higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

T250**(E)**(J26)T

NATIONAL CERTIFICATE

BUILDING SCIENCE N3

(15070023)

26 July 2018 (X-Paper)
13:00–16:00

Candidates will require drawing instruments.

Nonprogrammable calculators may be used.

This question paper consists of 6 pages and 1 formula sheet.

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. Rule off across the page on completion of each question.
5. ALL sketches and/or diagrams must be neat, reasonably large, in good proportion, fully labelled and done in pencil.
6. Assume that acceleration due to gravity g, is 9,81 m/s^2.
7. Write the formula before you start with the calculation.
8. Write neatly and legibly.

QUESTION 1

1.1 Hard water causes a number of problems regarding the use of water.

State FIVE problems caused by hard water. (5)

1.2 State THREE main purposes of paint. (3)
[8]

QUESTION 2

FIGURE 1 shows a cantilever beam loaded as shown.

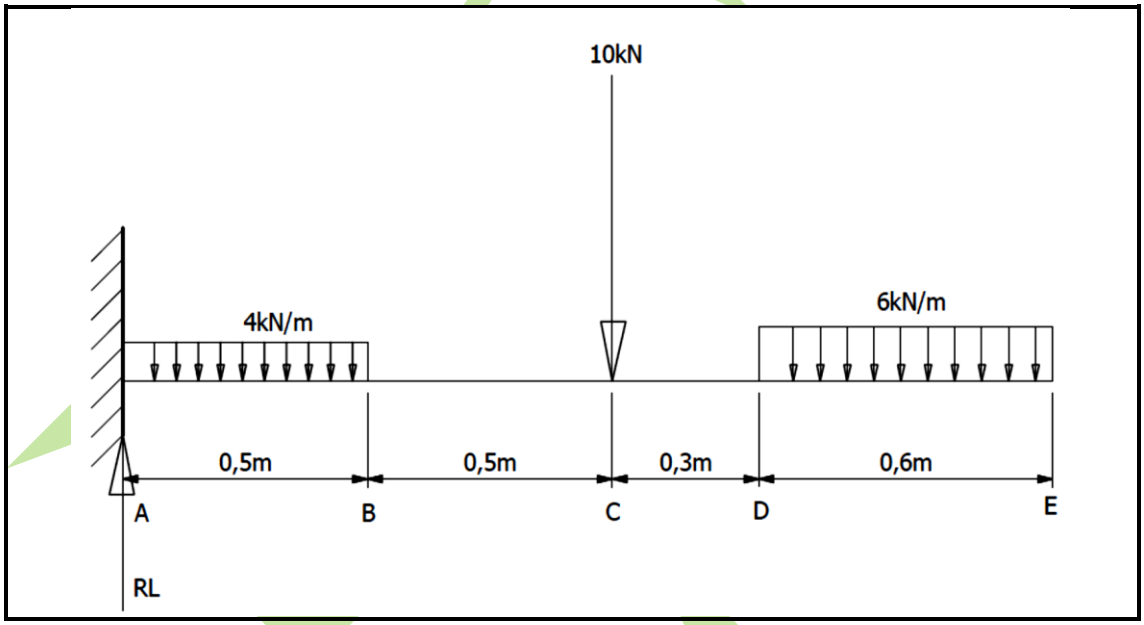

FIGURE 1

2.1 Calculate:

2.1.1 The magnitude of the reaction RL (2)

2.1.2 The bending moment at RL (3)

2.2 Draw a fully labelled *shear force diagram* to the linear scale of 1 cm : 0,2 m and the shear force scale of 1 cm : 5 kN. (7)

2.3 Draw a fully labelled *bending moment diagram* to a linear scale of 1 cm : 0,2 m and a bending moment scale of 1 cm : 1 kNm. (8)
[20]

QUESTION 3

3.1 Distinguish between *direct current* and *alternating current.* (2 × 2) (4)

3.2 Draw and fully label a 3-pin round plug. The drawing must include the following:

- Earth wire
- Live wire
- Neutral wire
- Brass pins
- Fuse

(8)
[12]

QUESTION 4

A pair of sheerlegs has legs of 7 m each, with the bases 4 m apart. A 12 m backstay stabilises the shear-legs and a 35 kN load is hung from the apex. The load is hung from the apex, 3 m beyond the base of the sheer-legs.

Graphically determine the forces acting in each of the legs.

Use the linear scale 1 cm = 1 m and the force scale 1 cm = 15 kN. **[10]**

QUESTION 5

5.1 Define *work done* as applicable to lifting machines. (2)

5.2 State any TWO laws of friction. (2)

5.3 A load of 1 000 N is lifted through a height of 3 m by an effort of 300 N moving through a distance of 25 m.

Calculate:

5.3.1 Velocity ratio

5.3.2 Mechanical advantage

5.3.3 Efficiency of the hoisting machine

(3 × 2) (6)
[10]

QUESTION 6

FIGURE 2 shows a plane laminar.

Analytically determine the position of the centroid with regard to OX and OY respectively. ALL dimensions on the laminar are in millimetres. NO marks will be awarded for using the graphical method.

Tabulate the work and answers as shown in TABLE 1.

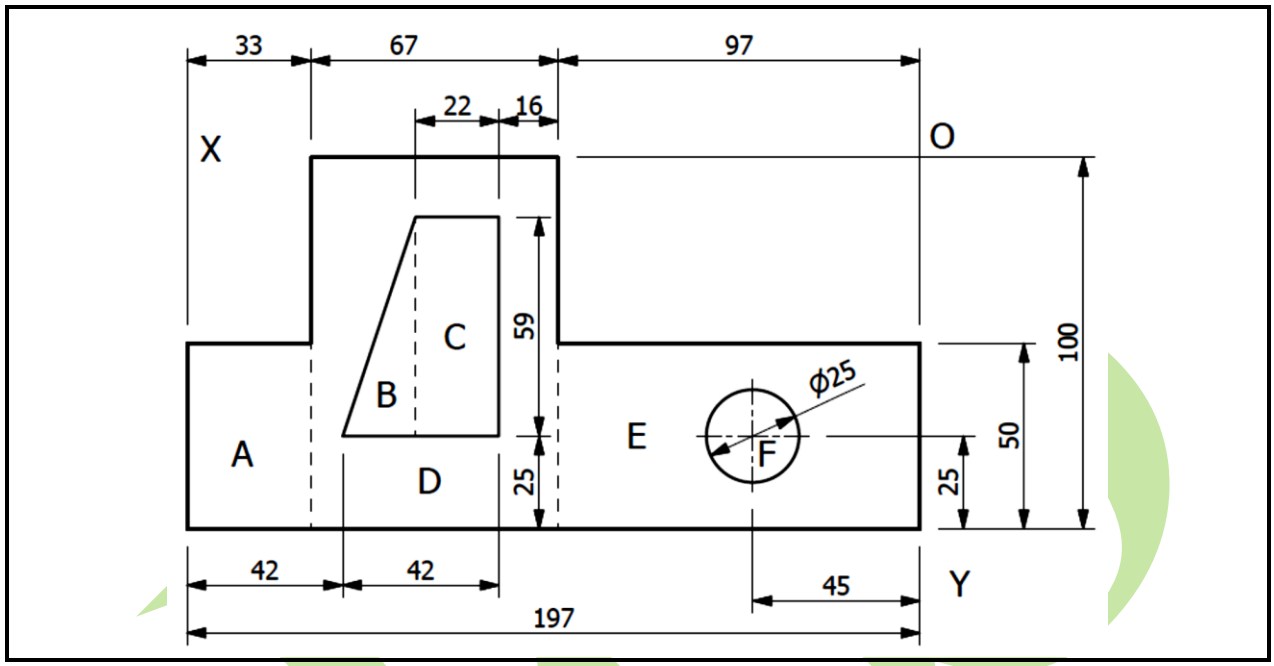

FIGURE 2

SHAPE	AREA (mm^2)	OY (mm)	OX (mm)	Aoy (mm^3)	Aox (mm^3)
A					
B					
C					
D					
E					
F					
SUM					

TABLE 1 **[20]**

QUESTION 7

7.1 Study FIGURE 3 and determine the magnitude of the reactions RL and RR respectively. (2 x 2) (4)

7.2 Graphically determine the *magnitude* and *nature* of member forces. Present your results in tabular form as shown in TABLE 2 and show the *nature* of member forces on a space diagram.

Use the linear scale 1 cm = 0,5 m and the force scale 1 cm = 2 kN. (16)
[20]

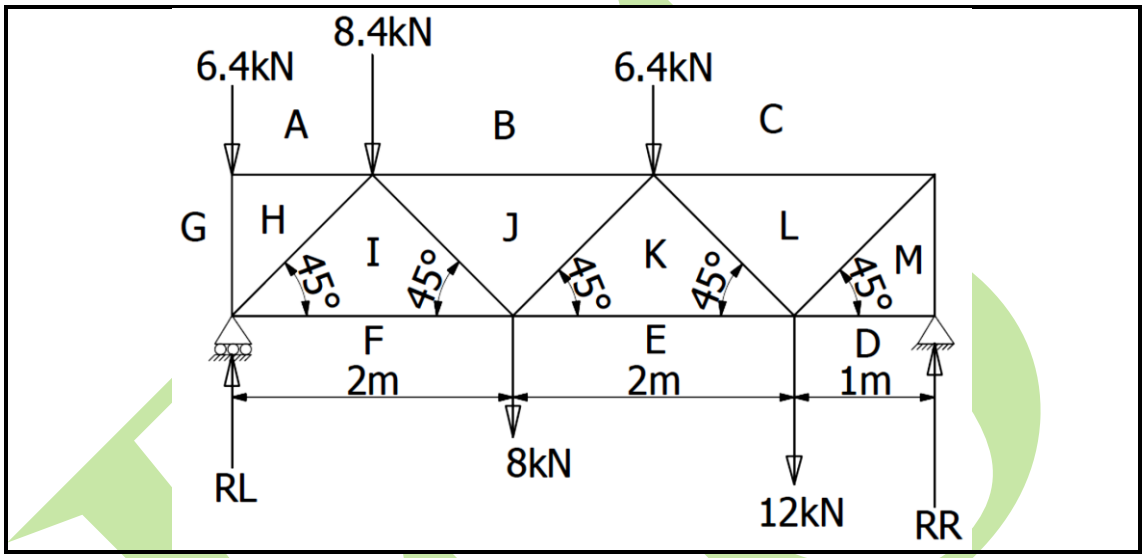

FIGURE 3

MEMBER	MAGNITUDE (kN)	NATURE
GH		
AH		
HI		
FI		
IJ		
BJ		
JK		
EK		
KL		
CL		
LM		
DM		
CM		

TABLE 2

TOTAL: 100

BUILDING SCIENCE N3

FORMULA SHEET

Any applicable formula may also be used.

1. $F = m \times g$
2. $A = \frac{\pi D^2}{4}$
3. $F = \mu \times W$
4. $\mu = \tan \emptyset$
5. Comp. // $= W \sin\emptyset$
6. Comp. $\perp = W \cos$
7. $F1 = \mu W \cos \emptyset + W \sin \emptyset$
8. $F\mu = \mu W \cos \emptyset$
9. $F2 = \mu W \cos \emptyset - W \sin \emptyset$
10. $s = ut + {}^{1}/_{2}at^2$
11. $v = u \pm 2as$
12. $v = u^2 \pm at$
13. $M = m \times v$
14. $m \times u = m \times v$
15. $VR = \frac{Effort\ distance}{Load\ distance}$
16. $MA = \frac{Load}{Effort}$
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. $AV = F \times S$
24. $MOM = F \times \perp S$
25. $A = L \times B$
26. $A = \pi r^2$
27. $A = {}^{1}/_{2}\ bh\ /\ {}^{1}/_{2}\ ab\ sin\ C$
28. $A = 4\pi r^2$
29. $\bar{x} = \frac{4r}{3\pi}$
30. $\bar{x} = \frac{1}{3}h$
31. $R = \sqrt{HC^2 + VC^2}$
32. $TAN\emptyset = \frac{VC}{HC} / \frac{VK}{HK}$
33. Mass of water in mixture =
    water: cement ration x mass of cement.
34. Work done by effort in raising the load =
    effort x velocity ratio (VR) x load distance
35. Compacting factor =
    Mass of partially compacted concrete
    Mass of fully compacted concrete