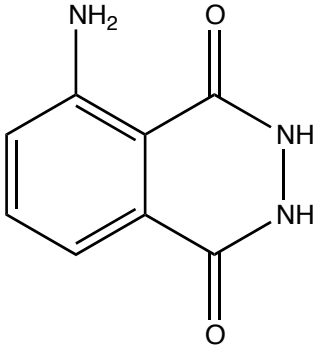
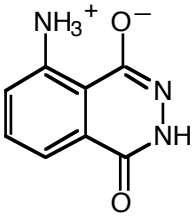
Luminol, a Chemiluminescent Substance

Some of the most impressive and aesthetically pleasing chemical reactions known are those that result in the phenomenon of *chemiluminescence*. While exothermic reactions usually release energy in the form of heat, some produce little or no heat and release their energy by the emission of light. These "glowing" reactions are generally oxidations, and a good example is the oxidation of 5-aminophthalhydrazide, or *luminol*, which produces a brilliant blue-green light.

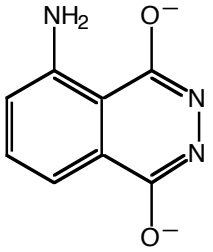


Luminol

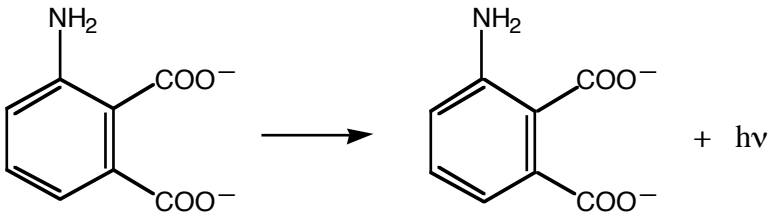
In neutral solution, luminol is zwitterionic:



When dissolved in a basic solution, luminol becomes dianionic:



The dianion can be oxidized to form a peroxide of unknown structure. This peroxide decomposes, releasing nitrogen gas and producing the 3-aminophthalate ion which exists in an excited state. As this molecule relaxes to the lower energy (ground) state, a photon of visible light is emitted resulting in the observed chemiluminescence.



Excited state Ground state

Bring this procedure with you to the last lab period

In a 150 mL beaker labeled A, dissolve 0.1 g of luminol in 5 mL of 3 M sodium hydroxide solution and 45 mL of water. In a 250 mL beaker labeled B, combine 10 mL of 3% aqueous potassium ferricyanide with 10 mL of 3% hydrogen peroxide and 80 mL of water. Now, in a dark area of the laboratory, pour the solution in beaker A and the solution in beaker B simultaneously into a funnel resting in the neck of a 250 mL Erlenmeyer flask. Add small amounts of ferricyanide crystals to increase the intensity of the glow. To quench the reaction, pour some of the luminescing solution into a 250 mL beaker, add a small amount of 3M HCl and observe the result. Now add 1 or 2 pellets of NaOH (**caution!** NaOH pellets are corrosive! Avoid contact with skin.), note what happens around the pellets, then swirl.