



**higher education
& training**

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

**NATIONAL CERTIFICATE
BUILDING SCIENCE N1**

(15070001)

**28 July 2021 (X-paper)
09:00–12:00**

Drawing instruments and nonprogrammable calculators may be used.

This question paper consists of 5 pages and 1 formula sheet.

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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. Start each question on a new page.
 5. Only use a black or blue pen.
 6. Write neatly and legibly.
-



QUESTION 1

Complete the following table by writing only the answer next to the question number (1.1–1.10) in the ANSWER BOOK. 

QUANTITY	UNIT	SYMBOL
Area	1.1	m ²
1.2	Newton	1.3
Density	1.4	1.5
1.6	1.7	K
Volume	1.8	cm ³
1.9	1.10	kPa

[10]**QUESTION 2**

Indicate whether the following statements are TRUE or FALSE by writing only 'True' or 'False' next to the question number (2.1–2.5) in the ANSWER BOOK.

- 2.1 The mass of an object is the force with which it is attracted to the earth's centre, and it is measured in kN. 
- 2.2 Gravity is the force of attraction that the earth exerts on other bodies.
- 2.3 Concrete is a mixture of Portland cement, fine aggregate of sand, coarse aggregate of stone, and water.
- 2.4 The process of sawing logs into planks and boards is known as seasoning.
- 2.5 Preservation of timber is the poisoning of the food on which fungi and insects live. 

(5 × 2)

[10]**QUESTION 3**

- 3.1 Sketch and describe a simple experiment to show that fluid pressure is the same in all directions.  (6)

- 3.2 A tank with a diameter of 1 050 mm is filled with water to a height of 1,5 m.

Calculate the water pressure at the bottom of the tank in kilopascals.

(8)

[14]

QUESTION 4

4.1 Define *relative density*. (3)

4.2 Calculate the density of paraffin by using the following information:

- Mass of an empty container = 23,5 g
 - Mass of an empty container and paraffin = 45,5 g
 - Volume of paraffin = 73,5 cm³.
- (6)

4.3 A piece of timber is 4,5 m long, 300 mm wide and 75 mm thick. The relative density of timber is 0,82.

Determine the mass of the piece of timber.

(8)
[17]

QUESTION 5

5.1 Graphically determine the magnitude, direction and sense of the resultant of the three coplanar forces shown in FIGURE 1 below.

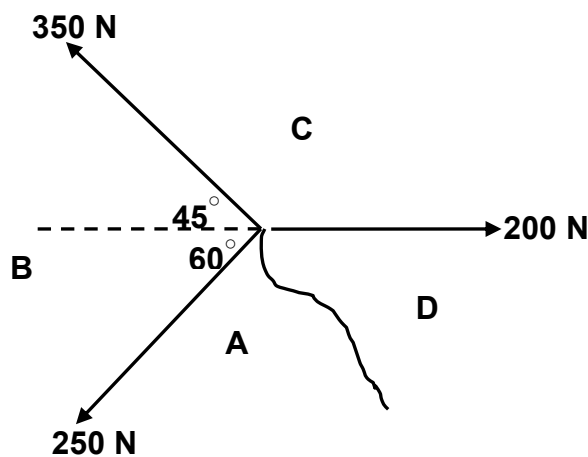


FIGURE 1


5.2 Graphically determine the horizontal and vertical components of a 55 N force acting at an angle of 45° to the horizontal.



(8)
[16]

QUESTION 6

- 6.1 A force of 220 N is acting towards the right-hand side and a force of 350 N is acting towards the left-hand side along the same line of action.

Determine the magnitude and direction of the resultant force.  (4)

- 6.2 A force of 50 kN is acting downwards at an angle of 60° to the horizontal.

Calculate the horizontal and vertical components. (6)
[10]

QUESTION 7

- 7.1 A concrete beam is 8 m long and has a mass of 3 200 kg. It is simply supported at both ends. 

Calculate the reaction force at each end of the beam in kilo newton (kN). (4)

- 7.2 FIGURE 2 below shows a beam with three forces acting on it.

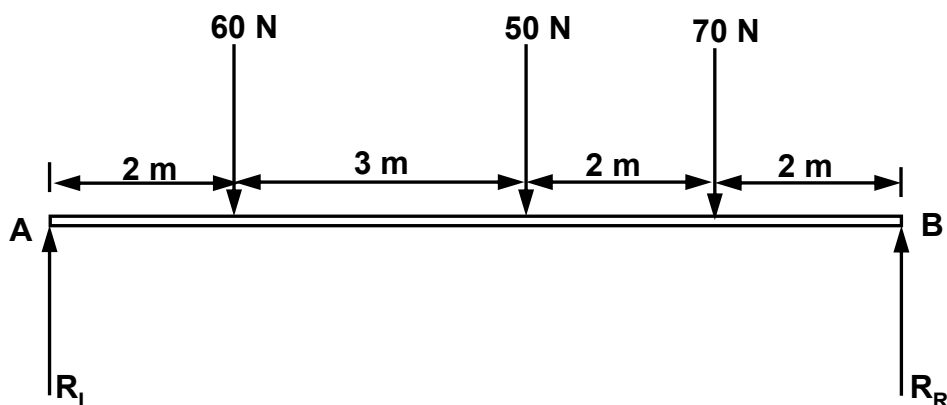


FIGURE 2

Determine the following by means of the link polygon method:

- 7.2.1 The reactions at the supports  (6)

- 7.2.2 The position and magnitude of the resultant of the THREE forces

Clearly indicate the distance from the resultant to the left-hand end (A) of the beam.

(13)
[23]

TOTAL: 100

BUILDING SCIENCE N1**FORMULA SHEET**

Any applicable formula may also be used.

- | | |
|--------------------------------------|--|
| 1. $F = m \times g$ | 12. $K = C + 273$ |
| 2. $\sin \theta = \frac{O}{S}$ | |
| $\sin \theta = \frac{T}{S}$ | 13. $VC / VK = F \cos \theta$ |
| 3. $\cos \theta = \frac{A}{H}$ | 14. $HC / HK = F \cos \theta$ |
| $\cos \theta = \frac{A}{S}$ | 15. $V = L \times B \times H$ |
| 4. $\tan \theta = \frac{O}{A}$ | 16. $\%MC = \frac{IW - DW}{DW} \times 100$ |
| $\tan \theta = \frac{T}{A}$ | $\%VI = \frac{AG - DG}{DG} \times 100$ |
| 5. $A = \frac{\pi D^2}{4} = \pi r^2$ | 17. $P = h \times d \times g$ |
| 6. $A = \frac{1}{2}(B \times h)$ | 18. (Water- cement ratio)
(Water – sementverhouding) |
| 7. $V = \frac{\pi D^2}{4} \times h$ | $W.C.R. = \frac{M.W}{M.C}$ |
| 8. $V = \frac{4}{3} \pi r^3$ | $W.S.V = \frac{M.W}{M.S}$ |
| 9. $V = \frac{1}{3} \pi r^2 h$ | 19. $R^2 = VC^2 + HC^2$ |
| 10. $D = \frac{M}{V}$ | $R^2 = VK^2 + HK^2$ |
| 11. $R.D. = \frac{M.S}{M.W}$ | 20. $W = P \times V \times g$
$G = P \times V \times g$ |
| $= \frac{D.S}{DW}$ | 21. $W = m \times g$ |
| | 22. $P_1 V_1 = P_2 V_2$ |