## 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 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 predications 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
The following three tests are completed by adding to phenol to these solutions.		
(a) Bromine water		
(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.		

# **Reactions of Phenols**



Methyl 4-hydroxybenzenecarboxylate

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. Allow to cool.	
3.	A sample of solid methyl 4- hydroxybenzoate is dissolved in 2cm <sup>3</sup> sodium hydroxide (2M).	
4.	3cm <sup>3</sup> dilute hydrochloric acid (2M) is then added.	

5.	The following two tests are completed on samples of the methyl 4-hydroxybenzoate solution.	
	(a) Sodium carbonate solution is added	
	(b) Magnesium metal is added	
6.	The following three tests are completed by adding to methyl 4-hydroxybenzoate to these solutions.	
	(a) Iron (III) chloride solution	
	(b) Bromine water	
	(c) 4cm <sup>3</sup> of dilute nitric acid is heated to boiling and then methyl 4- hydroxybenzoate is added. Allow the solution to cool.	
	(d) Methyl 4-hydroxybenzoate is dissolved in 4 cm <sup>3</sup> (2M) sodium hydroxide and then 1cm <sup>3</sup> ethanoic anhydride is added.	

When you have finished your tests rinse all spatulas and test tubes thoroughly with hot water before putting them in the washing up bowl. Place used gloves in the container provided.

Wash the bench where you were working thoroughly with the warm soapy water provided, and dry it off with a kitchen towel.

# 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)