

b)  $6f \Rightarrow l=3 \quad |\vec{L}| = \sqrt{12} \hbar$

# 19. H.W. 6g state

a)

# 20.

$n=1$  — non-degenerate

$n$   
 $l=0, 1, \dots, (n-1)$

$n=2$  4-degenerate

$m_l = l, \dots, -l$

$n=3$  9-degenerate

$l=0 \quad m_l=0 \quad \text{— 1}$   
 $l=1 \quad m_l=1, 0, -1 \quad \text{— 3}$

# 21.

# 22. H.W.

# 23.

$$R_{2p}(r) = A r e^{-r/2a_0}$$

$$P(r) = A^2 r^2 e^{-r/a_0}$$

$$\langle r \rangle = \int_0^{\infty} r r^2 |R_{2p}(r)|^2 dr$$

$$A = \left(\frac{1}{2a_0}\right)^{3/2} \frac{1}{\sqrt{3}a_0}$$

$$= A^2 \int_0^{\infty} r^5 e^{-r/a_0} dr$$

let  $\frac{r}{a_0} = \alpha \quad r^5 = \alpha^5 a_0^5 \quad dr = a_0 d\alpha$

$$\langle r \rangle = A^2 a_0^6 \int_0^{\infty} \alpha^5 e^{-\alpha} d\alpha = A^2 a_0^6 5!$$

$$5! = 5 \times 4 \times 3 \times 2$$

$$A^2 = \frac{1}{(2a_0)^3} \frac{1}{3a_0^2} = \frac{1}{3 \times 2 \times a_0^5}$$

$$\langle r \rangle = 5 a_0 = 5 \times 0.53 \text{ \AA} = \boxed{2.65 \text{ \AA}}$$