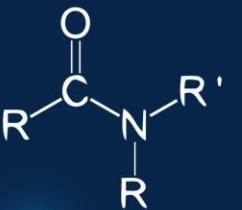
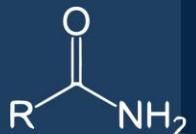
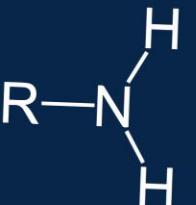


# AMINES - L1



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DESCRIPTION





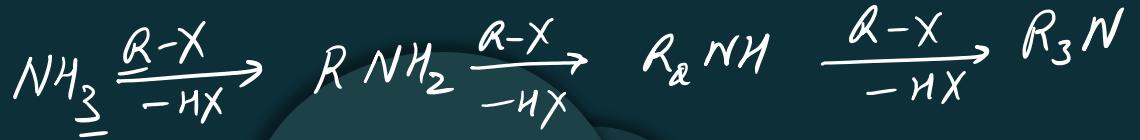
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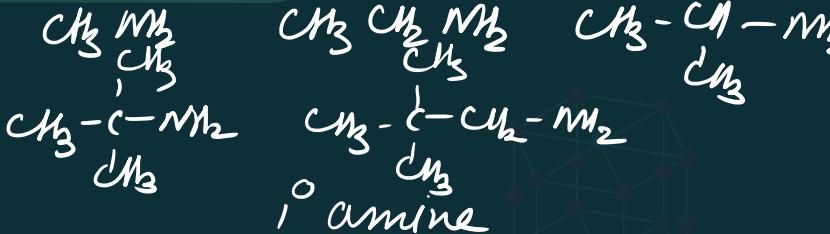


# Amines



Amines are compounds in which one or more **hydrogen atoms of ammonia** have been **replaced by alkyl/aryl group(s)**.

# Amines



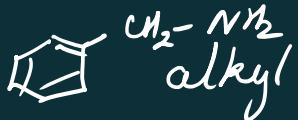
Degree of amine is decided by number of carbon attached to nitrogen

# Alkylamines and Arylamines

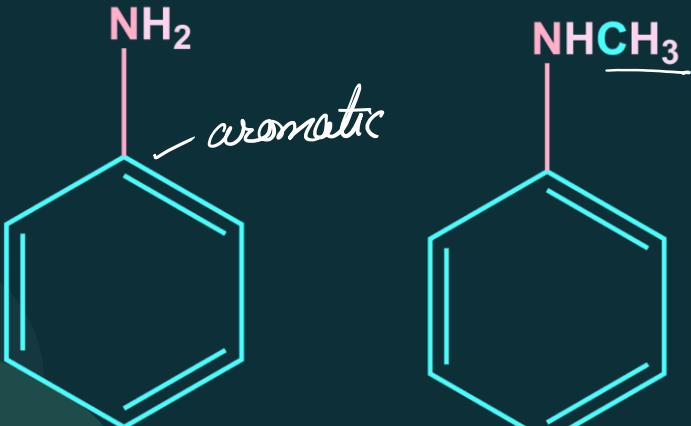


alkyl amine

Examples



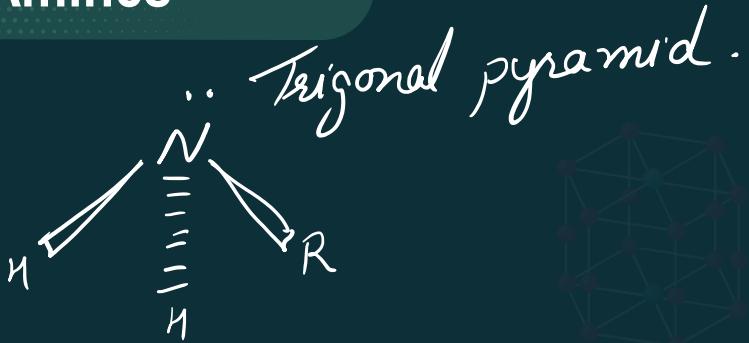
Examples



# Structure of Amines



The **nitrogen atom** of most amines is like that of ammonia. It is  **$sp^3$  hybridised**.



The three alkyl groups (or H atoms) occupy corners of a **tetrahedron**

The  **$sp^3$**  orbital containing the unshared electron pair is directed towards the other corner.

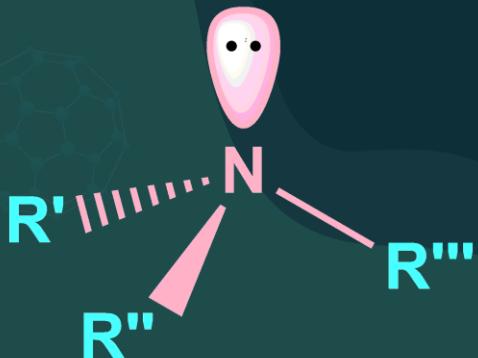
# Structure of Amines



Shape

**Trigonal  
pyramidal**

Bond angles are  
close to  $109.5^\circ$ .



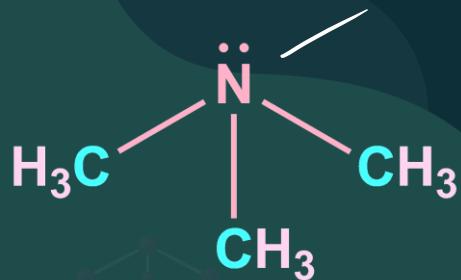
Due to the presence of  
**unshared pair** of electrons,  
the angle **C–N–E, (where E  
is C or H)**, is **less** than  
 **$109.5^\circ$**



# Structure of Amines



The bond angles for **trimethylamine** is **108.7°**.



# Nomenclature of Amines

amine  $-NH_2$

amine  
main chain

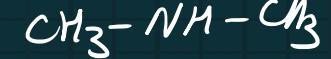
amine  
substituent

dimethyl/amine

$CH_3NH_2$  methyl/amine  
methanamine

$CH_3-CH(NH_2)-CH_3$  isopropylamine  $\rightarrow$  common  
propan-2-amine

$CH_2-NH_2$  ethenediamine  
 $CH_2-NH_2$  ethane-1,2-diamine



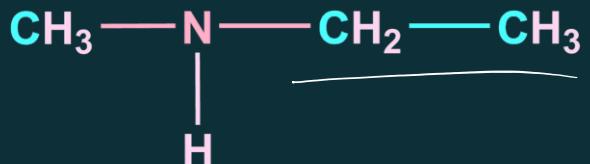
$N$ -methyl(methanamine)

↑  
locant

# Nomenclature of Amines

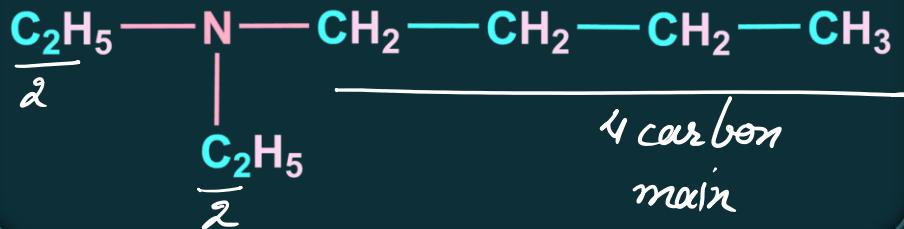


The **IUPAC** name of the compound is:



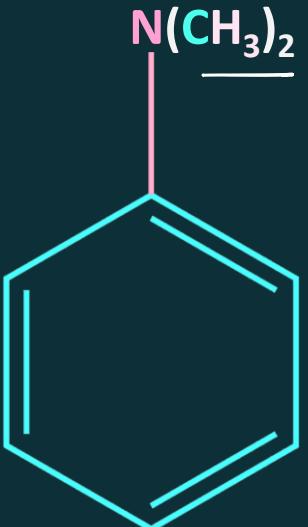
*n*-methylmethanamine

# The IUPAC name of the compound is:



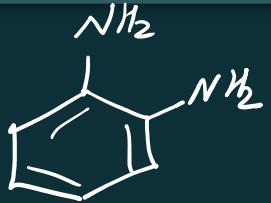
*N,N-diethylbutanamine*

The **IUPAC** name of the compound is:



*N,N-dimethylaniline*

The structure for **Benzene-1,2-diamine** is:



# Common Names

# Common Names

1° amines



Isopropylamine



Ethylamine

2° amines



Ethylmethylamine

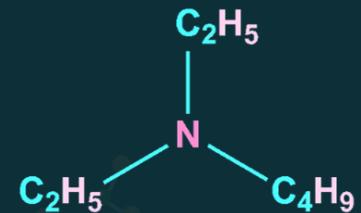


Ethylpropylamine

3° amines



Trimethylamine



Diethylbutylamine

# Basic Character of Amines

Weak Lewis bases like ammonia

Amines are relatively **weak bases**.

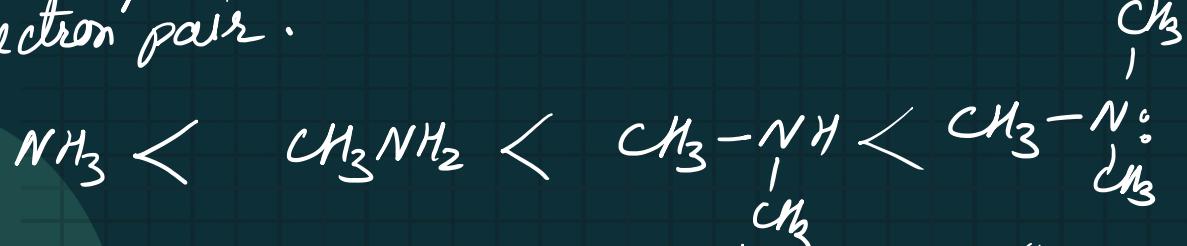
Most are stronger bases than water but are far weaker bases than hydroxide ions and alkoxide ions.

A convenient way to **compare** the basic strengths of amines is to compare their  **$K_b$**  or  **$pK_b$** .



# Basic Character of Amines

1. Non aqueous or gaseous phase  $\rightarrow$  Lewis base. ease of donating electron pair.



$CH_3$  is +I group  $\rightarrow$  increase electron density on nitrogen

so increases the basic character.

# Basic Character of Amines

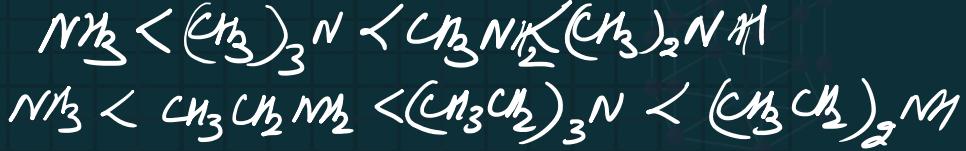


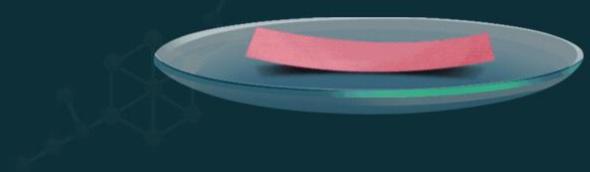
aq. medium  $\rightarrow$  There are two opposing factors -

- 1) inductive effect - acting opposite to each other -
- 2) hydration effect



As number of alkyl groups increase, inductive effect increases but hydration decreases.





# Basic Character of Amines



$K_b$

=

$$\frac{[\text{RNH}_3^+][\text{OH}^-]}{[\text{RNH}_2]}$$

$pK_b$

=

$$-\log K_b$$

# Basic Character of Amines



The equilibrium for an amine that is relatively more basic will lie **more towards the right** in equation, than for an amine that is less basic.

$K_b \uparrow$  or  $pK_b \downarrow$

Basicity  $\uparrow$

# Basic Character of Amines



Basic strength of amines  
can be studied in

Gaseous  
phase

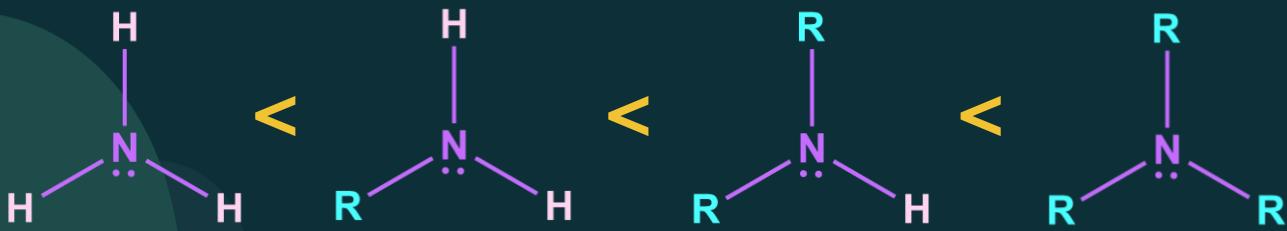
Aqueous  
phase

or non aqueous

# Basic Strength of 1°, 2°, and 3° Amines



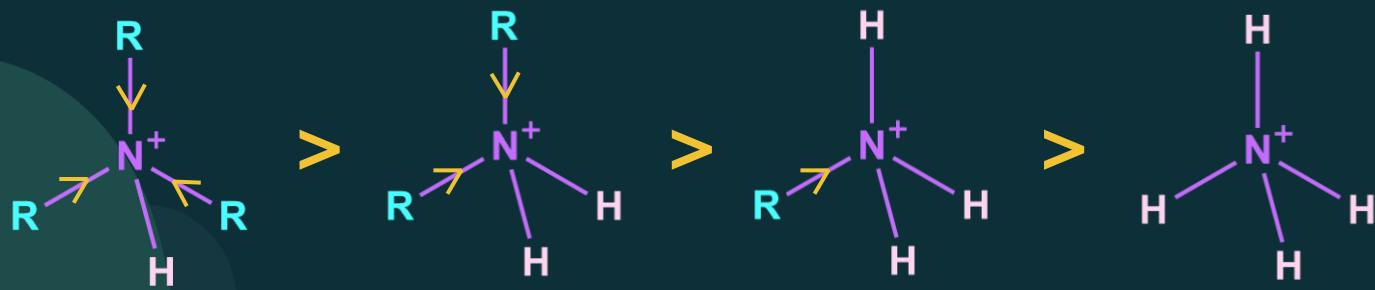
In gaseous phase,



where, R = Alkyl group

# Stability of Conjugate Acids

*in aq. medium*





# Basic Strength of Amines in Gaseous Phase



# Basic Character of Amines



Basic strength of amines  
can be studied in

Gaseous  
phase

Aqueous  
phase

# Basic Strength of Amines



In **aqueous** phase,  
the basic strength of  
amines depend on:

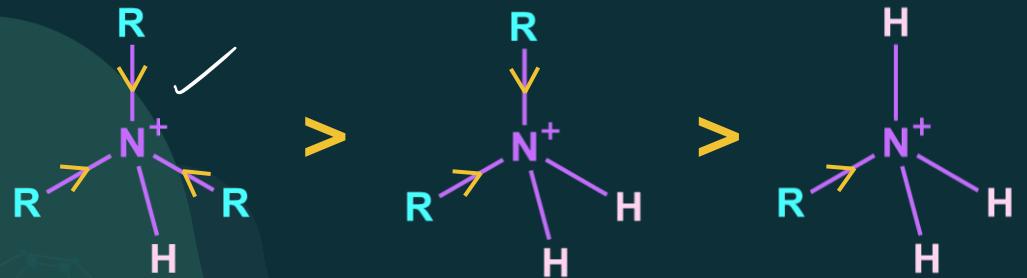
1

Electron donating  
effect of alkyl group

2

Solvation effect

# Electron Donating Effect of Alkyl Groups



# Basic Strength of Amines



In **aqueous** phase,  
the basic strength of  
amines depend on:

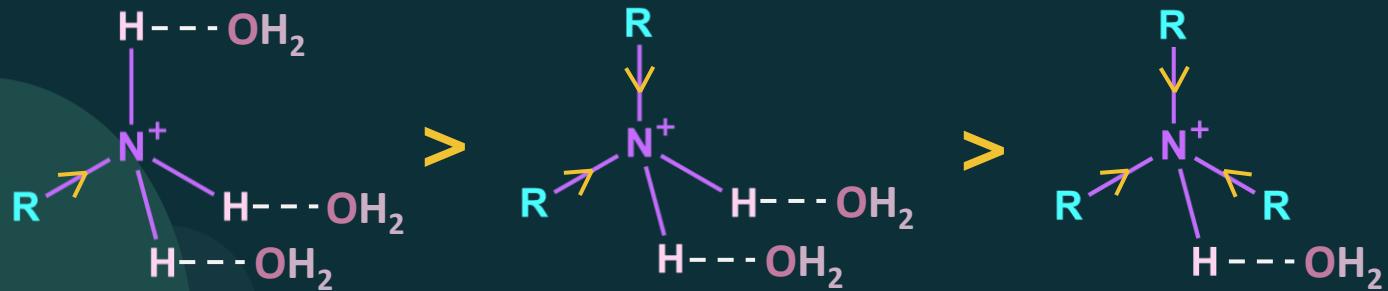
1

Electron donating  
effect of alkyl group

2

Solvation effect

# Solvation Effect



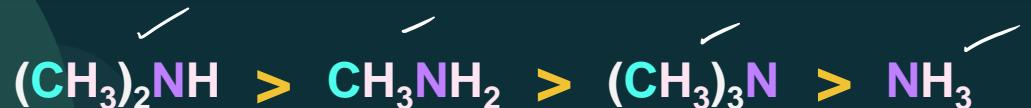
# Basic Strength in Aqueous Phase



aliphatic amines are stronger bases than ammonia.

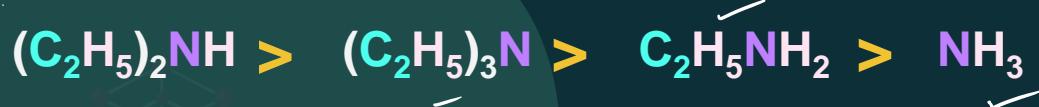
Case 1

When the alkyl group is  $-\text{CH}_3$



Case 2

When the alkyl group is  $-\text{C}_2\text{H}_5$



# The basic character of Ethyl Amine, Diethyl amine and Triethyl amine in chlorobenzene is:

*non aq medium  $\rightarrow$  same as vapour phase*

[AIIMS 2011]



# Basic character of Arylamines



# Basic Character of Arylamines



Electron pair is conjugated with benzene ring so is not easily donated.

Aromatic amines are **much weaker bases** than alkylamines.

# Basic Character of Arylamines

1. Electron W.G on benzene ring decrease the basic character -
2. EDG increase the basic character -

# Basic Character of Arylamines



E.g.: **Aniline**  
 $pK_b = 9.42$

The  **$pK_b$  values** of the **aromatic amines** indicate that they are much weaker bases than the **alkyl amines**.

*alkyl*

E.g.: **Cyclohexylamine**  
 $pK_b = 3.66$

# Basic character of Arylamines



NH<sub>2</sub>

NH<sub>2</sub>

pK<sub>b</sub>

3.66

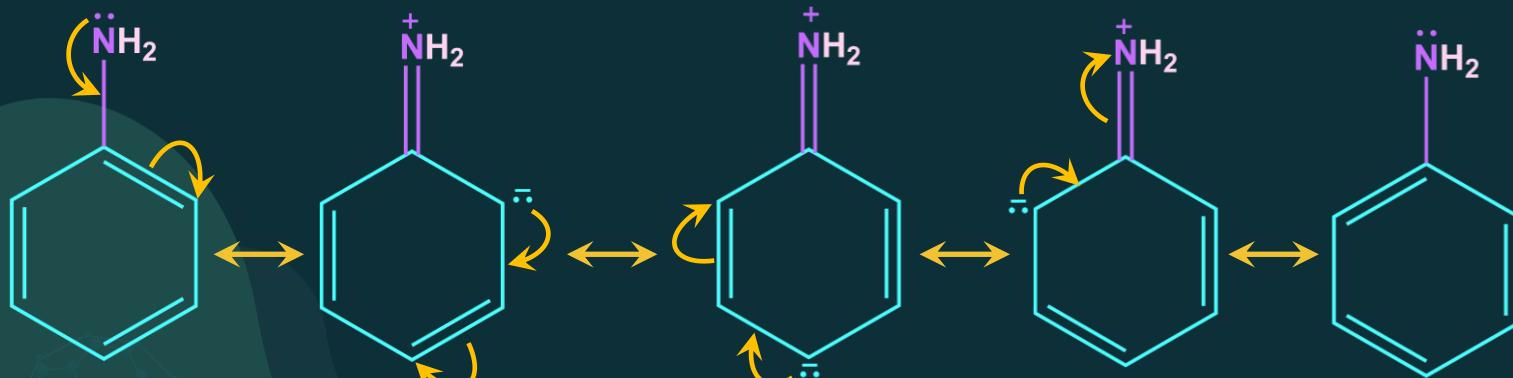
9.42

# Basic character of Arylamines



**Delocalisation** of the electron pair makes it less available to a proton, and also **delocalisation** of the electron pair **stabilises aniline**.

# Basic character of Arylamines

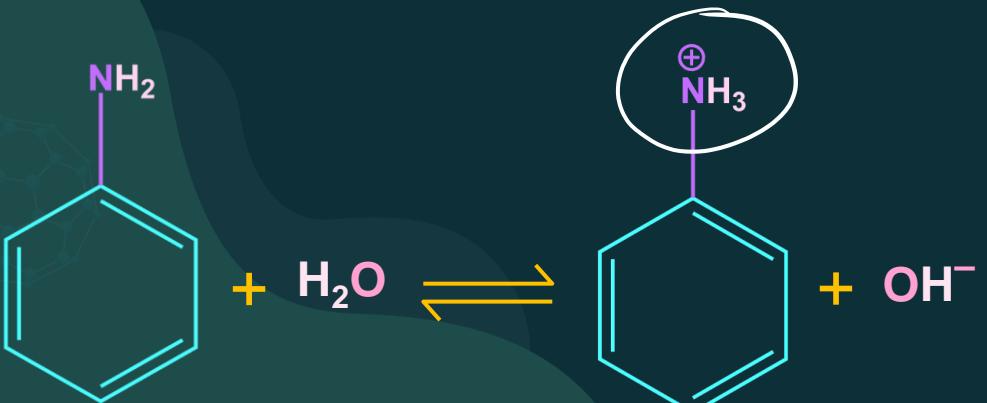


Electron density increases on *ortho* and *para* positions.

# Basic character of Arylamines



When aniline **accepts a proton**, it becomes an anilinium ion.



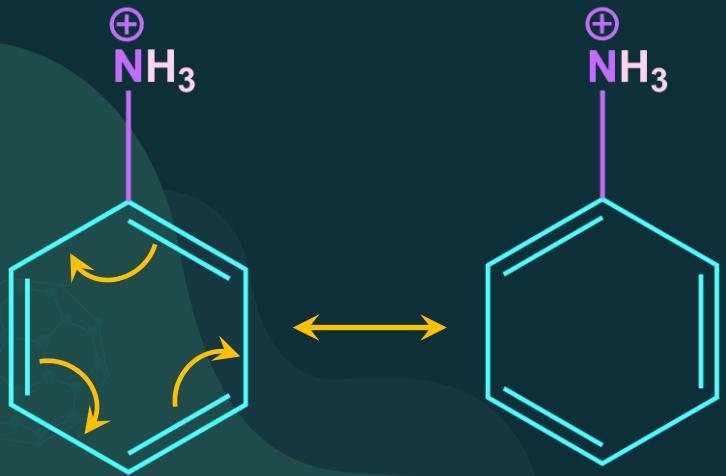
# Basic character of Arylamines



Once the electron pair of the nitrogen atom accepts the proton, it is **no longer available** to participate in resonance.

Only two resonance structures are possible for the anilinium ion.

# Basic character of Arylamines



# Basic character of Arylamines



*aniline*. Resonance does stabilise the anilinium ion considerably, but does not stabilise the anilinium ion to **a great extent** as it does with aniline.

# In Substituted Amines



Electron releasing  
group

$K_b$  value 

Electron withdrawing  
group

$K_b$  value 

# Arrange the following in the order of their $pK_b$ value?

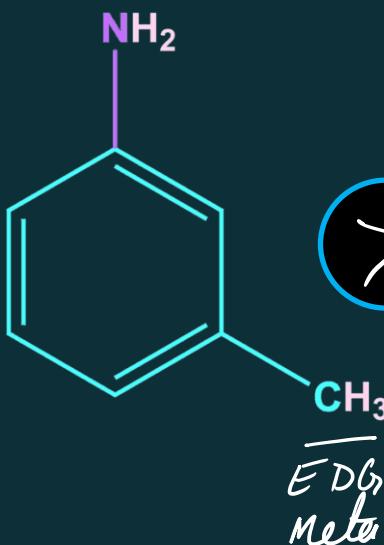
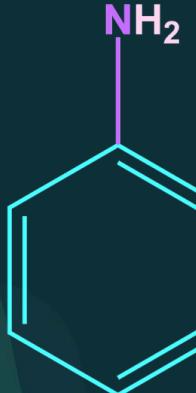


*least basic*

*most basic*

# Arrange the following in the order of their $pK_b$ value?

*Least basic*



*most basic*



# The **correct** statement regarding the basicity of arylamines is:



[NEET 2016]

- a) Arylamines are generally more basic than alkylamines because of aryl group. ✗
  
- b) Arylamines are generally more basic than alkylamines because the nitrogen atom in arylamines is sp-hybridised. ✗



# The **correct** statement regarding the basicity of arylamines is:



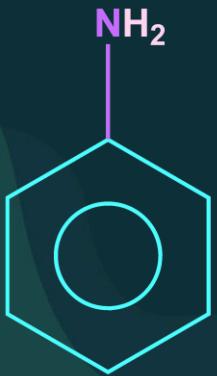
[NEET 2016]

- c) Arylamines are generally less basic than alkylamines because the nitrogen lone-pair electrons is delocalised by interaction with the aromatic ring  $\pi$  electron system.
- d) Arylamines are generally more basic than alkylamines because the nitrogen lone-pair electrons is not delocalised by interaction with the aromatic ring  $\pi$  electron system.

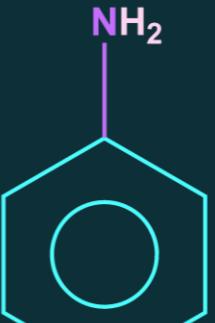
The correct increasing order of the basic strength for the following compounds is:

II < I < III

[NEET 2017]



(I)



(II)



(III)

*← wGr*

*NO<sub>2</sub>*

*CH<sub>3</sub>*

*Exo Gr*

The **correct increasing order of the basic strength** for the following compounds is:

[NEET 2017]

a)  $\text{III} < \text{I} < \text{II}$

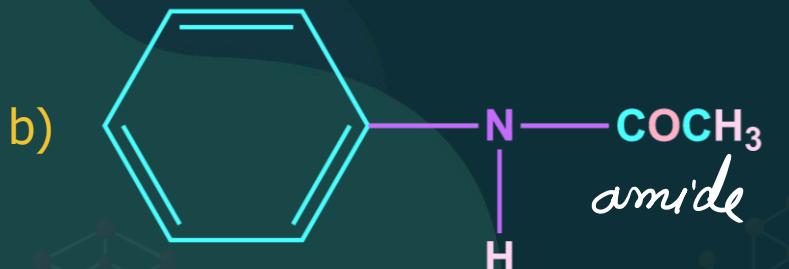
b)  $\text{III} < \text{II} < \text{I}$

c)  $\text{II} < \text{I} < \text{III}$

d)  $\text{II} < \text{III} < \text{I}$

# Which of the following is the **most basic**?

[NEET 2011]



# Which of the following is the **most basic**?

[NEET 2011]





“Stay Positive, Work Hard. Make It Happen!”

**THANK YOU**