basic education

Department:
Basic Education
REPUBLIC OF SOUTH AFRICA

NATIONAL SENIOR CERTIFICATE

GRADE 12

AGRICULTURAL TECHNOLOGY

NOVEMBER 2023

MARKS: 200

TIME: 3 hours

This question paper consists of 18 pages.

INSTRUCTIONS AND INFORMATION

1. GENERAL INSTRUCTIONS AND INFORMATION

    1.1 This question paper consists of TWO sections, namely SECTION A and SECTION B.

    1.2 BOTH sections are COMPULSORY.

    1.3 Answer ALL the questions in the ANSWER BOOK.

    1.4 Number the answers correctly according to the numbering system used in this question paper.

    1.5 You may use a non-programmable calculator.

    1.6 Show ALL calculations.

    1.7 Write neatly and legibly.

2. SECTION A: SHORT QUESTIONS

    2.1 This section consists of THREE questions.

    2.2 Follow the instructions when answering the questions.

3. SECTION B: STRUCTURED LONG QUESTIONS

    3.1 This section consists of FIVE questions.

    3.2 Start EACH question on a NEW page.

SECTION A

QUESTION 1

1.1 Various options are provided as possible answers to the following questions. Choose the answer and write only the letter (A–D) next to the question numbers (1.1.1 to 1.1.10) in the ANSWER BOOK, e.g. 1.1.11 D.

1.1.1 The … of the hammer mill facilitates the process of feeding hay into the machine.

A cyclone
B hopper
C fan
D hammer

1.1.2 The device that facilitates the power take-off shaft (PTO shaft) to operate at an angle:

A Universal joint
B Differential
C Stabilising chain
D Top link

1.1.3 A method used to change a tractor's mass displacement positively:

A Increase the speed of the tractor
B Decrease the wheel base of the tractor
C Increase the towing load
D Lower the tow bar

1.1.4 Where can the tractor's sensitivity element be installed?

A In front of the power take-off shaft (PTO shaft)
B At the base where the lifting arms are connected to the tractor
C In the clutch housing
D At the end of the steering mechanism

1.1.5 The material used for manufacturing the main structure of a centre-pivot irrigation system:

A Vesconite
B Copper
C PVC
D Galvanised steel

1.1.6 A device used to measure the moisture content of the soil:

A Evaporation pan
B Irrigation controller
C Neutron probe
D Thermometer

1.1.7 Regulates the one-directional flow of water in an irrigation system:

A Non-return valve
B Irrigation timer
C Water filter
D Sprinkler

1.1.8 A … is not a component of the oxyacetylene cutting torch.

A cutting lever
B blow pipe
C needle valve
D water trap

1.1.9 A device that prevents a flame from shooting back into the gas cylinder while working with the oxyacetylene cutting apparatus:

A Flashback arrestor
B Blow pipe
C Needle valve
D Spark preventer

1.1.10 Personal protection equipment safeguard the welding operator against … when welding.

A X-rays
B ultraviolet rays
C gamma rays
D neon rays (10 x 2) (20)

1.2 Change the underlined word(s) in the following to make the statements TRUE. Write only the appropriate word(s) next to the question numbers (1.2.1 to 1.2.5) in the ANSWER BOOK, e.g. 1.2.6 Tractor.

1.2.1 The final drive is built into the rear axle of a tractor to equalise the rotation between the rear wheels.

1.2.2 The straight gear runs at an angle across the outer circumference of the gear.

1.2.3 Bacteria, moulds, dust and viruses are examples of chemical hazards.

1.2.4 The discharged effluent from the septic tank is distributed through coiled pipes into a distribution field.

1.2.5 The gas flame melts metal when using the plasma-cutting machine.

(5 x 2) (10)

1.3 Choose a word/term from COLUMN B that matches a description in COLUMN A. Write only the letter (A–H) next to the question numbers (1.3.1 to 1.3.5) in the ANSWER BOOK, e.g. 1.3.6 J.

COLUMN A		COLUMN B	
1.3.1	The mechanism in the tractor's drive system that enables the engine drive to disengage when gears are changed	A	alternating current
1.3.2	The device that causes speed reduction and increased torque in a tractor	B	grease
1.3.3	A fitting used on a drive system for applying lubricants	C	water/moisture
1.3.4	A type of current produced by a photovoltaic solar panel	D	clutch
1.3.5	Can cause internal arcing that damages the torch of a plasma-cutting machine	E	direct current
		F	final drive
		G	grease nipple
		H	flywheel

(5 x 2) (10)

TOTAL SECTION A: 40

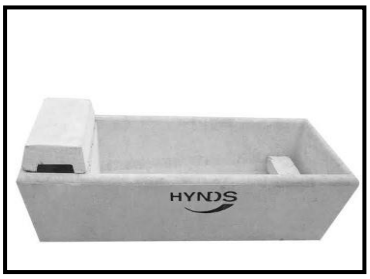
SECTION B

QUESTION 2: MATERIALS AND STRUCTURES

Start this question on a NEW page.

2.1 The pictures below show TWO types of water troughs. Water trough **A** is made from fibreglass and **B** from concrete.

A



B

2.1.1 Name a synthetic material, except fibreglass, that can be used to manufacture a water trough. (1)

2.1.2 Give TWO reasons why water trough **A** would be preferred to water trough **B**. (2)

2.1.3 Name the device that will be installed into the trough to allow water to flow into the trough when the water level drops. (1)

2.2 The picture below shows an example of a typical adhesive.

2.2.1 What is meant by the *load capacity* of an adhesive? (2)

2.2.2 Explain how the adhesion properties of an adhesive can be improved to strengthen the bond between two materials. (2)

2.3 The table below shows different synthetic materials. Complete the table by writing only the answer next to the question numbers (2.3.1 to 2.3.3) in the ANSWER BOOK.

	PVC	TEFLON
Distortion temperature	220 °C	2.3.1
Effect of heat	2.3.2	No effect
Applications	Water pipes	2.3.3

(3)

2.4 Name TWO effects of nickel on stainless steel. (2)

2.5 The picture below shows a brass bush.

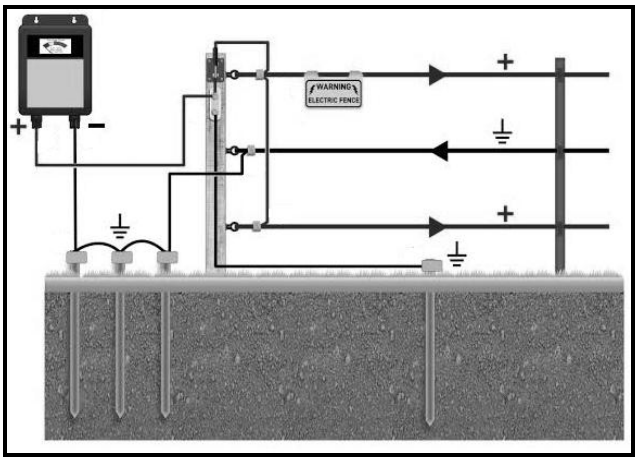
2.5.1 Name TWO metals that are used to manufacture brass. (2)

2.5.2 State TWO permanent joining methods that incorporate heat that is used to join brass. (2)

2.5.3 Name TWO properties of a brass alloy bush that make it more suitable to use in a certain application than a pure copper bush. (2)

2.6 Give THREE reasons why a Vesconite bush is preferred to a bearing. (3)

2.7 The picture below shows an electrical fence.



2.7.1 Name the depth to which the earth electrode must penetrate the soil when a high output energiser is used. (1)

2.7.2 Name a cost-effective method that can be used to protect steel posts against corrosion. (1)

2.7.3 State THREE causes of short circuits on an electrical fence. (3)

2.7.4 Explain why copper is the preferred material to manufacture the earth spikes used in an electric fence. (3)

2.8 A farmer needs to install an electrical fence with six strands of wire with a perimeter of 300 metres and with one gate.

Use the following information and calculate the total cost of the fence:

Four corner posts and two gate posts	R180,00 per post
One hundred droppers	R13,00 per dropper
Fence wire	R1,50 per metre
Isolators	R5,00 per isolator

(5)
[35]

QUESTION 3: ENERGY

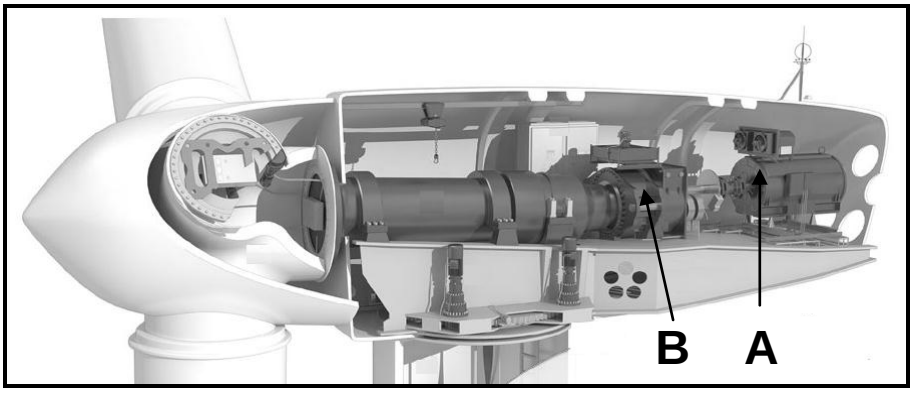
Start this question on a NEW page.

3.1 Complete the table below. Write only the answer next to the question numbers (3.1.1 to 3.1.3) in the ANSWER BOOK.

TYPE OF ALTERNATIVE FUEL	SOURCE OF FUEL
Ethanol	3.1.1
3.1.2	Woody plant fibre, coal or natural gas
Methane gas	3.1.3

(3)

3.2 The illustration below shows the internal sections of a wind turbine.



3.2.1 Name part **A**. (1)

3.2.2 Describe the function of the gearbox labelled as part **B**. (2)

3.2.3 Name the part that is installed on a wind turbine to measure wind speed. (1)

3.2.4 Explain the effect that a change in the pitch of the propeller blades has on the wind turbine. (2)

3.3 Study the picture of a solar system below and answer the questions that follow.

3.3.1 Identify FOUR aspects that have a negative influence on the efficient generation of electricity by the solar panel system. (4)

3.3.2 Explain to a farmer why a solar electric system is preferred to electricity provided by the national electricity grid. (3)

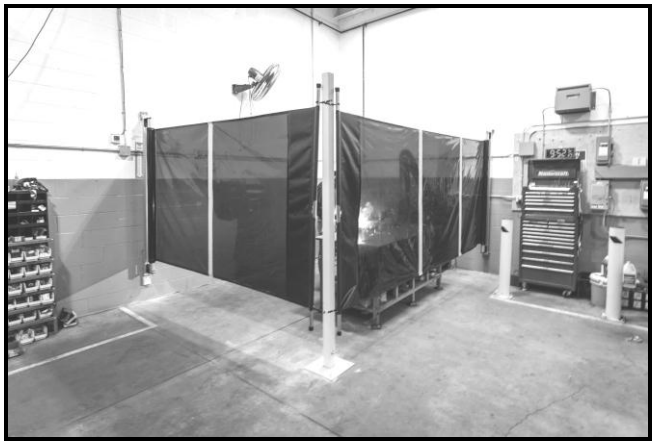
3.3.3 State THREE protective measures that can be installed to protect the solar system against theft and vandalism. (3)

3.4 State ONE precautionary measure that must be implemented to prevent over-cooling of a geothermal energy plant's heat source. (1)
[20]

QUESTION 4: SKILLS AND CONSTRUCTION PROCESSES

Start this question on a NEW page.

4.1 Safety measures are some of the most important aspects when performing tasks in the workshop, as shown below.



4.1.1 List FOUR safety equipment items that need to be present before performing any task in the workshop. (4)

4.1.2 Discuss FIVE ways in which a farmer can limit risks and improve the safety of workers when working with gas equipment in a workshop. (5)

4.1.3 Explain why it is not advisable to perform tasks when a person is alone in a workshop. (2)

4.2 Pictures **A** and **B** below show two different types of welding machines.

A

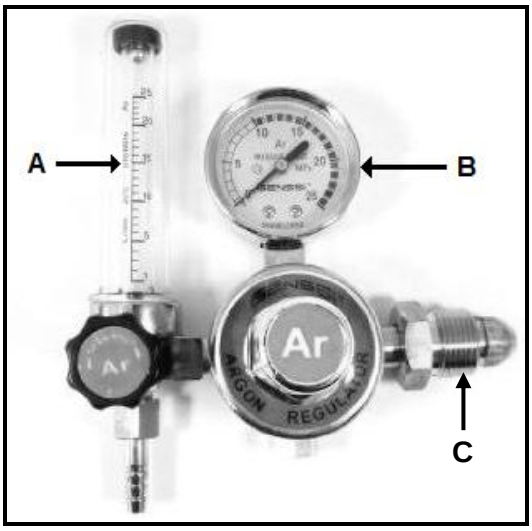
B

4.2.1 Identify the type of welding machine at **A** and **B**. (2)

4.2.2 Indicate which ONE of the welding machines above would require more technical skills to work with. Motivate your answer. (2)

4.2.3 Explain why it is not advisable to weld with welding machine **A** in an open area. (2)

4.3 Study the picture below and answer the questions that follow.



4.3.1 The gas pressure regulator shown above must be connected to the CO_2 cylinder with a threaded connector (**C**).

Indicate whether the threaded connector should be clockwise or anticlockwise. (1)

4.3.2 Identify the component (**A** or **B**) that indicates the rate at which the gas flows. (1)

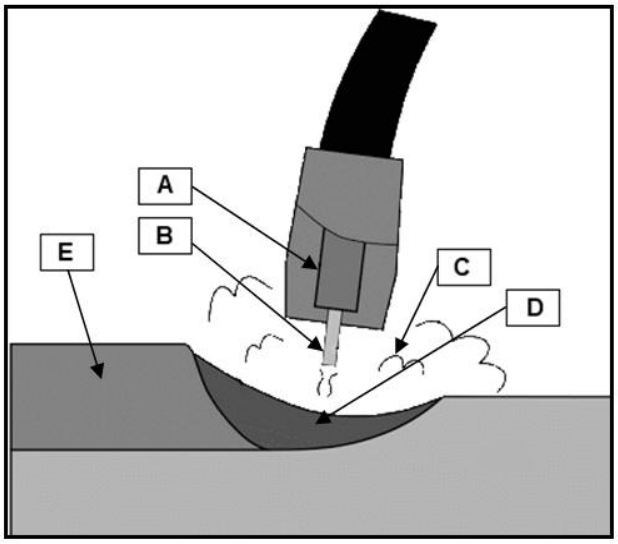
4.3.3 Name a defect that will occur when the gas working pressure is too low. (1)

4.4 The table below shows common MIG welding defects. Complete the table by writing only the answer next to the question numbers (4.4.1 to 4.4.4) in the ANSWER BOOK.

DEFECT	PROBABLE CAUSE	SOLUTION
4.4.1	Current too low Root gap too small	4.4.2
Spatter	Inadequate inductance Rusty or primed plate	4.4.3
Too much metal in the welding pool	4.4.4	Reduce wire speed

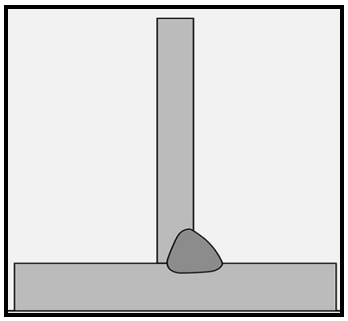
(4)

4.5 Label parts **A**, **B**, **C**, **D** and **E** in the MIG welding diagram below.



(5)

4.6 The picture below shows an arc weld T-joint.



4.6.1 Name the correct angle of the welding electrode in relation to the work piece when welding a T-joint. Give a reason for your answer. (2)

4.6.2 Name TWO methods that can be used to prevent shrinking and distortion when welding the two pieces of metal. (2)

4.7 Explain EACH of the following types of metal deterioration:

4.7.1 Friction (1)

4.7.2 Metal fatigue (1)

[35]

QUESTION 5: TOOLS, IMPLEMENTS AND EQUIPMENT

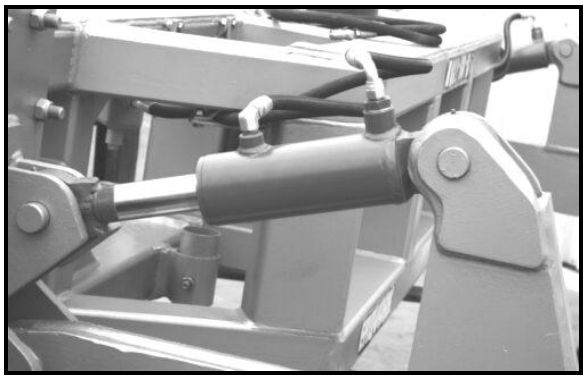
Start this question on a NEW page.

5.1 The picture below shows an edge cutter.

5.1.1 Name THREE items of personal protective equipment that must be worn when working with an edge cutter. (3)

5.1.2 List FOUR safety tips when working with an edge cutter. (4)

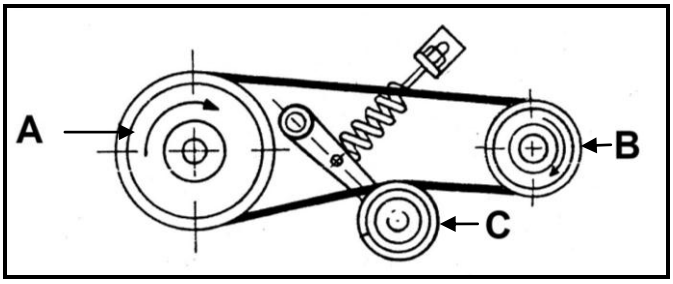
5.2 The image below shows a hydraulic cylinder fitted on a farm implement.



5.2.1 Identify the type of hydraulic cylinder shown in the image above. (1)

5.2.2 State FOUR advantages of the transmission oil that is used in the hydraulic cylinder. (4)

5.3 The illustration below shows a belt and pulley system found on a combine harvester.



5.3.1 Explain, by referring to the illustration above, why a V-belt would be preferred to a flat belt. (3)

5.3.2 Calculate the speed of pulley **B** if the speed of pulley **A** is 100 r/min. The diameter of pulley **A** is 300 mm and the diameter of pulley **B** is 120 mm.

Use the following formula:

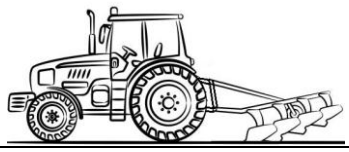
Na x Da = Ng x Dg

Na = speed of driving pulley
Da = diameter of driving pulley
Ng = speed of driven pulley
Dg = diameter of driven pulley (4)

5.3.3 Name pulley **C** and explain its function as applied in this system. (3)

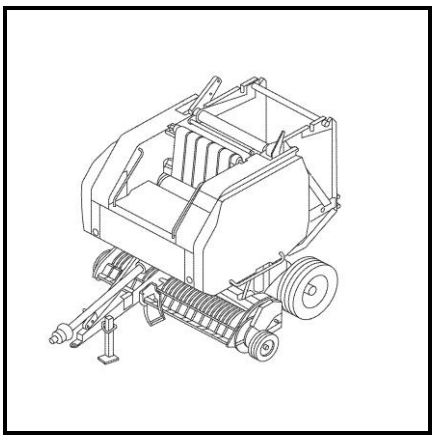
5.4 The images below show different problems associated with the hitching of an implement.

Complete the table by writing the answers next to the question numbers (5.4.1 to 5.4.3) in the ANSWER BOOK.

	PROBLEM	**SOLUTION**
	The rear end of the implement does not penetrate the soil.	5.4.1
	The implement works at an incorrect cross angle in relation to the tractor.	5.4.2
	The front of the tractor is lifting up.	5.4.3

(3)

5.5 The illustration below shows a round baler that can be used to bale round bales for animal feed. Study the illustration and answer the questions that follow.



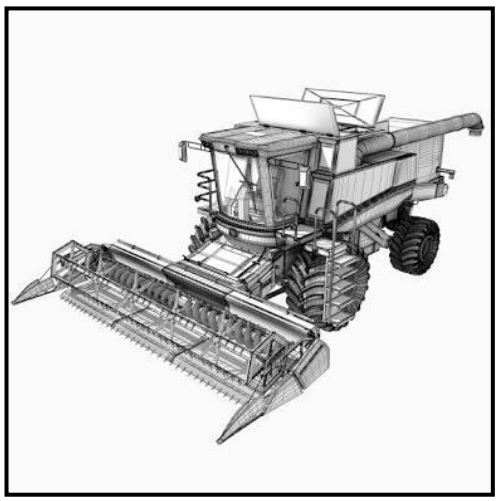
5.5.1 Identify the type of round baler in the illustration above and give a reason for your answer. (2)

5.5.2 Give TWO reasons for installing a slip clutch on the power take-off (PTO) shaft of the round baler. (2)

5.5.3 Explain FOUR tasks that must be completed when preparing a baler for the baling season. (4)

5.5.4 Suggest what should be done to prevent bales from rolling away when baling against a slope. (2)

5.6 The image below shows a combine harvester used for harvesting wheat.



5.6.1 Describe the working of the combine harvester from the moment that the wheat is cut and fed into the machine until the harvested wheat falls into the truck. (3)

5.6.2 Explain the disadvantages of NOT setting a combine harvester correctly before harvesting the wheat. (2)

[40]

QUESTION 6: WATER MANAGEMENT

Start this question on a NEW page.

6.1 The photograph below shows an irrigation sprinkler connected to a variable-rate applicator.

6.1.1 State the advantages of this type of irrigation sprinkler. (3)

6.1.2 Name TWO types of material that can block or obstruct this type of irrigation sprinkler. (2)

6.1.3 Name a device that can be installed in the irrigation system to prevent blockages. (1)

6.1.4 Name a specific device that is placed in a field to determine when the centre-pivot irrigation system must switch on to apply a certain amount of water to the crop according to the needs. (1)

6.2 The centre-pivot irrigation system below tends to get stuck in very wet clay soil. Suggest TWO ways in which to prevent this from happening.

(2)

6.3 Give the term used to describe the correct frequency and duration of irrigation in a field. (1)

6.4 Explain what *evapotranspiration* is and name a device that is used to measure it. (2)

6.5 The picture below shows a septic tank that is used to treat waste water from the farmhouse.

6.5.1 What is the purpose of the two round structures on top of the septic tank? (1)

6.5.2 Name THREE types of matter that can be found in the first compartment of a sewerage treatment system. (3)

6.5.3 Give TWO useful tips that must be considered when maintenance is done on the septic tank. (2)

6.5.4 Explain the functions of useful bacteria found in a septic tank. (3)

6.6 Discuss the function of the GPS device that is installed on a tractor. (2)

6.7 Explain the role of irrigation software in crop production. (5)

6.8 Give the name of EACH of the following water purification systems:

6.8.1 Remove impurities from water by a process of boiling and condensing (1)

6.8.2 Water is sent through two different liquids separated by a permeable film, which only allows water to pass through on molecular level (1)

[30]

TOTAL SECTION B: 160
GRAND TOTAL: 200