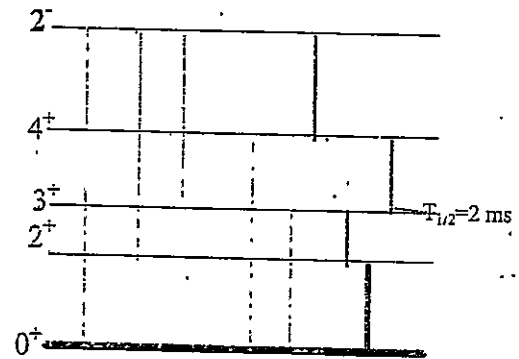


Answer the following questions

- 1-a-Draw a schematic diagram for the fast Slow coincidence spectrometer. Label each element and write down its function
 -What are the possible gamma transitions in coincidence with transitions number: 6, 2 and 8 (resolving time of the circuit is 10 ns).
 -Assume that the gate is changed to anticoincidence what would be the obtained the observed lines gated by line 1,2 and 9.



- 1-b- deduce the type and most probable multi-pole order of transition 1 and 9.

- 2-a-Draw a schematic diagram for the sum spectrometer. Discuss the mechanism of the detection of Gamma photon. and explain the function of each element in the spectrometer. Sketch the expected gamma spectrum if a gamma photon of Co-60 and compare the results to the spectrum detected by only on detector.

- 2-b-Explain how the neutron can be detected although it is a neutral particle

- 3-a-Radiation energy spectra can be classified into two main groups: first, those that consists of one or more discrete energies (line spectra) and those that consists of a broad distribution (continuous spectra). For each of the radiation sources listed below, indicate whether "line" or "continuous" and mention the appropriate detector used to detect such radiation

- 1- Alpha particles
- 2- Beta particles
- 3- Gammay rays
- 4- Characteristic x-rays
- 5- Conversion electron
- 6- Fission fragments
- 7- Annihilation radiation
- 8- Bremsstrahlung
- 9- Emitted beta particles from radioactive source
- 10- Emitted positron from a radioactive source

- 3-b Gamma rays spectrometer records peak corresponding to two different energy (435 and 490 keV. What must be the energy resolution of the system (expressed as%) in order just distinguish between these two peaks?

4-a-Find the solid angle subtended by the circular end surface of NaI detector (10 cm diameter) for a point source located at 20 cm from the surface along the cylindrical axis. If the efficiency of the detector at 1 MeV is 12% and the activity of the point source is 20 kBq. Calculate the number of counts that will appear under the photopeak in of 1 MeV in the pulse height spectrum during a 100 sec of counting.

b-Both the proportional counter and Geiger counter are based on gas multiplication. Comment on each separately and discuss their with respect to

- a) variation of pulse height with applied voltage
- b) the need for quenching
- c) ability to differentiate heavy charged particles and electrons radiation

c-compare between inorganic scintillator (NaI) and organic scintillator (plastic)

- 5- a- Draw a schematic diagram for the positron annihilation life time spectrometer.
- b- Label each element and write down its function in the system.
 - c - describe the source - sample - detector configuration and geometry and explain why the detectors must be at 180 degree.
 - d- what are the information obtained such measurements and what it is used for.