8-42. (a) $f\ \ u\ \ du = Ce^{-E/kT}du = Ce^{-Au^2/kT}du$ (from Equation 8-5)

$$1 = \int_{-\infty}^{+\infty} f\ \ u\ \ du = \int_{-\infty}^{+\infty} Ce^{-Au^2/kT}du = 2C\int_{-\infty}^{+\infty} e^{-Au^2/kT}du$$

$$= 2CI_0 = 2C\sqrt{\pi}\,\lambda^{-1/2}/2 \quad \text{where } \lambda = A/kT$$

$$= C\sqrt{\pi}\,\sqrt{kT/A} \rightarrow C = \sqrt{A/\pi kT}$$

(b) $\langle E \rangle = \langle Au^2 \rangle = \int_{-\infty}^{+\infty} Au^2 f\ \ u\ \ du = \int_{-\infty}^{+\infty} Au^2\sqrt{A/\pi kT}\,e^{-Au^2/kT}du$

$$= A\sqrt{A/\pi kT}\ \ 2I_2\ = A\sqrt{A/\pi kT}\,2\times\ \sqrt{\pi}/4\ \ \lambda^{-3/2} \quad \text{where } \lambda = A/kT$$

$$= \frac{1}{2}A\sqrt{A/kT}\ \ kT/A\ ^{3/2} = \frac{1}{2}kT$$