Q2 (a) Calculate the frequency & the wavelength of the radiation emitted, when an electron falls from the 2s level to the 1s level of the hydrogen atom.

(energy of electron in hydrogen atom for 2s, $E = 2.18 \times 10^{-18}$ J **and for 1s,** $E = 5.44 \times 10^{-19}$ J **)**

Answer

The energy difference between the two levels.

$\Delta E = 2.18 \times 10^{-18} - 5.44 \times 10^{-19}$

$\Rightarrow 1.64 \times 10^{-18}\ j.$

by equation $\Delta E = hv$

$$\text{frequncy of radiation submitted } v = \frac{\Delta E}{h}$$

$$= \frac{1.64 \times 10^{-18}}{6.626 \times 10^{-34}}$$

$$= 2.48 \times 10^{15}\ Hz$$

$by equation c = v\lambda$

$$the\ \text{valueevgth}\ \lambda = \frac{c}{v} = \frac{2.998 \times 10^{8}}{2.48 \times 10^{15}}$$

$$= 1.21 \times 10^{-7}\ m$$

$$= 1210 A^{0}$$

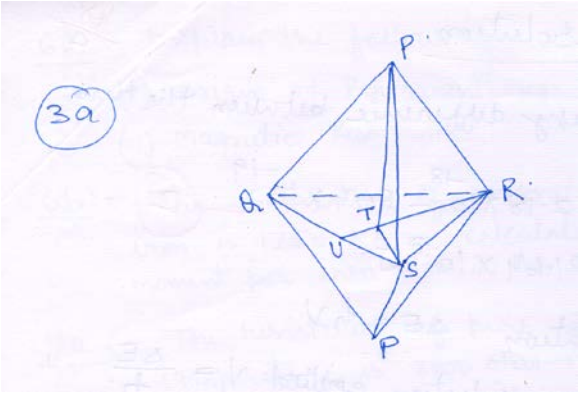
Q2 (b) There is no end centered tetragonal lattice in the Bravais list, but there is an end-centred orthorhombic lattice. Explain why this is so.

Answer Article 3.5 of Text Book I

Q3 (a) Calculate $\frac{c}{a}$ ratio for an ideally close packed HCP crystal.

Answer

The ……ABA…….type of stacking represents the HCP structure as shown in Figure here



$$\frac{c}{a} = \frac{2PT}{RS}$$

$$RU = \sqrt{Rs^2 - SU^2} = \sqrt{a^2 - a^2/4} = \frac{\sqrt{3}}{2}a$$

$$\Rightarrow RT = \frac{2}{3}RU = \frac{a}{\sqrt{3}}$$

$$\Rightarrow PT = \sqrt{PR^2 - RT^2} = \sqrt{a^2 - a^2/3} = \frac{\sqrt{2}}{\sqrt{3}}a$$

$$\Rightarrow \frac{c}{a} = \frac{2\frac{\sqrt{2}}{\sqrt{3}}}{a} = 1.633$$

Q3 (b) What is a Burger Vector? Discuss the steps used to determine Burger Vector of dislocation.

Answer Article 6.2(Figure6.7) of Textbook I

Q4 (a) Explain the following:
(i) Pipe diffusion (ii) Lattice diffusion

Answer Article 8.6 of Textbook I

Q4 (b) What is resistivity of conducting materials? Discuss the various factors which affects the resistivity.

Answer Article 2.2 of Textbook II

Q5 (a) Explain the effect of dielectric on the behaviour of a capacitor.

Answer Article 4.2 of Textbook II

Q5 (b) Explain the following:
(i) Ferro-electricity **(ii) Piezoelectricity**

Answer Article 5.13 of Textbook II

Q6 (a) Explain the following:
(i) Origin of permanent magnetic dipoles
(ii) Magnetic Resonance

Answer
(i) Article 6.3 of Textbook II
(ii) Article 6.16 of Textbook II

Q6 (b) The saturation of magnetization of BCC iron is 1750 kA/m. Calculate the net magnetic moment per iron atom in the crystal.

Answer

The lattice parameter of Bcc iron =2.87 A^0
Volume of the unit cell = $(2.87)^3 \times 10^{-30} m^3$
No of atoms ithe unit cell =2

Not magnetic moment per atoms = $1750 \times 1000 \times 2.87 \times 10 \times \frac{1}{2}$

$= 2.068 \times 10^{-23} Am^2$

MB the moments = $\frac{2.068 \times 10^{-23}}{9.273 \times 10^{-24}}$

$= 2.2$

Q7 (a) The resistivity of pure silicon at room temperature is 3000 ohm-m. Calculate the intrinsic carrier density.

Answer

$1\sigma = nee\omega + nne\omega$

In pure si, $heren_e = n_h = n_i = \frac{\sigma}{(\omega + \omega)e}$

$= \frac{1}{(.14 + .05) \times 3000 \times 1.602 \times 10^{-19}}$

$= 1.095 \times 10^{16} / m^3$

Q7 (b) Explain the following:

(i) Types of semiconductors
(ii) Hall effect
(iii) Thermal conductivity of semiconductors

Answer

(i) Article 7.3 of Textbook II
(ii) Article 7.6 of Textbook II
(iii) Article 7.7 of Textbook II

Q8 (a) Draw V-I characteristic of a P-N junction diode and explain the zener & avalanche breakdown.

Answer Article 8.2 of Textbook II

Q8 (b) Write applications of the following:

(i) Resistors
(ii) Paper capacitors
(iii) Air cored coils
(iv) Ferreed Relays

Answer Article 12.2/12.3/12.4/12.5 of Textbook II

Q9 Explain the following:

(i) Alloyed junction process.

(ii) Operation of JFET with high drain voltages.

Answer

(i) Article 14.1 of Textbook II

(ii) Article 14.9 of Textbook II

Text Books

1. Materials Science and Engineering – A First Course by V. Raghavan, Fifth Edition, Thirty-Fourth Print, April 2007 Edition, Prentice-Hall Of India Pvt Ltd.

2. Introduction to Electrical Engineering Materials by C.S. Indulkar and S. Thiruvengadam, 4th Edition, Reprint 2006, S. Chand and Company Ltd.