

Bago University
Department of Chemistry
First Semester Examination, March 2019

Fourth Year BSc
(Chemistry Specialization)
Answer any six Questions

Chem-4101
Inorganic Chemistry V
Time Allowed: (3) hours

1. (a) Fill in the blanks with the correct word(s), unit(s), and etc., as necessary.
- (i) The nucleus of an atom consists of protons and neutrons known as _____.
 - (ii) Mass defect is equal to the differences between the _____ and mass number.
 - (iii) Radio phosphorus is useful in _____ making.
 - (iv) Isomers have same Z and N, ie, same A values with different _____ states.
 - (v) α -particles are identified by doubly charged _____ ion.
 - (vi) Black arsenic can also be formed by cooling _____ at around 100-200 °C.
- (b) Select the correct statement(s), word(s), unit(s) and etc., given in the followings.
- (i) The radius of a heavy nucleus is on the order of (10^{-12} cm, 10^{-13} cm, 10^{-24} cm).
 - (ii) Alpha particle emission is accompanied by a decrease of (one, two, four) in mass number.
 - (iii) About (60%, 70%, 80%) of the arsenic are excreted mainly through urine.
 - (iv) The geometry of the molecule of NH_3 , can be described as (trigonal planar, bent shape, trigonal pyramid).
 - (v) (H_2O , BF_3 , XeF_4) molecule has C_3 axis.
 - (vi) Mercury metal is widely distributed in nature at (medium, very low, high) concentrations.
2. (a) How do nuclear reactions differ from ordinary chemical reactions?
(b) Describe the characteristics of alpha particles, beta particles, and gamma rays.
(c) The ratio of the mass of ^{208}Pb to that of ^{238}U in a certain rock specimen is found to be 0.5. Assuming that the rock originally contained no lead, estimate its age. (Half-life period of $^{238}\text{U} = 4.5 \times 10^9$ years)
3. (a) Name some radionuclides that have medical uses and give the uses.
(b) The actual mass of ^{64}Zn atom is 63.9291 amu. Calculate the mass deficiency in amu/atom and in g/mol for this isotope.
(c) Express the symbols for the daughter nuclide of the following nuclear reactions.
- (i) $^{237}\text{U} \xrightarrow{-\beta} ?$ (ii) $^{13}\text{C} \xrightarrow{-n} ?$ (iii) $^{224}\text{Rn} \xrightarrow{-\alpha} ?$

P.T.O

4. (a) Describe how radionuclides can be used in (a) research, (b) agriculture, (c) industry.
 (b) Fill in the missing symbols in the following nuclear reactions:
- (i) ${}_{11}^{23}\text{Na} + ? \rightarrow {}_{12}^{23}\text{Mg} + {}_0^1\text{n}$
- (ii) ${}_{42}^{96}\text{Mo} + {}_2^4\text{He} \rightarrow {}_{43}^{100}\text{Tc} + ?$
- (iii) ${}_{90}^{232}\text{Th} + ? \rightarrow {}_{96}^{240}\text{Cm} + 4{}_0^1\text{n}$
- (iv) $? + {}_1^1\text{H} \rightarrow {}_{14}^{29}\text{Si} + {}_0^0\gamma$
- (v) ${}_{83}^{209}\text{Bi} + ? \rightarrow {}_{84}^{210}\text{Po} + {}_0^1\text{n}$
- (vi) ${}_{92}^{238}\text{U} + {}_8^{16}\text{O} \rightarrow ? + 5{}_0^1\text{n}$
5. (a) Identify the symmetry elements belonging to the following molecules:
 (i) BrF_5 (ii) CO_3^{2-} (iii) C_6H_6 (iv) B_2H_6
- (b) Prove that (i) $C_3^{-1} C_3^1 = E$ (ii) $\sigma_{v(1)}^{-1} \sigma_{v(1)} = E$ for NH_3 molecule.
6. (a) To which symmetry operations of PF_5 are equivalent to the following combinations of operations.
 (i) $C_3^2 \cdot C_{2(2)} \sigma_{v(1)}$ (ii) $C_3^1 C_{2(3)} \sigma_{v(2)}$ (iii) $S_3^1 \cdot \sigma_{v(2)}$
- (b) Select the molecule which has the center of symmetry.
 (i) CCl_4 (ii) PCl_5 (iii) NH_3 (iv) CO_3^{2-} (v) BeCl_2 (vi) XeF_4
7. (a) Discuss the physical and chemical properties of mercury and its compounds.
 (b) Describe how does arsenic released into the atmosphere and water?
