Chapter-3 Homework

2- T = (273 + 35) ºK = 308 ºK
λ max T = 2.289 x 10^{-9} m-K Wein Displacement Law
λ = **9410 nm**

8- (a) f = 5 x 10^{14} Hz E = hf = **2.07 eV**
(b) f = 10 GHz E = hf = **4.14 x 10^{-5} eV**
(c) f = 30 MHz E = hf = **1.24 x 10^{-7} eV**

10- P = E/Δt = 100 000 J/s = (100 000 / 1.6 x 10 –19 J/eV) = 6.25 x 10^{25} eV/s
Eγ = h f = (4.136 x 10^{-15} eV-s) (94 x10^{6} /s) = 3.9 x 10^{-7} eV
Since P = N Eγ /Δt then N/Δt = = P / Eγ = **1.6 x 10^{30} photons/s**

13- V_S = 2.9 V for λ = 250 nm

KE_{MAX} = e Vs = hf - ϕ Photoelectric Equation
hf = 1240 / 250 nm = 4.96 eV

ϕ = e Vs – hf =(4.96 – 2.9 0) eV = **2.06 eV**

17- λ = 300 nm or Eγ = hf = 1240/300 = 4.13 eV
KE_{MAX} = e Vs = hf - ϕ Photoelectric Equation
(a) Li ϕ = 2.3 eV Yes Eγ > 2.3 eV
Be ϕ = 3.9 eV Yes Eγ > 3.9 eV
Hg ϕ = 4.5 eV No Eγ < 4.5 eV

(b) KE_{MAX} (Li) = hf - ϕ = 4.13 – 2.30 = **1.83 eV**
KE_{MAX} (Be) = hf - ϕ = 4.13 – 3.90 = **0.23 eV**

25- hf = 300.0 KeV λo = 1240 / 300000 = 0.00413 nm θ = 30º

λ' – λo = (h/mc)(1-cos θ) Compton Formula
(a) λ' – λo = .00243 nm (1-cos30º) = **3.25 x 10^{-4} nm**
(b) λ' = (λo + 0.000324) = **0.00445 nm**
Eγ' = 1240/ 0.00445 = **278.6 KeV**
(c) hf + mc^2 = hf' + (Te' + mc^2)
(d) Te' = hf –hf' = 300 – 278.6 = **21.4 KeV**

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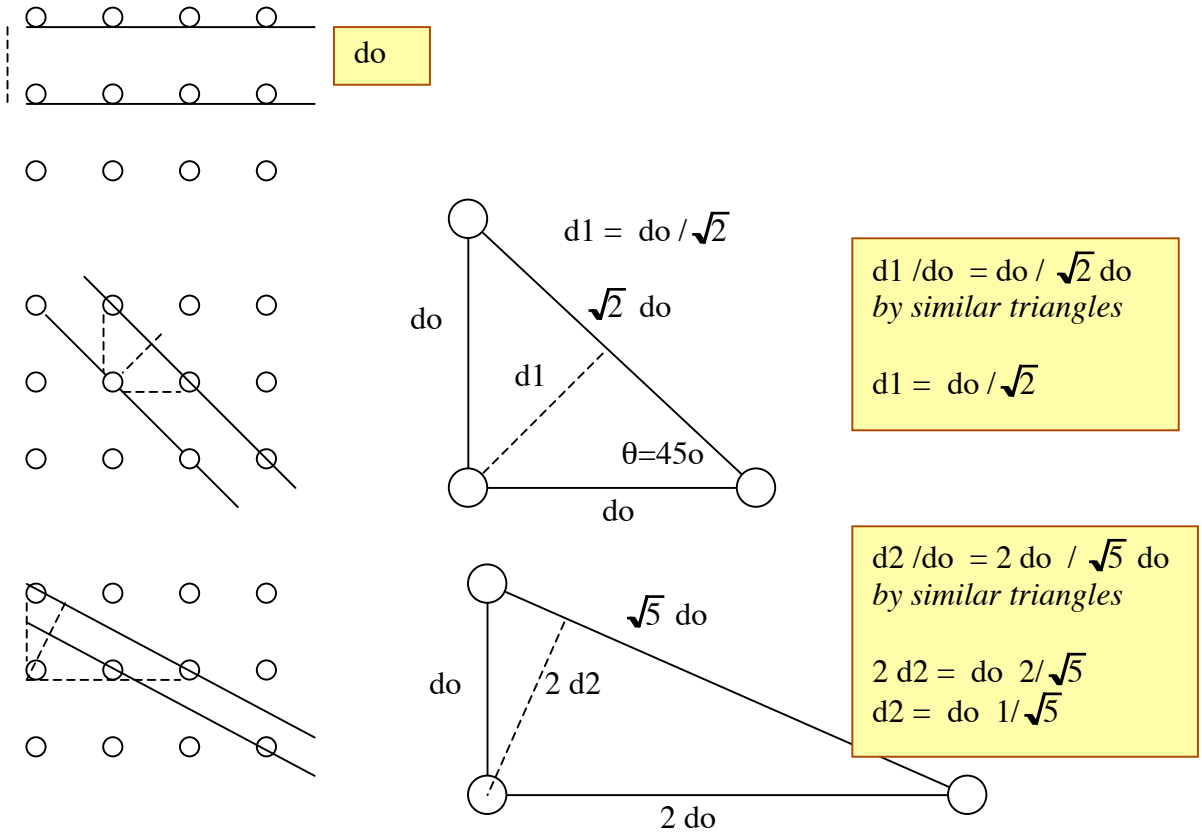

(a) First three plane spacings are **do, d1 = do / √2 , d2 = do / √5**

(b) $n\lambda = 2 d \sin\theta$ Bragg Equation $l = .0.626$ Ang do = 4 Ang

n = 1 d1 = 2.83 Ang
$1\lambda = 2 d1 \sin\theta$ $\theta = \sin^{-1}(\lambda / 2 d1) = \sin^{-1}(0.626/5.657)$ **= 6.35 º**
n = 2 d1 = 2.83 Ang
$2\lambda = 2 d1 \sin\theta$ $\theta = \sin^{-1}(\lambda / d1) =$ **12.8 º**
n = 3 d1 = 2.83 Ang
$3\lambda = 2 d1 \sin\theta$ $\theta = \sin^{-1}(3\lambda / 2 d1) =$ **19.3 º**