When an electron with kinetic energy 10,000 eV hits a metal target:

(a) A photon of wavelength 1A may be emitted
(b) A photon of wavelength 10A may be emitted
(c) A photon of wavelength 0.1A may be emitted
(d) All of (a), (b), (c)
(e) None of (a), (b), (c)
An electron scattered by a 1 Angstrom incident X-ray photon can have kinetic energy:

(a) More than 2000eV
(b) Between 1000eV and 2000eV
(c) Between 600eV and 1000eV
(d) Less than 1eV
(e) None of the above
Compton scattering: \( \lambda' - \lambda = \frac{h}{m_e c} (1 - \cos \theta) \); \( \frac{h}{m_e c} = 0.0243 \text{A} \)

An electron scattered by a 2 Angstrom incident X-ray photon is scattered at angle 5 degrees relative to the direction of the incident photon. The photon is scattered at angle:

(a) Between 1 and 10 degrees
(b) Between 10 and 60 degrees
(c) Between 60 and 150 degrees
(d) Between 150 and 180 degrees

(d) Between 150 and 180 degrees
10 Mev $\alpha$ particles are incident on an Au nucleus ($Z=79$). The radius of the Au nucleus is 7.3 fm. If 100 $\alpha$ particles scatter at 90 degrees, the number of $\alpha$ particles scattered at 180 degrees is:

(a) Between 40 and 60
(b) About 25
(c) Between 10 and 20
(d) Less than 10
(e) Can’t tell from this information

Note: you need to verify that the distance of closest approach for 10MeV $\alpha$'s is larger than 7.3 fm so that one can use the Rutherford formula.
A 5 MeV $\alpha$ particle is incident on an Au nucleus ($Z=79$). The radius of the Au nucleus is 7.3 fm. When the $\alpha$ particle is at distance 20 fm from the surface of the Au nucleus, its kinetic energy is:

(a) Between 3 and 5 MeV
(b) Between 1 and 3 MeV
(c) Between 0 and 1 MeV
(d) Negative

(e) This prof doesn’t know what he’s talking about

Because: potential energy of $\alpha$ particle at 27.3 fm from nucleus of Au is 8.3 MeV $> 5$ MeV, so $\alpha$ particle can’t get that close.