Homework 24.

Heisenberg's uncertainty principle

Please try to solve problems below using Heisenberg's uncertainty principle: $\Delta x \cdot \Delta p \geq \frac{\hbar}{2}$, where Δx is uncertainty of the particle coordinate, Δp – uncertainty in the particle momentum and $\hbar$ is the Planck's constant: $\hbar = 6.63 \cdot 10^{-34} J \cdot s$

1. A particle of mass m has a position uncertainty equal to its de-Broglie wavelength. What is the minimum relative uncertainty of its velocity $\boldsymbol{\Delta v/v}$?

2. A potential energy of a one-dimensional particle is expressed as:
$$E_p = \frac{kx^2}{2},$$
where $\boldsymbol{k}$ is a constant and $\boldsymbol{x}$ is the particle's coordinate. Use Heisenberg's uncertainty principle to estimate the minimum total energy (kinetic plus potential) of the particle as a function of $\boldsymbol{m}$, $\boldsymbol{k}$ and $\hbar$**.**