RAJARATA UNIVERSITY OF SRI LANKA
FCULTY OF APPLIED SCIENCES
B.Sc. Second year Semester I Examination – September/October 2014
CHE 2105 – Inorganic Chemistry II

Answer both questions.   **Time: 1 hour.**

Use of non-programmable calculator is permitted.

Electronic rest mass	$m_e = 9.11 \times 10^{-31}$ kg
Proton rest mass	$m_p = 1.672 \times 10^{-27}$ kg
Neutron rest mass	$m_n = 1.675 \times 10^{-27}$ kg
Magnitude of the electron charge	$e = 1.60 \times 10^{-19}$ C
Universal gas constant	$R = 8.314$ J mol^{-1} K^{-1}
Planck constant	$h = 6.626 \times 10^{-34}$ J s
Avogadro number	$N_A = 6.022 \times 10^{23}$ mol^{-1}
Speed of light	$c = 3.0 \times 10^{8}$ ms^{-1}
1 atomic mass unit (amu)	$1\,\text{amu} = 1.66 \times 10^{-27}$ kg
1 eV	$1\,\text{eV} = 1.602 \times 10^{-19}$ J

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1). (a) Write a balanced equation to show the reaction between CaH_2 and H_2O. How many grams of CaH_2 are needed to produce 26.4 L of H_2 gas at 20 $^{\circ}$C and 10^5 Pa?
(molar mass of H and Ca are 1 and 40 g/mol respectively)

(b) Arrange the increasing order of melting point of the alkali metal Li,Na,K.

(c) Write the balanced equation for the following reactions:

(i) $NH_3 + O_2 \rightarrow$

(ii) $Fe_2O_3 + CO \rightarrow$

(d)   Explain in terms of molecular geometry account that the CF_4 molecule is nonpolar whereas the SF_4 molecule is polar.

(e)   Draw the shape of SF^{3+} ion and predict the F-S-F angle.

(f)   Write a balanced ionic equation to represent the oxidation of iodide ion by permanganate ion in basic solution.

(g)   Name four types of detectors to detect radiation associated with radioactivity.

(h)   Give radiochemical equation for a fusion reaction of $^{235}_{92}U$ producing $^{141}_{56}Ba$ and $^{92}_{36}Kr$.

(i)   Calculate the energy released if the mass loss in reaction above (h), is 0.213 g for 1 mol of $^{235}_{92}U$.

(j)   Show that the half life ($t_{1/2}$) is independent of the initial concentration.

$(10 \times 12 \text{ marks} = 120 \text{ marks})$

2).   Answer either part (A) or part (B)

Part (A)

Answer all parts.

(a)   Write the balanced chemical reactions of the following:

  (i)   Solid ammonium nitrate is heated to temperature above 300 °C

  (ii)   A mixture of powdered iron(III) oxide and powdered aluminium metal is heated strongly.

(20 marks)

(b)   Sketch the trends for the properties mentioned below, and account for the trend in each case.

  (i)   Boiling point of the element Na,Mg and Al.

  (ii)   Solubility in water of $MgSO_4$, $CaSO_4$, $SrSO_4$, $BaSO_4$.

(20 marks)

(c)   Chalcopyrite ($CuFeS_2$) is a principle ore of copper. Calculate the amount of Cu obtained in 3.71×10^3 kg of chalcopyrite.

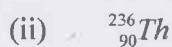The molar masses of Cu and $CuFeS_2$ are 63.5 g mol^{-1} and 183.5 g mol^{-1} respectively.
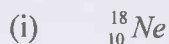
(20 marks)

(d)   Show the possible stereoisomers of octahedral complex ion of $[Mn(H_2O)_2(ox)_2]^{2-}$.

(20 marks)

Part (B)

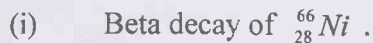Answer all parts.

(a)   Comment on the stability of the following nuclides, and the type of radioactive decay (if any) that they undergo.

(i) $^{18}_{10}Ne$

(ii) $^{236}_{90}Th$

(12 marks)

(b)   Write balanced nuclear equations for the following reactions.

(i)   Beta decay of $^{66}_{28}Ni$.

(ii)   Positron decay of $^{40}_{19}K$.

(12 marks)

(c)   Strontium-90 is one of the harmful nuclides resulting from nuclear fission explosions. Strontium-90 decays by beta particle emission with a half-life of 28.0 years. How long (in years) would it take for 99.0% of a sample of strontium-90 released in an atmospheric test of an atomic bomb to decay?

(32 marks)

(d)   Write down four uses of radioisotopes and briefly explain one of them.

(24 marks)