**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

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**EXAMINER** : DR X PAN
**MODERATOR** : M HENDERSON

**NUMBER OF PAGES** : 3 PAGES

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**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.

**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

**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>
<thead>
<tr>
<th>Table 1. Raw Material Composition</th>
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<tbody>
<tr>
<td>Name</td>
</tr>
<tr>
<td>-------</td>
</tr>
<tr>
<td>Ore</td>
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<tr>
<td>Quartz</td>
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<td>Coke</td>
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<table>
<thead>
<tr>
<th>Table 2. Atomic Weight</th>
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<tbody>
<tr>
<td>Element</td>
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<tr>
<td>Weight</td>
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</tbody>
</table>
Figure 1. SiO2-MgO-Al2O3 Phase Diagram

Total = 100