Atomic spectra - lab report example

Science, Physics

Atomic Spectra

When an element or its compound is volatilized on a flame the electrons in the atom are excited and jumps to the higher energy orbits. Here these electrons are unstable and try to return to their initial position. As the electron return back to its lower orbit the photon of a specific wavelength is emitted, and the wavelength depends on the difference in energy between the two states. Now the spectrum of these wavelengths (radiations) when observing against the dark background gives us the line emission spectra (line spectra occurs when some particular wavelengths are emitted).

d. (1 pt.) Do elements also exhibit line absorption spectra?

Yes, elements also exhibit line absorption spectra. It, in fact, is a reciprocal of the emission spectra.

When the light is passed through an element, the element absorbs certain wavelengths while the rest of the wavelength pass through it. This spectrum is called the absorption spectrum. The absorb wavelength appear as bright while the background is bright.

2. Discharge tubes:

a. (1 pt.) Give the wavelength of the lines present in one of the discharge tubes.

The wavelength of Oxygen discharge tube are

Purple (400 nm - 450 nm)

Blue (450nm - 520nm)

Green (520nm - 560nm)

Orange (580nm - 600nm)

Red (600nm - 630nm)

Yellow (560nm - 580nm)

b. (2 pts.) Give the energy (J/photon) and (kJ/mol photons) for each spectral line.

For Purple

(4. 97 x - 4. 41 x)J/photon and (299 – 265) (kJ/mol photons)

Blue

(4. 41 x - 3. 82 x) J/photon and (265 - 230) (kJ/mol photons)

Green

(3. 82 x - 3. 55 x) J/photon and (230 – 214) (kJ/mol photons)

Orange

(3. 42 x - 3. 31 x) J/photon and (206 – 199) (kJ/mol photons)

Red

(3. 31 x – 3. 15 x) J/photon and (199 – 189) (kJ/mol photons)

Yellow

(3. 55 x - 3. 42 x J/photon and (214 – 206) (kJ/mol photons)

c. (1 pt.) Which color has the most energy and which has the least?

Purple color has the most energy and the red color has the least.

3. Flame ionization:

a. (2 pts.) What was the identity of your unknown salt? Explain how you arrived at this

conclusion.

The wavelengths of one of the salt are Orange 580nm-600nm and Red 600nm to 680nm.

So the this is a calcium salt. As calcium salts give wavelengths of this range under the flame.

b. (3 pts.) Were there any ambiguities in determining the identity of the unknown? List

sources of error in the experimental method. Which source of error was most

problematic?

No, there is no ambiguity in determining the identity of the unknown as there are very less chance (negligible) that spectral lines of any two compounds match. The contamination of dust particles over the unknown is the most problematic error that can occur.

PRE LAB

1. (2 pts.) What are the hazards associated with the chemical used in this experiment? What safety precautions should be followed?

Octadecene is a hazard chemical. Its vapor should not be inhaled, and

contact with skin and eyes should be avoided. Trioctylphosphine is a corrosive chemical and it causes burns. Oleic acid is a very light and heat sensitive. It is irritating to the eyes, the respiratory system, and the skin. Elemental selenium is also a very hazard element. Its inhalation should be avoided, and contact to the skin. Cadmium oxide is highly toxic and causes carcinogens if inhaled or swallowed.

The safety precautions that should be taken care of Wearing gloves and eye protection. Working should be done in a fume hood environment and care should be taken in handling reagents. The disposal of waste should be proper.

2. (1 pt.) Your group should be ready to add the selenium solution to the cadmium solution as soon as the temperature reaches 225◦ C. What experimental difficulties arise of the cadmium heats for a long time in the octadecene solvent?

3. (1 pt.) Give some potential uses of quantum dots.

Quantum dots have its potential uses in biological imaging and in LED lighting.

4. The spectra below show a part of the absorption spectra for two different sizes of quantum dots.

a. (2 pts.) Which solution of quantum dots contains particles with the larger size? A or B

Explain your reasoning.

B solution of quantum dots contains particles with a larger size.

We know the larger particles have lower bandgap energy and absorb larger wavelengths. Thus B has greater absorbance at larger wavelengths than A.