



UNIVERSITY
OF
JOHANNESBURG

<u>PROGRAM</u>	: SSA EXAM FOR BACHELOR ENGINEERING METALLURGY
<u>SUBJECT</u>	: PRODUCTION OF IRON AND STEEL AND FERROUS METALLURGY
<u>CODE</u>	: PISMETA3/FMEMETA3
<u>DATE</u>	: ? July 2019
<u>DURATION</u>	: 08:30 - 11:30
<u>WEIGHT</u>	: 40 : 60
<u>TOTAL MARKS</u>	: 100
<u>EXAMINER</u>	: DR X PAN
<u>MODERATOR</u>	: Mr M Henderson
<u>NUMBER OF PAGES</u>	: 3 PAGES
<u>INSTRUCTIONS</u>	: ANSWER ALL QUESTIONS
<u>REQUIREMENTS</u>	: CALCULATOR, RULER

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QUESTION 1 (10 marks)

Please explain the meaning of the following, within the context of the subject of production of iron and steel:

- (1) Iron
- (2) Steel
- (3) Semi killed steels
- (4) Low alloy steels
- (5) Medium carbon steels
- (6) Good quality steels
- (7) BOP
- (8) BOF
- (9) EAF
- (10) AOD

QUESTION 2 (20 marks)

Draw the process flowsheet of BF ironmaking from iron ore to hot metal.

QUESTION 3 (10 marks)

Draw a profile of EAF with 10 names of the main function/area.

QUESTION 4 (10 marks)

State the step-by-step process of BOF steelmaking.

QUESTION 5 (20 marks, GA7 weight 100%)

To help understand the impact of ironmaking on the environment, calculate the amount of CO₂, generated when producing 1 ton of iron in a blast furnace, using the provided information:

Hot metal chemical composition, %

C	Si	Mn	P	S	Fe	total, %
5.5	4	5	0.04	0.04	rest	100

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Ore chemical composition, %

Fe2O3	Fe3O4	SiO2	Al2O3	MgO	MnO2	total, %
71.5	0	5.5	13	5	5	100

Atomic weight

C	O	Si	Mn	Fe	P	S
12	16	28	55	56	31	32

QUESTION 6 (30 marks)

You are required to do a charge calculation to determine what amount of raw materials (namely hot metal; scrap metal; lime and O₂), required to make **50 metric ton** of the designed low carbon steel in a BOF process, using the following information:

Assumption:

(1) Fe loss in BOF %	12
(2) scrap in charge %	12
(3) Slag Basicity	2.0

Hot metal chemical composition, %

C	Si	Mn	P	S	Fe	total, %
4.5	3	4	0.04	0.04	88.42	100

Scrap metal chemical composition%

C	Si	Mn	P	S	Fe	total, %
0.25	0.3	0.5	0.06	0.06	98.83	100

lime Chemical Composition%

CaO	MgO	Al2O3				total, %
98	1	1				100

Low carbon Steel chemical composition, %

C	Si	Mn	P	S	Fe	total, %
0.12	0.17	0.5	0.04	0.04	99.13	100

Atomic weight

C	O	Si	Mn	Fe	P	S
12	16	28	55	56	31	32

(END)

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