

Pb # 12.

$$(a) \quad n=7 \quad l=4 \quad j=\frac{9}{2}$$

state:  $7G_{9/2}$ 

$$(b) \quad n=6 \quad l=5$$

$$j = l \pm s \Rightarrow j = 5 \pm \frac{1}{2}$$

$$j = 5 + \frac{1}{2} = \frac{11}{2} \Rightarrow \text{state } 6H_{11/2}$$

$$j = 5 - \frac{1}{2} = \frac{9}{2} \Rightarrow \text{state } 6H_{9/2}$$

Pb # 14.

$$\vec{J} = \vec{L} + \vec{S}$$

$$\vec{J} \cdot \vec{J} = J^2 = (\vec{L} + \vec{S}) \cdot (\vec{L} + \vec{S}) = L^2 + S^2 + 2\vec{L} \cdot \vec{S}$$

$$\Rightarrow \vec{L} \cdot \vec{S} = \frac{1}{2}(J^2 - L^2 - S^2) = |\vec{L}| \cdot |\vec{S}| \cdot \cos\theta$$

$\theta$ : angle between  $\vec{L}$  &  $\vec{S}$ .

$$\Rightarrow \cos\theta = \frac{J^2 - L^2 - S^2}{2|\vec{L}| \cdot |\vec{S}|} = \frac{[j(j+1) - l(l+1) - s(s+1)]\hbar^2}{2\sqrt{l(l+1)}\sqrt{s(s+1)}\hbar^2}$$

$$P_{1/2} \Rightarrow l=1 \quad j=\frac{1}{2} \quad s=\frac{1}{2} \quad (j=l-s)$$

$$\cos\theta = \frac{\frac{1}{2}(\frac{1}{2}+1) - 1(1+1) - \frac{1}{2}(\frac{1}{2}+1)}{2\sqrt{1(1+1)}\sqrt{\frac{1}{2}(\frac{1}{2}+1)}} = -0.816 \Rightarrow \theta = 144.7^\circ$$

$$P_{3/2} \Rightarrow l=1 \quad j=\frac{3}{2} \quad s=\frac{1}{2} \quad (j=l+s)$$

$$\cos\theta = 0.408 \Rightarrow \theta = 65.9^\circ$$