higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

T250**(E)**(J30)T

NATIONAL CERTIFICATE

BUILDING SCIENCE N3

(15070023)

30 July 2019 (X-Paper)
09:00–12:00

This question paper consists of 8 pages and 1 formula sheet.

DEPARTMENT OF HIGHER EDUCATION AND TRAINING
REPUBLIC OF SOUTH AFRICA

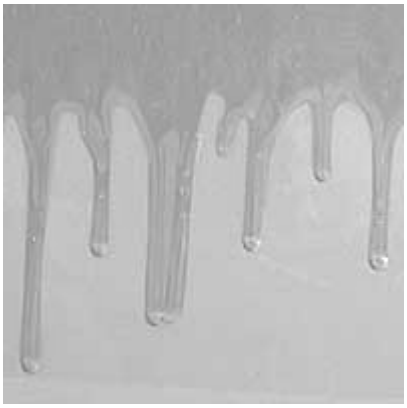
NATIONAL CERTIFICATE
BUILDING SCIENCE N3
TIME: 3 HOURS
MARKS: 100

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. Take gravitational acceleration, g, as 9,81 ms^{-2}.
6. Round off final answers to TWO decimals.
7. Write neatly and legibly.

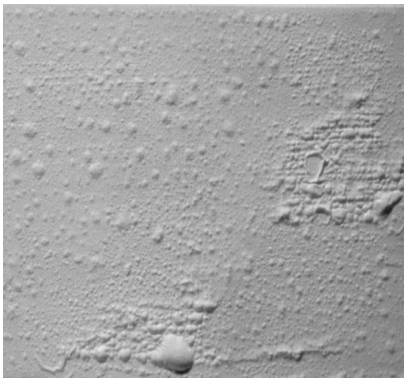
QUESTION 1

1.1 The following FIGURES show paint defects. Identity each defect and write the answer next to the letter (A–D) in the ANSWER BOOK.

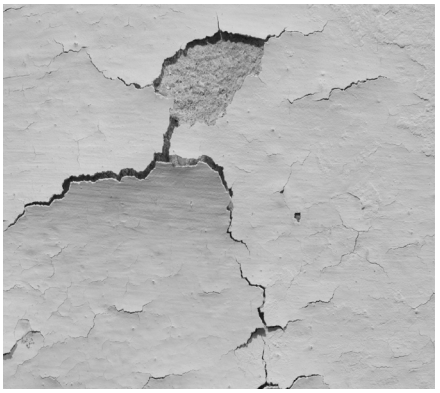


A

B



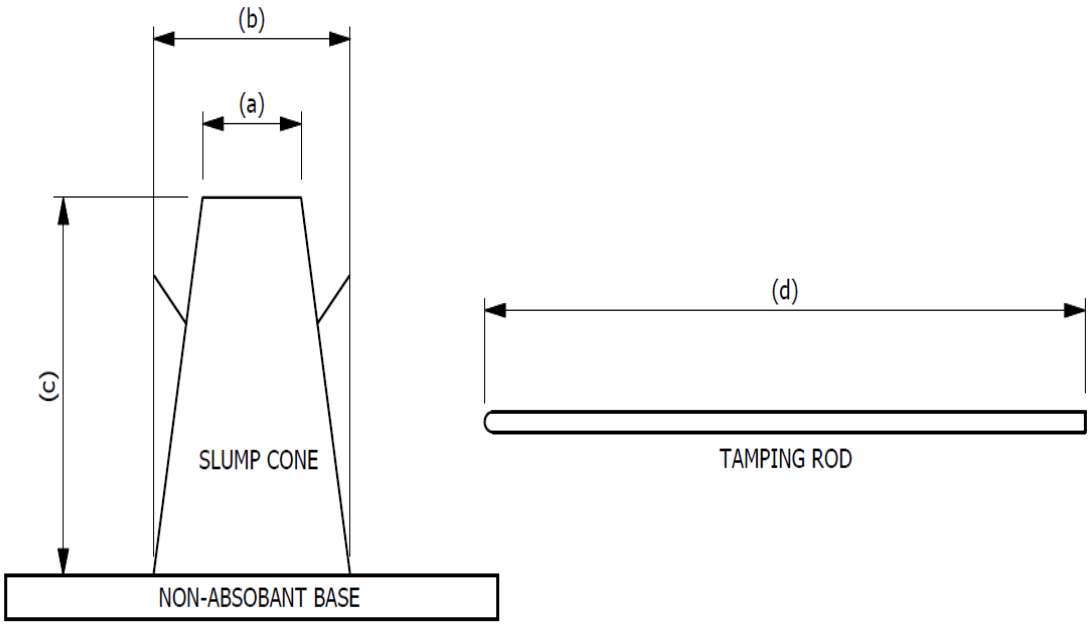
C



D

(4 × 1) (4)

1.2 The DIAGRAM below shows a slump cone and a tamping rod. Determine the dimensions and write the answer next to the letter (a–d) in the ANSWER BOOK.



SLUMP CONE AND TAMPING ROD (4)

1.3 Define the term *initial drying shrinkage* with reference to wet concrete. (1)

1.4 What is the purpose of a slump test? (1)
[10]

QUESTION 2

2.1 A pull of 500 N is required to move a pallet loaded with cement bags weighing 2 000 N along a wooden floor.

Calculate each of the following:

2.1.1 Coefficient of friction

2.1.2 Angle of friction

(2 × 3) (6)

2.2 A body with a mass of 25 kg is lifted by an effort of 85 N using pulley blocks. The upper block consist of three pulleys and the lower block of two pulleys.

Determine each of the following:

2.2.1 Velocity ratio

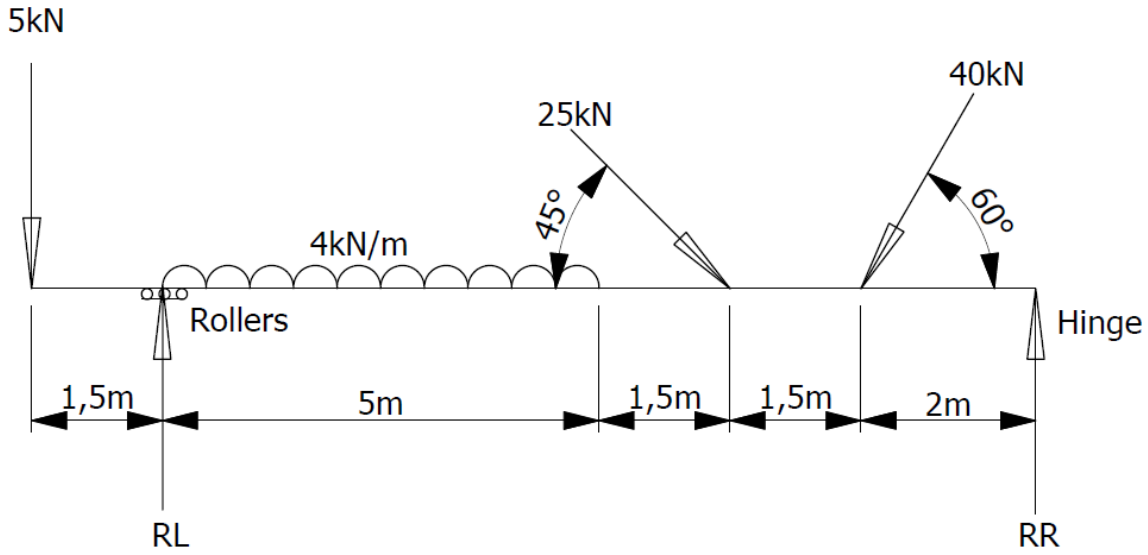
2.2.2 Mechanical advantage

2.2.3 Efficiency

(3 × 3) (9)
[15]

QUESTION 3

Below is a simply supported beam.



SIMPLY SUPPORTED BEAM

Calculate each of the following:

3.1 Magnitude of reaction RL (4)

3.2 Magnitude of vertical component of RR (4)

3.3 Magnitude of horizontal component of RR (2)

3.4 Magnitude of resultant of reaction RR (3)

3.5 Direction of reaction RR (3)

[16]

QUESTION 4

Graphically or analytically determine the position of the centroid in the DIAGRAM with respect to ON and OM.

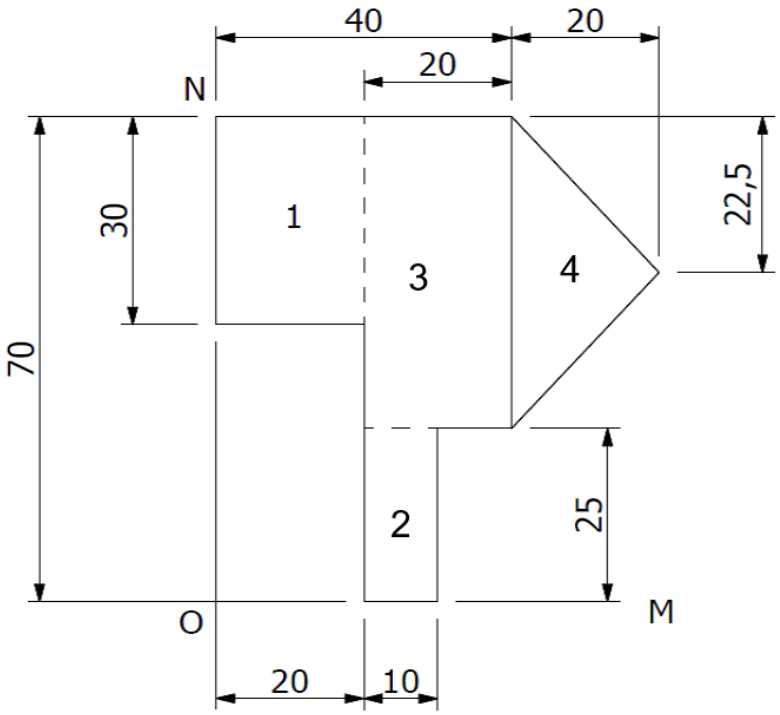
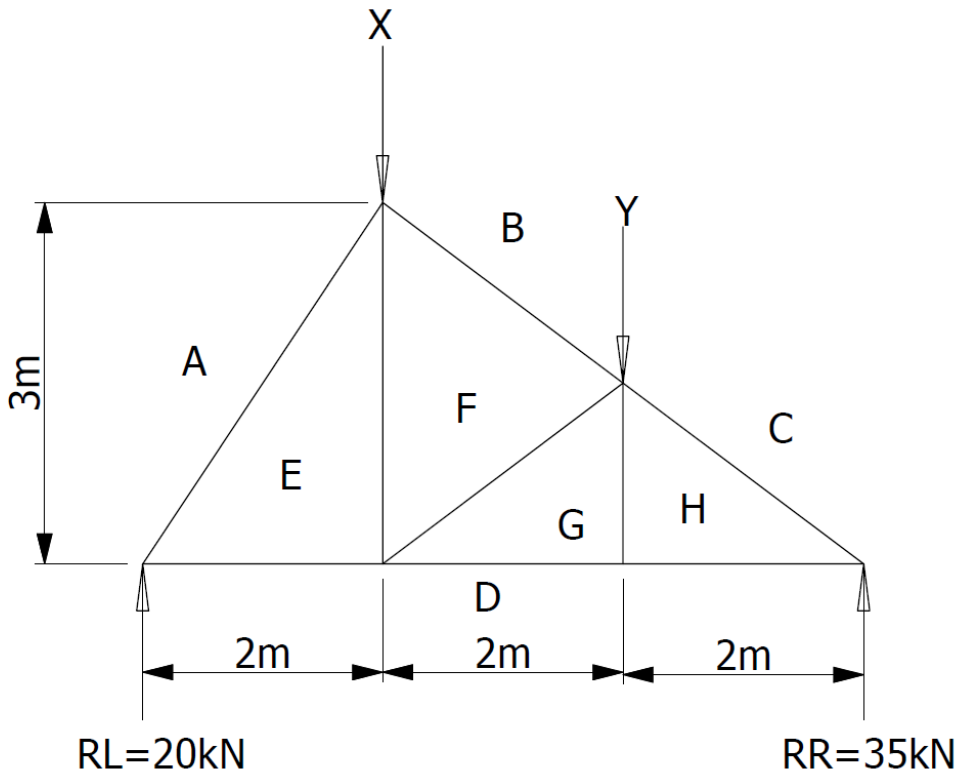


DIAGRAM **[16]**

QUESTION 5

In the simply supported truss the reactions RL and RR are given as 20 kN and 35 kN respectively.



SIMPLY SUPPORTED TRUSS

5.1 Calculate the magnitude of force Y by taking moments about X. (3)

5.2 Calculate the magnitude of force X by taking moments about Y. (3)

5.3 Graphically determine the magnitude and nature of the forces in ALL members.

Present the results in tabular format as shown below.

MEMBER	MAGNITUDE (kN)	NATURE
AE		
DE		
EF		
FG		
GH		
DG		
DH		
CH		
BF		

(15)
[21]

QUESTION 6

An electric heater rated 1,5 kW operates for 2 hours on a 220 V supply.

Determine the following:

6.1 Current flowing in the circuit (2)

6.2 Working resistance (2)

6.3 Energy used in 2 hours (3)

6.4 Cost of running the heater for 30 days at a tariff of R2 per kW.h assuming the heater operates for 2 hours daily (3)

[10]

QUESTION 7

The legs of a tripod are 7 m in length. The feet of the tripod forms an isosceles triangle on the same horizontal plane and the sides AB and AC are 5 m long. Side BC is 4 m in length.

Determine the force in the legs due to a 35 kN force supported at the apex of the tripod. **[12]**

TOTAL: 100

FORMULA SHEET

Any other applicable formula may also be used.

1. $F = m \times g$
2. $A = \frac{\pi D^2}{4}$
3. $F\mu = \mu \times W$
4. $\mu = \tan \phi$
5. Comp. $* = W \sin \phi$
6. Comp. $\zeta = W \cos \phi$
7. $F1 = \mu W \cos \phi + W \sin \phi$
8. $F\mu = \mu W \cos \phi$
9. $F2 = \mu W \cos \phi - W \sin \phi$
10. $s = ut + \frac{1}{2}at^2$
11. $v = u \pm 2as$
12. $v = u^2 \pm at$
13. $M = m\_ \times v$
14. $m \times u = m \times v$
15. $VR = \frac{Effort\ distance}{Load\ distance}$
16. $MA = \frac{Load}{Effort}$
17. $n = \frac{HV}{SV} \times 100$
18. $V = I \times R$
19. $R_T = R_1 + R_2 + R_3$
20. $\frac{1}{R_T} = \frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3}$
21. $P = V \times I$
22. $W = P \times t$
23. $AV = F \times S$
    $WD = F \times S$
24. $MOM = F \times \zeta S$
25. $A = L \times B$
26. $A = \pi r^2$
27. $A = \frac{1}{2}\ bh\ /\ \frac{1}{2}ab\sin C$
28. $A = 4\pi r^2$
29. $\bar{x} = \frac{4r}{3\pi}$
30. $\bar{x} = \frac{1}{3}h$
31. $R = \sqrt{HK^2 + VK^2}$
    $R = \sqrt{HC^2 + VC^2}$
32. $\text{TAN}\,\phi = \frac{VC}{HC} / \frac{VK}{HK}$
33. Mass of water in mixture =
    water:cement ratio × mass of cement
34. Work done by effort in raising
    the load = effort × velocity ratio (VR) ×
    load distance