Station 1: Fluorescent Funhouse

Objective: Observe how different materials fluoresce under UV light.

Materials:

- UV flashlight (450-470 nm)
- Tonic water
- Highlighter ink
- Laundry detergent (with whitener added)
- Fluorescent white paper
- Vaseline
- Toothpaste (with whitener added)
- Uranium glass
- Chlorophyll extract
- Fluorescent dye/paint
- Fluorescent rock(s)
- Various items that do not fluoresce
- Dark viewing box

Instructions:

1. Place each object into the dark box.
2. Shine the UV light on the object and observe.
3. Record the color of the object under normal light and under UV light as well as your observations.

Station 2: GloFish Observation

Objective: Examine GloFish © under normal and UV light

Materials:
GloFish © tank or GloFish video
UV flashlight or fish tank blacklight
Observation sheet

Instructions:
1. Observe the fish under normal lighting.
2. Turn off overhead lights and use UV flashlight or turn on the blacklight on the fish tank hood if included.
3. Note what colors appear and where.
4. Record the colors of the fish under normal light and under UV light as well as glow location or pattern.
5. Choose a second fish and repeat the procedure.

Station 3: UV-Vis Spectroscopy

Objective: Investigate how fluorescent molecules absorb and emit light using UV-Vis equipment.

Materials:

- UV-vis spectrophotometer
- Fluorescein stock solution
- Multiple highlighter ink extracts (yellow, green, pink, orange, blue, etc.)
- Distilled water
- Cuvettes
- Graduated cylinder
- Pipettes
- Test tubes (Eppendorf tubes or something similar)
- Kimwipes
- Data sheet

$M_1 \times V_1 = M_2 \times V_2$

M_1 = initial molarity (final concentration)

M_2 = final molarity (final concentration)

V_1 = volume of stock solution used

V_2 = final volume of diluted solution

Instructions:

1. Turn on the UV-Vis spectrophotometer and allow it to warm up.
2. Create two 10 mL dilutions of fluorescein (e.g. 1:10 and 1:100) Label your tubes.
    a. Label the test tubes including the following information: concentration (e.g. “0.1 M fluorescein”), date, and your initials or group number
    b. Use the dilution formula to determine the amount of each substance that you will need.
    c. Use a graduated cylinder or pipette to measure the calculated volume (V_1) of stock solution.
    d. Pour it into a clean test tube.
    e. Add enough distilled water to reach the final volume (V_2).
    f. Gently swirl or stir with a clean stirring rod. (Or cap and invert the test tube several times to ensure mixing.)
    g. Repeat the procedure with one highlighter color of your choice.
3. Rinse and fill a cuvette with distilled water to use as your blank. Wipe with a Kimwipe and zero the spectrophotometer.
4. Test each fluorescein dilution (1:1, 1:10, and 1:100). Rinse a cuvette with the sample, fill it, wipe it, and scan from 35-700 nm.
5. Record the peak absorbance wavelength and intensity.
6. Repeat the process with the chosen highlighter dilution series.
7. Test each additional highlighter color extraction (not diluted). Rinse a cuvette with the sample, fill it, wipe it, and scan from 35-700 nm.
8. Record the peak absorbance wavelength and intensity.
9. Compare how emission intensity changes across the different substances.

Station 4: Glow Stick Temperature Experiment

Objective: Test how temperature affects chemiluminescence

Materials:
3 glow sticks of same size and color
3 250 mL beakers (or cups- hot, room temp, ice water)
Water
Ice
Electric kettle, microwave, hot plate, etc. to obtain “hot” water
Timer
Thermometer (optional)

Instructions:

1. Activate (snap) each glow stick at the same time.
2. Shake glow sticks for 30 seconds.
3. Place 200 mL of “hot” water into one beaker.
4. Place 200 mL of room temperature water into a second beaker.
5. Place 200 mL of ice water into a third beaker.
6. Place one glow stick into each cup and start the stopwatch.
7. Record observations every 5 minutes for a total of 20 minutes.

Station 5: Light Interaction Model

Objective: Model how electrons interact with light by absorbing and releasing energy.

Method 1

Materials:
Beads, buttons, pom-poms (or something else to represent electrons)
Paper plate or printed diagram for electron shells
String, pipe cleaners, or yarn (represent energy movement)
Markers or sticky notes for labeling
Tape
Atom diagram template (optional)

Instructions:
Step 1: Build your atom model

1. Use your materials to create a nucleus in the center
2. Add one electron on the first energy level (this is the ground state).
3. Label the nucleus and ground state with sticky notes

Step 2: Model Excitation

1. Show the electron absorbing energy from a light source (like a photon)
2. Move the electron to a higher energy level (choose an outer ring).
3. Use string or a labeled arrow to show the direction of movement.
4. Add a label: “Electron absorbs energy -> moves to excited state”.

Step 3: Model Emission

1. Show the electron releasing energy by falling back to the ground state.
2. Attach a new arrow pointing back to the original energy level.
3. Label it: “Electron releases energy as light (emission)”.
4. Add a small paper circle or drawing to represent the photon being released

Method 2

Materials:
Liquid chalk markers

Use the steps listed for method 1 but draw and label the models on the lab benches using the liquid chalk markers.