

Printed Name: _____ ID Number: _____

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1. A star like our sun will burn all its fuel and then collapse to a white dwarf. Our sun has a mass of 2×10^{30} kg and will collapse to a radius of 6.4×10^3 km. Estimate the Fermi energy of the electrons at that point. Assume equal numbers of neutrons and protons.

2. What is the Bohr model DeBroglie wavelength of an electron orbit in the $n = 2$ state of the hydrogen atom?

3. For a Fermi electron gas at $T = 5800 \text{ K}$ with $E_F = 4.0 \text{ eV}$ the probability that a single state at $E = 3.0 \text{ eV}$ will be occupied is?

4. In a 3d subshell, what are the possible values for the magnetic quantum number m_l ?

5. The actual dissociation energy of a molecule at low temperature depends on the depth of the electronic attraction well and on any the zero point energy of any vibrational modes. If this dissociation energy for H_2 is 4.52 eV and the energy of a phonon of the vibrational mode is 0.54 eV. What is the low T dissociation energy of D_2 ?

6. What is the ratio of the number of $L=3$ to $L=1$ rotational states of a diatomic molecule at room temperature if the energy between the 2 states is 0.03 eV.

7. How many electrons can fit in a full $n = 4$ shell?

8. Sodium has an ionization energy of 5.10 eV for the outer electron in the $n = 3$ shell. What is the effective screened charge of the nucleus for that electron orbit?