6.41)

(a) The density of states in an interval $[v, v+dv]$ can be counted as in the 3D case except we have a circle and not a sphere. The number $\propto v$ since the area $\sim 2\pi v dv$. Thus,

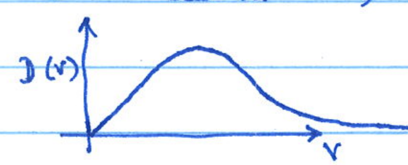
$$D(v)dv \approx C \cdot v dv \cdot e^{-mv^2/2kT}$$ where the normalization constant C can be determined by integration:

$$\int_0^\infty C \cdot v dv \cdot e^{-mv^2/2kT} = \frac{C}{2}\int_0^\infty d(v^2)\, e^{-mv^2/2kT}$$

$$= \frac{CkT}{m}\int_0^\infty du\, e^{-u} = \frac{CkT}{m} \cdot \Rightarrow C = \frac{m}{kT}$$ and

$$D(v)\, dv = \frac{mv}{kT} e^{-mv^2/2kT} dv.$$

(b) The tail is a long exponential as in 3D, but at low v the turn-on is linear:



The most likely $\vec{v} = (0,0)$ since there is no preferred direction in space. The most likely speed v occurs when $\frac{d}{dv}D(v) = 0$ i.e, $e^{-\frac{mv^2}{2kT}} - v \cdot \frac{2mv}{2kT} e^{-mv^2/2kT} = 0$

i.e., $v_{max} = \sqrt{\frac{kT}{m}}$