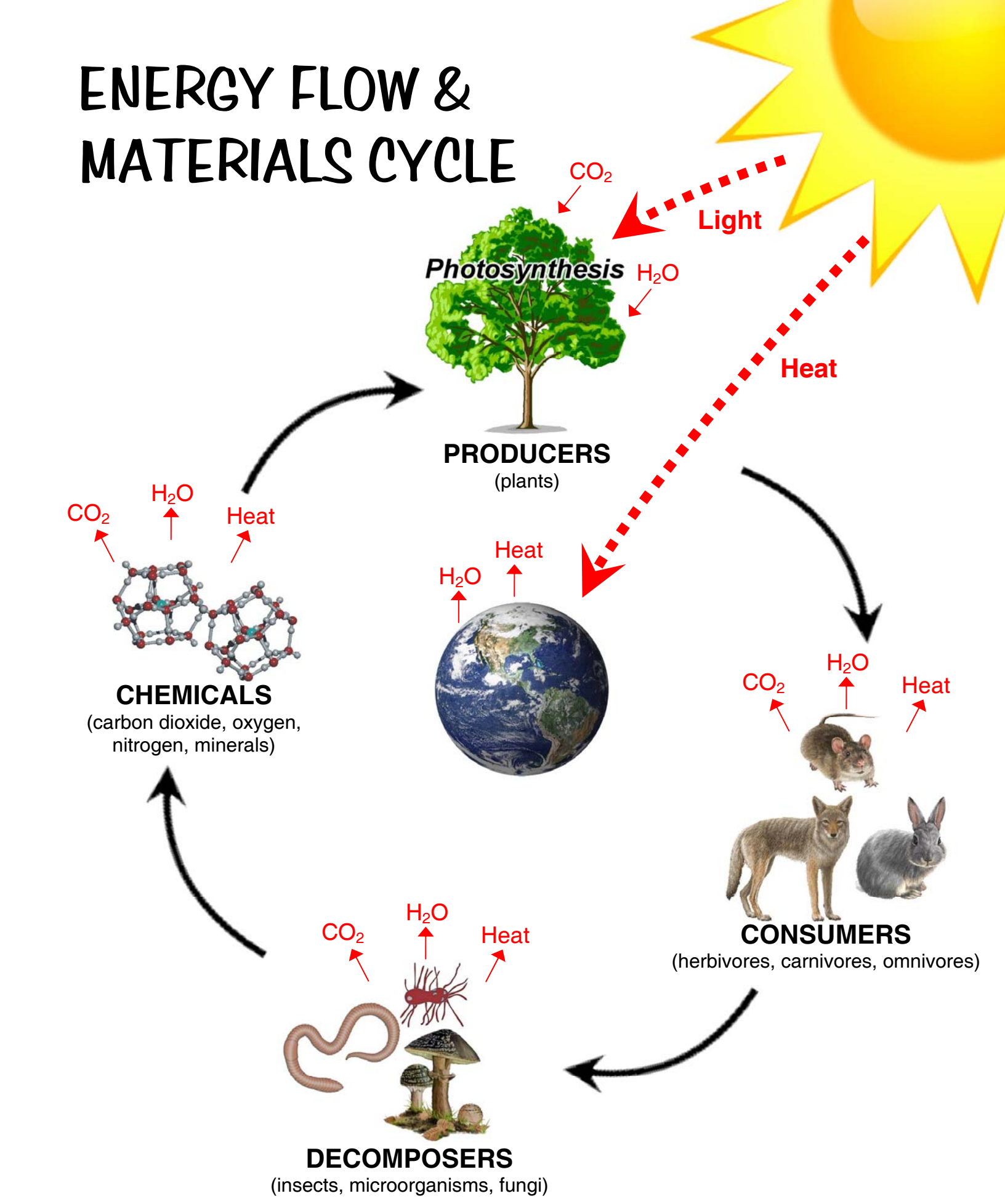ENERGY FLOW & MATERIALS CYCLE