



UNIVERSITY OF THE PUNJAB

B.S. 4 Years Program /Eighth Semester – 2019

Roll No. in Fig.

Roll No. in Words.

Paper: Nuclear Physics-II

Course Code: PHY-424 Part – I (Compulsory)

Time: 15 Min. Marks: 10

ATTEMPT THIS PAPER ON THIS QUESTION SHEET ONLY.

Division of marks is given in front of each question.

This Paper will be collected back after expiry of time limit mentioned above.

Signature of Supdt.:

Q.1. Encircle the correct option.

(10x1=10)

- i. The spin of ground state of all _____ nuclei is zero.
- a) even-odd b) even-even c) odd-odd d) odd-even
- ii. The reason for providing the thermal shielding in a fission reactor is to _____.
- a) Absorb the fast neutrons
- b) Protect the operating personnel from exposure to radiations
- c) Prevent the reactor wall from getting heated
- d) All of the above
- iii. The mass distribution of fission fragments must be _____ about the center.
- a) Symmetric b) Anti symmetric c) both a and b d) None of these
- iv. According to Liquid Drop model, the condition for a nucleus to undergo spontaneous fission is _____.
- a) $\frac{Z}{A} > 47$ b) $\frac{Z^2}{A} > 47$ c) $\frac{Z}{A^2} > 47$ d) $\frac{Z^2}{A} < 47$
- v. The material used to decelerate fast moving neutrons is called _____.
- a) Controller b) Coolant c) Moderator d) Reactor
- vi. In D-D reaction, the product proton or neutron has _____ % of the available energy.
- a) 80 b) 75 c) 85 d) 70

P.T.O.

vii. _____ source can give approximately mono-energetic neutrons.

- a) Photo-neutron b) Nuclear reactions c) Reactor d) Radioactive

viii. In γ induced reactions, change in nucleon number is _____.

- a) Definite b) Increased by 1 c) Decreased by 1 d) Zero

ix. Which of the following is not fissionable?

- a) Thorium b) Uranium c) Plutonium d) Iron

x. The compound nucleus model works best for _____.

- a) Low incident energies b) Heavy nuclei
c) Medium weight nuclei d) All of these



ATTEMPT THIS (SUBJECTIVE) ON THE SEPARATE ANSWER SHEET PROVIDED

Q 2: Write down short answers of the following:

(2x10=20)

- i) Write limitations of nuclear shell model.
- ii) Why do the reaction with $Q>0$ have neither threshold nor double valued behavior?
- iii) Write down the basic principle of proton neutron counter for the detection of fast neutrons.
- iv) What are the difficulties in achieving a self-sustained fusion reaction in laboratory?
- v) In what ways are FISSION and FUSION reactions similar?
- vi) In what ways are fission and fusion reactions different?
- vii) What do you mean by activation energy in a nuclear fission?
- viii) Define total nuclear cross-section.
- ix) Differentiate between stripping and picking up reactions.
- x) What do you mean by quasi stationary states?

P.T.O.

Q # 3

- a) Show that the reduction in energy ' ΔE ' of a neutron in an elastic collision with a nucleus of mass number ' A ' is :

$$\Delta E = E \left(1 - \left(\frac{A - 1}{A + 1} \right)^2 \right)$$

Where ' E ' is the initial energy of neutron. **(6)**

- b) What is a Thermo-Nuclear Fusion reaction? Write proton-proton cycle to discuss the fusion of four hydrogen nuclei. **(8)**

Q # 4

- a) Outline the compound nucleus theory for a nuclear reaction. Give one piece of example as an evidence of this theory. **(8)**
- b) Why do nuclei undergo fission? Write down the expression for the Coulomb barrier that inhibits the fission process. **(8)**