Bago University
Department of Chemistry
Second Semester Examination, September 2019

Fourth Year BSc **Chem 4107**
(Chemistry Specialization) **Inorganic Chemistry VI**
Answer *any six* Questions **Time Allowed: (3) hours**

1. (a) Fill in the blanks with the correct word(s), unit(s), and etc., as necessary.
   (i) Some nuclear reactors contain ——— which slow down the neutron.
   (ii) An important extractant for uranyl nitrate is ———.
   (iii) Electronic structure of $_{89}Ac$ is ———.
   (iv) For sub-shells that are less than half filled, the state having the lowest J value has ———.
   (v) In a correlation diagram, the states are shown in order of ———.
   (vi) For subshells that are more than half filled, having ——— J value has the lowest energy.

   (b) Select the correct statement(s), word(s), unit(s) and etc., given in the followings.
   (i) (N_f, N_p, N_w) is the concentration of uranium input fraction.
   (ii) The end product of the actinium decay series is (^{206}Pb, ^{207}Pb, ^{208}Pb).
   (iii) Energy released per one fission is about (200, 400, 25) MeV.
   (iv) The symbol (^3D, ^3P, ^1D) corresponds to the state in which L = 2 and the spin multiplicity is 3.
   (v) The highest possible value of M_L for low spin d^4 configuration in octahedral symmetry is (4, 5, 6).
   (vi) The huge electromagnetic separators are referred to as (cyclotron, calutron, centrifuge).

2. (a) Explain the followings.
   (i) Cyclotron (ii) nuclear reactor (iii) actinide elements

   (b) A ^{232}Th target was irradiated with thermal neutrons for a very long period. The induced activity immediately at the end of irradiation was found out to be 5290 Bq. Find the value of thermal neutron cross- section for ^{232}Th (n, γ) ^{238}Th reaction. Given; weight of target = 6.99 g , neutron flux = 3.66×10^4 n $cm^{-2}s^{-1}$ Th = 232, Cl = 35.5, O = 16 , Avogadro's number = 6.023×10^{23}

3. (a) Write a short account on the radiation hazard of transuranium elements.
   (b) Describe the underlying principle in the production of isotopes by neutron irradiation.

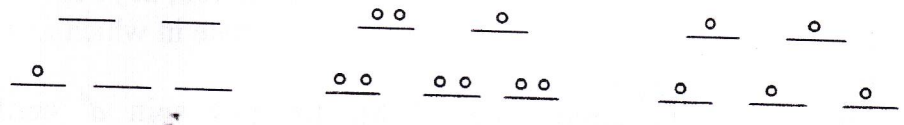
4. (a) Calculate the emitted particles for the Uranium decay series, Thorium decay series and Actinium decay series.
   (b) It was found that ^{239}Np nuclide emits gamma radiation of 106, 228 and 227 keV. If a scientist works with 10^{-3} Curie source of this element at a distance of 1food, find the amount of radiation dose it might receive in one hour.

P.T.O

5. (a) Determine the possible microstates for p^2 configuration and use them to prepare a microstate table.
   (b) Calculate Russell - Saunders terms for the following wave functions.
   (i) $1^+ 1^-$ (ii) $1^+ 0^+$ (iii) $0^+ 0^-$ (iv) $2^+ 2^-$
   (c) Explain Laporte selection rule with a suitable example.

6. (a) Calculate Russell - Saunders terms for $(2^+ 2^-)$, $(2^+ 1^+)$ and $(1^+ 1^-)$ wave functions.
   (b) Draw a figure showing LS coupling only and spin - orbit coupling for p^2 configuration.
   (c) Determine the ground terms for high spin and low spin d^5 configuration in octahedral symmetry.

7. (a) Describe the two extremes of a correlation diagram for d^2 configuration.
   (b) Write a short account on the distortion of d^9 metal in an octahedral complex with the help of figure.
   (c) Identify the following configurations as T, A or E states in octahedral complexes.



****