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Assignment 8

In [1]:
```
from scipy.optimize import fsolve
#specific volume of n-octane using Redlich-kwong equation of state
def specificvol(v):
    # for n-octane
    Tc=568.8 #K
    pc=24.5  #atm
    T=600    #K
    p=20     #atm
    R=0.08206 #l/gmol
    aRK=0.42748*(R*Tc)**2/pc
    aRK=aRK*(Tc/T)**0.5
    bRK=0.08664*(R*Tc/pc)
    return p*v**3-R*T*v**2+(aRK-p*bRK**2-R*T*bRK)*v-aRK*bRK
```

In [2]:
```
print(specificvol(2))
```

```
13.626115914387217
```

In [3]:
```
v=fsolve(specificvol,2)
print(v)
```

```
[1.75281907]
```

In [4]:
```
#python code to compute the compressibility factor for a number of pressure values.
from scipy.optimize import fsolve
import numpy as np
import matplotlib.pyplot as plt

#n-octane Redlich kwong equation
def specificvolRK(v,p):
    # for n-octane
    Tc=568.8 #K
    pc=24.5  #atm
    T=600    #K
    R=0.08206 #l/gmol
    aRK=0.42748*(R*Tc)**2/pc
    aRK=aRK*(Tc/T)**0.5
    bRK=0.08664*(R*Tc/pc)
    return p*v**3-R*T*v**2+(aRK-p*bRK**2-R*T*bRK)*v-aRK*bRK
```

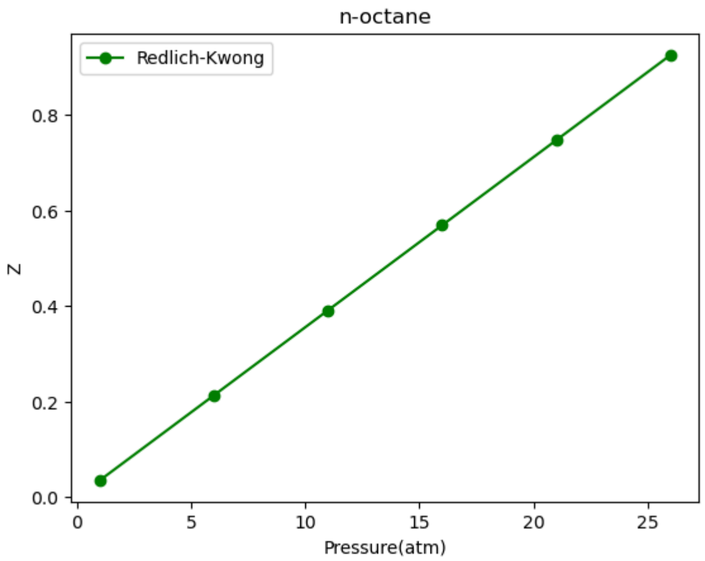
In [5]:
```
T=600
R=0.08206
pressure=np.arange(1,27,5)
print(pressure)
print(pressure[0])
print(pressure[5])
zcompRK=np.zeros(6,dtype=float)
zcompRKS=np.zeros(6,dtype=float)
zcompPR=np.zeros(6,dtype=float)
print(zcompRK)
```

```
[ 1  6 11 16 21 26]
1
26
[0. 0. 0. 0. 0. 0.]
```

In [9]:
```
for i in range (0,6,1):
    p=pressure[i]
    guess=R*T/p
    y=fsolve(specificvolRK,guess,p)
    z=p*v/(R*T)
    zcompRK[i]=z[0]
```

In [8]:
```
print(zcompRK)
plt.plot(pressure,zcompRK,'o-g',label='Redlich-Kwong')
plt.legend(loc='best')
plt.xlabel('Pressure(atm)')
plt.ylabel('Z')
plt.title('n-octane')
plt.show()
```

```
[0.03560035 0.21360213 0.3916039  0.56960568 0.74760745 0.92560923]
```


n-octane
Redlich-Kwong
Z
Pressure(atm)
0.0
0.2
0.4
0.6
0.8
0
5
10
15
20
25