higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

NATIONAL CERTIFICATE

BUILDING SCIENCE N1

(15070001)

23 November 2023 (X-paper)
09:00–12:00

Drawing instruments and nonprogrammable calculators may be used.

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

060Q1E2323

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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. Write neatly and legibly.

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QUESTION 1

Choose a word from COLUMN B that matches a description in COLUMN A. Write only the letter (A–E) next to the question number (1.1–1.15) in the ANSWER BOOK.

COLUMN A		COLUMN B	
1.1	Pressure	A	kN
1.2	Volume (liquids)	B	kg/m^3
1.3	Thermodynamic temperature	C	kPa
1.4	Weight	D	litre
1.5	Density	E	K

(5 × 1) **[5]**

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 is measured in kN.

2.2 Gravity is that 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]**

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QUESTION 3

3.1 Define the term, *relative density.* (3)

3.2 Given the following information, calculate the density of paraffin.

Mass of an empty container = 10,5 g

Mass of an empty container and paraffin = 43,5 g

Volume of paraffin = 31,4 cm^3. (5)

3.3 Determine the mass of timber which is 9 metres long, 228 mm wide and 50 mm thick. The relative density of timber is 0,75. (7)

[15]

QUESTION 4

4.1 List the properties of a good concrete mix. (6)

4.2 Calculate the total amount of water required, in litres, for a concrete mix that contains 40 kg of cement and has a water-cement ratio of 0,73. (4)

[10]

QUESTION 5

5.1 Convert 35 °C to Kelvin. (2)

5.2 With the aid of a neat, labelled sketch of a diaphragm pump, describe the operating principle of a diaphragm pump. (8)

5.3 Calculate the water pressure (in kilopascals) on the valve of a tap situated 35 metres below the water surface of a reservoir. The density of water is 1 000 kg/m^3. (5)

[15]

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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 following:

6.1.1 The resultant force (4)

6.1.2 The equilibrant force (2)

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

Calculate the horizontal and vertical components. (6)

6.3 Graphically determine the magnitude and direction of the equilibrant of the TWO concurrent coplanar forces shown in FIGURE 1, ADDENDUM A (attached). (6)
[18]

QUESTION 7

7.1 Explain what is meant by the term, *Bow's notation.* (3)

7.2 The four coplanar forces shown in FIGURE 2, ADDENDUM A (attached) are in equilibrium.

Graphically determine the magnitude and direction of the forces 'R' and 'S'. (9)
[12]

QUESTION 8

8.1 Define the term, *polygon of forces.* (4)

8.2 FIGURE 3, ADDENDUM A (attached) shows a simply supported beam with three forces acting on the beam.

By means of the link polygon method, determine the magnitude of the reactions R_L and R_R and the position of the resultant.

Clearly state the distance from the left-hand end 'A' of the beam to the resultant. (11)
[15]

TOTAL: 100

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ADDENDUM A

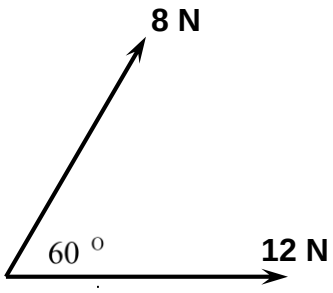


FIGURE 1

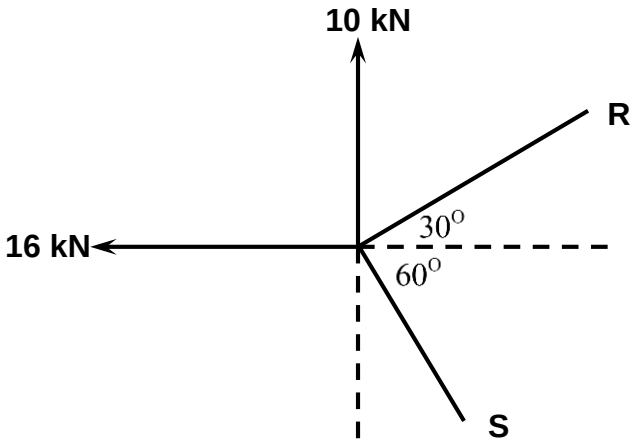


FIGURE 2

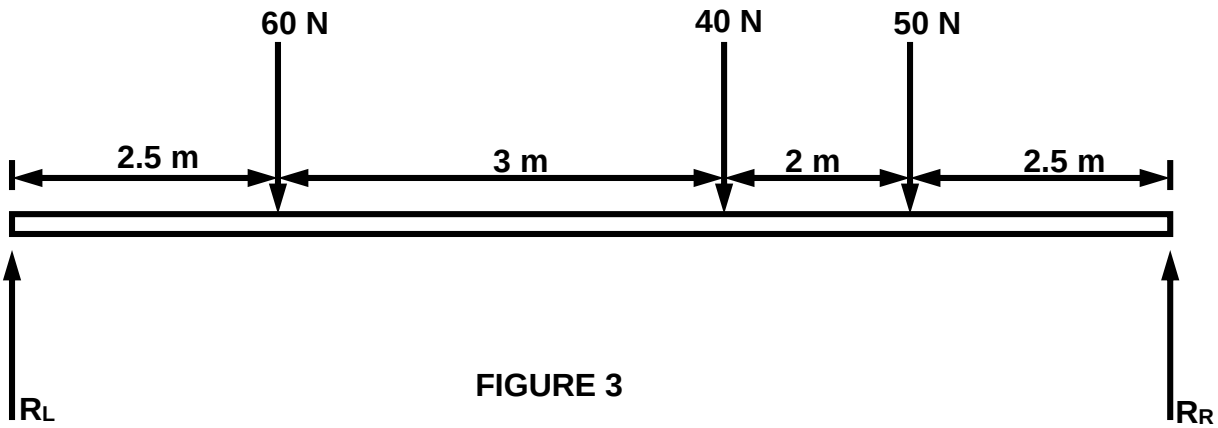


FIGURE 3

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BUILDING SCIENCE N1

FORMULA SHEET

Any applicable formula may also be used.

1. $F = m \times g$

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

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

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. $A = ½ (B \times h)$

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

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

12. $K = C + 273$

13. $VC/VK = F.\text{Sin}2$

14. $HC/HK = \text{F.Cos}2$

15. $V = \text{L} \times \exists \times \text{H}$

16. $\%MC = \frac{IW - DW}{DW} \times 100$

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

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

18. (Water-cement ratio)

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

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

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

    $R^2 = VC^2 + HK^2$

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

    $G = P \times V \times g$

21. $\text{W} = \text{m} \times \text{g}$

22. $P_1V_1 = P_2V_2$

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