higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

T240(**E**)(A3)T

NATIONAL CERTIFICATE

BUILDING SCIENCE N2

(15070012)

3 April 2018 (X-Paper)
09:00–12:00

Candidates need drawing instruments.
Nonprogrammable calculators may be used.

This question paper consists of 4 pages, 2 diagram sheets and 1 formula sheet.

DEPARTMENT OF HIGHER EDUCATION AND TRAINING
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NATIONAL CERTIFICATE
BUILDING SCIENCE N2
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. ALL the drawings must be drawn to the required scale.
5. All Sketches/diagrams must be done in pencil.
6. Use your own discretion where dimensions are not given.
7. Write neatly and legibly.

QUESTION 1

1.1 Define the following terms:

1.1.1 Relative density of material (specific gravity) (2)

1.1.2 Capillary action (3)

1.1.3 Propagation of heat (3)

1.1.4 Heat capacity (3)

1.2 What is the function of a hydrometer? (2)

1.3 Name TWO properties for each of the following roof coverings:

1.3.1 Malthoid bitumen

1.3.2 Clay tiles

(2 × 2) (4)
[17]

QUESTION 2

2.1 What does the abbreviation UDL refer to? (1)

2.2 Define the term *moment of a force*. (3)

2.3 The beam shown in FIGURE 1, DIAGRAM SHEET 1 (attached) is held at equilibrium by the reactions R_L and R_R.

Do not consider the weight of the beam and calculate the following:

2.3.1 Take moments about R_R to calculate the magnitude of R_L. (5)

2.3.2 Take moments about R_L to calculate the magnitude of R_R. (5)

2.3.3 Test the answers to prove the equilibrium. (2)
[16]

QUESTION 3

3.1 Redraw the framework shown in FIGURE 2, DIAGRAM SHEET 1 (attached) to a scale of 1:100 in the ANSWER BOOK. (2)

3.2 Complete the vector diagram in the ANSWER BOOK to a scale of 1 mm :1 kN that is required to graphically analyse the forces in the members of the framework mentioned in QUESTION 3.1. (5)

3.3 Graphically determine the magnitude and nature of the forces in each member of the framework and neatly tabulate the findings in the ANSWER BOOK. (9)
[16]

QUESTION 4

The sketch in FIGURE 3, DIAGRAM SHEET 2 (attached) shows a cross section of a structure used to support an overhead pulley system.

Calculate the position of the centre of gravity of the section from side A–B as indicated on the sketch. Neatly tabulate the answer. (All the measurements are in millimetres.)

[13]

QUESTION 5

5.1 Define the following terms:

5.1.1 Resultant

5.1.2 Equilibrant

(2 × 2) (4)

5.2 Calculate the magnitude and direction of the resultant force as indicated in FIGURE 4, DIAGRAM SHEET 2 (attached) by adding the components of the given forces. Neatly tabulate the required data. (14)

[18]

QUESTION 6

6.1 Explain, with the aid of a neat, labelled sketch, a suitable experiment to prove that metals expand in length when they are heated. (8)

6.2 Calculate the final temperature if the specific heat capacity of the water is 4 200 J/kg^{o}C, when 3 litres of water at a temperature of 30 ^{o}C is mixed with 5 litres of water at a temperature of 70 ^{o}C. (6)

6.3 Calculate the final length of a brass bar with an initial length of 600 mm, if it is heated from 18 ^{o}C to 145 ^{o}C. The coefficient of linear expansion of the brass is 20 × 10^{-6}/^{o}C. (6)

[20]

TOTAL: 100

DIAGRAM SHEET 1

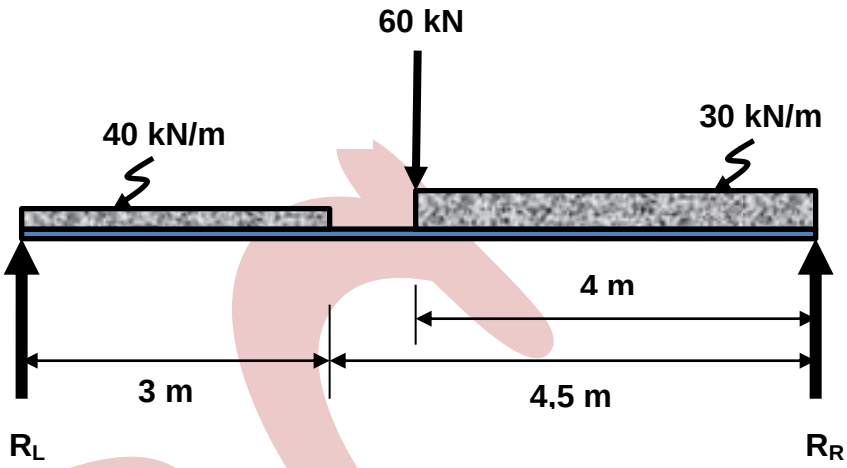

FIGURE 1

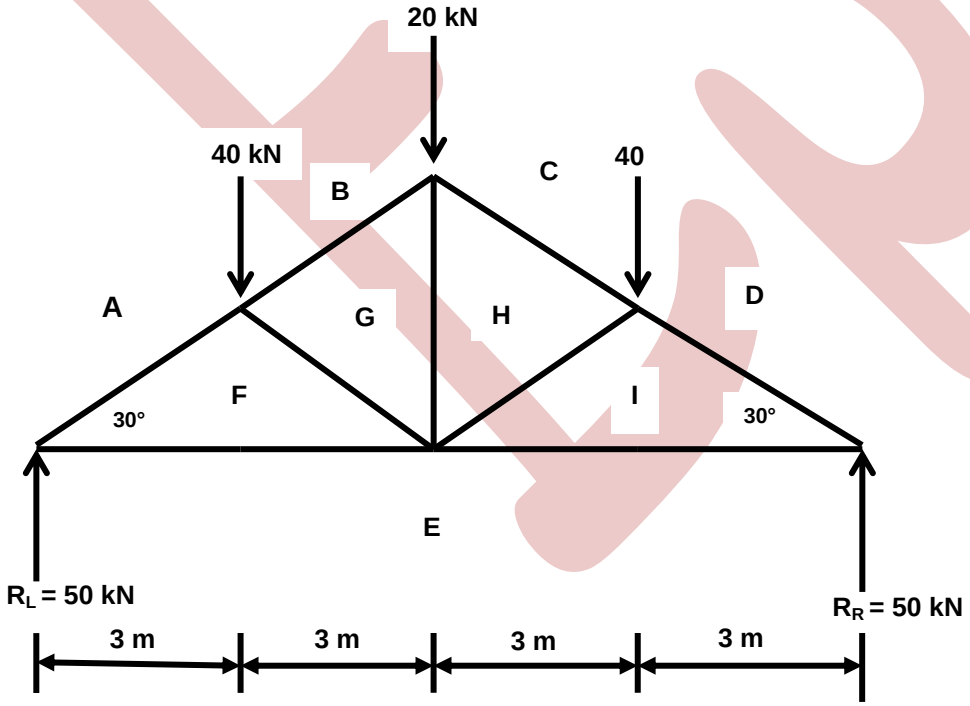

FIGURE 2

DIAGRAM SHEET 2

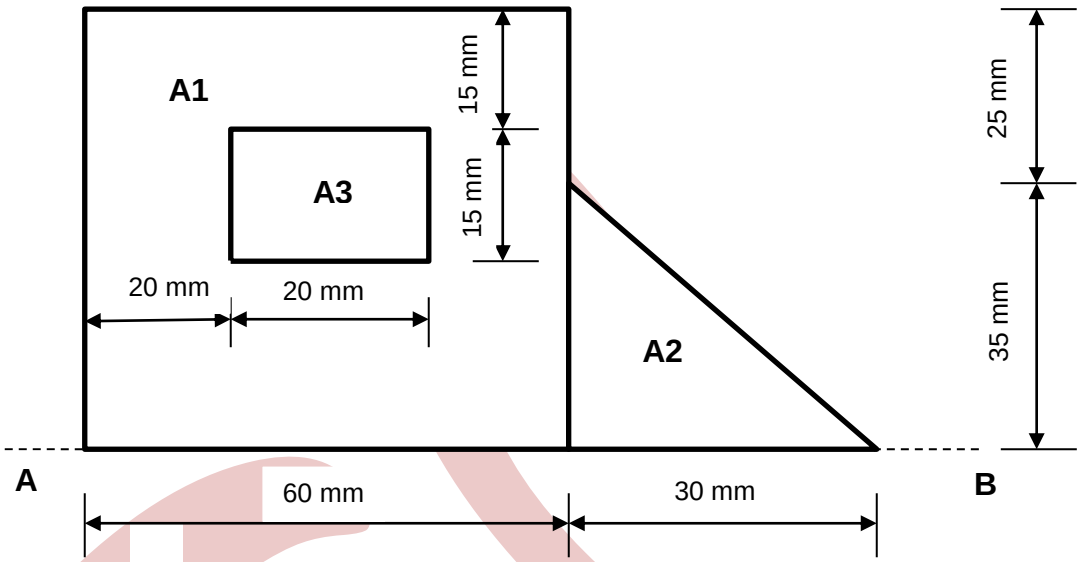

FIGURE 3

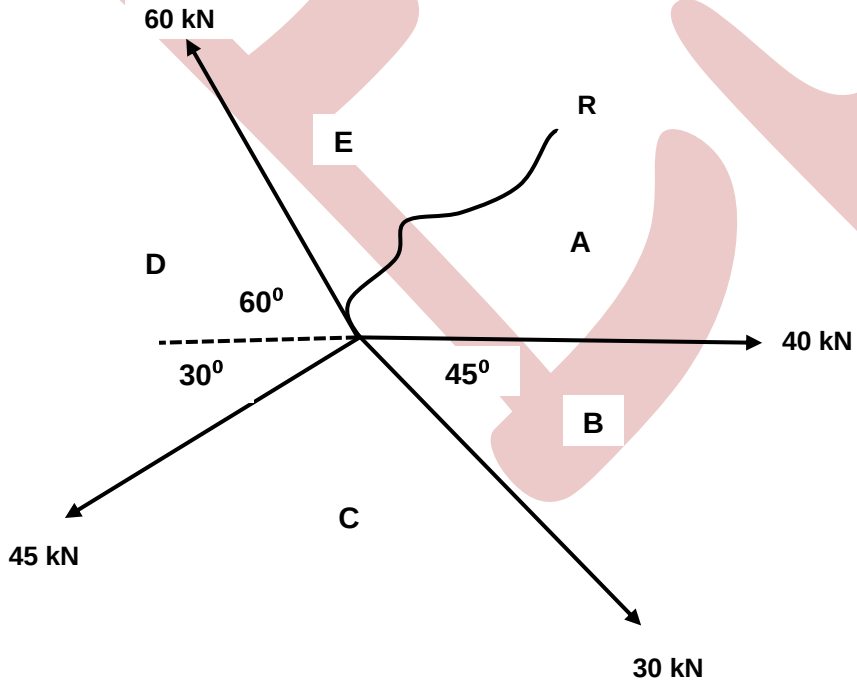

FIGURE 4

FORMULA SHEET

Any other applicable formula may also be used.

1. $F = m \times g$
2. $VC = W \sin\phi$
3. $HC = W \cos\phi$
4. $R = \sqrt{VC^2 + HC^2}$
5. $M = f \times s$
6. $\sum CM = \sum ACM$
7. $D = \frac{m}{V}$
8. $RD = \frac{DS}{D.W} = \frac{mS}{mW}$
9. Heat required $= m \times \Delta t \times SHC$
10. $\Delta L = L_O \times \Delta t \times \alpha$
11. *Heat Gain = Heat Loss*
12. $0°C = 273\ K$
13. Saturation coefficient $= \frac{Volume\ of\ water\ absorbed}{Bulk\ Volume - Solid\ Volume}$
14. % Porosity$= \frac{Bulk\ Volume - Solid\ Volume}{Bulk\ Volume} \times 100$
15. $\sum\uparrow forces = \sum\downarrow forces$
16. Tan ø $= \frac{\sum VC\surd}{\sum HC}$
17. $A = L \times B$
18. $A = \pi r^2$
19. $A = ½ (B \times H)$
20. $V = L \times B \times H$