```
import pandas as pd
import numpy as np
import seaborn as sns
import plotly.express as px
import matplotlib.pyplot as plt

from sklearn.preprocessing import StandardScaler
from sklearn.model_selection import train_test_split

from sklearn.linear_model import LogisticRegression
from sklearn.metrics import accuracy_score, classification_report, confusion_matrix
```

+ Code + Text

```
df = pd.read_csv("/content/water_potability.csv")
df.head()
```

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

```
df.columns
```

```
Index(['ph', 'Hardness', 'Solids', 'Chloramines', 'Sulfate', 'Conductivity',
       'Organic_carbon', 'Trihalomethanes', 'Turbidity', 'Potability'],
      dtype='object')
```

```
df.describe()
```

	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	3276.00000
mean	7.080795	196.369496	22014.092526	7.122277	333.775777	426.205111	14.284970	66.396293	3.96678
std	1.594320	32.879761	8768.570828	1.583085	41.416840	80.824064	3.308162	16.175008	0.78038
min	0.000000	47.432000	320.942611	0.352000	129.000000	181.483754	2.200000	0.738000	1.45000
25%	6.093092	176.850538	15666.690297	6.127421	307.699498	365.734414	12.065801	55.844536	3.43971
50%	7.036752	196.967627	20927.833607	7.130299	333.073546	421.884968	14.218338	66.622485	3.95502
75%	8.062066	216.667456	27332.762127	8.114887	359.950170	481.792304	16.557652	77.337473	4.50032
max	14.000000	323.124000	61227.196008	13.127000	481.030642	753.342620	28.300000	124.000000	6.73900

```
df.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 3276 entries, 0 to 3275
Data columns (total 10 columns):
 #   Column           Non-Null Count  Dtype
---  ------           --------------  -----
 0   ph               2785 non-null   float64
 1   Hardness         3276 non-null   float64
 2   Solids           3276 non-null   float64
 3   Chloramines      3276 non-null   float64
 4   Sulfate          2495 non-null   float64
 5   Conductivity     3276 non-null   float64
 6   Organic_carbon   3276 non-null   float64
 7   Trihalomethanes  3114 non-null   float64
 8   Turbidity        3276 non-null   float64
 9   Potability       3276 non-null   int64
dtypes: float64(9), int64(1)
memory usage: 256.1 KB
```

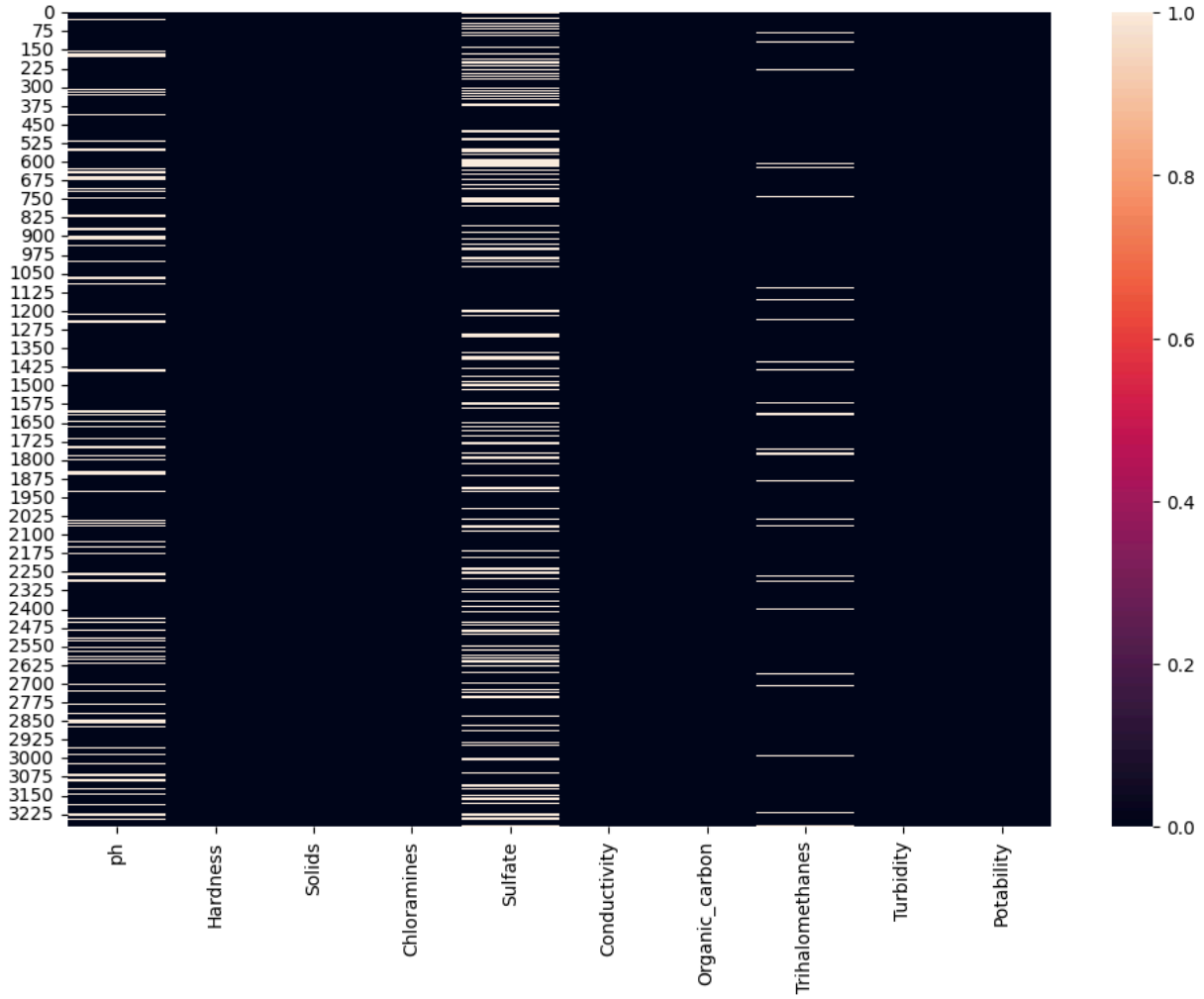
```
df.isnull().sum()
```

```
ph                 491
Hardness             0
Solids               0
Chloramines          0
Sulfate            781
Conductivity         0
```

```
Organic_carbon       0
Trihalomethanes    162
Turbidity            0
Potability           0
dtype: int64
```

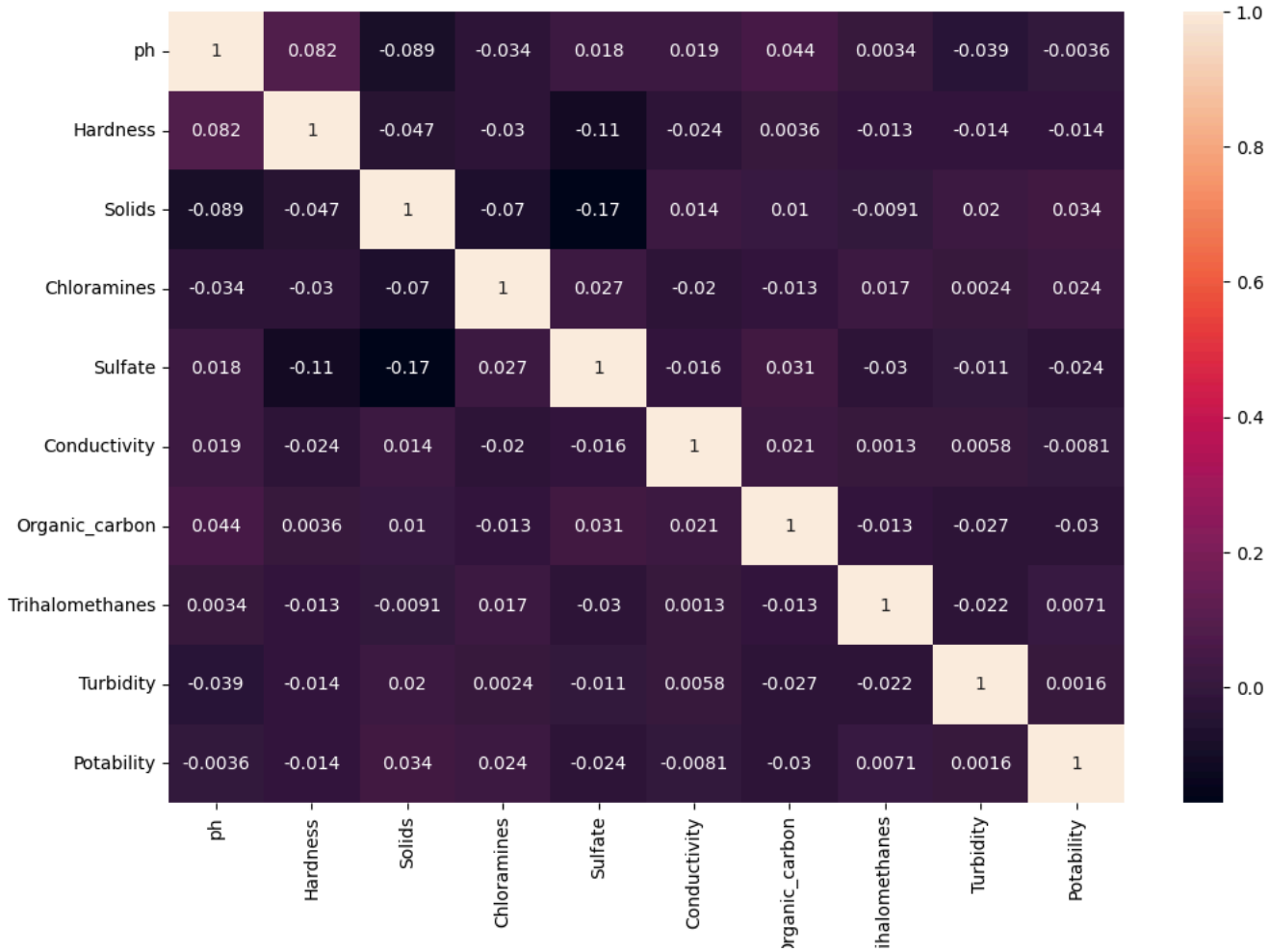
```
plt.figure(figsize=(12,8))
sns.heatmap(df.isnull())
```

```
<Axes: >
```



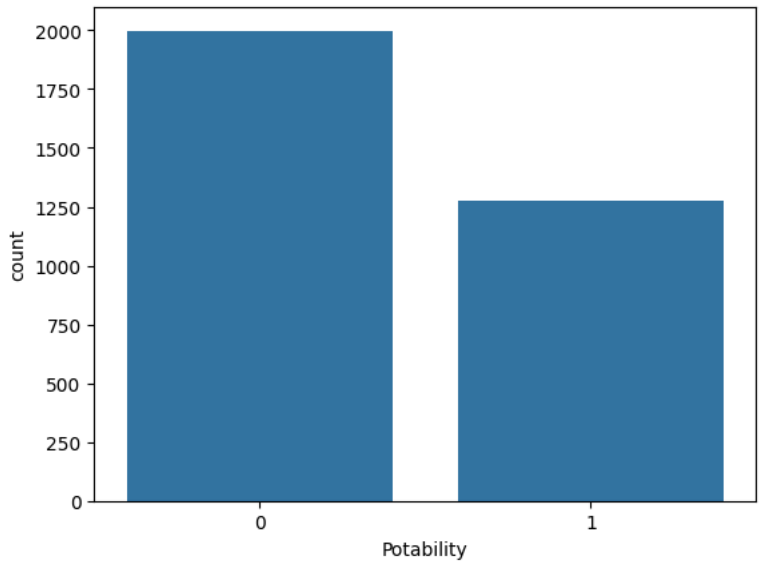

```
plt.figure(figsize=(12,8))
sns.heatmap(df.corr(),annot=True)
```

```
<Axes: >
```




```
sns.countplot(x="Potability",data=df)
```

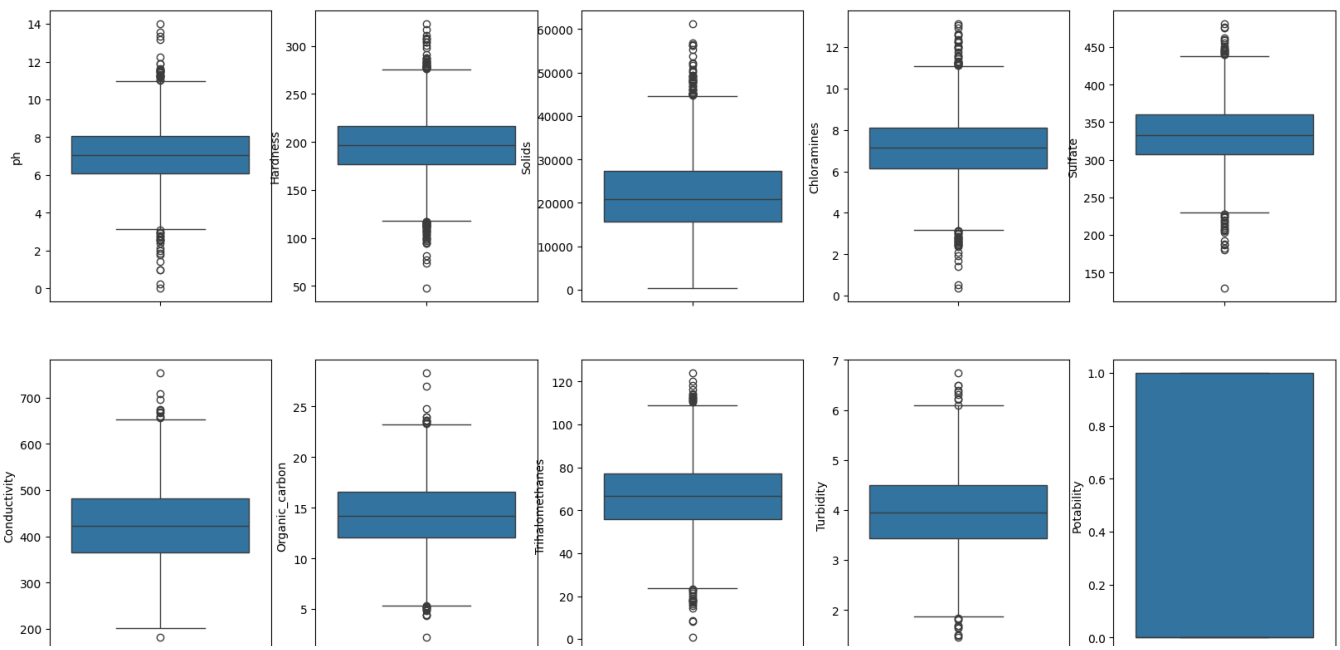
```
<Axes: xlabel='Potability', ylabel='count'>
```




```
df["Potability"].value_counts()
```

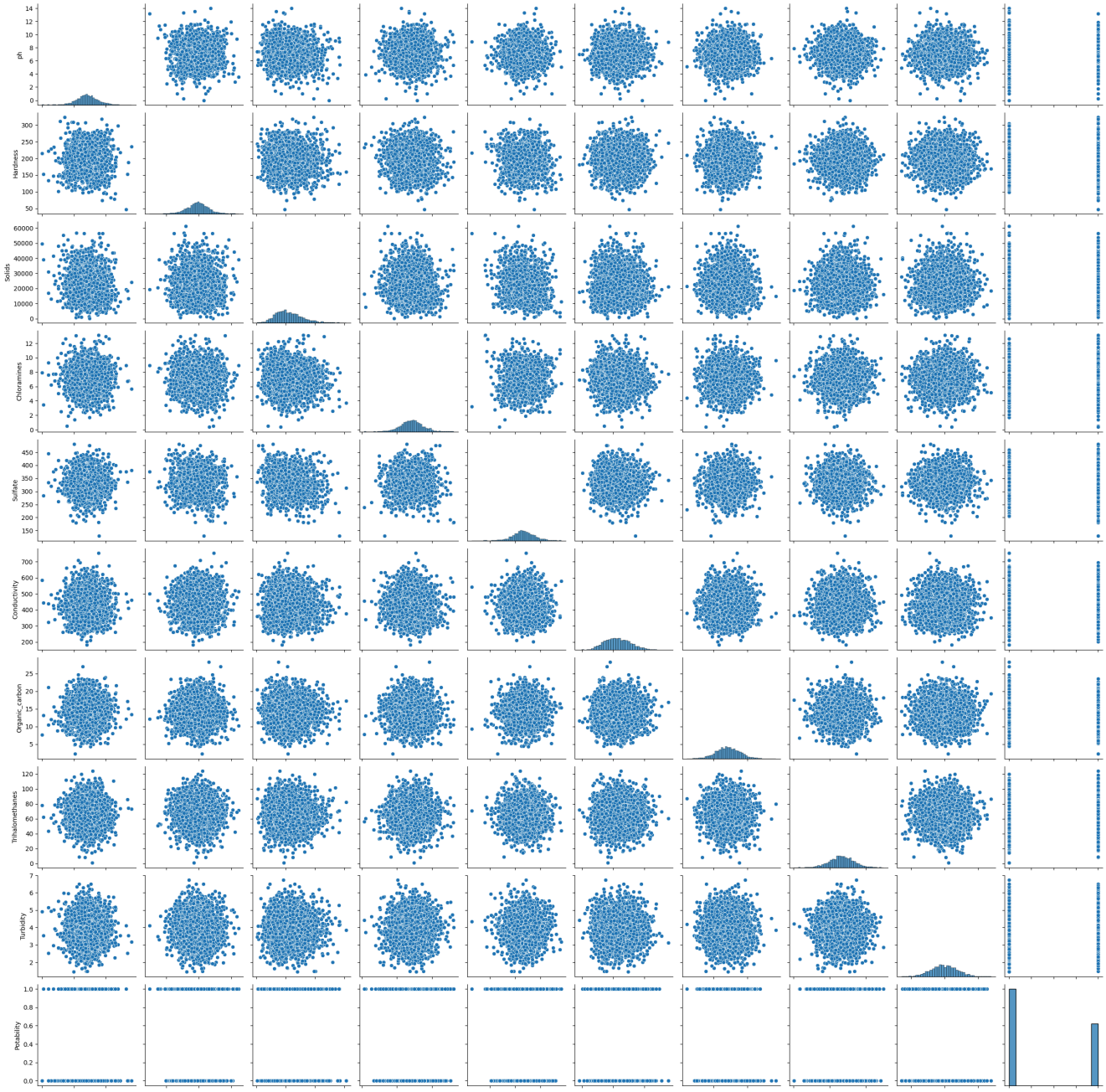
```
0    1998
1    1278
Name: Potability, dtype: int64
```

```
fig, ax = plt.subplots(ncols=5, nrows=2, figsize = (20,10))

ax = ax.flatten()

index = 0

for col,values in df.items():
  sns.boxplot(y=col,data=df,ax=ax[index])

  index +=1
```

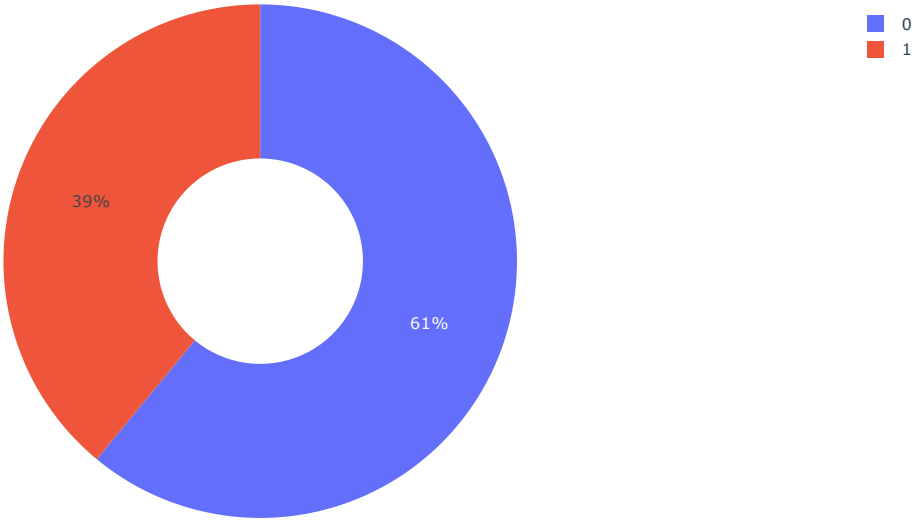



```
sns.pairplot(df)
```

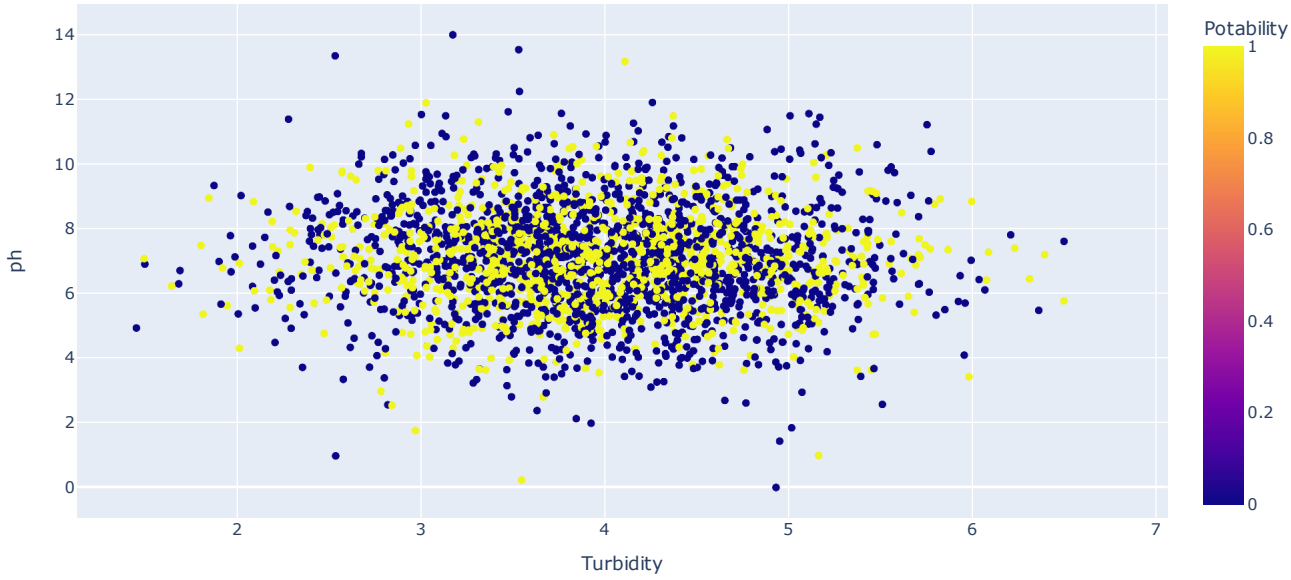
```
<seaborn.axisgrid.PairGrid at 0x782d4523e950>
```




```
fig = px.pie(df,names = "Potability",hole = 0.4)
fig.show()
```

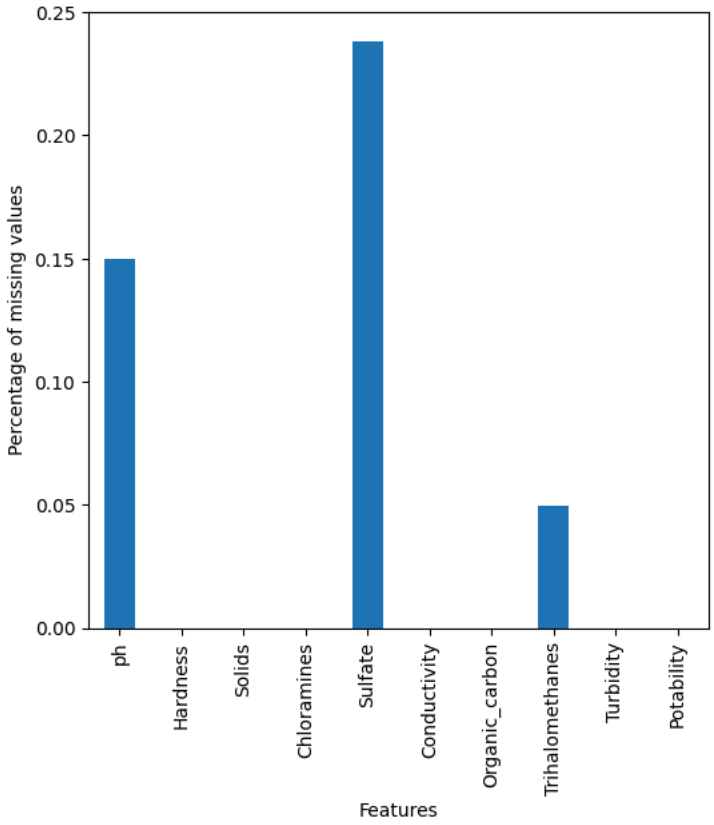



```
fig = px.scatter(df,x = "Turbidity",color = "Potability",y="ph")
fig.show()
```




```
df.isnull().mean().plot.bar(figsize = (6,6))
plt.xlabel("Features")
plt.ylabel("Percentage of missing values")
```

```
Text(0, 0.5, 'Percentage of missing values')
```



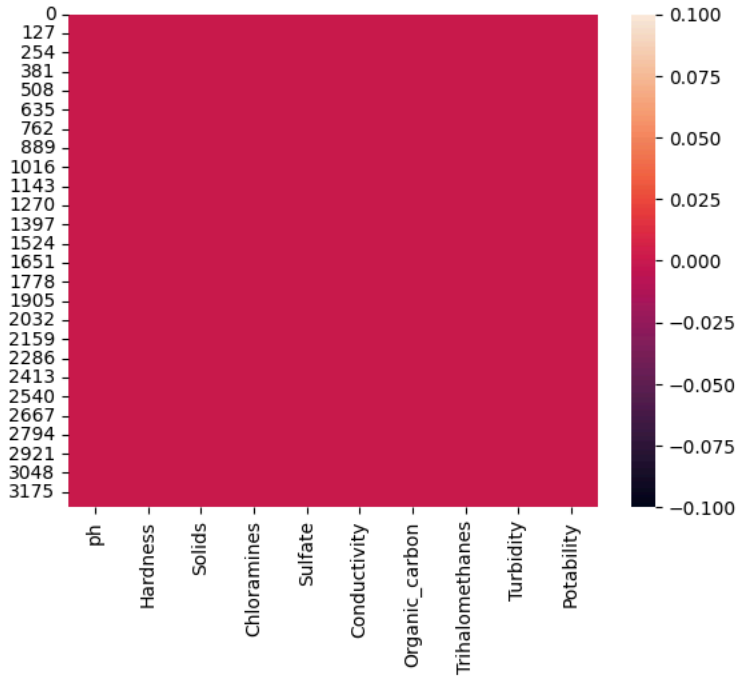

```
df["ph"] = df["ph"].fillna(df["ph"].mean())
df["Sulfate"] = df["Sulfate"].fillna(df["Sulfate"].mean())
df['Trihalomethanes'] = df["Trihalomethanes"].fillna(df["Trihalomethanes"].mean())
```

```
df.isnull().sum()
```

```
ph                0
Hardness          0
Solids            0
Chloramines       0
Sulfate           0
Conductivity      0
Organic_carbon    0
Trihalomethanes   0
Turbidity         0
Potability        0
dtype: int64
```

```
sns.heatmap(df.isnull())
```

```
<Axes: >
```




```
df.head()
```

	ph	Hardness	Solids	Chloramines	Sulfate	Conductivity	Organic_carbon	Trihalomethanes	Turbidity	Potabili
0	7.080795	204.890455	20791.318981	7.300212	368.516441	564.308654	10.379783	86.990970	2.963135	
1	3.716080	129.422921	18630.057858	6.635246	333.775777	592.885359	15.180013	56.329076	4.500656	
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4	9.092223	181.101509	17978.986339	6.546600	310.135738	398.410813	11.558279	31.997993	4.075075	

```
x = df.drop("Potability",axis=1)
y = df["Potability"]
```

```
x.shape , y.shape
```

```
((3276, 9), (3276,))
```

```
scaler = StandardScaler()
x = scaler.fit_transform(x)
x
```

```
array([[-6.04313345e-16,  2.59194711e-01, -1.39470871e-01, ...,
        -1.18065057e+00,  1.30614943e+00, -1.28629758e+00],
       [-2.28933938e+00, -2.03641367e+00, -3.85986650e-01, ...,
         2.70597240e-01, -6.38479983e-01,  6.84217891e-01],
       [ 6.92867789e-01,  8.47664833e-01, -2.40047337e-01, ...,
         7.81116857e-01,  1.50940884e-03, -1.16736546e+00],
       ...,
       [ 1.59125368e+00, -6.26829230e-01,  1.27080989e+00, ...,
        -9.81329234e-01,  2.18748247e-01, -8.56006782e-01],
       [-1.32951593e+00,  1.04135450e+00, -1.14405809e+00, ...,
        -9.42063817e-01,  7.03468419e-01,  9.50797383e-01],
       [ 5.40150905e-01, -3.85462310e-02, -5.25811937e-01, ...,
         5.60940070e-01,  7.80223466e-01, -2.12445866e+00]])
```

```
x_train,x_test,y_train,y_test = train_test_split(x,y,test_size=0.2)
```

```
x_train.shape , x_test.shape
```

```
((2620, 9), (656, 9))
```

LOGISTIC REGRESSION

> Indented block

```
from sklearn.linear_model import LogisticRegression
model_lr = LogisticRegression()
```

```
#Training Model
model_lr.fit(x_train,y_train)
```

```
▾ LogisticRegression
LogisticRegression()
```

```
#making prediction
pred_lr = model_lr.predict(x_test)
```

```
#accuracy score
accuracy_score_lr = accuracy_score(y_test,pred_lr)
accuracy_score_lr*100
```

```
65.09146341463415
```

Decision Tree Classifier

```
from sklearn.tree import DecisionTreeClassifier

#creating the model object
model_dt = DecisionTreeClassifier(max_depth = 4)
```

```
#Training of decision tree
model_dt.fit(x_train,y_train)
```

```
▾      DecisionTreeClassifier
DecisionTreeClassifier(max_depth=4)
```

```
#making prediction
pred_dt = model_dt.predict(x_test)
```

```
accuracy_score_dt = accuracy_score(y_test,pred_dt)
accuracy_score_dt*100
```

```
65.85365853658537
```

```
cm2 = confusion_matrix(y_test,pred_dt)
cm2
```

```
array([[385,  41],
       [183,  47]])
```

Random Forest Classifier

```
from sklearn.ensemble import RandomForestClassifier

model_rf = RandomForestClassifier()
```

```
#creating model object
model_rf = RandomForestClassifier()
```

```
#Training model RF
model_rf.fit(x_train,y_train)
```

```
▾ RandomForestClassifier
RandomForestClassifier()
```

```
#making prediction
pred_rf = model_rf.predict(x_test)


accuracy_score_rf = accuracy_score(y_test,pred_rf)
accuracy_score_rf*100
```

```
68.4451219512195
```

```
cm3 = confusion_matrix(y_test,pred_rf)
cm3
```

```
array([[360,  66],
       [141,  89]])
```

kNN -- K-Neighbours

```
from sklearn.neighbors import KNeighborsClassifier

#Creating Model object
#model_knn = KNeighborsClassifier()


for i in range(4,15):
  model_knn = KNeighborsClassifier(n_neighbors=i)
  model_knn.fit(x_train,y_train)
  pred_knn = model_knn.predict(x_test)
  accuracy_score_knn = accuracy_score(y_test,pred_knn)
  print(i,accuracy_score_knn)
```

```
4 0.6737804878048781
5 0.6280487804878049
6 0.6646341463414634
7 0.6615853658536586
8 0.6615853658536586
9 0.6478658536585366
10 0.6615853658536586
11 0.6661585365853658
12 0.6646341463414634
13 0.6524390243902439
14 0.6646341463414634
```

```
model_knn = KNeighborsClassifier(n_neighbors=11)
model_knn.fit(x_train,y_train)
pred_knn = model_knn.predict(x_test)
accuracy_score_knn = accuracy_score(y_test,pred_knn)
print(accuracy_score_knn*100)
```

```
66.61585365853658
```

SVM

```
from sklearn.svm import SVC

#Creating object of Model
model_svm = SVC(kernel="rbf")


#Model training
model_svm.fit(x_train,y_train)
```

```
SVC
SVC()
```

```
#Make prediction
pred_svm = model_svm.predict(x_test)


accuracy_score_svm = accuracy_score(y_test,pred_svm)
accuracy_score_svm*100
```

```
70.88414634146342
```