basic education

Department:
Basic Education
REPUBLIC OF SOUTH AFRICA

NATIONAL SENIOR CERTIFICATE

GRADE 12

AGRICULTURAL TECHNOLOGY

FEBRUARY/MARCH 2015

MEMORANDUM

MARKS: 200

This memorandum consists of 17 pages.

SECTION A

QUESTION 1

1.1	1.1.1	B✓✓	(2)
	1.1.2	C✓✓	(2)
	1.1.3	A✓✓	(2)
	1.1.4	D✓✓	(2)
	1.1.5	A✓✓	(2)
	1.1.6	C✓✓	(2)
	1.1.7	C✓✓	(2)
	1.1.8	D✓✓	(2)
	1.1.9	A✓✓	(2)
	1.1.10	C✓✓	(2)
			(20)
1.2	1.2.1	Argon✓✓	(2)
	1.2.2	Electric arc✓✓	(2)
	1.2.3	Reverse✓✓	(2)
	1.2.4	Galvanizing✓✓	(2)
	1.2.5	Cell phone/Satellite phone✓✓	(2)
			(10)
1.3	1.3.1	G✓✓	(2)
	1.3.2	E✓✓	(2)
	1.3.3	B✓✓	(2)
	1.3.4	C✓✓	(2)
	1.3.5	F✓✓	(2)
			(10)

TOTAL SECTION A: 40

SECTION B

QUESTION 2: MATERIALS AND STRUCTURES

2.1 **TWO reasons why each of the following alloy metals is used to fabricate the product**

Milk tanks

2.1.1
- Resistance to corrosion.✓
- Resistance to wear.✓
- Resistance to air, water and various chemical acids and alkalis.
- Resistance to the formation of scale. (Any 2) (2)

Electrical wire

2.1.2
- Copper is an excellent conductor of electricity.✓
- Copper is an excellent conductor of heat.✓
- Copper resist corrosion.
- Copper is soft and bends easily. (Any 2) (2)

Pipe fittings

2.1.3
- Wear resistance.✓
- Corrosion resistance.✓
- The machining ability of brass is good.
- Brass is the cheapest alloy metal to select. (Any 2) (2)

2.2 **The alloy element commonly used with tin to form soft solder**

Lead.✓ (1)

2.3 **FIVE conditions under which an adhesive could be used and should be taken into consideration when buying adhesive.**

- Heat resistance/Temperature✓
- Water-resistance✓
- Elasticity✓
- Load capacity✓
- Inflammability✓
- Duration of cohesion
- Duration of usability (Any 5) (5)

2.4 **FIVE reasons why farmers would prefer fibre glass water drinking troughs for animals**

- Fibre glass is light.✓
- Fibre glass is watertight.✓
- Can be formed into any shape.✓
- Can be sawn, drilled, and filled.✓
- Toughness.✓
- Easy repaired when break. (Any 5) (5)

2.5 **FIVE advantages of Teflon coated products**

- There is no better sealant than Teflon.✓
- Teflon has high dielectric strength.✓
- Teflon coating services will keep other materials covered so that those hazardous chemicals will not harm them.✓
- Teflon is heat and cold resistant. Not all kinds of coatings can withstand both blazing hot and freezing cold temperatures, especially those as extreme as 600 degrees Celsius or -454 degrees Celius.
- Since Teflon is non-sticky, it basically cleans itself.
- The coefficient of friction is low. There are several types of Teflon coatings, but they are all very smooth and do not put up much resistance, so any moving parts that are coated with it, slide gently and easily. (Any 5) (5)

2.6 2.6.1 **TWO methods that can be implemented to prevent lightning strikes from damaging the energizer**

- Installing lightning protectors.✓
- Switch off all electricity during thunderstorms.✓
- Disconnect when weather is bad. (Any 2) (2)

2.6.2 **Minimum distance that the earth wire/spike of the above energizer must be away from any other electrical system**

At least 2 meters✓ (1)

2.6.3 **Apart from lightning, THREE natural elements of nature that is extremely harmful to electric fence energizers.**

- Dust✓
- Water✓
- Fire✓ (3)

2.6.4 **TWO ways of increasing the earthing efficiency when erecting 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.✓ (2)

2.6.5 **FIVE requirements warning plates that are attached to electric fences should meet**

- Firmly clamped to the fence wires at intervals recommended to be of approximately 10 meters to 50 meters, but not exceeding 90 meters.✓
- 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 be the '**TAKE CARE - ELECTRIC FENCE'.**✓
- The inscription shall be indelible, inscribed on both sides and have a height of at least 25 mm.✓

(5)

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QUESTION 3: ENERGY

3.1 3.1.1 **How can the energy produced from this device be stored efficiently for use during windless days?**

Batteries✓ (1)

3.1.2 **THREE disadvantages of wind energy that will influence your choice when choosing an alternative energy source.**

- The main disadvantage regarding wind power is down to the winds unreliability factor.✓
- In many areas, the winds strength is too low to support a wind turbine or wind farm.✓
- Wind turbines generally 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.✓
- Wind turbine 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 3) (3)

3.2 3.2.1 **Heat energy that is extracted from the earth's inner core.**

Geothermal energy✓ (1)

3.2.2 **TWO important issues that can be raised during the initial survey phase before the exploration of the energy source commence.**

- 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? (Any 2) (2)

3.3 3.3.1 **THREE advantages of bio-fuel**

- The main advantage that bio-fuel has over other energy sources is the cost factor. ✓
- With the ever-increasing prices of crude oil, bio-fuel offers a cheaper solution to our energy needs. One of the main reasons for this low cost is that bio-fuels are made from plant and animal waste. ✓
- Biodegradable and do not harm the environment when combusted. ✓

- They are also comparatively lot less polluting. Lesser carbon emissions mean that these fuels are environment friendly, which is the need of the world today.
- For conventional fuels it takes years to regenerate whereas there is no such problem for bio-fuels.
- Doesn't require any radical changes to switch to the use of bio-fuels, unlike the difficulties in switching to other renewable energy sources such as solar and wind power.
- Are renewable sources of energy as you can just keep producing more.
- Ethanol is very inexpensive to produce.
- Can help prevent engine knocking. (Any 3) (3)

3.3.2 **TWO common alternative fuels that are obtained from plant origin.**

- Ethanol.✓
- Methanol.✓ (2)

3.4 **Explain the process that takes place in solar panels to transform sun energy into electricity.**

- When photons, contained within the sun's rays, hit the solar cells, the electrons absorb this solar energy.✓
- The electrons are transformed into conduction electrons.✓
- When the energy of these photons is great enough, the electrons are able to become free.✓
- The electrons now carry an electric charge through a circuit to the destination.✓ (4)

3.5 **FOUR disadvantages of solar energy**

- Some areas of the world are not able to benefit from photovoltaic energy.✓
- Due to the climate, weather patterns, or high levels of pollution.✓
- Sun energy is not available during the night time.✓
- A cloudy day makes this energy source ineffective.✓
- Produce low amounts of energy at low voltage and amperage. (Any 4) (4)

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QUESTION 4: SKILLS AND CONSTRUCTION PROCESSES

4.1 4.1.1 **TWO reasons for this problem**

- The torch is too close to the metal.✓
- The welding pool is too hot.✓
- Welding current is too low. (Any 2) (2)

4.1.2 **TWO methods of solving this problem in QUESTION 4.1.1**

- Use pliers to remove the blob.✓
- If the tip is totally blocked, unscrew and replace.✓ (2)

4.1.3 **TWO reasons for the occurrence of welding spatter when using the MIG-welding machine**

- Inadequate induction.✓
- Voltage is too low.✓
- Gas supplies not enough.
- Metal is dirty or wet. (2)

4.1.4 **TWO measures that can be applied to solve the problem of welding spatter**

- Increase the gas supply to the required reading.✓
- Increase the current. ✓
- Increase the voltage.
- Clean the surface with an angle grinder. (Any 2) (2)

4.2 **'Welding galvanized steel is very dangerous'. Give TWO reasons.**

- Galvanized steel contains a zinc coating✓ that produces poisonous carcinogenic gas when it is burnt.✓
- Exposure to this substance results in heavy metal poisoning. (Poisonous gasses are given off✓✓) (2)

4.3 **Correct process of overhead arc-welding**

- Use an arc as short as possible.✓
- Weld a number of runs without any lateral movement.✓
- When molten metal starts dripping, the amperage should be reduced slightly.✓
- Move electrode slightly faster.✓
- Hold electrode in same position as in relation to base metal. (Any 4) (4)

4.4 **THREE hazards to take into consideration when working with the plasma cutter**

- Fire hazard.✓
- Vision hazard.✓
- Breathing hazard.✓
- Electrical hazard. (Any 3) (3)

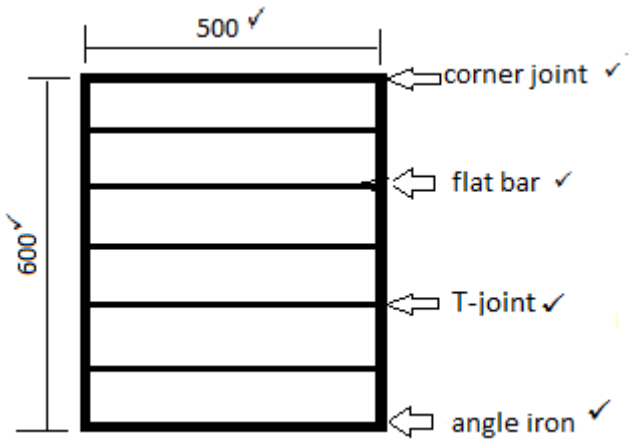
4.5 **Freehand top-view sketch of your design to protect the ball valve mechanism**

Marks will be allocated for the following:

4.5.1
- Functionality of the drawing. (1)
- Indicate the position of the 2 types of metal profiles that is going to be used in the manufacturing process of the grid. (2)

4.5.2 500 mm✓ and 600 mm✓(any applicable length) (2)

4.5.3 Butt✓ and T- joints✓ (2)



4.5.4 **Cutting list**

- 2 lengths angle iron of 500 x 25 x 6 mm.✓
- 2 lengths angle iron of 600 x 25 x 6 mm.✓
- 5 lengths flat bar of 500 x 25 x 6 mm (correlate with sketch).✓ (3)

4.5.5 **Method that can be used to prevent the metal grid from rusting.**

Painting with a rust resistant paint.✓ (1)

4.6 4.6.1 **TWO types of metals that can be cut by using an oxyacetylene cutting torch**

- Mild steel✓
- Cast iron✓
- Stainless steel (Any 2) (2)

4.6.2 **Explain the oxyacetylene cutting process from the moment the flame has been lit up to the moment that the cut is finished.**

- Heat the material until it is red hot.✓
- The steel turns into a liquid.✓
- Oxygen is then fed with the lever on the cutting attachment.✓
- The liquid iron is cleared from the cut by pressure from the oxygen stream.✓
- The steel actually ignites giving off more heat to keep the process going.✓ (5)

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QUESTION 5: TOOLS, IMPLEMENTS AND EQUIPMENT

5.1 5.1.1 **Main aim of the standardisation of farm implements.**

To help the farmer to work quicker, cheaper and more effectively.✓ (1)

5.1.2 **THREE advantages of farm implement standardisation**

- Any implement can be used on any 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/she will not have to take a special course on how to maintain it. (Any 3) (3)

5.2 5.2.1 **Name the component that allows the drive shaft to be used at different operating angles.**

Universal joint.✓ (1)

5.2.2 **Purpose of a bearing**

- Reducing friction in bearings is often important for efficiency.✓
- To reduce wear.✓
- To facilitate extended use at high speeds.
- To avoid overheating and premature failure of the bearing. (Any 2) (2)

5.3 5.3.1 **TWO functions of a differential**

- Changing direction of rotation.✓
- Speed reduction.✓
- Dividing rotation equal between the rear wheels. (Any 2) (2)

5.3.2 **Function of a differential lock**

A locked differential forces both left and right rear wheels on the same axle to rotate at the same speed under all circumstances.✓ (1)

5.3.3 **Main function of the final drive.**

- Further reduction in speed.✓
- More torque. (Any 1) (1)

5.4 **THREE properties of a good clutch**

- It should engage smoothly and not jam, slip or shudder.✓
- It should be capable of transferring the maximum load of the engine without slip.✓
- When the clutch is disengaged, it should do so completely and not tend to drag.✓
- The clutch should be of such a nature that it could be engaged or disengaged comfortably by hand or foot.
- The friction material used on the clutch plate should not only be highly worn and temperature resistant but should also be able to resist high temperatures. (Any 3) (3)

5.5 5.5.1 **Calculate the diameter of the driven pulley**

Na x Da = Ng x Dg ✓

3 000 x 200 = 4 000 x Dg ✓

$$Dg = \frac{3\,000 \times 200}{4\,000}$$ ✓

Driven pulley diameter = 150✓mm.✓ (5)

5.5.2 **Direction in which the driven pulley rotates**

Clockwise✓ (1)

5.5.3 **THREE safety precautions to consider when attaching the hammer mill to the PTO shaft of the tractor**

- Check if the anchor bolts of the static machine are tight.✓
- Check that the universal joints are well lubricated.✓
- Check that the driving shaft guard is present and without cracks.✓
- Ensure that the driving shaft is as straight as possible. (Any 3) (3)

5.6 5.6.1 **THREE advantages of making use of V-belts instead of flat belts**

- V-belts do not easily slip off pulleys.✓
- V-belts draw tighter around the pulleys when tension increases.✓
- Lubrication is never necessary.✓
- V-belts are relatively strong, and under normal circumstances do not easily break.
- Cold, moist conditions, age or use does not cause V-belts to stretch or shrink.
- V-belts last longer than flat belts. (Any 3) (3)

5.6.2 **THREE requirements for the screens used for safeguarding implements**

- Must appear neat.✓
- Safeguard the equipment.✓
- Removed and replaced easily.✓
- Do not become loose.
- Weight saving.
- Keep out all undesired matter. (Any 3) (3)

5.7 5.7.1 **Identify component A.**

A is the top link.✓ (1)

5.7.2 **Identify component B and explain its function.**

- B is a sensitivity element/automatic depth control mechanism.✓
- Its function is to excite the hydraulic system at a given moment.✓ (2)

5.8 5.8.1 **Which ONE of the safety device (A or B) will allow the tractor driver to proceed immediately with a task, after the obstruction has been removed?**

B✓ (1)

5.8. 2 **THREE functions of the slip clutch as found in the drive mechanism of a baling machine**

- Prevent heavy objects from being taken into the baler.✓
- Protect the pick-up if it is impeded by anything.✓
- Protect the auger if it becomes overloaded.✓ (3)

5.9 **Procedure when a rotavator is prepared for use**

- All grease points must be well greased.✓
- The correct tension must be set for all belts or chains.✓
- Check that all parts are functioning correctly by operating it slowly.✓
- Replace all worn parts immediately especially the cutter blades.✓
- Service according to manufacturer's specifications.
- Lift up all dust release guards.
- Check that there is no damage to the blades and that they are sharp.

(Any 4) (4)

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QUESTION 6: WATER MANAGEMENT

6.1 Basic procedures when selecting a pump

- Decide on the type of pump that best fits your needs, rotary, centrifugal, submersible, turbine, jet pump, etc.✓
- Estimate your flow (GPM) 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. ✓
- Would a different pump lower your irrigation costs or better fit your irrigation system design?
- Return once again to your irrigation design, can it be fine-tuned to better match your final pump selection?
- Return to the pump selection process and re-evaluate your pump selection, then make your final pump selection. (Any 4) (4)

6.2 Reason for dividing a garden irrigation system into different zones

There is usually not enough pressure and available water flow to operate all the sprinklers at once.✓ (1)

6.3 Name the spray nozzle

Variable-flow irrigation sprinkler head.✓ (1)

6.4 Function of an irrigation valve

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

6.5 THREE factors to consider when purchasing an irrigation sprinkler system.

- Size of area to be irrigated. ✓
- The shape of the land.✓
- Obstructions, such as trees or rocks, may require extra work to water around.✓
- The depth of the soil that needs to be watered.
- Time and effort available to use the system. (Any 3) (3)

6.6 **Explain the working of an irrigation sprinkler.**

- The water passes through the sprinkler head and 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.✓
- Lawn sprinkler heads can be recessed into the ground and forced up by the pressure of the water when the system is activated. Other systems can be fixed in a place above ground.✓ (3)

6.7 **TWO criteria that will influence the farmer's decision on when to irrigate a crop.**

- Intuition.✓
- Calendar days since the last rainfall or irrigation.✓
- Crop evapotranspiration.
- Soil water. (Any 2) (2)

6.8 **The working of this fire suppression sprinkler system**

- Built into the sprinkler head is a heat-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.✓
- In the event of a fire, the plug will melt and release the water that will in turn distinguish the fire.✓ (3)

6.9 6.9.1 **Functions of the TWO compartments**

- Anaerobic bacteria in the first tank break down sewage.✓
- Very little solids remain when the watery sewerage flows to the second tank.✓
- Sludge from the first tank must be pumped out periodically.✓
- Only liquid sewage remains in the second tank and drains away through the outlet pipe or stone trench.✓ (4)

6.9.2 **THREE criteria that must be followed when maintaining a septic tank**

- Septic tank sludge must be pumped out periodically.✓
- The frequency of pumping out will depend primarily on the amount of wastewater that goes through the system each day.✓
- The frequency also depends on how careful you are about not throwing excess fats, rinds 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.

- That is why it is best not to use a garbage disposal in the system when you have a septic tank, and why water should not be left running indiscriminately in sinks or toilets. (Any 3) (3)

6.10 **THREE places where a septic tank may NOT be built**

- Do not build near boreholes, drinking water installations.✓
- A suitable distance away from the house.✓
- Not near traffic.✓
- Not near places where people eat, wash or work regularly. (Any 3) (3)

6.11 6.11.1 **Explain the abbreviation *GPS*.**

GPS stands for the Global Positioning System.✓ (1)

6.11.2 **How can a farmer use a GPS device?**

Device that pinpoint a precise location on the earth. Harvester✓ (1)
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TOTAL SECTION B: 160
GRAND TOTAL: 200