



higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

T250(E)(A1)T

NATIONAL CERTIFICATE

BUILDING SCIENCE N3

(15070023)

1 April 2019 (X-Paper)

09:00–12:00

Nonprogrammable calculators and drawing instruments may be used.

This question paper consists of 7 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. Sketches must be large, neat and fully labelled.
 5. Take gravitational acceleration (g) as $9,81 \text{ ms}^{-2}$.
 6. Round off final answers to TWO decimal places.
 7. Write neatly and legibly.
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QUESTION 1

- 1.1 Distinguish between *thermoplastics* and *thermosetting plastics*. (2)
- 1.2 What is the purpose of a concrete compression test? (1)
- 1.3 Outline the effect or effects on pipes and fittings for each of the following types of water:
- 1.3.1 Pure soft water 
 - 1.3.2 Soft water and very soft water
 - 1.3.3 Cold permanent hard water
 - 1.3.4 Hot temporary hard water
- (4 × 1) (4)
- 1.4 State THREE methods for maintaining moist conditions in concrete during the early stages of hardening. (3)
-  [10]

QUESTION 2

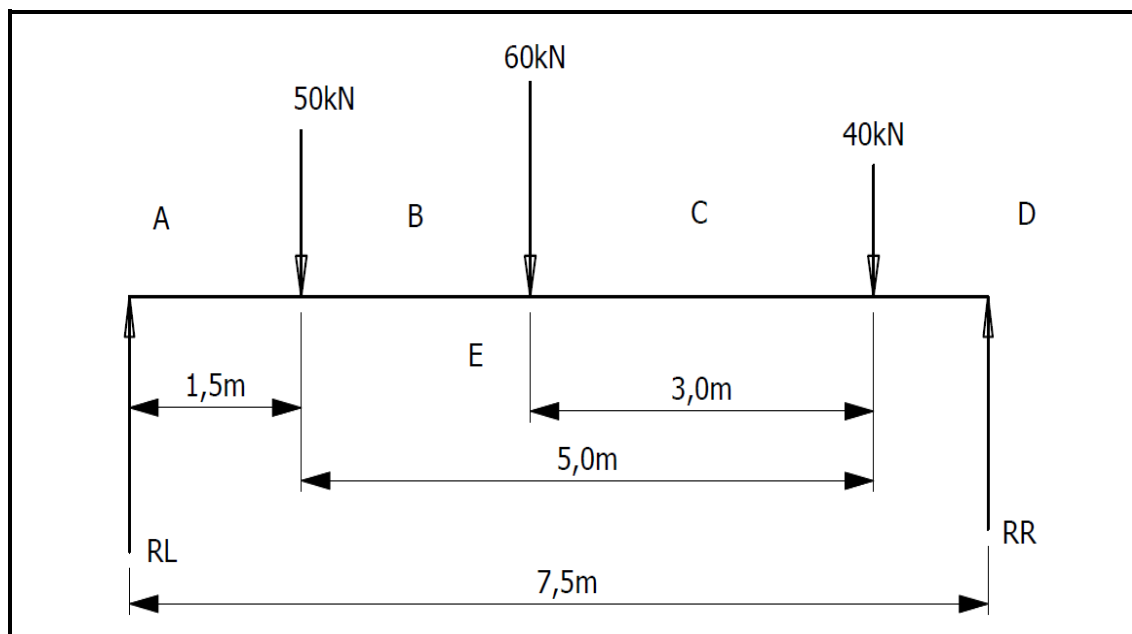
An object of mass 33 kg rests in an inclined plane forming 30° to the horizontal. The coefficient of friction between the surfaces is 0,5.

Calculate:

- 2.1 The component of weight of the block perpendicular to the plane
 - 2.2 The component of weight of the block parallel to the plane
 - 2.3 The frictional force 
 - 2.4 The smallest parallel force to the plane that will move the body up the plane
 - 2.5 The smallest parallel force to the plane that will move the body down the plane
- (5 × 3) [15]

QUESTION 3

3.1 FIGURE 1 shows a simply supported beam.

**FIGURE 1**

Determine the reactions RL and RR graphically. NO marks will be given for using the analytical method.

(6)

3.2 Draw a shear-force diagram to a linear scale of 1 cm:0,5 m and a force scale of 1 cm:10 kN.

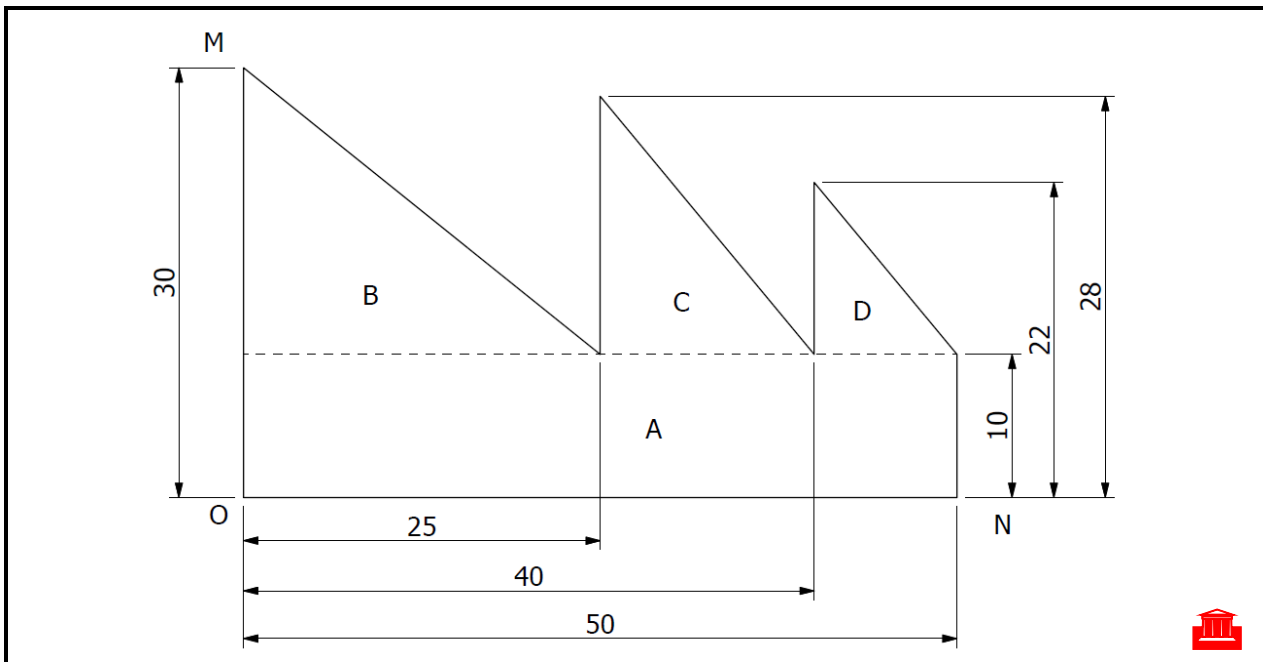
(5)

3.3 Draw a bending moment diagram to a linear scale of 1 cm:0,5 m and a moment scale of 1 cm:3 kN.m.

(5)
[16]

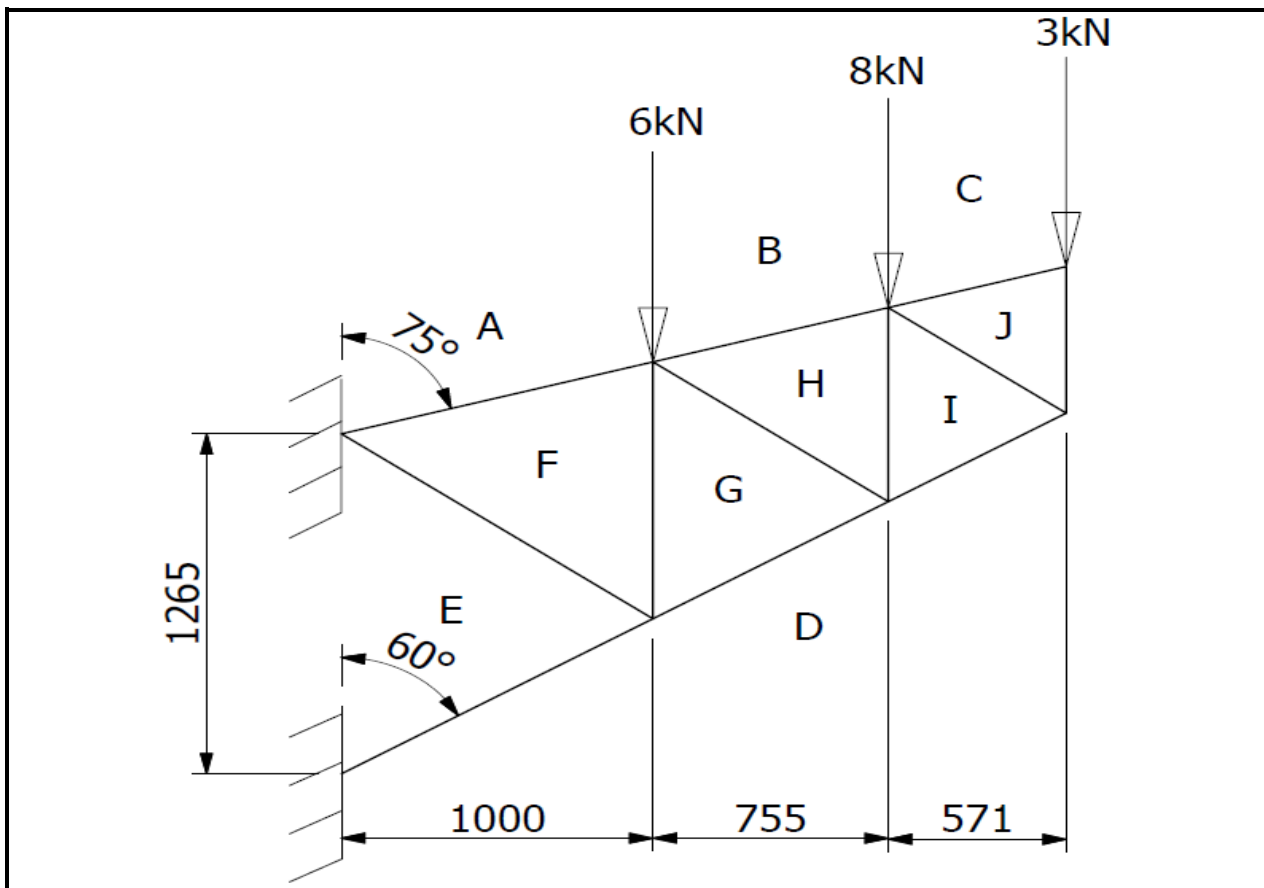
QUESTION 4

Determine the position of the centroid with respect to ON and OM analytically for FIGURE 2. NO marks will be given for using the graphical method.

**FIGURE 2****[16]**

QUESTION 5

FIGURE 3 shows a cantilever truss.

**FIGURE 3**

Determine the member forces action in the frame graphically. Present the results in tabular format. NO marks will be given for using the analytical method.

Force scale: 1 cm = 1 kN

**[21]****QUESTION 6**

- 6.1 Give TWO reasons for enclosing the filament of an incandescent light bulb in a glass vacuum. (2)
- 6.2 Outline SIX safety precautions applicable when using portable electric tools. (6)
- 6.3 What are the properties of a good electric insulator? (2)

**[10]**

QUESTION 7

A pair of shear legs is separated at the bottom at a distance of 5 m. The legs are each 8 m in length. A 14 m-long backstay is provided and a 50 kN load is suspended from the apex.



Determine the forces acting in the backstay and in each leg graphically. The overhang is given as 3,5 m.

[12]**TOTAL: 100**

FORMULA SHEET

Any other applicable formula may be used.

$$1. F = m \times g$$

$$2. A = \frac{\pi D^2}{4}$$

$$3. F\mu = \mu \times W$$

$$4. \mu = \tan \phi$$

$$5. \text{Comp. } * = W \sin \phi$$

$$6. \text{Comp. } \zeta = W \cos \phi$$

$$7. F1 = \mu W \cos \phi + W \sin \phi$$

$$8. F\mu = \mu W \cos \phi$$

$$9. F2 = \mu W \cos \phi - W \sin \phi$$

$$10. s = ut + \frac{1}{2}at^2$$

$$11. v = u \pm 2as$$

$$12. v = u^2 \pm at$$

$$13. M = m \times v$$

$$14. m \times u = m \times v$$

$$15. VR = \frac{\text{Effort distance}}{\text{Load distance}}$$

$$16. MA = \frac{\text{Load}}{\text{Effort}}$$

$$17. n = \frac{MA}{VR} \times 100$$

$$18. V = I \times R$$

$$19. R_T = R_1 + R_2 + R_3$$

$$20. \frac{1}{R_T} = \frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3}$$

$$21. P = V \times I$$

$$22. W = P \times t$$

$$23. WD = F \times S$$

$$24. MOM = F \times \zeta S$$

$$25. A = L \times B$$

$$26. A = \pi r^2$$

$$27. A = \frac{1}{2}bh / \frac{1}{2}ab\sin C$$

$$28. A = 4\pi r^2$$

$$29. \bar{x} = \frac{4r}{3\pi}$$

$$30. \bar{x} = \frac{1}{3}h$$

$$31. R = \sqrt{HC^2 + VC^2}$$

$$32. \tan \phi = \frac{VC}{HC}$$

$$33. \text{Mass of water in mixture} = \text{water:cement ratio} \times \text{mass of cement}$$

$$34. \text{Work done by effort in raising the load} = \text{effort} \times \text{velocity ratio (VR)} \times \text{load distance}$$