



PROGRAM : NATIONAL DIPLOMA
(ENGINEERING METALLURGY)

SUBJECT : **PRODUCTION OF IRON AND STEEL 2**

CODE : **PRS21-1**

DATE : 15 JULY 2019 (Supplementary Exam)

DURATION : 08:00 – 11:00 (3 HOURS)

WEIGHT : 40:60

TOTAL MARKS : 100

ASSESSOR : Mr MB MOLALA

MODERATOR : Mr M Kalenga

NUMBER OF PAGES : 3

INSTRUCTIONS

- First read carefully through all questions; only then
- Answer all questions in any sequence – but
- Please start answering each question on a new page
- One Calculator per student

Question 1

- 1.1 Given the blast furnace reactions $C + CO_2 = 2CO$ and $2CO = C + CO_2$:
- 1.1.1 Calculate the temperature range for the carbon deposition reaction. (8)
- 1.1.2 In which zone of the blast furnace does each of the above occur? (3)
- 1.1.3 What is the effect of temperature on the two reactions? (3)
- 1.1.4 Briefly explain the alternative iron making method and give its advantages over the blast furnace process. (6)
- 1.1.5 “On gas”, “boxed”, and “On blast” are all terms used in iron making. To what process do the terms relate? And explain what takes place during each of them. (5)

[25]

Question 2

- 2.1 Explain the importance of the following processes and how they are achieved:
- 2.1.1 Desulphurisation of hot metal. (5)
- 2.1.2 Dephosphorisation in the LD. (5)
- 2.1.3 Decarburisation to 0.02%. (5)
- 2.1.4 “Carbon catch”. (5)
- 2.1.5 Slag splashing. (5)

[25]

Question 3

- 3.1 Pertaining to steel making:
- 3.1.1 What should be done along the whole process chain to improve quality of steel (6)
- 3.1.2 What is the function of graphite in the dolomite refractory for the LD vessel? (4)
- 3.1.3 Explain reblow with respect to the LD process. (3)
- 3.1.4 Explain turn-down with respect to the LD process. (3)

3.2 Comment on the correctness about the LD process:

3.2.1 At the end of the blow silicon content was slightly higher than carbon content. (3)

3.2.2 Sulphur content was improved from 0.06% in hot metal to 0.03% by LD blowing (3)

3.2.3 It is better to add aluminium first before alloying additions. (3)

[25]

Question 4

4.1 Comment on the following views given by the plant operator at the blast furnace and where appropriate give the correct explanation:

4.1.1 High Sulphur and low Silicon in iron are a result of low temperature and low reducing potential. (5)

4.1.2 Blast furnace conditions can be suited for the control of sulphur and not phosphorus. (5)

4.1.3 Productivity of the blast furnace is a fixed constant that cannot be changed. (5)

4.1.4 The refractory linings of the blast furnace should have high abrasion resistance at the top and high heat resistance at the bottom. (5)

4.1.5 Wide particle size distribution of charge is necessary for blast furnace permeability. (5)

[25]

TOTAL MARKS: [100]

Thermodynamic data:

