Answer on Question #42888, Physics, Molecular Physics | Thermodynamics

Task:

1. A paramagnetic gas at temperature 27°C is placed in an external uniform H magnetic field of magnitude 1.5 T. If the atoms of the gas have magnetic dipole moment $\mu = 2.0\mu_B$, then the energy difference between parallel alignment and antiparallel alignment of the atom's magnetic dipole moment with the magnetic field is :

(a) 2.3 x 10^{-22} J *(b)5.6* x 10^{-23} J

(c)1.9 x 10^{-24} J (d) 1.6 x 10^{-25} J

Solution:

$$\theta_1 = 0, \theta_2 = 180^0, \mu_B = 9.27 \cdot 10^{-24} J/T.$$
$$\mu H(\cos\theta_1 - \cos\theta_2) = 2\mu H = 4\mu_B \cdot 1.5 = 6 \cdot 9.27 \cdot 10^{-24} \approx 5.6 \cdot 10^{-23} J.$$

Answer: *(b)5.6* x 10^{-23} J

2. A series RLC circuit has inductance L = 12 mH, capacitance C = 1.2 μF , and resistance R =12 Ω . At what time will the amplitude of the charge oscillations in the circuit be 10% of its initial value?

(a)2.0ms (b)3.0ms

(c)4.0ms (d) 5.0ms

Solution:

$$\ln\frac{A_0 e^{-\beta t}}{A_0 e^{-\beta(t+\Delta t)}} = \ln(1/0.1) = \beta\Delta t = \frac{2R}{L}\Delta t \Rightarrow \Delta t = \frac{\ln(1/0.1)L}{2R} \approx 2.0ms$$

Answer: (a)2.0ms