cheg231 homework 4 question 3 calculations

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In [16]:
```
from thermo.chemical import Chemical
import numpy as np
import sympy as sp

methane = Chemical('methane', T=283, P=115114)
vunderbar = methane.Vm  # m³/ mol
print(f'thermo package specific volume = {vunderbar:.8f} m³/mol')

Vn = 8.3145 * 283 / 115114
print(f'ideal gas volume = {Vn:.8f} m³/mol')
```

```
thermo package specific volume = 0.02044055 m³/mol
ideal gas volume = 0.02044064 m³/mol
```

Ideal gas volume seems pretty good to me–I'll use that for my calculations. Evaluating the integral:

In [17]:
```
def methane_cp(T):
    return 19.875 + (5.021e-2 * T) + (1.268e-5 * T**2) + (-11.004e-9 * T**3)

Ti = 283
Tf = 600
temperatures = np.arange(Ti, Tf, 0.0001)

T = sp.symbols('T')
cp = methane_cp(T)
deltaH = sp.integrate(cp, (T, Ti, Tf))

print(f'delta h = {deltaH:.3f} J/mol')
```

```
delta h = 13805.818 J/mol
```

converting 100 CFM to mol/sec with the ideal gas calc. volume

In [18]:
```
ndot = 100 * (1/35.3147) * (1/Vn) / 60
print(f'ndot = {ndot:.3f} mol/sec')
```

```
ndot = 2.309 mol/sec
```

multiplying and getting into better units

In [19]:
```
qdot = ndot * deltaH / 1000
# round to 1 sigfig
qd = round(qdot, -1)
print(f'heat flow: {qdot:.2f} kJ/s')
print(f'heat flow (with sigfigs??): {qd:.0f} kJ/h')
```

```
heat flow: 31.88 kJ/s
heat flow (with sigfigs??): 30 kJ/h
```