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

GKD 320
SOIL CHEMISTRY / GRONDCHEMIE

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Semester test / *Semestertoets*
October / Oktober 2010
Time / *Tyd*: 60 min
Marks / Punte : 30

Question 1 / Vraag 1

Differentiate between the solubility product (K_{sp}) and the Ion Activity Product (IAP) of a mineral with an appropriate example. / *Onderskei tussen die oplosbaarheidsproduk (K_{sp}) en die Ioon Aktiwiteits Product (IAP) van 'n vastefase met 'n gepaste voorbeeld*. (5)

Question 2 / Vraag 2

X-Ray Diffraction (XRD) showed that kaolinite is present in a highly weathered soil sample, however, computed ion activities based on analysis of saturated paste extracts suggest that the soil solution was unsaturated with respect to this mineral. Give possible explanations for these seemingly contradicting results. / *X-Straal Diffraksie (XRD) het gewys dat kaoliniet teenwoordig is in 'n hoogs verweerde grondmonster, maar berekende ion aktiwiteite gebaseer op die analiese van versadigde pasta ekstrakte dui aan dat die grondoplossing onderversadig is met hierdie mineraal . Gee moonltike verklarings vir hierdie verskynsel.* (5)

Question 3 / Vraag 3

An ash coloured B horizon in a wetland smells like rotten egg. Discuss the redox status of this soil horizon with reference to redox sequence in the soil, the primary oxidant under these conditions, the expected pe range of this horizon and the element/s that can potentially be oxidised under these conditions. /'n *Gryskleurige B horison van 'n grondprofiel in 'n vleiland het 'n vrot eier reuk. Bespreek die redoxstatus van hierdie horison met verwysing na die redox opeenvolging in grond, die primêre oksideermiddel onder hierdie toestande, die verwagte pe reikwydte en ook die element / e wat moontlik onder hierdie toestande ge-oksideer kan word.* (10)

Question 4 / Vraag 4

Basic furnace slag from the steel industry is often used as a soil ameliorant to combat soil acidification. However, slag contains a significant amount of Chromium and transform in the soil to $Cr(OH)_{3\ (s)}$. With the information below calculate the solubility of $Cr(OH)_{3\ (s)}$.at a pH of 6. Do you think Cr in this form poses a significant environmental risk if the pH is kept in this range. / *Basiese slag van die staalindustrie word in die landbou gebruik as 'n bekalkingsmateriaal. Hierdie materiaal bevat betekenisvolle hoeveelhede Chroom en transformeer in die grond na $Cr(OH)_{3\ (s)}$. . Met die onderstaande inligting bereken die oplosbaarheid van $Cr(OH)_{3\ (s)}$. by 'n pH van 6. Dink jy Cr in hierdie vorm hou 'n omgewings gevaar in as die pH om en by 6 gehou word.* (10)

Reaction	log K (I = 0)
$Cr(OH)_3(s) = Cr^{3+} + 3\ OH^-$	−30.0
$Cr^{3+} + OH^- = CrOH^{2+}$	10
$Cr^{3+} + 2\ OH^- = Cr(OH)_2^+$	18.3
$Cr^{3+} + 3\ OH^- = Cr(OH)_3(aq)$	24.0
$Cr^{3+} + 4\ OH^- = Cr(OH)_4^-$	28.6
$3\ Cr^{3+} + 4\ OH^- = Cr_3(OH)_4^{5+}$	47.8
$H^+ + OH^- = H_2O$	14.0

(Stumm & Morgan, 1998)