

Chemguide – answers

AMINES: INTRODUCTION

1. a) A primary
B primary
C tertiary
D secondary

(What matters is the number of hydrocarbon groups attached *directly* to the nitrogen.)

- b) A 2-aminobutane
D dimethylamine

(Other names are also possible. If you have been taught different names then use them.)

2. a) van der Waals dispersion forces, dipole-dipole attractions and hydrogen bonds.

b) As the molecules get bigger, the potential for van der Waals dispersion forces increases, and so more energy is needed to boil the amine.

c) The dispersion forces and hydrogen bonding will be much the same, but with the nitrogen in the middle of the molecule rather than at the end, the permanent dipole is rather smaller, and so the dipole-dipole attractions will be a bit weaker.

d) A molecule of a tertiary amine can't form hydrogen bonds with other tertiary amine molecules. Hydrogen bonding needs a hydrogen atom attached to an electronegative element, and in a tertiary amine, there aren't any hydrogens attached to the nitrogen.

e) They can all form hydrogen bonds with water (including the tertiary amines). When the amine dissolves, hydrogen bonds between amine molecules and between water molecules have to be broken, but are replaced by similar strength hydrogen bonds between amine molecules and water molecules. In the case of a tertiary amine, you can get a hydrogen bond between the lone pair on the nitrogen and a slightly positive hydrogen atom from the water.

f) You have to break increasing numbers of hydrogen bonds in the water as the bigger amines fit between the water molecules, but these are only replaced by hydrogen bonds involving the single nitrogen atom. It becomes energetically unprofitable.