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**NATIONAL
SENIOR CERTIFICATE**

GRADE 12

AGRICULTURAL TECHNOLOGY

NOVEMBER 2022

MARKS: 200

TIME: 3 hours

This question paper consists of 19 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 Which ONE of the following is NOT a safety measure when using a tractor lawnmower?

- A Be aware of power take-offs (PTOs).
- B Turn off the engine before dismounting.
- C Extra riders are allowed on the mower to monitor the process.
- D Both feet must be kept on the footrest of the mower.

1.1.2 Which ONE of the following devices can NOT make use of pneumatics?

- A Hydraulic cylinders
- B Spray gun
- C Air wrench
- D Nail gun

1.1.3 Which ONE of the following power take-off (PTO) safety measures is wrong and does NOT fit in with the rest?

- A Use the PTO shaft at a 90° angle.
- B Stop the PTO before dismounting the tractor.
- C Ensure that PTO screens are in place before starting to work.
- D Never climb over a PTO shaft while it is in motion.

1.1.4 Which ONE of the following can NOT cause a tractor to overturn because of centre of gravity movement?

- A Carrying a bale too high on the front-end loader
- B Rounding corners at high speed
- C Working against a slope
- D Filling the tractor rear wheels with water

1.1.5 Which ONE of the following is used to adjust the cross angle of an implement in relation to a tractor?

- A Top link
- B Automatic depth control
- C Levelling box
- D Stabilising chains

- 1.1.6 The process whereby household water goes through two different filters which are separated by a permeable film. This film allows water to pass through at the molecular level:
- A Distillation
 - B Evaporation
 - C Transpiration
 - D Reverse osmosis
- 1.1.7 In an array of six solar panels connected in series measuring 180 watts each, the total output power will be equal to ...
- A 360 W.
 - B 1,08 kW.
 - C 1,14 kW.
 - D 540 W.
- 1.1.8 A/An ... is included in the electric circuit of a home protecting a user from electric shock by a faulty appliance.
- A transistor
 - B relay
 - C lightning protector
 - D earth-leakage circuit-breaker
- 1.1.9 ... is/are essential when working with dangerous gases in the workplace.
- A A face mask
 - B A helmet
 - C A respirator
 - D Ear protection
- 1.1.10 A ... does NOT play a role in the rectification process of an inverter welder current.
- A ballast resistor
 - B diode
 - C capacitor
 - D transformer
- (10 x 2) (20)

1.2 Change the UNDERLINED word 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 In a geothermal plant, underground fuel is used to generate power.

1.2.2 A hammer mill is an example of fixed capital.

1.2.3 Mechanisation allows for tractors and implements to be interchangeable and easier to handle.

1.2.4 The function of a differential is to further reduce speed and create less torque.

1.2.5 Energy generated by a photovoltaic cell can be stored in a resistor.
(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	Fermenting and distilling starch and sugar crops	A	biodiesel
1.3.2	Gas from soil and landfills	B	universal joint
1.3.3	Helps the farmer to produce better, quicker, cheaper and more effectively	C	fertilisation
1.3.4	Type of coupling that allows a rod to bend in any direction; commonly used in shafts that transmit rotary motion	D	methane
		E	carbon monoxide
		F	mechanisation
		G	ethanol
1.3.5	Trans-esterification of fatty acids	H	power take-off shaft

(5 x 2)

(10)

TOTAL SECTION A: 40

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

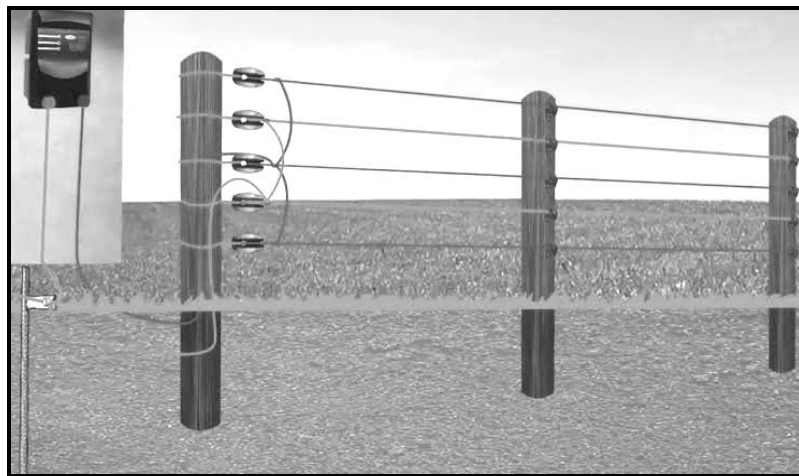
Start this question on a NEW page.

- 2.1 Name the alloy metal that is specifically used to manufacture EACH of the following products and give a reason why the metal is used:
- 2.1.1 Wine tanks (2)
- 2.1.2 Fitting for hot-water copper pipes (2)
- 2.1.3 Hammers that can be used in an explosive atmosphere (2)
- 2.2 Give ONE example of where the following materials are used on a farm:
- 2.2.1 High-tensile steel (1)
- 2.2.2 Cast iron (1)
- 2.3 Describe the *annealing process* of copper. (2)
- 2.4 The picture below shows a fibreglass water trough. There is a crack in the trough and an adhesive is needed to repair the crack.



- 2.4.1 Name the TWO most important aspects to consider when choosing an adhesive to repair the fibreglass water trough. (2)
- 2.4.2 Explain the process of preparing the fibreglass water trough before the adhesive is applied. (2)
- 2.4.3 Name TWO methods besides adhesives used to join fibreglass parts. (2)
- 2.4.4 Name TWO methods to add colour to a fibreglass trough. (2)

- 2.5 Analyse the effect of extreme heat on the following materials:
- 2.5.1 Bakelite (1)
- 2.5.2 Perspex (1)
- 2.5.3 Silicon (1)
- 2.6 Discuss the *friction ability* of Vesconite. (2)
- 2.7 The picture below shows an electric fence on a farm. The voltage of the fence is 10 000 volts.



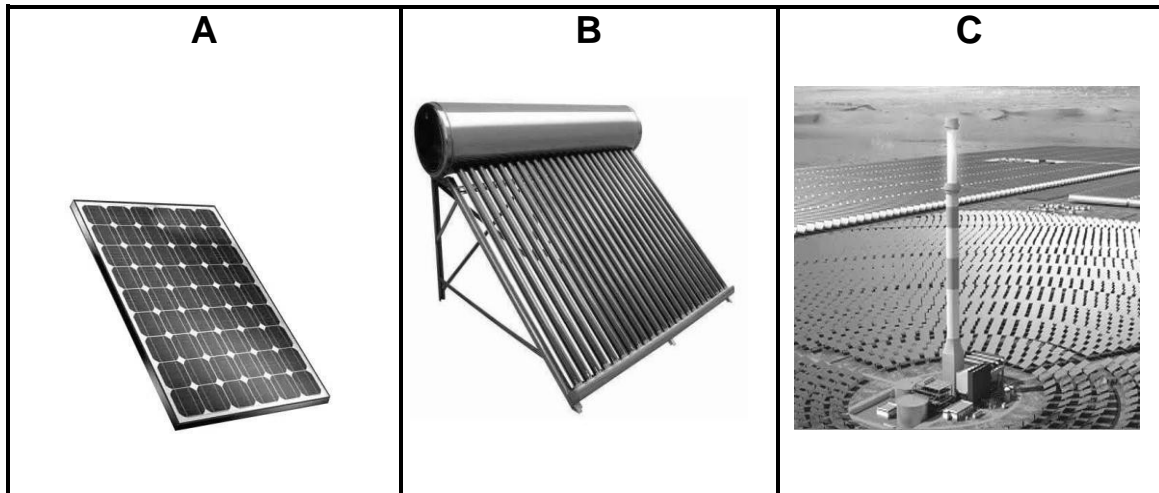
- 2.7.1 Give THREE design requirements prescribed for warning signs on electric fences. (3)
- 2.7.2 Suggest TWO situations in which an electrical fence could be used on a farm. (2)
- 2.7.3 Name TWO alternative energy sources that could be used to provide energy to an electrical fence. (2)
- 2.8 Identify the THREE components needed to create a fire. (3)
- 2.9 Give TWO reasons for using resin casting as an insulating material when joining three-phase electrical wires. (2)

[35]

QUESTION 3: ENERGY

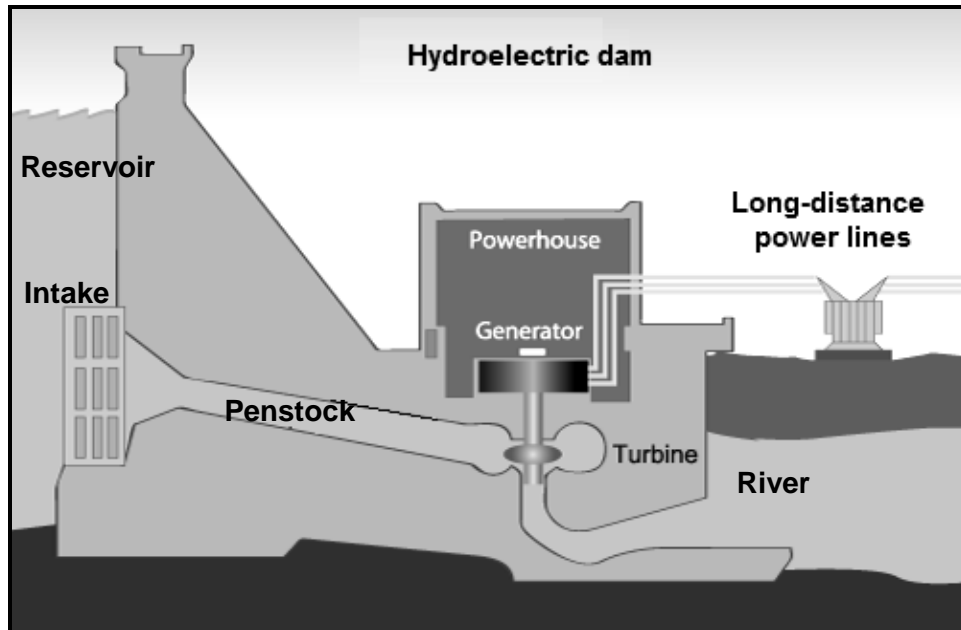
Start this question on a NEW page.

- 3.1 Study the pictures of the alternative energy sources **A**, **B** and **C** below and answer the questions that follow.



- 3.1.1 Choose the energy source that makes use of a generator. (1)
- 3.1.2 Describe the working principles of energy source **B**. (3)
- 3.1.3 Identify the device that must be connected to energy source **A** to change direct current to alternating current. (1)
- 3.1.4 Identify energy source **C**. (1)
- 3.2 State TWO disadvantages of wind turbine blades turning too fast. (2)
- 3.3 State THREE geographical challenges that may arise when doing a survey for a geothermal energy power station. (3)
- 3.4 Petroleum is a fuel resource that depletes rapidly.
- 3.4.1 Name an alternative racing fuel that could supplement petroleum. (1)
- 3.4.2 Identify THREE substances that could be used to manufacture the alternative racing fuel named in QUESTION 3.4.1. (3)

3.5 Study the image of a power plant below and answer the questions that follow.



3.5.1 State THREE disadvantages associated with hydroelectric power plants. (3)

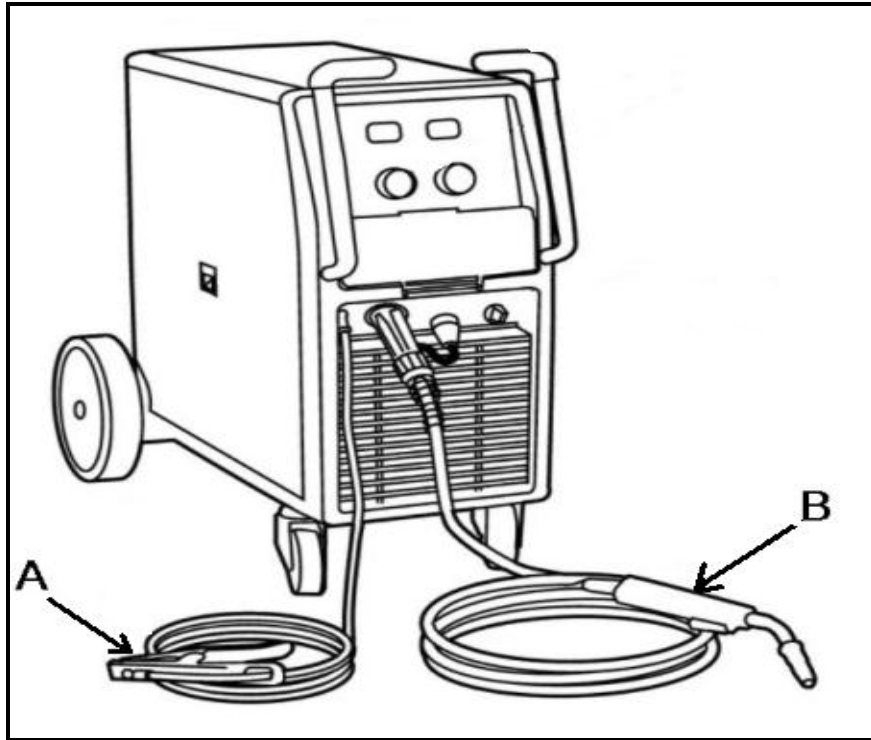
3.5.2 Give TWO reasons why hydroelectric power plants are limited in South Africa. (2)

[20]

QUESTION 4: SKILLS AND CONSTRUCTION PROCESSES

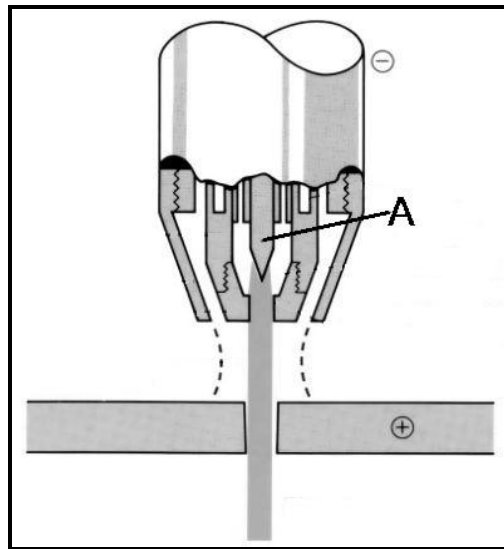
Start this question on a NEW page.

- 4.1 Study the illustration of an MIG welding machine below and answer the questions that follow.



- 4.1.1 Identify parts **A** and **B**. (2)
- 4.1.2 Name the apparatus that can be attached to the welding machine to weld aluminium. (1)
- 4.1.3 Name TWO gases that can be used with MIG welding. (2)
- 4.1.4 Name THREE different metals that can be welded successfully with the MIG welding machine. (3)

4.2 Plasma cutting is a quick and effective way to cut through steel. The diagram below shows the nozzle of a plasma cutter.



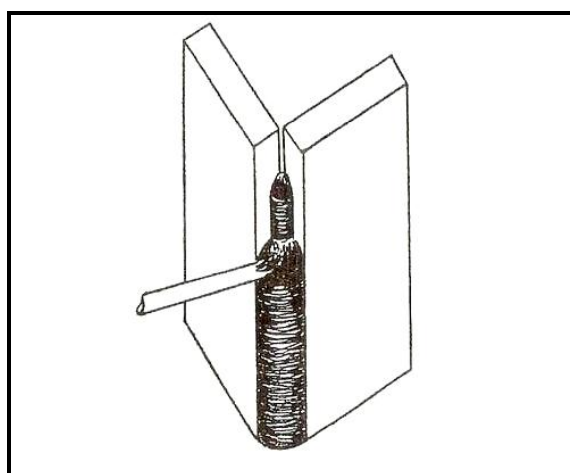
4.2.1 Identify the material used for part **A**. (1)

4.2.2 Briefly describe the *plasma-cutting process*. (3)

4.3 Name TWO types of metals that can be cut using oxyacetylene. (2)

4.4 Briefly describe the process of shutting down an oxyacetylene flame and bleeding the system. (5)

4.5 Study the illustration of an arc welding process below and answer the questions that follow.

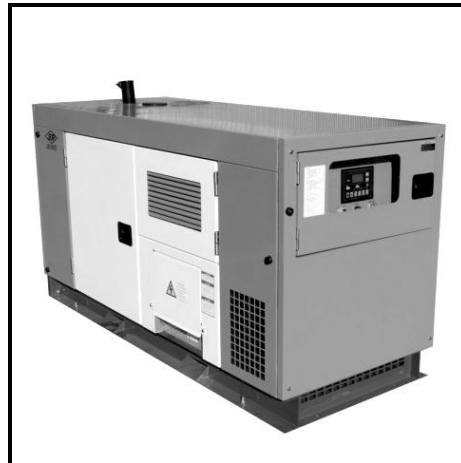


4.5.1 Describe the *process of vertical up arc welding*. (5)

4.5.2 Draw THREE different types of welding runs used for vertical welding. (3)

4.6 Read the scenario below.

You have been requested to install a 50 kVA generator, similar to the one shown below, on a dairy farm to prevent the farmer from suffering great losses during power failures.



The generator must be installed on a strong, level concrete foundation.

The measurements for the generator are 2 300 mm long, 1 000 mm wide and 1 300 mm high.

The size of the (concrete) block is 2 500 mm x 1 200 mm x 250 mm.

4.6.1 Calculate the volume of concrete needed.

Formula: Volume = length x width x height

(3)

4.6.2 Design and sketch a roof that has to protect the generator from unfavourable weather conditions. Show at least TWO measurements.

Marks will be allocated as follows:

Roof and construction	2
Poles	1
Measurements	1
Neatness	1

(5)
[35]

QUESTION 5: TOOLS, IMPLEMENTS AND EQUIPMENT

Start this question on a NEW page.

- 5.1 During the maize harvesting season, a farmer notices that rain is an imminent hazard.



- 5.1.1 State TWO measures the farmer can take to ensure that the maize will be harvested on time. (2)
- 5.1.2 Identify an alternative method, other than a combine harvester, that can be used for harvesting. Justify your answer. (2)

- 5.2 The picture below shows a baler.



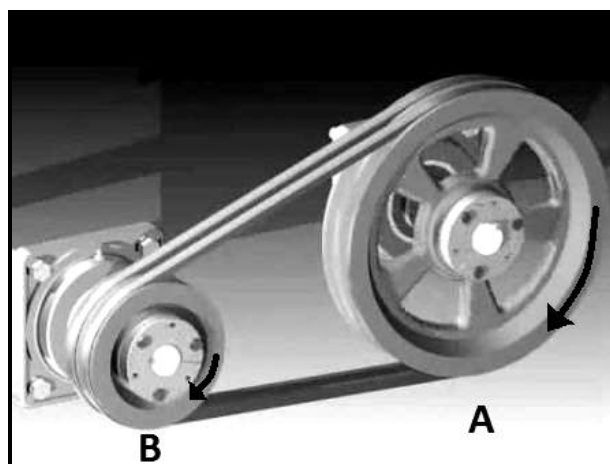
- 5.2.1 Recommend THREE aspects to consider when buying a new baler. (3)
- 5.2.2 As you prepare to buy a second-hand baler, one becomes available at a reasonable price. Name THREE points to consider before buying a second-hand baler. (3)

5.3 The pictures below show two baling machines.



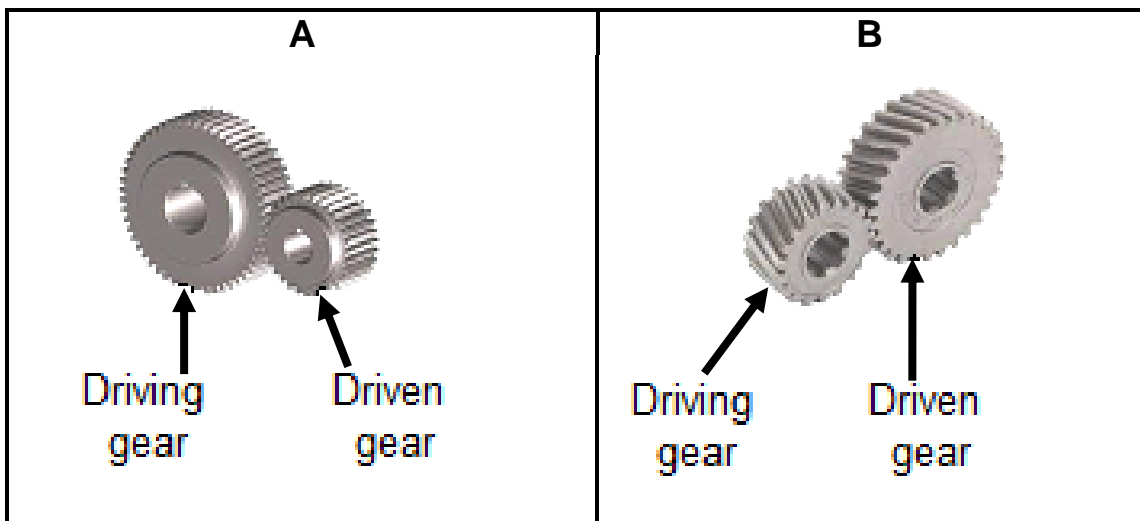
- 5.3.1 Which ONE of the bales in **A** or **B** would use less space during transportation? (1)
- 5.3.2 Give ONE reason to justify your answer to QUESTION 5.3.1. (1)
- 5.3.3 From the bales (in **A** or **B**) above, identify the bale that can be wrapped. (1)
- 5.3.4 Give a reason why the baling process in **B** can be used until it starts raining. (1)
- 5.3.5 Name FIVE round baler safety measures that young, upcoming farmers should consider. (5)

5.4 The picture below indicates the direction in which two pulleys, **A** and **B**, rotate.



- 5.4.1 Identify the type of belt which would best fit on the pulley system above. Give ONE reason for your answer. (2)
- 5.4.2 Indicate how you can change the direction in which pulley **A** rotates. (1)

5.5 Study the pictures of two types of gears below and answer the questions that follow.



5.5.1 Identify gears **A** and **B**. (2)

5.5.2 Calculate and determine the ratio of the gear connection in **A** using the following information:

Driving gear: 128 teeth
Driven gear: 16 teeth

(3)

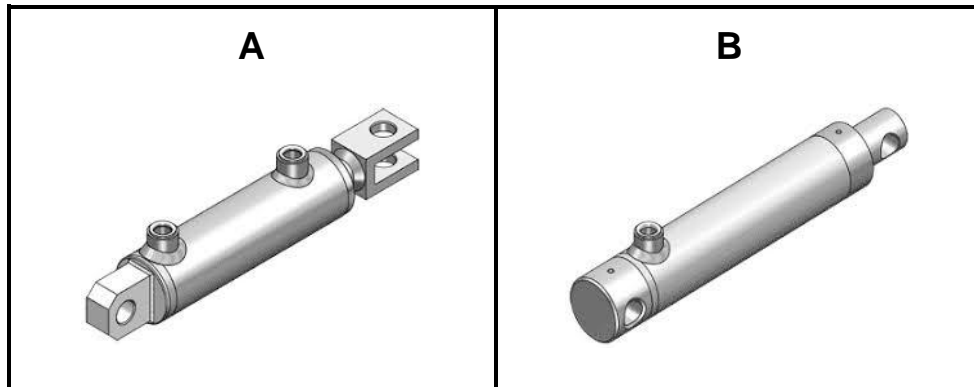
5.5.3 Tabulate ONE advantage and ONE disadvantage of EACH gear assembly. Redraw the table in your ANSWER BOOK and complete it.

GEAR ASSEMBLY	ADVANTAGE	DISADVANTAGE
A		
B		

(4)

5.5.4 From the gears identified in QUESTION 5.5.1, choose the gear assembly which would improve speed. (2)

5.6 Study the pictures below and answer the questions that follow.






- 5.6.1 Identify cylinders **A** and **B**. (2)
- 5.6.2 Choose which **ONE** of the cylinders is most suitable on a front-end loader. (1)
- 5.6.3 Briefly explain the reason for the answer to QUESTION 5.6.2. (2)
- 5.6.4 Give **TWO** reasons to justify the use of transmission oil in a tractor hydraulic system. (2)
- [40]**

QUESTION 6: WATER MANAGEMENT

Start this question on a NEW page.

6.1 The pictures below show three components of an irrigation system. Name the different components and give ONE function of EACH. Write only the answer next to the question numbers (6.1.1 to 6.1.6) in the ANSWER BOOK.

	NAME OF COMPONENT	FUNCTION OF COMPONENT
	6.1.1	6.1.2
	6.1.3	6.1.4
	6.1.5	6.1.6

(6)

6.2 A farmer has a submersible pump in a borehole that provides water to the irrigation system of his grazing field. It takes 8 minutes to fill the 10 000-litre reservoir.

6.2.1 Give TWO reasons for determining the flow rate of the pump. (2)

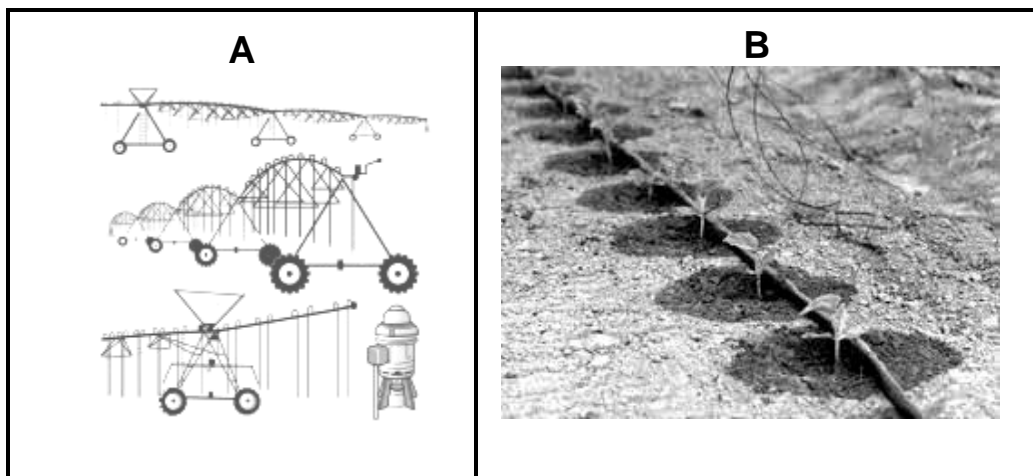
6.2.2 Calculate the flow rate in litres per minute of the pump.

$$\text{Flow rate} = \text{Content} \div \text{Time}$$

(Show ALL calculations.) (3)

6.3 A hunter shot a kudu and needs to notify the ranger of the exact location of the animal. What type of device is suitable for sending this location? (1)

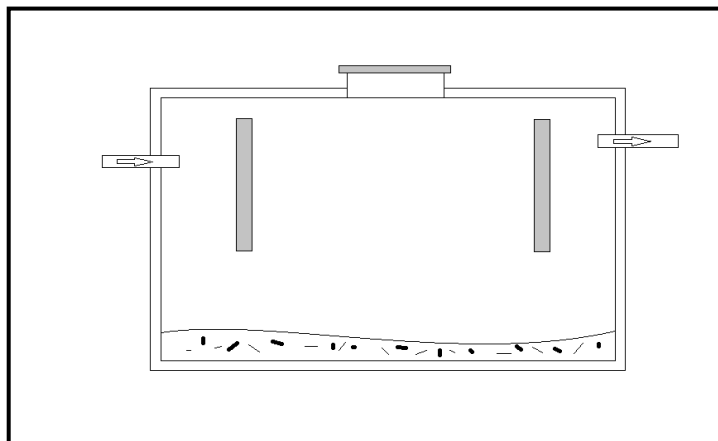
6.4 Study the pictures of two irrigation systems below and answer the questions that follow.



6.4.1 Choose the irrigation system, **A** or **B**, that is most suitable for fields on steep slopes. Motivate your answer. (3)

6.4.2 Why would irrigation system **A** be preferred to system **B** on a planted grazing field? (2)

6.5 The design below shows a septic tank.



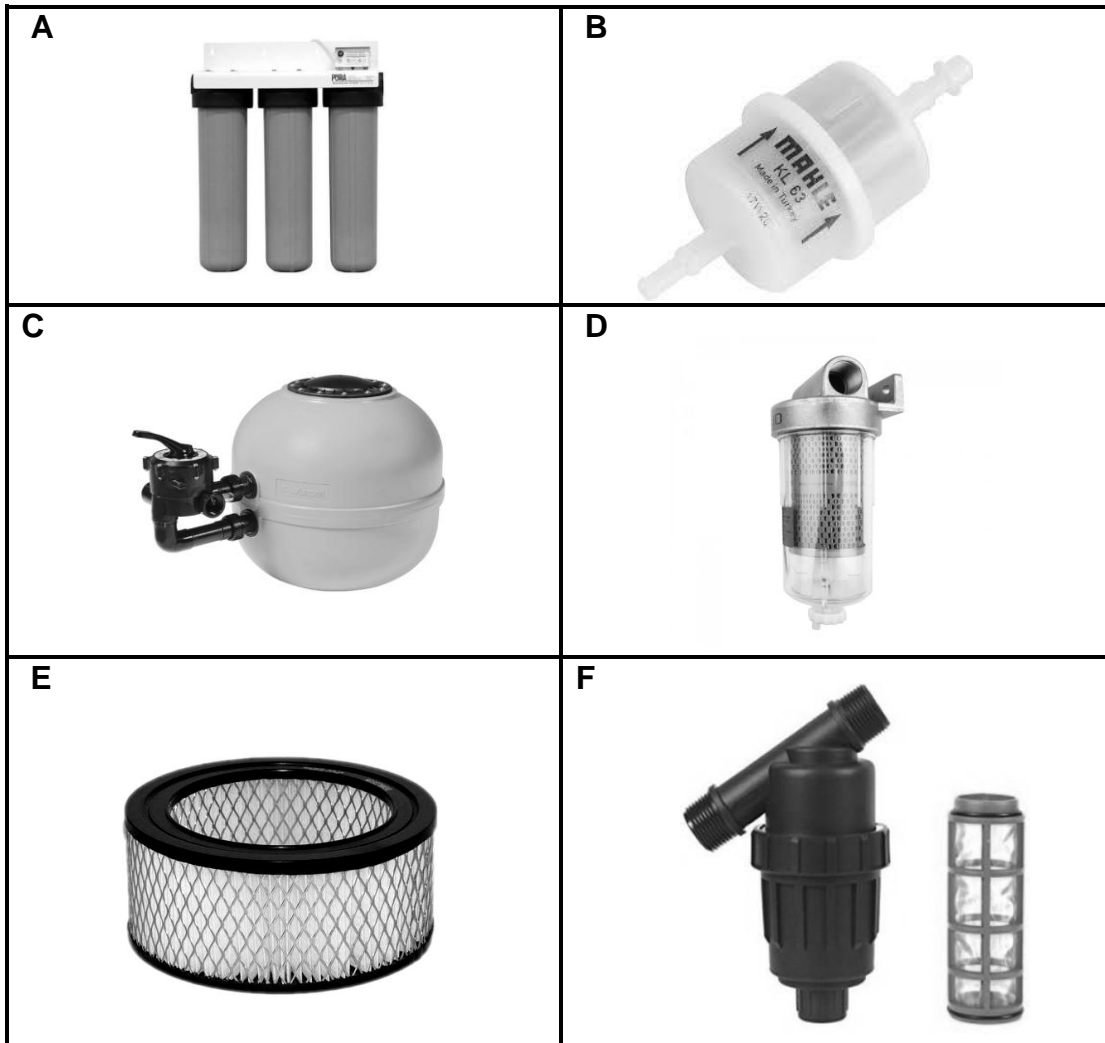
6.5.1 Identify the design error in the drawing of the septic tank above. (2)

6.5.2 Describe the importance of installing a manhole in a septic tank. (4)

6.5.3 Suggest a suitable drainage system to be connected to the outlet of the septic tank. (1)

6.6 What is the main cause of blockages in the sewage system of a town or city? (1)

6.7 Study the images below and answer the questions that follow.



- 6.7.1 Identify the type of filter that connects with a water softener. Write only the letter (A–F). (1)
- 6.7.2 Which ONE of the filters above is installed ON a micro-irrigation system? Write only the letter (A–F). (1)
- 6.7.3 Give ONE example of where filter C will be used. (1)
- 6.7.4 Rewrite the following sentence to make the statement TRUE:
Filtration always takes place from the **inside/outside** to the **inside/outside** of the filter. (2)

[30]

TOTAL SECTION B: 160
GRAND TOTAL: 200