



STUDENT NUMBER

CENTRE NUMBER

HIGHER SCHOOL CERTIFICATE EXAMINATION

1997

RURAL TECHNOLOGY

2 UNIT

(85 Marks)

*Time allowed—Three hours
(Plus 5 minutes reading time)*

EXAMINER'S USE ONLY

Question	
1	
2	
3	
4	
5	
6	
7	
8	

DIRECTIONS TO CANDIDATES

- Write your Student Number and Centre Number at the top right-hand corner of this page.
- Attempt ALL Questions.
- The marks allocated to each Section are shown in this paper.
- Write your answers in the spaces provided in this paper.
- Board-approved calculators may be used.
- The Formulae Sheet will not be collected.

SECTION I—FARM MACHINERY
(20 Marks)

QUESTION 1

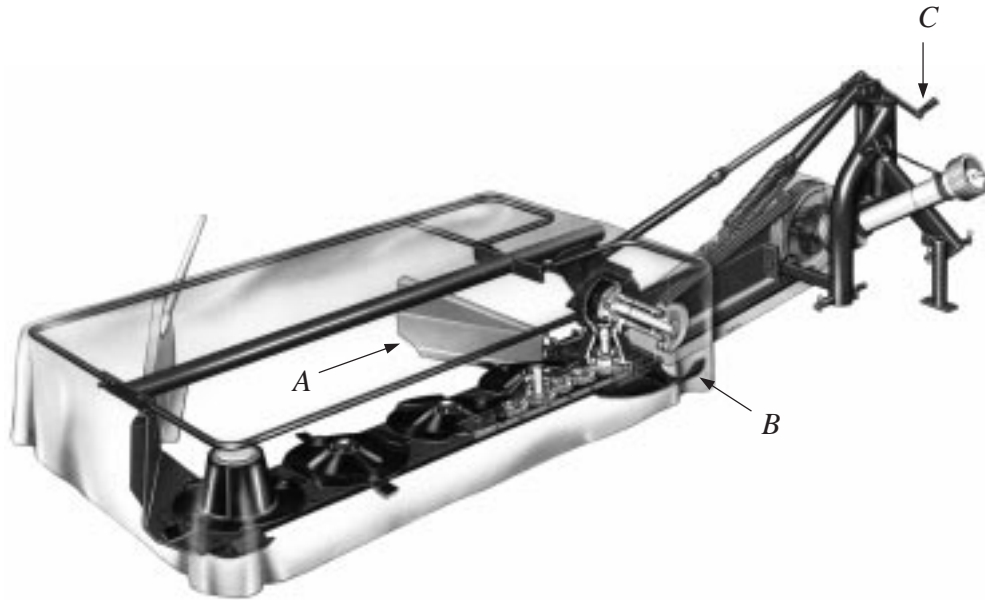


FIG. 1

- (a) (i) Name the machine shown in Figure 1.
.....
- (ii) What is the function of this machine?
.....
.....
- (iii) How is this machine attached to the tractor?
.....
- (iv) What are TWO advantages of this attachment method?
 - 1.
 - 2.

QUESTION 1. (Continued)

(v) What is the power source for this machine?

.....
.....

(vi) Name and give the function of *A* and *B*.

1. Name of *A*

Function of *A*

2. Name of *B*

Function of *B*

(vii) Give TWO safety features on this machine.

1.

2.

(viii) What is the purpose of the handle *C*?

.....
.....

(ix) Belts are used in this machine. Give TWO reasons for this.

1.

2.

(x) Gears are used in this machine. Give TWO reasons for this.

1.

2.

(xi) Name the gears used to change the direction of power at right angles.

.....

QUESTION 1. (Continued)

- (b) (i) When a tractor passes over soil it compacts the soil, which can lead to reduced yield of field crops. Table 1 below gives the effect of soil compaction on the yield of field crops.

For the TWO field crops given, calculate the grain yield percentage reduction due to *six* tractor passes. Complete the table with your answer.

TABLE 1. THE EFFECT OF SOIL COMPACTION ON YIELD OF FIELD CROPS

CROP	GRAIN YIELD (kg/ha)		CALCULATIONS	% YIELD REDUCTION
	<i>0 tractor passes</i>	<i>6 tractor passes</i>		
Wheat	1740	1020	
Barley	2363	1236	

QUESTION 1. (Continued)

- (ii) The graph in Figure 2 shows the effect of the number of tractor passes on soil penetration.

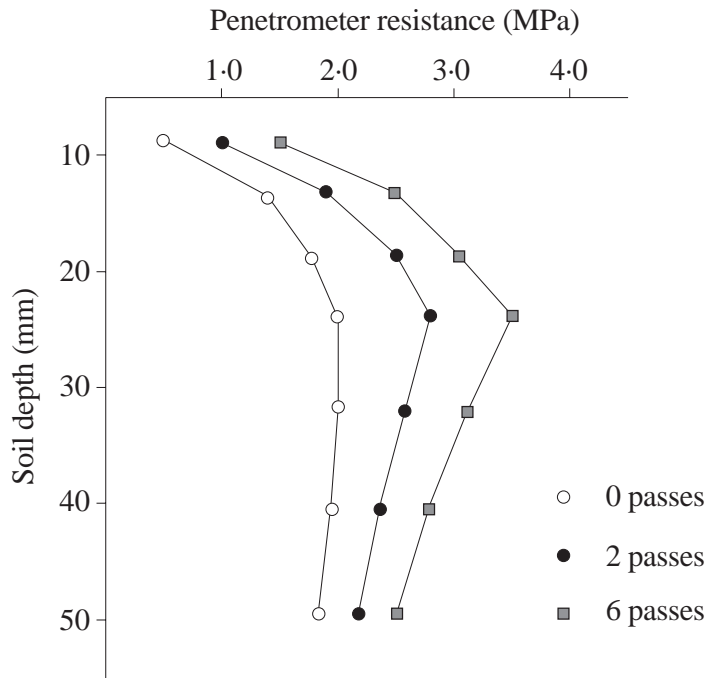


FIG. 2. THE EFFECT OF THE NUMBER OF TRACTOR PASSES ON SOIL PENETRATION

At what soil depth is compaction a maximum?

.....

- (c) List TWO functions of engine oil.

(i)

(ii)

- (d) List THREE safety precautions to be observed when operating a tractor.

(i)

(ii)

(iii)

QUESTION 1. (Continued)

- (e) A two-cylinder, four-stroke engine has a bore of 60 mm and a stroke of 50 mm. What is its capacity in cubic centimetres? Show your working.

Capacity

- (f) Define the term *compression ratio*, with the aid of a neat sketch.

.....
.....
.....
.....
.....

- (g) List THREE causes of a drop in engine compression in a four-stroke engine.

- (i)
- (ii)
- (iii)

- (h) What TWO factors influence a farmer's decision to use round baling instead of square baling?

- (i)
- (ii)

- (i) Calculate the sowing rate in kg/ha if a 3.0 m wide combine distributes 9 kg of seed over 150 metres.

Sowing rate

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SECTION II—FARM STRUCTURES

(10 Marks)

QUESTION 2

- (a) Figure 3 shows a topographic map of a farming district. Use the map to answer the following questions.

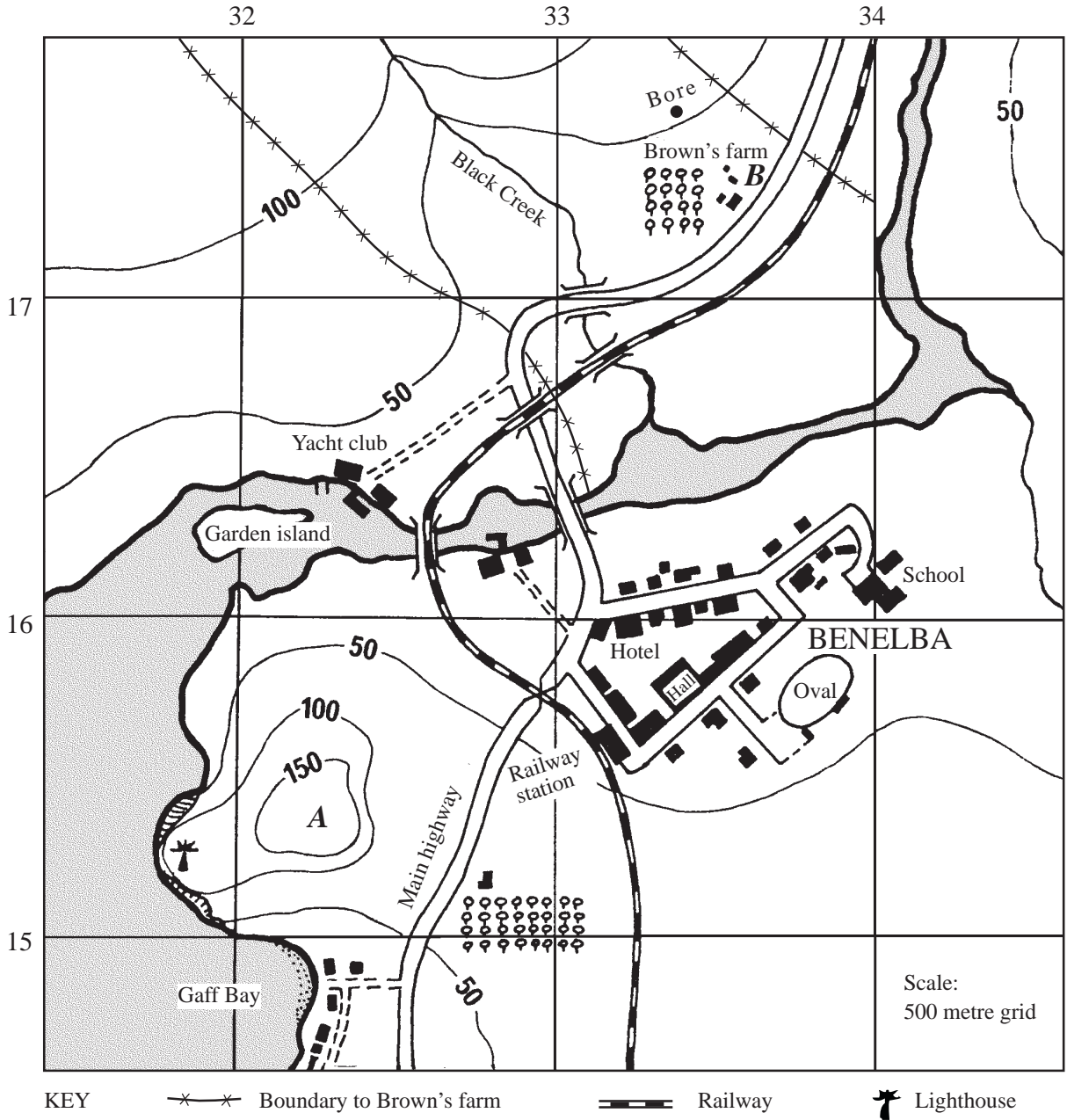


FIG. 3. TOPOGRAPHIC MAP OF BENELBA

QUESTION 2. (Continued)

(d) Fencing is important to efficient farm management. Give THREE reasons for this.

- (i)
- (ii)
- (iii)

(e) Temporary fences are more economical to erect than boundary fences. Give TWO reasons for this.

- (i)
- (ii)

(f) (i) Name the type of fencing system shown in Figure 4.

.....

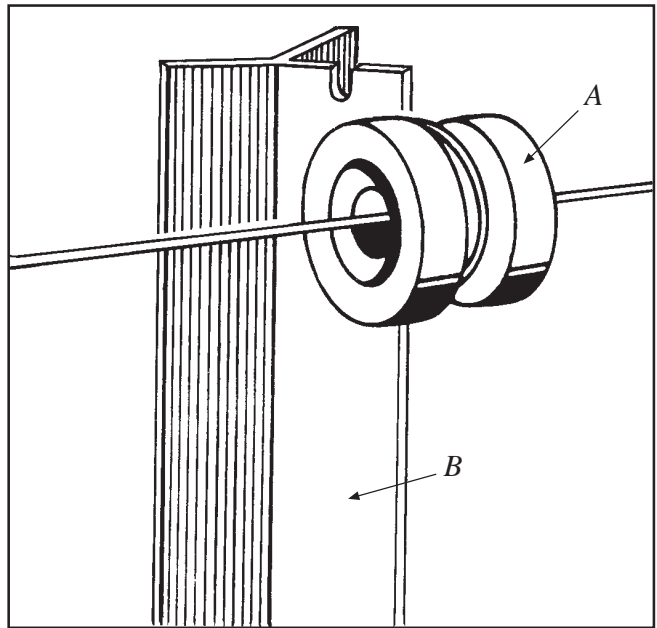


FIG. 4

(ii) Name the parts indicated at A and B.

A

B

(iii) Name a suitable material from which A could be manufactured, and give a reason.

Material

Reason

QUESTION 2. (Continued)

(g) (i) Name the type of fencing wire shown in Figure 5.

Name

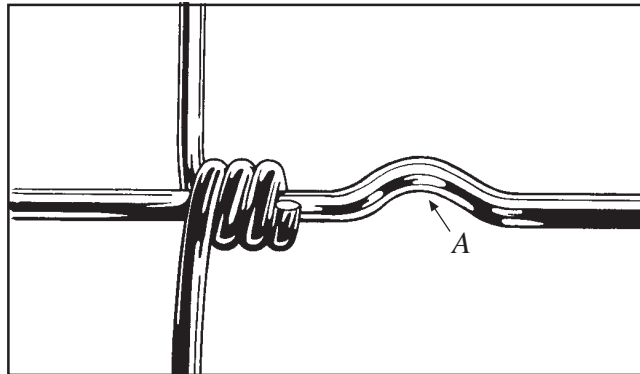


FIG. 5

(ii) Describe the purpose of feature A in Figure 5.

Purpose

(h) List FIVE necessary tools required to erect a permanent fence.

- (i)
- (ii)
- (iii)
- (iv)
- (v)

QUESTION 3. (Continued)



TOP VIEW



FRONT VIEW

QUESTION 4. (6 marks)

Figure 7 shows the top and front views of part of a hopper made from galvanised steel sheet. The hopper is to be fabricated in four sections, and a template for one quarter of the shape is to be drawn.

On page 15, draw the quarter development of part A of the hopper *abcde*. Do not add any seam allowances.

Take sizes from the views shown.

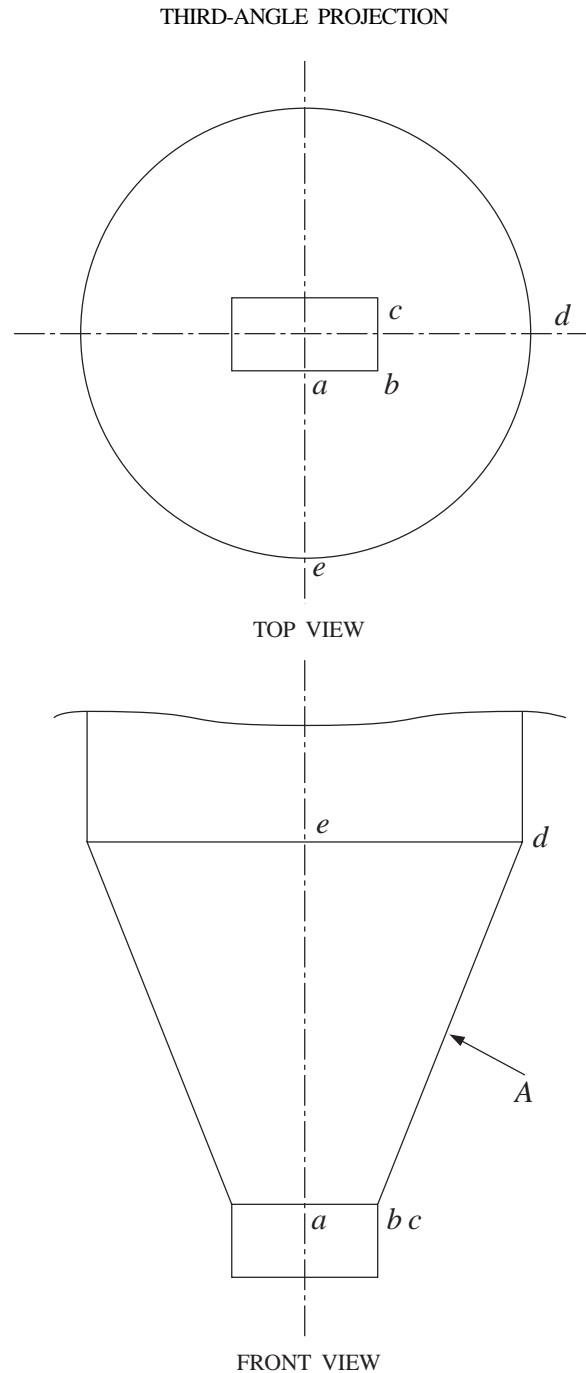


FIG. 7

QUESTION 4. (Continued)

.....

QUESTION 5. (6 marks)

Figure 8 shows an orthogonal drawing of a forked bracket in third-angle projection.

On page 17, draw an isometric drawing of the forked bracket, viewed in the direction of the arrow A. Use the starting point given.

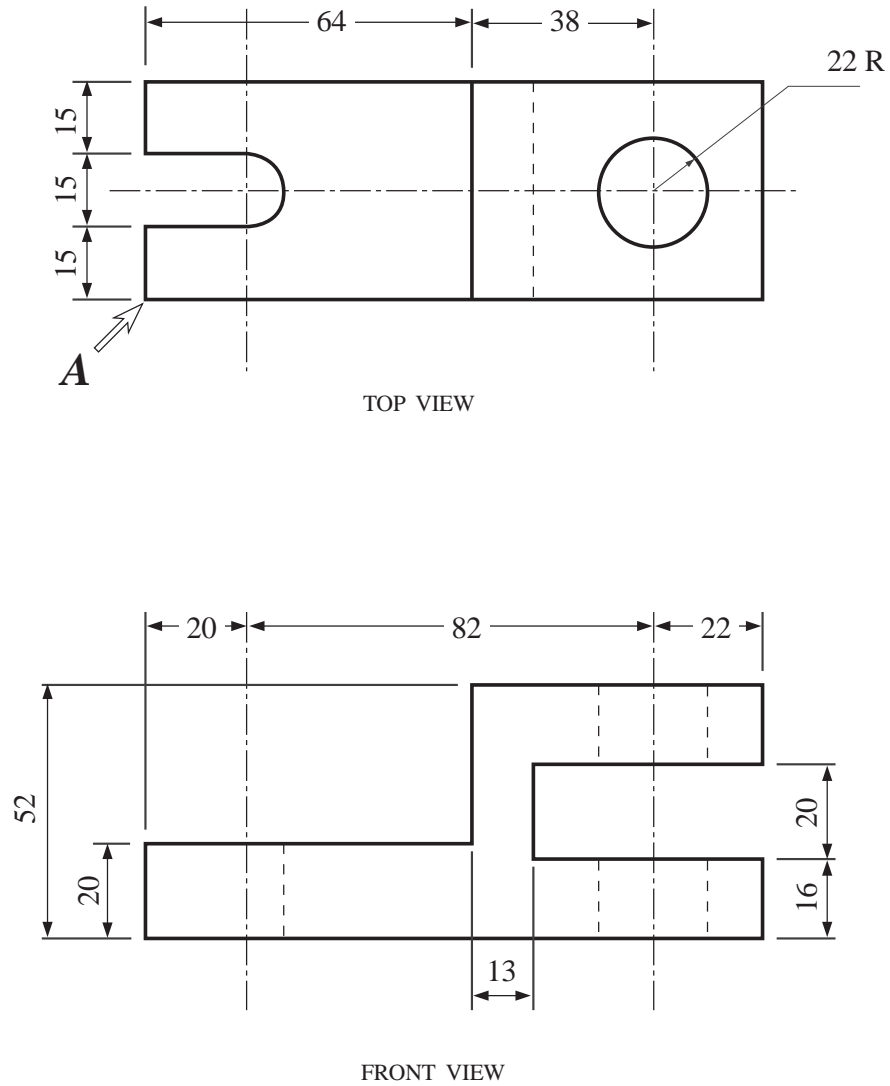
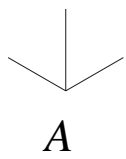


FIG. 8

QUESTION 5. (Continued)



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SECTION IV—RELATED MATERIALS SCIENCE

(10 Marks)

QUESTION 6

(a) Figure 9 represents various types of forces encountered in farm machinery. In the space provided, name the effect of each type of force on the material.

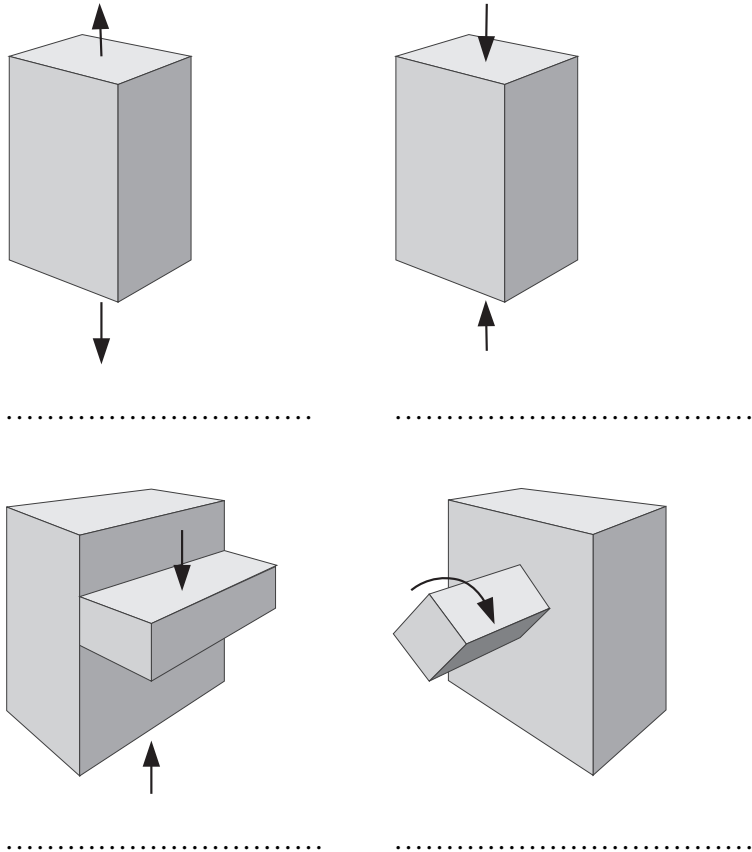


FIG. 9

(b) Name THREE principal causes for the deterioration of timber.

- (i)
- (ii)
- (iii)

(c) Name TWO methods of reducing or preventing deterioration in timber.

- (i)
- (ii)

QUESTION 6. (Continued)

- (d) Figure 10 illustrates the shape of one end of a timber board. The board shows evidence of one timber defect. Name the defect, and indicate how the piece of timber can be reconditioned.

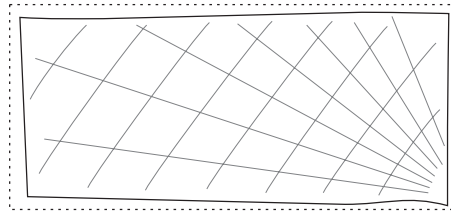


FIG. 10

Name

Reconditioning method

- (e) A spring balance reads in newtons (N). In Figure 11, determine the reading on the spring balance.

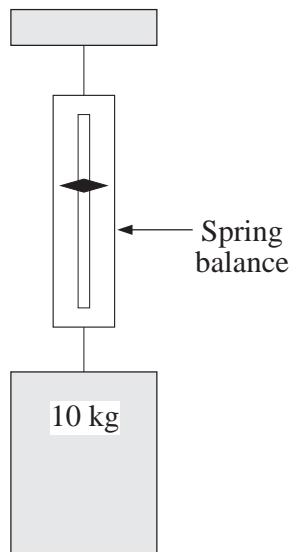


FIG. 11

Spring balance reading..... N

- (f) Calculate how much work in joules has been done when a 10 kg mass is lifted a distance of 1 m.

Work done J

QUESTION 6. (Continued)

- (g) An electricity meter disk makes one revolution every 30 seconds when a small electric pump is running. A note on the meter states 266.6 rev/kWh. How much power is the electric motor using? Show all calculations.

Power W

- (h) A car accelerates from 40 km/h to 100 km/h in 2 seconds. Calculate its uniform acceleration in m/s^2 . Show all working.

Acceleration

- (i) Figure 12 shows THREE forces acting on the point A. Using a graphical method, determine whether point A is in equilibrium, or not, and give a reason.

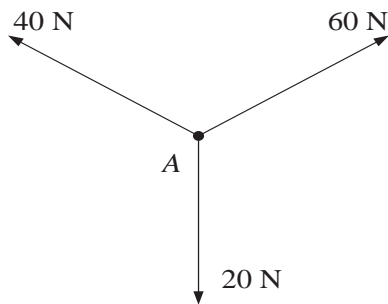


FIG. 12

Is the system in equilibrium?

Reason

.....

SECTION V—FARM WATER SUPPLIES

(15 Marks)

QUESTION 7

(a) What is the major problem with shallow-dam water storage?

.....
.....
.....

(b) Describe the ideal site requirements for the following dams:

(i) Turkey-nest dam

(ii) Gully storage

(c) What effective treatment could be used to seal a leaking dam?

.....
.....
.....

(d) Give THREE factors that should be considered when establishing a suitable rural domestic water supply.

(i)

(ii)

(iii)

(e) With reference to farm irrigation, describe what is meant by:

(i) centre pivot irrigation

.....

(ii) drip irrigation

.....

(iii) flood irrigation

.....

QUESTION 7. (Continued)

(f) Water flow through a pipe fitting is shown in Figure 13.

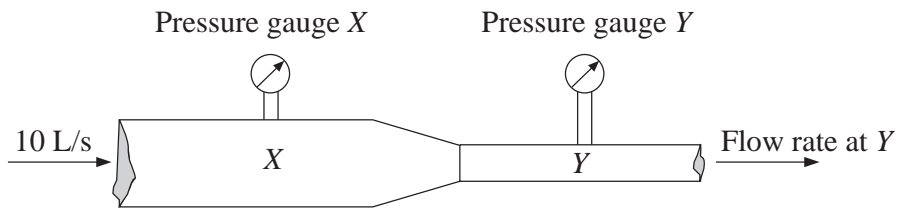


FIG. 13

Parts (i), (ii), and (iii) are multiple-choice questions. Circle the alternative A, B, or C that best answers the question.

- (i) The flow rate at *Y* is
 - (A) equal to 10 L/s.
 - (B) greater than 10 L/s.
 - (C) less than 10 L/s.

- (ii) The velocity at point *X* is
 - (A) equal to velocity at point *Y*.
 - (B) greater than velocity at point *Y*.
 - (C) less than velocity at point *Y*.

- (iii) The pressure at point *X* is
 - (A) equal to pressure at point *Y*.
 - (B) greater than pressure at point *Y*.
 - (C) less than pressure at point *Y*.

(g) Describe what is meant by the following water treatment processes.

- (i) Flocculation
-
- (ii) Sedimentation
-
- (iii) Filtration
-

QUESTION 7. (Continued)

- (h) Name a common water-sterilising agent.
.....
- (i) State ONE advantage for each of the following domestic water-tank materials.
 - (i) Galvanised steel
Advantage
 - (ii) Fibreglass
Advantage
- (j) How are sand filters usually cleaned?
.....
.....
- (k) Name ONE of the chemicals that can cause hardness of water.
.....
- (l) What is the maximum practical suction lift for a centrifugal pump?
.....
- (m) Irrigation sprinklers should operate at correct water pressure and flow rate. List FOUR causes of faulty water pressure and/or flow rate.
 - (i)
 - (ii)
 - (iii)
 - (iv)
- (n) You are selecting a water pump. What FOUR critical aspects need to be taken into consideration, in terms of technical specifications?
 - (i)
 - (ii)
 - (iii)
 - (iv)

SECTION VI—TOPICAL STUDY
POWER TRANSMISSION

(10 Marks)

QUESTION 8

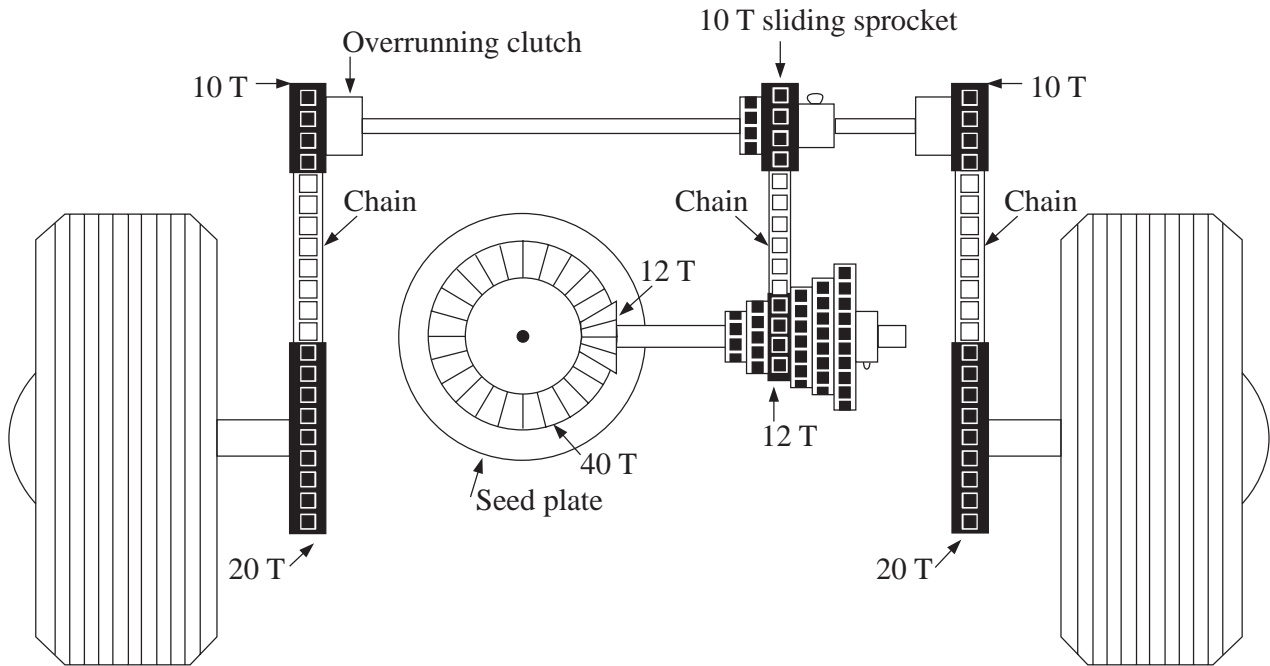


FIG. 14

- (a) Figure 14 shows the seed-plate drive mechanism in a combine seeder.
- (i) Explain why the mechanism is driven off the wheels, even though a PTO is available.

 - (ii) State the purpose of the overrunning clutch, and describe how it works.
 Purpose
 Description
- (b) Agricultural-type chains are used on seeders. Explain why chains are used in this application.

QUESTION 8. (Continued)

- (c) Explain why the sliding sprocket has to slide.

.....
.....

- (d) Explain why there is a need to vary the speed of the seed plate.

.....
.....

- (e) If the ground wheel is rotating at 40 r.p.m., calculate the speed of the seed plate. Show all working.

Speed

Question 8 continues on page 26

QUESTION 8. (Continued)

(f) Draw a schematic diagram, name the parts, and show the flow of hydraulic fluid for:

(i) a hydraulic system that delivers rotating motion;

(ii) a hydraulic system that delivers reciprocating motion.

QUESTION 8. (Continued)

(g) Name and describe TWO methods of keeping belt tension in machines. Give an advantage of each method.

(i) Name

Description

Advantage

(ii) Name

Description

Advantage

(h) Name and sketch THREE different drive belt types. Give a typical use for each.

(i) Sketch

Use

(ii) Sketch

Use

(iii) Sketch

Use

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Not to be collected at the conclusion of the examination.

FORMULAE

Dynamics

$$v = u + at$$

$$s = ut + \frac{1}{2}at^2$$

$$s = \left(\frac{u+v}{2}\right)t$$

$$v^2 = u^2 + 2as$$

$$F = ma$$

$$P = \frac{W}{t}$$

$$W = Fs$$

Statics

If a body is in equilibrium, then:

$$\sum F_x = 0; \quad \sum F_y = 0; \quad \sum M = 0$$

$$M = Fd$$

Machines

$$RPM_1 \times Dia_1 = RPM_2 \times Dia_2$$

Area of circle

$$A = \frac{\pi}{4}d^2$$

Circumference of circle

$$C = \pi d$$

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