10.3) a) ESTIMATE THE ENERGY OF THE INNERMOST ELECTRON OF LEAD.

b) WHAT IS ITS MOST PROBABLE RADIUS?

FOR Pb, $Z = 82$

a) THE INNERMOST e^- WILL NOT BE SHIELDED SO IT WILL "SEE" THE ENTIRE NUCLEAR CHARGE.

$$E_{1s,Pb} = -Z^2 E_R \qquad (10.9)$$

$$= -(82)^2 (13.6)^2$$

$$\boxed{E_{1s,Pb} = -91.4\ keV}$$ THAT'S A STRONG BOND!

b) THE MOST PROBABLE RADIUS IS GIVEN BY (10.10)

$$r_{mp} \approx \frac{n^2 a_B}{Z_{eff}}$$

THE INNERMOST e^- IS IN THE $n = 1$ LEVEL AND $Z_{eff} = 82$

$$r_{mp,1s,Pb} \approx \frac{(1)}{(82)^2}(5.29 \times 10^{-11}\ m)$$

$$r_{mp,1s,Pb} \approx 6.45 \times 10^{-13}\ m$$

OR

$$\boxed{r_{mp,1s,Pb} \approx 645\ fm}$$ TINY