UNIVERSITY OF PRETORIA / UNIVERSITEIT VAN PRETORIA
DEPARTMENT OF PLANT PRODUCTION AND SOIL SCIENCE /
DEPARTEMENT PLANTPRODUKSIE EN GRONDKUNDE

GKD 320
SOIL CHEMISTRY / GRONDCHEMIE

| Internal examiner / Interne eksaminator: | Mr P.C. de Jager |
| External examiner / Eksterne eksaminator: | Mr Teunis Vahrmeijer |

Semester test / *Semestertoets*
August / Augustus 2010
Time / *Tyd*: 90 min
Marks / Punte : 45

Question 1 / Vraag 1

In your own words, define the soil solution and give examples of two important processes that take place in the soil solution. / *Definieer die grondoplossing in jou eie woorde en gee voorbeelde van twee belangrike prosesse wat daarin voorkom.* (8)

Question 2 / Vraag 2

Name the four of the most abundant cations generally found in the soil solution, indicated if they are A or B type cations and give also concentration ranges for these cations. **NB! Clearly indicate the unit that you are using.** / *Gee die vier katione wat die volopste is in die grondoplossing, dui aan of dit A of B tipe katione is en ook die konsentrasie reikwydte wat jy verwag. **NB! Wys duidelik die eenhede wat jy gebruik.*** (12)

Question 3 / Vraag 3

3.1) Define solution speciation and support your answer by giving a mass balance equation that you typically would expect for calcium. / *Definieer oplossings spesiëring en gee 'n massabalans wat jy tipies verwag vir kalsium in oplossing.* (5)

3.2) Why does "free" (uncomplexed) Ca^{2+} in solution exists as an aquacation, while "free" Fe^{3+} exists as an hydroxocation and P^{5+} exists as an oxoanion? *Hoekom kom vry Ca^{2+} in oplossing voor as 'n aquakatioon, terwyl vry Fe^{3+} voorkom as 'n hidroksiekatioon en P^{5+} as 'n oksi-anioon.* (6)

Question 4 / Vraag 4

An accident results in mercury pollution of a soil, a consultant suggests that a solution containing an organic ligand should be used to wash the soil clean. Do you think this is a good idea? Briefly discuss what you expect will happen with reference to the A or B type character of the cation and the type of complexation you expect. / *'n Ongeluk veroorsaak die kwik besoedeling van 'n grond, 'n konsultant beveel aan dat 'n oplossing wat 'n organiese ligand bevat gebruik moet word om die grond mee skoon te was. Dink jy dit is 'n goeie idee? Bespreek kortliks wat jy dink gaan gebeur, verwys na die A of B tipe eienskappe van die kation en die tipe kompleksering wat jy verwag.* (8)

Question 5 / Vraag 5

Ignore solution complexation and calculate the activity of Na^+ and SO_4^{2-} in a 0.010 M NaCl and 0.010 M $MgSO_4$ solution. *Ignoreer oplossings kompleksering en bereken die aktiwiteit van Na^+ en SO_4^{2-} 'n 0.010 M NaCl en 0.010 M $MgSO_4$ oplossing.* (6)

Information sheet / *Informasieblad*

$$I = \frac{1}{2}\sum z_i^2 C_i$$

I = ionic strenght
Z_i = charge of ion i
C_i = concentration of ion I

$$\log \gamma_i = -\left[Az_i^2\left[\frac{I^{0.5}}{1+I^{0.5}} \right] - 0.3I \right]$$

γ_i = activity coefficient of ion I
A = constant related to die dielectrical constant of water
= 0.5 at 298 K