DBMS MINIPROJECT

TOPIC –WASTE MANAGEMENT SYSTEM

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1.INTRODUCTION

1.Purpose

The Waste Management System is a comprehensive, database-driven project designed to efficiently manage waste collection, processing, and recycling operations for both customers and collector. The system provides functionalities such as registering customers, recording waste types, scheduling waste collections, managing collection plants, and processing transactions and payments. It automates critical tasks such as waste tracking, reward-payment calculations in case of recyclable items, and data retrieval, ensuring accuracy and minimizing manual intervention. The primary purpose of this project is to streamline and simplify various waste management operations, promote recycling, and enhance customer engagement through a reward-based system.

2. Scope

For Customer:

- **Register and Manage Profile:** Users can create and update their profiles with personal and contact information.
- **View Waste Types:** Users can view different categories of waste and understand their recyclability.

- **Schedule Waste Collections:** Users can request waste collections by specifying waste types, quantities, and preferred collection dates.
- **Track Collections:** Users can monitor the status of their waste collections and view history.
- **View and Redeem Rewards(Payment):** Users can view accumulated rewards based on their recyclable waste contributions and redeem them.

For Collector:

- **Manage Customers:** Administrators can add, update, or remove customer profiles and contact details.
- **Manage Waste Types:** Administrators can define, update, or delete waste categories and associated rates per kilogram.
- **Manage Collection Plants:** Administrators can oversee collection plant details, including location, capacity, and personnel.
- **Schedule and Monitor Collections:** Administrators can assign waste collection requests to specific collection plants and monitor real-time collection statuses.
- **Process Transactions and Rewards:** Administrators can handle financial transactions related to waste collections and manage the reward system of recycled items.

3. Definitions

- **Customer Profile:** A database entry containing a customer's personal and contact information.
- **Waste Type:** A classification of waste based on its nature (e.g., dry, wet) and recyclability and waste elements.
- **Collection Plant:** A facility responsible for collecting, processing, and recycling waste from designated areas.
- **Transaction Record:** A database entry detailing a financial transaction related to waste collection and reward and status of payment.

- **Reward System:** A mechanism that calculates and distributes incentives to customers based on their recyclable waste contributions.
- **Collector profile:** A component that assigns waste collection to appropriate collection plants based on various criteria.

2.SYSTEM OVERVIEW

Database:

- Stores tables for customer profiles and contact details , waste types (eg: e-waste, biodegradable waste)and waste items(Mobile phones, plastic bags etc) , collection plant details, waste collection records, and transaction information between customer and collector.

Stored procedure:

- The daily_bill_generation procedure calculates the total payment for a customer based on the recyclable waste they provided to a specific collector, using the rate per kilogram for each waste type. The result (pay) represents the customer's total compensation.

1. **Triggers :**

    - The after_insert_customer_waste_collection trigger logs a transaction in the Transaction table with a randomized status and calculated payment each time a new waste collection record is added. It calls the daily_bill_generation procedure to determine the payment amount.

Prepared Statements and Queries:

- Automate data retrieval for user authentication, waste type details, collection schedules, and transaction histories.

- Enable filtering and display of relevant records (e.g., collections by date, waste type, or customer).

Views:

- Provide views of waste collection ,customer associated with it and the specific collector collecting the waste to collection plant.
- financial transactions and overall system performance between customer and collector**.**

3.FUNCTIONAL REQIREMENTS:

Customer Authentication:

- The system should allow users to sign up, log in, Delete account, show transaction and authenticate based on their credentials(Phone no).
- It should verify user information and provide access based on the role (customer, collector).

Waste Collection Management:

- Customers should be able to view waste collection ,waste type and necessary details.
- Collectors should be able to view, update ,insert delete , and manage scheduled waste collections and their own account.

Transaction Management:

- The system should handle financial transactions between customer and collector related to waste collection, including payment processing and tracking status.
- It should automatically calculate the payment amount based on the waste quantity and type.

Customer and Collector Interaction:

- The system should allow customers to track the status of their waste collection and payments.
- Collectors should have real-time access to scheduled collections and transaction statuses.

Waste Type and Category Management:

- The system should allow collector plant to define different waste types (dry, wet, recyclable, non-recyclable) and their corresponding rates.
- New waste elements can be added under existing waste types.

Data Integrity:

- The system should ensure referential integrity across all tables (e.g., linking customers to waste collections and transactions) to prevent orphaned or invalid records.

4.NON FUNCTIONAL REQIREMENTS:

1.Usability

- **User-Friendly Interface**: The system should provide an intuitive, easy-to-navigate interface for both collector and customers to manage waste collection, track payments, and view transaction histories. Features such as customer sign-ups, login management, waste collection tracking, and payment processing is straightforward and simple to use.
- **Automated Processes**: Automate critical tasks such as calculating payments based on waste quantity, checking for recyclable materials, generating transaction records, and triggering payment status

updates. This minimizes manual intervention and streamlines operational workflows.

- **Efficient Waste Collection Management**: Administrators should be able to quickly view, update, and manage waste collection records, transaction details, and payment statuses. The system should allow real-time updates and ensure all data is processed efficiently to reduce delays in customer service or waste collection operations.

2. Reliability

- **Accurate User Authentication**: Ensure robust user authentication processes to prevent unauthorized access to sensitive data. All customer and collector logins should be validated securely, and the system should guarantee that only authorized users can access specific functionalities (e.g., viewing or updating waste collection details).
- **Data Integrity**: The system must maintain data integrity across all records. It should use database constraints, triggers, and stored procedures to enforce referential integrity between customer data, waste collection details, transaction information, and payment records. This ensures that data remains consistent and avoids issues like missing waste collection entries or payment discrepancies.
- **Consistent Waste Collection Data**: Waste collection data, including the quantity of waste collected, rate per kg , collection status, and recycling information, should be updated reliably in real-time. Any changes transactions must be tracked consistently and immediately reflected across the system to maintain accurate records.

4.Performance:

The system should ensure fast query execution for large datasets and provide real-time updates for actions like payment calculations and collection tracking.

5. Real-Time Feedback:

Minimal response times are crucial, with near-instantaneous updates for administrators, collectors, and customers on system actions and transaction statuses.

6.Scalability:

The system should support growing data volumes efficiently, handling increased customers, collections, and transactions without performance degradation.

7.Security:

Sensitive data, including customer and transaction information, should be securely stored and transmitted using encryption and secure authentication protocols.

5.DATABASE DESIGN

Customer table: Stores user(customer) credentials and basic information for authentication

(Customer_id PRIMARY KEY, Customer_name, c_society , c_city ,c_pincode)

Customer_Contact_Details Table: Stores multiple contact numbers for each customer.

(Customer_id ,phone_no)

- Primary Key: (Customer_id, phone_no)
- Foreign Key: Customer_id REFERENCES Customer(Customer_id))

Waste_Type Table: Defines various waste types with their attributes**.**

(Waste_Type_ID PRIMARY KEY, Waste_Type_Name ,Dry_Wet ,Rate_per_kg)

Waste_Element Table: Lists individual waste items under each waste type.

(Waste_ID PRIMARY KEY,Waste_Name)

Collection_Plant Table: Stores details about waste collection plants.

(Collector_ID PRIMARY KEY, Collector_Name, Collector_Dept, Collection_Plant_Area,Collection_Plant_City)

8.7**Customer_Waste_Collection Table:** Records information about waste collections from customers.

(Customer_id ,Waste_type_id ,Waste_id ,Collector_ID ,Date_of_Collection ,Quantity ,Is_recyclable)

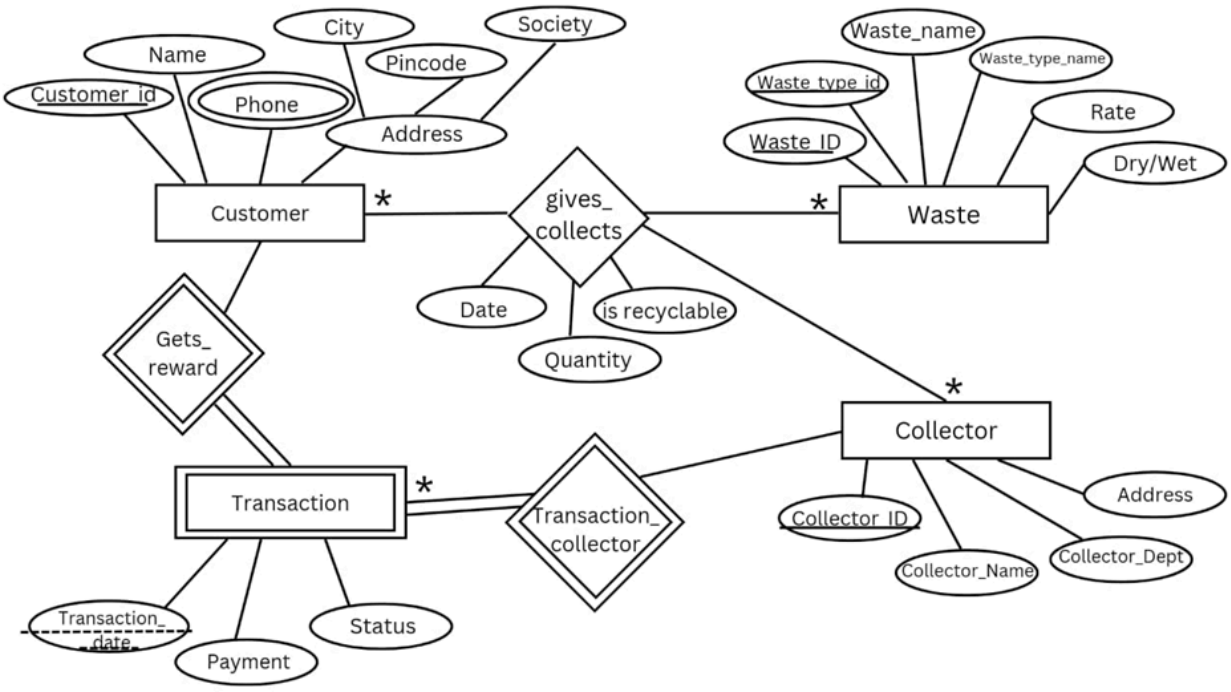
- Primary Key: (Customer_id, Waste_type_id, Waste_id, Collector_ID)
- Foreign Keys:
    - Customer_id REFERENCES Customer(Customer_id)
    - Waste_type_id REFERENCES Waste_Type(Waste_Type_ID)
    - Waste_id REFERENCES Waste_Element(Waste_ID)
    - Collector_ID REFERENCES Collection_Plant(Collector_ID)

8.8 Transaction Table : Manages financial transactions related to waste collections and rewards.

(Customer_ID ,Collector_ID ,Transaction_date ,Status,Payment)

- Primary Key: (Customer_ID, Collector_ID)
- Foreign Keys:
    - Customer_ID REFERENCES Customer(Customer_ID) ON DELETE CASCADE
    - Collector_ID REFERENCES Collection_Plant(Collector_ID) ON DELETE CASCADE

ER DIAGRAM



TABLES FROM ERD

FOLLOWING TABLES ARE IN 1NF

```
CREATE TABLE Customer (
   Customer_id INT AUTO_INCREMENT PRIMARY KEY ,
   Customer_name VARCHAR(50) NOT NULL,
   c_society VARCHAR(100),
   c_city VARCHAR(30),
   c_pincode BIGINT
  );

Alter table customer auto_increment=1;

CREATE TABLE Customer_contact_details (
    Customer_id INT,
    phone_no BIGINT,
    PRIMARY KEY (Customer_id, phone_no),
    FOREIGN KEY (Customer_id) REFERENCES Customer(Customer_id)
```

```
  );

 CREATE TABLE Waste (
      Waste_Type_ID INT,
       Waste_Type_Name VARCHAR(50) UNIQUE ,
       Waste_ID INT ,
       Waste_Name VARCHAR(50) UNIQUE,
       Dry_Wet VARCHAR(3),
       Rate_per_kg FLOAT(10,2),
       PRIMARY KEY (Waste_Type_ID, Waste_ID)
    );

CREATE TABLE Collection_Plant (
    Collector_ID  INT  PRIMARY  KEY AUTO_INCREMENT,
    Collector_Name VARCHAR(50),
    Collector_Dept VARCHAR(50),
    Collection_Plant_Area VARCHAR(50),
    Collection_Plant_City VARCHAR(20)
     );

Alter table Collection_Plant auto_increment=1;

 CREATE TABLE Customer_Waste_Collection (
    Customer_id INT,
    Waste_type_id INT,
    Waste_id INT,
    Collector_ID  INT ,
    Date_of_Collection DATE,
    Quantity FLOAT(10,2),
    Is_recyclable VARCHAR(15),
   PRIMARY KEY (Customer_id, Waste_type_id, Waste_id,Collector_ID),
   FOREIGN KEY (Customer_id) REFERENCES Customer(Customer_id),
   FOREIGN KEY (Waste_type_id, Waste_id) REFERENCES Waste(Waste_type_id,
Waste_id)
  FOREIGN KEY (Collector_ID ) REFERENCES Collection_plant( Collector_ID )
   );

 CREATE TABLE Transaction (
   Customer_ID INT,
   Collector_ID INT,
```

```
  Transaction_date DATE,
  Status VARCHAR(50),
  Payment DECIMAL(10, 2),
  FOREIGN KEY (Customer_ID)
    REFERENCES Customer(Customer_ID)
    ON DELETE CASCADE,
  FOREIGN KEY (Collector_ID)
    REFERENCES Collection_plant(Collector_ID)
    ON DELETE CASCADE
);
```

2NF

There exists functional dependency in Waste table.
Candidate key - (Waste_Type_ID, Waste_ID)
Waste_type_id can uniquely identify Waste_type_name ,Dry_Wet,Rate_per_kg.
Waste_id can uniquely identify Waste_name.

```
CREATE TABLE Waste_Type (
      Waste_Type_ID INT PRIMARY KEY,
      Waste_Type_Name VARCHAR(30) UNIQUE ,
      Dry_Wet VARCHAR(3),
      Rate_per_kg FLOAT(10,2)
   );

CREATE TABLE Waste_Element (
      Waste_ID INT PRIMARY KEY,
      Waste_Name VARCHAR(30) UNIQUE
   );

CREATE TABLE Customer_Waste_Collection (
   Customer_id INT,
   Waste_type_id INT,
   Waste_id INT,
   Collector_ID  INT ,
   Date_of_Collection DATE,
   Quantity FLOAT(10,2),
   Is_recyclable VARCHAR(15),
   PRIMARY KEY (Customer_id, Waste_type_id, Waste_id,Collector_ID),
   FOREIGN KEY (Customer_id) REFERENCES Customer(Customer_id),
```

```
FOREIGN KEY (Waste_type_id) REFERENCES Waste_Type(Waste_type_id),
FOREIGN KEY (Waste_id) REFERENCES Waste_Element(Waste_id),
FOREIGN KEY (Collector_ID ) REFERENCES Collection_Plant( Collector_ID )
);
```

ALL THE TABLES IN 2NF ARE IN 3NF FORM AS THERE IS NO TRANSITIVE DEPENDENCY.

Queries -

Table Creation

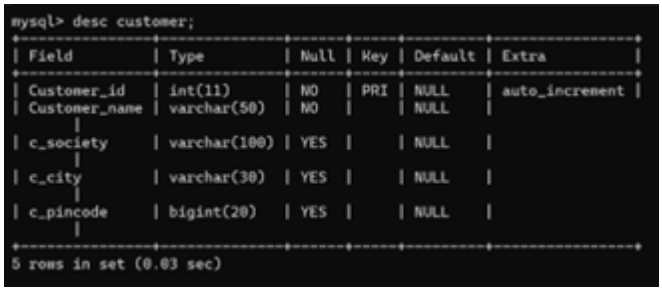
1.Create Customer table

Query:

```
CREATE TABLE Customer (
  Customer_id INT AUTO_INCREMENT PRIMARY KEY ,
  Customer_name VARCHAR(50) NOT NULL,
  c_society VARCHAR(100),
  c_city VARCHAR(30),
  c_pincode BIGINT
 );
```

Alter table customer auto_increment=1;

Output:



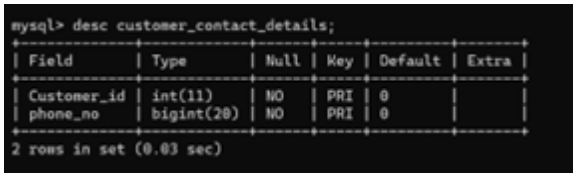
```
mysql> desc customer;
+---------------+--------------+------+-----+---------+----------------+
| Field         | Type         | Null | Key | Default | Extra          |
+---------------+--------------+------+-----+---------+----------------+
| Customer_id   | int(11)      | NO   | PRI | NULL    | auto_increment |
| Customer_name | varchar(50)  | NO   |     | NULL    |                |
| c_society     | varchar(100) | YES  |     | NULL    |                |
| c_city        | varchar(30)  | YES  |     | NULL    |                |
| c_pincode     | bigint(20)   | YES  |     | NULL    |                |
+---------------+--------------+------+-----+---------+----------------+
5 rows in set (0.03 sec)
```

2.Create Customer_contact_details table

Query:

```
CREATE TABLE Customer_contact_details (
   Customer_id INT,
   phone_no BIGINT,
   PRIMARY KEY (Customer_id, phone_no),
   FOREIGN KEY (Customer_id) REFERENCES Customer(Customer_id)
  );
```

Output:



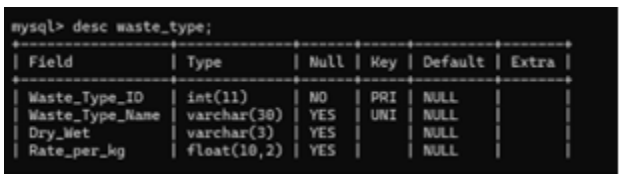
```
mysql> desc customer_contact_details;
+-------------+------------+------+-----+---------+-------+
| Field       | Type       | Null | Key | Default | Extra |
+-------------+------------+------+-----+---------+-------+
| Customer_id | int(11)    | NO   | PRI | 0       |       |
| phone_no    | bigint(20) | NO   | PRI | 0       |       |
+-------------+------------+------+-----+---------+-------+
2 rows in set (0.03 sec)
```

3. CREATE Waste_Type table

Query:

```
CREATE TABLE Waste_Type (
     Waste_Type_ID INT PRIMARY KEY,
     Waste_Type_Name VARCHAR(30) UNIQUE ,
     Dry_Wet VARCHAR(3),
     Rate_per_kg FLOAT(10,2)
   );
```

Output:



```
mysql> desc waste_type;
+-----------------+-------------+------+-----+---------+-------+
| Field           | Type        | Null | Key | Default | Extra |
+-----------------+-------------+------+-----+---------+-------+
| Waste_Type_ID   | int(11)     | NO   | PRI | NULL    |       |
| Waste_Type_Name | varchar(30) | YES  | UNI | NULL    |       |
| Dry_Wet         | varchar(3)  | YES  |     | NULL    |       |
| Rate_per_kg     | float(10,2) | YES  |     | NULL    |       |
```

4.Create Waste_Element table

Query:

```
CREATE TABLE Waste_Element (
    Waste_ID INT PRIMARY KEY,
    Waste_Name VARCHAR(30) UNIQUE
  );
```

Output:

```
mysql> desc Waste_Element;
+------------+-------------+------+-----+---------+-------+
| Field      | Type        | Null | Key | Default | Extra |
+------------+-------------+------+-----+---------+-------+
| Waste_ID   | int(11)     | NO   | PRI | NULL    |       |
| Waste_Name | varchar(30) | YES  | UNI | NULL    |       |
+------------+-------------+------+-----+---------+-------+
2 rows in set (0.01 sec)
```

5.Create Customer_Waste_Collection table

Query:

```
CREATE TABLE Customer_Waste_Collection (
        Customer_id INT,
  Waste_type_id INT,
  Waste_id INT,
  Collector_ID  INT ,
  Date_of_Collection DATE,
  Quantity FLOAT(10,2),
  Is_recyclable VARCHAR(15),
  PRIMARY KEY (Customer_id, Waste_type_id, Waste_id,Collector_ID),
  FOREIGN KEY (Customer_id) REFERENCES Customer(Customer_id),
  FOREIGN KEY (Waste_type_id) REFERENCES Waste_Type(Waste_type_id),
  FOREIGN KEY (Waste_id) REFERENCES Waste_Element(Waste_id),
  FOREIGN KEY (Collector_ID ) REFERENCES Collection_Plant( Collector_ID )
 );
```

Output:

```
mysql> desc Customer_Waste_Collection;
+--------------------+--------------+------+-----+---------+-------+
| Field              | Type         | Null | Key | Default | Extra |
+--------------------+--------------+------+-----+---------+-------+
| Customer_id        | int(11)      | NO   | PRI | 0       |       |
| Waste_type_id      | int(11)      | NO   | PRI | 0       |       |
| Waste_id           | int(11)      | NO   | PRI | 0       |       |
| Collector_ID       | int(11)      | NO   | PRI | 0       |       |
| Date_of_Collection | date         | YES  |     | NULL    |       |
| Quantity           | float(10,2)  | YES  |     | NULL    |       |
| Is_recyclable      | varchar(15)  | YES  |     | NULL    |       |
+--------------------+--------------+------+-----+---------+-------+
7 rows in set (0.01 sec)
```

6. Create Collection_Plant table

Query:

```
CREATE TABLE Collection_Plant (
   Collector_ID  INT  PRIMARY  KEY AUTO_INCREMENT,
   Collector_Name VARCHAR(50),
   Collector_Dept VARCHAR(50),
   Collection_Plant_Area VARCHAR(50),
   Collection_Plant_City VARCHAR(20)
    );
```

Output:

```
mysql> desc collection_plant;
+----------------------+-------------+------+-----+---------+----------------+
| Field                | Type        | Null | Key | Default | Extra          |
+----------------------+-------------+------+-----+---------+----------------+
| Collector_ID         | int(11)     | NO   | PRI | NULL    | auto_increment |
| Collector_Name       | varchar(50) | YES  |     | NULL    |                |
| Collector_Dept       | varchar(50) | YES  |     | NULL    |                |
| Collection_Plant_Area| varchar(50) | YES  |     | NULL    |                |
| Collection_Plant_City| varchar(20) | YES  |     | NULL    |                |
+----------------------+-------------+------+-----+---------+----------------+
5 rows in set (0.03 sec)
```

7.Create Transaction table

Query :

```
 CREATE TABLE Transaction (
    Customer_ID INT,
    Collector_ID INT,
    Transaction_date DATE,
    Status VARCHAR(50),
    Payment DECIMAL(10, 2),
    FOREIGN KEY (Customer_ID)
    REFERENCES Customer(Customer_ID)
    ON DELETE CASCADE,
   FOREIGN KEY (Collector_ID)
    REFERENCES Collection_plant(Collector_ID)
     ON DELETE CASCADE
  );
```

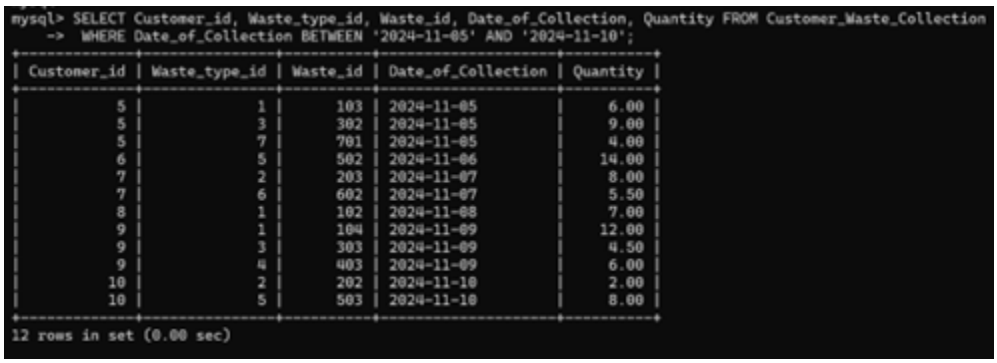
Output :

```
mysql> desc transaction;
+------------------+---------------+------+-----+---------+-------+
| Field            | Type          | Null | Key | Default | Extra |
+------------------+---------------+------+-----+---------+-------+
| Customer_ID      | int(11)       | YES  | MUL | NULL    |       |
| Collector_ID     | int(11)       | YES  | MUL | NULL    |       |
| Transaction_date | date          | YES  |     | NULL    |       |
| Status           | varchar(50)   | YES  |     | NULL    |       |
| Payment          | decimal(10,2) | YES  |     | NULL    |       |
+------------------+---------------+------+-----+---------+-------+
5 rows in set (0.04 sec)
```

8.BETWEEN Query for waste collected from 2024-11-05 to 2024-11-10

Query:
SELECT Customer_id, Waste_type_id, Waste_id, Date_of_Collection, Quantity FROM Customer_Waste_Collection
WHERE Date_of_Collection BETWEEN '2024-11-05' AND '2024-11-10';

Output:



```
mysql> SELECT Customer_id, Waste_type_id, Waste_id, Date_of_Collection, Quantity FROM Customer_Waste_Collection
    ->  WHERE Date_of_Collection BETWEEN '2024-11-05' AND '2024-11-10';
+-------------+---------------+----------+--------------------+----------+
| Customer_id | Waste_type_id | Waste_id | Date_of_Collection | Quantity |
+-------------+---------------+----------+--------------------+----------+
|           5 |             1 |      103 | 2024-11-05         |     6.00 |
|           5 |             3 |      302 | 2024-11-05         |     9.00 |
|           5 |             7 |      701 | 2024-11-05         |     4.00 |
|           6 |             5 |      502 | 2024-11-06         |    14.00 |
|           7 |             2 |      203 | 2024-11-07         |     8.00 |
|           7 |             6 |      602 | 2024-11-07         |     5.50 |
|           8 |             1 |      102 | 2024-11-08         |     7.00 |
|           9 |             1 |      104 | 2024-11-09         |    12.00 |
|           9 |             3 |      303 | 2024-11-09         |     4.50 |
|           9 |             4 |      403 | 2024-11-09         |     6.00 |
|          10 |             2 |      202 | 2024-11-10         |     2.00 |
|          10 |             5 |      503 | 2024-11-10         |     8.00 |
+-------------+---------------+----------+--------------------+----------+
12 rows in set (0.00 sec)
```

9.LIKE for customer name ending with r

Query:

SELECT Customer_id,Customer_name, c_society,c_city,c_pincode FROM Customer WHERE Customer_name LIKE '%r';

Output:

```
mysql> SELECT Customer_id,Customer_name, c_society,c_city,c_pincode FROM Customer WHERE Customer_name LIKE '%r';
+-------------+---------------+-----------------------+-----------+-----------+
| Customer_id | Customer_name | c_society             | c_city    | c_pincode |
+-------------+---------------+-----------------------+-----------+-----------+
|           1 | Rajesh Kumar  | Greenfield Apartments | Mumbai    |    400001 |
|           6 | Rohit Kapoor  | Sunshine Villas       | Mumbai    |    400002 |
|           7 | Sneha Iyer    | Orchid Residency      | Ahmedabad |    380001 |
|           9 | Meera Nair    | Royal Greens          | Jaipur    |    302001 |
|          16 | Neeraj Kumar  | Olive Heights         | Chennai   |    600002 |
+-------------+---------------+-----------------------+-----------+-----------+
5 rows in set (0.00 sec)
```

10.ORDER BY for descending order of quantity
Query:
SELECT Customer_id, Waste_type_id, Waste_id, Collector_ID, Date_of_Collection, Quantity FROM Customer_Waste_Collection ORDER BY Quantity DESC;

Output:

```
mysql> SELECT Customer_id, Waste_type_id, Waste_id, Collector_ID, Date_of_Collection, Quantity FROM Customer_Waste_Collection
    -> ORDER BY Quantity DESC;
+-------------+---------------+----------+--------------+--------------------+----------+
| Customer_id | Waste_type_id | Waste_id | Collector_ID | Date_of_Collection | Quantity |
+-------------+---------------+----------+--------------+--------------------+----------+
|           2 |             5 |      501 |            8 | 2024-11-02         |    20.00 |
|           1 |             1 |      101 |            1 | 2024-11-01         |    15.50 |
|           6 |             5 |      502 |           15 | 2024-11-06         |    14.00 |
|          12 |             1 |      101 |            4 | 2024-11-12         |    13.00 |
|           1 |             4 |      401 |            5 | 2024-11-01         |    12.00 |
|           9 |             1 |      104 |            7 | 2024-11-09         |    12.00 |
|          15 |             5 |      501 |            8 | 2024-11-15         |    12.00 |
|          17 |             1 |      102 |            3 | 2024-11-17         |    11.00 |
|          14 |             1 |      103 |            1 | 2024-11-14         |    10.00 |
|           2 |             1 |      102 |            9 | 2024-11-02         |    10.00 |
|           5 |             3 |      302 |           10 | 2024-11-05         |     9.00 |
|           3 |             6 |      601 |            6 | 2024-11-03         |     9.00 |
|          12 |             6 |      601 |            6 | 2024-11-12         |     9.00 |
|          19 |             5 |      502 |           13 | 2024-11-19         |     9.00 |
```

11.GROUP BY for quantity of recyclable and non recyclable waste
Query:
SELECT Is_recyclable, SUM(Quantity) AS Total_Quantity FROM Customer_Waste_Collection GROUP BY Is_recyclable;
Output:

```
mysql> SELECT Is_recyclable, SUM(Quantity) AS Total_Quantity FROM Customer_Waste_Collection GROUP BY Is_recyclable;
+--------------+----------------+
| Is_recyclable | Total_Quantity |
+--------------+----------------+
| No           |         108.50 |
| Yes          |         190.00 |
+--------------+----------------+
2 rows in set (0.00 sec)
```

12. Number of Waste Types Collected by Each Collector
Query:
SELECT cp.Collector_Name, COUNT(DISTINCT wc.Waste_type_id) AS Waste_Types_Handled FROM Collection_Plant cp
JOIN Customer_Waste_Collection wc ON cp.Collector_ID = wc.Collector_ID
GROUP BY cp.Collector_Name ORDER BY Waste_Types_Handled DESC;
Output:

```
mysql> SELECT cp.Collector_Name, COUNT(DISTINCT wc.Waste_type_id) AS Waste_Types_Handled FROM Collection_Plant cp
    -> JOIN Customer_Waste_Collection wc ON cp.Collector_ID = wc.Collector_ID
    -> GROUP BY cp.Collector_Name ORDER BY Waste_Types_Handled DESC;
+----------------+---------------------+
| Collector_Name | Waste_Types_Handled |
+----------------+---------------------+
| Kiran Nair     |                   3 |
| Sunil Rao      |                   2 |
| Anita Patel    |                   2 |
| Suresh Deshmukh|                   2 |
| Arun Mehta     |                   2 |
| Pavan Jain     |                   2 |
| Sangeeta Rao   |                   2 |
| Amitabh Gupta  |                   1 |
| Karan Kumar    |                   1 |
| Priya Kapoor   |                   1 |
| Rajesh Sharma  |                   1 |
| Neha Joshi     |                   1 |
| Rina Roy       |                   1 |
| Vikram Singh   |                   1 |
| Deepa Menon    |                   1 |
+----------------+---------------------+
15 rows in set (0.00 sec)
```

13.CROSS JOIN for all possible ways of customer and collector
Query:
SELECT c.Customer_id, c.Customer_name, c.c_city, cp.Collector_ID, cp.Collector_Name, cp.Collection_Plant_City FROM Customer c CROSS JOIN Collection_Plant cp;

Output:

```
mysql> SELECT c.Customer_id, c.Customer_name, c.c_city, cp.Collector_ID, cp.Collector_Name, cp.Collection_Plant_City FROM Customer c
CROSS JOIN Collection_Plant cp;
+-------------+---------------+-----------+--------------+----------------+-----------------------+
| Customer_id | Customer_name | c_city    | Collector_ID | Collector_Name | Collection_Plant_City |
+-------------+---------------+-----------+--------------+----------------+-----------------------+
|           1 | Rajesh Kumar  | Mumbai    |            1 | Rajesh Sharma  | Delhi                 |
|           1 | Rajesh Kumar  | Mumbai    |            2 | Anita Patel    | Mumbai                |
|           1 | Rajesh Kumar  | Mumbai    |            3 | Sunil Rao      | Chennai               |
|           1 | Rajesh Kumar  | Mumbai    |            4 | Priya Kapoor   | Delhi                 |
|           1 | Rajesh Kumar  | Mumbai    |            5 | Vikram Singh   | Kolkata               |
|           1 | Rajesh Kumar  | Mumbai    |            6 | Neha Joshi     | Mumbai                |
|           1 | Rajesh Kumar  | Mumbai    |            7 | Arun Mehta     | Hyderabad             |
|           1 | Rajesh Kumar  | Mumbai    |            8 | Deepa Menon    | Pune                  |
|           1 | Rajesh Kumar  | Mumbai    |            9 | Karan Kumar    | Bangalore             |
|           1 | Rajesh Kumar  | Mumbai    |           10 | Rina Roy       | Kolkata               |
|           1 | Rajesh Kumar  | Mumbai    |           11 | Amitabh Gupta  | Delhi                 |
|           1 | Rajesh Kumar  | Mumbai    |           12 | Sangeeta Rao   | Hyderabad             |
|           1 | Rajesh Kumar  | Mumbai    |           13 | Pavan Jain     | Pune                  |
|           1 | Rajesh Kumar  | Mumbai    |           14 | Kiran Nair     | Chennai               |
|           1 | Rajesh Kumar  | Mumbai    |           15 | Suresh Deshmukh| Mumbai                |
|           2 | Anita Sharma  | Delhi     |            1 | Rajesh Sharma  | Delhi                 |
|           2 | Anita Sharma  | Delhi     |            2 | Anita Patel    | Mumbai                |
|           2 | Anita Sharma  | Delhi     |            3 | Sunil Rao      | Chennai               |
|           2 | Anita Sharma  | Delhi     |            4 | Priya Kapoor   | Delhi                 |
|           2 | Anita Sharma  | Delhi     |            5 | Vikram Singh   | Kolkata               |
|           2 | Anita Sharma  | Delhi     |            6 | Neha Joshi     | Mumbai                |
|           2 | Anita Sharma  | Delhi     |            7 | Arun Mehta     | Hyderabad             |
|           2 | Anita Sharma  | Delhi     |            8 | Deepa Menon    | Pune                  |
|           2 | Anita Sharma  | Delhi     |            9 | Karan Kumar    | Bangalore             |
|           2 | Anita Sharma  | Delhi     |           10 | Rina Roy       | Kolkata               |
|           2 | Anita Sharma  | Delhi     |           11 | Amitabh Gupta  | Delhi                 |
|           2 | Anita Sharma  | Delhi     |           12 | Sangeeta Rao   | Hyderabad             |
```

14. INNER JOIN
Query:
SELECT cwc.Customer_id, c.Customer_name, cwc.Waste_type_id, cwc.Waste_id, cwc.Collector_ID, cwc.Date_of_Collection, cwc.Quantity, cwc.Is_recyclable

FROM Customer_Waste_Collection cw
INNER JOIN Customer c ON cwc.Customer_id = c.Customer_id;
Output:

```
    -> INNER JOIN Customer c ON cwc.Customer_id = c.Customer_id;
```

Customer_id	Customer_name	Waste_type_id	Waste_id	Collector_ID	Date_of_Collection	Quantity	Is_recyclable
1	Rajesh Kumar	1	101	1	2024-11-01	15.50	Yes
1	Rajesh Kumar	4	401	5	2024-11-01	12.00	Yes
2	Anita Sharma	1	102	9	2024-11-02	10.00	Yes
2	Anita Sharma	3	301	2	2024-11-02	5.00	Yes
2	Anita Sharma	5	501	8	2024-11-02	20.00	No
3	Suresh Singh	6	601	6	2024-11-03	9.00	Yes
4	Priya Mehta	2	201	3	2024-11-04	3.50	No
4	Priya Mehta	4	402	5	2024-11-04	7.00	Yes
5	Arjun Patil	1	103	1	2024-11-05	6.00	Yes
5	Arjun Patil	3	302	10	2024-11-05	9.00	Yes
5	Arjun Patil	7	701	13	2024-11-05	4.00	No
6	Rohit Kapoor	5	502	15	2024-11-06	14.00	No
7	Sneha Iyer	2	203	11	2024-11-07	8.00	No
7	Sneha Iyer	6	602	14	2024-11-07	5.50	Yes
8	Vikas Yadav	1	102	9	2024-11-08	7.00	Yes
9	Meera Nair	1	104	7	2024-11-09	12.00	Yes
9	Meera Nair	3	303	2	2024-11-09	4.50	Yes
9	Meera Nair	4	403	5	2024-11-09	6.00	Yes
10	Ravi Desai	2	202	3	2024-11-10	2.00	No
10	Ravi Desai	5	503	15	2024-11-10	8.00	No
11	Kiran Kulkarni	8	801	7	2024-11-11	1.50	No
12	Nisha Agarwal	1	101	4	2024-11-12	13.00	Yes
12	Nisha Agarwal	4	401	5	2024-11-12	3.50	Yes
12	Nisha Agarwal	6	601	6	2024-11-12	9.00	Yes
13	Amit Gupta	7	702	13	2024-11-13	5.00	No
14	Sunil Joshi	1	103	1	2024-11-14	10.00	Yes
14	Sunil Joshi	2	201	11	2024-11-14	4.00	No
15	Pooja Reddy	3	301	10	2024-11-15	7.00	Yes
15	Pooja Reddy	4	403	14	2024-11-15	2.50	Yes

15. MULTIPLE INNER JOIN
Query: SELECT c.Customer_name, wt.Waste_Type_Name, we.Waste_Name, cp.Collector_Name, cwc.Date_of_Collection, cwc.Quantity, cwc.Is_recyclable
FROM Customer_Waste_Collection cwc
INNER JOIN Customer c ON cwc.Customer_id = c.Customer_id
INNER JOIN Waste_Type wt ON cwc.Waste_type_id = wt.Waste_Type_ID
INNER JOIN Waste_Element we ON cwc.Waste_id = we.Waste_ID
INNER JOIN Collection_Plant cp ON cwc.Collector_ID = cp.Collector_ID;
Output:

```
    -> INNER JOIN Collection_Plant cp ON cwc.Collector_ID = cp.Collector_ID;
+---------------+---------------------+---------------------+----------------+--------------------+----------+---------------+
| Customer_name | Waste_Type_Name     | Waste_Name          | Collector_Name | Date_of_Collection | Quantity | Is_recyclable |
+---------------+---------------------+---------------------+----------------+--------------------+----------+---------------+
| Rajesh Kumar  | Municipal Solid Waste | Plastic Bottles   | Rajesh Sharma  | 2024-11-01         |    15.50 | Yes           |
| Arjun Patil   | Municipal Solid Waste | Cardboard         | Rajesh Sharma  | 2024-11-05         |     6.00 | Yes           |
| Sunil Joshi   | Municipal Solid Waste | Cardboard         | Rajesh Sharma  | 2024-11-14         |    10.00 | Yes           |
| Anita Sharma  | E-Waste             | Old Computers       | Anita Patel    | 2024-11-02         |     5.00 | Yes           |
| Meera Nair    | E-Waste             | TV Sets             | Anita Patel    | 2024-11-09         |     4.50 | Yes           |
| Vijay Rao     | Hazardous Waste     | Medical Waste       | Anita Patel    | 2024-11-18         |     5.00 | No            |
| Priya Mehta   | Hazardous Waste     | Used Batteries      | Sunil Rao      | 2024-11-04         |     3.50 | No            |
| Ravi Desai    | Hazardous Waste     | Medical Waste       | Sunil Rao      | 2024-11-10         |     2.00 | No            |
| Divya Pandey  | Municipal Solid Waste | Food Waste        | Sunil Rao      | 2024-11-17         |    11.00 | Yes           |
| Nisha Agarwal | Municipal Solid Waste | Plastic Bottles   | Priya Kapoor   | 2024-11-12         |    13.00 | Yes           |
| Vijay Rao     | Municipal Solid Waste | Plastic Bottles   | Priya Kapoor   | 2024-11-18         |     8.00 | Yes           |
| Rajesh Kumar  | Organic Waste       | Vegetable Peels     | Vikram Singh   | 2024-11-01         |    12.00 | Yes           |
| Priya Mehta   | Organic Waste       | Garden Waste        | Vikram Singh   | 2024-11-04         |     7.00 | Yes           |
| Meera Nair    | Organic Waste       | Fruit Scraps        | Vikram Singh   | 2024-11-09         |     6.00 | Yes           |
| Nisha Agarwal | Organic Waste       | Vegetable Peels     | Vikram Singh   | 2024-11-12         |     3.50 | Yes           |
| Suresh Singh  | Plastic Waste       | Plastic Bags        | Neha Joshi     | 2024-11-03         |     9.00 | Yes           |
| Nisha Agarwal | Plastic Waste       | Plastic Bags        | Neha Joshi     | 2024-11-12         |     9.00 | Yes           |
| Meera Nair    | Municipal Solid Waste | Glass Bottles     | Arun Mehta     | 2024-11-09         |    12.00 | Yes           |
| Kiran Kulkarni | Radioactive Waste  | Nuclear Waste       | Arun Mehta     | 2024-11-11         |     1.50 | No            |
| Divya Pandey  | Radioactive Waste   | Contaminated Equipment | Arun Mehta  | 2024-11-17         |     6.50 | No            |
| Anita Sharma  | Demolition Waste    | Concrete            | Deepa Menon    | 2024-11-02         |    20.00 | No            |
| Pooja Reddy   | Demolition Waste    | Concrete            | Deepa Menon    | 2024-11-15         |    12.00 | No            |
| Anita Sharma  | Municipal Solid Waste | Food Waste        | Karan Kumar    | 2024-11-02         |    10.00 | Yes           |
| Vikas Yadav   | Municipal Solid Waste | Food Waste        | Karan Kumar    | 2024-11-08         |     7.00 | Yes           |
| Arjun Patil   | E-Waste             | Mobile Phones       | Rina Roy       | 2024-11-05         |     9.00 | Yes           |
| Pooja Reddy   | E-Waste             | Old Computers       | Rina Roy       | 2024-11-15         |     7.00 | Yes           |
| Sneha Iyer    | Hazardous Waste     | Paint Cans          | Amitabh Gupta  | 2024-11-07         |     8.00 | No            |
| Sunil Joshi   | Hazardous Waste     | Used Batteries      | Amitabh Gupta  | 2024-11-14         |     4.00 | No            |
| Neeraj Kumar  | Organic Waste       | Garden Waste        | Sangeeta Rao   | 2024-11-16         |     5.00 | Yes           |
```

16. LEFT JOIN

Query:

```
SELECT c.Customer_id, c.Customer_name, c.c_city, cwc.Waste_type_id,
cwc.Quantity
FROM Customer c
LEFT JOIN Customer_Waste_Collection cwc ON c.Customer_id =
cwc.Customer_id;
```

Output:

```
    ->
    -> LEFT JOIN Customer_Waste_Collection cwc ON c.Customer_id = cwc.Customer_id;
+-------------+---------------+------------+---------------+----------+
| Customer_id | Customer_name | c_city     | Waste_type_id | Quantity |
+-------------+---------------+------------+---------------+----------+
|           1 | Rajesh Kumar  | Mumbai     |             1 |    15.50 |
|           1 | Rajesh Kumar  | Mumbai     |             4 |    12.00 |
|           2 | Anita Sharma  | Delhi      |             1 |    10.00 |
|           2 | Anita Sharma  | Delhi      |             3 |     5.00 |
|           2 | Anita Sharma  | Delhi      |             5 |    20.00 |
|           3 | Suresh Singh  | Bangalore  |             6 |     9.00 |
|           4 | Priya Mehta   | Pune       |             2 |     3.50 |
|           4 | Priya Mehta   | Pune       |             4 |     7.00 |
|           5 | Arjun Patil   | Pune       |             1 |     6.00 |
|           5 | Arjun Patil   | Pune       |             3 |     9.00 |
|           5 | Arjun Patil   | Pune       |             7 |     4.00 |
|           6 | Rohit Kapoor  | Mumbai     |             5 |    14.00 |
|           7 | Sneha Iyer    | Ahmedabad  |             2 |     8.00 |
|           7 | Sneha Iyer    | Ahmedabad  |             6 |     5.50 |
|           8 | Vikas Yadav   | Ahmedabad  |             1 |     7.00 |
|           9 | Meera Nair    | Jaipur     |             1 |    12.00 |
|           9 | Meera Nair    | Jaipur     |             3 |     4.50 |
|           9 | Meera Nair    | Jaipur     |             4 |     6.00 |
|          10 | Ravi Desai    | Jaipur     |             2 |     2.00 |
|          10 | Ravi Desai    | Jaipur     |             5 |     8.00 |
|          11 | Kiran Kulkarni | Lucknow   |             8 |     1.50 |
|          12 | Nisha Agarwal | Kanpur     |             1 |    13.00 |
|          12 | Nisha Agarwal | Kanpur     |             4 |     3.50 |
|          12 | Nisha Agarwal | Kanpur     |             6 |     9.00 |
|          13 | Amit Gupta    | Surat      |             7 |     5.00 |
|          14 | Sunil Joshi   | Indore     |             1 |    10.00 |
|          14 | Sunil Joshi   | Indore     |             2 |     4.00 |
```

17.RIGHT JOIN

Query:

```
SELECT c.Customer_id, c.Customer_name, c.c_city, cwc.Waste_type_id,
cwc.Quantity
FROM Customer c
RIGHT JOIN Customer_Waste_Collection cwc ON c.Customer_id =
cwc.Customer_id;
```

Output:

```
    -> RIGHT JOIN Customer_Waste_Collection cwc ON c.Customer_id = cwc.Customer_id;
+-------------+---------------+------------+---------------+----------+
| Customer_id | Customer_name | c_city     | Waste_type_id | Quantity |
+-------------+---------------+------------+---------------+----------+
|           1 | Rajesh Kumar  | Mumbai     |             1 |    15.50 |
|           1 | Rajesh Kumar  | Mumbai     |             4 |    12.00 |
|           2 | Anita Sharma  | Delhi      |             1 |    10.00 |
|           2 | Anita Sharma  | Delhi      |             3 |     5.00 |
|           2 | Anita Sharma  | Delhi      |             5 |    20.00 |
|           3 | Suresh Singh  | Bangalore  |             6 |     9.00 |
|           4 | Priya Mehta   | Pune       |             2 |     3.50 |
|           4 | Priya Mehta   | Pune       |             4 |     7.00 |
|           5 | Arjun Patil   | Pune       |             1 |     6.00 |
|           5 | Arjun Patil   | Pune       |             3 |     9.00 |
|           5 | Arjun Patil   | Pune       |             7 |     4.00 |
|           6 | Rohit Kapoor  | Mumbai     |             5 |    14.00 |
|           7 | Sneha Iyer    | Ahmedabad  |             2 |     8.00 |
|           7 | Sneha Iyer    | Ahmedabad  |             6 |     5.50 |
|           8 | Vikas Yadav   | Ahmedabad  |             1 |     7.00 |
|           9 | Meera Nair    | Jaipur     |             1 |    12.00 |
|           9 | Meera Nair    | Jaipur     |             3 |     4.50 |
|           9 | Meera Nair    | Jaipur     |             4 |     6.00 |
|          10 | Ravi Desai    | Jaipur     |             2 |     2.00 |
|          10 | Ravi Desai    | Jaipur     |             5 |     8.00 |
|          11 | Kiran Kulkarni | Lucknow   |             8 |     1.50 |
|          12 | Nisha Agarwal | Kanpur     |             1 |    13.00 |
|          12 | Nisha Agarwal | Kanpur     |             4 |     3.50 |
|          12 | Nisha Agarwal | Kanpur     |             6 |     9.00 |
|          13 | Amit Gupta    | Surat      |             7 |     5.00 |
|          14 | Sunil Joshi   | Indore     |             1 |    10.00 |
|          14 | Sunil Joshi   | Indore     |             2 |     4.00 |
|          15 | Pooja Reddy   | Chennai    |             3 |     7.00 |
|          15 | Pooja Reddy   | Chennai    |             4 |     2.50 |
```

18.SUB QUERY for displaying waste name whose rate is less than quantity

Query:

```
SELECT Waste_Type_Name, Rate_per_kg
FROM Waste_Type
 WHERE Rate_per_kg < ANY (
SELECT Quantity
FROM Customer_Waste_Collection);
```

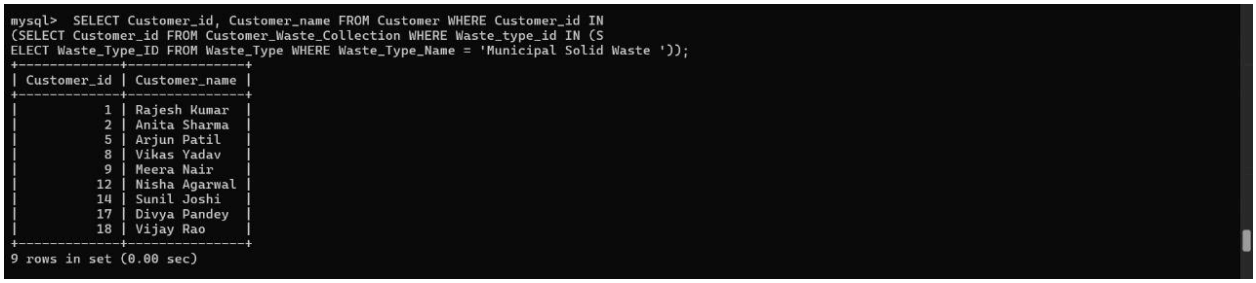
Output:

```
mysql> SELECT Waste_Type_Name, Rate_per_kg
    ->
    -> FROM Waste_Type
    ->
    -> WHERE Rate_per_kg < ANY (
    ->
    ->     SELECT Quantity
    ->
    ->     FROM Customer_Waste_Collection
    ->
    -> );
+----------------------+-------------+
| Waste_Type_Name      | Rate_per_kg |
+----------------------+-------------+
| Municipal Solid Waste |        5.00 |
| Organic Waste        |        2.50 |
| Demolition Waste     |       12.00 |
| Plastic Waste        |        3.00 |
+----------------------+-------------+
4 rows in set (0.01 sec)
```

19. IN connector
Query:

```
SELECT Customer_id, Customer_name
FROM Customer
WHERE Customer_id IN (
 SELECT Customer_id FROM Customer_Waste_Collection
 WHERE Waste_type_id IN (
SELECT Waste_Type_ID  FROM Waste_Type
 WHERE Waste_Type_Name = ' Municipal Solid Waste '  )
);
```

Output:



```
mysql>  SELECT Customer_id, Customer_name FROM Customer WHERE Customer_id IN
(SELECT Customer_id FROM Customer_Waste_Collection WHERE Waste_type_id IN (S
ELECT Waste_Type_ID FROM Waste_Type WHERE Waste_Type_Name = 'Municipal Solid Waste '));
+-------------+---------------+
| Customer_id | Customer_name |
+-------------+---------------+
|           1 | Rajesh Kumar  |
|           2 | Anita Sharma  |
|           5 | Arjun Patil   |
|           8 | Vikas Yadav   |
|           9 | Meera Nair    |
|          12 | Nisha Agarwal |
|          14 | Sunil Joshi   |
|          17 | Divya Pandey  |
|          18 | Vijay Rao     |
+-------------+---------------+
9 rows in set (0.00 sec)
```

20.

```
SELECT Customer_id, Customer_name
FROM Customer
WHERE EXISTS (
        SELECT 1
        FROM Customer_Waste_Collection
        WHERE Customer.Customer_id =
Customer_Waste_Collection.Customer_id
);
```

Output:

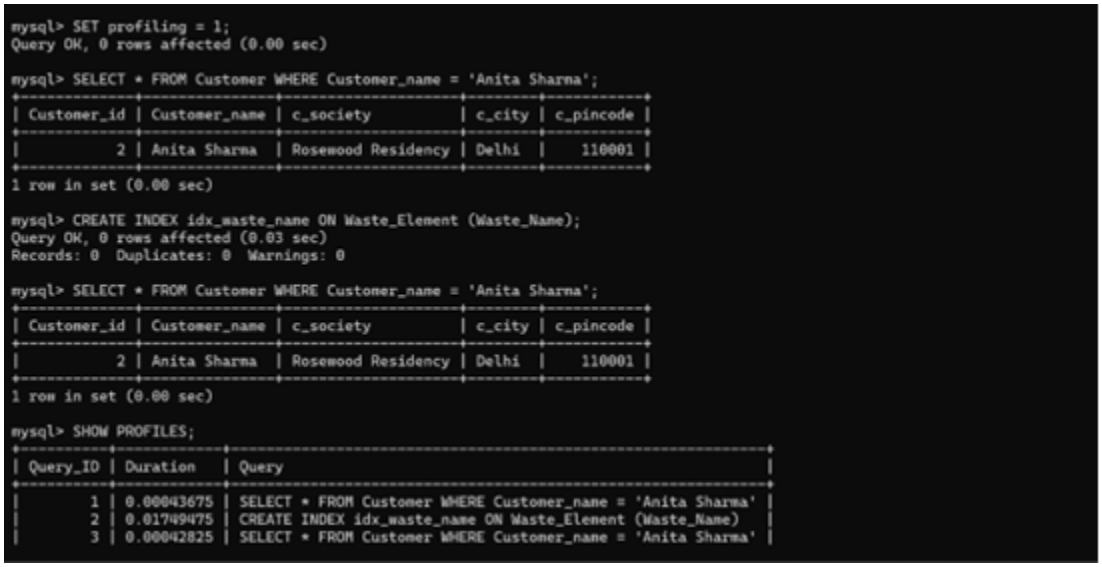
```
    -> WHERE EXISTS (
    ->
    ->     SELECT 1
    ->
    ->     FROM Customer_Waste_Collection
    ->
    ->     WHERE Customer.Customer_id = Customer_Waste_Collection.Customer_id
    ->
    -> );
+-------------+----------------+
| Customer_id | Customer_name  |
+-------------+----------------+
|           1 | Rajesh Kumar   |
|           2 | Anita Sharma   |
|           3 | Suresh Singh   |
|           4 | Priya Mehta    |
|           5 | Arjun Patil    |
|           6 | Rohit Kapoor   |
|           7 | Sneha Iyer     |
|           8 | Vikas Yadav    |
|           9 | Meera Nair     |
|          10 | Ravi Desai     |
|          11 | Kiran Kulkarni |
|          12 | Nisha Agarwal  |
|          13 | Amit Gupta     |
|          14 | Sunil Joshi    |
|          15 | Pooja Reddy    |
|          16 | Neeraj Kumar   |
|          17 | Divya Pandey   |
|          18 | Vijay Rao      |
|          19 | Snehal Shah    |
|          20 | Asha Menon     |
```

21.Create INDEX

Query:

```
SET profiling = 1;
SELECT * FROM Customer WHERE Customer_name = 'Anita Sharma';
CREATE INDEX idx_waste_name ON Waste_Element (Waste_Name);
SELECT * FROM Customer WHERE Customer_name = 'Anita Sharma';
SHOW PROFILES;
```

Output:



```
mysql> SET profiling = 1;
Query OK, 0 rows affected (0.00 sec)

mysql> SELECT * FROM Customer WHERE Customer_name = 'Anita Sharma';
+-------------+---------------+-------------------+--------+------------+
| Customer_id | Customer_name | c_society         | c_city | c_pincode |
+-------------+---------------+-------------------+--------+------------+
|           2 | Anita Sharma  | Rosemood Residency | Delhi  |    110001 |
+-------------+---------------+-------------------+--------+------------+
1 row in set (0.00 sec)

mysql> CREATE INDEX idx_waste_name ON Waste_Element (Waste_Name);
Query OK, 0 rows affected (0.03 sec)
Records: 0  Duplicates: 0  Warnings: 0

mysql> SELECT * FROM Customer WHERE Customer_name = 'Anita Sharma';
+-------------+---------------+-------------------+--------+------------+
| Customer_id | Customer_name | c_society         | c_city | c_pincode |
+-------------+---------------+-------------------+--------+------------+
|           2 | Anita Sharma  | Rosemood Residency | Delhi  |    110001 |
+-------------+---------------+-------------------+--------+------------+
1 row in set (0.00 sec)

mysql> SHOW PROFILES;
+----------+------------+-----------------------------------------------------------------+
| Query_ID | Duration   | Query                                                           |
+----------+------------+-----------------------------------------------------------------+
|        1 | 0.00043675 | SELECT * FROM Customer WHERE Customer_name = 'Anita Sharma'     |
|        2 | 0.01749475 | CREATE INDEX idx_waste_name ON Waste_Element (Waste_Name)       |
|        3 | 0.00042825 | SELECT * FROM Customer WHERE Customer_name = 'Anita Sharma'     |
```

22.Create VIEW
Query:

```
CREATE VIEW CustomerWasteDetails AS
SELECT c.Customer_id, c.Customer_name, wt.Waste_Type_Name,
we.Waste_Name, cp.Collector_Name, cwc.Date_of_Collection, cwc.Quantity,
cwc.Is_recyclable
FROM Customer_Waste_Collection cwc
JOIN Customer c ON c.Customer_id = cwc.Customer_id
JOIN Waste_Type wt ON cwc.Waste_type_id = wt.Waste_Type_ID
JOIN Waste_Element we ON cwc.Waste_id = we.Waste_ID
JOIN Collection_Plant cp ON cwc.Collector_ID = cp.Collector_ID;
```

Output:

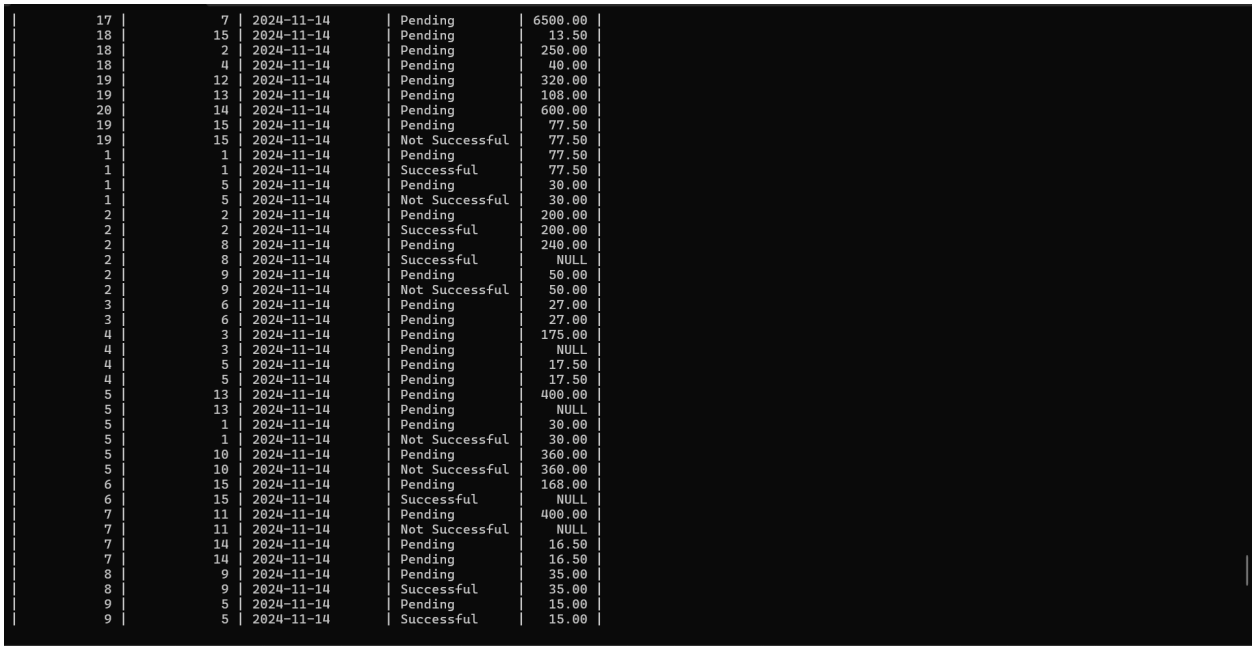
```
mysql> SELECT * FROM CustomerWasteDetails;
+-------------+---------------+-----------------+-----------------+----------------+-----------------+----------+---------------+
| Customer_id | Customer_name | Waste_Type_Name | Waste_Name      | Collector_Name | Date_of_Collection | Quantity | Is_recyclable |
+-------------+---------------+-----------------+-----------------+----------------+-----------------+----------+---------------+
|           5 | Arjun Patil   | Biomedical Waste | Syringes        | Pavan Jain     | 2024-11-05      |     4.00 | No            |
|          20 | Asha Menon    | Biomedical Waste | Syringes        | Kiran Nair     | 2024-11-20      |     6.00 | No            |
|          13 | Amit Gupta    | Biomedical Waste | Bandages        | Pavan Jain     | 2024-11-13      |     5.00 | No            |
|           2 | Anita Sharma  | Demolition Waste | Concrete        | Deepa Menon    | 2024-11-02      |    20.00 | No            |
|          15 | Pooja Reddy   | Demolition Waste | Concrete        | Deepa Menon    | 2024-11-15      |    12.00 | No            |
|           6 | Rohit Kapoor  | Demolition Waste | Bricks          | Suresh Deshmukh | 2024-11-06      |    14.00 | No            |
|          19 | Snehal Shah   | Demolition Waste | Bricks          | Pavan Jain     | 2024-11-19      |     9.00 | No            |
|          10 | Ravi Desai    | Demolition Waste | Wood Scraps     | Suresh Deshmukh | 2024-11-10      |     8.00 | No            |
|           2 | Anita Sharma  | E-Waste         | Old Computers   | Anita Patel    | 2024-11-02      |     5.00 | Yes           |
|          15 | Pooja Reddy   | E-Waste         | Old Computers   | Rina Roy       | 2024-11-15      |     7.00 | Yes           |
|           5 | Arjun Patil   | E-Waste         | Mobile Phones   | Rina Roy       | 2024-11-05      |     9.00 | Yes           |
|          19 | Snehal Shah   | E-Waste         | Mobile Phones   | Sangeeta Rao   | 2024-11-19      |     8.00 | Yes           |
|           9 | Meera Nair    | E-Waste         | TV Sets         | Anita Patel    | 2024-11-09      |     4.50 | Yes           |
|           4 | Priya Mehta   | Hazardous Waste | Used Batteries  | Sunil Rao      | 2024-11-04      |     3.50 | No            |
|          14 | Sunil Joshi   | Hazardous Waste | Used Batteries  | Amitabh Gupta  | 2024-11-14      |     4.00 | No            |
|          10 | Ravi Desai    | Hazardous Waste | Medical Waste   | Sunil Rao      | 2024-11-10      |     2.00 | No            |
|          18 | Vijay Rao     | Hazardous Waste | Medical Waste   | Anita Patel    | 2024-11-18      |     5.00 | No            |
|           7 | Sneha Iyer    | Hazardous Waste | Paint Cans      | Amitabh Gupta  | 2024-11-07      |     8.00 | No            |
|           1 | Rajesh Kumar  | Municipal Solid Waste | Plastic Bottles | Rajesh Sharma | 2024-11-01      |    15.50 | Yes           |
|          12 | Nisha Agarwal | Municipal Solid Waste | Plastic Bottles | Priya Kapoor   | 2024-11-12      |    13.00 | Yes           |
|          18 | Vijay Rao     | Municipal Solid Waste | Plastic Bottles | Priya Kapoor   | 2024-11-18      |     8.00 | Yes           |
|           2 | Anita Sharma  | Municipal Solid Waste | Food Waste      | Karan Kumar    | 2024-11-02      |    10.00 | Yes           |
|           8 | Vikas Yadav   | Municipal Solid Waste | Food Waste      | Karan Kumar    | 2024-11-08      |     7.00 | Yes           |
|          17 | Divya Pandey  | Municipal Solid Waste | Food Waste      | Sunil Rao      | 2024-11-17      |    11.00 | Yes           |
|           5 | Arjun Patil   | Municipal Solid Waste | Cardboard       | Rajesh Sharma  | 2024-11-05      |     6.00 | Yes           |
|          14 | Sunil Joshi   | Municipal Solid Waste | Cardboard       | Rajesh Sharma  | 2024-11-14      |    10.00 | Yes           |
|           9 | Meera Nair    | Municipal Solid Waste | Glass Bottles   | Arun Mehta     | 2024-11-09      |    12.00 | Yes           |
|           1 | Rajesh Kumar  | Organic Waste   | Vegetable Peels | Vikram Singh   | 2024-11-01      |    12.00 | Yes           |
|          12 | Nisha Agarwal | Organic Waste   | Vegetable Peels | Vikram Singh   | 2024-11-12      |     3.50 | Yes           |
|           4 | Priya Mehta   | Organic Waste   | Garden Waste    | Vikram Singh   | 2024-11-04      |     7.00 | Yes           |
|          16 | Neeraj Kumar  | Organic Waste   | Garden Waste    | Sangeeta Rao   | 2024-11-16      |     5.00 | Yes           |
|           9 | Meera Nair    | Organic Waste   | Fruit Scraps    | Vikram Singh   | 2024-11-09      |     6.00 | Yes           |
|          15 | Pooja Reddy   | Organic Waste   | Fruit Scraps    | Kiran Nair     | 2024-11-15      |     2.50 | Yes           |
|           3 | Suresh Singh  | Plastic Waste   | Plastic Bags    | Neha Joshi     | 2024-11-03      |     9.00 | Yes           |
|          12 | Nisha Agarwal | Plastic Waste   | Plastic Bags    | Neha Joshi     | 2024-11-12      |     9.00 | Yes           |
|           7 | Sneha Iyer    | Plastic Waste   | Single-use Plastics | Kiran Nair | 2024-11-07      |     5.50 | Yes           |
|          18 | Vijay Rao     | Plastic Waste   | Single-use Plastics | Suresh Deshmukh | 2024-11-18      |     4.50 | Yes           |
```

23.TRIGGER for details to be in transaction table

Query:

```
DELIMITER //

CREATE TRIGGER after_waste_collection_insert
AFTER INSERT ON Customer_Waste_Collection
FOR EACH ROW
BEGIN
  DECLARE payment_amount FLOAT(10,2);
  DECLARE transaction_status VARCHAR(50);

  -- Call the daily_bill_generation stored procedure to calculate payment
  CALL daily_bill_generation(NEW.Customer_id, NEW.Collector_ID,
payment_amount);

  -- Randomly assign a transaction status
  SET transaction_status = CASE FLOOR(RAND() * 3)
    WHEN 0 THEN 'Pending'
    WHEN 1 THEN 'Successful'
    WHEN 2 THEN 'Not Successful'
  END;

  -- Insert the generated payment and status into the Transaction table
  INSERT INTO Transaction (Customer_ID, Collector_ID, Transaction_date,
Status, Payment)
  VALUES (NEW.Customer_id, NEW.Collector_ID, NOW(), transaction_status,
payment_amount);

END//

DELIMITER ;
```

OUTPUT



17	7	2024-11-14	Pending	6500.00
18	15	2024-11-14	Pending	13.50
18	2	2024-11-14	Pending	250.00
18	4	2024-11-14	Pending	40.00
19	12	2024-11-14	Pending	320.00
19	13	2024-11-14	Pending	108.00
20	14	2024-11-14	Pending	600.00
19	15	2024-11-14	Pending	77.50
19	15	2024-11-14	Not Successful	77.50
1	1	2024-11-14	Pending	77.50
1	1	2024-11-14	Successful	77.50
1	5	2024-11-14	Pending	30.00
1	5	2024-11-14	Not Successful	30.00
2	2	2024-11-14	Pending	200.00
2	2	2024-11-14	Successful	200.00
2	8	2024-11-14	Pending	240.00
2	8	2024-11-14	Successful	NULL
2	9	2024-11-14	Pending	50.00
2	9	2024-11-14	Not Successful	50.00
3	6	2024-11-14	Pending	27.00
3	6	2024-11-14	Pending	27.00
4	3	2024-11-14	Pending	175.00
4	3	2024-11-14	Pending	NULL
4	5	2024-11-14	Pending	17.50
4	5	2024-11-14	Pending	17.50
5	13	2024-11-14	Pending	400.00
5	13	2024-11-14	Pending	NULL
5	1	2024-11-14	Pending	30.00
5	1	2024-11-14	Not Successful	30.00
5	10	2024-11-14	Pending	360.00
5	10	2024-11-14	Not Successful	360.00
6	15	2024-11-14	Pending	168.00
6	15	2024-11-14	Successful	NULL
7	11	2024-11-14	Pending	400.00
7	11	2024-11-14	Not Successful	NULL
7	14	2024-11-14	Pending	16.50
7	14	2024-11-14	Pending	16.50
8	9	2024-11-14	Pending	35.00
8	9	2024-11-14	Successful	35.00
9	5	2024-11-14	Pending	15.00
9	5	2024-11-14	Successful	15.00

24.PROCEDURE for daily bill generation
Query:

```
DELIMITER //

CREATE PROCEDURE daily_bill_generation(
        IN customerId INT,
        IN collectorId INT,
        OUT pay FLOAT(10,2)
)
BEGIN
        DECLARE quantity_pay FLOAT(10,2);

        -- Calculate the payment only for specified customer and collector
        SELECT SUM(cwc.Quantity * w.Rate_per_kg) INTO quantity_pay
        FROM Customer_Waste_Collection cwc
        JOIN Waste_Type w ON cwc.Waste_type_id = w.Waste_type_id
        WHERE cwc.Customer_id = customerId
        AND cwc.Collector_ID = collectorId
        AND cwc.Is_recyclable = 'yes';

        SET pay = quantity_pay;
```

```
END//

DELIMITER ;
```

Output for trigger and procedure :

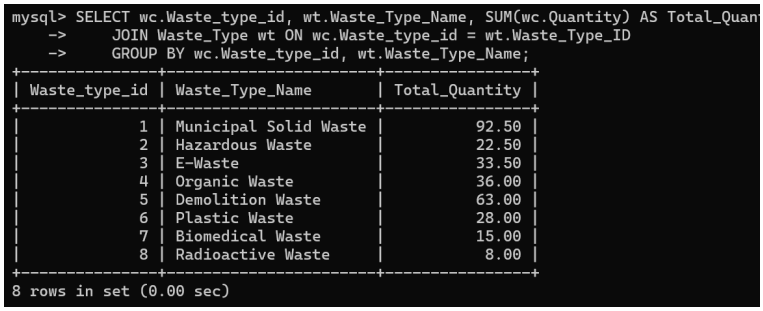
25.GROUP BY
Query:

SELECT wc.Waste_type_id, wt.Waste_Type_Name, SUM(wc.Quantity) AS Total_Quantity FROM Customer_Waste_Collection wc

JOIN Waste_Type wt ON wc.Waste_type_id = wt.Waste_Type_ID

GROUP BY wc.Waste_type_id, wt.Waste_Type_Name;

Output:



```
mysql> SELECT wc.Waste_type_id, wt.Waste_Type_Name, SUM(wc.Quantity) AS Total_Quant
    ->     JOIN Waste_Type wt ON wc.Waste_type_id = wt.Waste_Type_ID
    ->     GROUP BY wc.Waste_type_id, wt.Waste_Type_Name;
+---------------+----------------------+----------------+
| Waste_type_id | Waste_Type_Name      | Total_Quantity |
+---------------+----------------------+----------------+
|             1 | Municipal Solid Waste |          92.50 |
|             2 | Hazardous Waste      |          22.50 |
|             3 | E-Waste              |          33.50 |
|             4 | Organic Waste        |          36.00 |
|             5 | Demolition Waste     |          63.00 |
|             6 | Plastic Waste        |          28.00 |
|             7 | Biomedical Waste     |          15.00 |
|             8 | Radioactive Waste    |           8.00 |
+---------------+----------------------+----------------+
8 rows in set (0.00 sec)
```

26.GROUP BY
Query:

SELECT Collector_ID, SUM(Quantity) AS Total_Quantity FROM Customer_Waste_Collection WHERE Date_of_Collection BETWEEN '2024-11-01' AND '2024-11-10' GROUP BY Collector_ID;

Output:

```
+--------------+----------------------+----------------+
8 rows in set (0.00 sec)

mysql> SELECT Collector_ID, SUM(Quantity) AS Total_Quantity FROM Customer_Waste_Collection WHERE Date_of_Collection BETWEEN '2024-11-
01' AND '2024-11-10' GROUP BY Collector_ID;
+--------------+----------------+
| Collector_ID | Total_Quantity |
+--------------+----------------+
|            1 |          21.50 |
|            2 |           9.50 |
|            3 |           5.50 |
|            5 |          25.00 |
|            6 |           9.00 |
|            7 |          12.00 |
|            8 |          20.00 |
|            9 |          17.00 |
|           10 |           9.00 |
|           11 |           8.00 |
|           13 |           4.00 |
|           14 |           5.50 |
|           15 |          22.00 |
+--------------+----------------+
13 rows in set (0.00 sec)
```

27.ORDER BY ,LIMIT,ORDER BY
Query:

SELECT c.Customer_id, c.Customer_name, SUM(wc.Quantity) AS Total_Quantity_Collected FROM Customer c

-> JOIN Customer_Waste_Collection wc ON c.Customer_id = wc.Customer_id

-> GROUP BY c.Customer_id, c.Customer_name

-> ORDER BY Total_Quantity_Collected DESC LIMIT 5;

Output:

```
mysql> SELECT c.Customer_id, c.Customer_name, SUM(wc.Quantity) AS Total_Quantity_Collected FROM Customer c
    ->      JOIN Customer_Waste_Collection wc ON c.Customer_id = wc.Customer_id
    ->     GROUP BY c.Customer_id, c.Customer_name
    ->     ORDER BY Total_Quantity_Collected DESC LIMIT 5;
+-------------+---------------+--------------------------+
| Customer_id | Customer_name | Total_Quantity_Collected |
+-------------+---------------+--------------------------+
|           2 | Anita Sharma  |                    35.00 |
|           1 | Rajesh Kumar  |                    27.50 |
|          12 | Nisha Agarwal |                    25.50 |
|           9 | Meera Nair    |                    22.50 |
|          15 | Pooja Reddy   |                    21.50 |
+-------------+---------------+--------------------------+
5 rows in set (0.00 sec)
```