EX. 1 (27/10/2011) (T. CM)

- DETERMINE THE PARTITION FUNCTION $Z = Z(\beta)$ IN THE CANONICAL ENSEMBLE FOR A ONE-DIMENSIONAL HARMONIC OSCILLATOR WITH FREQUENCY ω.

  DETERMINE ALSO $\langle E \rangle$, $\Delta E = \sqrt{\langle E^2 \rangle - \langle E \rangle^2}$, AND THE ENTROPY S.

- CONSIDER THE CASE IN WHICH A PARTICLE CAN BE DESCRIBED BY THE HILBERT-SPACE $\{|E_1\rangle, |E_2\rangle, |E_3\rangle\}$

  DETERMINE $Z(\beta)$ (CANONICAL), THE ENERGY AND THE ENTROPY.

- CONSIDER THE POTENTIAL

  $$V(x) = \frac{1}{2} m \omega_1^2 x^2 + \frac{1}{2} m \omega_2^2 y^2 + \frac{1}{2} m \omega_3^2 z^2$$

  DETERMINE $Z(\beta)$ FOR A SINGLE PARTICLE (CANONICAL).

- CONSIDER THE HILBERT-SPACE $\{|+\rangle, |-\rangle\}$ (SPIN OF A SINGLE ELECTRON). CONSIDER:

  $$Z = \langle + | e^{-\beta S_z} |+\rangle + \langle - | e^{-\beta S_z} |-\rangle$$

  $S_z |+\rangle = \frac{1}{2} |+\rangle$

  $S_z |-\rangle = -\frac{1}{2} |-\rangle$

  DETERMINE THE PROBABILITY THAT THE SYSTEM IS DESCRIBED BY $|+\rangle$ ($P_{|+\rangle}$) OR BY $|-\rangle$ ($P_{|-\rangle}$)

  IN WHICH LIMIT DOES $P_{|+\rangle} = 1$ HOLD ?

  IN WHICH CASE $P_{|+\rangle} = P_{|-\rangle}$?