

THE CATHOLIC UNIVERSITY OF EASTERN AFRICA

FACULTY OF SCIENCE

NATURAL SCIENCE (PHYSICS) DEPARTMENT

PHY 406: Nuclear Physics Assignment II

Date: 2nd April 2020

Duration: 1hr

Attempt ALL Questions

- Q1 (a) With the aid of a diagram state the ordering of the first six lowest nuclear energy level (3m)
- (b) Give the expected shell model spin and parity assignments for the ground states Of Pr (A=141, Z= 49) (1m)
- (c) Determine the magnetic moments of the nuclides in (b) above, in terms of, the nuclear magnetron (4m)
- Q2 (a) (i) Define the term degeneracy (1m)
- (ii) Determine the degeneracy for the level $l = 3$ (2m)
- (b) If the spin-orbit potential is included in (a)(ii) above, determine
- (i) the possible values of j (2m)
- (ii) (ii)
- (iii) the degeneracy of each level (3m)
- (c) Identify the following types of Nuclear reactions
- i) $^{12}\text{C} (p,p)^{12}\text{C}$ (1m)
- ii) $^7\text{Li} (d,p)^8\text{Li}$ (1m)
- iii) $^2\text{H}(\gamma, p) n$ (1m)
- iv) $^{16}\text{O}(d,t)^{15}\text{O}$ (1m)
- Q3 Derive an expression for the average values of the spin-orbit interaction and hence determine the energy splitting in terms of the quantum orbital quantum number and Planck's constant. (10marks)