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GRADE 12

AGRICULTURAL TECHNOLOGY

NOVEMBER 2024

MARKING GUIDELINES

MARKS: 200

These marking guidelines consist of 15 pages.



SECTION A**QUESTION 1**

1.1	1.1.1	B✓✓		
	1.1.2	D✓✓		
	1.1.3	B✓✓		
	1.1.4	C✓✓		
	1.1.5	C✓✓		
	1.1.6	B✓✓		
	1.1.7	A✓✓		
	1.1.8	B✓✓		
	1.1.9	D✓✓		
	1.1.10	B✓✓	(10 x 2)	(20)
1.2	1.2.1	helical ✓✓		
	1.2.2	geothermal ✓✓		
	1.2.3	shaft✓✓		
	1.2.4	parallel✓✓		
	1.2.5	shortest/ closest/ easiest✓✓	(5 x 2)	(10)
1.3	1.3.1	E✓✓		
	1.3.2	G✓✓		
	1.3.3	C✓✓		
	1.3.4	H✓✓		
	1.3.5	A✓✓	(5 x 2)	(10)

TOTAL SECTION A: 40

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

2.1 Linking of elements to the specific influence it has on stainless steel.

2.1.1 E ✓ (1)

2.1.2 D ✓ (1)

2.1.3 A ✓ (1)

2.2 The words provided in the list below.

2.2.1 Copper ✓ (1)

2.2.2 Soft ✓ (1)

2.2.3 Bronze ✓ (1)

2.2.4 Hammer ✓ (1)

2.2.5 Silver white metal ✓ (1)

2.2.6 Surface coating for canned food ✓ (1)

2.3 TWO important factors that should be considered when choosing an adhesive for a specific application.

- The type of material to be joined ✓
- The conditions under which the adhesive will be used ✓ (2)

2.4 2.4.1 A reason why fibreglass is used to repair damaged boat hulls.

- Easy repairable ✓
- Lightweight ✓
- Easy to colour ✓ (Any 1) (1)

2.4.2 THREE personal protective equipment that must be used when working with fibreglass.

- Safety gloves ✓
- Safety goggles ✓
- Respiration mask ✓
- Overall ✓ (Any 3) (3)



- 2.4.3 **A cleaning agent that can be used to remove resin or catalyst from your skin when working with fibreglass.**
- Liquid thinners ✓
 - Acetone ✓
 - Thinners ✓
 - White vinegar ✓
 - Rubbing alcohol ✓
 - Petrol ✓
 - Water and soap (Any 1)
- (1)
- 2.5 **ONE use of Vesconite from the list below to each of the applications.**
- 2.5.1 Lift arm bush ✓ (1)
- 2.5.2 Metal to metal bearing bush ✓ (1)
- 2.5.3 Shackle pin bush ✓ (1)
- 2.5.4 Centre pivot bush ✓ (1)
- 2.6 2.6.1 **The type of electric fence shown in picture A and picture B.**
- Picture A- Temporary ✓
 - Picture B- Permanent ✓
- (2)
- 2.6.2 **ONE advantage of electric fence A.**
- It is moveable/can be set up in another area/ cheaper/ easy to install ✓ (1)
- 2.6.3 **Explanation why barbed or razor wire should never be used in the construction of an electric fence.**
- A person or animal getting in contact with the fence might get stuck/injured ✓ and cannot be easily freed from the fence. ✓ (2)
- 2.7 **Complete the table below.**
- 2.7.1 1 000 and lower ✓ (1)
- 2.7.2 4 m ✓ (1)
- 2.7.3 33,000 and above ✓ (1)



2.8 Design of a warning sign that should be placed on an electric fence to warn people of imminent danger.

- The warning signs shall be at least 100mm✓ x 200mm.✓
- The background colour of both sides shall be yellow.✓
- The inscription shall be black and shall be the 'TAKE CARE - ELECTRIC FENCE'.✓
- The correct drawing of the pictogram.✓

(5)



2.9 An energizer earth system should be at least 5 meters away from the main supply unit.

No✓, at least 10 meters, to minimize interference on the electric line.✓

(2)

[35]

QUESTION 3: ENERGY

3.1 **FOUR different renewable alternative energy sources that can be used on a farm to compensate for load shedding.**

- Wind.✓
- Solar.✓
- Bio energy.✓
- Hydro.✓

(4)

3.2 3.2.1 **A device used on the wind turbine to direct the turbine into the wind.**

Fin/Tail on the anemometer/lidar.✓

(1)

3.2.2 **THREE important requirements to consider before choosing the wind turbine to generate electricity on a farm.**

- Sufficient availability of wind.✓
- Consider the surrounding environment of the placement location.✓
- Overall cost, including installation.✓
- To be effective and efficient.✓
- Wind speed approaching your home from open fields and spaces may be more powerful than inner town or city locations.✓
- Consider the way the land around you lies by looking at large hills and mountains.✓
- Thorough research about the types of turbines.✓
- Hiring a professional to do a survey on the surrounding area, to determine if a wind turbine would be economically viable in your surrounding area.✓

(Any 3)

(3)

3.2.3 **TWO factors that might cause wind turbine failure.**

- Blades spinning too fast.✓
- Lack of periodic maintenance or service/ Lubrication✓
- Bird strikes.✓
- Vandalism/Theft.✓
- Age of the turbine.✓
- Metal fatigue.✓
- Lightning.✓
- Electrical faults.✓
- Broken blades.✓

(Any 2)

(2)



3.3 TWO advantages and TWO disadvantages of solar energy.

ADVANTAGES	DISADVANTAGES
<ul style="list-style-type: none"> • Limitless.✓ • Completely clean.✓ • Environmentally friendly.✓ • Extremely portable.✓ • Generates more power necessary for a single family's needs.✓ • Extra power can be fed back into the power grid.✓ • No loadshedding.✓ (Any 2) 	<ul style="list-style-type: none"> • Limited due to bad climate/ weather and high levels of pollution.✓ • Not available during night.✓ • Produce low amounts of energy at low voltage and amperage.✓ • High costs.✓ • Batteries run flat.✓ (Any 2)

(4)

3.4 3.4.1 A fuel that methanol can be easily transformed into

Hydrogen.✓

(1)

3.4.2 TWO natural sources available on the farm that can be used to make methanol.

- Woody plant fibre.✓
- Sewage.✓
- Fermented manure.✓
- Methane gas in landfills.✓
- Animal matter. ✓

(Any 2)

(2)

3.5 The manufacturing process of biodiesel.

Biodiesel is manufactured from vegetable oils✓ e.g. soya, canola, sunflower seed, algae or animal fats✓, and involves the base-catalysed transesterification✓ of fatty acids with methanol or ethanol✓ to give the corresponding methyl esters or ethyl esters.✓ (Any 3)

(3)

[20]

QUESTION 4: SKILLS AND CONSTRUCTION PROCESSES**4.1 4.1.1 Meaning of MIG.**

- M-Metal✓
- I-Inert/Insert/Inactive✓
- G-Gas✓

(3)

4.1.2 The parts of the MIG welding machine as labelled from A to D.

- A. Welding wire/Gas cylinder.✓
- B. Wire speed/ current control knob.✓
- C. Welding torch.✓
- D. Earth clamp.✓

(4)

4.1.3 The role that gas plays in the MIG-welding process.

The Inert gas, that is not flammable✓, is delivered to the welding joint to shield the welding bead from oxygen.✓

(2)

4.1.4 The purpose of spot welding.

To prevent two pieces of metal from moving apart✓ by spot welding the opposite ends before welding starts.✓

AND

The application of pressure and heat without the use of a filler material✓ to join metal with the aid of an electrical current.✓

(2)

4.2 The effect that gravity has on the vertical upwards arc welding process and TWO methods that can be used to control this effect.

Gravity can cause metal to drip or run down.✓

AND

- Keep the puddle small.✓
- Electrode size plays a role in penetration.✓
- Use quick freeze electrodes.✓
- Current must be adjusted correctly to prevent the molten metal from dripping.✓

(Any 2)

(3)

4.3 The welding process where worn parts of a grader blade are build up with a wear resistant metal.

Hard facing/casting.✓

(1)

4.4 The process of preparing a broken cast iron part, before the welding process starts.

- Make sure that all rust, grease, dirt and/or any other substances, which can weaken the join has been removed, before starting with the process of joining.✓
- Remember to remove the surface layer of the metal where the join is to be made.✓



- Cover the suspect area with white chalk. Vaseline in the cracks will colour the chalk grey or show a wet line.✓
- Mark the line by means of a prick-punch and hammer to prevent the line from disappearing when grinding out the V-groove.✓
- Pre-heating of a casting to be welded prevents the forming of new cracks.✓ (Any 5) (5)

4.5 TWO types of wear that metals can be subjected to.

- Metal against metal friction.✓
- Serious jolts or shocks of metal against rock.✓
- Scraping plus jolts and shocks.✓
- Serious scraping.✓ (Any 2) (2)

4.6 Effects of EACH of actions when cutting with the oxy-acetylene cutting apparatus.

4.6.1 Moving the cutting torch too fast.

The flame will not penetrate the work piece thoroughly because the metal is not melted thoroughly.✓ (1)

4.6.2 Moving the cutting torch too slow.

- The cut will be porous.✓
- The cut will not look neat.✓ (Any 1) (1)

4.7 4.7.1 TWO factors that must be considered before buying a plasma-cutting machine.

- Capacity of the machine.✓
- Availability and size of the air compressor.✓
- Availability of pipe connector fittings.✓
- Water trap fitted to the air compressor.✓
- Type of material to be cut.✓
- Costs.✓ (Any 2) (2)

4.7.2 TWO gasses that can be used in the plasma cutting process to remove the molten metal.

- Argon✓
- Nitrogen✓
- Oxygen✓
- Regular air✓
- Helium.✓ (Any 2) (2)

4.7.3 The plasma cutting process.

It involves the use of a tungsten electrode✓ and high pressure plasma✓ to generate and carry an electrical arc✓ between the copper nozzle and work piece.✓ (4)

4.7.4 THREE safety measures that must be kept in mind when working with a plasma-cutting machine.

- Fireproof gloves and a face shield must be worn at all times.✓
- All plasma-cutting machines are potential fire hazards because they blow hot metal and sparks.✓



- Flame-resistant clothing should always be worn.✓
- Any flammable material should be a minimum of 10m away from the machine while it is being operated.✓
- Touching any live electrical parts can result in a serious or fatal shock or burn.✓
- Do not operate the machine when standing in water.✓
- Good ventilation.✓

(Any 3)

(3)

[35]**QUESTION 5: TOOLS, IMPLEMENTS AND EQUIPMENT**

5.1 5.1.1 **The type of bale forming system is used in this type of baling machine.**

Belt type/Vermeer type.✓

(1)

5.1.2 **The bale forming process inside the baling chamber.**

- It has a bale forming mechanism that tightly rolls the hay into a round bale.✓
- Baling chamber is initially small but enlarges gradually as the hay is fed into the chamber.✓
- A system of pulleys, belts and chains keeps the tension of the bale constant while it is turning around.✓
- The baling chamber enlarges with the expanding bale.✓
- If the bale is large, enough ropes are bounded around the bale and the fully formed bale is ejected.✓

(5)

5.1.3 **THREE tasks that should be performed when doing maintenance.**

- Lubricate all moving parts.✓
- Release tension on all chains and belts.✓
- Replace all worn sprockets and gears.✓
- Remove excess bales from the baling chamber.✓
- Check tire pressure.✓
- Inspect all bearings for any play.✓
- Replace all worn out parts.✓
- Check all electronic instruments.✓
- Sharpen all blades.✓
- Inspect all hydraulic parts.✓
- Check all safety clutches.✓

(Any 3)

(3)

5.1.4 **TWO safety precautions that must be kept in mind when ejecting a round bale against a slope.**

- Very steep slopes may require that the bale be moved to a flat location before ejection.✓
- Always orient the bale correctly before ejecting the bale from the bale chamber.✓
- Place the bale on its flat side.✓
- Watch out for bystanders.✓

(2)



5.2 Comparing the friction clutch to the hydraulic clutch.

	FRICITION CLUTCH	HYDRAULIC CLUTCH
APPLICATION	5.2.1 Light duty vehicles✓	5.2.3 Heavy duty vehicle/ Earth moving equipment✓
LOAD CAPACITY	5.2.2 Minimum/Light duty✓	5.2.4 Maximum/Heavy duty✓

(4)

5.3 FOUR irresponsible human behaviours that can cause tractor rollovers.

- Cornering at high speeds.✓
- Driving off the shoulder of roads.✓
- Working against a steep ditch, hill or washout.✓
- Carrying loads too high in the front-end loader.✓
- Hitching point too high when pulling heavy loads.✓
- Towing loads too fast down a hill.✓
- Operating tractor without sufficient brakes.✓
- Tractor sliding off a loading ramp.✓

(Any 4)

(4)

5.4 The consequences of the following installation errors.

5.4.1 The mass of moving parts is not spread equally over bearings of a hammer mill.

Excessive mass on the one bearing✓ will cause the bearing to fail and seize.✓

(2)

5.4.2 The cyclone of the hammer mill does not hang level.

- Cyclonic action of the cyclone will not work properly.✓
- Wear will occur.✓

(2)

5.5 The type of hydraulic cylinder installed in the power steering system of a tractor. Motivation.

Double action hydraulic cylinder.✓

The steering system must be able to operate cylinder on the front wheels in two directions.✓

(2)

5.6 5.6.1 A device that must be installed between parts A and B to enable them to turn as a unit.

- Key.✓
- Taper lock.✓
- Allen cap screw.✓

(Any 1)

(1)



- 5.6.2 **Calculation of the speed ratio of the pulley system, if pulley B rotates at a speed of 1200 r/min and pulley C at a speed of 600 r/min.
Show all calculations.**

$$\begin{aligned}\text{Speed ratio} &= \frac{\text{Drive pulley}}{\text{Driven pulley}} \checkmark \\ &= \frac{1200}{600} \checkmark \\ &= 1 : 2 / 2:1 \checkmark \checkmark\end{aligned}\quad (4)$$

- 5.6.3 **THREE disadvantages of V-belts.**

- V-belts are more difficult to install than flat belts. ✓
 - V-belts are not normally manufactured in very long lengths. ✓
 - 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 other types of belts. ✓
 - V-belts cannot be joined. ✓
- (Any 3) (3)

- 5.7 5.7.1 **Identification of the gears shown as A and B.**

- A- Spiral/worm gear. ✓
B- Bevel/straight gear. ✓
- (2)

- 5.7.2 **TWO functions of this type of gear assembly.**

- Change the drive input angle. ✓
 - Increase torque. ✓
 - Speed reduction. ✓
- (Any 2) (2)

- 5.7.3 **The substance used inside this gearbox to reduce wear and friction.**

oil. ✓

(1)

- 5.8 **TWO advantages of mechanisation.**

- Increased productivity. ✓
 - Increased quality. ✓
 - Help the farmer to produce better, quicker, cheaper and more effectively. ✓
 - Better yield. ✓
- (Any 2) (2)

[40]



QUESTION 6: WATER MANAGEMENT6.1 6.1.1 **The type of irrigation system in picture A.**

Drip irrigation.✓

(1)

6.1.2 **A type of filter system that can be installed in an irrigation system to prevent blockage of the sprayer nozzles.**

- Sand filter/ Gravel filter.✓
- Element filter.✓
- Screen filter.✓
- Centrifugal filter.✓
- Disc filter.✓

(Any 1)

(1)

6.1.3 **THREE reasons why a farmer would prefer irrigation system A.**

- Less water consumption.✓
- Water is focused to the roots of the plant.✓
- Can irrigate in windy conditions.✓
- Can irrigate any shape of land.✓
- Can irrigate against steep slopes.✓
- Less electrical consumption.✓

(Any 3)

(3)

6.1.4 **The function of the down pipes connected to the goosenecks on a centre pivot irrigation system.**

It allows the sprinkler head to be lowered closer to the crop✓ thus limiting evaporative losses.✓

(2)

6.2 **TWO advantages of an irrigation timer that is installed in an irrigation system.**

- The irrigation timer is set to automatically start or end the irrigation intervals to prevent under and over irrigation.✓
- The irrigation timer can be controlled remotely.✓

(2)

6.3 **The design of a septic tank as used in a household sewage system.**

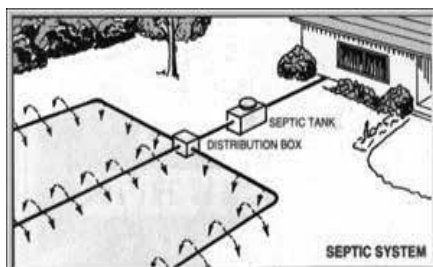
- Although designs vary, most septic tanks consist of a watertight, below ground, tank that has one or two manhole covers (buried a few inches below ground) to provide access for cleaning and inspection.✓
- Effluent from the house flows into the tank through an inlet pipe near the top on the one side. It flows out through a discharge or overflow pipe at the other side.✓
- The pipe may end in a large tee fitting or into a baffle (wall) preventing the effluent from flowing straight across from one pipe to the other.✓
- The incoming effluent will be diverted downward with a minimum of splashing, allowing the solids to sink to the bottom.✓
- Outgoing effluent is drawn from several feet below the top layer of the floating waste (grease, oil, scum) 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.✓
- A manhole is installed at top for inspection and cleaning.✓

(Any 5)

(5)



- 6.4 **Design of a distribution field used to evenly distribute the wastewater from the septic tank to the absorption field.**



Distribution box	✓
Labelling	✓
Direction of flow	✓
Pipe system	✓
Measurements	✓

(5)

- 6.5 **Calculation of the flow rate of the water through the system.**

$$\text{Flow rate} = \frac{10\,000 \text{ litre}}{80 \text{ minutes}} \checkmark$$

$$\text{Flow rate} = 125 \checkmark \text{ l/min} \checkmark$$

(3)

- 6.6 6.6.1 **TWO different systems that can be used to connect the motor shown in picture A to the centrifugal pump shown in picture B.**

- V-belts. ✓
- Flange coupling. ✓

(2)

- 6.6.2 **FOUR disadvantages of the irrigation system.**

- Blockages. ✓
- Erodes easily. ✓
- Causes salinity in soil. ✓
- Requires regular flushing of system. ✓
- Difficult to identify faulty drippers. ✓

(Any 4)

(4)

- 6.6.3 **TWO water filtration methods that can be used to filter irrigation water.**

- Sand filter. ✓
- Filament/Cartridge filter. ✓

(2)

[30]

TOTAL SECTION B: 160
GRAND TOTAL: 200

