In [84]:
```
import pandas as pd
import numpy as np
from sklearn.preprocessing import StandardScaler ,FunctionTransformer
from sklearn.neighbors import KNeighborsClassifier
import seaborn as sns
import matplotlib.pyplot as plt
from sklearn.compose import ColumnTransformer
from sklearn.model_selection import train_test_split ,GridSearchCV
from sklearn.pipeline import Pipeline
from sklearn.impute import SimpleImputer
```

In [107]:
```
# import csv files

data = pd.read_csv("../DataSets/water_potability.csv")
data.head()
```

Out[107]:

	ph	Hardness	Solids	Chloramines	Sulfate	Conductivity	Organic_carbon	Trihalomethanes	Turbidity	Potability
0	NaN	204.890455	20791.318981	7.300212	368.516441	564.308654	10.379783	86.990970	2.963135	0
1	3.716080	129.422921	18630.057858	6.635246	NaN	592.885359	15.180013	56.329076	4.500656	0
2	8.099124	224.236259	19909.541732	9.275884	NaN	418.606213	16.868637	66.420093	3.055934	0
3	8.316766	214.373394	22018.417441	8.059332	356.886136	363.266516	18.436524	100.341674	4.628771	0
4	9.092223	181.101509	17978.986339	6.546600	310.135738	398.410813	11.558279	31.997993	4.075075	0

In [108]:
```
data.isna().sum()
```

Out[108]:
```
ph                 491
Hardness             0
Solids               0
Chloramines          0
Sulfate            781
Conductivity         0
Organic_carbon       0
Trihalomethanes    162
Turbidity            0
Potability           0
dtype: int64
```

In [109]:
```
data.describe()
```

Out[109]:

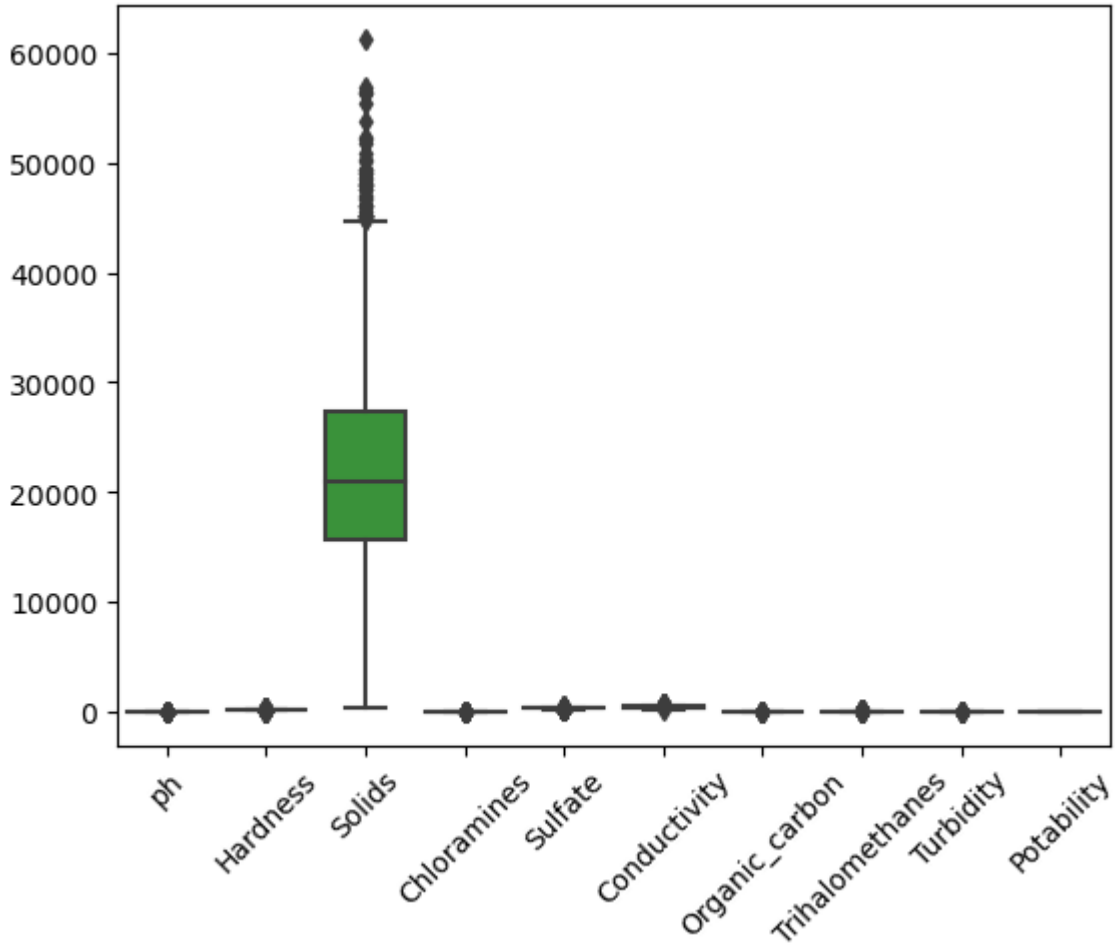
	ph	Hardness	Solids	Chloramines	Sulfate	Conductivity	Organic_carbon	Trihalomethanes	Turbidity
count	2785.000000	3276.000000	3276.000000	3276.000000	2495.000000	3276.000000	3276.000000	3114.000000	3276.000000
mean	7.080795	196.369496	22014.092526	7.122277	333.775777	426.205111	14.284970	66.396293	3.966786
std	1.594320	32.879761	8768.570828	1.583085	41.416840	80.824064	3.308162	16.175008	0.780382
min	0.000000	47.432000	320.942611	0.352000	129.000000	181.483754	2.200000	0.738000	1.450000
25%	6.093092	176.850538	15666.690297	6.127421	307.699498	365.734414	12.065801	55.844536	3.439711
50%	7.036752	196.967627	20927.833607	7.130299	333.073546	421.884968	14.218338	66.622485	3.955028
75%	8.062066	216.667456	27332.762127	8.114887	359.950170	481.792304	16.557652	77.337473	4.500320
max	14.000000	323.124000	61227.196008	13.127000	481.030642	753.342620	28.300000	124.000000	6.739000

In [110]:
```
## Fill the nan values with mean
data.fillna(data.mean() , inplace = True)
data.head()
```

Out[110]:

	ph	Hardness	Solids	Chloramines	Sulfate	Conductivity	Organic_carbon	Trihalomethanes	Turbidity	Potability
0	7.080795	204.890455	20791.318981	7.300212	368.516441	564.308654	10.379783	86.990970	2.963135	0
1	3.716080	129.422921	18630.057858	6.635246	333.775777	592.885359	15.180013	56.329076	4.500656	0
2	8.099124	224.236259	19909.541732	9.275884	333.775777	418.606213	16.868637	66.420093	3.055934	0
3	8.316766	214.373394	22018.417441	8.059332	356.886136	363.266516	18.436524	100.341674	4.628771	0
4	9.092223	181.101509	17978.986339	6.546600	310.135738	398.410813	11.558279	31.997993	4.075075	0

In [111]:
```
# now try to visualize it


sns.boxplot(data = data )
plt.xticks(rotation = 45);
```



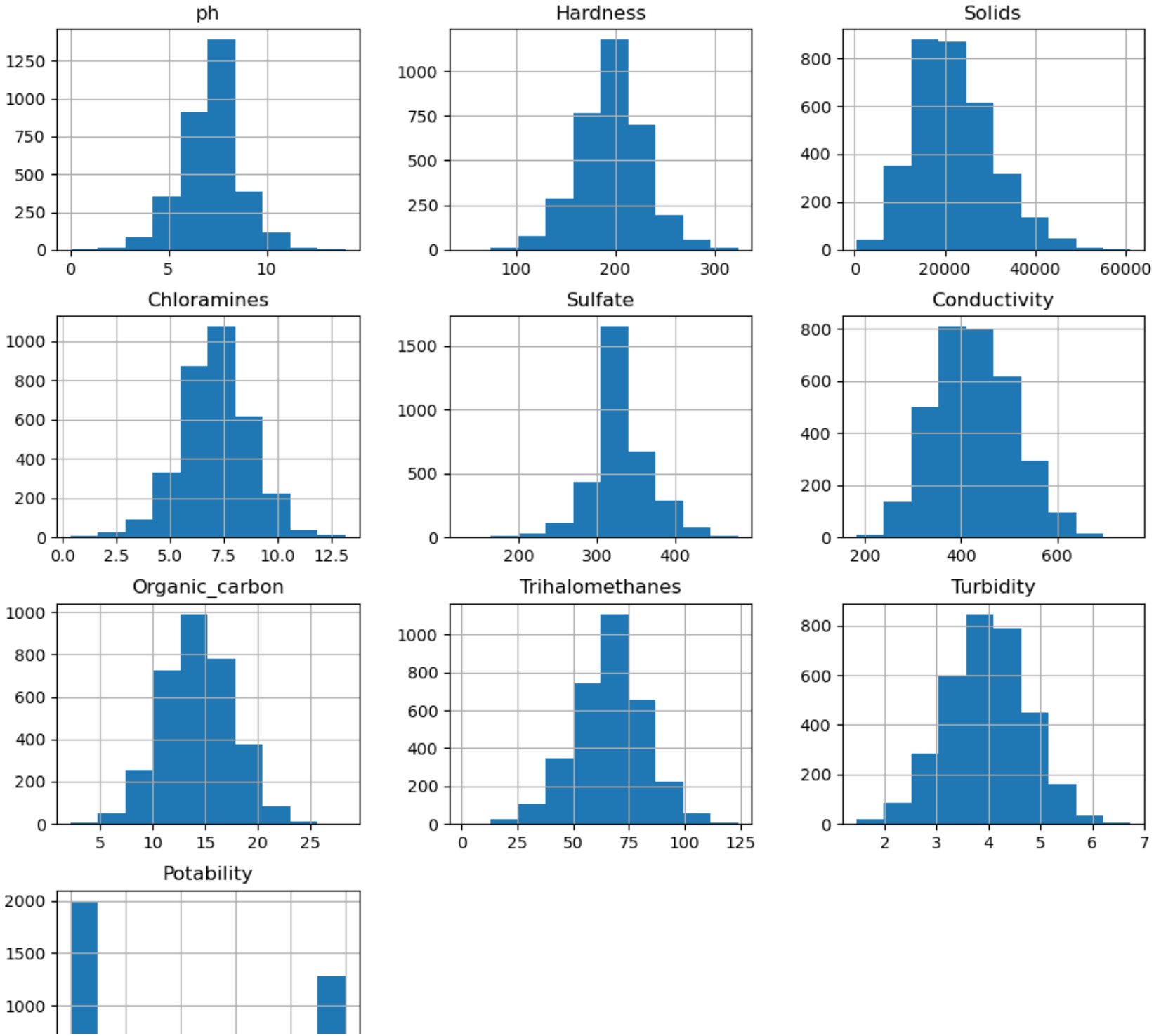
In [112]:
```
d = data.corr()
plt.figure(figsize=(12,12))
sns.heatmap(d,annot=True)
```

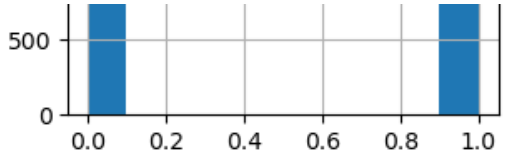
Out[112]:
```
<Axes: >
```


ph 1 0.076 -0.082 -0.032 0.014 0.017 0.04 0.003 -0.036 -0.0033
Hardness 0.076 1 -0.047 -0.03 -0.093 -0.024 0.0036 -0.013 -0.014 -0.014
Solids -0.082 -0.047 1 -0.07 -0.15 0.014 0.01 -0.0089 0.02 0.034
Chloramines -0.032 -0.03 -0.07 1 0.024 -0.02 -0.013 0.017 0.0024 0.024
Sulfate 0.014 -0.093 -0.15 0.024 1 -0.014 0.027 -0.026 -0.0098 -0.021
Conductivity 0.017 -0.024 0.014 -0.02 -0.014 1 0.021 0.0013 0.0058 -0.0081
Organic_carbon 0.04 0.0036 0.01 -0.013 0.027 0.021 1 -0.013 -0.027 -0.03
Trihalomethanes 0.003 -0.013 -0.0089 0.017 -0.026 0.0013 -0.013 1 -0.022 0.007
Turbidity -0.036 -0.014 0.02 0.0024 -0.0098 0.0058 -0.027 -0.022 1 0.0016
Potability -0.0033 -0.014 0.034 0.024 -0.021 -0.0081 -0.03 0.007 0.0016 1
1.0
0.8
0.6
0.4
0.2
0.0


ph
Hardness
Solids
Chloramines
Sulfate
Conductivity
Organic_carbon
Trihalomethanes
Turbidity
Potability

In [113]:
```
data.hist(figsize=(12,12));
```


ph
Hardness
Solids
Chloramines
Sulfate
Conductivity
Organic_carbon
Trihalomethanes
Turbidity
Potability



In [114]:
```
data.head()
```

Out[114]:

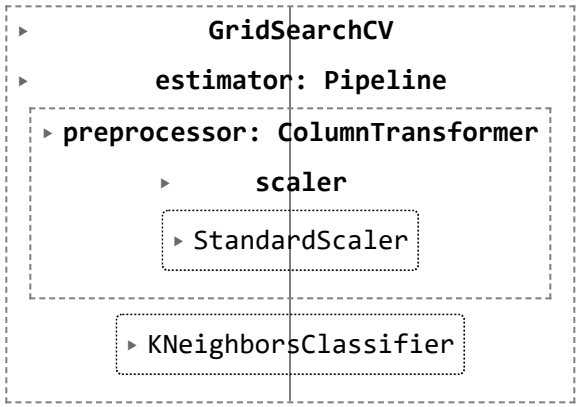
	ph	Hardness	Solids	Chloramines	Sulfate	Conductivity	Organic_carbon	Trihalomethanes	Turbidity	Potability
0	7.080795	204.890455	20791.318981	7.300212	368.516441	564.308654	10.379783	86.990970	2.963135	0
1	3.716080	129.422921	18630.057858	6.635246	333.775777	592.885359	15.180013	56.329076	4.500656	0
2	8.099124	224.236259	19909.541732	9.275884	333.775777	418.606213	16.868637	66.420093	3.055934	0
3	8.316766	214.373394	22018.417441	8.059332	356.886136	363.266516	18.436524	100.341674	4.628771	0
4	9.092223	181.101509	17978.986339	6.546600	310.135738	398.410813	11.558279	31.997993	4.075075	0

In [115]:
```
X = data.drop("Potability",axis=1)
Y = data["Potability"]




scaler = Pipeline([("scaler",StandardScaler())])


preprocessing  = ColumnTransformer([("scaler",scaler,X.columns)])

pipeline  = Pipeline([("preprocessor",preprocessing ),
                      ("estimator",KNeighborsClassifier())])
# train _test_split
np.random.seed(42)
x_train ,x_test ,y_train ,y_test = train_test_split(X , Y ,test_size =0.2 ,random_state = 42)

pipeline.fit(x_train ,y_train)
pipeline.score(x_test , y_test)
```

Out[115]: 0.6280487804878049

In [116]:
```
params = {
    "estimator__n_neighbors": [1, 5, 10],
    "estimator__leaf_size": [1,  45],
    "estimator__weights": ["uniform", "distance"]
}

grid = GridSearchCV(pipeline, params ,cv = 5)
grid.fit(x_train , y_train)
```

Out[116]:



In [117]:
```
grid.best_params_
```

Out[117]:
```
{'estimator__leaf_size': 1,
 'estimator__n_neighbors': 10,
 'estimator__weights': 'uniform'}
```

In [118]:
```
grid.best_score_
```

Out[118]:
```
0.6358778625954198
```

In [119]:
```
y_pred = grid.predict(x_test)
x_test
```

Out[119]:

	ph	Hardness	Solids	Chloramines	Sulfate	Conductivity	Organic_carbon	Trihalomethanes	Turbidity
2947	7.080795	183.521107	20461.252710	7.333212	333.119476	356.369022	20.179029	67.019903	4.886634
2782	6.643159	188.913541	32873.820022	6.791509	333.848842	336.561501	14.706810	67.844849	4.562198
1644	7.846058	224.058877	23264.109968	5.922367	300.402620	387.971336	13.406737	43.075186	2.487969
70	7.160467	183.089310	6743.346066	3.803036	277.599099	428.036344	9.799625	90.035374	3.884891
2045	6.615350	179.240661	26392.863612	9.309160	333.775777	496.363562	12.786595	78.262369	4.453443
...	...	...	...	...	...	...	...	...	...
208	10.026159	224.266358	14962.177833	7.428313	336.972950	517.512842	18.858519	65.363452	4.182278
1578	6.865569	231.445054	22585.788809	5.676387	333.775777	496.603425	16.154964	91.461709	4.916218
565	7.459145	217.700130	19436.503542	4.639116	352.424439	494.094339	14.460295	57.196188	3.841052
313	5.862641	185.065220	44069.272158	4.382721	412.690111	331.570139	15.306079	59.605812	5.507421
601	7.080795	220.552524	28135.076838	7.978098	307.652451	421.464253	17.532298	86.848098	3.569570

656 rows × 9 columns

In [121]:
```
data.head()
```

Out[121]:

	ph	Hardness	Solids	Chloramines	Sulfate	Conductivity	Organic_carbon	Trihalomethanes	Turbidity	Potability
0	7.080795	204.890455	20791.318981	7.300212	368.516441	564.308654	10.379783	86.990970	2.963135	0
1	3.716080	129.422921	18630.057858	6.635246	333.775777	592.885359	15.180013	56.329076	4.500656	0
2	8.099124	224.236259	19909.541732	9.275884	333.775777	418.606213	16.868637	66.420093	3.055934	0
3	8.316766	214.373394	22018.417441	8.059332	356.886136	363.266516	18.436524	100.341674	4.628771	0
4	9.092223	181.101509	17978.986339	6.546600	310.135738	398.410813	11.558279	31.997993	4.075075	0

In [129]:
```
# Prompt the user for input
ph = float(input("Enter the pH: "))
hardness = float(input("Enter the Hardness: "))
solids = float(input("Enter the Solids: "))
chloramines = float(input("Enter the Chloramines: "))
sulfate = float(input("Enter the Sulfate: "))
conductivity = float(input("Enter the Conductivity: "))
organic_carbon = float(input("Enter the Organic Carbon: "))
trihalomethanes = float(input("Enter the Trihalomethanes: "))
turbidity = float(input("Enter the Turbidity: "))

# Create a DataFrame with the user input
data = pd.DataFrame({
    'ph': [ph],
    'Hardness': [hardness],
    'Solids': [solids],
    'Chloramines': [chloramines],
    'Sulfate': [sulfate],
    'Conductivity': [conductivity],
    'Organic_carbon': [organic_carbon],
    'Trihalomethanes': [trihalomethanes],
    'Turbidity': [turbidity]
})

# Predict the data

transformData = pipeline["preprocessor"].transform(data)
prediction = pipeline["estimator"].predict(transformData)

print("The Label is:", prediction[0])
```

```
Enter the pH: 7
Enter the Hardness: 204
Enter the Solids: 20791
Enter the Chloramines: 7.30
Enter the Sulfate: 368
Enter the Conductivity: 563.3
Enter the Organic Carbon: 10.37
Enter the Trihalomethanes: 86.9
Enter the Turbidity: 2.9
The Label is: 0
```

In [ ]: