Ist Ü2

3)

$$f(x)=\begin{cases} a x^2 e^{-bx^2} &, x\geq 0\\ 0 &, x<0\end{cases} \qquad b=\frac{m}{2kT}$$

$$1=\int_{-\infty}^{\infty} f(x)\,dx = \int_0^\infty a x^2 e^{-bx^2}\,dx = a\int_0^\infty \underbrace{x}_{u}\cdot\underbrace{(xe^{-bx^2})}_{v'}\,dx \qquad \Rightarrow v=-\frac{e^{-bx^2}}{2b}$$

$$= a\left(x\cdot\left(-\frac{e^{-bx^2}}{2b}\right)\Big|_0^\infty - \int_0^\infty 1\cdot\left(-\frac{e^{-bx^2}}{2b}\right)dx\right)$$

$$= a\left(\left(-\frac{1}{2b}\,xe^{-bx^2}\right)\Big|_0^\infty + \frac{1}{2b}\int_0^\infty e^{-bx^2}\,dx\right)$$

$$=\frac{a}{2b}\left(\left(\lim_{x\to+\infty}(-xe^{-bx^2})\right)+\int_0^\infty \frac{1}{\sqrt{b}}\,e^{-y^2}\,dy\right) \qquad \left[\begin{array}{l} y=\sqrt{b}\,x \\ dx=\frac{1}{\sqrt{b}}\,dy\end{array}\right.$$

$$=\frac{a}{2b}\left(0 + \frac{1}{\sqrt{b}}\,\frac{\sqrt{\pi}}{2}\right)$$

$$=\frac{a\sqrt{\pi}}{4b\sqrt{b}}$$

$$\Rightarrow 4b\sqrt{b}=a\sqrt{\pi} \iff a=\frac{4b\sqrt{b}}{\sqrt{\pi}}=\frac{4b\sqrt{b\pi}}{\pi}$$