

Printed Name: _____ ID Number: _____

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1. What is the DeBroglie wavelength in nm of a He atom with kinetic energy of 0.020 eV?

The rest mass energy of He is 3727×10^6 eV. See if you can use this to answer.

2. A nucleus emits a gamma ray of energy 1.0 MeV from a state that has a lifetime of 1.2 ns. What is the uncertainty in energy of the ray?

3. A particle is confined in a two dimensional box that has of length L along the x direction and $2L$ along y . Find the lowest levels, in energy, which are degenerate. List the states in terms of quantum numbers n_x and n_y .

4. An electron is trapped in a one-dimensional square well of length $L = 0.132$ nm. What is the energy of the $n = 10$ state in eV? The rest mass energy of an electron is 0.511×10^6 eV.

5. What angles does the L vector make with the z-axis $l = 2$?

6. List the excited states (in spectroscopic or chemical notation ie 3p etc.) to which the 4p state can relax?

7. The Neon core has 10 electrons filling the closed core shells. Aluminum has 13 electrons. List the electron states in (spectroscopic notation ie 2s etc.) for the electrons outside the Neon core?

8. A certain excited state of an atom has the configuration $4d^1 5d^1$. What are the possible L and S values?

9. The diatomic molecule NaCl has a reduced mass of 13.96 u. It has an atom separation distance of 0.236 nm. What is the energy emitted in a transition from the $L = 3$ to $L = 2$ rotational state in eV?

10. Given that the vibrational frequency of the H_2 molecule is 1.32×10^{12} Hz, find the vibrational frequency of the D_2 molecule.