higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

T240**(E)**(N25)
NOVEMBER EXAMINATION

NATIONAL CERTIFICATE

BUILDING SCIENCE N1

(15070001)

25 November 2013 (X-Paper)
09:00–12:00

Calculators may be used.

Candidates will require 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, neat, reasonably large and fully labelled.
6. Assume that a 1 kg mass exerts a force of 10 N.
7. Numerical answers are to be rounded off to two decimal places after the decimal comma.
8. Write the formula before starting with a calculation.
9. Write neatly and legibly.

QUESTION 1

1.1 Define the *law of Boyle.* (3)

1.2 Convert 300 K to °C (2)

1.3 The volume of a gas is 6 m^3 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

2.1 Give THREE examples of materials suitable for the use as damp-proof course. (3)

2.2 Calculate the water : cement ratio of a concrete mixture that contains 40 g of cement and 16 litres of water. (4)

2.3 The mass of a wet wood sample is 85 g and the mass of a dried sample of wood is 60 g.

Calculate the percentage of moisture. (3)
[10]

QUESTION 3

Calculate the following:

3.1 The area of a rectangle 70 cm by 25 cm. (3)

3.2 The volume of a timber beam that is 10 m long, 150 mm wide and 250 deep. (3)

3.3 Complete the following table of SI units and symbols.

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

(4)
[10]

QUESTION 4

4.1 Define *porosity.* (3)

4.2 Name THREE woodboring insects found in South Africa. (3)

4.3 State FOUR properties which concrete must possess to be workable. (4)
[10]

QUESTION 5

5.1 Explain briefly what is meant by the density of a material. (3)

5.2 Name a formula to obtain the relative density of a material. (1)

5.3 A timber beam 6 m long, 80 mm wide and 110 mm deep has a mass of 30 kg.

Calculate the density of the timber in kg/m^3. (6)
[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, ADDENDUM A (attached) is in equilibrium.

Determine graphically the magnitude and direction of forces 'P' and Q.

Clearly show the direction on your space diagram. (7)
[10]

QUESTION 7

7.1 Define:

7.1.1 A force

7.1.2 A Newton

(2 x 2) (4)

7.2 Determine graphically the magnitude and direction of the resultant of the two coplanar concurrent forces shown in FIGURE 2, ADDENDUM A (attached). (6)
[10]

QUESTION 8

Three forces act upon a beam as shown in FIGURE 3, ADDENDUM A (attached).

Determine by means of the link polygon method:

8.1 The reactions at the supports.

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

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

[15]

QUESTION 9

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

9.2 FIGURE 4, ADDENDUM A (attached), shows four forces acting on a pin.

Determine graphically and clearly show the magnitude and direction of the equilibrant, also the magnitude of the horizontal and vertical components of the equilibrant. (12)

[15]

TOTAL: 100

ADDENDUM A

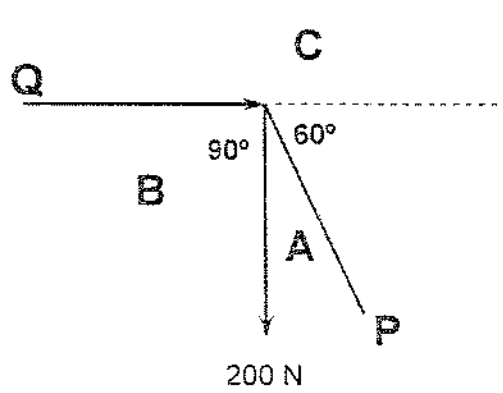

FIGURE 1

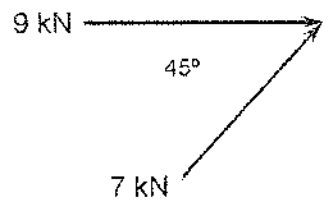

FIGURE 2

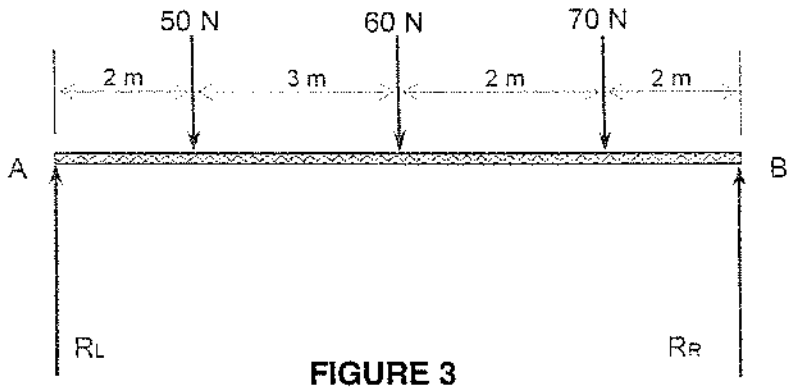

FIGURE 3

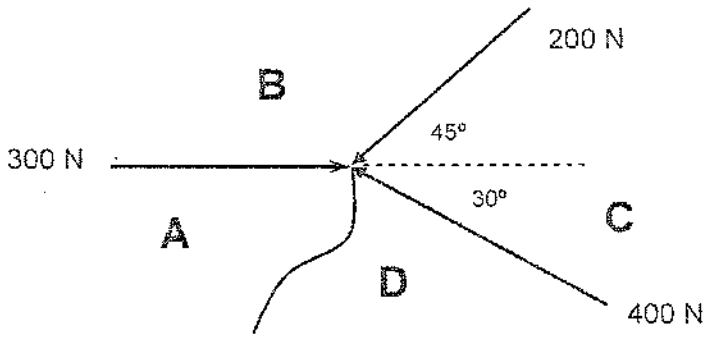

FIGURE 4 / FIGUUR 4

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. $A = ½ (B \times h)$

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. $P_1V_1 = P_2V_2$

14. $VC/VK = F.\text{Sin}\square$

15. $HC/HK = \text{F.Cos}\square$

16. $V = \text{L} \times \square \times \text{H}$

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