General and Inorganic Chemistry II – preliminary test

This test demonstrates the level of knowledge that students should know when starting the General and Inorganic Chemistry II course. Solve it, check your answers against the solution provided in the separate PDF file and see how many points you obtain:

80–100 points: a solid base, upon which GIC II can be build
60–80 points: minor gaps that should be filled easily
40–60 points: larger gaps but still possible to catch up with some effort
below 40: enrolment is possible but missing knowledge must be acquired beforehand

In the first class, ask your assistant where to find the necessary sources.

1. Name the following compounds (5x1 p):

$(NH_4)HSeO_3$

Na_2CS_3

HNO_4

$[CoCl_2(en)_2]^+$

$[Fe(CN)_5(NO)]^{2-}$

2. Write the formula (5x1 p):

vanadate(3–) anion

tin(IV) chloride-tribromide

nitryl nitrate

ammonium hexanitrocobaltate(III)

dichlorido-bis(methylammin)copper(II) complex

3. Rewrite the following chemical equation into an ionic form (5 p.) and balance it (5 p):

$KMnO_4 + (COOH)_2 + H_2SO_4 \rightarrow MnSO_4 + CO_2$

4. Based on a balanced reaction, determine, whether the following reaction proceeds in acidic or alkali solution (10 p):

$MnO_4^- + NO_2^- + ??? \rightarrow MnO_4^{2-} + NO_3^- + H_2O$

5. Write electron configurations of caesium atom and Co^{3+} cation (2x5 p).

6. In each pair, choose the particle with a bigger radius (2x1 p):

Fe^{2+} vs Fe^{3+} Be^{2+} vs Ca^{2+}

7. In each pair, choose the atom with a higher ionization energy (2x1 p):

Cl vs I		K vs Ca

8. The aqueous solution of Na_2CO_3 is: acidic – neutral – basic (choose one option) (6 p). Why? Demonstrate by a chemical equation (4 p).

9. Draw the molecular orbitals scheme for the molecule of NO^+ (6 p). Calculate the bond order (2 p) and determine whether the molecule is paramagnetic or diamagnetic (2 p).

10. Draw Lewis structures of BCl_3 and PCl_3. Determine the hybridization of the central atom's atomic orbitals and the shape of both molecules. With respect to the central atom, determine their acid-base behaviour in terms of the Lewis theory of acidity (2x5 p).

11. Complete reactions that proceed. Balancing is not necessary.. (each reaction 2 p, i.e. 13x2 p. in total).

$Cr + H_2O \rightarrow$

$PBr_3 + H_2O \rightarrow$

$SO_3 + H_2O \rightarrow$

$BaCl_2 + H_2O \rightarrow$

$LiH + H_2O \rightarrow$

$Sr + H_2O \rightarrow$

$SO_2Cl_2 + H_2O \rightarrow$

$CO_2 + OH^- \rightarrow$

$Pt + OH^- \rightarrow$

$Se + OH^- \rightarrow$

$Al + OH^- \rightarrow$

$K_2SO_3 + HBr \rightarrow$

$CsI + HBr \rightarrow$