**Assignment number 2 CD100 August 23, 2007 SKH**

(1) Debye formula for heat capacity for the monoatomic crystal is given by

$$C_{vm} = 3Rf \text{ where } f = 9R\left(\frac{T}{\Theta_D}\right)^3 \int_0^{\Theta_D/T} \frac{x^4 e^x dx}{(e^x - 1)^2}$$

Using series and limits show that (a) at high temperature the Heat capacity equation falls to classical value that is 3R and (b) and low temperature the heat capacity is proportional to $T^3$ *(This is a famous* "$T^3$ law". Clue: refer Physical Chemistry by Maquarrie and Simon pages 7??)

(2) When lithium is irradiated with light, the kinetic energy of ejected electron is $2.935\times10^{9}$J for $\lambda$=300nm and $1.28\times10^{-19}$J for $\lambda$=400nm

Calculate (a) Planck's constant (b) Threshold frequency (c) work function of Li metal from this data.

(3) Calculate the threshold frequency of sodium metal. (given $\phi_{sodium}$=1.82eV)

(4) Some of the data for the kinetic energy of ejected electrons as a function of $\lambda$ of the incident radiation for the photoelectric effect for the Na metal is

| $\lambda$(nm) | 100 | 200 | 300 | 400 | 500 |
|---|---|---|---|---|---|
| KE/eV | 10.1 | 3.94 | 1.88 | 0.842 | 0.222 |

Plot the data in the desire form and calculate the *h* and the work function $\phi_{sodium}$ from the graph.

(5) Calculate number of photons in 2.00mJ light pulse at wavelength(a)1.06μm (b)537nm (c) 266nm

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(5) Debye formula for heat capacity for the monoatomic crystal is given by

$C_{vm} = 3Rf$ where $f = 9R\left(\dfrac{T}{\Theta_D}\right)^3 \displaystyle\int_0^{\Theta_D/T} \frac{x^4 e^x dx}{(e^x-1)^2}$

Using series and limits show that (a) at high temperature the Heat capacity equation falls to classical value that is 3R and (b) and low temperature the heat capacity is proportional to $T^3$ *(This is a famous* "$T^3$ law". Clue: refer Physical Chemistry by Maquarrie and Simon pages 7??)

(6) When lithium is irradiated with light, the kinetic energy of ejected electron is $2.935\times10^{9}$J for $\lambda$=300nm and $1.28\times10^{-19}$J for $\lambda$=400nm

Calculate (a) Planck's constant (b) Threshold frequency (c) work function of Li metal from this data.

(7) Calculate the threshold frequency of sodium metal. (given $\phi_{sodium}$=1.82eV)

(8) Some of the data for the kinetic energy of ejected electrons as a function of $\lambda$ of the incident radiation for the photoelectric effect for the Na metal is

| $\lambda$(nm) | 100 | 200 | 300 | 400 | 500 |
|---|---|---|---|---|---|
| KE/eV | 10.1 | 3.94 | 1.88 | 0.842 | 0.222 |

Plot the data in the desire form and calculate the *h* and the work function $\phi_{sodium}$ from the graph.

(5) Calculate number of photons in 2.00mJ light pulse at wavelength(a)1.06μm (b)537nm (c) 266nm