**Orbitals Interactive Simulation**

**3D Quadric Surface Equations**

**1s Orbital**

z2 = 16 - x2 - y2

**2s Orbital**

z2 = 30 - x2 - y2

**2p Orbitals**

**2px**

* z2 = (4/9)x2 - y2 - 4, -12<x & x<12
* z2 = 60 - (15/4)(x-12)2 - y2, x>11.5
* z2 = 60 - (15/4)(x+12)2 - y2, x<-11.5

**2py**

* z2 = (4/9)y2 - x2 - 4, -12<y & y<12
* z2 = 60 - (15/4)(y-12)2 - x2, y>11.5
* z2 = 60 - (15/4)(y+12)2 - x2, y<-11.5

**2pz**

* z2 = (9/4)x2 + (9/4)y2 + 9, -12<z & z<12
* -(z-12)2 = x2/4 + y2/4 - 15, z>11.5
* -(z+12)2 = x2/4 + y2/4 - 15, z<-11.5

**3s Orbital**

z2 = 45 - x2 - y2

**3p Orbitals**

**3px**

* z2 = 60 - 1.5(x-10)2 - y2, x>8
* 1.05z2 = 60 - 9(x-8)2 - 1.05y2, x>8
* z2 = 60 - 1.5(x+10)2 - y2, x<-8
* 1.05z2 = 60 - 9(x+8)2 - 1.05y2, x<-8
* 4z2 = 60 - 6(x-4)2 - 4y2, x>4
* 0.78z2 = 12 - 9(x-4)2 - 0.78y2, x>4
* 4z2 = 60 - 6(x+4)2 - 4y2, x<-4
* 0.78z2 = 12 - 9(x+4)2 - 0.78y2, x<-4

**3py**

* z2 = 60 - 1.5(y-10)2 - x2, y>8
* 1.05z2 = 60 - 9(y-8)2 - 1.05x2, y>8
* z2 = 60 - 1.5(y+10)2 - x2, y<-8
* 1.05z2 = 60 - 9(y+8)2 - 1.05x2, y<-8
* 4z2 = 60 - 6(y-4)2 - 4x2, y>4
* 0.78z2 = 12 - 9(y-4)2 - 0.78x2, y>4
* 4z2 = 60 - 6(y+4)2 - 4x2, y<-4
* 0.78z2 = 12 - 9(y+4)2 - 0.78x2, y<-4

**3pz**

* y2 = 60 - 1.5(z-10)2 - x2, z>8
* 1.05y2 = 60 - 9(z-8)2 - 1.05x2, z>8
* y2 = 60 - 1.5(z+10)2 - x2, z<-8
* 1.05y2 = 60 - 9(z+8)2 - 1.05x2, z<-8
* 4y2 = 60 - 6(z-4)2 - 4x2, z>4
* 0.78y2 = 12 - 9(z-4)2 - 0.78x2, z>4
* 4y2 = 60 - 6(z+4)2 - 4x2, z<-4
* 0.78y2 = 12 - 9(z+4)2 - 0.78x2, z<-4

**4s Orbital**

z2 = 60 - x2 - y2

**3d Orbitals**

**3dx2 - y2**

* z2 = 0.15x2 - y2 - 1, -18<x<18
* z2 = 43 - 1.5(x-18)2 - y2, x>16
* z2 = 43 - 1.5(x+18)2 - y2, x<-16
* z2 = 0.15y2 - x2 - 1, -18<y<18
* z2 = 43 - 1.5(y-18)2 - x2, y>16
* z2 = 43 - 1.5(y+18)2 - x2, y<-16

**3dz2**

* y2 = 0.15z2 - x2 - 1, -18<z<18
* y2 = 43 - 1.5(z-18)2 - x2, z>16
* y2 = 43 - 1.5(z+18)2 - x2, z<-16
* TORUS EQUATION

**3dyz**

* ((√2/2)\*y + (√2/2)\*z)2 = 0.15y2 - x2 - 1, y-z<40 & y-z>-40
* (-(√2/2)\*y + (√2/2)\*z)2 = 0.15y2 - x2 - 1, y+z<40 & y+z>-40
* (z-19)2 = 63 - x2 - 0.99(y+22)2
* (z+19)2 = 63 - x2 - 0.99(y-22)2
* (z-19)2 = 63 - x2 - 0.99(y-22)2
* (z+19)2 = 63 - x2 - 0.99(y+22)2

**3dyx**

* z2 = 0.15y2 - ((√2/2)\*y + (√2/2)\*x)2 - 1, x-y<40 & x-y>-40
* z2 = 0.15y2 - (-(√2/2)\*y + (√2/2)\*x)2 - 1, x+y<40 & x+y>-40
* z2 = 63 - (x-19)2 - 0.99(y+22)2
* z2 = 63 - (x+19)2 - 0.99(y-22)2
* z2 = 63 - (x-19)2 - 0.99(y-22)2
* z2 = 63 - (x+19)2 - 0.99(y+22)2

**3dxz**

* y2 = 0.15z2 - ((√2/2)\*z + (√2/2)\*x)2 - 1, x-z<40 & x-z>-40
* y2 = 0.15z2 - (-(√2/2)\*z + (√2/2)\*x)2 - 1, x+z<40 & x+z>-40
* (z-22)2 = 63 - (x-19)2 - 0.99y2
* (z+22)2 = 63 - (x-19)2 - 0.99y2
* (z-22)2 = 63 - (x+19)2 - 0.99y2
* (z+22)2 = 63 - (x+19)2 - 0.99y2