



higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

T190(E)(A6)T
APRIL EXAMINATION
NATIONAL CERTIFICATE
BUILDING SCIENCE N1
(15070001)

6 April 2016 (X-Paper)
09:00–12:00

Candidates may use calculators and drawing instruments.

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

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. Rule off on completion of EACH answer.
 5. ALL sketches and/or diagrams must be done in pencil and must be neat, reasonably large and fully labelled.
 6. Answers are to be rounded off to TWO decimal places after the decimal comma.
 7. Write the formula before starting with a calculation.
 8. Write neatly and legibly.
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QUESTION 1

- 1.1 Define the *law of Boyle*. (3)
- 1.2 Convert 200 K to °C. (2)
- 1.3 The volume of a gas is 4 m³ at a pressure of 250 kPa.

Calculate the volume of the gas if the pressure is increased to 400 kPa while the temperature remains constant.

(5)
[10]

QUESTION 2

Calculate the following:

- 2.1 The area of a rectangle 50 cm by 15 cm. (3)
- 2.2 The volume of a timber beam that is 9 m long, 150 mm wide and 250 mm deep. (3)
- 2.3 Copy and complete the following TABLE of SI units and symbols in the ANSWER BOOK.

QUANTITY	UNIT	SYMBOL
Volumes(liquids)	?	?
?	pascal	?
Force	?	?

(8 × ½) (4)
[10]

QUESTION 3

- 3.1 Give THREE examples of materials suitable for use as a damp-proof course. (3 x 1) (3)
- 3.2 Calculate the water : cement ratio of a concrete mixture that contains 30 kg of cement and 15 litres of water. (4)
- 3.3 The mass of a wet wood sample is 75 g and the mass of a dried sample of wood is 50 g.

Calculate the percentage of moisture of the wood.

(3)
[10]

QUESTION 4

- 4.1 Explain briefly what is meant by the density of a material. (3)
- 4.2 Write a formula to obtain the relative density of a material. (1)
- 4.3 A timber beam 5 m long, 70 mm wide and 120 mm deep has a mass of 40 kg.
Calculate the density of the timber in kg/m^3 . (6)
[10]

QUESTION 5

- 5.1 Define *porosity*. (3)
- 5.2 Name THREE wood-boring insects found in South Africa. (3 × 1) (3)
- 5.3 State FOUR properties which concrete must possess to be workable. (4 × 1) (4)
[10]

QUESTION 6

- 6.1 Explain what is meant by the triangle of forces. (3)
- 6.2 The THREE concurrent, coplanar forces in FIGURE 1, DIAGRAM SHEET (attached) are in equilibrium.
Determine graphically the magnitude and direction of forces 'P' and 'Q'. (7)
[10]

QUESTION 7

- 7.1 Define the following:
- 7.1.1 A force
- 7.1.2 A newton (2 × 2) (4)
- 7.2 Determine graphically the magnitude and direction of the resultant of the two coplanar concurrent forces shown in FIGURE 2, DIAGRAM SHEET (attached). (6)
[10]

QUESTION 8

8.1 Define the *polygon of forces*. (3)

8.2 FIGURE 3, DIAGRAM SHEET (attached), shows four forces acting on a pin.

Determine graphically and clearly show the magnitude and direction of the equilibrant, and also the magnitude of the horizontal and vertical components of the equilibrant.

(12)
[15]

QUESTION 9

Three forces act upon a beam as shown in FIGURE 4, DIAGRAM SHEET (attached). Determine by means of the link polygon method:

9.1 The reactions at the supports. (6)

9.2 The position and magnitude of the resultant of the three forces.

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

(9)
[15]

TOTAL: 100

BUILDING SCIENCE N1

DIAGRAM SHEET

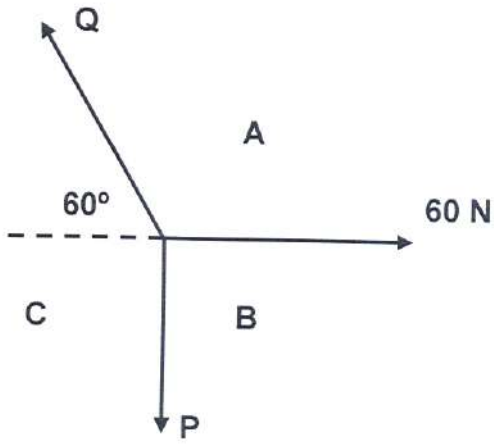


FIGURE 1

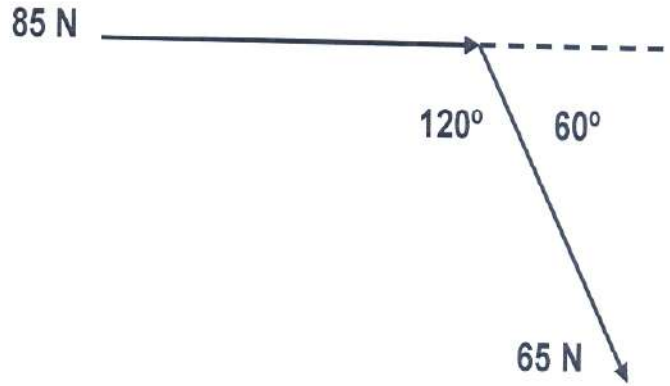


FIGURE 2

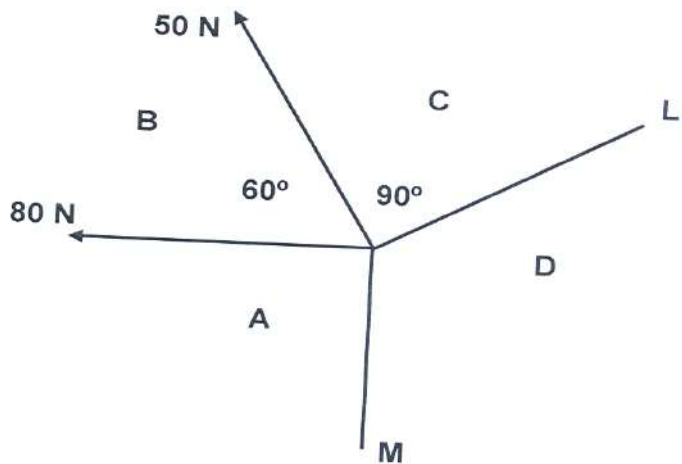


FIGURE 3

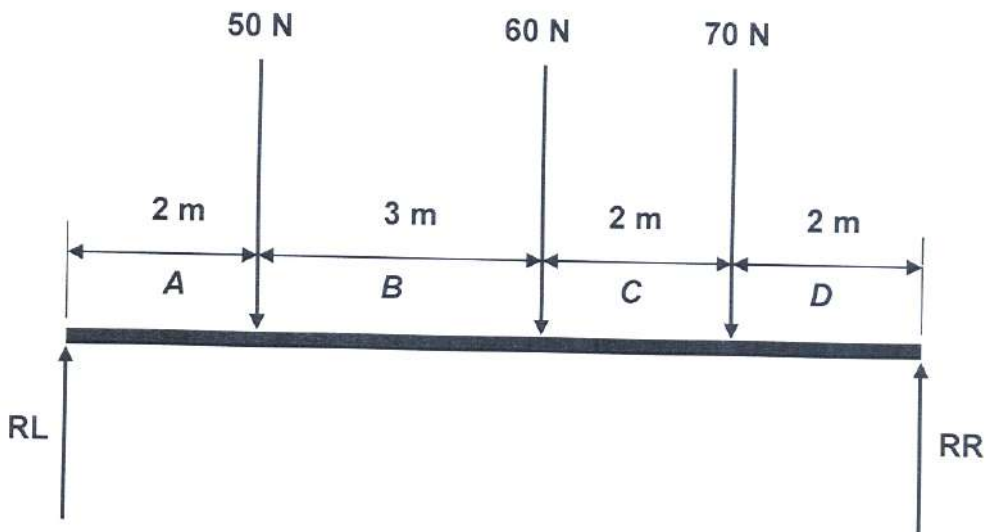


FIGURE 4

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

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. $VC/VK = F \cdot \sin^2$

15. $HC/HK = F \cdot \cos^2$

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. $W = m \times g$