

## Supplemental Materials

### **The Pixel Paradox and Transition Metal Spectroscopy: One of many uses of the handheld digital microscope in chemical demonstrations**

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#### ***Modification of a “DocCam”:***

We purchased used or refurbished Logitech® QuickCam Communicate STX®<sup>1</sup> “DocCams” for less than \$20 online, but other “DocCams” probably are suitable. We modified the camera as follows:

With a small flat screwdriver, pry off the gray cover with the snapshot button from the spherical camera case. Pry off the snapshot button, insert a size P0 (very small) Phillips screwdriver into the hole that is revealed, and remove the small screw that holds the two hemispheres together. Carefully separate the two hemispheres, removing the circuit board, shown in Figure 3, and the tiny microphone (3/16” diameter, on red and black wires) from its soft rubber mount. Unscrew the lens as far as possible to get close up pictures, or completely remove it, reverse it, and reattach it with tape for larger magnification. The lens is shown removed from the sensor in Figure 1. It is still possible to take snapshots by touching the microswitch on the circuit board.

When the camera is first plugged into the computer USB port, the Windows® XP “New Hardware Wizard” will automatically download

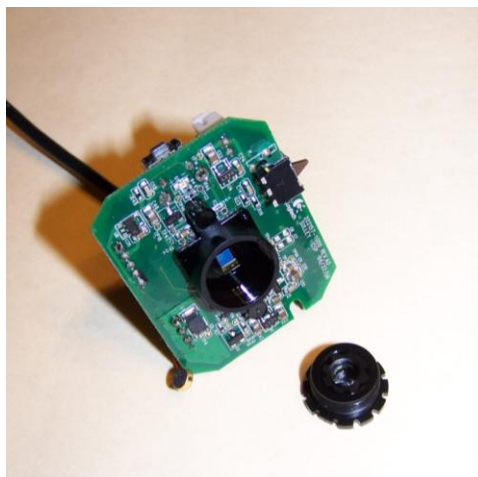


Figure: The camera circuit board with lens removed.

drivers and control software from the Logitech online site<sup>2</sup>.

***Preparation of cobalt complex solutions for spectroscopy(1):***

**[Co(H<sub>2</sub>O)<sub>6</sub>]<sup>3+</sup>** : Prepare a tricarbonatocobaltate(III) solution as described below, then add 20 mL of the solution gradually (to avoid excessive frothing) to 80 mL of 4 M nitric acid.

To prepare tricarbonatocobaltate(III) solution, dissolve 2.99 g of Cobalt(II) nitrate hexahydrate in 50 mL distilled water and add 0.5 mL of 30% hydrogen peroxide.

Combine the solution all at once in a large beaker (to contain the frothing mixture) with a solution containing 16.9 g of sodium bicarbonate in 50 mL of water and 0.5 mL of 30% hydrogen peroxide.

**[Co(C<sub>2</sub>O<sub>4</sub>)<sub>3</sub>]<sup>3-</sup>**: Dissolve 0.0613 g of cobalt(II) nitrate hexahydrate in 50 mL of distilled water. To 10 mL of this solution, add 1.55 g of potassium oxalate monohydrate, then 10 mL of 3% hydrogen peroxide, and heat to 30-40°C with stirring for 10 to 15 minutes until the solution turns blue-green.

***Hazards:*** The procedure should be carried out in a hood, because these compounds are suspected carcinogens by inhalation. Rubber gloves should be worn because they are skin irritants. Cobalt complexes should be disposed of as hazardous waste. Cobalt is a micronutrient (essential in vitamin B<sub>12</sub>), but ingestion of excessive amounts has led to a variety of health problems, discovered when cobalt was added to beer as a foam stabilizer in the 1960s (4).

## Notes

1. The camera has a fixed Focus VGA sensor with still image resolution of 640 x 480, up to 1.3 megapixel with software enhancement. It is capable of up to 30 frames per second with USB 2.0. It was purchased from Reforger.com through Amazon.com (retail \$49.95).
2. <http://www.logitech.com/> (accessed 9/5/08).

## Literature Citation:

1. Riordan, A.R.; A. Jansma; S. Fleischman; D.B. Green; D. R. Mulford. *The Chemical Educator*, **2005**, Vol. 10, No. 2, Published on Web 02/03/2005, 10.1333/s00897040867a, © 2005 *The Chemical Educator*  
[<http://chemeducator.org/sbibs/s0010002/1020115dm.htm>] (last accessed 4/14/09).