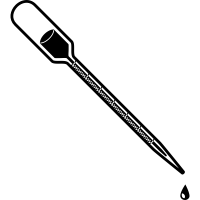
**Lab Activity Handout Answers**

**Problem**: Which nanoparticle will bleach (or “photo-sanitize”) water the fastest after UV light exposure: titanium dioxide, zinc oxide, or magnesium oxide?

**Hypothesis**: I predict that the titanium dioxide nanoparticle will bleach the fastest

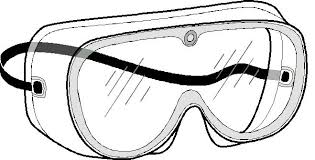
because the chemical properties of titanium dioxide make it the most effective.

**Materials**:

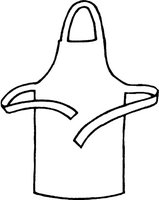
    

**SAFETY**

**Equipment**

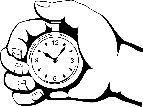
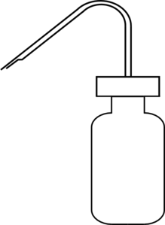


\_\_\_goggles\_\_



lab coat/apron

graduated cylinder methyl orange methylene blue micro pipette marker

   ZnO zinc oxide\_

stopwatch plastic cups (2-oz) distilled water MgO magnesium oxide

TiO2 titanium dioxide

**Procedure**:

1. Collect all \_materials\_; designate responsibilities to each lab group member, if needed.
2. Obtain \_8\_\_ plastic cups with lids and pour \_20\_\_ ml of distilled water into each cup.
3. Pour \_\_\_3\_\_ml of methyl \_\_orange\_\_\_ into the 4 cups with water.
4. Pour \_\_\_3\_\_ml of methylene \_\_\_blue\_\_\_\_\_\_\_\_ into the other 4 cups with water.
5. Label the four methyl orange cups as \_\_\_ZnO\_\_\_\_\_\_\_, \_\_\_\_\_\_\_MgO\_\_, \_\_\_\_\_TiO2\_\_\_\_\_\_\_\_, & “CONTROL.”
6. Label the four methylene blue cups as \_\_\_\_\_\_ZnO\_\_\_\_\_\_\_\_, \_\_MgO\_\_\_\_\_\_, \_\_TiO2\_\_\_\_\_\_\_\_, & “CONTROL.”
7. Use a \_\_\_pipette\_\_\_\_\_\_ to place \_\_\_3\_\_\_\_ drops of each sample oxide as labeled on your cups & be sure to \_\_\_\_\_stir/mix\_\_\_\_\_\_ your solutions well.
8. Take a \_\_\_picture\_\_\_ of your methyl orange and methylene blue labeled cups with your phone (before light exposure) and be ready to take your cups outside for UV light exposure.
9. Using a stopwatch, record the time in \_\_\_seconds\_ it takes for each sample to bleach (do not run longer than 10 min). Take another picture of the cups (after light exposure).

Data Table:

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| COMPLETE BLEACHING AFTER UV EXPOSURE in seconds | | | | |
| Sample solutions | CONTROL | Titanium Dioxide | Magnesium Oxide | Zinc Oxide |
| Methylene blue | No bleaching |  |  |  |
| Methyl orange | No bleaching |  |  |  |

Illustration: (students color in their results using their picture before & after light exposure.)

**Samples before UV light exposure**

Methylene Blue Samples Methyl Orange Samples

ZnO MgO TiO2  ZnO MgO TiO2

**Samples after UV light exposure**

Methylene Blue Samples Methyl Orange Samples

c

c

c

c

c

c

ZnO MgO TiO2  ZnO MgO TiO2

Conclusion: I accept my hypothesis because titanium dioxide was the nanoparticle that bleached the dye the fastest. This is due to its photocatalytic properties that we discussed in class.