







Total work considered for efficiency: 829.799 J

Total heat considered for efficiency: 3292.930 J

Efficiency (Work/Heat): 0.252

**End of stage 1: Equilibrium**

Current Time [s]: 0.200  
Avg Temperature Particles [K]: 599.431  
Volume [m<sup>3</sup>]: 0.249  
Internal pressure [Pa]: 20139.951  
External pressure [Pa]: 19954.700  
Total Energy [J]: 7476.441  
Total Work (by System) [J]: -18.753  
Total recorded work [J]: 0.000  
Work during current stage [J]: -18.753  
Total Heat (into System) [J]: -24.808  
Total recorded heat [J]: 0.000  
Heat during current stage [J]: -24.808  
 $pV/nRT$ : 1.007

**End of stage 2: Isothermal expansion**

Current Time [s]: 0.700  
Avg Temperature Particles [K]: 606.352  
Volume [m<sup>3</sup>]: 0.507  
Internal pressure [Pa]: 10025.319  
External pressure [Pa]: 9977.350  
Total Energy [J]: 7562.741  
Total Work (by System) [J]: 3413.968  
Total recorded work [J]: 3432.721  
Work during current stage [J]: 3432.721  
Total Heat (into System) [J]: 3494.193  
Total recorded heat [J]: 3519.001  
Heat during current stage [J]: 3519.001  
 $pV/nRT$ : 1.007

**End of stage 3: Adiabatic expansion**

Current Time [s]: 1.200  
Avg Temperature Particles [K]: 405.203  
Volume [m<sup>3</sup>]: 0.938  
Internal pressure [Pa]: 3592.686  
External pressure [Pa]: 3620.650  
Total Energy [J]: 5054.652  
Total Work (by System) [J]: 5912.047  
Total recorded work [J]: 5930.800  
Work during current stage [J]: 2498.080  
Total Heat (into System) [J]: 3484.765  
Total recorded heat [J]: 3519.001

Heat during current stage [J]: -9.428

$pV/nRT$ : 1.000

**End of stage 4: Isothermal compression**

Current Time [s]: 1.700

Avg Temperature Particles [K]: 405.645

Volume [ $m^3$ ]: 0.459

Internal pressure [Pa]: 7499.822

External pressure [Pa]: 7241.300

Total Energy [J]: 5059.091

Total Work (by System) [J]: 3445.189

Total recorded work [J]: 3463.942

Work during current stage [J]: -2466.858

Total Heat (into System) [J]: 1021.271

Total recorded heat [J]: 3519.001

Heat during current stage [J]: -2463.494

$pV/nRT$ : 1.022

**End of stage 5: Adiabatic compression**

Current Time [s]: 2.200

Avg Temperature Particles [K]: 615.975

Volume [ $m^3$ ]: 0.251

Internal pressure [Pa]: 20859.176

External pressure [Pa]: 19954.700

Total Energy [J]: 7682.624

Total Work (by System) [J]: 821.291

Total recorded work [J]: 840.044

Work during current stage [J]: -2623.898

Total Heat (into System) [J]: 1021.271

Total recorded heat [J]: 3519.001

Heat during current stage [J]: 0.000

$pV/nRT$ : 1.021

**End of stage 6: Equilibrium (end of experiment)**

Current Time [s]: 2.400

Avg Temperature Particles [K]: 591.087

Volume [ $m^3$ ]: 0.249

Internal pressure [Pa]: 19833.584

External pressure [Pa]: 19954.700

Total Energy [J]: 7372.108

Total Work (by System) [J]: 789.900

Total recorded work [J]: 808.653

Work during current stage [J]: -31.391

Total Heat (into System) [J]: 679.239

Total recorded heat [J]: 3176.969

Heat during current stage [J]: -342.032

$pV/nRT$ : 1.006

```
#Carnot experiment file 2.0
#experimentFileTmp.txt
#Settings
    Step size                : 0.00005
    Animation fps            : 20
    Reports per second       : 100
    Number of moles          : 1.0
    Number of particles      : 15000
    Particle mass            : 28.0
    Initial particle temperature : 600.0
    Particle heat exchange rate : 100.0
    Chamber width            : 1.0
    Chamber height           : 1.0
    Chamber depth            : 1.0
    Piston mass              : 0.2
    Initial heater temperature : 19954.7
#Scheduler
    scheduler name           : Equilibrium
    scheduler duration       : 0.2
    schedule piston?         : true
    schedule heaters?        : true
    schedule pressure?       : false
    report heat?             : false
    report work?             : false
    piston mode              : 0
    chamber volume           : 0.25
    heater mode              : 1
    heater temperature       : 600.0
    heater rate              : 100.0
    pressure mode            : 0
    pressure                 : 30000.0
#Scheduler
    scheduler name           : Isothermal expansion
    scheduler duration       : 0.5
    schedule piston?         : false
    schedule heaters?        : true
    schedule pressure?       : true
    report heat?             : true
    report work?             : true
    piston mode              : 0
    chamber volume           : 0.25
    heater mode              : 1
    heater temperature       : 600.0
    heater rate              : 100.0
    pressure mode            : 0
    pressure                 : 9977.35
#Scheduler
    scheduler name           : Adiabatic expansion
    scheduler duration       : 0.5
    schedule piston?         : false
    schedule heaters?        : true
    schedule pressure?       : true
    report heat?             : false
    report work?             : true
    piston mode              : 0
    chamber volume           : 0.5
    heater mode              : 0
```

```
heater temperature : 400.0
heater rate        : 100.0
pressure mode      : 0
pressure           : 3620.65
#Scheduler
scheduler name     : Isothermal compression
scheduler duration : 0.5
schedule piston?   : false
schedule heaters?  : true
schedule pressure? : true
report heat?       : false
report work?       : true
piston mode        : 0
chamber volume     : 0.5
heater mode         : 1
heater temperature  : 400.0
heater rate         : 100.0
pressure mode      : 0
pressure           : 7241.3
#Scheduler
scheduler name     : Adiabatic compression
scheduler duration : 0.5
schedule piston?   : false
schedule heaters?  : true
schedule pressure? : true
report heat?       : false
report work?       : true
piston mode        : 0
chamber volume     : 0.5
heater mode         : 0
heater temperature  : 300.0
heater rate         : 100.0
pressure mode      : 0
pressure           : 19954.7
#Scheduler
scheduler name     : Equilibrium
scheduler duration : 0.2
schedule piston?   : false
schedule heaters?  : true
schedule pressure? : false
report heat?       : true
report work?       : true
piston mode        : 0
chamber volume     : 0.5
heater mode         : 1
heater temperature  : 600.0
heater rate         : 100.0
pressure mode      : 0
pressure           : 30000.0
```