Slope of potential energy (`ramp.m`)

Let take a ramp (i.e a smooth variation) of potential energy of height 2 eV and slope a. Two values are considered: $a_1 = 10\,000\,(\text{eV.nm}^{-1})$ and $a_2 = 1\,(\text{eV.nm}^{-1})$. The transmission probability T versus energy $\mathcal{E}$ (Fig. 1) is obtained with:

```
a1=10000; Epi=0; Epf=2; m=1;
ramp(Epi,Epf,a1,m);
```

For $\mathcal{E} > \mathcal{E}_{p,0}$, T tends rapidly to 1 if a is low (classical approximation). For a_1, the distance $(\Delta x)_1$ over which the transition between 0 and 2 eV occurs is 2×10^{-4} nm; for a_2, $(\Delta x)_2 =$ 2 nm. Compared to the de Broglie wavelength, for $\mathcal{E} = 3$ eV before and after the ramp, one finds respectively $\lambda_{DB,e} = 0.708$ nm and $\lambda_{DB,s} = 1.226$ nm:

```
E=3; LdB=LambdaDB(E,m,[Epi Epf])
LdB = 0.708  1.226
```

For a_2, $\lambda_{DB,e}$ and $\lambda_{DB,s}$ are lower than $(\Delta x)_2$; it is the classical approximation ($T \approx 1$). For a_1, $\lambda_{DB,e}$ and $\lambda_{DB,s}$ are higher than $(\Delta x)_1$; so $T < 1$. On the contrary, if $\mathcal{E} = 2{,}1$ eV, the classical approximation is not justified for $a = a_2$ since $\lambda_{DB,e} = 0.846$ nm and $\lambda_{DB,s} =$ 3.878 nm:

```
E=2.1; LdB=LambdaDB(E,m,[Epi Epf])
LdB = 0.846  3.878
```

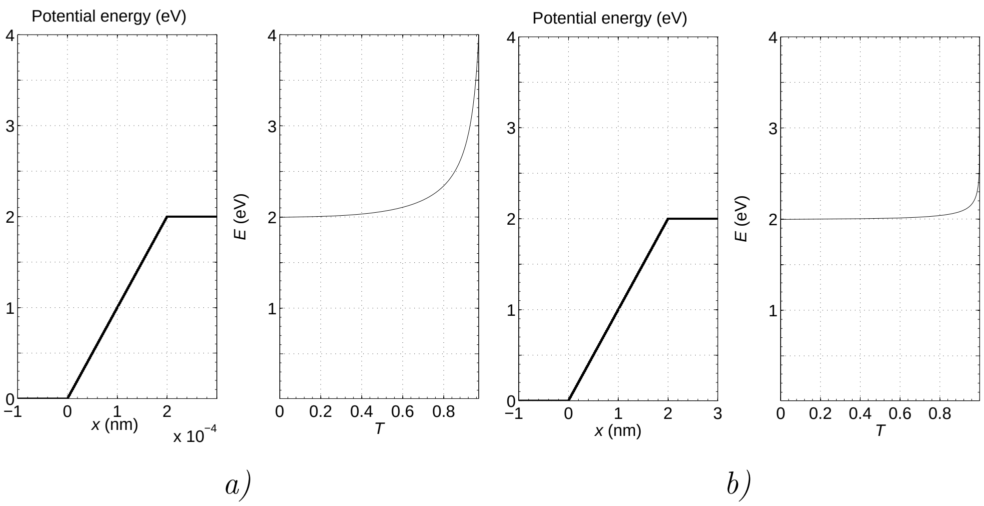

FIG. 1 – *Ramp of potential energy of slope a a)* $1\,0000\,(\text{eV.nm}^{-1})$ *b)* $1\,(\text{eV.nm}^{-1})$