



higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

NATIONAL CERTIFICATE

BUILDING SCIENCE N3

(15070023)

7 April 2021 (X-paper)

09:00–12:00

This question paper consists of 7 pages and 1 formula sheet.

056Q1A2107

DEPARTMENT OF HIGHER EDUCATION AND TRAINING
REPUBLIC OF SOUTH AFRICA
NATIONAL CERTIFICATE
BUILDING SCIENCE N3
TIME: 3 HOURS
MARKS: 100

INSTRUCTIONS AND INFORMATION

1. Answer all the questions.
 2. Read all the questions carefully.
 3. Number the answers according to the numbering system used in this question paper.
 4. Round off all intermediate and final calculations to TWO decimal places.
 5. Start each section on a new page.
 6. Use only blue or black ink.
 7. Write neatly and legibly.
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QUESTION 1

- 1.1 Define the term *concrete*. (1)
- 1.2 State the difference between thermoplastic and thermosetting plastic. (2×2) (4)
- 1.3 Outline the process followed during surface treatment of new wood before painting, (5)
- [10]**

**QUESTION 2**

- 2.1 An overhang beam is loaded as depicted in FIGURE 1 below with reactions $R_L = 1,97$ kN on the left-hand side and $R_R = 11,93$ on the right-hand side.

Calculate the magnitude of the point load P .

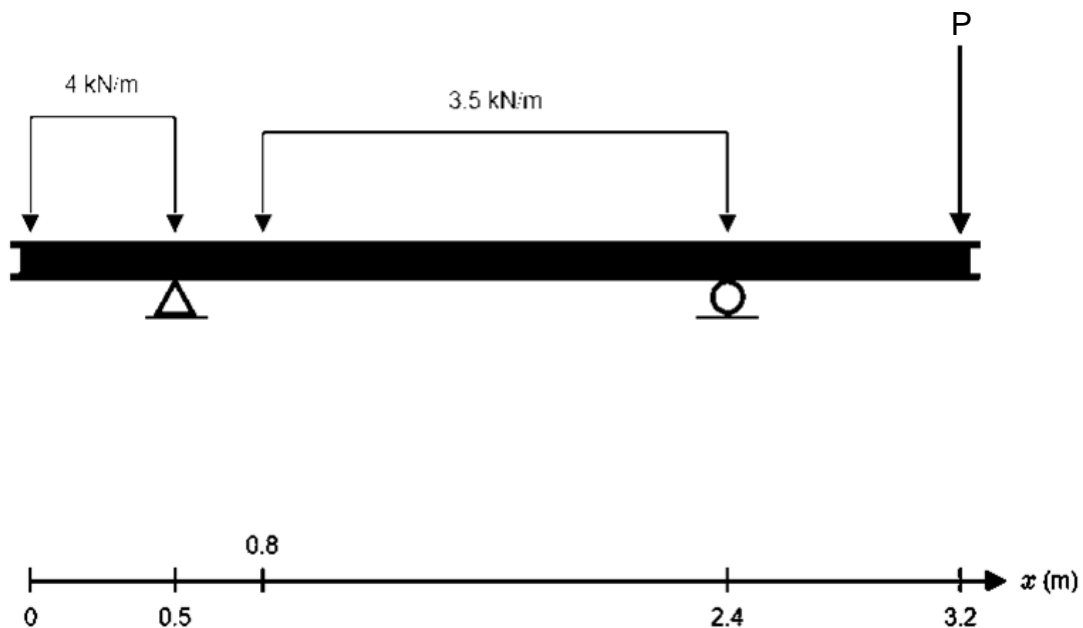


FIGURE 1

- 2.2 Draw a fully labelled shear force diagram to a linear scale of 1 cm:0,5 m and a force scale of 1 cm:5 kN. (4)
- 2.3 Do the necessary calculations and draw a fully labelled bending moment diagram to a linear scale of 1 cm:0,5 m and a moment scale of 1 cm:5 kNm (8)

[20]



QUESTION 3

- 3.1 A simple supported roof truss is loaded as shown in FIGURE 2 below.
- Strictly redraw the space diagram and show the nature of the member of the forces. (5)
- 3.2 Use the graphical **OR** analytical method to determine the magnitude or reactions (4)
- 3.3 Tabulate your results as shown in TABLE 1

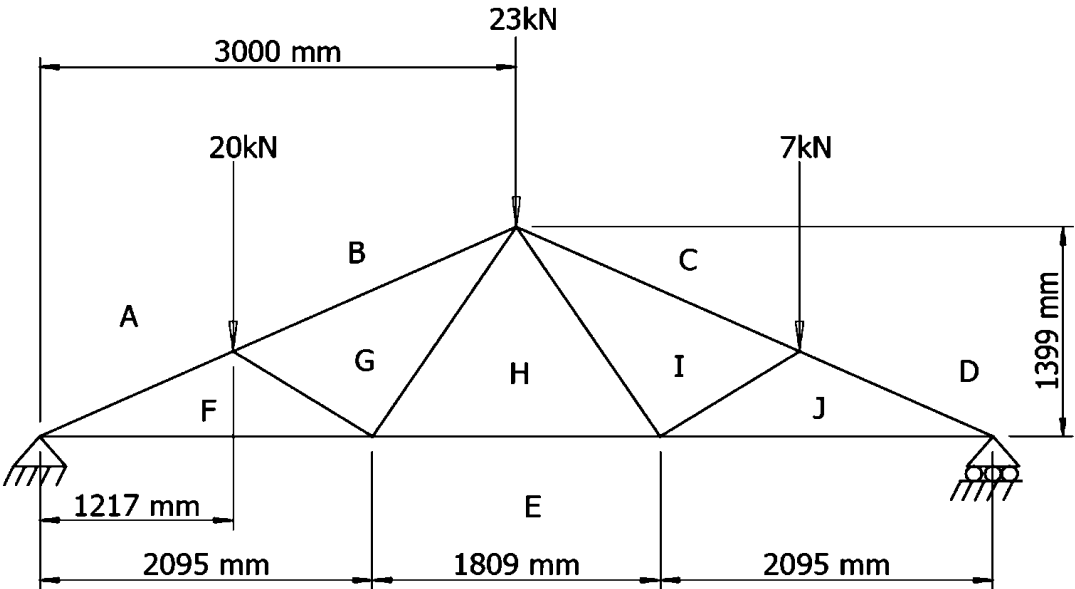


FIGURE 2

MEMBER	MAGNITUDE (kN)	NATURE
AF		
BG		
CI		
DJ		
EJ		
EH		
EF		
FG		
GH		
HI		
IJ		

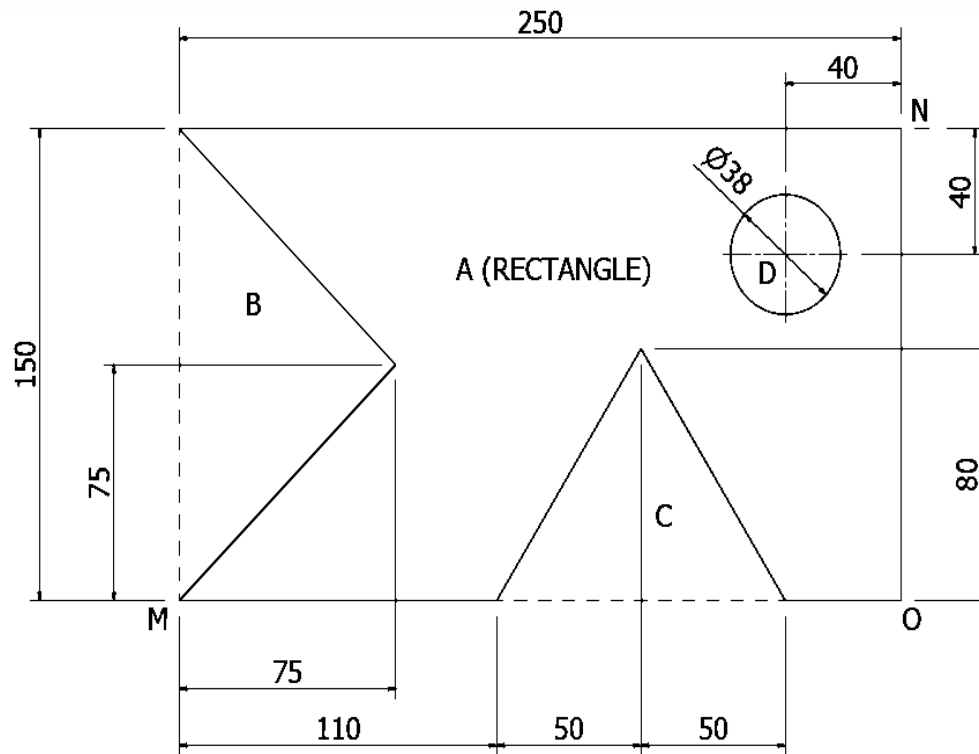
TABLE 1

(11)

[20]

QUESTION 4

- 4.1 Define *centroid*. (2)
- 4.2 A plane lamina is shown in FIGURE 2 below. (18)

**FIGURE 2****[20]**

QUESTION 5

FIGURE 3 below shows a tripod.

Graphically determine the maximum load that can be suspended at the apex if the legs are subjected to the loads shown on the diagram.

OS= FORCE IN LEG OA = 1kN

O'B= TRUE LENGTH OF THIRD LEG = 4.5m

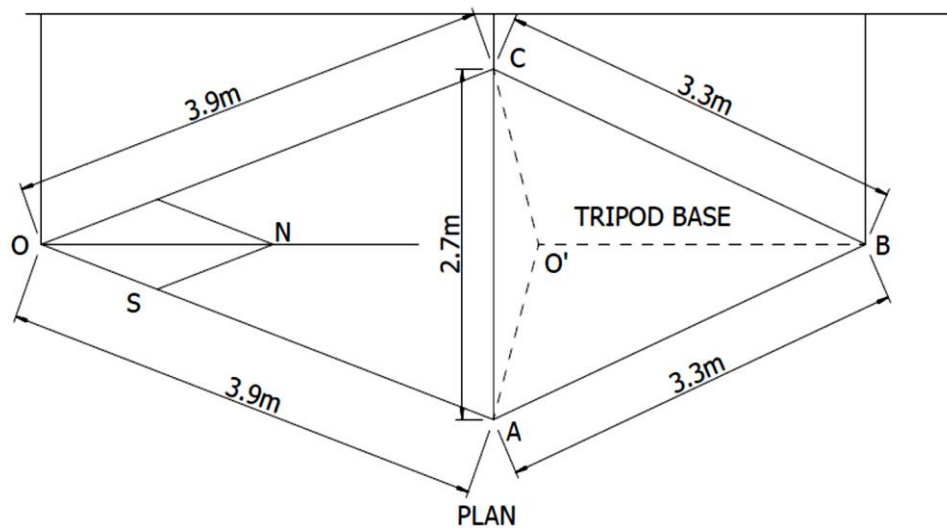


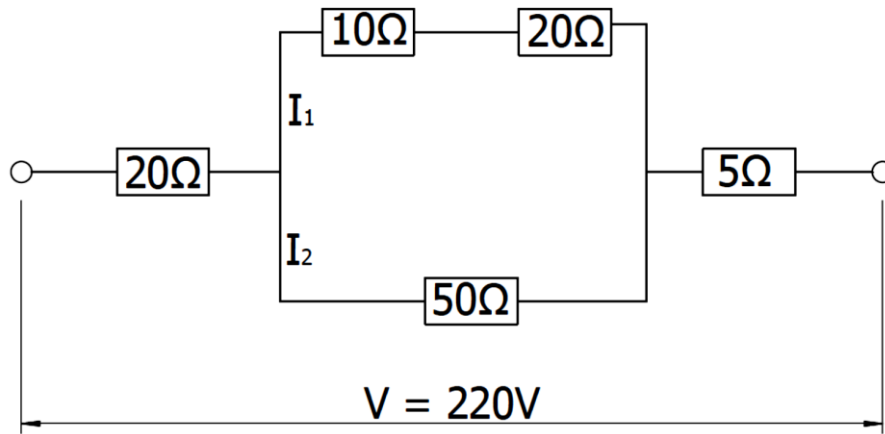
FIGURE 3

[10]

QUESTION 6

- 6.1 Calculate the power rating of an energy saving refrigerator which consumes 360 kWh annually on a 220 V supply and is switched on for 24 hours per day. The monthly energy bill for this refrigerator is R40,00. (4)

- 6.2 Calculate the total current flowing in the electrical circuit shown in FIGURE 4 below.

**FIGURE 4**

- 6.3 What is the purpose of a fuse? (2)

[10]**QUESTION 7**

- 7.1 Define *velocity ratio*. (2)

- 7.2 A load weighing 843N is raised using a wheel and axle machine. The machine has a velocity ratio of 2,5 while the diameter of the drum is 200 mm. If an effort of 15 0N is applied, calculate the following

7.2.1 Mechanical advantage

7.2.2 Efficiency

7.2.3 Distance moved by effort in one drum revolution

(3 × 2) (6)

- 7.3 Define *moment of a force*. (2)

[10]**TOTAL: 100**

FORMULA SHEET

Any applicable formula may be used.

1. $F = m \times g$
2. $A = \frac{\pi D^2}{4}$
3. $F\mu = \mu \times W$
4. $\mu = \tan \phi$
5. Comp. $\ast = W \sin \phi$
Komp. $\ast = W \sin \phi$
6. Comp. $\zeta = W \cos \phi$
Komp. $\zeta = W \cos \phi$
7. $F1 = \mu W \cos \phi + W \sin \phi$
8. $F\mu = \mu W \cos \phi$
9. $F2 = \mu W \cos \phi - W \sin \phi$
10. $s = ut + \frac{1}{2}at^2$
11. $v = u \pm 2as$
12. $v = u^2 \pm at$
13. $M = m \times v$
14. $m \times u = m \times v$
15. $VR = \frac{\text{Effort distance}}{\text{Load distance}}$
 $SV = \frac{\text{Magafstand}}{\text{Lasafstand}}$
16. $MA = \frac{\text{Load}}{\text{Effort}}$
 $HV = \frac{Las}{Mag}$
17. $n = \frac{HV}{SV} \times 100$
18. $V = I \times R$
19. $R_T = R_1 + R_2 + R_3$
20. $\frac{1}{R_T} = \frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3}$
21. $P = V \times I$
22. $W = P \times t$
23. $AV = F \times S$
 $WD = F \times S$
24. $MOM = F \times \zeta S$
25. $A = L \times B$
26. $A = \pi r^2$
27. $A = \frac{1}{2}bh / \frac{1}{2}absin C$
28. $A = 4\pi r^2$
29. $\bar{x} = \frac{4r}{3\pi}$
30. $\bar{x} = \frac{1}{3}h$
31. $R = \sqrt{HK^2 + VK^2}$
 $R = \sqrt{HC^2 + VC^2}$
32. $TAN \phi = \frac{VC}{HC} / \frac{VK}{HK}$
33. Mass of water in mixture =
water:cement ratio \times mass of cement
34. Work done by effort in raising
the load = effort \times velocity
ratio (VR) \times load distance