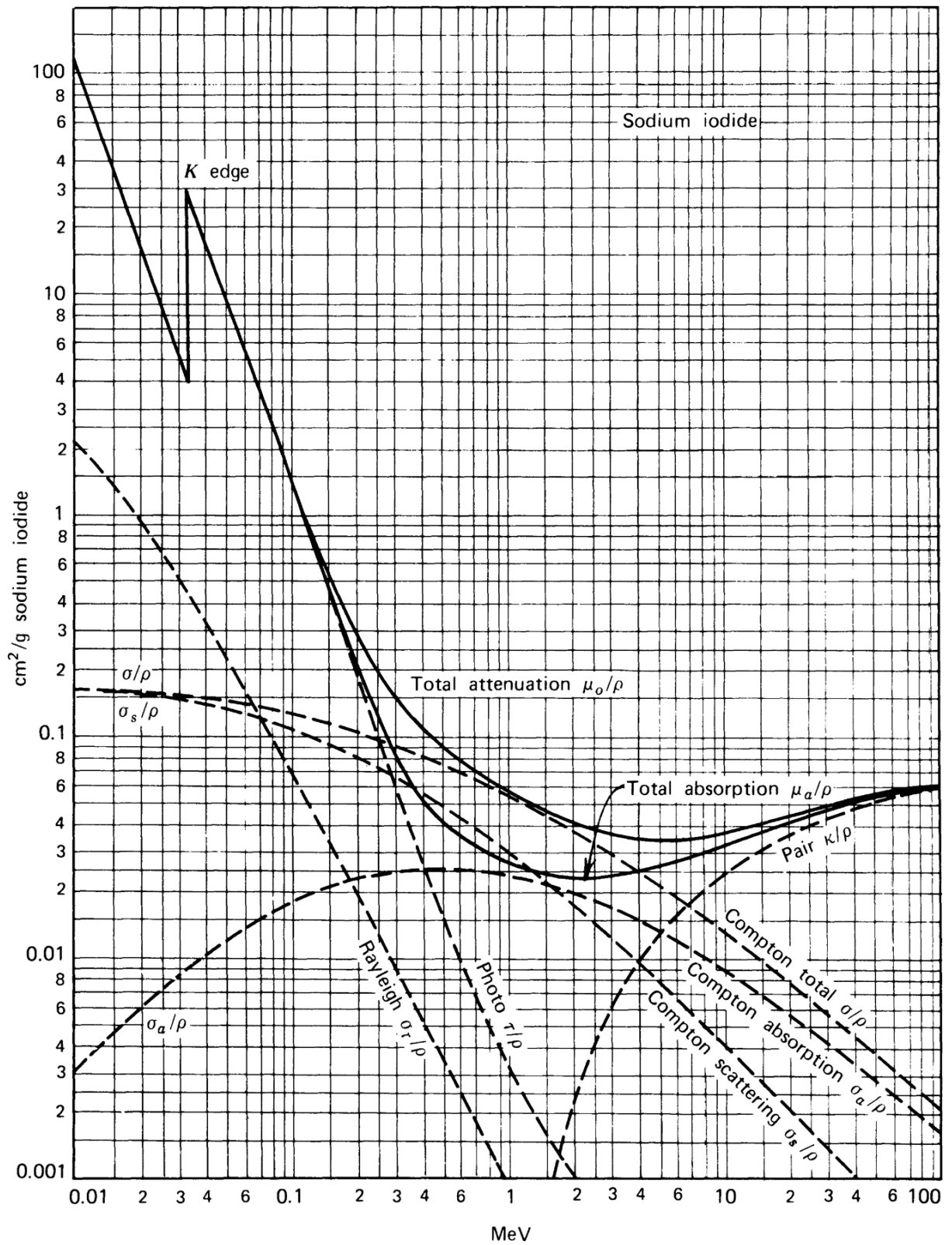


SPA 3609 Tutorial 2, Questions for formative feedback

1. Estimate the ratio of the probability, per atom, of photoelectric absorption of a gamma ray in silicon to that in germanium.
2. Indicate which of the three major processes (photoelectric, Compton, pair-production) is *dominant* in the following interactions of gamma rays:
 - I. 1 MeV in aluminium
 - II. 100 keV in hydrogen
 - III. 100 keV in iron
 - IV. 10 MeV in carbon
 - V. 10 MeV in lead
3. Using the data in the figure below, (a) calculate the mean free path of 1 MeV gamma rays in NaI ($\rho = 3.67 \text{ gcm}^{-3}$) and (b) determine the probability that a 600 keV gamma ray undergoes a *photoelectric* interaction in 1 cm of NaI.



Gamma ray interactions in NaI

4. A cylindrical proportional tube has a $60\ \mu\text{m}$ diameter anode wire and a 4 cm diameter cathode. Assuming that it is operated at a potential difference of 2 kV and that a minimum electric field of 1 MV/m is needed for gas multiplication determine what fraction of the volume of the counter provides gas multiplication.

[You will need to remind yourself/look up the expression for the electric field from a cylindrical co-axial geometry, please note that in an examination I would *not* expect you to memorise or derive such an equation]