Orbitals and Quantum Numbers
Practice Questions

1. What are the shapes of s, p, and d orbitals respectively?

s = spherical  p = dumbbell  d = cloverleaf

2. How many 1s orbitals are there in an atom? 4p orbitals? 4d orbitals?

1s: 1  4p: 3  4d: 5

3. What is the maximum number of orbitals with:

n = 4  l = 1  3 (the 4p orbitals)
n = 2  l = 2  none (l must be < n)
n = 3  l = 2  5 (the 3d orbitals)
n = 5  l = 1  m_l = -1  1 (3 q.n. define a unique orbital)

4. Which orbitals cannot exist?

2p  3p  4d  3f  6s  2d

3f and 2d

5. Write a set of quantum numbers for a 4f orbital.

n = 4  l = 3  m_l = 3, 2, 1, 0, -1, -2, -3
6. Describe the electrons defined by the following quantum numbers:

<table>
<thead>
<tr>
<th>n</th>
<th>l</th>
<th>m_l</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3s electron or orbital</td>
</tr>
<tr>
<td>2</td>
<td>1</td>
<td>1</td>
<td>2p electron or orbital</td>
</tr>
<tr>
<td>4</td>
<td>2</td>
<td>-1</td>
<td>4d electron or orbital</td>
</tr>
<tr>
<td>3</td>
<td>3</td>
<td>2</td>
<td>not allowed (l must be &lt; n)</td>
</tr>
<tr>
<td>3</td>
<td>1</td>
<td>2</td>
<td>not allowed (m_l must be between -l and l)</td>
</tr>
</tbody>
</table>