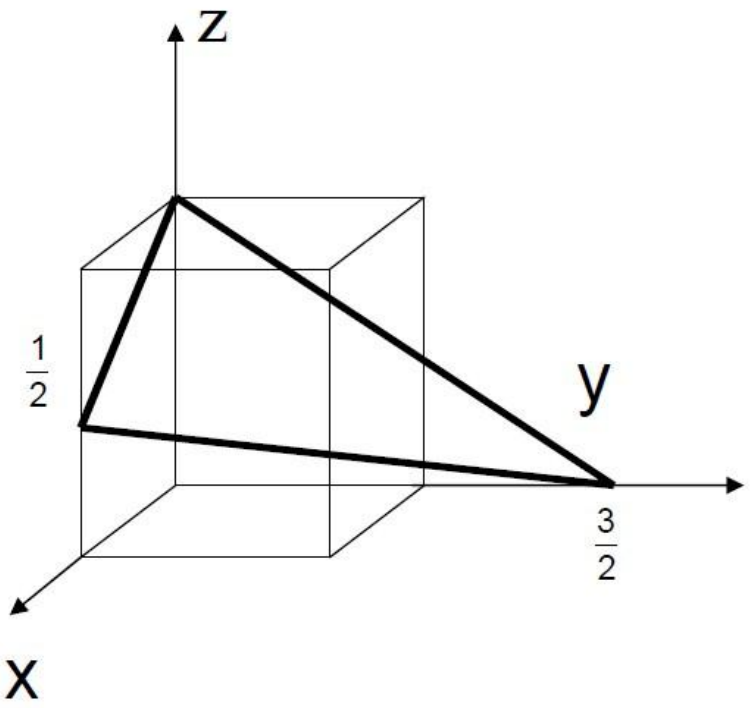
Practice Problems

Practice Problems

1. Determine the Miller indices of the plane in the figure below.

a) (623)
b) (431)
c) (341)
d) (432)
e) (346)



Practice Problems

Answer:

e) (346)

Practice Problems

2. Consider a metal with an FCC structure and an atomic weight of 92.9. When monochromatic x-radiation having a wavelength of 0.1028 nm is focused on the crystal, the angle of diffraction (2θ) for the (311) set of planes in this metal occurs at 71.2 degrees (for the first order reflection n=1).

a. Calculate the interplanar spacing for this set of planes.
b. Calculate the lattice parameter for this metal.
c. Calculate the density of the metal (units of g/cm^3)

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Answer:

a) $d = \frac{\lambda}{2\sin\theta} = \frac{0.1028}{2\sin(71.2/2)} = 0.0883nm$

b) $a = d\sqrt{h^2 + k^2 + l^2} = 0.0883\sqrt{3^2 + 1^2 + 1^2} = 0.293nm$

c) $\rho = \frac{nA}{a^3 N_A} = \frac{4 \cdot 92.9}{6.02 \times 10^{23}} (0.293 \times 10^{-7})^3 \cdot = 24.53 g/cm^3$

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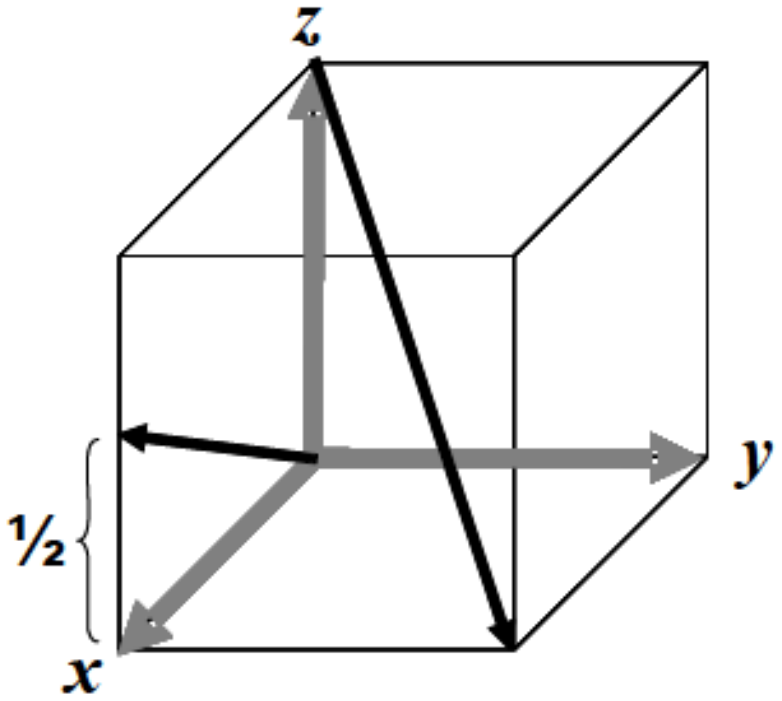
3. Determine the Miller indices of the two directions shown in the figure below:

a) [101] and $[\bar{1}12]$

b) [211] and $[21\bar{1}]$

c) [201] and $[11\bar{1}]$

d) [002] and $[\bar{2}11]$



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Answer:

For the first direction, use (0,0,0) as the point of origin:

x=1, y=0, z= ½. Clear the fractions to get [201]

For the second direction, use (0,0,1) as the point of origin:

x= 1, y=1, z=-1 or $[11\bar{1}]$

So the answer is **c)**

Practice Problems

4. Refer to the table below and determine which **two** elements are likely to have the greatest mutual solubility.

	Nb	Fe	Cu	Ni
Crystal structure	**BCC**	**BCC**	**FCC**	**FCC**
Lattice Parameter	**0.330 nm**	**0.286 nm**	**0.361**	**0.352**
Electronegativity	**1.61**	**1.83**	**1.90**	**1.91**

(a) Nb-Fe
(b) Nb-Ni
(c) Fe-Cu
(d) Cu-Ni

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Answer:

There are several factors that improve mutual solubility which include:

- Similar size
- Same crystal structure
- Similar electronegativity

For this reason, Cu-Ni should have the best mutual solubility. So the answer is **d)**.

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5. How many directions belong to the <100> family?

a) 2

b) 4

c) 6

d) 12

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Answer

We have three principal axes [100], [010], [001] as well as their reverse directions. So the total is 6 or **c)**.