In [1]:

```
#importing libraries
import numpy as np
import pandas as pd
import matplotlib.pyplot as plt
import seaborn as sns
%matplotlib inline
```

In [2]:

```
#load the data
df=pd.read_csv("winequality_white.csv")
```

In [3]:

```
#shape of data
df.shape
```

Out[3]:

```
(4898, 12)
```

In [4]:

```
#features in data
df.columns
```

Out[4]:

```
Index(['fixed acidity', 'volatile acidity', 'citric acid', 'residual sugar',
       'chlorides', 'free sulfur dioxide', 'total sulfur dioxide', 'density',
       'pH', 'sulphates', 'alcohol', 'quality'],
      dtype='object')
```

In [5]:

```
#few datapoints
df.head()
```

Out[5]:

	fixed acidity	volatile acidity	citric acid	residual sugar	chlorides	free sulfur dioxide	total sulfur dioxide	density	pH	sulphates	alcohol	quality
0	7.0	0.27	0.36	20.7	0.045	45.0	170.0	1.0010	3.00	0.45	8.8	6
1	6.3	0.30	0.34	1.6	0.049	14.0	132.0	0.9940	3.30	0.49	9.5	6
2	8.1	0.28	0.40	6.9	0.050	30.0	97.0	0.9951	3.26	0.44	10.1	6
3	7.2	0.23	0.32	8.5	0.058	47.0	186.0	0.9956	3.19	0.40	9.9	6
4	7.2	0.23	0.32	8.5	0.058	47.0	186.0	0.9956	3.19	0.40	9.9	6

EDA

In [6]:

```
df.describe()
```

Out[6]:

	fixed acidity	volatile acidity	citric acid	residual sugar	chlorides	free sulfur dioxide	total sulfur dioxide	density	

	fixed acidity	volatile acidity	citric acid	residual sugar	chlorides	free sulfur dioxide	total sulfur dioxide	density	
count	4898.000000	4898.000000	4898.000000	4898.000000	4898.000000	4898.000000	4898.000000	4898.000000	4898.00
mean	6.854788	0.278241	0.334192	6.391415	0.045772	35.308085	138.360657	0.994027	3.18826
std	0.843868	0.100795	0.121020	5.072058	0.021848	17.007137	42.498065	0.002991	0.15100
min	3.800000	0.080000	0.000000	0.600000	0.009000	2.000000	9.000000	0.987110	2.72000
25%	6.300000	0.210000	0.270000	1.700000	0.036000	23.000000	108.000000	0.991723	3.09000
50%	6.800000	0.260000	0.320000	5.200000	0.043000	34.000000	134.000000	0.993740	3.18000
75%	7.300000	0.320000	0.390000	9.900000	0.050000	46.000000	167.000000	0.996100	3.28000
max	14.200000	1.100000	1.660000	65.800000	0.346000	289.000000	440.000000	1.038980	3.82000

1-there is wide range of all the features. 2-mean value of all the features are less than medium value. 3-there are some features whose max value so there may be some features with outliers.

In [7]:

```
#checking the missing data
df.isnull().any().any()
```

Out[7]:

```
False
```

there is no missing data.

In [8]:

```
#data information
df.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 4898 entries, 0 to 4897
Data columns (total 12 columns):
fixed acidity           4898 non-null float64
volatile acidity        4898 non-null float64
citric acid             4898 non-null float64
residual sugar          4898 non-null float64
chlorides               4898 non-null float64
free sulfur dioxide     4898 non-null float64
total sulfur dioxide    4898 non-null float64
density                 4898 non-null float64
pH                      4898 non-null float64
sulphates               4898 non-null float64
alcohol                 4898 non-null float64
quality                 4898 non-null int64
dtypes: float64(11), int64(1)
memory usage: 459.3 KB
```

all the features are numerical & mostly in decimal except quality.

In [9]:

```
#number of unique value in each features
for col in df.columns.values:
    print("Number of unique values of {} : {}".format(col, df[col].nunique()))
```

```
Number of unique values of fixed acidity : 68
Number of unique values of volatile acidity : 125
Number of unique values of citric acid : 87
Number of unique values of residual sugar : 310
Number of unique values of chlorides : 160
Number of unique values of free sulfur dioxide : 132
Number of unique values of total sulfur dioxide : 251
Number of unique values of density : 890
Number of unique values of pH : 103
Number of unique values of sulphates : 79
Number of unique values of alcohol : 103
Number of unique values of quality : 7
```

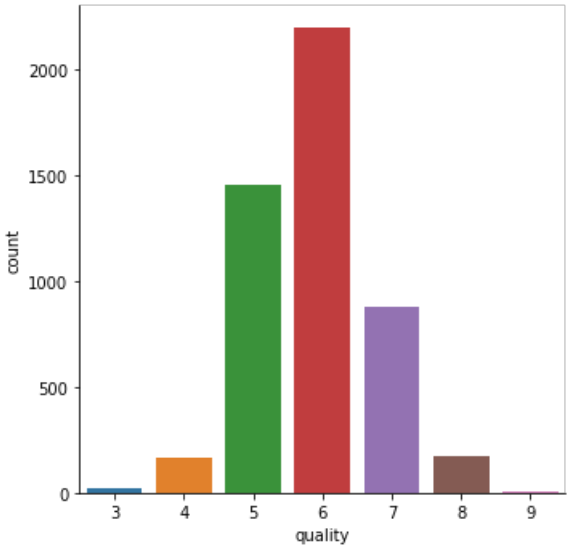
the feature which has max unique value is density. the feature which has min unique value is quality.

In [10]:

```
sns.catplot(x='quality',data=df,kind='count')
```

Out[10]:

```
<seaborn.axisgrid.FacetGrid at 0x12fc0cea5f8>
```



In [11]:

```
df['quality'].value_counts()
```

Out[11]:

```
6    2198
5    1457
7     880
8     175
4     163
3      20
9       5
Name: quality, dtype: int64
```

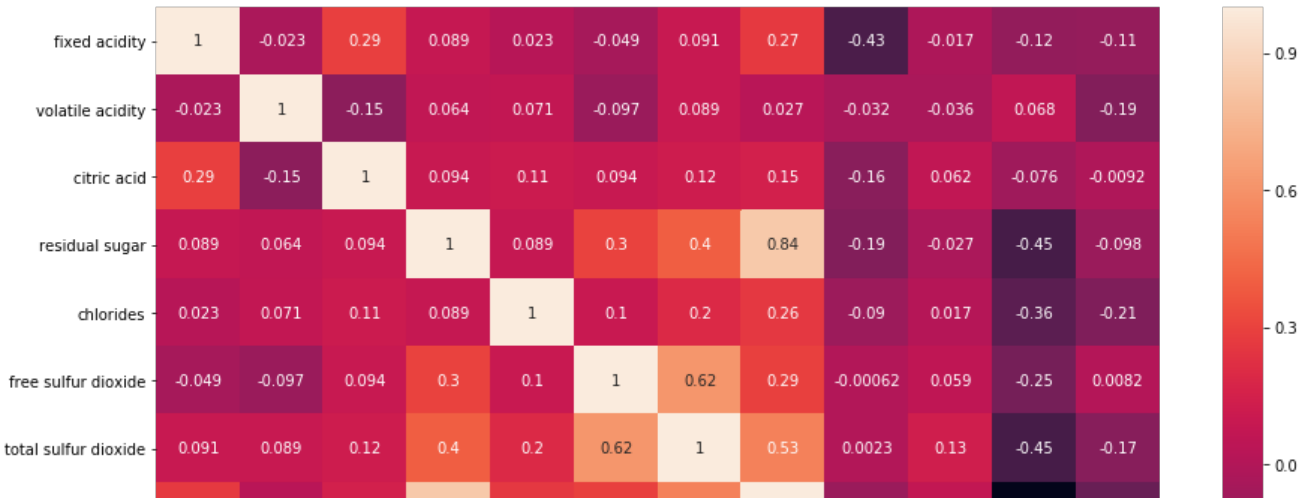
most of the wine has quality between 5 & 6.

In [14]:

```
plt.figure(figsize=(15,10))
sns.heatmap(df.corr(), annot=True)
```

Out[14]:

```
<matplotlib.axes._subplots.AxesSubplot at 0x12fc3f594a8>
```



In [ ]:

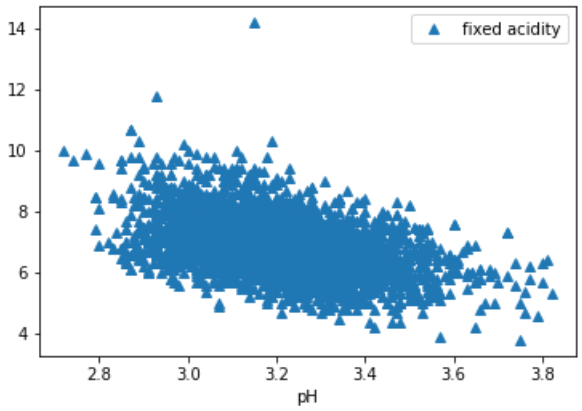
```
1-density & residual sugar has strong positive correlation
2-density & alcohol has strong negative correlation.
3-pH & fixed acidity has negative correlation.
4-density & fixed acidity has positive correlation.
5-citric acid & fixed acidity has positive correlation.
6-citric acid & volatile acidity has negative correlation.
7-free sulphur dioxide & total sulphur dioxide has positive correlation.
```

In [22]:

```
df.plot(x='pH', y='fixed acidity', style='^')
```

Out[22]:

```
<matplotlib.axes._subplots.AxesSubplot at 0x12fcbb7cdd8>
```

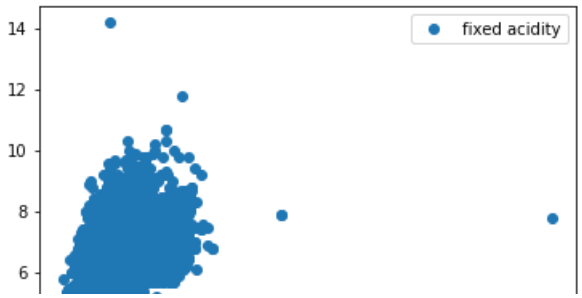


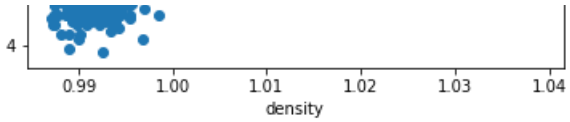
In [23]:

```
df.plot(x='density', y='fixed acidity', style='o')
```

Out[23]:

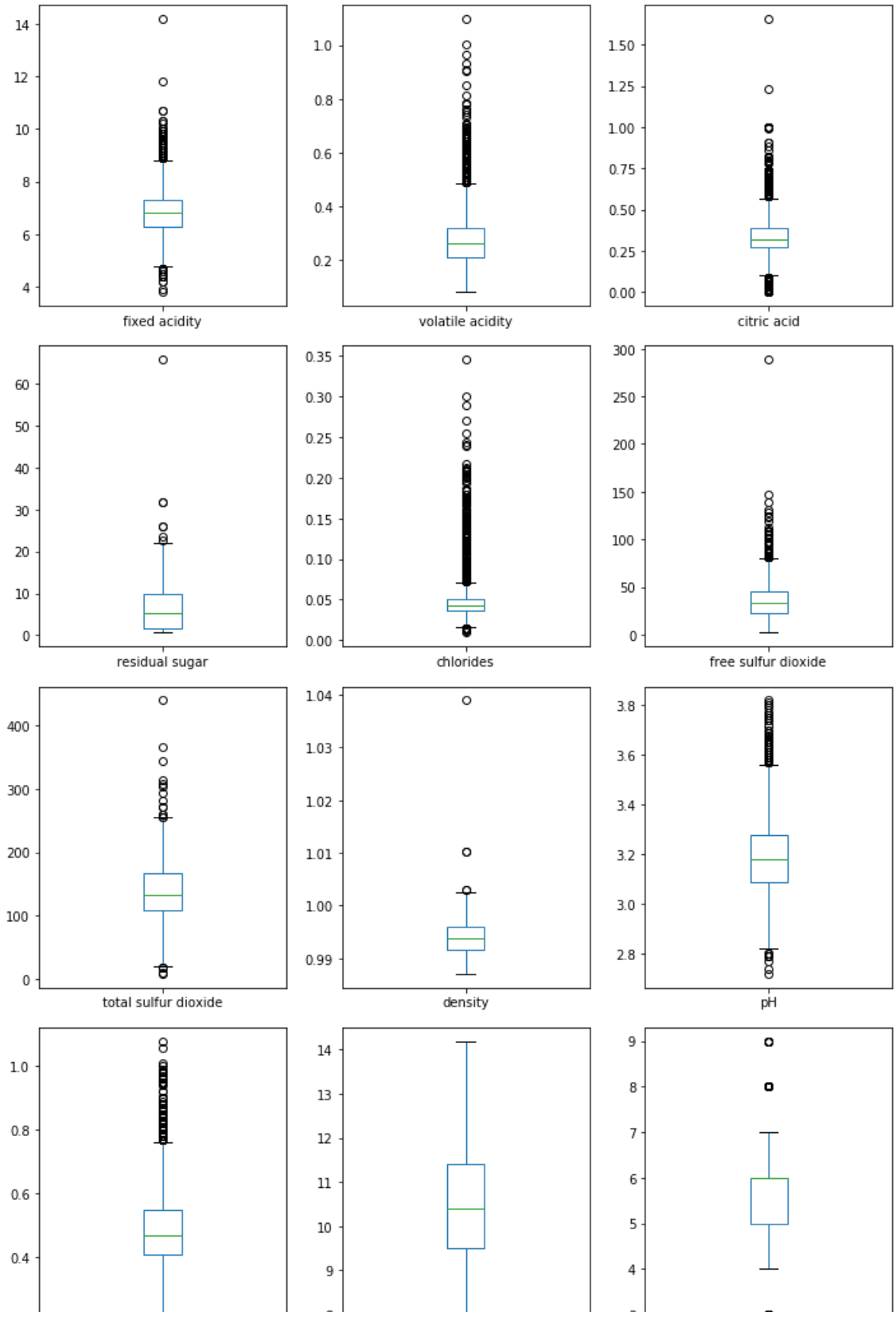
```
<matplotlib.axes._subplots.AxesSubplot at 0x12fcbbcada0>
```

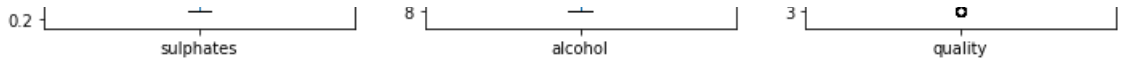




In [15]:

```
plt.figure(figsize=(10,15))
for i, col in enumerate(list(df.columns.values)):
    plt.subplot(4,3,i+1)
    df.boxplot(col)
    plt.grid()
    plt.tight_layout()
```

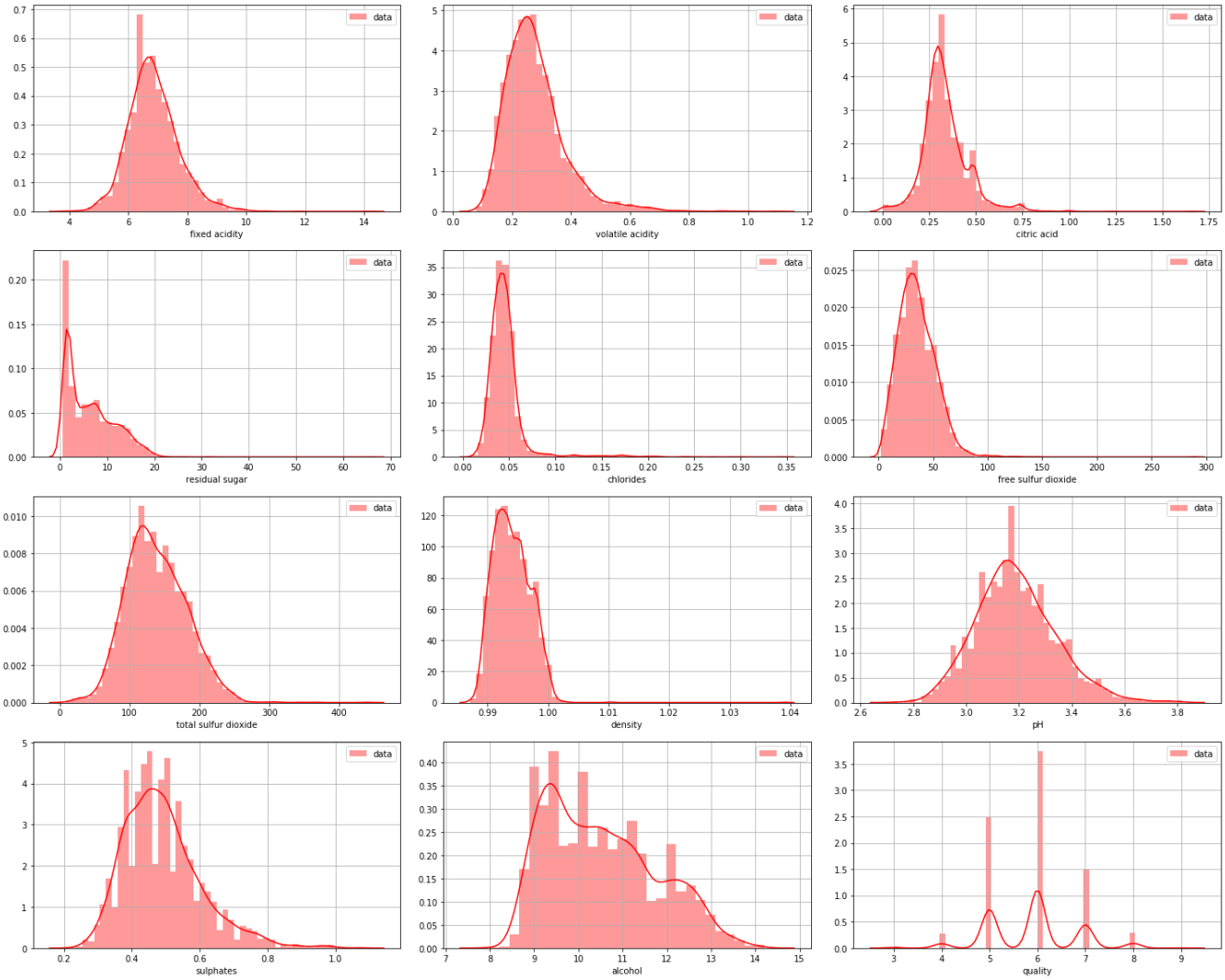




except alcohol,all other features have outliers

In [16]:

```
plt.figure(figsize=(20,16))
for i, col in enumerate(list(df.columns.values)):
    plt.subplot(4,3,i + 1)
    sns.distplot(df[col],color='r',kde=True,label='data')
    plt.grid()
    plt.legend(loc='upper right')
    plt.tight_layout()
```



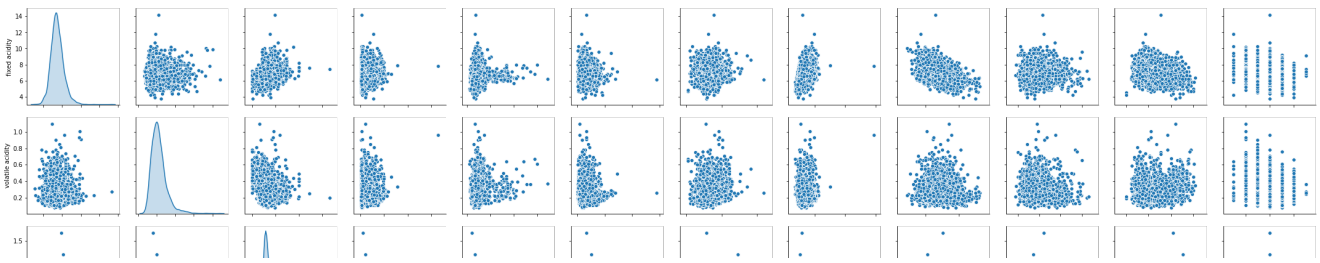
all the features are either left or rightly skewed except for the pH variable which is almost looking like normal distribution

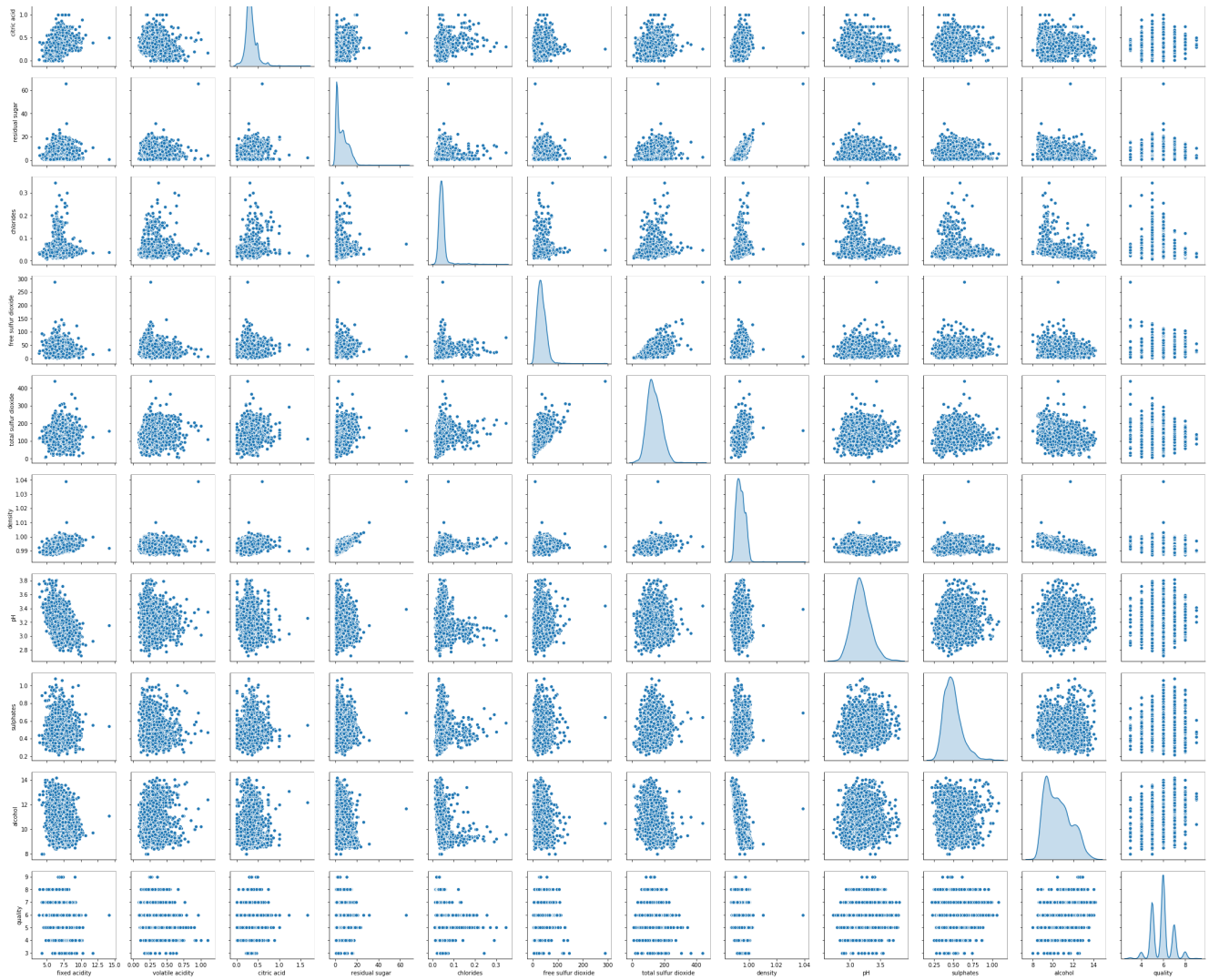
In [24]:

```
sns.pairplot(data=df,kind='scatter',diag_kind='kde')
```

Out[24]:

```
<seaborn.axisgrid.PairGrid at 0x12fcbbb2e80>
```




fixed acidity
volatile acidity
citric acid
residual sugar
chlorides
free sulfur dioxide
total sulfur dioxide
density
pH
sulphates
alcohol
quality