



UNIVERSITY OF
KWAZULU-NATAL
INYUVESI
YAKWAZULU-NATALI

SCHOOL OF ENGINEERING

MAIN EXAMINATIONS: NOVEMBER 2019

COURSE AND CODE: MATERIALS OF CONSTRUCTION

ENCH2MS

DURATION: 2 HOURS

TOTAL MARKS: 80

INTERNAL EXAMINER: MR EM OBWAKA

INTERNAL MODERATOR: DR K OSMAN

EXTERNAL MODERATOR: DR M LASICH

INSTRUCTIONS:

1. ALL questions should be attempted.
2. Any programmable or non-programmable calculator may be used provided it has been cleared of any information that would subvert the purpose of the examination.
3. Calculations must be shown in sufficient detail to illustrate your understanding of the procedure.
4. This examination question paper, together with all associated diagrams **MUST BE HANDED IN TOGETHER WITH YOUR SCRIPT.**

Student Number:

QUESTION 2

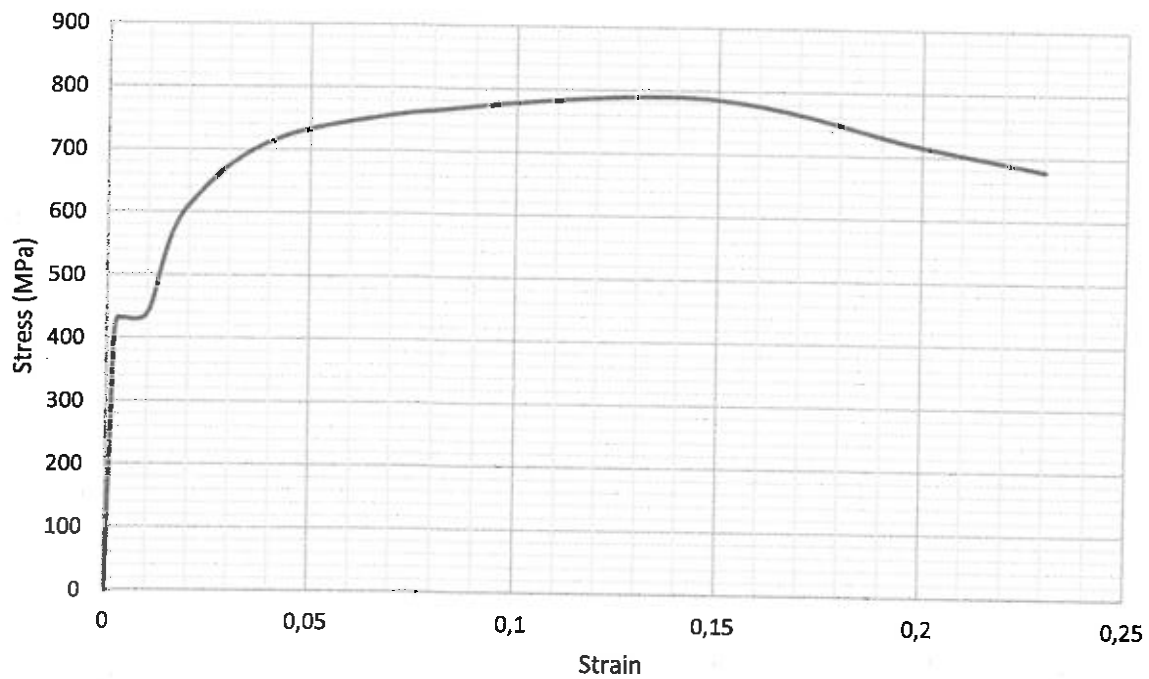
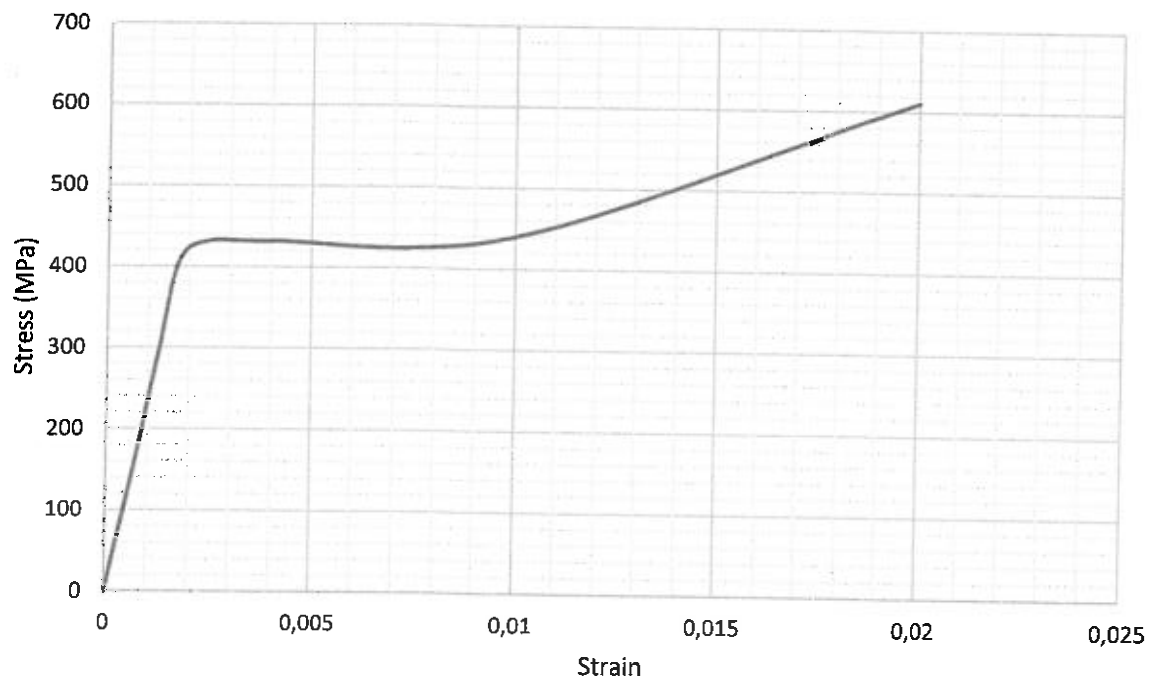
A tension test was performed on a steel specimen having an original diameter of 12.5 mm and a gauge length of 50 mm. The data is listed in Table 2.1 below:

Table 2.1: Tension test data

Load (kN)	Elongation, Δl , mm
0	0
7.0	0.0125
21.0	0.0375
36.0	0.0625
50.0	0.0875
53.0	0.125
53.0	0.2
54.0	0.5
75.0	1.0
90.0	2.5
97.0	7.0
87.8	10.0
83.3	11.5

Figures 2.1 and 2.2 provided on page 3 were obtained from the above data.

- (a) Determine the modulus of elasticity. (4)
- (b) Determine the yield stress. (3)
- (c) Determine the ultimate tensile strength (ultimate stress). (3)
- (d) Determine the percentage elongation. (3)
- (e) Determine the rupture stress (engineering stress at fracture). (3)
- (f) Determine the strength economy given that the density of the steel sample is 7840 kg/m^3 . (4)
- (g) Determine the stiffness. (4)

QUESTION 2 continued ...**Figure 2.1: Stress versus Strain****Figure 2.2: Stress versus Strain****TOTAL /24/**

QUESTION 3

- (a) Upon consideration of the $\text{SiO}_2 - \text{Al}_2\text{O}_3$ phase diagram provided in Figure 3.1 below, for each pair of the following list of compositions, which would you judge to be the more desirable refractory?

Justify your choices.

- (i) 99.8 wt % $\text{SiO}_2 - 0.2$ wt % Al_2O_3 and 99.0 wt % $\text{SiO}_2 - 1.0$ wt % Al_2O_3

(4)

- (ii) 70 wt % $\text{Al}_2\text{O}_3 - 30$ wt % SiO_2 and 74 wt % $\text{Al}_2\text{O}_3 - 26$ wt % SiO_2

(4)

- (b) Compute the mass fractions of liquid in the following fireclay refractory materials at 1600 °C.

- (i) 25 wt % $\text{Al}_2\text{O}_3 - 75$ wt % SiO_2

(4)

- (ii) 45 wt % $\text{Al}_2\text{O}_3 - 55$ wt % SiO_2

(4)

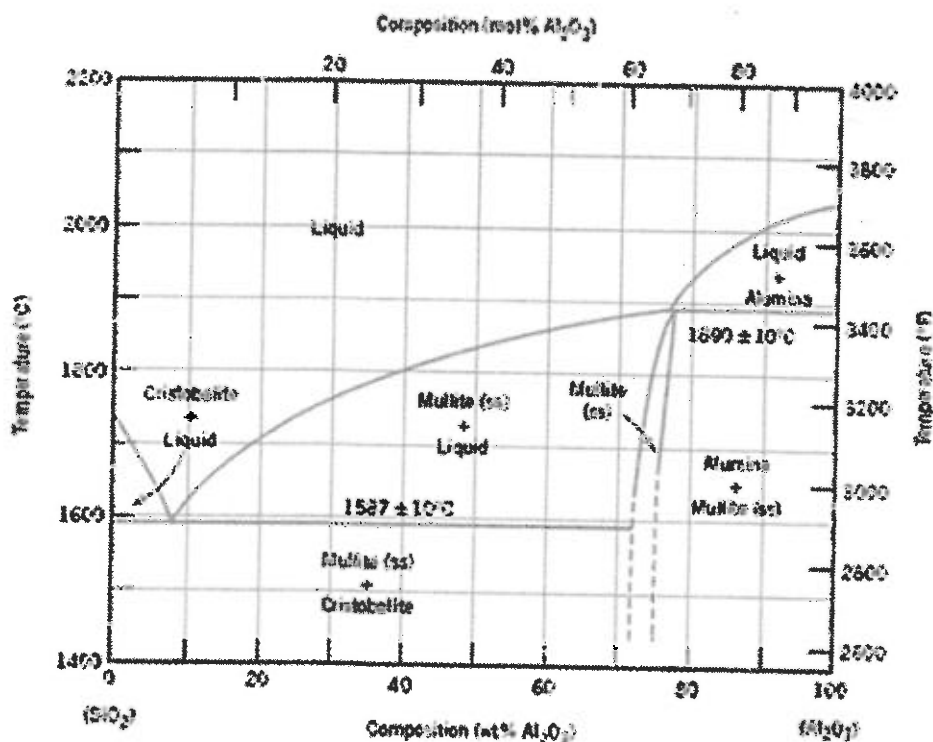


Figure 3.1: The Silica – alumina phase diagram

QUESTION 4

- (a) What is a standard? (4)
- (b) How are standards developed? (4)
- (c) What are possible benefits of standards? (4)
- (d) What is the International Organisation for Standardisation (ISO)? (4)

TOTAL /16/