```
clear
% U5.2 desorption
% A is benzene
% B is steam
% C is an oil

t = 120+273;   % K
p = 760*133.3; % Pa
xin = 0.1;        % mol-A / mol
Xin = xin/(1-xin) % mol-A/mol-C
```

```
Xin = 0.1111
```

```
yield = 0.9; % fraction removed from the oil
Xout = Xin*(1-yield) % mol-A/molC
```

```
Xout = 0.0111
```

```
nLin = 100; % mol/h
nC = (1-xin)*nLin % mol/h
```

```
nC = 90
```

```
nBratio = 2; % "nB = nBration*nBmin"
```

Equilibrium

```
% Let us try to use Raoults law for the equilibrium
% (extrapolating e-tables - 120C is out of scope)
psat = 1e3*exp(13.8858-2788.51/(t+(-52.36))) % Pa
```

```
psat = 2.9878e+05
```

```

% other source (https://en.wikipedia.org/wiki/Benzene_(data_page))
psat1=log(760/101.325)-8.433613*log(t)-6281.04/t+71.10718+6.198413e-6*t^2 % mmHg
```

```
psat1 = 7.7164
```

```
psat1=exp(psat1)*133.3 % Pa
```

```
psat1 = 2.9924e+05
```

```
% ...confirs that the saturated pressure is almost the same

psi = psat/p % y=psi*x
```

```
psi = 2.9492
```

```
% FUNCTION "phi" to describe equilibrium as "Y = phi(X) * X"
phi = @(x) psi./(1+x*(1-psi))
```

```
phi = function_handle with value:
    @(x)psi./(1+x*(1-psi))
```

```
Xeq = linspace(Xout,Xin,100);
Yeq = phi(Xeq).*Xeq;
```

```
Yin = 0
```

```
Yin = 0
```

```
% working line and equilibrium
MYout = 0.404; % fix this value visually according to graph (working line should touch

nBmin = nC*(Xin-Xout)/(MYout-Yin) % mol/h
```

```
nBmin = 22.2772
```

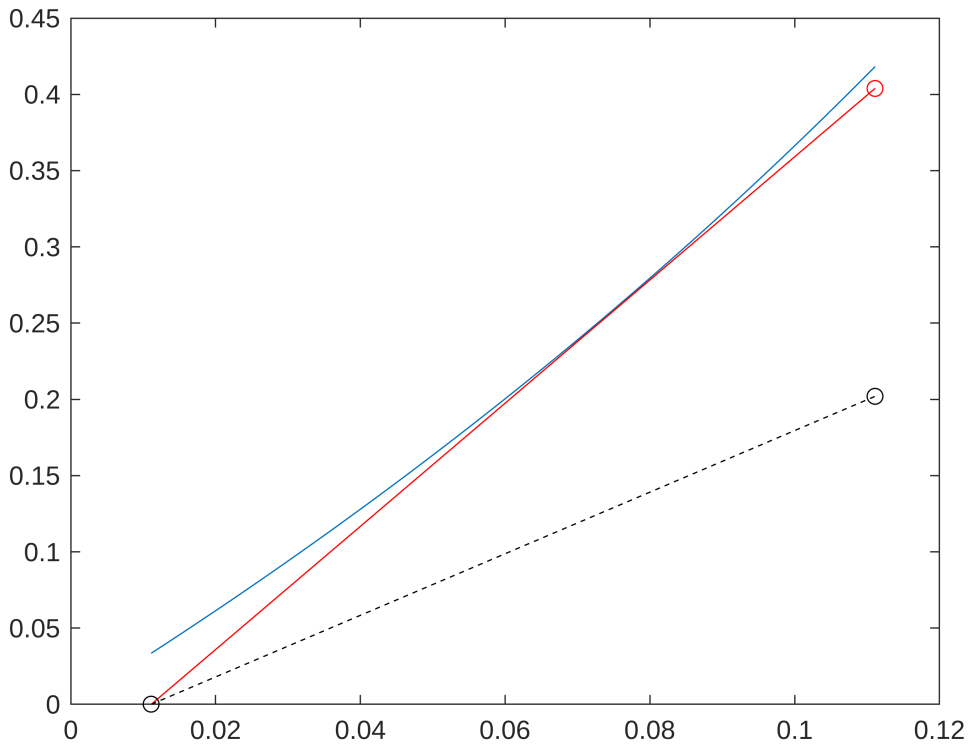
```
nB = nBratio*nBmin % mol/h [Expecting 44.1 mol/h]
```

```
nB = 44.5545
```

```
Yout = Yin + nC/nB*(Xin-Xout) % mol-A/mol-B
```

```
Yout = 0.2020
```

```
plot(Xeq,Yeq,'-',                  ... % equilibrium line (blue)
    [Xout Xin],[Yin MYout],'ro-', ... % working line nBmin (red)
    [Xout Xin],[Yin Yout], 'ko--')     % working line 2*nBmin (black)
```



```
title('Desorption - finding nBmin')
xlabel('X / mol-A/mol-C')
ylabel('Y / mol-A/mol-B')
```

```
% Converting Yout to mole fractions (same as volume fractions)
yout = Yout/(1+Yout) % mol-A/mol [Expecting 16.8%]
```

```
yout = 0.1681
```

Results: Steam consumprion is 44.55 mol/h (reported result is 44.1 mol/h, value in book 89.2 mol/h is an error). Benzene content in the outgoing steam is 16.8 vol. % (reported result 16.9 vol %)