3. electron density is $\rho_e = N_e/a^3 = 112/(0{,}543\ nm)^3 \approx 700\ nm^{-3}$

a) $\rho_e \cdot 1000\ nm^3 \approx \underline{7 \cdot 10^5 \text{ electrons}}$

b) $1\mu m^3 = (10^3 nm)^3 = 10^9\ nm^3$

$\rho_e \cdot 10^9\ nm^3 = \underline{7 \cdot 10^{11} \text{ electrons}}$

c) $\cancel{1mm^3 = (10^3 \mu m)^3 = 10^9 \mu m^3}$

$1mm^3 = (10^6 nm)^3 = 10^{18}\ nm^3$

$\rho_e \cdot 10^{18}\ nm^3 \approx \underline{7 \cdot 10^{20} \text{ electrons}}$

4. 100 petaFLOPS (10^{17} FLOPS)

a) A person weighing 100 kg, with approximately the same density as water will have a volume of approximately:

$V = 100\ dm^3 = 100\,(10^8 nm)^3 = 10^{26}\ nm^3$

the number of electrons is then:

$\rho_e \cdot V \approx \underline{7 \cdot 10^{28} \text{ electrons}}$

To calculate all electrons would take

$7 \cdot 10^{28} / 10^{17} = 7 \cdot 10^{11}$ seconds.

That is $7 \cdot 10^{11} / (3600 \cdot 24 \cdot 365) \approx 22197$ years

In a lifetime of 80 years it would be able to calculate:

$100 \cdot \frac{80}{22197} \approx 0{,}36\%$ of the person

b) ~~The total number of terms is the product of terms in the first sum and the number in the second.~~

~~$\sum_{i=1}^{Ne}$ has Ne terms while $\sum_{j>i}^{Ne}$ has~~

The number of terms is $\sum_{i}^{Ne} \sum_{j>i}^{Ne} 1 = \overbrace{1 + 2 + 3 + \ldots + (Ne-2) + (Ne-1)}^{Ne \text{ terms}}$

(assuming i starting at 1)

reordering the terms: $\sum_{i}^{Ne} \sum_{j>i}^{Ne} 1 = \overbrace{1 + (Ne-1) + 2\,(Ne-2) + \ldots \frac{Ne}{2} + \left(Ne - \frac{Ne}{2}\right)}^{Ne \text{ terms}}$

$= \sum_{i}^{Ne/2} Ne = \frac{Ne}{2} \cdot Ne = Ne^2/2 = \frac{(7 \cdot 10^{20})^2}{2} = \underline{2{,}45 \cdot 10^{41}}$