higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

T250**(E)**(N21)T
NOVEMBER EXAMINATION

NATIONAL CERTIFICATE

BUILDING SCIENCE N2

(15070012)

21 November 2013 (X-Paper)
09:00–12:00

Candidates will require drawing instruments.

Calculators may be used.

This question paper consists of 5 pages, 1 formula sheet and 2 diagram sheets.

DEPARTMENT OF HIGHER EDUCATION AND TRAINING
REPUBLIC OF SOUTH AFRICA

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. Rule off on completion of each answer.
5. ALL the sketches and/or diagrams must be done in pencil. The sketches and/or diagrams must be neat, reasonably large and fully labelled.
6. Untidy and/or illegible work will be strictly penalised.
7. Assume 1 kg mass exerts a force of 10 N.
8. Write down the formula before you start with the calculation.
9. Write neatly and legibly.

QUESTION 1

1.1 Define the following:

1.1.1 The equilibrant of a system of forces

1.1.2 The resultant of a system of forces

(2 × 2) (4)

1.2 Graphically find the magnitude and direction of the resultant force of the system of coplanar concurrent forces shown in FIGURE 1 on the attached DIAGRAM SHEET 1. (10)
[14]

QUESTION 2

2.1 Define the term *couple.* (2)

2.2 FIGURE 2, DIAGRAM SHEET 1 (attached), shows a lever held in position by a pivot at O and by a force F.

2.2.1 Graphically determine the magnitude of force F.

2.2.2 Graphically determine the magnitude and direction of the pivot at point O. (10)
[12]

QUESTION 3

3.1 Define the *centre of gravity of a lamina.* (3)

3.2 FIGURE 3, DIAGRAM SHEET 2 (attached), shows a lamina of which the triangle section has been removed that is symmetrical about its vertical axis X-X.

(11)

Calculate the distance of the centre of gravity from the side A-B. **[14]**

QUESTION 4

FIGURE 4, DIAGRAM SHEET 2 (attached), shows a simply supported beam 11 metres long supported at points C and D. The beam supports a 4 kN/m distributed load that stretches from points C to D and two point loads as shown.

Calculate the magnitude of the reactions R_L and R_R.

NB: Ignore the mass of the beam. **[10]**

QUESTION 5

A symmetrical roof truss loaded as shown in FIGURE 5, DIAGRAM SHEET 2 (attached) is in equilibrium.

5.1 Determine the support reactions. (1)

5.2 Draw, to a suitable scale, the frame. Indicate which members are in tension and which are in compression (4½)

5.3 Draw, to a suitable scale, the force/stress diagram. (4½)

5.4 Copy and complete the following TABLE in the ANSWER BOOK.

MEMBER	MAGNITUDE OF FORCE	NATURE
AF		
BG		
CH		
DJ		
EF		
FG		
GH		
HJ		
JE		

(5)
[15]

QUESTION 6

6.1 Define the difference between *heat* and *temperature.* (4)

6.2 Name at least THREE causes of heat. (3)

6.3 Give at least THREE effects of heat on a substance. (3)

6.4 Name the THREE ways in which heat is transmitted. (3)
[13]

QUESTION 7

7.1 State the difference between *density* and *relative density* (specific weight) of a substance. (5)

7.2 A material has a relative density (specific weight) of substance of 0,8.

Find the density of the substance in kg/m^2. (2)

7.3 A sample of 2 m^3 of a material has a mass of 4 200 kg.

Find the relative density of the material. (2)
[9]

QUESTION 8

8.1 Explain what *surface tension* is. (2)

8.2 Calculate the surface tension of a liquid with a density of 1 250 kg/m^3 which rose 40 mm up inside a capillarity tube with a radius of 8 mm. Use gravity as 9, 81 m/s^2. (3)

8.3 Briefly describe what is meant by *porosity of material.* (2)

8.4 Calculate the percentage porosity of a piece of brick material.

Given the following:

The bulk (apparent) volume of the brick = 7,46 cm^3
The solid (absolute) volume determined by crushing to powder = 6,2 cm^3 (3)

8.5 Determine the saturation of a brick when 0,035 cm^3 water is absorbed and the volume of voids is calculated to be 0,42 cm^3. (3)
[13]

TOTAL: 100

BUILDING SCIENCE N2

FORMULA SHEET

Any other applicable formula may also be used.

1. $F = m \times g$

2. $VC = R \sin 2$
   $HC = R \cos 2$

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

4. $M = F \times s$

5. $\Gamma CWM = \Gamma ACWM$

6. $\Gamma F = \Gamma . F$

7. $x = \frac{\Sigma Ax}{\Sigma A}$

8. $T = \frac{g.\rho.h.r}{2}$

9. $\tau = r.F. \sin 2$

10. $\%\ Porosity = \frac{Bulk\ Volume - Solid\ Volume}{Bulk\ Volume} \times 100$

11. $Saturation\ coefficient = \frac{Volume\ of\ water\ absorbed}{Bulk\ Volume - Solid\ Volume}$

12. $D = \frac{m}{V}$

13. $RD = \frac{DS}{D.W} = \frac{mS}{mW}$

14. $0°C = 273\ K$

15. $Lu = Lo \times \Delta t \times \forall$

16. $Heat\ Required = Lo \times \Delta t \times SHC$

17. $Heat\ Gain = Heat\ Loss$

18. $\%\ Porosity = \frac{Bulk\ volume - Solid\ volume}{Bulk\ volume} \times \frac{100}{1}$

DIAGRAM SHEET 1

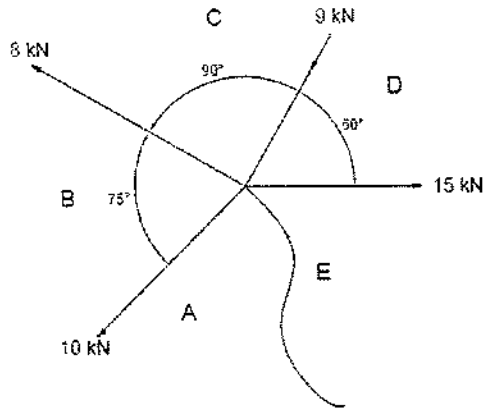

FIGURE 1

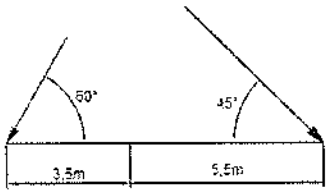

FIGURE 2

DIAGRAM SHEET 2

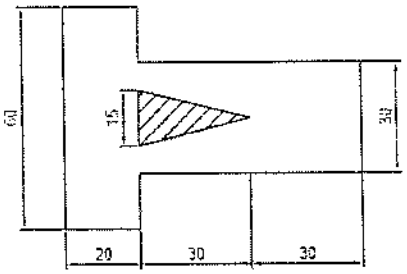

FIGURE 3

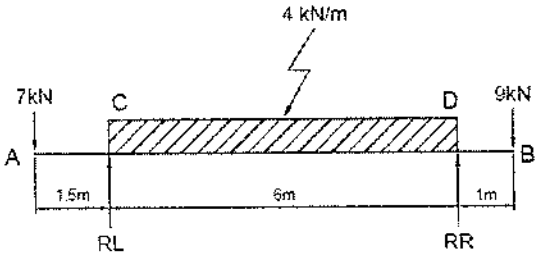

FIGURE 4

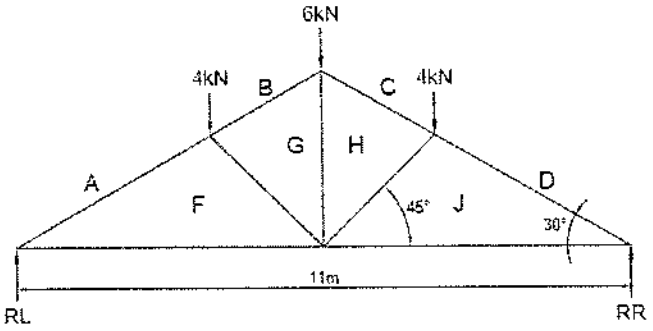

FIGURE 5