



higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

NATIONAL CERTIFICATE BUILDING SCIENCE N1

(15070001)

**7 April 2021 (X-paper)
09:00–12:00**

Calculators and drawing instruments may be used.

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

054Q1A2107


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. Drawings must be neat and in good proportion and may be done in pencil.
 5. Only use a black or blue pen.
 6. Work neatly.
-

QUESTION 1

Give the name of the SI unit together with the symbol in which each is measured:

- 1.1 Moment of force
- 1.2 Pressure 
- 1.3 Density
- 1.4 Thermodynamic temperature
- 1.5 Weight of a concrete beam

(5 × 1) **[5]**

QUESTION 2

- 2.1 Make a large, neat drawing of the cross section of a tree trunk and label the different parts. (8)
- 2.2 Describe the principle of preservation of timber. (4)
- 2.3 Name TWO methods of seasoning. (2)
- 2.4 A timber board is 750 mm long, 400 mm wide and 50 mm high.

Calculate the volume:




- 2.4.1 In cm^3
- 2.4.2 In m^3

(2 × 3) (6)
[20]

QUESTION 3

Indicate whether the statements are TRUE or FALSE by writing 'True' or 'False' next to the question number (3.1–3.5) in the ANSWER BOOK.

- 3.1 Porosity is the movement of water into something due to capillarity caused by the ability of very narrow openings to attract moisture into them.
- 3.2 Boyles' law states that the volume of a given mass of gas is inversely proportional to the pressure exerted on it, providing the temperature remains constant. 
- 3.3 The gravity of an object is the force with which it is attracted to the earth's centre.

3.4 Bow's notation is the numbering of the spaces between lines of action in a system of forces.



3.5 When a number of forces act upon a body, they are called a system of forces.

(5 × 2) [10]

QUESTION 4

4.1 Name THREE ingredients of concrete. (3)

4.2 What is meant by the term bulking of sand? (3)

4.3 Calculate the water-cement ratio of a concrete mixture which contains a 60 kg bag of cement and 25 litres of water. (4)
[10]



QUESTION 5

5.1 State Charles' law. (3)

5.2 A gas cylinder has a 6 m³ volume of gas which is under pressure of 250 kPa.
Calculate the volume of the gas if the pressure is increased to 650 kPa while the temperature remains constant. (4)

5.3 Calculate the pressure (in kilopascal) acting at a depth of 45 m beneath the surface of the water in a reservoir. The density of water is 1 000 kg/m³. (6)
[13]

QUESTION 6

6.1 A force of 630 N is acting towards the right-hand side and a force of 440 N is acting towards the left-hand side along the same line of action.

Determine the magnitude and direction of:



6.1.1 The resultant force (4)

6.1.2 The equilibrant force (2)

6.2 A force of 125 kN is acting downwards at an angle of 30° to the horizontal line.
Calculate the horizontal and vertical components. (6)

6.3 Determine graphically the magnitude and direction of the equilibrant of the TWO concurrent coplanar forces shown in FIGURE 1 on the DIAGRAM SHEET. (6)
[18]

QUESTION 7

Determine graphically the resultant force of the system of concurrent coplanar forces, shown in FIGURE 2 on the DIAGRAM SHEET.

[12]**QUESTION 8**

FIGURE 3 on the DIAGRAM SHEET shows a simply supported beam with three forces resting 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.

**[12]****TOTAL: 100**

DIAGRAM SHEET

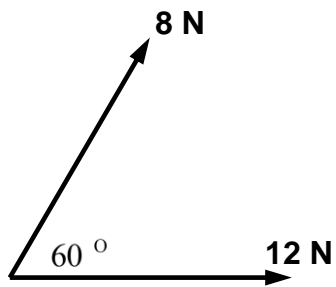


FIGURE 1

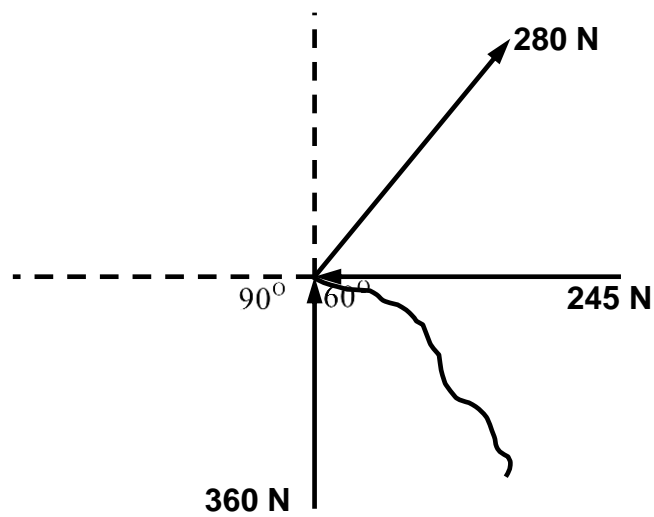


FIGURE 2

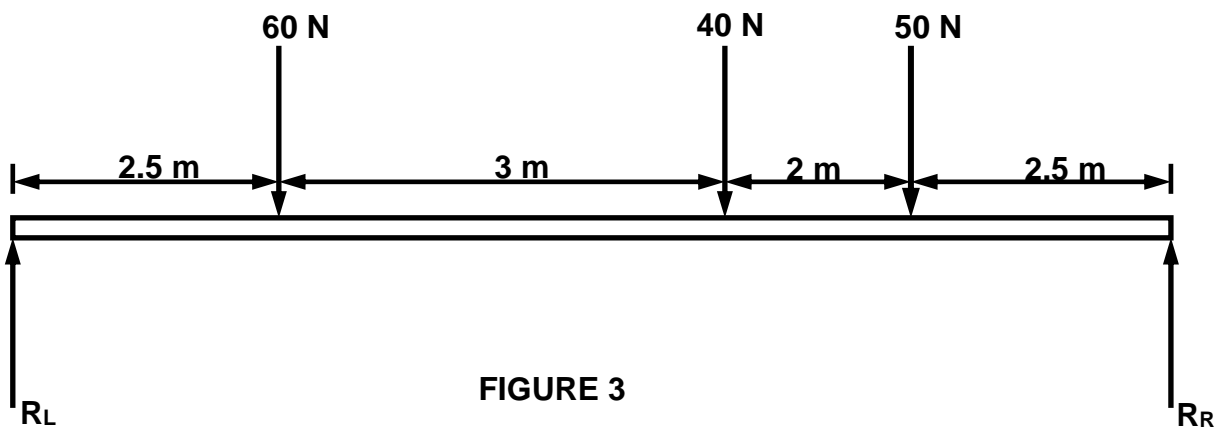


FIGURE 3

FORMULA SHEET

Any applicable formula may 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. $A = \frac{1}{2} (B \times h)$

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

12. $K = C + 273$

13. $P_1 V_1 = P_2 V_2$

14. $HC/HK = F \cdot \cos \Theta$

15. $HC/HK = F \cdot \cos \Theta$

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

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

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

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

19. (Water-cement ratio)

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

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

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

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

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

$$G = P \times V \times g$$

22. $W = m \times g$