Name :

Neptun id. number:

”Nobel-prize physics in …”

Make Up Test 9.

1. The Heisenberg uncertainty principle states, that if the measurement of the position of a particle is made with the uncertainty Δx and the simultaneous measurement of its linear momentum is made with the uncertainty Δp_x, the product of the two uncertainties is restricted to:

a. $\Delta x \cdot \Delta p_x \geq \hbar/2$ b. $\Delta x \cdot \Delta p_x \geq \hbar$ c. $\Delta x \cdot \Delta p_x = h/2$ d. $\Delta x \cdot \Delta p_x \geq h/2$ e. none of them

2. Another form of the uncertainty principle relates measurement of energy and time:

a. $\Delta E \cdot \Delta t \geq h/2$ b. $\Delta E \cdot \Delta t = h/2.$ c. $\Delta E \cdot \Delta t \geq \hbar$ d. $\Delta E \cdot \Delta t \geq \hbar/2$ e. none of them

3. Another form of the uncertainty principle relates measurement of angular momentum and angular position:

a. $\Delta L \cdot \Delta \varphi \geq h/2$ b. $\Delta L \cdot \Delta \varphi = h/4\pi.$ c. $\Delta L \cdot \Delta \varphi \geq \hbar$ d. $\Delta L \cdot \Delta \varphi \geq h/4\pi$ e. none of them

4. For quantum cryptography it is required:

a. two basis b. OTP c. optical fibers d. nonpolarizing beam splitter e. none of them

5. A proton has a kinetic energy of 1.0 MeV. If its momentum is measured with an uncertainty of 5.0%, what is the minimum uncertainty in its position?

a. $4.6*10^{-14}$ m b. $2.9*10^{-14}$ m c. $7.3*10^{-6}$ m d. $2{,}8*10^{-10}$ m e. none of them

Show your work!