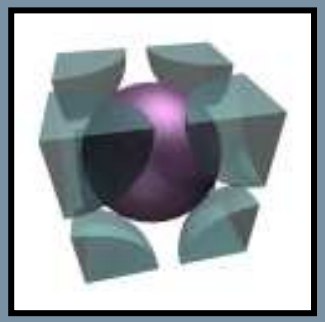

$$V_{atom} = (1)\left(\frac{4}{3}\pi R^3\right) + \left(\frac{1}{8}\right)(8)\left(\frac{4}{3}\pi R^3\right)$$
$$= 8.373R^3$$

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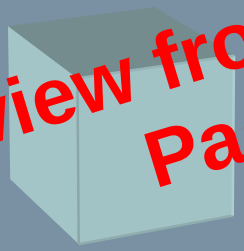

$$V_{unit} = a^3$$

$$\sqrt{3}a = 4R$$

$$a = \frac{4}{\sqrt{3}}R$$

$$a^3 = \frac{4^3}{\sqrt{3}^3}R^3$$
$$= \frac{64}{3\sqrt{3}}R^3$$
$$= 12.32R^3$$

$$APF = \frac{V_{atom}}{V_{unit}} = \frac{8.373R^3}{12.32R^3} = 0.68$$

Metallurgical
Engineering

ตัวอย่างโลหะที่มีโครงสร้างผลึกแบบ HCP

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Metal	Lattice constants, nm		Atomic radius *R*, nm	*c/a* ratio	% deviation from ideality
	a	*c*			
Cadmium	0.2973	0.5618	0.149	1.890	+15.7
Zinc	0.2665	0.4947	0.133	1.856	+13.6
Ideal HCP				1.633	0
Magnesium	0.3209	0.5209	0.160	1.623	−0.66
Cobalt	0.2507	0.4069	0.125	1.623	−0.66
Zirconium	0.3231	0.5148	0.160	1.593	−2.45
Titanium	0.2950	0.4683	0.147	1.587	−2.81
Beryllium	0.2286	0.3584	0.113	1.568	−3.98

Metallurgical Engineering

$$V_{cell} = 3a^2 \sin 60c$$

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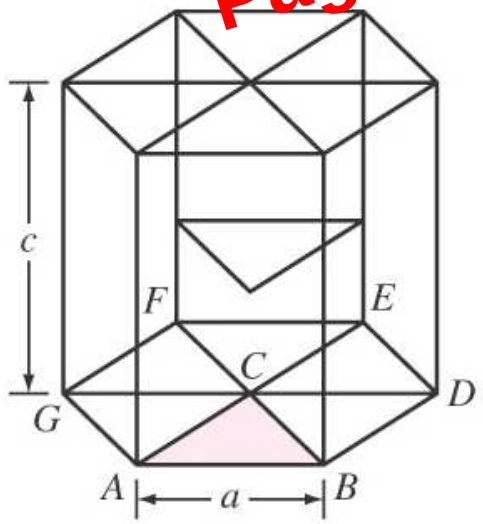
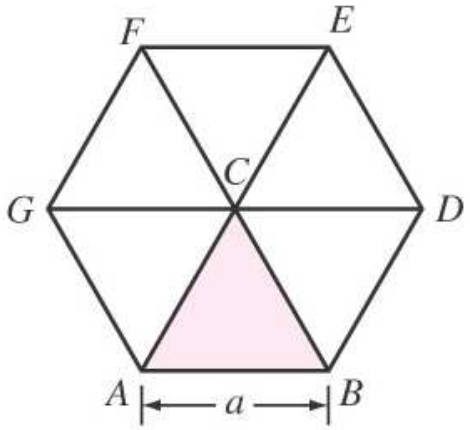
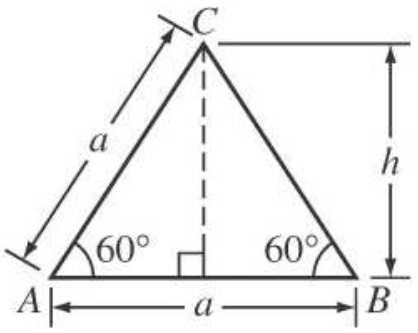


(a)



(b)



(c)

Engineering

Atomic Position in Cubic Unit Cell

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ถ้าติดลบให้ติดเครื่องหมายลบด้านหน้า

$$(x, \bar{y}, z)$$

ใช้ comma คั่น

ปิดด้วยวงเล็บ

Metallurgical Engineering

Direction in Cubic Unit Cell

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ถ้าติดลบ ใช้ขีดด้านบน

$[x\bar{y}z]$

ไม่ใช้ comma คั่น

ปิดด้วย Square Bracket

Metallurgical Engineering

Crystallographic Plane in Cubic Unit Cells

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Exercises

Draw the following crystallographic planes in cubic unit cells

$a)(101)$

$b)(1\bar{1}0)$

$c)(221)$

$d)(110)$

Metallurgical Engineering

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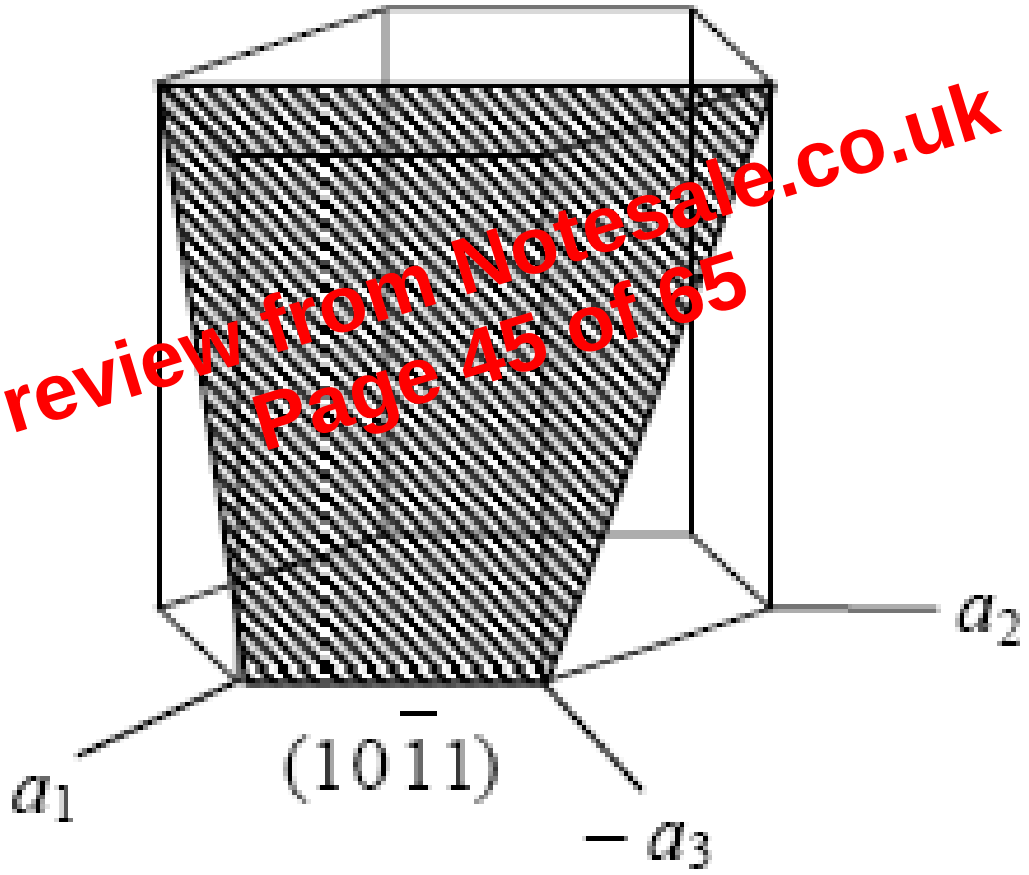

$$a_1 = 1$$

$$a_2 = \infty$$

$$a_3 = -1$$

$$c = 1$$

$$(1,\infty,-1,1)$$

$$(1,0,-1,1)$$

$$(10\bar{1}1)$$

Metallurgical Engineering

Volume and Planar Density Calculations

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Calculate the planar atomic density on the (110) plane of α iron in atoms/mm2. The lattice constant of α iron is 0.287 nm.

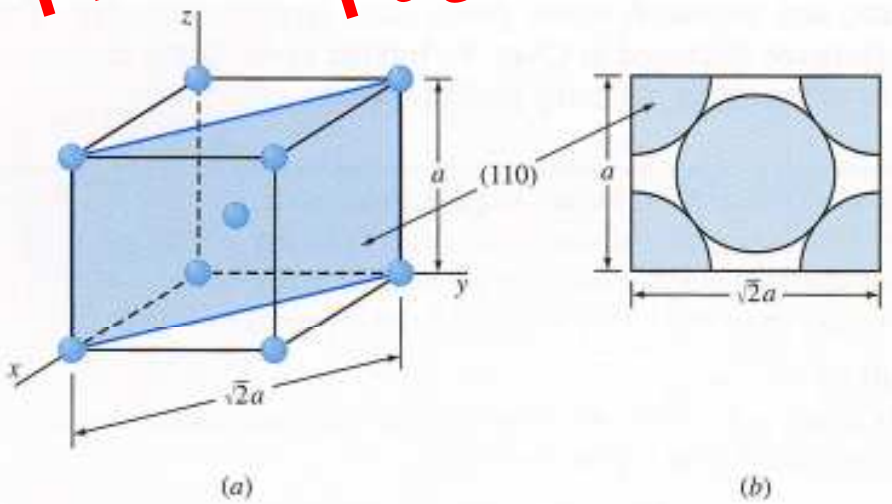

Figure 3.22
(*a*) A BCC atomic-site unit cell showing a shaded (110) plane.
(*b*) Areas of atoms in BCC unit cell cut by the (110) plane.

$$\rho_p = \frac{1+\left(4\times\frac{1}{4}\right)}{\left(\sqrt{2}a\right)(a)} = \frac{2}{\sqrt{2}a^2}$$

$$= \frac{2}{\sqrt{2}(0.287)^2} = 17.2\,\frac{atoms}{nm^2}$$

$$= 17.2\times10^{12}\,\frac{atoms}{mm^2}$$

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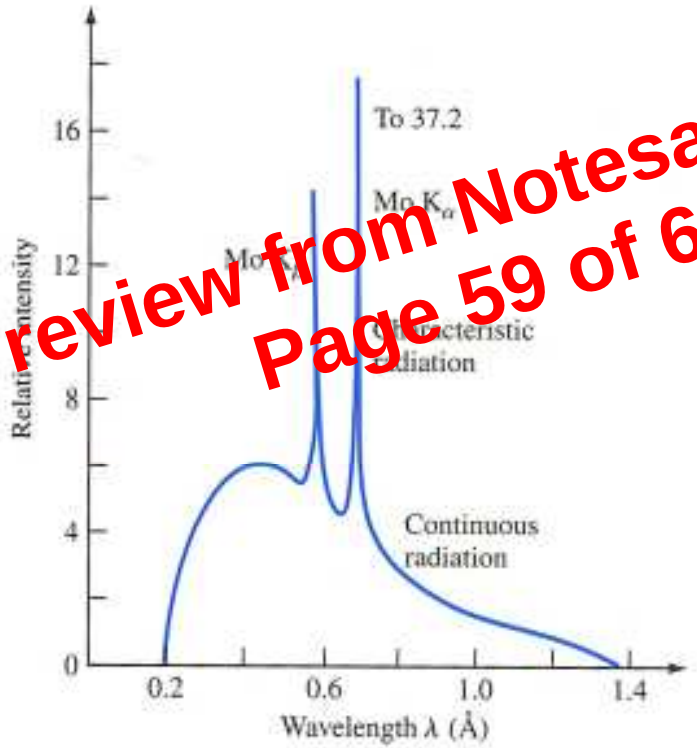

Figure 3.26
X-ray emission spectrum produced when molybdenum metal is used as the target metal in an x-ray tube operating at 35 kV.

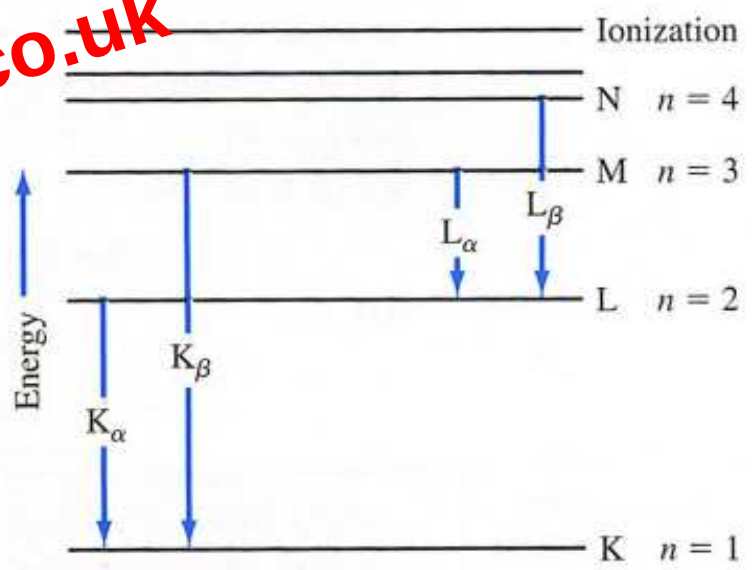

Figure 3.27
Energy levels of electrons in molybdenum showing the origin of K_α and K_β radiation.

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X-Ray Diffractometer

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