

**Q1.** (a) Name the compound  $(\text{CH}_3)_2\text{NH}$

.....

**(1)**

(b)  $(\text{CH}_3)_2\text{NH}$  can be formed by the reaction of an excess of  $\text{CH}_3\text{NH}_2$  with  $\text{CH}_3\text{Br}$ . Name and outline a mechanism for this reaction.

*Name of mechanism* .....

*Mechanism*

**(5)**

(c) Name the type of compound produced when a large excess of  $\text{CH}_3\text{Br}$  reacts with  $\text{CH}_3\text{NH}_2$ . Give a use for this type of compound.

*Type of compound* .....

*Use* .....

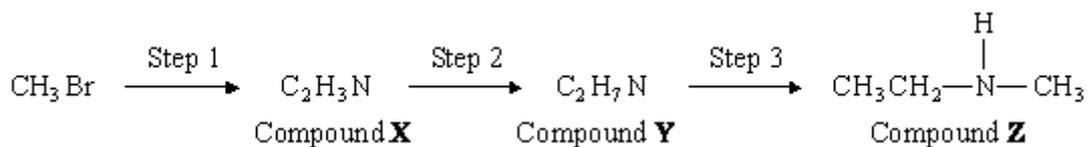
**(2)**

(d) Draw the structures of the two compounds formed in the reaction of  $\text{CH}_3\text{NH}_2$  with ethanoic anhydride.

**(2)**

**(Total 10 marks)**

**Q2.** Compound **Z** can be formed via compounds **X** and **Y** in the three step synthesis shown below.



Identify compounds **X** and **Y** and give reagents and conditions for Steps 1 and 2.

State the **type** of compound of which **Z** is an example.

Compound **Z** reacts with a large excess of bromomethane to form a solid product. Draw the structure of this product and name the type of mechanism for this reaction.

**(Total 9 marks)**

**Q3.** (a) Outline a mechanism for the formation of ethylamine from bromoethane. State why the ethylamine formed is contaminated with other amines. Suggest how the reaction conditions could be modified to minimise this contamination.

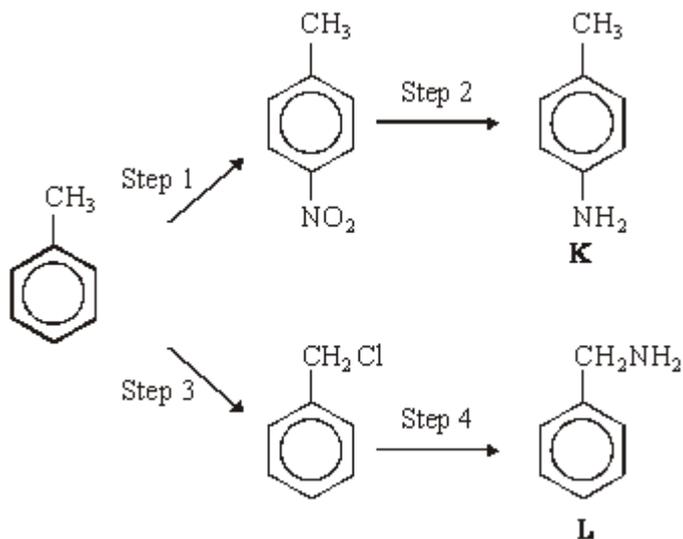
**(6)**

(b) Suggest one reason why phenylamine cannot be prepared from bromobenzene in a similar way. Outline a synthesis of phenylamine from benzene. In your answer you should give reagents and conditions for each step, but equations and mechanisms are not required.

**(5)**

**(Total 11 marks)**

**Q4.** The following reaction scheme shows the formation of two amines, **K** and **L**, from methylbenzene.



- (a) (i) Give the reagents needed to carry out Step 1. Write an equation for the formation from these reagents of the inorganic species which reacts with methylbenzene.

Reagents .....

Equation .....

- (ii) Name and outline a mechanism for the reaction between this inorganic species and methylbenzene.

Name of mechanism .....

Mechanism

(7)

- (b) Give a suitable reagent or combination of reagents for Step 2.

.....

(1)

- (c) (i) Give the reagent for Step 4 and state a condition to ensure that the primary amine is the major product.

*Reagent* .....

*Condition* .....

- (ii) Name and outline a mechanism for Step 4.

*Name of mechanism* .....

*Mechanism*

(7)  
(Total 15 marks)

- Q5.** (a) Name and outline a mechanism for the formation of butylamine,  $\text{CH}_3\text{CH}_2\text{CH}_2\text{CH}_2\text{NH}_2$ , by the reaction of ammonia with 1-bromobutane,  $\text{CH}_3\text{CH}_2\text{CH}_2\text{CH}_2\text{Br}$ .

*Name of mechanism* .....

*Mechanism*

(5)

- (b) Butylamine can also be prepared in a two-step synthesis starting from 1-bromopropane,  $\text{CH}_3\text{CH}_2\text{CH}_2\text{Br}$ . Write an equation for each of the two steps in this synthesis.

Step 1

.....

Step 2

.....

(3)

- (c) (i) Explain why butylamine is a stronger base than ammonia.

.....

.....

.....

- (ii) Identify a substance that could be added to aqueous butylamine to produce a basic buffer solution.

.....

(3)

- (d) Draw the structure of a tertiary amine which is an isomer of butylamine.

(1)

(Total 12 marks)

