In [83]:

```
#importing the library
import numpy as np
import pandas as pd
from sklearn.model_selection import train_test_split
from sklearn.linear_model import LinearRegression
import matplotlib.pyplot as plt
import seaborn as sns
```

In [84]:

```
df = pd.read_csv('airquality.csv')
df
```

Out[84]:

	Unnamed: 0	Ozone	Solar.R	Wind	Temp	Month	Day
0	1	41.0	190.0	7.4	67	5	1
1	2	36.0	118.0	8.0	72	5	2
2	3	12.0	149.0	12.6	74	5	3
3	4	18.0	313.0	11.5	62	5	4
4	5	NaN	NaN	14.3	56	5	5
...	...	...	...	...	...	...	...
148	149	30.0	193.0	6.9	70	9	26
149	150	NaN	145.0	13.2	77	9	27
150	151	14.0	191.0	14.3	75	9	28
151	152	18.0	131.0	8.0	76	9	29
152	153	20.0	223.0	11.5	68	9	30

153 rows × 7 columns

In [85]:

```
#dropping the unnamed column
df= df.drop(labels = ['Unnamed: 0'],axis=1)
df
```

Out[85]:

	Ozone	Solar.R	Wind	Temp	Month	Day
0	41.0	190.0	7.4	67	5	1
1	36.0	118.0	8.0	72	5	2
2	12.0	149.0	12.6	74	5	3
3	18.0	313.0	11.5	62	5	4
4	NaN	NaN	14.3	56	5	5
...	...	...	...	...	...	...
148	30.0	193.0	6.9	70	9	26
149	NaN	145.0	13.2	77	9	27
150	14.0	191.0	14.3	75	9	28
151	18.0	131.0	8.0	76	9	29
152	20.0	223.0	11.5	68	9	30

153 rows × 6 columns

In [86]:

```
#calculating the null values
df.isnull().sum()
```

Out[86]:

```
Ozone      37
Solar.R     7
Wind        0
Temp        0
Month       0
Day         0
dtype: int64
```

In [87]:

```
column_means= df.mean()
df = df.fillna(column_means)
df
```

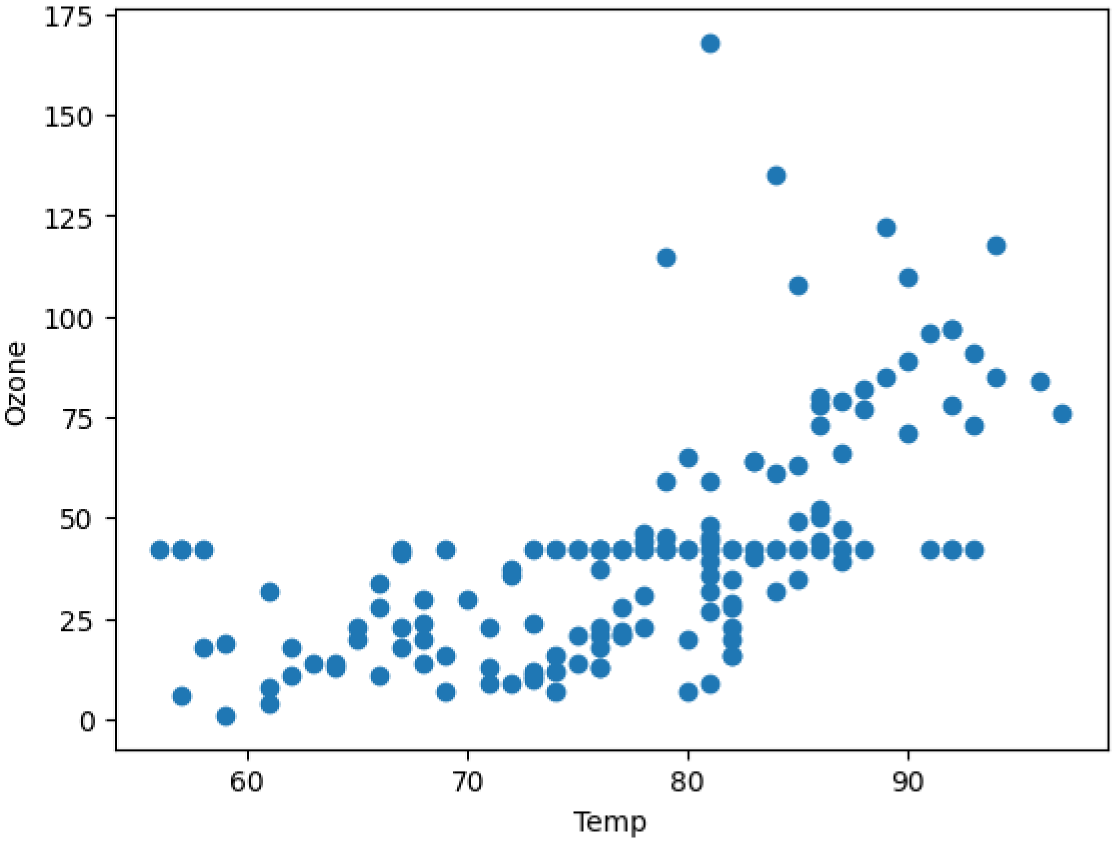
Out[87]:

	Ozone	Solar.R	Wind	Temp	Month	Day
0	41.00000	190.000000	7.4	67	5	1
1	36.00000	118.000000	8.0	72	5	2
2	12.00000	149.000000	12.6	74	5	3
3	18.00000	313.000000	11.5	62	5	4
4	42.12931	185.931507	14.3	56	5	5
...	...	...	...	...	...	...
148	30.00000	193.000000	6.9	70	9	26
149	42.12931	145.000000	13.2	77	9	27
150	14.00000	191.000000	14.3	75	9	28
151	18.00000	131.000000	8.0	76	9	29
152	20.00000	223.000000	11.5	68	9	30

153 rows × 6 columns

In [88]:
```
plt.xlabel('Temp')
plt.ylabel('Ozone')
plt.scatter(df['Temp'],df['Ozone'])
```

Out[88]:
```
<matplotlib.collections.PathCollection at 0x155e890e500>
```



In [89]:

```
# data set for two variables.
df2 = df[['Ozone','Temp']]
df2
```

Out[89]:

	Ozone	Temp
0	41.00000	67
1	36.00000	72
2	12.00000	74
3	18.00000	62
4	42.12931	56
...	...	...
148	30.00000	70
149	42.12931	77
150	14.00000	75
151	18.00000	76
152	20.00000	68

153 rows × 2 columns

In [90]:

```
df2.corr()
```

Out[90]:

	Ozone	Temp
Ozone	1.000000	0.608742
Temp	0.608742	1.000000

In [91]:

```
#splitting the dataset into 75 and 20 perent
from sklearn.model_selection import train_test_split
x = df2['Temp']
Y = df2['Ozone']
X = x.array.reshape(-1,1)

X_train,X_test,Y_train,Y_test = train_test_split(X,Y,test_size=0.25)
```

In [92]:

```
from sklearn.linear_model import LinearRegression
regressor = LinearRegression()
```

In [93]:

```
regressor = regressor.fit(X_train,Y_train)
regressor
```

Out[93]:

```
▾ LinearRegression
LinearRegression()
```

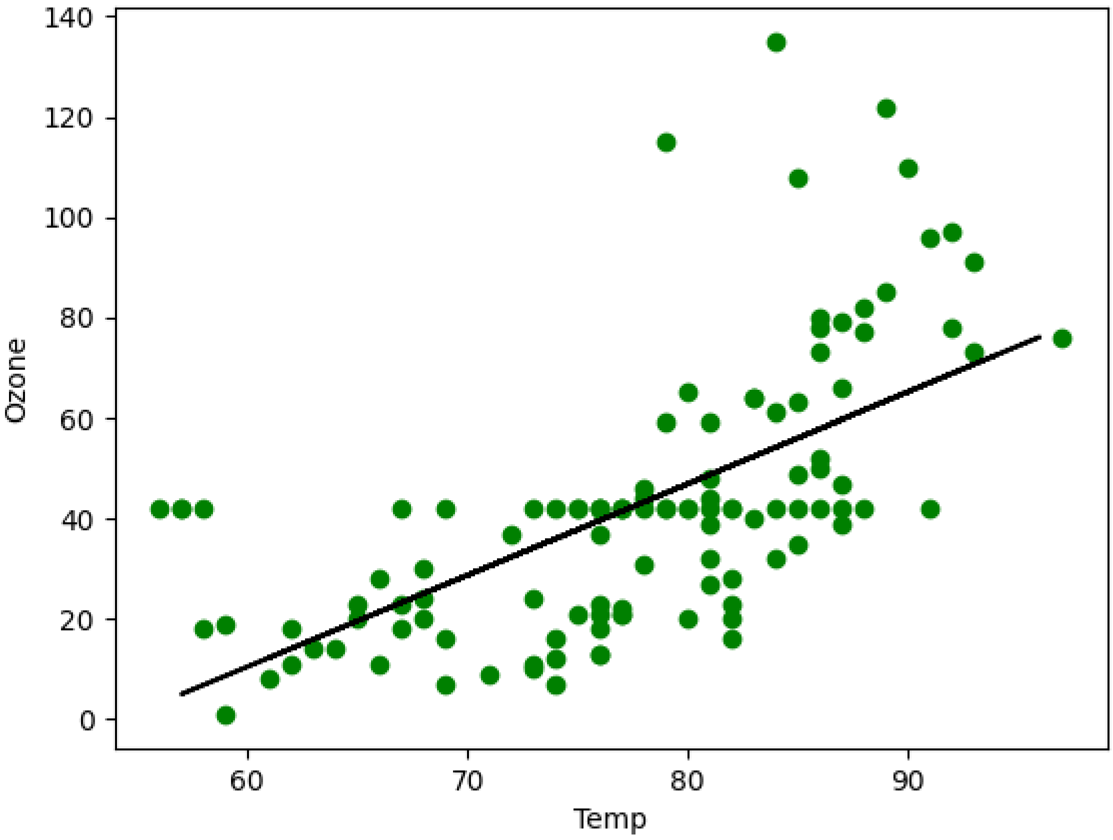
In [94]:
```
Y_pred = regressor.predict(X_test)
results = pd.DataFrame({'Actual': Y_test, 'Predicted': Y_pred})
print(results)
```

```
        Actual  Predicted
37    29.00000  50.568770
145   36.00000  48.746363
41    42.12931  70.615251
68    97.00000  68.792844
122   85.00000  72.437659
137   13.00000  30.522290
135   28.00000  41.456734
23    32.00000  12.298216
99    89.00000  65.148029
103   44.00000  57.858400
130   23.00000  43.279141
115   45.00000  45.101548
121   84.00000  76.082473
31    42.12931  43.279141
0     41.00000  23.232660
64    42.12931  54.213585
101   42.12931  68.792844
75     7.00000  46.923956
16    34.00000  21.410253
116  168.00000  48.746363
77    35.00000  50.568770
60    42.12931  52.391178
42    42.12931  68.792844
106   42.12931  45.101548
49    12.00000  34.167104
93     9.00000  48.746363
13    14.00000  25.055068
17     6.00000   5.008587
94    16.00000  50.568770
1     36.00000  32.344697
39    71.00000  65.148029
144   23.00000  30.522290
150   14.00000  37.811919
148   30.00000  28.699882
120  118.00000  72.437659
113    9.00000  32.344697
22     4.00000  12.298216
28    45.00000  48.746363
143   13.00000  17.765438
```

In [95]:
```
from sklearn.metrics import r2_score
r2_score(Y_test,Y_pred)
```

Out[95]:
```
0.3266134652335819
```

In [96]:
```
plt.xlabel('Temp')
plt.ylabel('Ozone')
plt.scatter(X_train, Y_train,color='g')
plt.plot(X_test, Y_pred,color='k')
plt.show()
```



In [97]:
```
from sklearn.metrics import mean_absolute_error, mean_squared_error
mae = mean_absolute_error(Y_test, Y_pred)
mse = mean_squared_error(Y_test, Y_pred)
rmse = np.sqrt(mse)
```

In [98]:
```
print(f'Mean absolute error: {mae:.2f}')
print(f'Mean squared error: {mse:.2f}')
print(f'Root mean squared error: {rmse:.2f}')
```

```
Mean absolute error: 19.01
Mean squared error: 756.61
Root mean squared error: 27.51
```

In [99]:

```
# Correlation between all features
df.corr()
```

Out[99]:

	Ozone	Solar.R	Wind	Temp	Month	Day
Ozone	1.000000	0.302970	-0.530936	0.608742	0.149081	-0.011355
Solar.R	0.302970	1.000000	-0.055245	0.262569	-0.072904	-0.145621
Wind	-0.530936	-0.055245	1.000000	-0.457988	-0.178293	0.027181
Temp	0.608742	0.262569	-0.457988	1.000000	0.420947	-0.130593
Month	0.149081	-0.072904	-0.178293	0.420947	1.000000	-0.007962
Day	-0.011355	-0.145621	0.027181	-0.130593	-0.007962	1.000000

In [100]:

```
from sklearn.model_selection import train_test_split
X1 = df.drop(columns = 'Ozone').values
Y1 = df['Ozone'].values
X1_train,X1_test,Y1_train,Y1_test = train_test_split(X1,Y1,test_size=0.75)
```

In [101]:

```
print(X1)
```

```
[  8.           9.7         59.           5.          21.        ]
[320.          16.6         73.           5.          22.        ]
[ 25.           9.7         61.           5.          23.        ]
[ 92.          12.          61.           5.          24.        ]
[ 66.          16.6         57.           5.          25.        ]
[266.          14.9         58.           5.          26.        ]
[185.93150685   8.         57.           5.          27.        ]
[ 13.          12.          67.           5.          28.        ]
[252.          14.9         81.           5.          29.        ]
[223.           5.7         79.           5.          30.        ]
[279.           7.4         76.           5.          31.        ]
[286.           8.6         78.           6.           1.        ]
[287.           9.7         74.           6.           2.        ]
[242.          16.1         67.           6.           3.        ]
[186.           9.2         84.           6.           4.        ]
[220.           8.6         85.           6.           5.        ]
[264.          14.3         79.           6.           6.        ]
[127.           9.7         82.           6.           7.        ]
[273.           6.9         87.           6.           8.        ]
[291.          13.8         90.           6.           9.        ]
```

In [102]:
```
print(Y1)
```

```
[ 41.          36.          12.          18.          42.12931034
  28.          23.          19.           8.          42.12931034
   7.          16.          11.          14.          18.
  14.          34.           6.          30.          11.
   1.          11.           4.          32.          42.12931034
  42.12931034  42.12931034  23.          45.         115.
  37.          42.12931034  42.12931034  42.12931034  42.12931034
  42.12931034  42.12931034  29.          42.12931034  71.
  39.          42.12931034  42.12931034  23.          42.12931034
  42.12931034  21.          37.          20.          12.
  13.          42.12931034  42.12931034  42.12931034  42.12931034
  42.12931034  42.12931034  42.12931034  42.12931034  42.12931034
  42.12931034 135.          49.          32.          42.12931034
  64.          40.          77.          97.          97.
  85.          42.12931034  10.          27.          42.12931034
   7.          48.          35.          61.          79.
  63.          16.          42.12931034  42.12931034  80.
 108.          20.          52.          82.          50.
  64.          59.          39.           9.          16.
  78.          35.          66.         122.          89.
 110.          42.12931034  42.12931034  44.          28.
  65.          42.12931034  22.          59.          23.
  31.          44.          21.           9.          42.12931034
  45.         168.          73.          42.12931034  76.
 118.          84.          85.          96.          78.
  73.          91.          47.          32.          20.
  23.          21.          24.          44.          21.
  28.           9.          13.          46.          18.
  13.          24.          16.          13.          23.
  36.           7.          14.          30.          42.12931034
  14.          18.          20.        ]
```

In [103]:
```
from sklearn.linear_model import LinearRegression
regressor1 = LinearRegression()
regressor1.fit(X1_train,Y1_train)
```

Out[103]:
```
▾ LinearRegression

LinearRegression()
```

In [104]:

```
Y1_pred = regressor1.predict(X1_test)
results = pd.DataFrame({'Actual': Y1_test, 'Predicted': Y1_pred})
print(results)
```

```
        Actual  Predicted
0     42.12931  52.235006
1     91.00000  67.732838
2     42.12931  61.680567
3     42.12931  34.555904
4     14.00000  44.143845
..         ...        ...
110  118.00000  66.189771
111   42.12931  13.439943
112   42.12931  49.717369
113    7.00000  52.265827
114   13.00000  26.079276

[115 rows x 2 columns]
```

In [105]:

```
r2_score(Y1_test,Y1_pred)
```

Out[105]:

```
0.3815797431103587
```

In [106]:

```
from sklearn.metrics import mean_absolute_error, mean_squared_error
mae = mean_absolute_error(Y1_test, Y1_pred)
mse = mean_squared_error(Y1_test, Y1_pred)
rmse = np.sqrt(mse)
```

In [107]:

```
print(f'Mean absolute error: {mae:.2f}')
print(f'Mean squared error: {mse:.2f}')
print(f'Root mean squared error: {rmse:.2f}')
```

```
Mean absolute error: 17.71
Mean squared error: 527.82
Root mean squared error: 22.97
```

In [108]:

```
regressor1.score(X1_train,Y1_train)
```

Out[108]:

```
0.4079207012555187
```

In [109]:

```
#New dataframe
df_new =df[['Ozone','Solar.R','Wind','Temp']]
df_new.head()
```

Out[109]:

	Ozone	Solar.R	Wind	Temp
0	41.00000	190.000000	7.4	67
1	36.00000	118.000000	8.0	72
2	12.00000	149.000000	12.6	74
3	18.00000	313.000000	11.5	62
4	42.12931	185.931507	14.3	56

In [110]:

```
from sklearn.model_selection import train_test_split
X2 = df_new.drop(columns = 'Ozone')
Y2 = df_new['Ozone']
X2_train,X2_test,Y2_train,Y2_test = train_test_split(X2,Y2,test_size=0.75)
```

In [111]:

```
from sklearn.linear_model import LinearRegression
reg= LinearRegression()
reg.fit(X2_train,Y2_train)
```

Out[111]:

```
▾ LinearRegression

LinearRegression()
```

In [112]:

```
reg.score(X2_train,Y2_train)
```

Out[112]:

```
0.5582358933693639
```

In [113]:

```
print(reg.intercept_)
```

```
-93.11743667777014
```

In [114]:

```
print(reg.coef_)
```

```
[ 0.03530763 -0.62420077  1.72068999]
```

In [115]:

```
print(reg.predict([[229.000000 , 10.3    , 90]]))
```

```
[63.40084154]

C:\Users\rushi\AppData\Local\Programs\Python\Python310\lib\site-packages\sklear
n\base.py:450: UserWarning: X does not have valid feature names, but LinearRegr
ession was fitted with feature names
  warnings.warn(
```

In [116]:

```
Y2_pred = reg.predict(X2_test)
results = pd.DataFrame({'Actual': Y2_test, 'Predicted': Y2_pred})
print(results)
```

```
        Actual  Predicted
142   16.00000  50.082370
98   122.00000  66.530615
88    82.00000  61.204722
66    40.00000  53.982639
137   13.00000  25.827698
..         ...        ...
67    77.00000  64.864764
139   18.00000  21.463731
65    64.00000  53.007344
42    42.12931  68.270303
36    42.12931  43.212216

[115 rows x 2 columns]
```

In [117]:

```
r2_score(Y2_test,Y2_pred)
```

Out[117]:

```
0.39433768379241485
```

In [118]:

```
from sklearn.metrics import mean_absolute_error, mean_squared_error
mae = mean_absolute_error(Y2_test, Y2_pred)
mse = mean_squared_error(Y2_test, Y2_pred)
rmse = np.sqrt(mse)
```

In [119]:

```
print(f'Mean absolute error: {mae:.2f}')
print(f'Mean squared error: {mse:.2f}')
print(f'Root mean squared error: {rmse:.2f}')
```

```
Mean absolute error: 16.62
Mean squared error: 542.41
Root mean squared error: 23.29
```

In [ ]:

In [ ]: