basic education

Department:
Basic Education
REPUBLIC OF SOUTH AFRICA

SENIOR CERTIFICATE EXAMINATIONS/ NATIONAL SENIOR CERTIFICATE EXAMINATIONS

AGRICULTURAL TECHNOLOGY

2022

MARKS: 200

TIME: 3 hours

This question paper consists of 17 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 Non-programmable calculators may be used.

    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 types of gases used in MIG welding:

A Argon, helium and CO_2
B Compressed air
C CO_2 and oxygen
D Acetylene and argon

1.1.2 Typical voltage range of the plasma-cutting machine:

A 10 to 100 volts
B 220 to 230 volts
C 20 to 50 volts
D 350 to 380 volts

1.1.3 A pneumatic tool that can be used to loosen wheel nuts on a tractor:

A Vice-grip spanner
B Torque wrench
C Ratchet spanner
D Air wrench

1.1.4 Which ONE of the following is regarded as a secondary cultivation tool?

A Plough
B Rotavator
C Tiller
D Ripper

1.1.5 A lawnmower cutting blade is manufactured from …

A carbon steel.
B stainless steel.
C brass.
D cast iron.

1.1.6 Which ONE of the following can NOT be used to provide drive from the tractor to the water pump on a crop sprayer?

A V-belt
B PTO shaft
C Drive chain
D Flat belt

1.1.7 The ram-type baler is fitted with a … attached to the side of the ram to separate the hay in the baling chamber from the rest.

A packing arm
B blade
C needle
D auger

1.1.8 This action causes a wind turbine to work less efficiently:

A Increasing the number of blades
B Changing the pitch of the blades to increase the surface area
C Changing the direction of the turbine to face the incoming wind
D Lack of maintenance

1.1.9 The energy contained in sunrays:

A Kinetic
B Static
C Solar
D X-ray

1.1.10 ... changes the band structure of stainless steel and causes a reduction in striking strength.

A Manganese
B Nickel
C Titanium
D Tungsten (10 x 2) (20)

1.2 Change the UNDERLINED word(s) in the following to make the statements TRUE. Write 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 <u>black</u> gas hose of the cutting torch is connected to the acetylene gas cylinder.

1.2.2 <u>Brazing</u> is a welding process during which worn parts can be built up by padding with a wear-resistant metal.

1.2.3 <u>Air pollution</u> is a serious health risk that can cause stress, fatigue and damage to the ears.

1.2.4 <u>VRT</u> systems can be used to pinpoint the exact position up to one metre.

1.2.5 <u>Oval bales</u> are easily handled and storage space is optimally utilised. (5 x 2) (10)

1.3 Choose a word or term in COLUMN B that matches the 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	A method of harvesting maize in wet conditions	A	water
		B	combine harvester
1.3.2	A major cause of metal fatigue on a hammer mill	C	nickel
1.3.3	A welding rod used to weld cast-iron parts	D	flint lighter
		E	hand-picking
1.3.4	A material that can be welded with a MIG welder	F	aluminium
1.3.5	The tool used to light the oxyacetylene welding flame	G	vibration
		H	lighter

(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 photograph below shows a person making a gasket for a differential cover.

State THREE possible factors that should be considered when choosing a suitable adhesive for this specific application. (3)

2.2 Discuss the advantages of using a water trough made of glass fibre rather than steel. (3)

2.3 Name FOUR chemical substances that do NOT have any effect on Teflon. (4)

2.4 The Vesconite bushes shown below are manufactured from highly specialised, internally lubricated, thermoplastic polymers.

2.4.1 Give ONE reason why Vesconite is used in dry applications and explain the answer. (2)

2.4.2 State TWO circumstances where Vesconite can be effectively used on a tractor to replace existing metal bushes. (2)

2.5 Metal cans are used for the storage and preservation of food and drinks.

2.5.1 State THREE factors that must be taken into consideration when identifying tin for the manufacturing of food cans. (3)

2.5.2 Indicate TWO commercial uses of tin, other than using it in the food canning industry. (2)

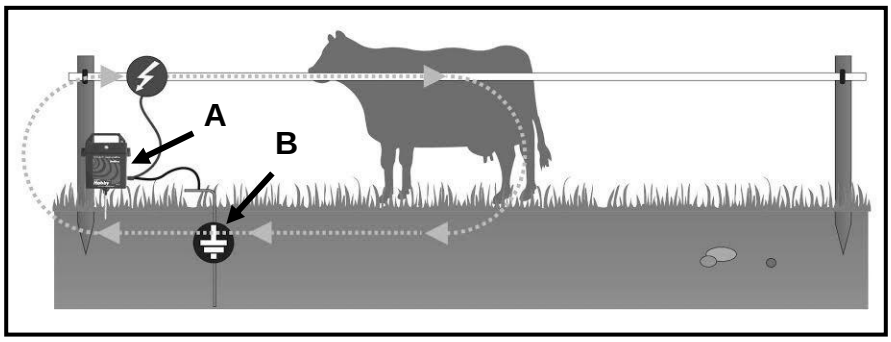
2.6 Explain TWO properties of bronze bushes that make them better suited for use in implements. (2)

2. 7 State THREE influences of manganese on stainless steel. (3)

2.8 The picture below shows a brass fitting. Justify the use of brass over copper for the manufacturing of water couplings.

(2)

2.9 The Illustration below shows an electrical fence that is used on a farm to keep animals separated. Study the illustration and answer the questions that follow.



2.9.1 Identify components **A** and **B** in the illustration. (2)

2.9.2 What is the maximum voltage allowed by legislation that can be applied in the system above? (1)

2.9.3 Describe the daily tasks that must be carried out to maintain an electric fence. (2)

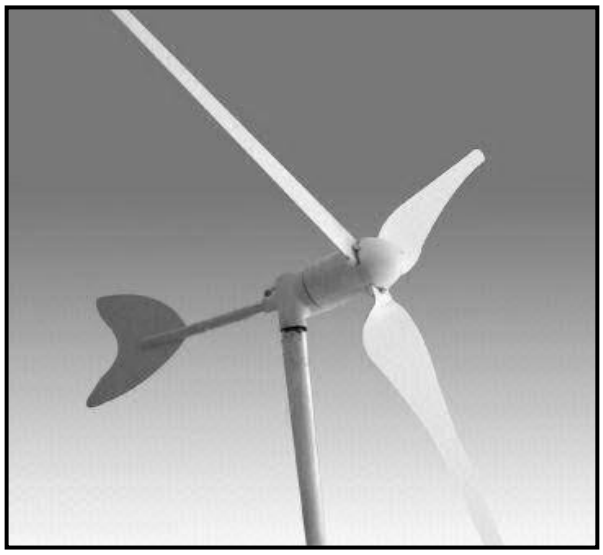
2.9.4 Explain FOUR soil conditions that can have a negative effect on the earthing efficiency of an electrical fence. (4)

[35]

QUESTION 3: ENERGY

Start this question on a NEW page.

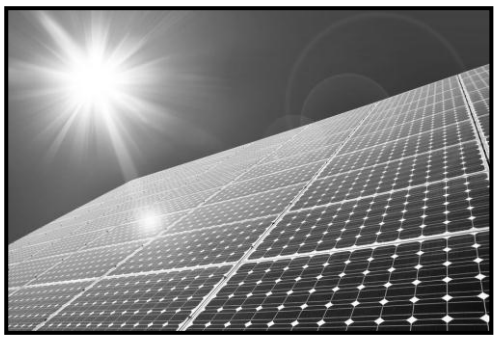
3.1 The image below shows a wind turbine.



3.1.1 State THREE important factors that must be considered when installing a wind turbine. (3)

3.1.2 Explain TWO benefits of wind turbines to a farm owner. (2)

3.2 Study the image below and answer the questions that follow.



3.2.1 Name the semi-conductive material used for the manufacturing of the photovoltaic solar panels. (1)

3.2.2 Explain the process when electrical energy is generated in a solar panel. (4)

3.3 Explain the advantages of a geothermal power station over a coal power station. (4)

3.4 State FOUR benefits of biofuel. (4)

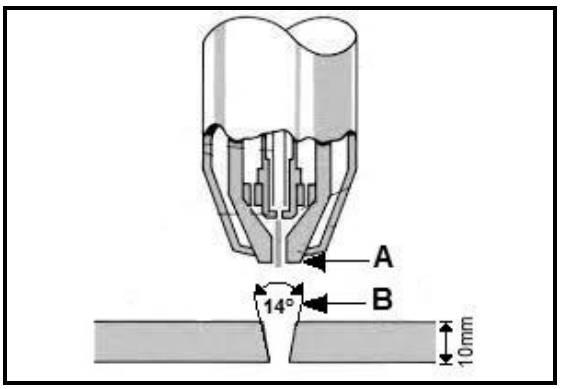
3.5 Name TWO resources for the manufacturing of methanol. (2)

[20]

QUESTION 4: SKILLS AND CONSTRUCTION PROCESSES

Start this question on a NEW page.

4.1 The diagram below shows the cutting nozzle of a plasma-cutting machine that is used to cut stainless steel.



4.1.1 Identify part **A**. (1)

4.1.2 Identify the problem indicated by arrow **B** that can occur when thick materials are cut with the plasma-cutting machine. (1)

4.1.3 Suggest an action to address the problem identified in QUESTION 4.1.2. (1)

4.1.4 Name TWO types of gases that are commonly used in the plasma-cutting process. (2)

4.2 Study the picture below of the oxyacetylene cutting apparatus that is used to cut metals and answer the questions that follow.

4.2.1 Name the TWO gases used during the oxyacetylene cutting process. (2)

4.2.2 List the advantages of the use of the oxyacetylene apparatus over the plasma cutter. (3)

4.2.3 Name the important safety measures to adhere to when working with the oxyacetylene cutting apparatus. (3)

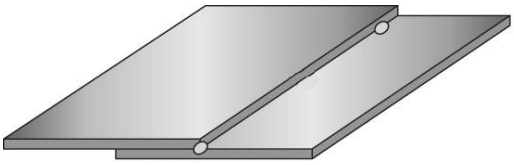
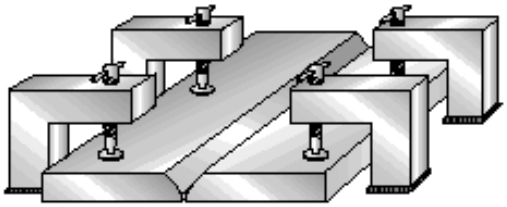
4.3 The picture below shows the MIG welding torch.

4.3.1 Describe the process when replacing a worn welding tip. (4)

4.3.2 Explain the use of anti-spatter spray during the MIG welding process. (2)

4.3.3 Give FOUR reasons for the welding wire not running smoothly through the welding hose. (4)

4.4 The table below shows three measures that can prevent different joints from moving during welding. Complete the table by naming the preventative measures in QUESTIONS 4.4.1 to 4.4.3.

4.4.1	
4.4.2	
4.4.3	

(3)

4.5

SCENARIO

You have been requested to design and manufacture a door for a horse stable.

The dimensions of the stable opening are 2 000 mm x 1 000 mm.

Two hinges and a latch must be attached to the door.

Given:

- Square tubing: 50 mm x 50 mm x 3 mm
- Round bar: 10 mm
- Mild steel plate: 1 000 mm x 1 000 mm x 3 mm
- Two hinges and one latch

Use the information above and draw a sketch of the stable door.

Marks will be allocated for the following:

Design	1
Hinges and latch	2
Dimensions	2
Neatness	1

(6)

4.6 A farmer must repair a broken implement in a field. Explain why he/she would use an inverter welder powered by a generator rather than a MIG welder. (3)

[35]

QUESTION 5: TOOLS, IMPLEMENTS AND EQUIPMENT

Start this question on a NEW page.

5.1 The picture below shows a fifteen-hectare lucerne field.

5.1.1 Name FIVE basic implements that can be used in the harvesting of lucerne. (5)

5.1.2 State THREE advantages of using machinery in the harvesting process. (3)

5.1.3 Name another method that can be used to cut lucerne. (1)

5.1.4 Name ONE safety device that is installed on a baling machine to protect the parts from being damaged by accidental obstructions. (1)

5.2 A combine harvester is a very expensive machine to operate and a farmer must do a cost calculation before he/she wants to use this machine for harvesting purposes.

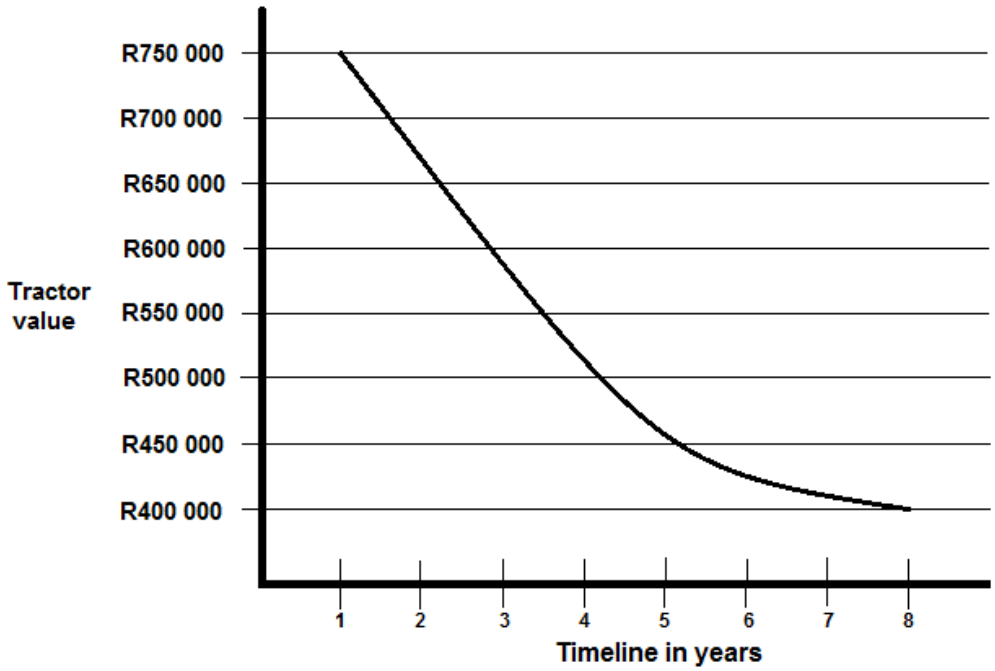
5.2.1 Use the following information (excluding value-added tax) to calculate the running costs of a combine harvester:

Fuel	R8 100,00
Oil	R1 200,00
Filters	R1 500,00
Labour	R3 000,00
Parts	R8 000,00

Show ALL calculations. (2)

5.2.2 Calculate the value-added tax (15%) payable on the total running cost of the combine harvester. (2)

5.3 The graph below illustrates the timeline of a new tractor bought by a farmer. The tractor was bought with a five-year maintenance plan.

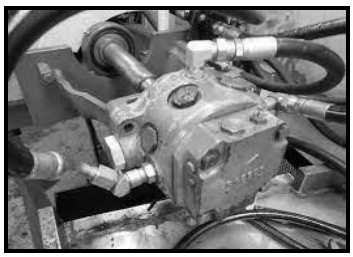


5.3.1 Give the graph a suitable label. (1)

5.3.2 Determine the right time to sell the tractor by analysing the data in the graph above AND give TWO reasons for your answer. (3)

5.3.3 State THREE actions a farmer can take to minimise excessive depreciation on the value of second-hand implements. (3)

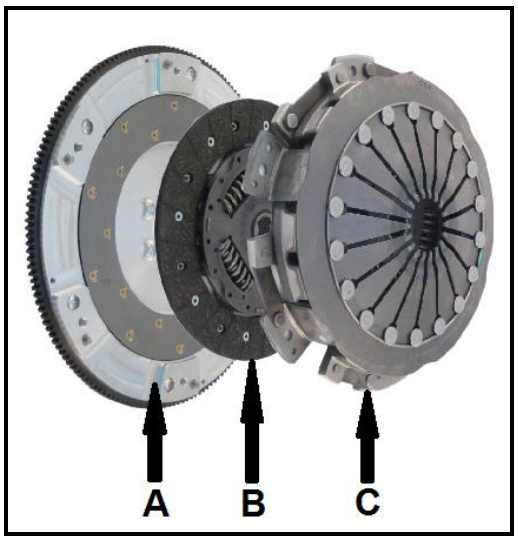
5.4 The pictures below illustrate three components used to link an implement to a tractor.

A	B	C
		

5.4.1 Identify components **A**, **B** and **C** and state TWO functions of EACH. (9)

5.4.2 Describe THREE important safety precautions applicable to component **C**. (3)

5.5 The picture below illustrates the THREE main components of a clutch assembly.



5.5.1 Identify components **A**, **B** and **C**. (3)

5.5.2 Give FOUR reasons for equipping a tractor with a clutch. (4)
[40]

QUESTION 6: WATER MANAGEMENT

Start this question on a NEW page.

6.1 Study the image of a centre-pivot irrigation system below and answer the questions that follow.

6.1.1 Explain the structure's ability to carry the heavy load of the irrigation system. (2)

6.1.2 Suggest ONE possible cause of sprinkler nozzle blockage and give a solution to the problem. (2)

6.1.3 State THREE factors to consider when selecting a water pump for the system above. (3)

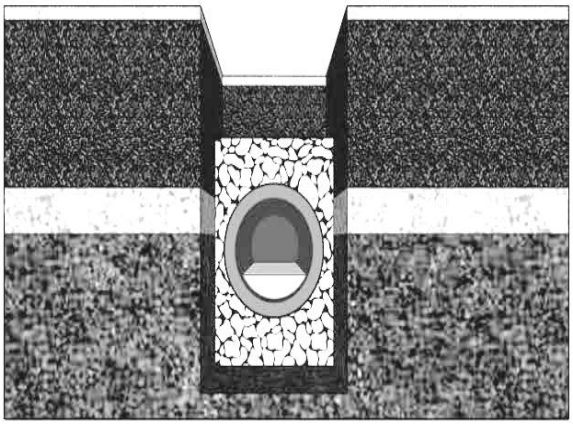
6.2 Name the process when an irrigation farmer sets the correct frequency and duration of water application to a crop to maximise plant growth. (1)

6.3 The image below shows a septic tank.

6.3.1 Identify the component indicated by arrow **A** and state its function. (2)

6.3.2 Name the requirements that must be adhered to to keep this septic system functional. (4)

6.4 The illustration below shows a drainage system that can be used to drain waterlogged fields.



6.4.1 Explain the technical layout of this drainage system. (3)

6.4.2 Name a system that can quickly move large amounts of water from waterlogged fields. (1)

6.4.3 Explain a few aspects that can cause problems if there is no drainage system installed around the perimeter of a building. (3)

6.5 The pictures below show irrigation timers. Study the pictures and answer the questions that follow.

A

B

6.5.1 Identify timer **A**. (1)

6.5.2 State TWO disadvantages of timer **B**. (2)

6.5.3 Identify the timer (**A** or **B**) that has a multiple programming function. (1)

6.6 State THREE advantages of using the faucet-water filtration system shown below.

(3)

6.7 Recommend a monitoring system for EACH scenario in the table below. Write the answers next to the question numbers (6.7.1 and 6.7.2) in the ANSWER BOOK.

SCENARIO	MONITORING SYSTEM
Control the fertiliser application rate to a crop precisely	6.7.1
Determine areas of undergrowth in a field	6.7.2

(2)
[30]

TOTAL SECTION B: 160
GRAND TOTAL: 200