

## Colorful Drink Mix Reactions with Metal

**Materials:** unsweetened powdered drink mix (any combination of Red 40, Yellow 5, Yellow 6, Blue 1 dyes), fine steel wool (#0000), coarse steel wool (#3), 3 150-mL beakers or 3 9-oz clear and colorless plastic cups, balance, hot and room temperature tap water, 2-L plastic beverage bottle with a lid, 100-mL graduated cylinder, clock, timer, paper towels, white paper, pH meter, and distilled water

**Safety:** wear safety goggles and gloves

### Procedure:

1. Fill a clean, empty 2-L plastic beverage bottle with room temperature water, and add one packet of unsweetened powdered drink mix. Screw the lid tightly onto the bottle. Shake the bottle until the powdered mix dissolves.
2. Label three 150-mL beakers or 9-oz. plastic cups as: “control” (no metal added), “fine steel wool”, and “coarse steel wool”. (Picture A)



A

B

3. Measure 60 mL of the prepared drink from step 1 into each of the labeled containers. (Picture B)
4. Using gloves, measure a 2.4-g sample of fine steel wool on a balance. Repeat for coarse steel wool. **Caution:** steel wool can be sharp and cut into hands. Compare the appearance of the two samples. (Pictures C & D)



C

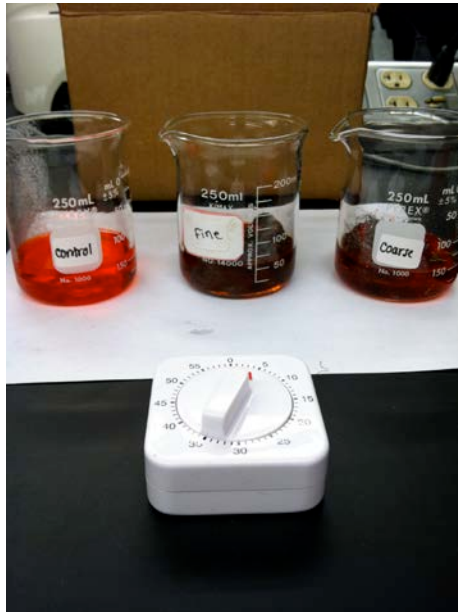


D

5. Rinse the steel wool samples for about 45 seconds in hot tap water. Squeeze the samples gently to remove excess water and blot with paper towels.

6. Fluff each steel wool sample to the approximate volume of the beverage in the labeled containers from step 2.

7. Add the steel wool samples to their labeled containers from step 2, and push the samples down so they are mostly submerged. Record the start time.



E



F

8. Record initial color and pH observations. (Pictures E & F)

9. Make observations every 5 minutes for evidence of any reaction. Place the containers on a piece of white paper to aid color observations. You may briefly lift the steel wool out of the beverage for each observation.

9. Using a calibrated pH meter, measure the pH of the “control”, “fine steel wool”, and “coarse steel wool” reactions every 10 minutes and record. When measuring pH, tilt the beaker/plastic cup or move the steel wool out of the way so that it doesn't touch the electrode. Be sure to rinse the pH electrode with distilled water and blot dry with a paper towel after each pH measurement.

10. Record the time when the reaction appears to be complete in each container, and measure the final pH. What does the pH indicate about the reaction?

11. When the reactions are complete, remove the coarse and fine steel wool, dry them with a paper towel, and throw them away. Then neutralize the coarse and fine steel wool solutions with sodium bicarbonate. The control solution can be dumped out in the sink.

**Appearances of Steel Wool**

| Coarse Steel Wool | Fine Steel Wool |
|-------------------|-----------------|
|                   |                 |

**Reaction Start and Finish**

| Reaction          | Start Time | End Time |
|-------------------|------------|----------|
| Control           |            |          |
| Coarse Steel Wool |            |          |
| Fine Steel Wool   |            |          |

**Observations:**

**Control**

| Time  | Color | pH | Other |
|-------|-------|----|-------|
| Start |       |    |       |
| End   |       |    |       |

**Coarse Steel Wool**

| Time   | Color | pH | Other |
|--------|-------|----|-------|
| Start  |       |    |       |
| 5 min  |       |    |       |
| 10 min |       |    |       |
| 15 min |       |    |       |
| 20 min |       |    |       |
| 25 min |       |    |       |
| 30 min |       |    |       |
| 35 min |       |    |       |
| 40 min |       |    |       |

|        |  |  |  |
|--------|--|--|--|
| 45 min |  |  |  |
| 50 min |  |  |  |
| 55 min |  |  |  |
| 60 min |  |  |  |

**Fine Steel Wool**

| Time   | Color | pH | Other |
|--------|-------|----|-------|
| Start  |       |    |       |
| 5 min  |       |    |       |
| 10 min |       |    |       |
| 15 min |       |    |       |
| 20 min |       |    |       |
| 25 min |       |    |       |
| 30 min |       |    |       |
| 35 min |       |    |       |
| 40 min |       |    |       |
| 45 min |       |    |       |
| 50 min |       |    |       |

|        |  |  |  |
|--------|--|--|--|
| 55 min |  |  |  |
| 60 min |  |  |  |

**Source:** "Kool Reaction from the Fine Print." Journal of Chemical Education. Vol. 83 No. 12. December 2006. <http://pubs.acs.org/doi/pdf/10.1021/ed083p1792A>

**VWR Consumable Part Numbers:**

|                            |              |
|----------------------------|--------------|
| Weight boats               | 89106-766    |
| 100 mL graduated cylinders | 65000-006    |
| pH 10 buffer solution      | 66170-848    |
| pH 4 buffer solution       | 66170-830    |
| pH 7 buffer solution       | 66170-840    |
| potassium chloride         | BDH0258-500G |