.
- No objects blocking the sun's rays/ weather conditions.

(Any 3) (3)

3.2.2 Is it possible to store the energy?

Yes✓ (1)

3.2.3 Motivation for 3.2.2. (The answer should be YES in 3.2.2)

The electric energy produced during daytime can be used to charge a battery that can be used during night time.✓ (1)

3.2.4 The device that can be used to change the direct current to alternating current.

Inverter/transformer/converter.✓ (1)

3.3 Description of how this structure generates electrical energy.

- Wind turns a turbine's/ generator blades,✓ which are shaped to harness the wind.✓
- This turning motion is then transferred by gears to the turbine's rotor,✓ causing the turbine/generator to generate electricity.✓ (4)

3.4 Methanol can be obtained from different products. Name TWO.

- Methane gas in landfills.✓
- Fermented waste products such as sewage and manure.✓ (2)

3.5 3.5.1 TWO advantages of geothermal energy.

- A geothermal system does not create any pollution.✓
- The cost of the land to build a geothermal power plant on is usually less expensive. (affordable) ✓
- Geothermal plants take up very little room, so you do not need to purchase a larger area of land.
- Geothermal energy is very clean, you may receive tax cuts, and/or no environmental bills or quotas to comply with the countries carbon emission scheme (if they have one).
- No fuel is used to generate the power.
- The overall financial aspect of these plants is outstanding; you only need to provide power to the water pumps, which can be generated by the power plant itself anyway. (Any 2) (2)

3.5.2 ONE instance where the use of geothermal energy can cause pollution.

Harmful gasses that escape from deep within the earth.✓ (1)

3.5.3 Consequences if you pump too much cold water into the Geothermal heat source.

It will result in the rocks cooling down too much resulting in the geothermal heat source to be cooled down.✓ (2)

3.6 TWO disadvantages of wind as an alternative energy source.

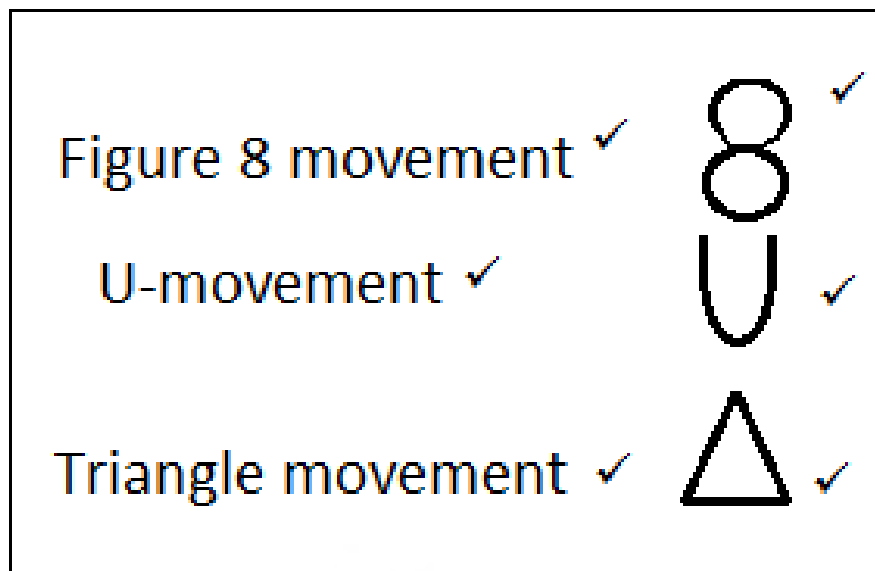
- Wind is unreliable. In many areas, the winds strength is too low to support a wind turbine or wind farm, and this is where the use of solar could be a great alternative.✓
 - Produce a lot less electricity than the average fossil fuelled power station, requiring multiple wind turbines to be built in order to make an impact.✓
 - Construction can be very expensive and costly to surrounding wildlife during the build process.
 - The noise pollution from commercial wind turbines is sometimes similar to a small jet engine.
 - Protests and/or petitions usually confront any proposed wind farm development. People feel the countryside should be left intact for everyone to enjoy its beauty. (Any 2) (2)
- [20]

QUESTION 4: SKILLS AND CONSTRUCTION PROCESSES**4.1 4.1.1 THREE limitations of the MIG welding machine.**

- Higher initial setup cost. ✓
 - Atmosphere surrounding the welding process has to be stable (hence the shielding gasses), 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.
 - Needs electricity
- (Any 3) (3)

4.1.2 FOUR reasons that make porosity occur in welding joints.

- Gas flow too low or too high. (wrong welding technique) ✓
 - Blocked nozzle. ✓
 - Leaking gas lines. ✓
 - Draughty conditions. ✓
 - Nozzle distance from work too far.
 - Painted, wet or oily welding area.
 - Wet or rusty electrode/wire.
- (Any 4) (4)

4.1.3 Name and draw THREE other welding run figures.

(6)

4.2 4.2.1 **The farmer's preference for plasma cutting machines instead of an oxy-acetylene cutting torch.**

- **Economical:** Plasma cutting is more economical than oxy-fuel for thickness under 25 mm and comparable up to about 50 mm.✓
- **Rapid cutting speeds:** Plasma arc cutting is faster than oxy-fuel for cutting steel up to 50 mm thick and is competitive for greater thickness.✓
- **Wide range of materials and thickness:** Plasma cutting systems can yield quality cuts on both ferrous and nonferrous metals.✓
- **Easy to use:** Plasma cutting requires only minimal operator training. (3)
The torch is easy to operate. (Any 3)

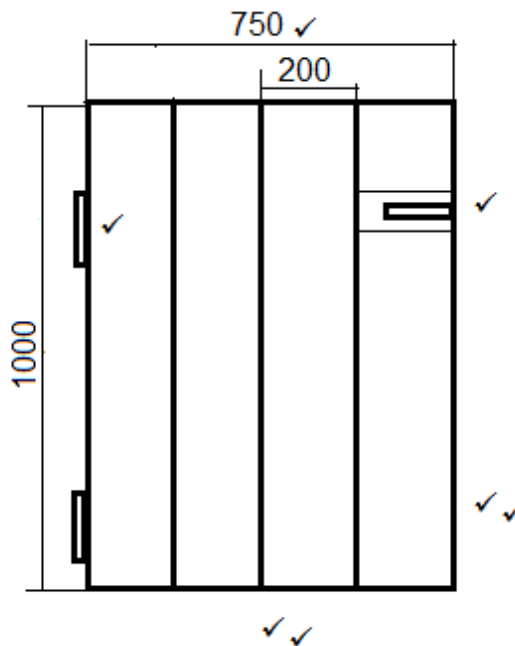
4.2.2 **TWO gasses for plasma cutting, and ONE application for each.**

Compressed Air:✓	Mild steel, aluminium or stainless steel.✓	
Oxygen:✓	Carbon steel.✓	
Nitrogen:	All types of metal/steel.	
Argon hydrogen	Cutting thick metal/steel.	(Any 4) (4)

4.3 **FOUR categories of personal protection.**

- Work clothing✓ (Overall)
 - Eye protection✓ (Safety glasses, welding helmet, welding goggles, safety visor)
 - Ear protection ✓ (Muffs, plugs)
 - Hand protection✓ (Leather gloves)
 - Respiratory equipment (Breathing mask, mask)
 - Feet protection (Safety shoes)
 - Leg protection (Leather spats)
 - Face protection (welding helmet, safety glasses)
 - Head protection (4)
- (Only one answer per category)

4.4 Freehand sketch of the gate with two hinges and a lock mechanism.



Tolerance accepted, (1 or 2 marks)

Proportional drawing	(2)
Practical applicability	(2)
Show TWO hinges.	(1)
Show ONE lock mechanism.	(1)
Show measurements.	(1)
Show the cutting list of the material to be used.	(2)
Pipe \varnothing 25 mm x 5 x 1 000 mm. ✓ \varnothing 25 mm x 2 x 750 mm.	
Flat bar 25 mm x 6 mm 3 x 950 mm. ✓ (must correlate with the drawing) (1 mark for pipe and 1 mark for flat bar if correlate with the sketch)	

(9)

4.5 Parts labelled as A and B.

- A Cutting nozzle. ✓
- B Cutting Oxygen lever. ✓

(2)
[35]

QUESTION 5: TOOLS, IMPLEMENTS AND EQUIPMENT5.1 5.1.1 **Name the device.**

Grease nipple.✓ (1)

5.1.2 **The main function of this device.**

A grease fitting or grease nipple is a metal fitting used in mechanical systems to feed lubricants, usually lubricating grease, into a bearing under moderate to high pressure using a grease gun.✓ (1)
✓

5.2 **Gears labelled A, B and C**

- A Straight cut gear or spur gear.✓
 B Helical gear.✓
 C Double helical gear or herringbone gear.✓ (3)

5.3 **Calculate the amount of teeth on the driven gear**

Gear ratio = $\frac{\text{drive gear}}{\text{driven gear}}$

$$1 : 3 = \frac{60}{3}$$

OR $3 \times 60 = 180$

Driven gear = 20✓✓teeth

Driven gear = 180✓✓teeth

(4)

5.4 **Safety mechanism that is built into the system of farm implements.**

Shear bolt or shear pin.✓

Ram stop safety mechanism.

Ratchet plate

Slip clutch

Pressure relief valve

Kill switch

(Any 1)

(1)

5.5 5.5.1 **Main reason for side overturns.**

Side overturns result from the change in the tractor's centre of gravity due to the additional weight of the bale.✓ (1)

5.5.2 **THREE precautionary measures to safeguard a worker from being crushed while lifting bales.**

- Make sure that the tractor is fitted with a cage or cabin.✓
 - Do not lift the bale too high.✓
 - The tractor must stand level so that the bale cannot dislodge.✓
 - Make sure the bale is securely on the fork.
 - Apply handbrake
- (Any 3) (3)

5.6 5.6.1 **Correct method for coupling a trailer.**

A✓ (1)

5.6.2 **Motivation.**

Assure the tractor drawbar is in the lowest, most centred and stationary position.✓

This will prevent the tractor's front wheels from lifting and keep the wheels moving in a straight line and provide extra steering control.✓ (2)

5.6.3 **Why a low gear be selected for a tractor.**

The low gears in the gearbox help to brake the tractor to support the brakes if they are not sufficient when pulling a heavy load.✓ (1)

5.6.4 **Why bales should not touch the tyres.**

The friction of the hay against the rotating tyre can generate enough heat to ignite the hay at higher speeds.✓ (1)

5.6.5 **THREE safety precautions.**

- Keep people out of the area between the trailer and tractor during hitching.✓
- Hand signals should be used and understood by both the operator and those assisting.✓
- Hitch the trailer only to the drawbar; never attach to any other point on the tractor.✓
- Assure the tractor drawbar is in the lowest, most centred and stationary position. This will keep the tractor's front wheels moving straight and provide extra steering control.
- Use a safety locking hitch-pin and secure the trailer with chains.
- Wight ratio between tractor and trailer.

(3)

(Any 3)

5.7 5.7.1 **Working of the double-action hydraulic cylinder.**

- When the **control lever** is in neutral position, the oil is pumped to the control valve and back to the oil container via the oil filter.✓
- The moment the control lever is shifted to the lift position, the control valve directs the **pressurised oil** to the piston end of the hydraulic cylinder causing the piston to **move to the right**, and the implement is lifted.✓
- In order to force the implement into the soil, the operator moves the control lever to the 'lower' position and now the control valve will direct the pressurised oil along the second pipe into the shaft-end of the cylinder (where the shaft is connected to the piston), causing the piston **to move to the left**.✓
- In this way the operator controls the implement **positively in two directions**.✓

(4)

5.7.2 THREE advantages of transmission oil.

- Not compressible.✓
- Good lubrication qualities.✓
- Remains liquid over a large temperature range.✓
- Not volatile.
- Relatively cheap.
- Easily conductible in pipes.
- Flows through filters, pipes, oil pumps and cylinders with ease.
- Contains detergents that keep parts clean. (Any 3) (3)

5.7.3 Strongest side of the double action hydraulic cylinder.

The side without the shaft.✓ (1)

5.7.4 Motivation.

The side without the shaft is stronger than the side with the shaft because the area that is subjected to the oil pressure in the cylinder is larger than the part of the cylinder, which contains the shaft.✓ (1)

5.8 5.8.1 THREE main components of the clutch.

Clutch plate✓
Pressure plate✓
Release bearing✓ (3)

5.8.2 THREE reasons for equipping a tractor with a clutch.

- Engine drive needs to be disengaged when gears are changed.✓
- Drive should be disengaged when the tractor is started.✓
- The clutch is disengaged to allow engine speed to increase and then engage to give greater torque.✓
- Allows the operator to stop the tractor belt pulley or power take off shaft without stopping the engine. (Any 3) (3)

5.9 The parts that should receive special attention when examining the tractor.

- Engine ✓
- Gearbox ✓
- Final drive ✓
- Cooling system
- Fuel system
- Steering mechanism
- Instruments
- Battery (Any 3) (3)

[40]

QUESTION 6: WATER MANAGEMENT**6.1 6.1.1 Reason for the centre-pivot irrigation system considered as a labour saving system.**

- No labourers needed to shift the pipes/system.✓
- One-man operation.✓
- Automated watering system/scheduling.✓
- Pesticides/fertilisers are applied through the system. (Any 3) (3)

6.1.2 Design principles of effective watering in a centre-pivot irrigation system.

- The size of the nozzles✓ varies from small nearer to the centre and larger to the outside.✓
- Distance between adjacent sprinklers✓ decrease to the outside of the pivot.✓ (4)

6.2 THREE reasons for the use of irrigation software.

- To save water.✓
- It is used as part of water scheduling.✓
- Time saving. ✓
- Labour friendly.
- For a big system, software may be the only way to control the system.
- Software can be used to control when water is turned on and off, how frequently watering occurs, and how much water is delivered at any given time.
- On a huge farm or large landscaped estate, managing water needs manually or with a restrictive timer system may not be feasible, making software critically important.
- Such programs typically include tracking utilities, which keep track of how much water is used, monitor average rainfall, and collect other useful data. (Any 3) (3)

6.3 6.3.1 Why is it necessary to install such a system in the farmhouse?

- Due to pollution and other contaminants in drinking water supplies, it has become necessary to clean all usable water from harmful microbes, bacteria and chemicals.✓
- A water filter removes impurities from the water that have influences on plants, animals and humans.✓ (2)

6.3.2 THREE other effective processes that can be used to purify drinking water.

- Distil process.✓
- Reverse osmosis.✓
- Whole-house water purification systems.✓
- Faucet water filters.
- Jug or pitcher that filters water. (3)
- Boil water
- Add water purification agents (Any 3)

6.4 Problems associated with irrigation of agricultural land.

- Competition for surface water rights.✓
- Depletion of underground aquifers.✓
- Ground subsidence.✓
- Under irrigation or irrigation giving only just enough water for the plant (e.g. in drip-line irrigation) gives poor soil salinity control which leads to increased soil salinity with consequent build-up of toxic salts on soil surface in areas with high evaporation. This requires either leaching to remove these salts and a method of drainage to carry the salts away.✓
- When using drip lines, the leaching is best done regularly at certain intervals (with only a slight excess of water), so that the salt is flushed back under the plant's roots.
- Over-irrigation because of poor distribution uniformity or management wastes water, chemicals, and may lead to water pollution.
- Deep drainage (from over-irrigation) may result in rising water tables that in some instances will lead to problems of irrigation salinity.
- Irrigation with saline or high-sodium water may damage soil structure.
- Scarcity of labourers. (Any 3) (3)

6.5 FOUR different types of home drainage systems.

- French drain✓
- Channel drain✓
- Downspouts✓
- Slope drain✓
- Drainage ditch (Any 4) (4)

6.6 THREE substances that must never be flushed down a toilet.

- Non-degradable materials.
- Plastic✓
- Cigarette butts, rags, etc. ✓
- Disinfectants✓ (3)
- Bleaches, oils or fats (Any 3)

6.7 6.7.1 THREE advantages of Variable Rate Technology (VRT).

- Cost saving✓
- Time saving✓
- Saving on time using implements and tractors✓
- Labour saving
- Ability to precisely control the rate of application
- Interaction between implements for precision farming (Any 3) (3)

6.7.2 TWO other systems that are used for precision farming other than VRT.

- GIS - Geographic Information System✓
- GPS - Global Positioning System✓
- Google earth (2)
- Computer systems (any 2) [30]

TOTAL SECTION B: 160
GRAND TOTAL: 200