Amines

Standard difficulty · 20 questions · 40 marks · Time: 40 minutes

Name: _____ Date: _____ Score: ____ / 40

Show your working for Sections B and C. Answers are on the last page — try every question first!

Section A — Choose the correct answer 8 × 1 = 8 marks

1. Amines are basic because the nitrogen atom has:

(a) no lone pair **(b)** a double bond

(c) a positive charge **(d)** a lone pair of electrons

2. The IUPAC name of $C_2H_5NH_2$ (ethylamine) is:

(a) ethanamine **(b)** propan-1-amine

(c) N-methylethanamine **(d)** N,N-dimethylaniline

3. N,N-dimethylaniline ($C_6H_5N(CH_3)_2$) is a:

(a) primary (1°) amine **(b)** secondary (2°) amine

(c) tertiary (3°) amine **(d)** quaternary ammonium salt

4. With Hinsberg's reagent (benzenesulphonyl chloride), N,N-dimethylaniline ($C_6H_5N(CH_3)_2$) gives:

(a) a sulphonamide that does not dissolve in alkali

(b) a sulphonamide that dissolves in alkali

(c) a yellow oily nitrosoamine only

(d) no reaction

5. The correct order of increasing basic strength in water is:

(a) phenylmethanamine < methanamine < N-methylmethanamine

(b) N-methylmethanamine < phenylmethanamine < methanamine

(c) N-methylmethanamine < methanamine < phenylmethanamine

(d) phenylmethanamine < N-methylmethanamine < methanamine

6. Benzenediazonium chloride reacts with Cu powder with HCl. The product is:

(a) 4-aminoazobenzene (a yellow dye) **(b)** chlorobenzene

(c) 4-hydroxyazobenzene (an orange dye) **(d)** iodobenzene

7. 2-phenylethanamide is warmed with Br_2 and aqueous NaOH. The product is:

(a) butan-1-amine **(b)** ethanamine

(c) phenylmethanamine **(d)** propan-1-amine

8. Assertion (A): Methanamine (CH_3NH_2) gives the carbylamine (isocyanide) test.
Reason (R): Only tertiary amines give an isocyanide with chloroform and alcoholic KOH.

(a) Both A and R are true, and R is the correct explanation of A.

(b) Both A and R are true, but R is not the correct explanation of A.

(c) A is true, but R is false.

(d) A is false, but R is true.

Section B — Short answer — 8 × 2 = 16 marks

9. Why are aliphatic amines stronger bases than ammonia?

10. Give the IUPAC name of $(C_2H_5)_3N$ (triethylamine), classify it, and say what it gives with Hinsberg's reagent.

11. Arrange in increasing order of basic strength in aqueous solution: phenylmethanamine, benzenamine, N-methylmethanamine.

12. What is formed when benzenediazonium chloride reacts with H_3PO_2 (hypophosphorous acid)? Name the reaction.

13. 116.1 g of heptanamide undergoes Hoffmann bromamide degradation with 100% yield. Name the amine and find its mass. (C = 12, H = 1, N = 14, O = 16)

14. How would you tell phenylmethanamine from N-methylmethanamine?

15. How would you convert aniline to benzene?

16. What happens when N-methylaniline ($C_6H_5NHCH_3$) is treated with nitrous acid ($NaNO_2$ and HCl) in the cold?

Section C — Word problems — 4 × 4 = 16 marks

17. Describe three methods of preparing amines, with equations.

18. Identify the compounds in: nitrobenzene —Fe/HCl→ A —Br_2 water→ B.

19. Arrange in increasing order of basic strength in water, and explain using the inductive effect, solvation and resonance: phenylmethanamine, benzenamine, N-methylaniline, N-ethylethanamine.

20. 57.5 g of hexanamide ($CH_3(CH_2)_4CONH_2$) is treated with Br_2 and NaOH. Write the equation, name the product and find its mass for an 80% yield. Why can this method not make secondary amines? (C = 12, H = 1, N = 14, O = 16)

Want another sheet on this chapter? In the Ambiful Worksheets app every sheet is new, with its answer key, and your child never gets the same question twice.

Scan the code to get the free app, or open **worksheets.ambiful.com/get**

Answer key

Amines · AW-12C-AMN-2026-V1 · For parents — fold back or tear off before handing the sheet to your child.

Q	Answer	Working
1	**(d) a lone pair of electrons**	—
2	**(a) ethanamine**	N-substituents are named with the prefix N-
3	**(c) tertiary (3°) amine**	count the carbon groups on nitrogen
4	**(d) no reaction**	N,N-dimethylaniline is tertiary (3°)
5	**(a) phenylmethanamine < methanamine < N-methylmethanamine**	pKb: N-methylmethanamine 3.27, phenylmethanamine 4.7, methanamine 3.38 (lower pKb, stronger base)
6	**(b) chlorobenzene**	—
7	**(c) phenylmethanamine**	Hoffmann bromamide degradation: the amine has one carbon fewer than the amide
8	**(c) A is true, but R is false.**	A is true: it is a primary (1°) amine. R is false.
9	**Alkyl groups release electrons (+I effect), raising the electron density on nitrogen, so the lone pair is more available to accept a proton.**	—
10	**N,N-diethylethanamine; tertiary (3°); no reaction**	Hinsberg: 1° soluble in alkali, 2° insoluble, 3° no reaction
11	**benzenamine < phenylmethanamine < N-methylmethanamine**	pKb: phenylmethanamine 4.7, benzenamine 9.38, N-methylmethanamine 3.27; aryl amines are weak because the lone pair is spread into the ring
12	**benzene; reduction**	the N_2^+ group is replaced or the ion couples
13	**hexan-1-amine; 90.9 g**	$RCONH_2 + Br_2 + 4NaOH \rightarrow RNH_2 + Na_2CO_3 + 2NaBr + 2H_2O$; M(amine) = 101
14	**Hinsberg's reagent: phenylmethanamine gives a sulphonamide that dissolves in alkali; N-methylmethanamine gives a sulphonamide that does not dissolve in alkali. Also, only the primary amine (phenylmethanamine) gives the carbylamine test**	Hinsberg separates 1°, 2° and 3° amines
15	**diazotise, then H_3PO_2**	—
16	**a yellow oily N-nitrosoamine forms**	the products depend on the class and on whether the amine is aromatic
17	**Reduction of nitro compounds: $C_6H_5NO_2 + 6[H]$ (Sn/HCl) $\rightarrow C_6H_5NH_2 + 2H_2O$. Ammonolysis of alkyl halides gives a mixture of 1°, 2° and 3° amines and the quaternary salt. Reduction of nitriles ($LiAlH_4$ or H_2/Ni) and of amides ($LiAlH_4$). Gabriel synthesis gives pure**	—

Q	Answer	Working
	primary aliphatic amines. Hoffmann bromamide degradation gives a primary amine with one carbon fewer.	
18	**A = aniline, B = 2,4,6-tribromoaniline**	follow each reagent in turn
19	**benzenamine < N-methylaniline < phenylmethanamine < N-ethylethanamine**	alkyl groups (+I) raise basicity, but in water solvation and crowding make the order of methyl amines 2° > 1° > 3°; in aryl amines the lone pair is delocalised into the ring, so they are much weaker. pKb: phenylmethanamine 4.7, benzenamine 9.38, N-methylaniline 9.3, N-ethylethanamine 3
20	**$CH_3(CH_2)_4CONH_2 + Br_2 + 4NaOH \rightarrow CH_3(CH_2)_4NH_2 + Na_2CO_3 + 2NaBr + 2H_2O$; pentan-1-amine; 34.8 g; the reaction removes the carbonyl carbon and always leaves an $–NH_2$ group, so only primary amines form**	mol = 0.5