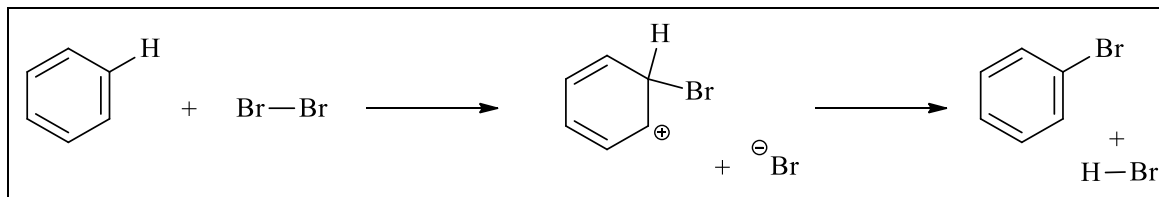


Marks
9

- Benzene can undergo an S_EAr reaction with bromine, Br_2 , as shown below. Demonstrate your understanding of this reaction by adding curly arrows to complete the mechanism.



Explain what each part of the abbreviation S_EAr means.

S =

E =

Ar =

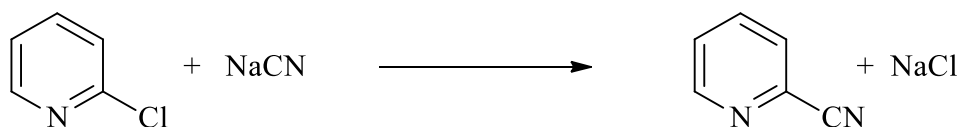
Identify one nucleophile and one electrophile in the scheme above.

nucleophile

electrophile

Iron(III) bromide, $FeBr_3$, is often added to the reaction shown above. Why?

2-Chloropyridine can undergo the following reaction with sodium cyanide.

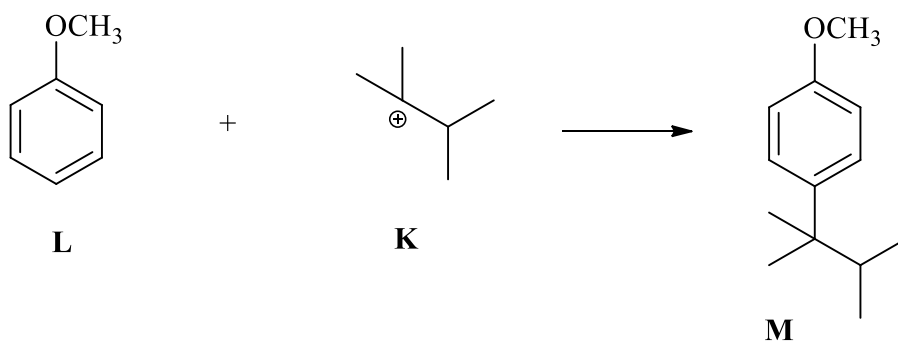


This reaction also proceeds via a two-step mechanism and an ionic (*i.e.* charged) intermediate. Apply your understanding of organic reactions to propose a mechanism for this reaction.

If the reaction of benzene shown above is S_EAr , how would you classify this reaction of chloropyridine?

Reaction of **K** with anisole (methoxybenzene, **L**) gives **M** as the major product.
Propose a mechanism for this transformation.

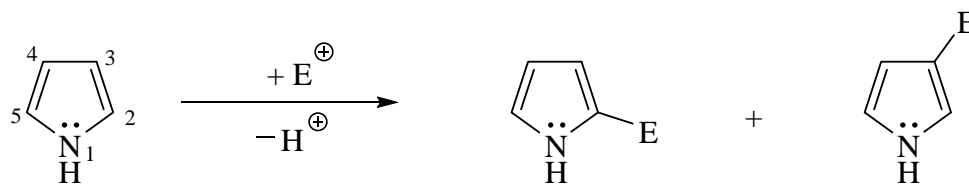
**Mark
s**
4



Briefly explain why the 4-substituted product **M** is formed preferentially.

Marks
5

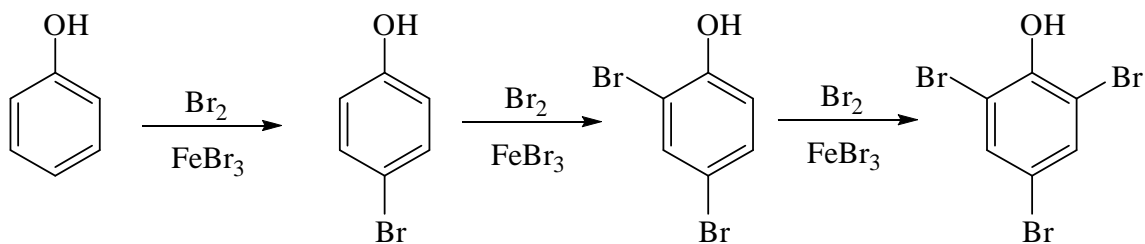
- In the electrophilic aromatic substitution (S_EAr) of pyrrole, the 2-substituted derivative is the major product.



Draw the cationic (Wheland-type) intermediate formed during reaction at the 2-position, and the equivalent intermediate formed during reaction at the 3-position. Using these structures, explain why reaction at the 2-position is faster, and leads to the major product.

Marks
3

- The bromination of phenol proceeds as follows.



Show the Wheland intermediate for one of these steps and explain why bromination occurs at positions 2, 4 and 6, but not at positions 3 and 5.