







Total work considered for efficiency: 1046.742 J

Total heat considered for efficiency: 3353.221 J

Efficiency (Work/Heat): 0.312

**End of stage 1: Equilibrium**

Current Time [s]: 1.000

Avg Temperature Particles [K]: 596.374

Volume [m<sup>3</sup>]: 0.252

Internal pressure [Pa]: 19467.170

External pressure [Pa]: 19954.700

Total Energy [J]: 7438.387

Total Work (by System) [J]: 35.803

Total recorded work [J]: 0.000

Work during current stage [J]: 35.803

Total Heat (into System) [J]: -8.231

Total recorded heat [J]: 0.000

Heat during current stage [J]: -8.231

$pV/nRT$ : 0.989

**End of stage 2: Isothermal expansion**

Current Time [s]: 6.000

Avg Temperature Particles [K]: 595.135

Volume [m<sup>3</sup>]: 0.490

Internal pressure [Pa]: 9988.643

External pressure [Pa]: 9977.350

Total Energy [J]: 7423.145

Total Work (by System) [J]: 3345.584

Total recorded work [J]: 3309.781

Work during current stage [J]: 3309.781

Total Heat (into System) [J]: 3286.514

Total recorded heat [J]: 3294.744

Heat during current stage [J]: 3294.744

$pV/nRT$ : 0.990

**End of stage 3: Adiabatic expansion**

Current Time [s]: 11.000

Avg Temperature Particles [K]: 396.143

Volume [m<sup>3</sup>]: 0.904

Internal pressure [Pa]: 3755.769

External pressure [Pa]: 3620.650

Total Energy [J]: 4940.650

Total Work (by System) [J]: 5827.432

Total recorded work [J]: 5791.629

Work during current stage [J]: 2481.848

Total Heat (into System) [J]: 3285.135

Total recorded heat [J]: 3294.744

Heat during current stage [J]: -1.379

$pV/nRT$ : 1.031

**End of stage 4: Isothermal compression**

Current Time [s]: 16.000

Avg Temperature Particles [K]: 399.165

Volume [ $m^3$ ]: 0.458

Internal pressure [Pa]: 6850.267

External pressure [Pa]: 7241.300

Total Energy [J]: 4980.409

Total Work (by System) [J]: 3548.071

Total recorded work [J]: 3512.269

Work during current stage [J]: -2279.360

Total Heat (into System) [J]: 1047.604

Total recorded heat [J]: 3294.744

Heat during current stage [J]: -2237.531

$pV/nRT$ : 0.944

**End of stage 5: Adiabatic compression**

Current Time [s]: 21.000

Avg Temperature Particles [K]: 599.720

Volume [ $m^3$ ]: 0.249

Internal pressure [Pa]: 20054.148

External pressure [Pa]: 19954.700

Total Energy [J]: 7480.904

Total Work (by System) [J]: 1048.331

Total recorded work [J]: 1012.528

Work during current stage [J]: -2499.740

Total Heat (into System) [J]: 1047.604

Total recorded heat [J]: 3294.744

Heat during current stage [J]: 0.000

$pV/nRT$ : 1.002

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

Current Time [s]: 22.000

Avg Temperature Particles [K]: 601.566

Volume [ $m^3$ ]: 0.249

Internal pressure [Pa]: 19709.027

External pressure [Pa]: 19954.700

Total Energy [J]: 7504.619

Total Work (by System) [J]: 1044.584

Total recorded work [J]: 1008.782

Work during current stage [J]: -3.747

Total Heat (into System) [J]: 1068.253

Total recorded heat [J]: 3315.393

Heat during current stage [J]: 20.649

$pV/nRT$ : 0.982

```

#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       : 1.0
    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       : 5.0
    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       : 5.0
    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 : 5.0
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 : 5.0
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 : 1.0
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
```