**Name of the Student**:_____
**Max. Marks : 22 Marks** **Time : 22 Minutes**

Q1.

This question is about the preparation of an ester.

(a) Ester **F** can be prepared from propan-2-ol and ethanoic acid.

Give an equation for this reaction.

Name ester **F**.

Equation

_____

Name _____

**(2)**

This method is used to prepare a sample of ester **F**.

**Step 1**
Mix 10 $cm^3$ of propan-2-ol with 10 $cm^3$ of ethanoic acid.
Add 5 drops of concentrated sulfuric acid.
Reflux this reaction mixture for 20 minutes.

**Step 2**
Transfer the cooled reaction mixture to a separating funnel.
Add 20 $cm^3$ of aqueous sodium carbonate and shake the mixture.

**Step 3**
Transfer the organic layer to a beaker and add 5 g of anhydrous magnesium sulfate.
Decant off the organic liquid.

**Step 4**
Collect the ester using simple distillation.

(b) Describe how **Step 1** should be done.

In your description you should

- give details of suitable equipment used to add each reagent to the reflux apparatus
- draw a labelled diagram of the apparatus used for refluxing the reaction mixture
- explain any safety precautions needed other than eye protection.

_____

_____

**(6)**

(c) In **Step 2** the reaction mixture from **Step 1** is shaken with aqueous sodium carbonate.

State the purpose of the sodium carbonate.

Suggest a precaution that should be taken while this mixture is shaken in the separating funnel.

Give a reason for your suggested precaution.

Purpose of sodium carbonate _____

_____

Precaution _____

_____

Reason _____

_____

**(3)**

(d) Give the reason for the use of anhydrous magnesium sulfate in **Step 3**.

_____

_____

**(1)**

(e) Suggest how the purity of the ester can be confirmed during the distillation in **Step 4**.

_____

_____

**(1)**

**(Total 13 marks)**

Q2.

This question is about amines.

(a) An incomplete equation for Step **1** in the reaction between bromoethane and an amine is shown.

Complete the equation.

In Step **2** of this reaction, the product of Step **1** forms a secondary amine.

Name the secondary amine formed.

Amine name _____

**(2)**

(b) $CH_3CHBrCH_2CH_3$ reacts with $NH_3$

Draw the skeletal formula of the major organic product formed when

- an excess of $NH_3$ is used
- an excess of $CH_3CHBrCH_2CH_3$ is used.

Product with excess $NH_3$

Product with excess $CH_3CHBrCH_2CH_3$

**(2)**

(c) **Figure 1** shows a two-step synthesis to make amine **G**.

**Figure 1**

$$\xrightarrow{\text{Step 1}} (CH_3)_2CHCN + Br^-$$

$$(CH_3)_2CHCN + 2\,H_2 \xrightarrow{\text{Step 2}}$$

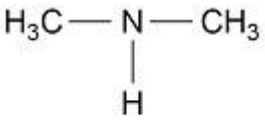
Amine **G**

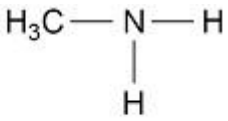
Complete **Figure 1** by drawing the mechanism for Step **1** and the displayed formula of amine **G**.

**(3)**

(d) **Figure 2** shows two amines, **P** and **Q**.

**Figure 2**





Explain why **P** is a stronger base than **Q**.

_____

_____

_____

_____

**(2)**

**(Total 9 marks)**