



PROGRAM : SSA NATIONAL DIPLOMA
ENGINEERING METALLURGY

SUBJECT : **PRODUCTION OF IRON AND STEEL 3**

CODE : **PRS302**

DATE : SUMMER SSA EXAMINATION 2017
9 JANUARY 2017

DURATION : (SESSION 1) 08:00 - 11:00

WEIGHT : 40 : 60

TOTAL MARKS : 100

EXAMINER : DR X PAN

MODERATOR : M HENDERSON

NUMBER OF PAGES : 3 PAGES

INSTRUCTIONS : ANSWER ALL QUESTIONS

REQUIREMENTS : CALCULATOR, Ruler

QUESTION 1 (10 marks)

Please draw a diagram and use percentage to explain how the chromite resources/reserves are used in the world.

[10]

QUESTION 2 (20 marks)

Conventional SAF process and Outokumpu process are two of the production processes used to produce charge chrome in South Africa.

(1) Draw the flowsheet of conventional SAF process

(2) Draw the flowsheet of Outokumpu process

[20]

QUESTION 3 (70 marks)

After changing to new raw materials, it is required to determine the charge recipe before the new materials can be fed in a SAF.

Calculate the charge recipe for production of charge ferrochrome, using the information of raw materials in Table 1. The atomic weights of some elements are listed in Table 2, and a SiO₂-MgO-Al₂O₃ phase diagram is in Figure 1.

Start with a batch of **27 230 kg ore**, then calculate the amount of flux (quartz) and reductant (coke), required to produce an alloy with **3-5% Si, 6-8% C** and a slag with **12-14% Cr₂O₃, 6-8% FeO**. The required liquidus temperature is **1800 °C** for the slag of SiO₂-MgO-Al₂O₃.

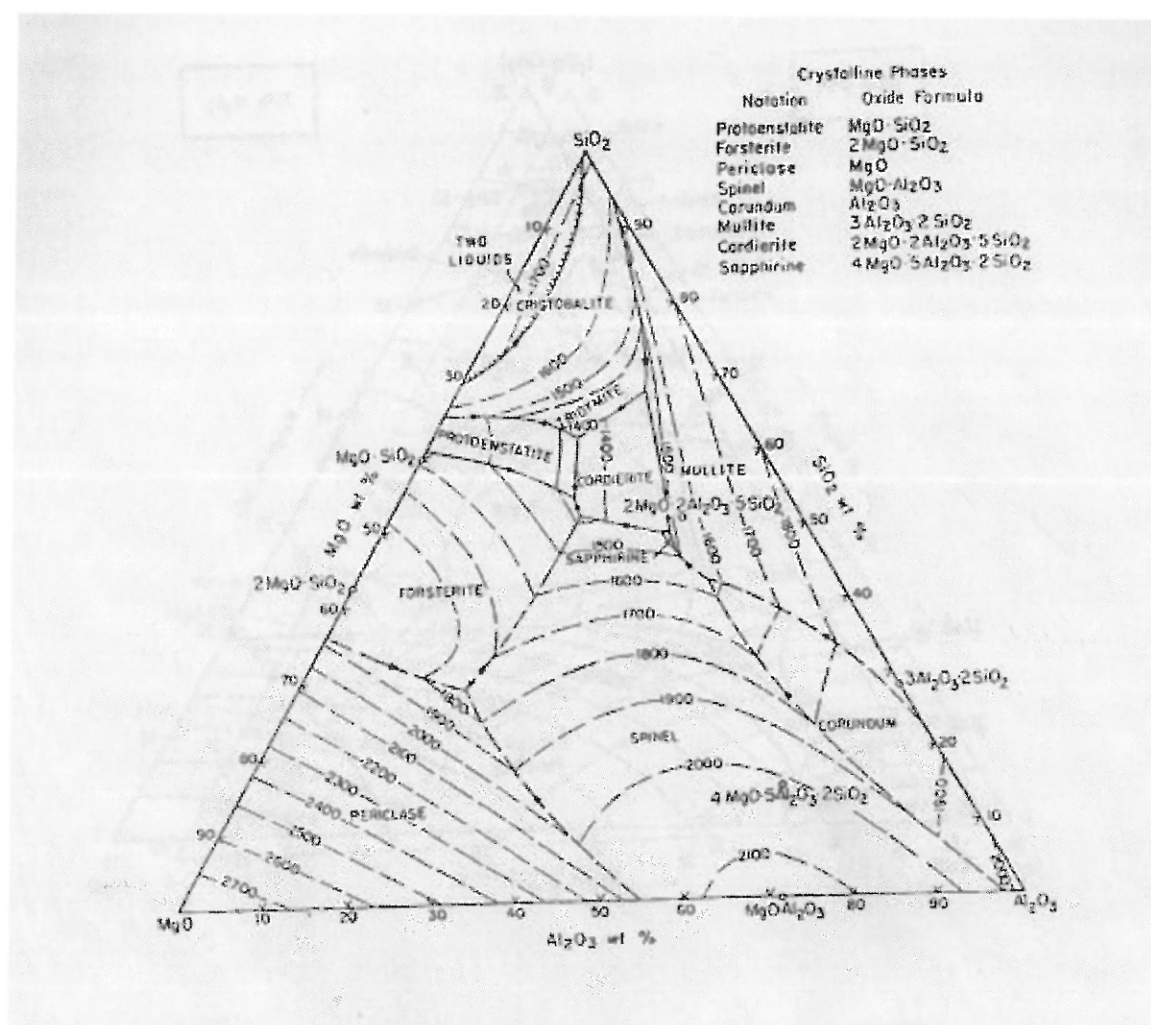
Please submit the Figure 1 together with your answer sheet.

Table 1. Raw Material Composition

Name	Cr ₂ O ₃ %	FeO%	Fe ₂ O ₃ %	MgO%	SiO ₂ %	Al ₂ O ₃ %	H ₂ O%	C%
Ore	39	15	8	12	9	12	5	0
Quartz	0	0		0	100	0	0	0
Coke	0	0		0	7	4	0	89

Table 2. Atomic Weight

Element	Fe	Cr	Si	Al	Mg	O	C	H
Weight	56	52	28	27	24	16	12	1

Figure 1. SiO₂-MgO-Al₂O₃ Phase Diagram

[70]

Total = 100