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education

Department:
Education
REPUBLIC OF SOUTH AFRICA

T250(**E**)(A9)T
APRIL 2010

NATIONAL CERTIFICATE

BUILDING SCIENCE N2

(15070012)

9 April (X-Paper)
09:00 – 12:00

Candidates will require drawing instruments, pens and a ruler.

Calculators may be used.

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

DEPARTMENT OF EDUCATION
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 correctly according to the numbering system used in this question paper.
4. Rule off on completion of each answer.
5. ALL sketches and/or diagrams must be done in pencil. The sketches must be neat, reasonably large, in relation and fully labelled.
6. Assume that 1 kg mass exerts a force of 10 N.
7. Write down the formula before you start with the calculation.
8. Write neatly and legibly.

QUESTION 1

1.1 Porous materials, if submerged in water, will not necessarily absorb water into its volume. Briefly name TWO reasons why this could happen. (4)

1.2 A steel block is fully submerged in oil with a density of 810 kg/m^3. The block has an apparent mass of 110 kg when fully submerged.

Calculate the following:

1.2.1 The actual mass of the steel block if it has a volume of 14×10^{-3} m^3. (4)

1.2.2 The relative density of the steel. (3)
[11]

QUESTION 2

2.1 The system of forces shown in FIGURE 1 on the DIAGRAM SHEET (attached) is held in equilibrium by force 'S'.

Calculate the following:

2.1.1 The sum of the horizontal components of the four known forces (5)

2.1.2 The sum of the vertical components of the four known forces (5)

2.1.3 The magnitude of the unknown force 'S' (2)

2.1.4 The angle and direction of the unknown force 'S' (2)

2.2 Describe a force in terms of the effect that it will have on body. (2)
[16]

QUESTION 3

3.1 Define the *law of moments*. (3)

3.2 The structure shown in FIGURE 2 on the DIAGRAM SHEET (attached) supports a load of 110 kN and is held in equilibrium by the reaction force at the hinge and the force 'F'.

Determine, by graphical methods, the magnitude of force 'F' and the magnitude and direction of the reaction at the hinge.
(No marks will be allocated for any calculation.) (9)
[12]

QUESTION 4

4.1 What is meant by the following terms:

4.1.1 Specific heat capacity (3)
4.1.2 Coefficient of linear expansion of a material (3)

4.2 A metal rod has length of 3 045 mm at a temperature of 17 °C. The length of the rod increases to 3 047,18 mm when the temperature is raised to 89 °C.

Calculate the following:

4.2.1 The increase in length of the rod (1)
4.2.2 The change in temperature of the rod (1)
4.2.3 The coefficient of linear expansion of the rod material (3)

4.3 A copper ball with a mass of 4,5 kg and at a temperature of 183 °C is immersed in 30 kg of water at a temperature 19 °C. The specific heat capacity of copper and water is 0,385 kJ/kg.°C and 4,186 kJ/kg.°C respectively.

Calculate the final temperature of the water and the ball if no heat is lost in the process. (7)
[18]

QUESTION 5

Determine graphically the magnitude and nature of the members of the framework shown in FIGURE 3 on the DIAGRAM SHEET (attached). Clearly indicate the nature of the members on the space diagram.

Tabulate your results. **[14]**

QUESTION 6

6.1 Explain how you would determine the density of an irregular object. (5)

6.2 Calculate the position of the centroid of the lamina shown in FIGURE 4 on the DIAGRAM SHEET (attached), of which the round section is removed. Give the position with regard to side Y-Y.
(No marks will be allocated for a graphical solution.) (12)
[17]

QUESTION 7

The system of forces acting on a beam as shown in FIGURE 5 on the DIAGRAM SHEET (attached) is held in equilibrium by the reactions R_L and R_R. Apply the law of moments and determine the magnitude of R_L and R_R. Do not consider the weight of the beam in the calculations. **[12]**

TOTAL: 100

DIAGRAM SHEET

QUESTION 2.1

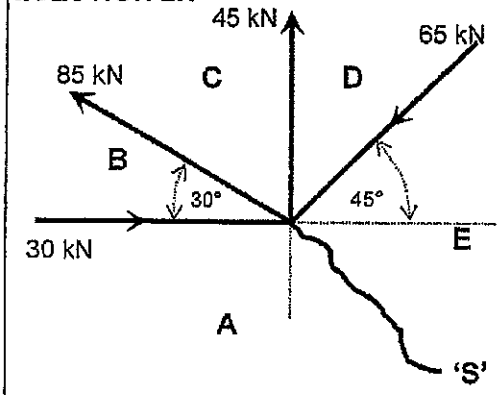

FIGURE 1

QUESTION 3.2

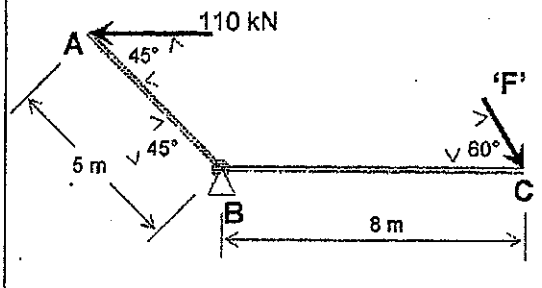

FIGURE 2

QUESTION 5

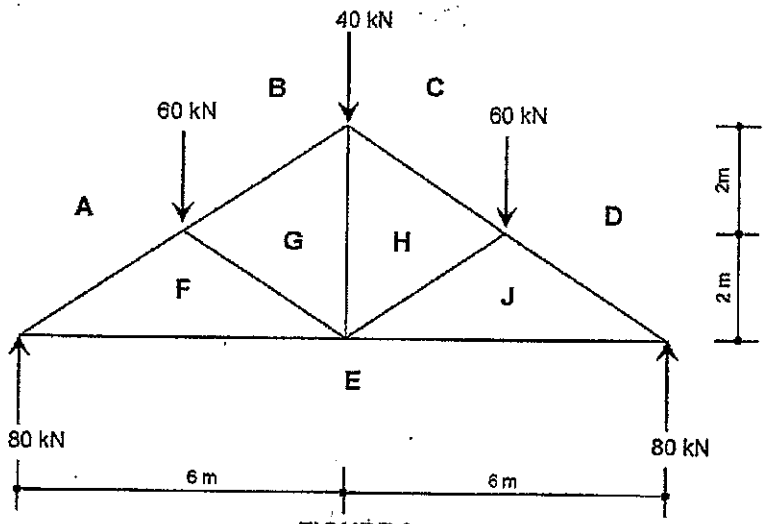

FIGURE 3

QUESTION 6.2

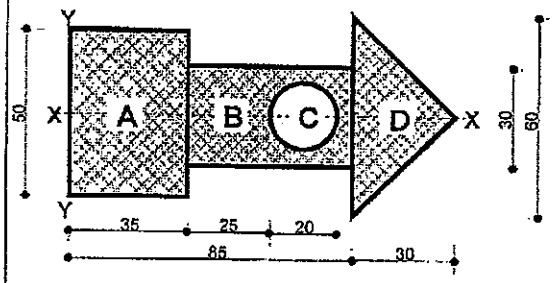

FIGURE 4

QUESTION 7

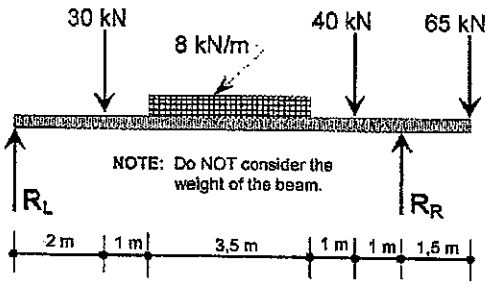

FIGURE 5

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. $Heat\ Gain = Heat\ Loss$