import pandas as pd

from sklearn.ensemble import GradientBoostingRegressor

import itertools

import matplotlib.pyplot as plt

# Load dataset

file\_path = r" "

df = pd.read\_csv(file\_path)

# View the first few rows to ensure the dataset is loaded correctly

print(df.head())

# Assume the dataset contains 'Dose (mol%)', 'Concentration', 'Temperature', and 'Response' columns

# Adjust column names if necessary

X = df[['Dose (mol%)', 'Concentration', 'Temperature']] # Features

y = df['Response'] # Target variable (Response)

# Train the Gradient Boosting model

model = GradientBoostingRegressor()

model.fit(X, y)

# Generate all combinations of 'Dose (mol%)' and 'Temperature' using itertools.product

dose\_values = [0, 2, 5, 7, 10]

temperature\_values = [25, 100, 150, 200, 250]

new\_data = pd.DataFrame(

itertools.product(dose\_values, temperature\_values),

columns=['Dose (mol%)', 'Temperature']

)

new\_data['Concentration'] = 100 # Set concentration to 100 for all samples

# Ensure the feature column order matches the training order

new\_data = new\_data[['Dose (mol%)', 'Concentration', 'Temperature']]

# Make predictions

predictions = model.predict(new\_data)

# Print formatted prediction results

for i, (dose, temp, prediction) in enumerate(zip(new\_data['Dose (mol%)'], new\_data['Temperature'], predictions)):

print(f"Dose: {dose} mol%, Temperature: {temp}°C, Predicted Response: {prediction:.4f}")