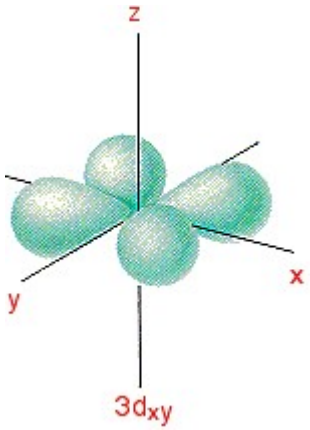
COMPLEX IONS: d-ORBITALS



1. The diagram shows the shape of a $3d_{xy}$ orbital.

   a) Using the axes arranged the same way, draw the shapes of the $3d_{xz}$ and $3d_{yz}$ orbitals.

   b) Still using the same axes, give the names and shapes of the other two 3d orbitals.

   c) All five of these 3d orbitals are said to be *degenerate*. What does that mean?

2. Consider an ion with the formula $[M(H_2O)_6]^{2+}$, where M is a transition metal.

   a) What shape do the six water molecules take up around the central metal atom?

   The presence of the water molecules raises the energy of the 3d orbitals, and splits them into two groups, one of which is at a higher energy level than the other.

   b) Why does the presence of the water molecules raise the energy of the 3d orbitals?

   c) How many 3d orbitals are now in each of the two groups of orbitals? Explain the reason for this.