



PROGRAM : B ENG TECH
PHYSICAL METALLURGY

SUBJECT : **CORROSION TECHNOLOGY 3A**

CODE : **CORMTA3**

DATE : SSA EXAMINATION
15 JULY 2019

DURATION : 11:30 - 14:30

WEIGHT : 40 : 60

FULL MARKS : 100

TOTAL MARKS : 100

EXAMINER : MR G A COMBRINK

MODERATOR : DR H MOLLER

NUMBER OF PAGES : 3 PAGES

INSTRUCTIONS : ALL THE ANSWERS MUST BE COMPLETED IN THE
EXAM SCRIPT

REQUIREMENTS: : ONE ANSWER SCRIPT
ONE POCKET CALCULATOR
NO CORRECTION FLUID SHALL BE USED

QUESTION 1

Give the definition of corrosion.

[3]

QUESTION 2

A car component manufacturer that is located in Port Elizabeth (PE) South Africa manufactures untreated (no protective coating) metal car components for the local and export market. During October during a period of high humidity in the ambient atmosphere, clean and rust free automotive components are packed **into airtight and completely sealed** container and shipped off to Detroit in the Northern USA by container ship over the Atlantic Ocean. The container is off-loaded and arrives in Detroit at the end of January. When the container is opened in Detroit for inspection the automotive components are rusted. Explain how this could have happened and what could have been done to prevent it from happening? (Note that October is summer time in PE, SA and the ambient conditions are typically high humidity atmospheres whereas January in Detroit, USA it is cold winter with typically snow around)

[10]

QUESTION 3

Draw and label the basic corrosion cell, explain what the purpose is of every component, what happens at each part and give a typical reaction that can occur at appropriate sites. What can be done to influence the corrosion rate?

[12]

QUESTION 4

A piece of Iron is submerged in flowing and highly aerated clean fresh water that has a pH of 7.05 (there is lots of dissolved oxygen in the water).

4.1 Draw the Evans diagram of the system. (5)

4.2 If the flow of the water is increased show how the evens diagram changes. (5)

[10]

QUESTION 5

5.1 Explain what the function of the chromium oxide layer is that forms on the surface of a chromium containing steel and how does it do this? (3)

5.2 How much Cr must be present in the bulk material to allow a self-healing layer to be formed on its surface in a normal air atmosphere? (2)

5.3 What are steels containing the minimum amount of Cr as mentioned above called as a group? Name the four types of this type of material. (5)

[10]

QUESTION 6

Briefly give the anodizing process and explain what it is. (Give the process and explain why the metal used as the cathode is chosen). Name at least two metals to can be anodized. Draw a schematic section of an anodized metal giving typical film thickness and configuration. Why is it necessary to seal the anodized surface and how is it done?

[15]

QUESTION 7

How does an organic coating affect the corrosion rate and explain why this is so? How many coats of paint would you apply onto a steel surface that is to do service internally as a water holding tank? Give generic names to the various layers of coating.

[10]

QUESTION 8

Name the two generic types of paint coatings and explain their curing (drying) mechanism.

[10]

QUESTION 9

9 What is: -

9.1 Filiform Corrosion

9.2 Pitting Corrosion

9.3 Crevice Corrosion

9.4 Galvanic Corrosion

9.5 Differential Oxygen corrosion

[20]

Total Marks

[100]

Full Marks

[100]
