



# basic education

Department:  
Basic Education  
**REPUBLIC OF SOUTH AFRICA**

## **NATIONAL SENIOR CERTIFICATE**

**GRADE 12**

**AGRICULTURAL TECHNOLOGY**

**NOVEMBER 2017**

**MARKS: 200**

**TIME: 3 hours**

**This question paper consists of 16 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 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 number (1.1.1–1.1.10) in the ANSWER BOOK, for example 1.1.11 D.

1.1.1 The best type of isolation material that is used to isolate an electric fence line from the supporting posts is ...

- A copper.
- B aluminium.
- C ceramic.
- D steel.

1.1.2 There is a constant change in the angle between the welding rod and the work piece during this welding process:

- A Pipe welding
- B Overhead welding
- C Vertical welding
- D Horizontal welding

1.1.3 The gas that must be removed when doing metal inert-gas (MIG) welding because it makes welding difficult:

- A Helium
- B Oxygen
- C Argon
- D Shielding gas

1.1.4 Timing of the ram baler means the ...

- A exact moment when the needles lift the binding rope so that the compressed hay can be bound.
- B number of bales that are produced by the baler.
- C rotational speed of the power take-off shaft (PTO) in relation to the ground speed of the baler.
- D protection of the auger when overloading occurs.

1.1.5 The main function of the shear bolt is to act as a ... mechanism.

- A slip
- B safety
- C drive
- D cutting

1.1.6 The three-point mechanism was designed by ...

- A John Deere.
- B Henry Ford.
- C Alva Laval.
- D Harry Ferguson.

1.1.7 Black smoke from the exhaust of a tractor indicates ...

- A a too rich diesel mixture.
- B a water leak into the combustion chamber.
- C worn piston rings.
- D that the engine uses oil.

1.1.8 Stainless steel is a combination of the following metals:

- A Steel, aluminium, zinc and nickel
- B Steel, copper, tin and lead
- C Steel, chromium, magnesium and nickel
- D Steel, silver, brass and lead

1.1.9 The synthetic material with the best heat resistance ability:

- A Bakelite
- B Perspex
- C Rubber
- D Nylon

1.1.10 Vibration in the hammer mill can be reduced by ...

- A applying the handbrake on the tractor.
- B anchoring the hammer mill properly.
- C using V-belts to drive the hammer mill.
- D using new sieves on the hammer mill.

(10 x 2) (20)

1.2 Change the UNDERLINED word in each of the following statements to make the statements TRUE. Write only the word next to the question number (1.2.1–1.2.5) in the ANSWER BOOK, for example 1.2.6 Tractor.

1.2.1 Cast iron must be cooled to prevent cracking of the joint after welding.

1.2.2 Deep holes are drilled into the earth until a gas source for harnessing geothermal energy is found.

1.2.3 The alternator converts direct current into alternating current.

1.2.4 Implements, equipment and machinery are examples of fixed capital.

1.2.5 A bearing is a machine component that creates friction between the moving component and the shaft.

(5 x 2) (10)

- 1.3 Choose a word/term from COLUMN B that matches the description in COLUMN A. Write down only the letter (A–H) next to the question number (1.3.1–1.3.5) in the ANSWER BOOK, for example 1.3.6 I.

COLUMN A		COLUMN B	
1.3.1	A drive system that draws tighter round the pulley when the tension on it increases	A	variable-rate technology (VRT)
		B	chain
1.3.2	The drive method that has the ability to drive a machine over a long distance	C	Internet
		D	weather station
1.3.3	The pneumatic tool that is used in a farm workshop to fasten nuts and bolts	E	hydraulic wrench
		F	air pressure wrench
1.3.4	The device with the ability to precisely control the fertiliser application rate on a planter	G	flat belt
		H	V-belt
1.3.5	The source from which the smart controller of a centre-pivot irrigation system receives its data		

(5 x 2)

(10)

**TOTAL SECTION A: 40**

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

(Start this question on a NEW page.)

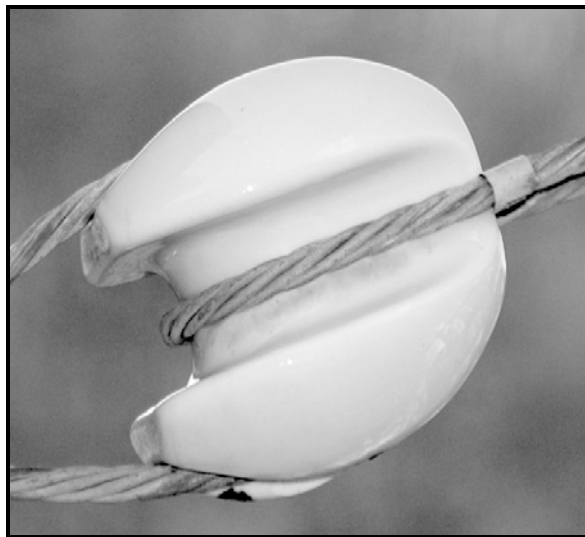
2.1 A farmer has to erect an electric fence around the buildings on the farm for security reasons.

2.1.1 Name the minimum size of the warning sign for an electric fence. (2)

2.1.2 Write down the minimum distance between two separate electric fences with different energisers. (1)

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

2.1.4 How would you know when an isolator, like the one below, is cracked?



2.1.5 How are electric fence wires protected against rust? (2)

2.1.6 Make a neat freehand drawing of a standard electric fence with various essential components. (1)

Marks will be awarded as follows:

- Labels (1)
- Correct layout (1)
- Any FOUR components (4)

2.2 Farmers prefer using glass fibre for various purposes on a farm because of its properties.

2.2.1 State FOUR precautionary measures that must be followed when working with glass fibre. (4)

2.2.2 State THREE uses of glass fibre products on a farm. (3)

2.3 Below is a photograph of a typical adhesive. Answer the questions that follow.



2.3.1 Explain the term *inflammability* of an adhesive. (2)

2.3.2 What recommendations would you make to improve the cohesion properties of an adhesive? (2)

2.4 The following questions refer to synthetic materials.

2.4.1 Name TWO uses of Vesconite on a farm. (2)

2.4.2 What is the melting point of Teflon? (1)

2.4.3 Why is it easy to remove a Vesconite bush from a shaft or housing? (1)

2.5 Stainless steel is an alloy that consists of various elements.

2.5.1 How will you reduce magnetism in stainless steel when you do not want to lose tensile strength? (1)

2.5.2 Name THREE influences that nickel has on stainless steel. (3)

2.6 Copper is alloyed with various metals to get different properties.

2.6.1 Name the metal that is added to copper to form bronze. (1)

2.6.2 State TWO uses of phosphor bronze as a copper alloy. (2)

[35]

**QUESTION 3: ENERGY**

**(Start this question on a NEW page.)**

- 3.1 A photograph of a wind turbine is shown below. Answer the questions that follow.



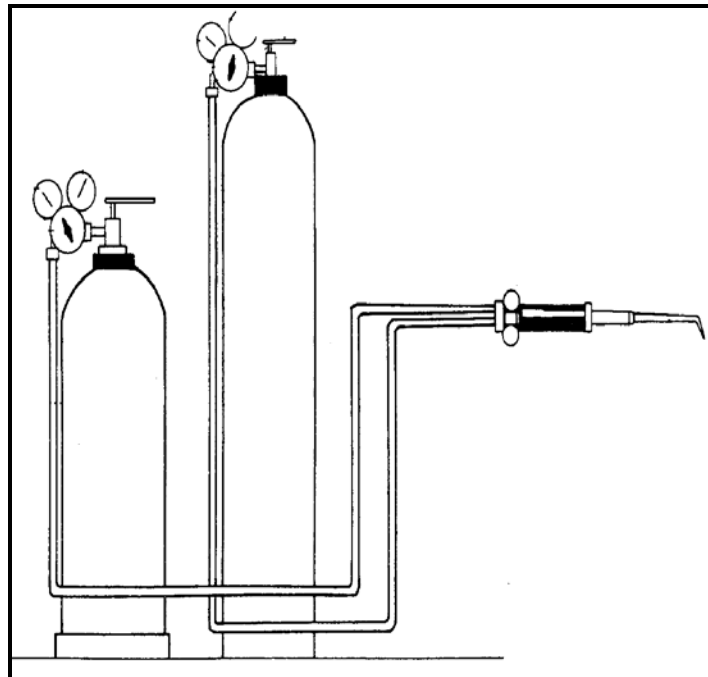
- 3.1.1 Name THREE environmental factors that must be considered before purchasing a wind turbine for use on a farm. (3)
- 3.1.2 State FOUR advantages of using wind energy to generate electricity on a farm. (4)
- 3.1.3 The rotor of a wind turbine produces low-speed rotation with a high torque. What device can be installed in the wind turbine to increase the speed of the input shaft? (1)
- 3.2 Describe FIVE technical factors that can prevent a photovoltaic system from functioning effectively. (5)
- 3.3 Discuss the function and working of an inverter in a 12 volt system when you want to use a 220 volt electric drill. (4)
- 3.4 Name THREE plants that can be used to manufacture biodiesel. (3)

**[20]**



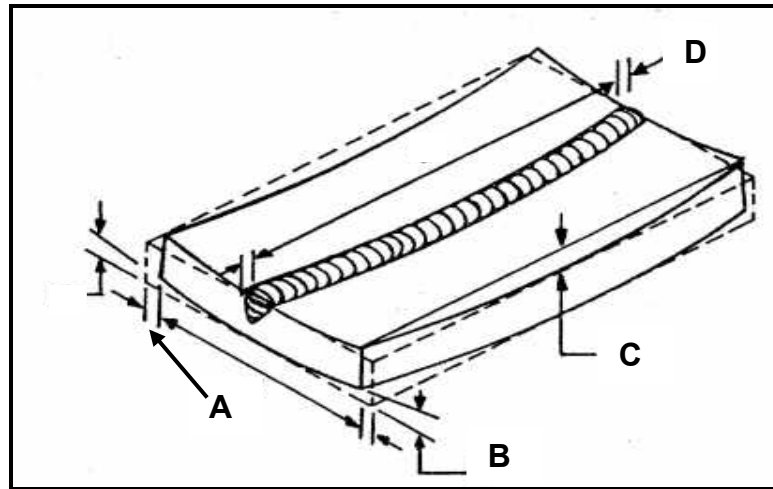
**QUESTION 4: SKILLS AND CONSTRUCTION PROCESSES****(Start this question on a NEW page.)**

- 4.1 Plasma cutting is an advanced method used to cut metal.
- 4.1.1 Name TWO types of gases that may be used when cutting with the plasma-cutting machine. (2)
- 4.1.2 What is the polarity of the earth clamp on the plasma-cutting machine? (1)
- 4.1.3 Name TWO important personal safety items that must be worn for protection when doing plasma cutting. (2)
- 4.2 The illustration below shows an oxyacetylene welding apparatus. Answer the questions that follow.

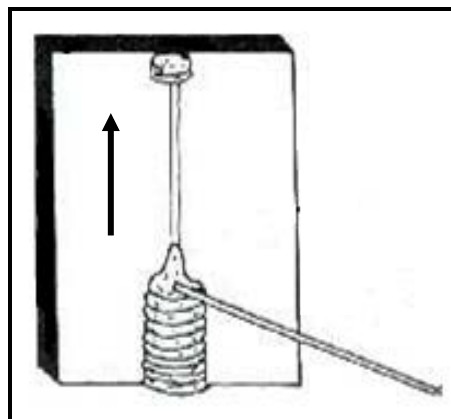


- 4.2.1 Name THREE types of metal that can be cut with an oxyacetylene cutting set. (3)
- 4.2.2 Describe the procedures that must be followed to successfully weld with the oxyacetylene apparatus in the overhead welding position. (4)

- 4.3 The sketch below shows FOUR types of metal distortion that can occur during the arc-welding process. Answer the questions that follow.



- 4.3.1 Name the type of metal distortion that occurs at **A** and **B**. (2)
- 4.3.2 State THREE factors that can influence the shrinking that occurs in a welding joint. (3)
- 4.3.3 State TWO measures to prevent distortion of a welding joint. (2)
- 4.4 Describe the vertical up arc welding process, as shown in the sketch below.



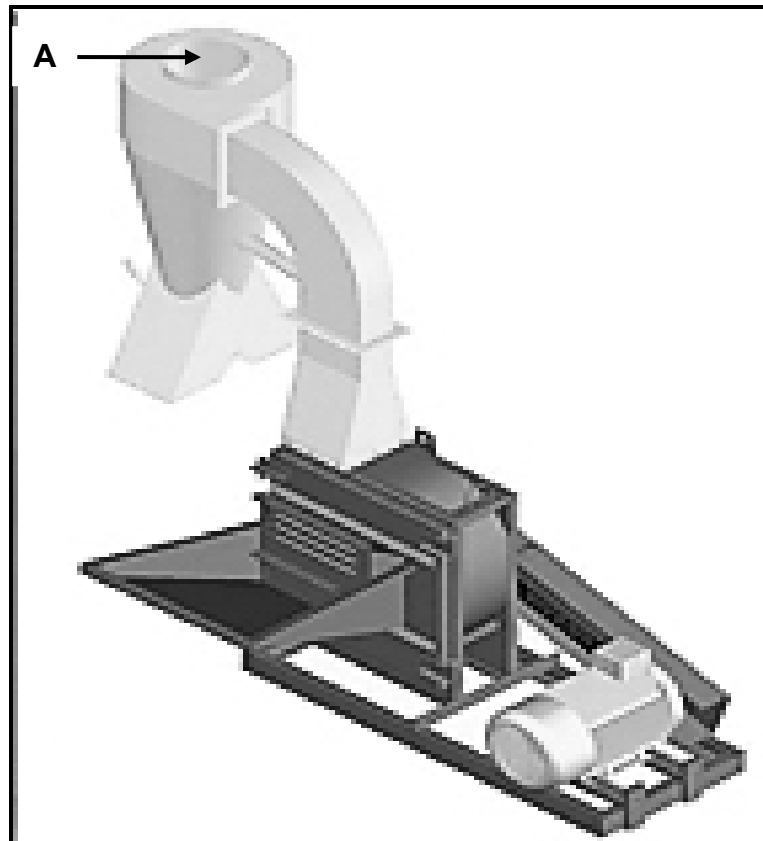
- 4.5 A cast-iron part must be welded with an arc-welding machine. Explain the procedure to follow when preparing the cast iron for the welding process. (6)
- 4.6 Metal inert-gas (MIG) welding is preferred by many welding operators to weld metal projects.
- 4.6.1 State THREE disadvantages of MIG welding. (3)
- 4.6.2 State THREE possible causes of porosity when doing MIG welding. (3)

[35]

**QUESTION 5: TOOLS, IMPLEMENTS AND EQUIPMENT**

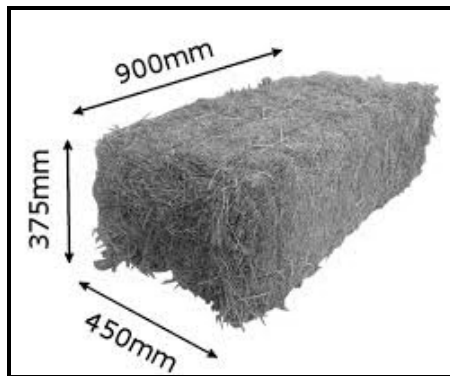
**(Start this question on a NEW page.)**

- 5.1 The picture below shows a hammer mill that is used to pulverise silage. Answer the questions that follow.



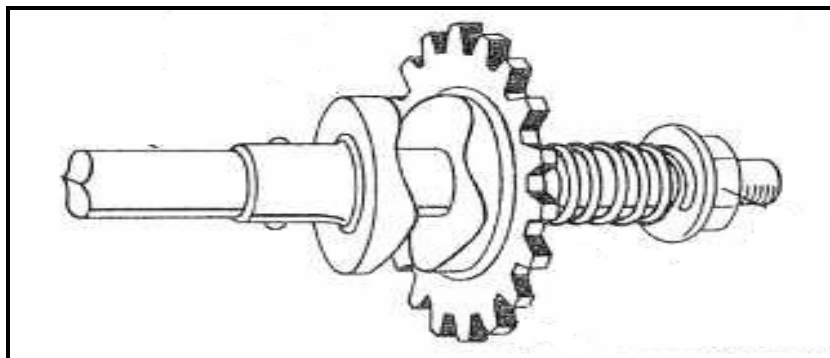
- 5.1.1 Identify component **A** in the picture above. (1)
- 5.1.2 Describe the function of the component identified in QUESTION 5.1.1. (1)
- 5.1.3 State the function of the following components of a hammer mill:
- (a) Sieves (1)
  - (b) Hammers (1)
  - (c) Fan (1)
- 5.2 Name TWO essential clothing items for personal protection that must be worn when using a push lawnmower. (2)

- 5.3 Tabulate the differences between Bale **A** and Bale **B**, shown in the pictures below, under the following headings:

**BALE A****BALE B**

- |       |                      |     |
|-------|----------------------|-----|
| 5.3.1 | Storage space needed | (2) |
| 5.3.2 | Bale handling        | (2) |
| 5.3.3 | Rope consumption     | (2) |

- 5.4 State TWO functions of the type of slip clutch shown in the sketch below.



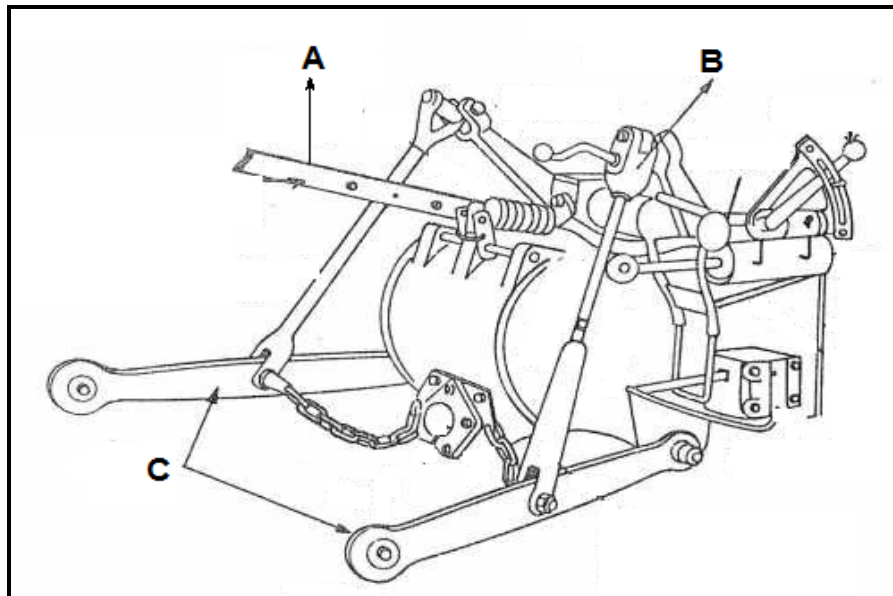
(2)

- 5.5 State FOUR general problems that can occur when using the combine harvester below.



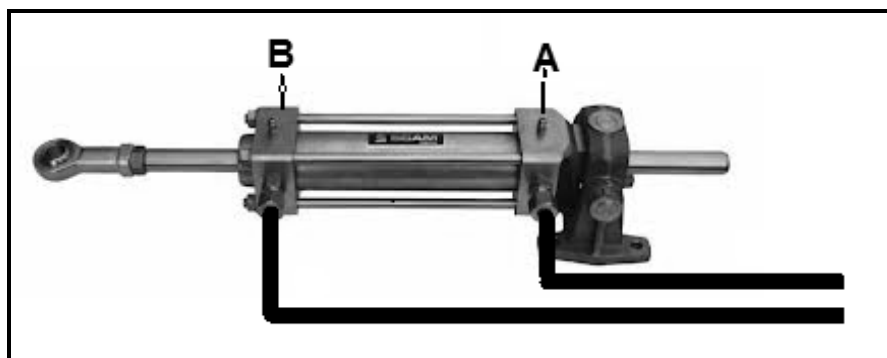
(4)

- 5.6 The sketch below shows the back side of a tractor. Answer the questions that follow.



- 5.6.1 Name the mechanism in the sketch above that is used to hitch an implement to a tractor. (1)
- 5.6.2 Name components **A**, **B** and **C**, as shown in the sketch above, and state the function of EACH. (6)

- 5.7 The picture below shows a hydraulic cylinder. Answer the questions that follow.



- 5.7.1 Give ONE reason why air must be removed from a hydraulic system. (1)
- 5.7.2 Which side of this cylinder is the strongest: **A** or **B**? (1)
- 5.7.3 Explain your answer to QUESTION 5.7.2. (1)
- 5.7.4 Where can this type of cylinder be used? Give a reason for your answer. (2)

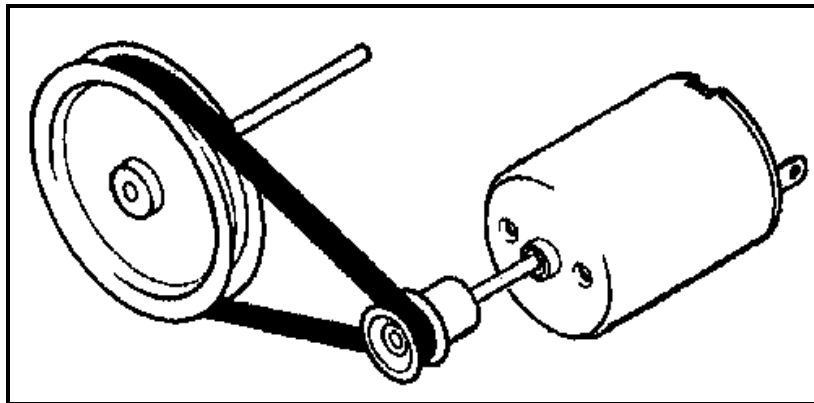
- 5.8 State THREE factors that can cause a decrease in the value of a tractor. (3)

- 5.9 The sketch below shows an electric motor connected to a pulley with a fan belt. The pulley diameter on the electric motor is 70 mm and the turning speed is 4 000 revolutions per minute. The pump that is connected to the driven pulley requires a speed of 2 000 revolutions per minute.

Calculate the diameter of the driven pulley by using the formula below. Show ALL calculations.

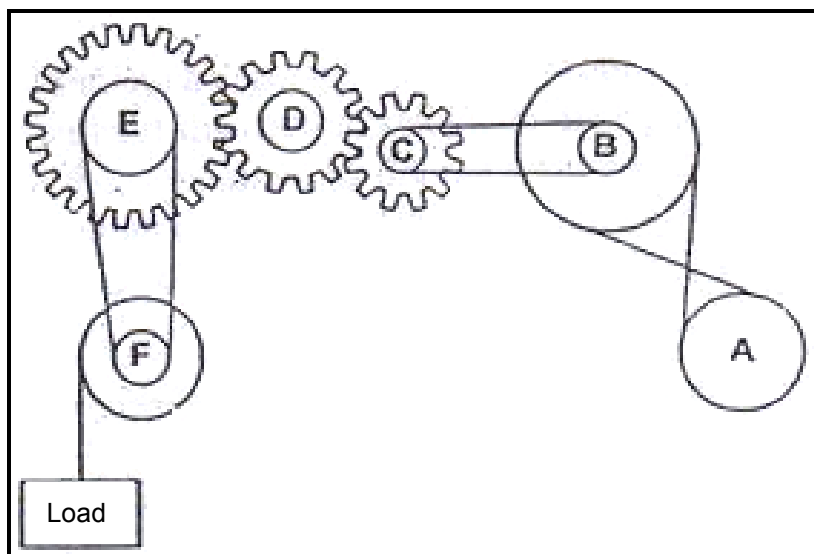
$$N_a \times D_a = N_g \times D_g$$

Where:  $N_a$  = Speed of driving pulley  
 $D_a$  = Diameter of driving pulley  
 $N_g$  = Speed of driven pulley  
 $D_g$  = Diameter of driven pulley



(5)

- 5.10 What will happen to the load on the left-hand side if pulley **A** on the right-hand side is turned clockwise?

(1)  
[40]

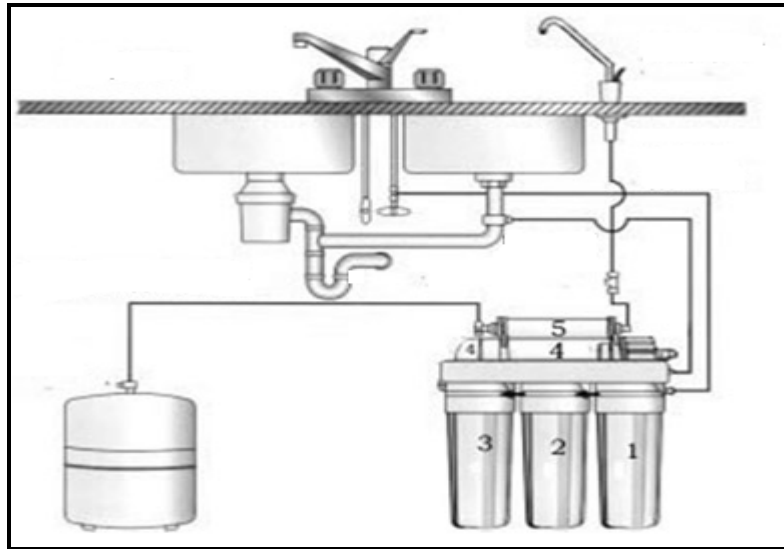
**QUESTION 6: WATER MANAGEMENT****(Start this question on a NEW page.)**

- 6.1 Explain the basic steps that a farmer should follow when selecting a pump for a specific irrigation system. (5)
- 6.2 Centre-pivot irrigation systems are very efficient when large fields must be irrigated.



- 6.2.1 Discuss the design principles that are incorporated into the sprayers of the centre-pivot system to ensure the equal distribution of water from the centre of the pivot to the outer end of the pivot. (3)
- 6.2.2 Explain why calibration of the water distribution system on a centre pivot is necessary. Refer to the movement of the centre pivot and the layout of the land. (3)
- 6.2.3 State TWO common soil problems when water distribution is not correctly calibrated in an irrigation system. (2)
- 6.3 Precision farming means that a farmer must use all available technology to improve productivity in a very competitive and complicated agricultural environment.
- 6.3.1 Name a device that can be used to determine soil water content and explain the necessity for such a device in irrigation management. (4)
- 6.3.2 Explain why evapotranspiration is measured in a maize crop. (2)
- 6.4 Calculate the flow rate of water in a pipe delivery system if it takes 5 minutes to fill a 15 000 litre tank. Show ALL calculations. (4)

- 6.5 A water purification system has become a necessity in many parts of the world due to water pollution.



- 6.5.1 Name the type of water purification system in the sketch above. (1)
- 6.5.2 Describe the working of the water purification system in QUESTION 6.5.1. (2)
- 6.5.3 Name the process that takes place when water is purified by sending it through different liquids, separated by a thin permeable film which only allows water to pass through at molecular level. (1)
- 6.6 Describe the process of breaking down household sewerage in a septic tank. (3)
- [30]**

**TOTAL SECTION B: 160**  
**GRAND TOTAL: 200**