QUESTION 1

Your supervisor asks you several questions related to shielding calculations for a photon source.

GIVEN: Density of iron = 7.8 g cm^{-3}

STATE ALL ASSUMPTIONS

POINTS

20 A. In **FIGURE 1**,

1. Name the interaction coefficient that each of the curves (A, B, C, D) represents. **Be sure that you indicate the proper name for the interaction coefficient.**

2. For curve A, explain why there is a sharp increase in the curve at about 2 keV.

3. For curve C, describe the process involved and explain why the curve does not exist below approximately 1.02 MeV.

10 B. Assume that you are protecting personnel with a concrete shield and you don't know the energy spectrum of the photons against which you must shield. What value of the interaction coefficient from Figure 1 would you use? **Justify your answer.**

10 C. 1. Explain why the two curves in **FIGURE 2** are very similar below 50 keV.

2. Explain why the two curves in **FIGURE 2** are different above 50 keV. Include a discussion of region in both curves.

10 D. Photons from a 1 MeV mono-energetic photon source are normally incident on a 10 cm thick iron shield. The incident photon fluence rate is 1×10^{6} cm^{-2} s^{-1}. Calculate the uncollided fluence rate after the shielding. Discuss what the buildup factor is and how it applies to the uncollided fluence rate. **Justify your answer.**

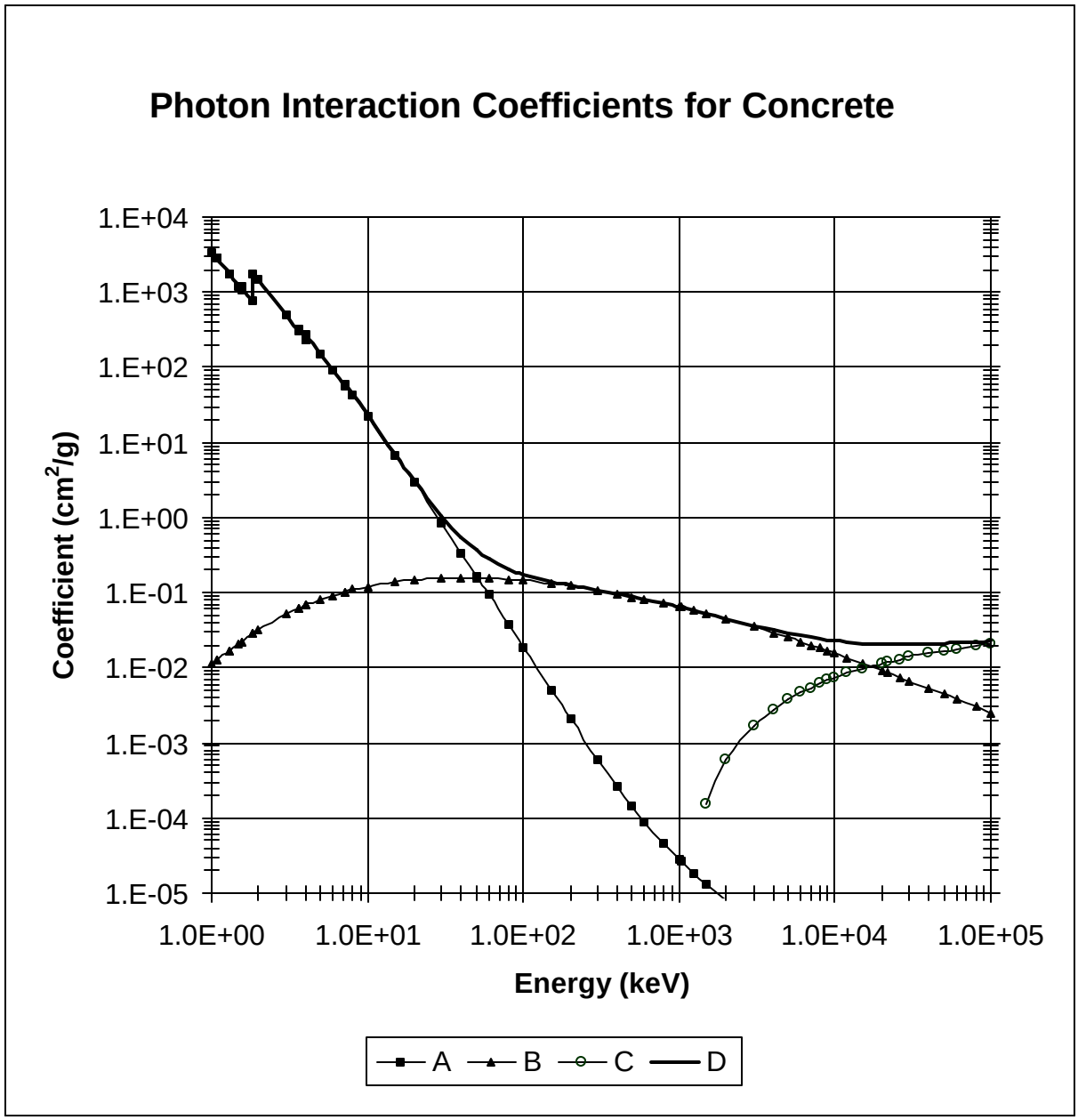
Photon Interaction Coefficients for Concrete
Coefficient (cm2/g)
1.E+04
1.E+03
1.E+02
1.E+01
1.E+00
1.E-01
1.E-02
1.E-03
1.E-04
1.E-05
1.0E+00
1.0E+01
1.0E+02
1.0E+03
1.0E+04
1.0E+05
Energy (keV)
A
B
C
D

FIGURE 1

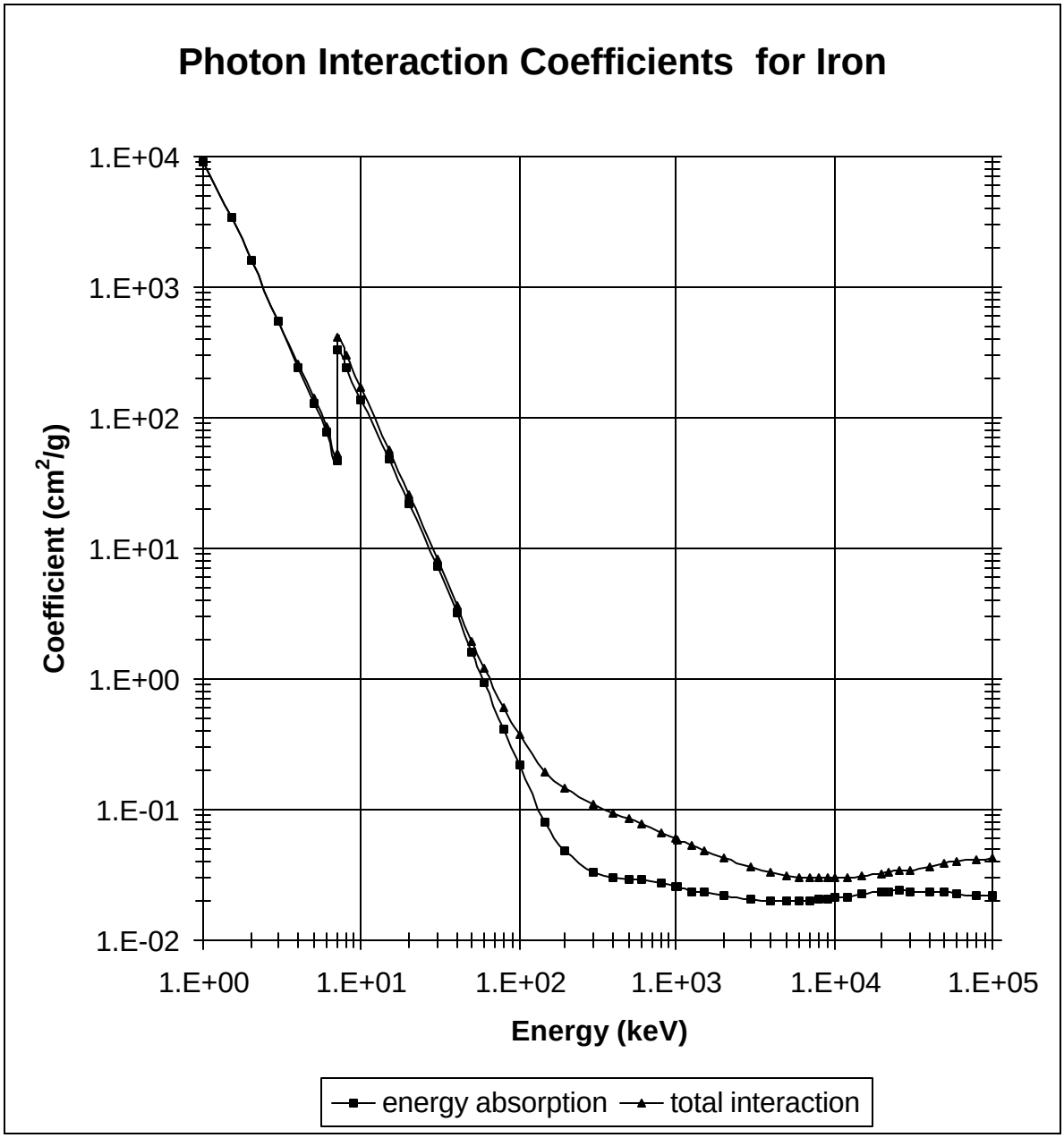
Photon Interaction Coefficients for Iron
Coefficient (cm²/g)
1.E+04
1.E+03
1.E+02
1.E+01
1.E+00
1.E-01
1.E-02
1.E+00
1.E+01
1.E+02
1.E+03
1.E+04
1.E+05
Energy (keV)
energy absorption
total interaction

FIGURE 2