General and Inorganic Chemistry II – preliminary test; solution

1. Calculate the oxidation number of the highlighted atom (4x1 p)

$H_4\mathbf{Si^{IV}}O_4$ $(\mathbf{C^{III}}OOH)_2$ $\mathbf{N^{V}}O_2^+$ $\mathbf{B^{III}}_5O_8^-$

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

H_2SeO_3	selenous acid
Na_2CO_3	sodium carbonate
NO_2	nitrogen dioxide *or* nitrogen(IV) oxide
KHS	potassium hydrogensulfide
$[Co(H_2O)_4(NH_3)_2]^{2+}$	tetraaqua-diammincobalt (II) cation

3. Write the formula (5x1 p):

perchlorate anion	$ClO4^-$
tin tetrabromide	$SnBr_4$
ammonium nitrate	NH_4NO_3
strontium peroxide	SrO_2
tripotassium hexacyanidoferrate(III)	$K_3[Fe(CN)_6]$

4. Balance the following two reactions (3x5 p.):

$Cr_2O_3 + 3\ CCl_4 \rightarrow 2\ CrCl_3 + 3\ COCl_2$

$2\ KMnO_4 + 5\ (COOH)_2 + 3\ H_2SO_4 \rightarrow 2\ MnSO_4 + 10\ CO_2 + K_2SO_4 + 8\ H_2O$

$SeO_3^{2-} + Cl_2 + 2\ OH^- \rightarrow SeO_4^{2-} + 2\ Cl^- + H_2O$

5. Based on a balanced reaction, determine, whether the following reaction proceeds in acidic or alkali solution (5 p):

alkali: $2\ MnO_4^- + NO_2^- + 2\ OH^- \rightarrow 2\ MnO_4^{2-} + NO_3^- + H_2O$

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

Cs: $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 4s^2\ 3d^{10}\ 4p^6\ 5s^2\ 4d^{10}\ 5p^6\ 6s^1$ *or* Cs: [Xe] $6s^1$

Co^{2+} : $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ (4s^0)\ 3d^7$ *or* Co^{2+} : [Ar] $3d^7$

7. In each pair, choose the element with a higher electronegativity (3x1 p):

Mg vs Ba	Mg
Si vs Cl	Cl
F vs Sb	F

8. In each pair, choose the compound, whose bond is more ionic (3x1 p):

KF vs SO_2	KF
SO_4^{2-} vs Na_3N	Na_3N
BBr_3 vs $BaBr_2$	$BaBr_2$

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).

The solution is basic: Na^+ is not hydrolysing, carbonate hydrolyses ($CO_3^{2-} + H_2O \leftrightarrows HCO_3^- + OH^-$)

9. Read through the statements below and classify them as true or false (5 p each statement, i.e. 50 in total):

a) Maximum oxidation number of p-block elements is given as (number of the group–10). – TRUE

b) The maximum oxidation number of manganese is +VII. – TRUE

c) Iron is not a noble metal, therefore it forms cations readily. – TRUE

d) All metals are inert towards water under normal conditions (101,325 Pa, 20 °C). – FALSE

e) Molecule of oxygen (O_2) contains a triple bond. – FALSE

f) All gaseous non-metals form diatomic molecules. – FALSE

g) Water is a polar solvent. – TRUE

h) A covalent bond is based on sharing valence electrons. – TRUE

i) The molecule of nitrogen (N_2) is very stable and reacts only under specific conditions. – TRUE

j) Most elements in the PT are gases. – FALSE