higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

NATIONAL CERTIFICATE

BUILDING SCIENCE N1

(15070001)

17 November 2022 (X-paper)
09:00–12:00

Drawing instruments and nonprogrammable calculators may be used.

This question paper consists of 4 pages, an addendum and a formula sheet.

062Q1E2217

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DEPARTMENT OF HIGHER EDUCATION AND TRAINING
REPUBLIC OF SOUTH AFRICA

NATIONAL CERTIFICATE
BUILDING SCIENCE N1
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. Use only a black or a blue pen.
5. Start each question on a new page.
6. Write neatly and legibly.

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QUESTION 1

The table below shows the physical quantities, SI units and symbols used in building science. Complete the table by writing the answer next to the question number (1.1–1.10) in the ANSWER BOOK.

Physical quantity	SI Unit	Symbol
1.1	millimetre	mm
Weight	1.2	kN
1.3	kilopascal	1.4
Area	1.5	m^2
1.6	Kelvin	1.7
Volume of liquids	1.8	1.9
Moment of Force	Newton metre	1.10

(10 × 1) **[10]**

QUESTION 2

2.1 Briefly explain what is meant by *density of a material*. (3)

2.2 Determine the mass of an object in kg if the volume of the object is 15 cm^3 and the density of the object 13,8 g/cm^3. (6)

2.3 Give the formula to calculate the relative density of a material. (1)

[10]

QUESTION 3

3.1 Calculate the amount of water required in litres for a concrete mixture of 100 kg of cement with a water/cement ratio of 0,04. (4)

3.2 Sketch and describe a simple experiment to show that the down-, up- and sideward pressure at a point in fluids are equal. (6)

3.3 List SEVEN properties of a good concrete mix. (7)

[17]

QUESTION 4

4.1 Define *Boyle's Law*. (4)

4.2 The volume of a gas is 6 m^3 with pressure of 280 kPa.

Calculate the volume of the gas if the pressure is increased to 400 kPa when the volume remains the same. (6)

4.3 Convert 75 °C to the thermodynamic temperature scale. (2)

[12]

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QUESTION 5

5.1 Define the term, *porosity*. (3)

5.2 Sketch and describe the experiment to show that water rises higher in a material with smaller pores. (8)

5.3 A wet concrete block has a mass of 5,5 kg. After curing and drying, the mass of a concrete block is 4,8 kg.

Calculate the percentage moisture content of the concrete block. (4)

[15]

QUESTION 6

6.1 A 6,3 kN force is acting to the left and a force of 3 150 N is acting to the right along the same line of action.

Determine the magnitude and direction of the following:

6.1.1 The resultant force (N)

6.1.2 The equilibrant (N)

(2 × 2) (4)

6.2 Graphically determine the magnitude and the sense of direction of the resultant of the TWO forces shown in FIGURE 1 on the ADDENDUM (attached).

Determine the angle between the resultant and the 60 N force.

(8)

[12]

QUESTION 7

FIGURE 2 on the ADDENDUM (attached) shows FOUR forces acting on a pin.

Graphically determine and clearly show the magnitude and direction of the equilibrant and calculate the magnitude of the horizontal and vertical components of the equilibrant.

[12]

QUESTION 8

THREE forces act on a beam as shown in FIGURE 3 on the ADDENDUM (attached).

By means of the link-polygon method, determine the position and magnitude of the resultant of the THREE forces.

Clearly show the distance from the resultant to the left-hand end of the beam.

[12]

TOTAL: 100

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ADDENDUM

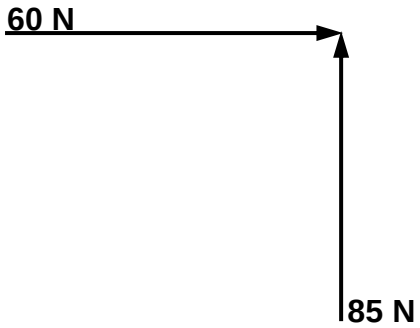


FIGURE 1

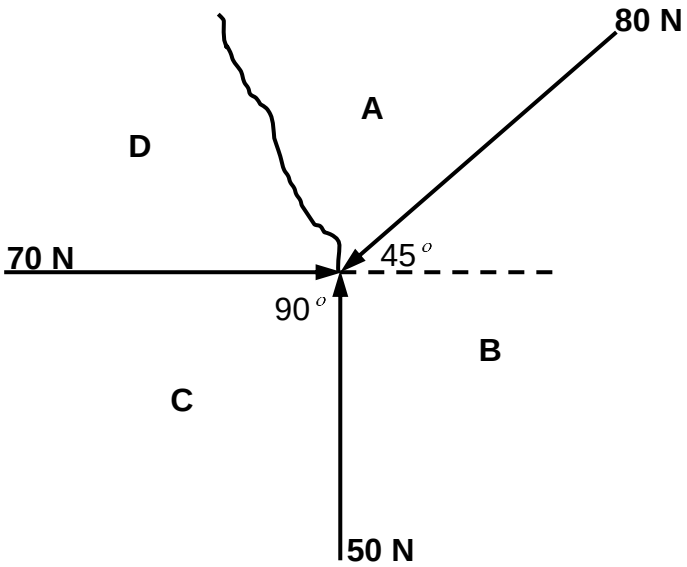


FIGURE 2

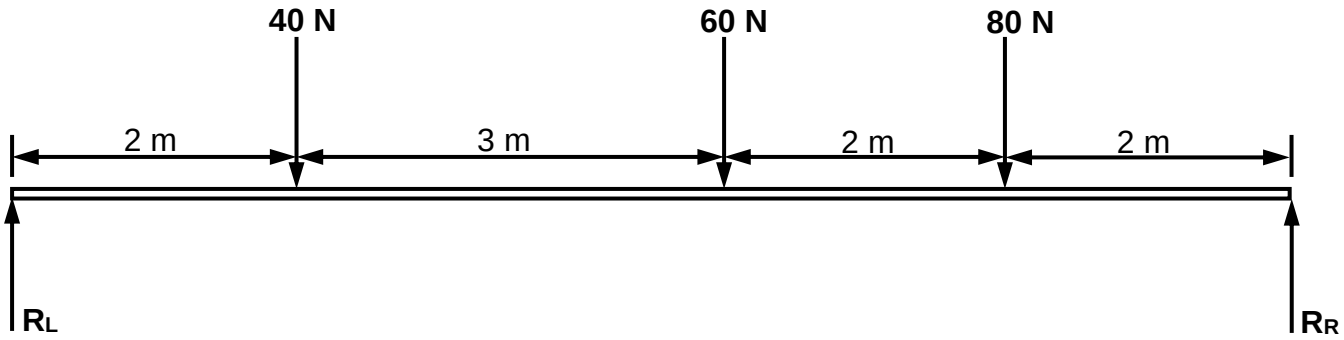


FIGURE 3

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BUILDING SCIENCE N1

FORMULA SHEET

Any applicable formula may also be used.

1. $F = m \times g$

2. $\sin \theta = \frac{O}{S}$

$\sin \theta = \frac{T}{S}$

3. $\cos \theta = \frac{A}{H}$

$\cos \theta = \frac{A}{S}$

4. $\tan \theta = \frac{O}{A}$

$\tan \theta = \frac{T}{A}$

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

6. $A = \frac{1}{2}(B \times h)$

7. $V = \frac{\pi D^2}{4} \times h$

8. $V = \frac{4}{3} \pi r^3$

9. $V = \frac{1}{3} \pi r^2 h$

10. $D = \frac{M}{V}$

11. $R.D. = \frac{M.S}{M.W}$

$= \frac{D.S}{DW}$

12. $K = C + 273$

13. $VC / VK = F \cos \theta$

14. $HC / HK = F \cos \theta$

15. $V = L \times B \times H$

16. $\%MC = \frac{IW - DW}{DW} x100$

$\%VI = \frac{AG - DG}{DG} x\ 100$

17. $P = h \times d \times g$

18. (Water- cement ratio)
(Water – sementverhouding)

$W.C.R. = \frac{M.W}{M.C}$

$W.S.V = \frac{M.W}{M.S}$

19. $R^2 = VC^2 + HC^2$

$R^2 = VK^2 + HK^2$

20. $W = P \times V \times g$
$G = P \times V \times g$

21. $W = m \times g$

22. $P_1V_1 = P_2V_2$

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