higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

T230**(E)**(M29)T

NATIONAL CERTIFICATE

BUILDING SCIENCE N1

(15070001)

29 March 2018 (X-Paper)
09:00–12:00

Nonprogrammable calculators and drawing instruments may be used.

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.   Untidy and/or illegible work will be penalised.

7.   Assume that 1 kg mass exerts a force of 10 N.

8.   Round off numerical answers to TWO decimal places.

9.   Write the formula before starting with a calculation.

10.   Write neatly and legibly.

Please turn over

QUESTION 1

Choose an SI unit from COLUMN B that matches a quantity of measurement in COLUMN A. Write only the letter (A–E) next to the question number (1.1–1.5) 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. Choose the answer and write 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 measured in kN.

2.2　　Gravity is the force of attraction that the earth exerts on other bodies.

2.3　　Concrete is a mixture of Portland cement, fine aggregate of sand and 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 food on which fungi and insects live.

(5 × 2)　　**[10]**

QUESTION 3

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

3.2 Calculate the density of paraffin when the following information is given:

- 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 m 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 Sketch and label a diaphragm pump and describe its principle of operation. (8)

5.3 Calculate the water pressure (in kilopascal) 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]

QUESTION 6

6.1   A force of 220 N is acting towards the right and a force of 350 N is acting towards the left 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 downwards at an angle of 60° to the horizontal.

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 (attached).   (6)
[18]

QUESTION 7

7.1   Explain the term *Bow's notation*.   (3)

7.2   The four coplanar forces in FIGURE 2 on the DIAGRAM SHEET (attached) are in equilibrium.

Determine graphically 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 on the DIAGRAM SHEET (attached) shows a simply supported beam with three forces resting on the beam.

Determine the magnitude of the reactions R_L and R_R and the position of the resultant by means of the link-polygon method. Clearly state the distance from the left end A of the beam to the resultant.   (11)
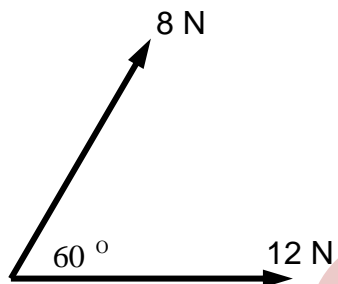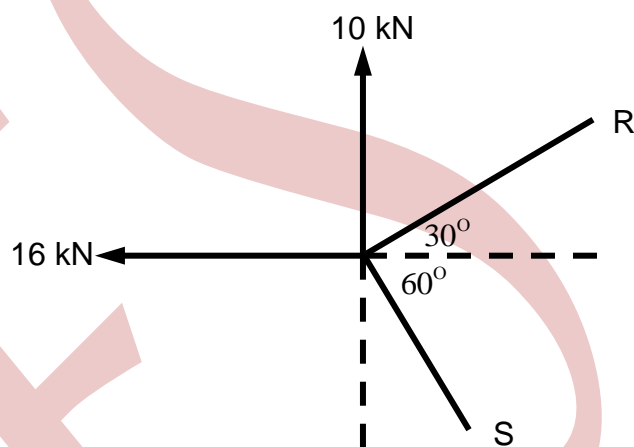**[15]**

TOTAL :   100

DIAGRAM SHEET

8 N

60°   12 N

FIGURE 1

10 kN

R

16 kN

30°
60°

S

FIGURE 2

60 N   40 N   50 N

2,5 m   3 m   2 m   2,5 m

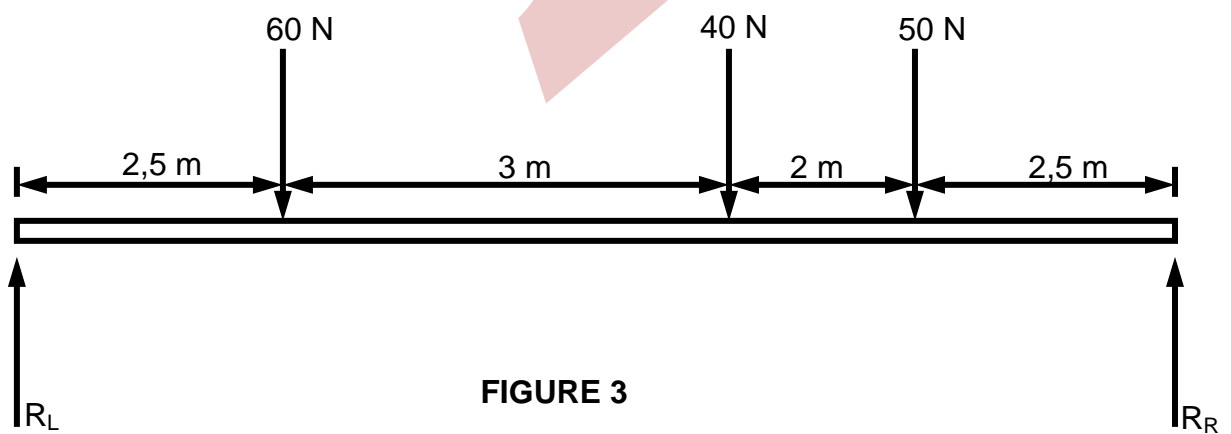R_L R_R

FIGURE 3

FORMULA SHEET

Any applicable formula may also be used.

1. $F = m \times g$

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

3. $\cos\theta = \dfrac{A}{H}$

4. $\tan\theta = \dfrac{O}{A}$

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

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

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

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

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

10. $D = \dfrac{M}{V}$

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

12. $K = C + 273$

13. $P_1 V_1 = P_2 V_2$

14. $VC = F.\sin 2$

15. $HC = F.\cos 2$

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

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

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

19. Water-cement ratio:

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

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

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

22. $W = m \times g$