BOARD OF STUDIES
NEW SOUTH WALES

STUDENT NUMBER

CENTRE NUMBER

HIGHER SCHOOL CERTIFICATE EXAMINATION

2000

RURAL TECHNOLOGY

2 UNIT

(85 Marks)

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

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.

MARKER'S USE ONLY

Question	
1	
2	
3	
4	
5	
6	
7	
8	

SECTION I—FARM MACHINERY

(20 Marks)

QUESTION 1

(a) Figure 1 shows a diagram of the basic functional components of a typical self-propelled header harvester.

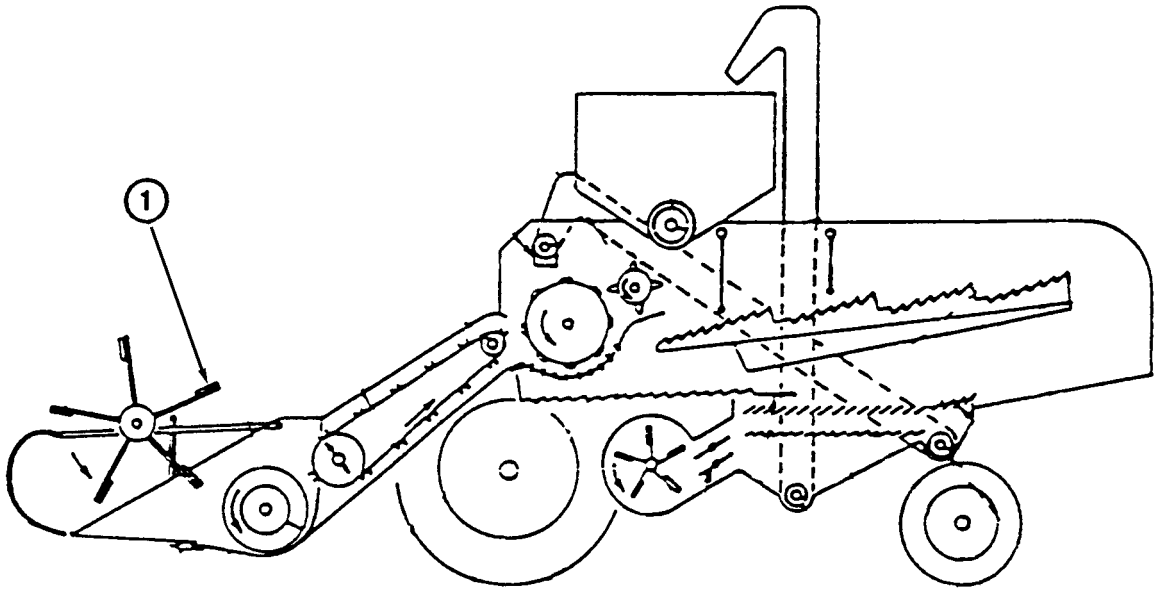


FIG. 1

Some parts of the header harvester are listed in the table.

(i) Use the numbers from the table, and arrows, to indicate these parts on the diagram in Figure 1.

Parts—Reel, auger, straw walker, sieve, drum, concave

The reel has been indicated as an example.

(ii) Complete the table by describing the function of each part listed.

The function of the reel has been completed as an example.

No.	*Component*	*Description of function*
1	Reel	Pull crop into cutter bar and steady it for cutting
2	Auger	
3	Straw walker	
4	Sieve	
5	Drum	
6	Concave	

QUESTION 1 (Continued)

(iii) 1 Explain the major difference between axial flow and conventional header harvesters.

.....

.....

2 Explain why the difference outlined above is an advantage for the axial flow header harvester.

.....

.....

(iv) 1 Name TWO components of the header harvester that should be adjusted if the husk is not coming off the seed cleanly.

Part 1 .....

Part 2 .....

2 Name TWO components that should be adjusted if the seed sample is not clean (eg if straw particles are found in the seed sample).

Part 1 .....

Part 2 .....

(v) State THREE safety procedures to be followed when making adjustments to the header harvester.

1 .....

2 .....

3 .....

(vi) Name the Australian individual most responsible for the development of the header harvester.

.....

Question 1 continues on page 4

QUESTION 1 (Continued)

(b) Answer the following questions with reference to the graph in Figure 2.

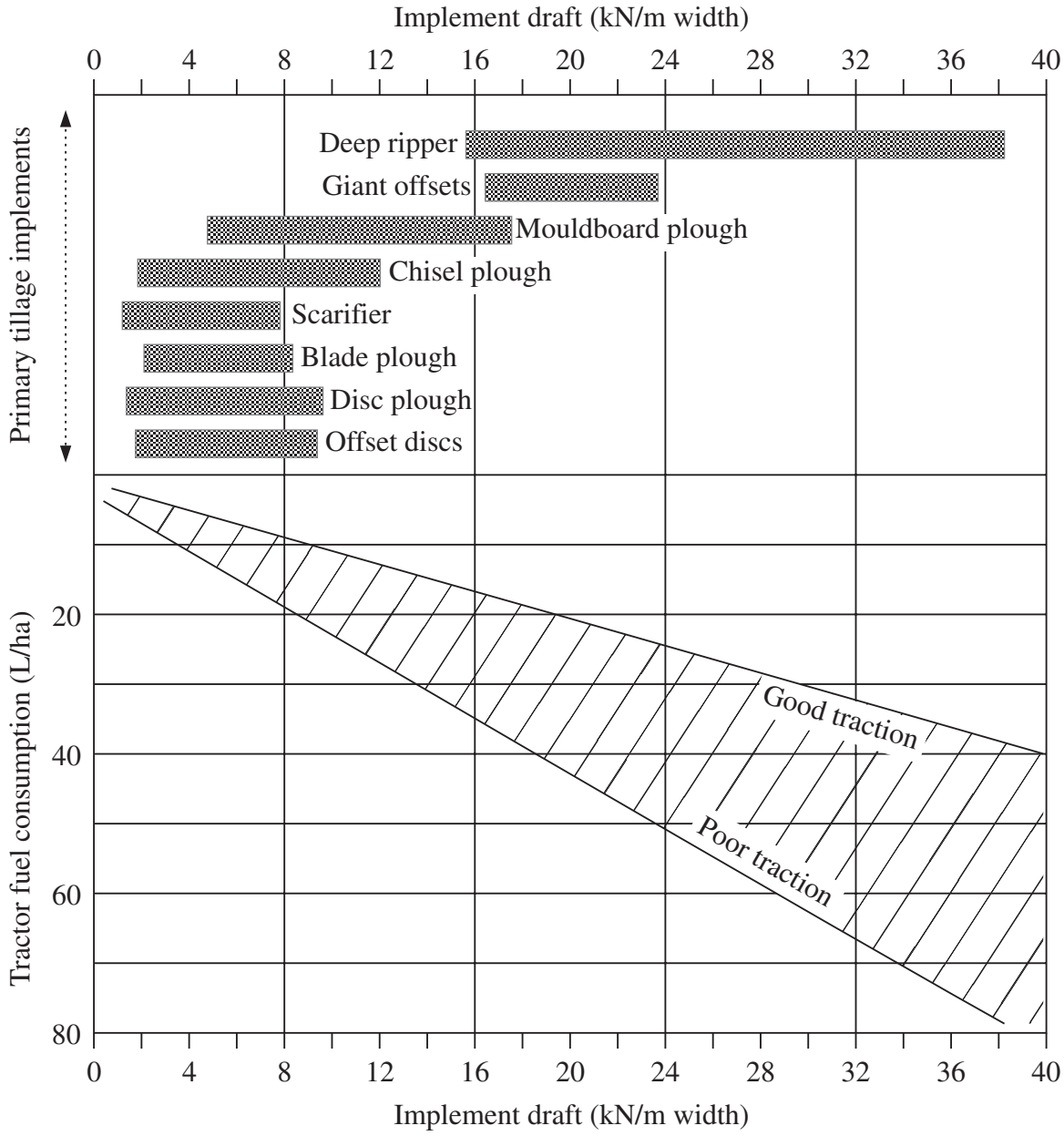


FIG. 2

QUESTION 1 (Continued)

(i) Determine the approximate fuel consumption, in litres per hectare, for a mouldboard plough operating at 16 kN/m width in poor traction conditions.

.....

(ii) A deep ripper is to be operated at 24 kN/m width. Determine the difference in litres of fuel used per hectare if the operation is carried out in both good and poor traction conditions.

.....

(iii) From the graph in Figure 2, state the minimum and maximum draft force for a blade plough.

Minimum force ..... kN/m

Maximum force ..... kN/m

(iv) Give TWO reasons why the deep ripper has such a broad range of implement draft values (16 kN/m to 38 kN/m).

1 .....

2 .....

(c) (i) Is drawbar power the same as engine power for a given tractor?

.....

(ii) Explain your answer to part (i) with reference to traction.

.....

.....

Question 1 continues on page 6

QUESTION 1 (Continued)

(d) A diagram of a broadacre air seeder is given in Figure 3.

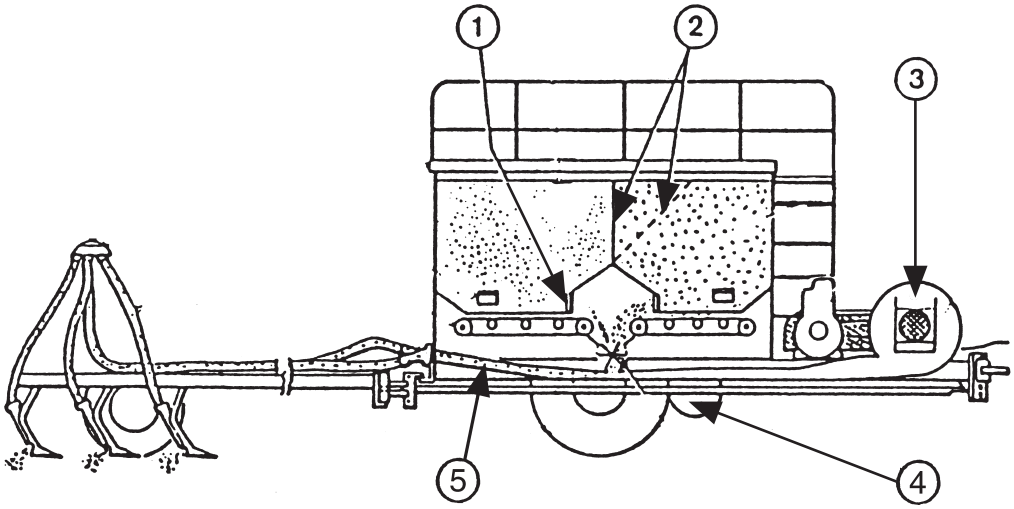


FIG. 3

(i) Name the parts indicated by the numbered arrows.

① .....

② .....

③ .....

④ .....

⑤ .....

(ii) State TWO advantages of an air seeder over a conventional combine seeder.

1 .....

2 .....

QUESTION 1 (Continued)

(e) The operation of a seeding machine requires it to be calibrated. One method of doing this is the field method, where the seed being distributed is collected in a bag as the machine travels over a set distance.

The formula for checking calibration over a test distance of 100 m is given.

$$\text{Amount to be collected (kg)} = \frac{[\text{Desired seeding rate (kg/ha)}] \times [\text{Machine width (m)}]}{100}$$

(i) Calculate the amount to be collected over a test distance of 100 m if the desired seeding rate is 128 kg/ha and the machine width is 6 m.

Amount to be collected ..... kg

(ii) This machine may be calibrated by another method without taking it out of the machinery shed. List the major steps involved in this method.

.....

.....

.....

.....

(iii) There may be a variation between the calibration results in parts (i) and (ii). Give ONE reason for this possible variation.

.....

.....

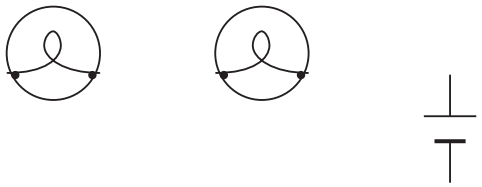
Question 1 continues on page 8

QUESTION 1 (Continued)

(f) The figures both show electrical circuit symbols for a DC power source and two lamps.

Complete the wiring diagrams to indicate how wires would be connected if the systems were wired in series and in parallel.

(i) Series



(ii) Parallel

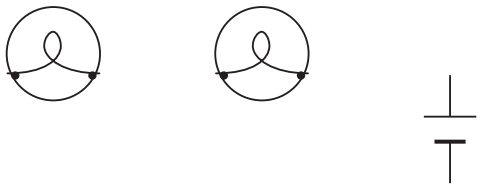


FIG. 4

SECTION II—FARM STRUCTURES

(10 Marks)

QUESTION 2

(a) (i) What are THREE advantages of a permanent electric fence over a conventional fence?

1 .....

2 .....

3 .....

(ii) Draw a simple diagram of a permanent electric fence, and name the main components.

(iii) Give ONE reason why the electric current pulses in an electric fence.

.....

.....

(iv) There are three power sources available for electric fences. Complete the table by naming each of these sources, and giving ONE advantage and ONE disadvantage of each.

	Power source	*Advantage*	*Disadvantage*
1			
2			
3			

Question 2 continues on page 10

QUESTION 2 (Continued)

(b) The topographic map shown in Figure 5 has slopes indicated between the points *A* and *B*, *A* and *C*, and *A* and *D*.

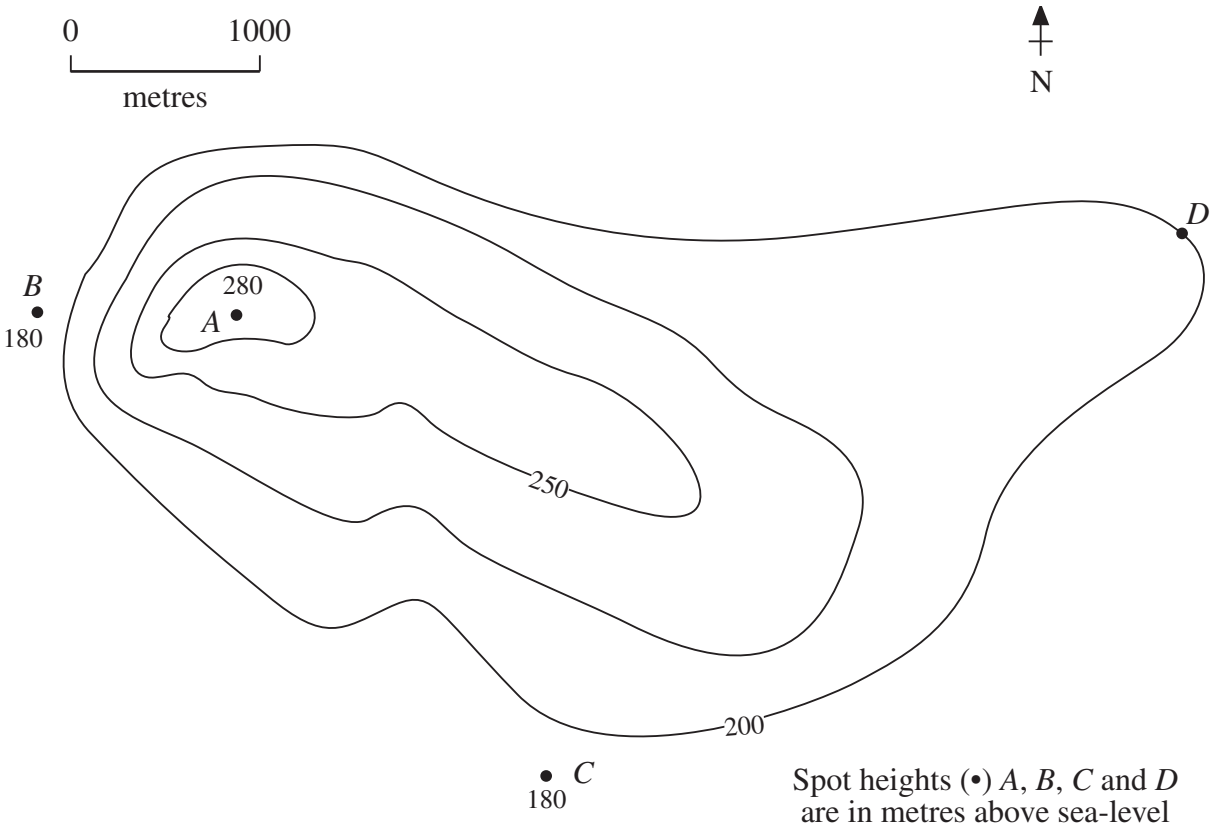


FIG. 5

(i) State the steepest slope.

.....

(ii) At which point — *A*, *B*, *C* or *D* — is the topography most likely to be:

1 suitable for cultivation?

.....

2 suitable for grazing?

.....

3 best protected by green timber?

.....

QUESTION 2 (Continued)

(c) State the contour interval used on this map.

.....

(d) Calculate the difference in height between point *A* and point *C*.

.....

.....

(e) Draw on the map the most likely drainage line for water run-off southwards between point *A* and point *C*.

(f) Farm planners use a land classification system to determine suitable land use. Describe TWO factors that a farmer would take into account when assessing land use capability.

(i) .....

(ii) .....

(g) When a farm plan is developed, an aerial photograph and a set of overlays is required. State FOUR main features that would be shown on the permanent (or infrastructure) overlay.

(i) .....

(ii) .....

(iii) .....

(iv) .....

(h) (i) State THREE reasons why a farmer should consider tree planting as part of a farm plan.

1 .....

2 .....

3 .....

(ii) A farmer has decided to plant radiata pine trees. Explain TWO factors that may have been considered when this choice was made.

1 .....

.....

2 .....

.....

SECTION III—FARM GRAPHICS

(20 Marks)

QUESTION 3 (10 marks)

A dimensioned exploded isometric drawing of a masonry bolt is given in Figure 6.

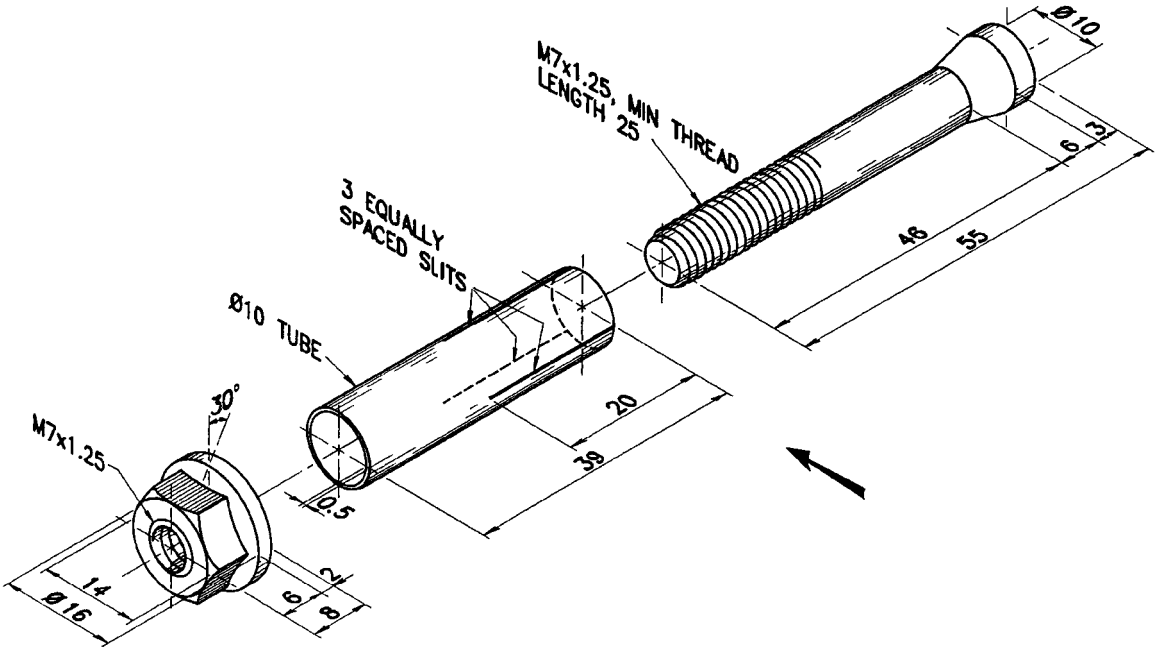


FIG. 6

(a) Using the centre lines on page 13, draw a front view and a left-hand end view of the masonry bolt when assembled.

Draw the front view, as seen from the arrow, at a scale of 2 : 1. Do NOT show hidden outlines.

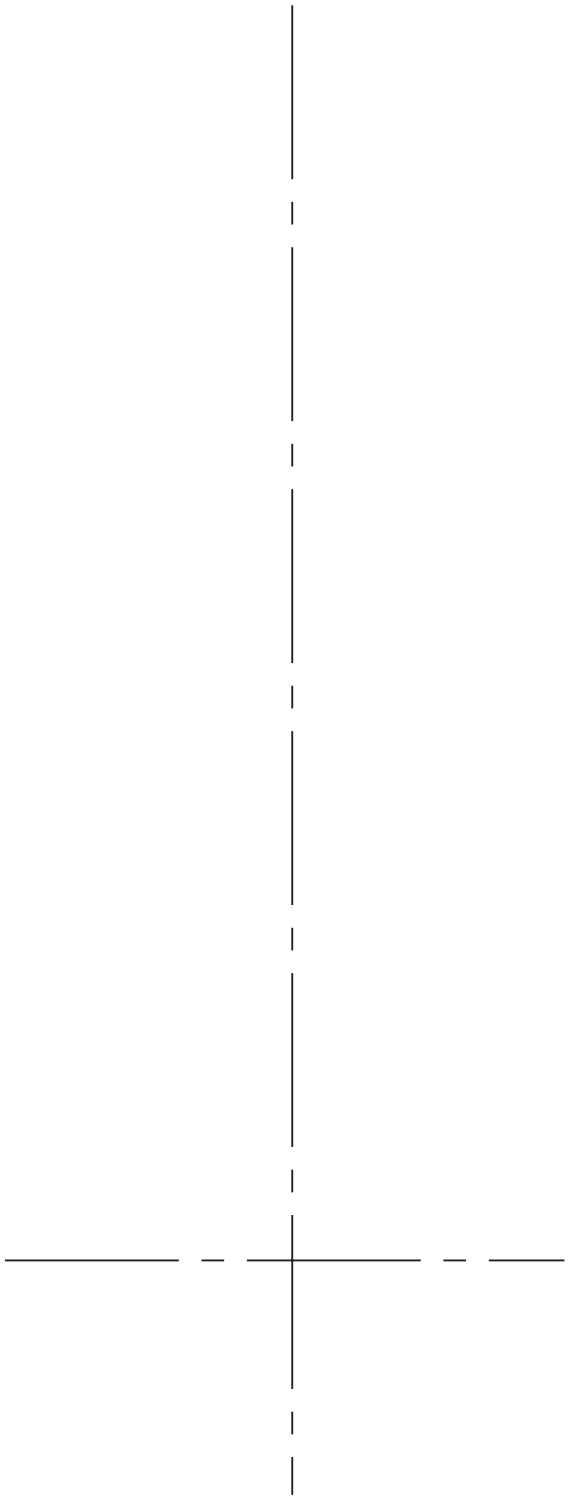
Show the parts assembled, with the nut positioned so that the tube would be on the point of expanding on the tapered portion of the bolt.

(b) Draw dimension lines to indicate three sizes.

(c) Itemise the drawing and complete the material list given.

QUESTION 3 (Continued)

ITEM	PART NAME	MATERIAL	QUANTITY
1	NUT		1



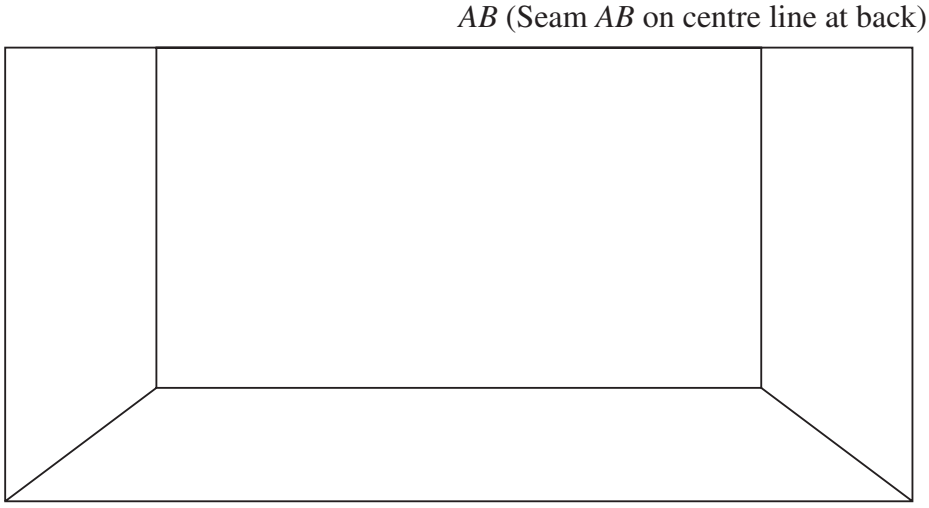
QUESTION 4 (5 marks)

Figure 7 shows top and front views of a grain chute in third angle projection. The grain chute is to be folded from a single piece of sheet metal, with the join on the line *AB*.

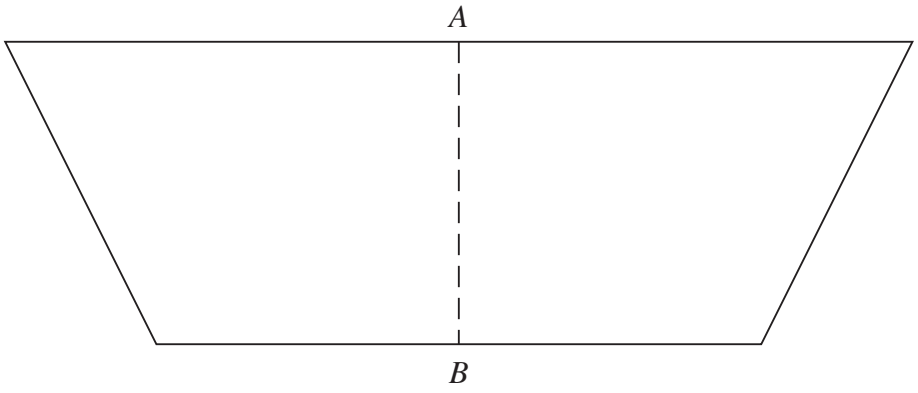
Take sizes directly from Figure 7 to draw a half-pattern development of the grain chute.

The line *AB* on page 15 is given as a starting point.

Do NOT add any seam allowances.



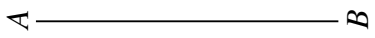
Top View



Front View

FIG. 7

QUESTION 4 (Continued)



QUESTION 5 (5 marks)

Details of a holding plate are given in the third angle orthogonal drawing in Figure 8.

Make an isometric drawing of the holding plate when viewed in the direction indicated by arrow A.

A starting point is given on page 17.

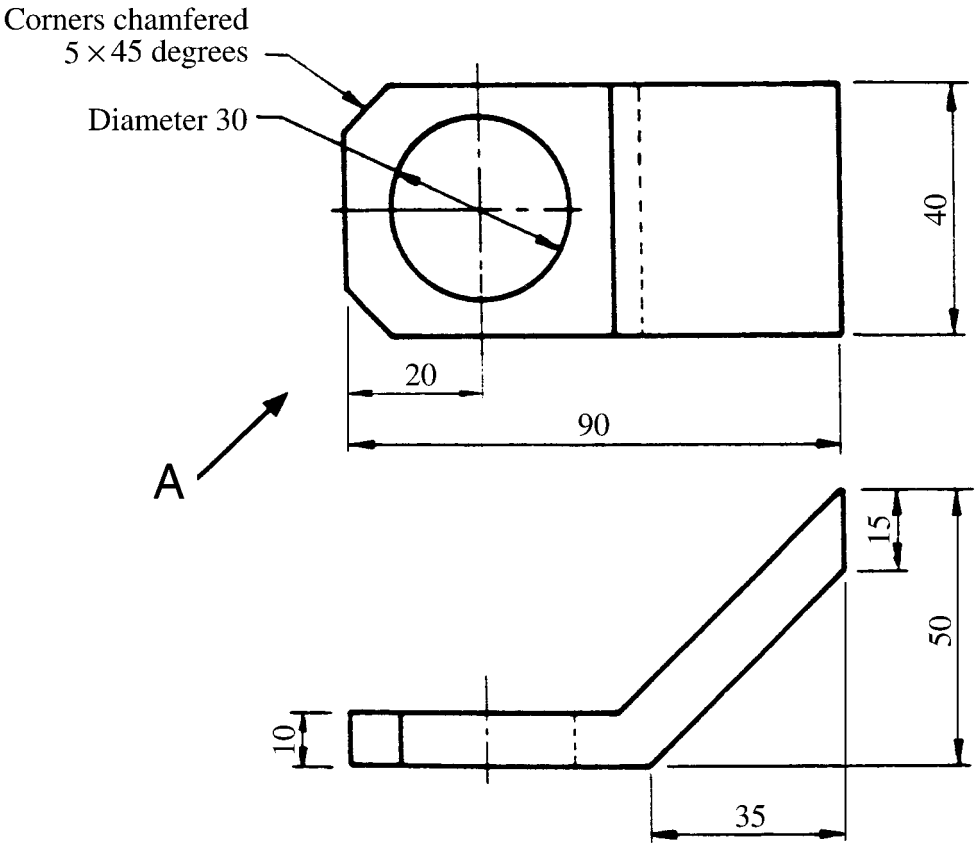
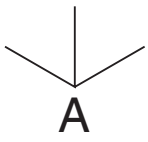


FIG. 8

QUESTION 5 (Continued)



SECTION IV—RELATED MATERIALS SCIENCE

(10 Marks)

QUESTION 6

(a) The main groups into which timber defects may be classified are:

Growth (*G*), Milling (*M*), Grain (*N*), Seasoning (*S*) and Fungal (*F*).

Complete the table by indicating into which group the following defects should be classified.

Defect	*Group*
Wet rot	
Bow	
Knot	
Waney edge	
Checking	
Dry rot	
Heart shake	
Compression wood	
Burl	
Spring	

(b) List the information that should be included in a timber order.

(i) .....

(ii) .....

(iii) .....

(iv) .....

(v) .....

(c) Explain what is meant by the term *lineal metre* when used for buying timber.

.....

.....

QUESTION 6 (Continued)

(d) (i) In the diagram in Figure 9, the force in the wire is 1000 N, and it tends to lift the post out of the ground. What is the magnitude of this lifting force?

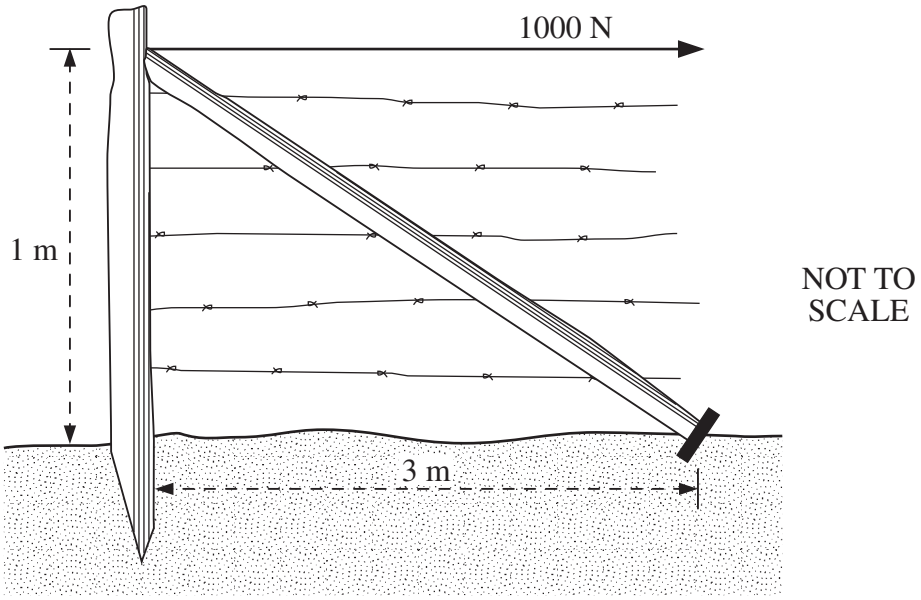


FIG. 9

Magnitude ..... N

(ii) What type of force is in the wire?

.....

(iii) What type of force is in the diagonal brace?

.....

(e) Fencing wires may be of high carbon or low carbon content. State ONE advantage of each type.

High carbon .....

Low carbon .....

Question 6 continues on page 20

QUESTION 6 (Continued)

(f) Figure 10 shows a fabricated galvanised steel pipe gate.

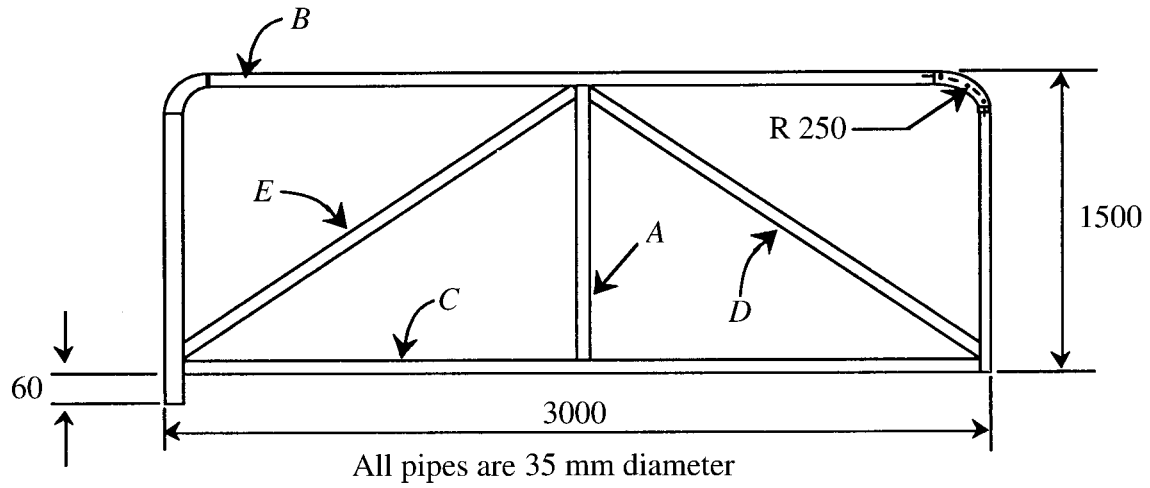


FIG. 10

(i) Calculate the length of pipe required for each of the members *A*, *B* and *C*. Members *D* and *E* are both 2000 mm in length.

Length *A* ..... mm

Length *B* ..... mm

Length *C* ..... mm

(ii) If the cost of suitable second-hand galvanised steel pipe is \$1·50 per metre, calculate the total cost of pipe required to manufacture TWO of these gates.

Cost for TWO gates \$.....

(g) The documentation for a vehicle roadworthiness test states that, from a speed of 50 km/h, a vehicle must be able to decelerate at 6 m/s^2. How many seconds would it take for a vehicle to stop under these conditions?

Time to stop ..... seconds

SECTION V—FARM WATER SUPPLIES

(15 Marks)

QUESTION 7

(a) Answer these questions with reference to the pump performance diagram in Figure 11.

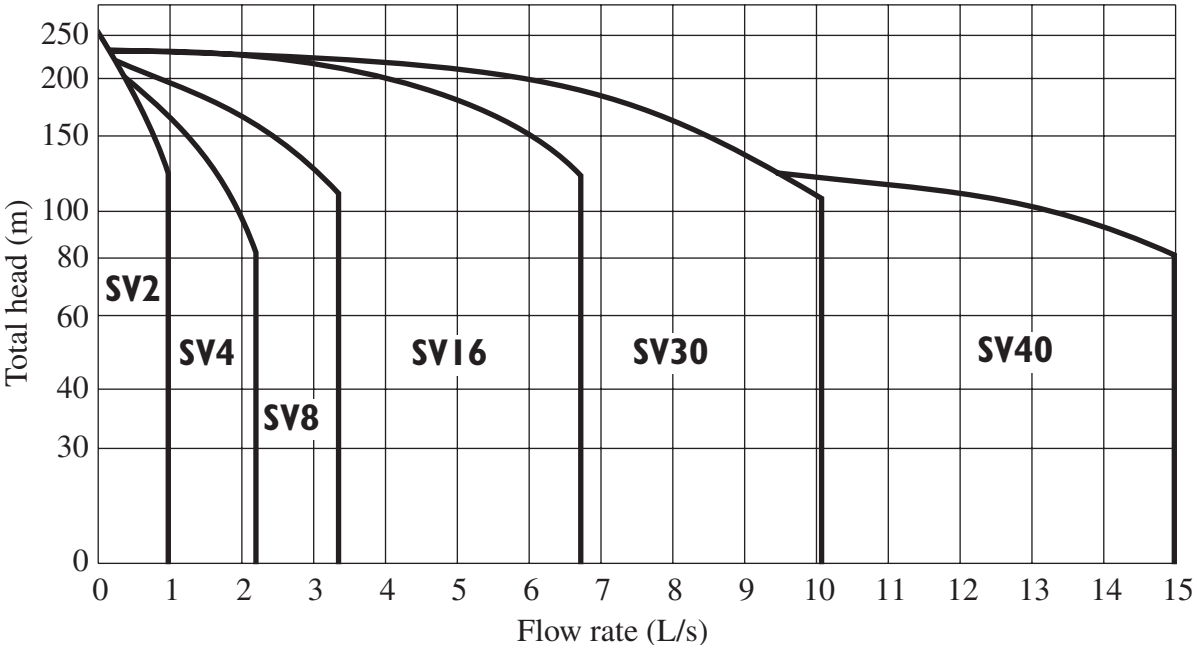


FIG. 11

(i) Could pump SV8 be used in a situation where the total dynamic head required was 150 m at a flow rate of 3 L/s?

.....

(ii) Which pump should be used if the pumping conditions required 100 m total dynamic head at a flow rate of 9 L/s?

.....

(iii) A pump operating with a total head of 150 m and a flow rate of 3 L/s is sometimes required to operate with a flow rate of 5 L/s. What is the most suitable pump for both conditions?

.....

(iv) The head is 80 m. If the flow rate was changed from 10 to 15 L/s would the pump need to be changed? Explain your answer.

.....

.....

Question 7 continues on page 22

QUESTION 7 (Continued)

(b) List THREE of the factors that make up the total head of a pumping system.

(i) .....

(ii) .....

(iii) .....

(c) (i) Domestic farm water systems often collect rain water. Complete the table to show THREE materials frequently used for water tanks, and state ONE advantage for each.

	Material	*Advantage*
1		
2		
3		

(ii) State TWO ways to keep dust and leaves out of the tank.

1 .....

2 .....

(d) (i) Water is often pressurised for domestic use.

1 What type of pump would be suitable for this application?

.....

2 Why?

.....

.....

(ii) For domestic use, a water pump is coupled to a pressure tank. Why is the pressure tank needed?

.....

.....

QUESTION 7 (Continued)

(e) (i) Explain why pumping from a farm dam requires a foot valve.

.....

.....

(ii) Draw a cross-section diagram to show a suitable position for a foot valve in a dam.

(f) Explain why it is necessary to prime a centrifugal pump before use.

.....

.....

.....

(g) State TWO uses for multistage centrifugal pumps.

(i) .....

(ii) .....

Question 7 continues on page 24

QUESTION 7 (Continued)

(h) State THREE conditions necessary for the growth of toxic algae.

(i) .....

(ii) .....

(iii) .....

(i) State TWO possible causes, and suitable methods of treatment, for a blockage in a micro-irrigation system.

Cause 1 .....

Treatment 1 .....

Cause 2 .....

Treatment 2 .....

(j) Why is the use of a settling tank important in a water supply system that draws water from a bore or dam?

.....

.....

SECTION VI—TOPICAL STUDY
RIPARIAN MANAGEMENT

(10 Marks)

QUESTION 8

(a) (i) What is *riparian land*?

.....

.....

(b) Give TWO examples of areas that would be designated as riparian land.

(i) .....

(ii) .....

(c) Give THREE reasons why it is important to carefully manage riparian land.

(i) .....

(ii) .....

(iii) .....

(d) List THREE ways in which stock can affect riparian vegetation.

(i) .....

(ii) .....

(iii) .....

(e) Stock access to, and grazing pressure on, riparian land must be controlled. Describe and evaluate TWO methods of achieving this.

(i) .....

.....

(ii) .....

.....

Question 8 continues on page 26

QUESTION 8 (Continued)

(f) Discuss TWO ways in which riparian vegetation can influence river ecosystems.

(i) .....

.....

(ii) .....

.....

(g) What are the TWO main types of river bank erosion?

(i) .....

(ii) .....

(h) State TWO ways in which vegetation can be used to stabilise a stream bank.

(i) .....

(ii) .....

(i) Name TWO Australian organisations that can provide assistance in a coordinated effort to develop and protect riparian land.

(i) .....

(ii) .....

(j) A cross-section of a stream bank is shown in Figure 12.

Draw and label, on the cross-section, the range of vegetation that would be found on this stream bank under ideal conditions for good riparian management.

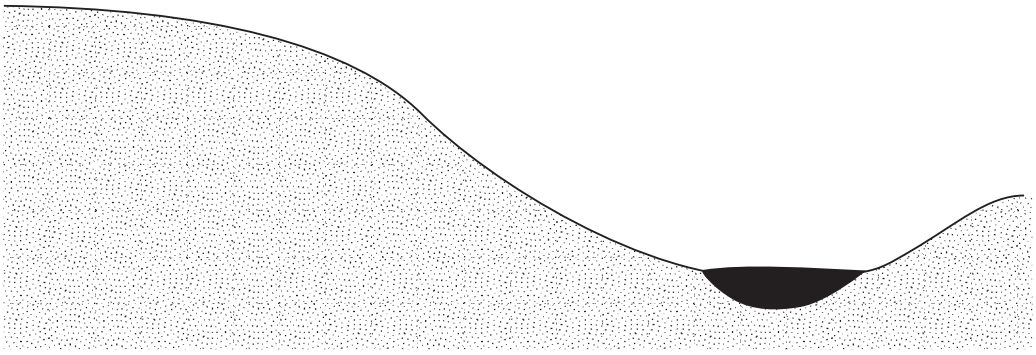


FIG. 12

QUESTION 8 (Continued)

(k) Off-river watering of stock is an important aspect of riparian management. Name and describe the use of TWO devices that allow for off-river watering of stock.

Device 1 .....

Description of use .....

.....

Device 2 .....

Description of use .....

.....

End of paper

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2000
HIGHER SCHOOL CERTIFICATE EXAMINATION
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2 UNIT

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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