Amines

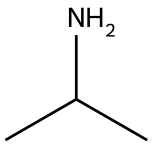
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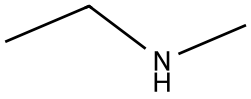
Show your working where needed.

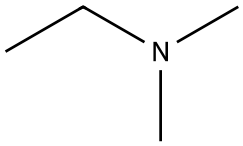
Name _____ Date _____

1. Classify the amines shown

Classify A, B and C as primary, secondary or tertiary amines. State what you counted.

A 

B 

C 

2. Form a salt

Write an equation for propylamine, $CH_3CH_2CH_2NH_2$, reacting with dilute hydrochloric acid. Explain the role of the nitrogen lone pair.

3. Control the products of substitution

Bromoethane reacts with ethanolic ammonia. Draw the first two steps leading to the primary amine. Explain why a large excess of ammonia favours this amine.

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4. A reaction of butanenitrile

Butanenitrile, $CH_3CH_2CH_2C{\equiv}N$, is treated with hydrogen over nickel. Draw the organic product and give a balanced equation using H_2. Track the nitrile carbon in the product.

5. The reduction mixture

Nitrobenzene is heated with tin and concentrated hydrochloric acid. Give an equation using [H] for the overall conversion to the free amine. Explain why adding sodium hydroxide is necessary to obtain it.

6. Compare bases

Put phenylamine, ammonia and ethylamine in order of increasing basicity using the AQA lone-pair model. Explain the order.

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7. Check a functional-group claim

A student calls $CH_3C(=O)NHCH_2CH_3$ a secondary amine. Name the compound, explain your classification using the bond to nitrogen and give two reactants that could make it by acylation.

8. Trimethylamine and iodoethane

Trimethylamine reacts with iodoethane. Draw or write the full salt and explain what happens to the nitrogen lone pair.

9. Extra challenge · Follow successive reactions at nitrogen

During exhaustive alkylation, ethylamine reacts with excess iodomethane. Give the structures of the possible neutral secondary and tertiary amine intermediates and the final salt.

Explain how each neutral intermediate is formed and why the final nitrogen centre cannot react in the same way again.

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