



**higher education
& training**

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

T230(E)(A1)T

NATIONAL CERTIFICATE

BUILDING SCIENCE N1

(15070001)

1 April 2019 (X-Paper)

09:00–12:00

Calculators may be used.

This question paper consists of 6 pages 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. Sketches must be large, neat and fully labelled.
 5. Assume that a 1 kg mass exerts a force of 10 N.
 6. Write the formula before starting with any calculation.
 7. Round off numerical answers to two decimal places after the decimal comma.
 8. Write neatly and legibly.
-

QUESTION 1

1.1 A concrete beam has the following dimensions:

Length = 3 250 mm

Width = 750 mm

Depth = 350 mm



Calculate the volume in the following:

1.1.1 mm³

1.1.2 m³

(2 × 3) (6)

1.2 If the density of the concrete beam in QUESTION 1.1 is 2 400 kg/m³, calculate the mass of the beam.



(4)
[10]

QUESTION 2

2.1 Calculate the quantity of water required for a concrete mixture of 150 kg of cement with water:cement ratio of 0,06. The answer must be in the unit of water.



(4)

2.2 With the aid of a diagram, briefly explain how pressure in water varies according to depth.

(6)

2.3 With the aid of a sketch, describe the best practical test for determining the desired workability of concrete.

(8)
[18]

QUESTION 3

3.1 Define *Charles's Law*.

(3)

3.2 A quantity of gas has a volume of 9 m³ when under a pressure of 350 kilopascals.



Calculate the pressure when the gas occupies a volume of 5 m³ and the temperature does not change.

(3)

3.3 With the aid of a sketch, describe how moisture is prevented from penetrating between the following:

- The bottom rail and sill
- The sill and brickwork in a timber window construction

(8)
[14]

QUESTION 4

4.1 Briefly explain the following terms as used in connection with timber:

4.1.1 Seasoning

4.1.2 Conversion

4.1.3 Preservation



(3 × 2) (6)

4.2 Name FOUR types of effective water-soluble preservatives. (4)

4.3 A piece of timber with moisture content has a mass of 1 250 g. After oven-drying to a constant mass, it weighs 985 g.



Calculate the moisture content of the timber in %.

(4)
[14]

QUESTION 5

Indicate whether the following statements are TRUE or FALSE. Choose the answer and write only 'True' or 'False' next to the question number (5.1–5.5) in the ANSWER BOOK.

5.1 A force is that which changes or tends to change the state of rest or uniform motion of a body in a straight line.



5.2 When several forces act upon a body, they are coplanar forces.

5.3 The weight of an object is the quantity of matter it contains.

5.4 The equilibrant of two or more forces is a single force that can replace or produce the effect of the two or more forces.

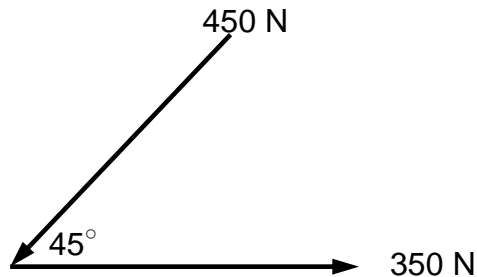


5.5 Gravity is the force with which something is attracted to the earth's centre.

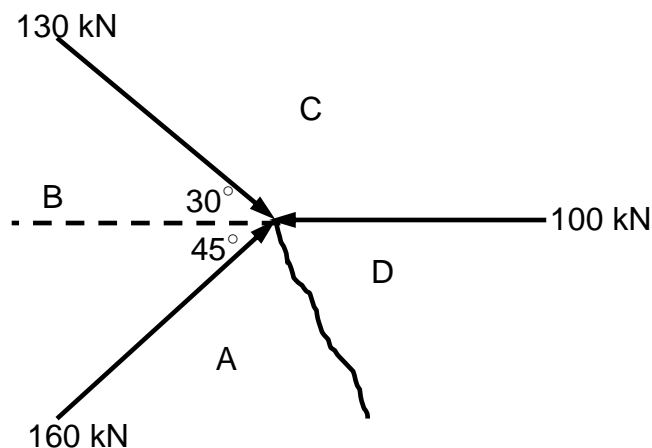
(5 × 2) [10]

QUESTION 6

- 6.1 Define the term *parallelogram of forces*. (4)
- 6.2 Graphically determine the magnitude, direction and sense of the resultant of the two coplanar forces shown in FIGURE 1 below. (8)

**FIGURE 1****[12]****QUESTION 7**

Study FIGURE 2 below which show coplanar forces acting in one point and answer the questions.

**FIGURE 2**

- 7.1 Graphically determine the magnitude and direction of the equilibrant of the coplanar forces. (8)
- 7.2 7.2.1 Calculate the magnitude of the horizontal components of the equilibrant in QUESTION 7.1.1.
- 7.2.2 Calculate the magnitude of the vertical components of the equilibrant in QUESTION 7.1.1.

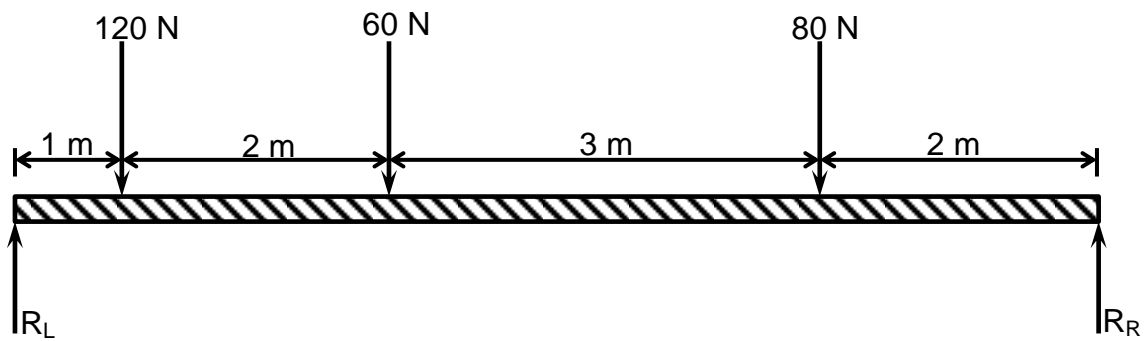
(2 × 2)

(4)

[12]

QUESTION 8

FIGURE 3 below shows three forces acting on a beam.

**FIGURE 3**

Determine the reactions at the supports by means of a link polygon diagram.

[10]**TOTAL: 100**

BUILDING SCIENCE N1**FORMULA SHEET**

Any applicable formula may also be used.

$$1. \quad F = m \times g$$

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

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

$$3. \quad \cos \theta = \frac{A}{H}$$

$$\cos \theta = \frac{A}{S}$$

$$4. \quad \tan \theta = \frac{O}{A}$$

$$\tan \theta = \frac{T}{A}$$

$$5. \quad A = \frac{\pi D^2}{4} = \pi r^2$$

$$6. \quad A = \frac{1}{2} (B \times h)$$

$$7. \quad V = \frac{\pi D^2}{4} \times h$$

$$8. \quad V = \frac{4}{3} \pi r^3$$

$$9. \quad V = \frac{1}{3} \pi r^2 h$$

$$10. \quad D = \frac{M}{V}$$

$$11. \quad R.D. = \frac{M.S}{M.W}$$

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

$$12. \quad K = C + 273$$

$$13. \quad P_1 V_1 = P_2 V_2$$

$$14. \quad VC/VK = F \cdot \sin 2$$

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

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

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

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

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

$$19. \quad (\text{Water-cement ratio})$$

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

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

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

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

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

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

$$22. \quad W = m \times g$$