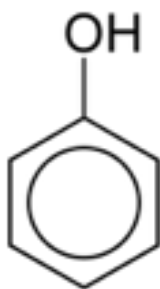


## Phenols Pre-Lab Activity

Research and detail the safety hazards of working with phenol. Describe the procedures for working with phenol safely.



The -OH group on the ring has two opposite effects on the reactivity of the ring:

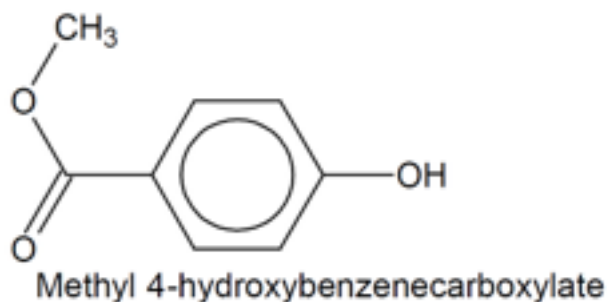
- the oxygen atom is more electronegative than the carbon atom so the electron density is \_\_\_\_\_ in comparison to benzene
- the lone pairs on the oxygen overlap with the delocalised ring which \_\_\_\_\_ the electron density of the ring in comparison to benzene.

Working out which effect is more important allows chemists to make further predictions about the reactions of benzene and phenol.

Predict what you would observe in each of these reactions if each of the effects above were the most important.

| Test                                                                                                                                                                                                                                                      | Predictions if the inductive effect is more important | Predictions if the mesomeric effect is more important |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------|-------------------------------------------------------|
| <p>The following three tests are completed by adding to phenol to these solutions.</p> <p>(a) Bromine water</p> <p>(b) 4cm<sup>3</sup> of dilute nitric acid is heated to boiling and then phenol is added. Cool the solution rapidly in an ice bath.</p> |                                                       |                                                       |

## Reactions of Phenols



Carry out the following tests on methyl 4-hydroxybenzoate (a phenol) and carefully tabulate your observations.

### Safety:

Use small quantities and clear any spills immediately. For these tests it is advisable to wear protective gloves.

### Method:

| Test                                                                                                                                                                          | Observations |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------|
| 1. A sample of solid methyl 4-hydroxybenzoate is heated gently in a test tube.                                                                                                |              |
| 2. A sample of methyl 4-hydroxybenzoate is added to 2cm <sup>3</sup> of distilled water and heated to boiling and then a few drops of UI are added.<br><br>Allow to cool.     |              |
| 3. A sample of solid methyl 4-hydroxybenzoate is dissolved in 2cm <sup>3</sup> sodium hydroxide (2M).<br><br>4. 3cm <sup>3</sup> dilute hydrochloric acid (2M) is then added. |              |



# Phenols Post-Lab Analysis

## Section A

For each of the reactions account for the observations that you have made, comparing your observations to your predictions. Write balanced equations for any reactions that have occurred. In particular, where appropriate, contrast your observations with those that you would expect (a) from benzene, (b) from simple alcohols and (c) carboxylic acids. Lay out your analysis in a logical manner.

(15 marks)

## Section B

Phenylalanine and tyrosine are examples of amino acids.

Draw their structures.

Compare the relative reactivity of phenylalanine and tyrosine with bromine. Include mechanisms for the reactions occurring and explain any differences in reaction conditions.

(10 marks)