

Woodenbox

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1 Global

Used products

COMSOL Multiphysics

1.1 Definitions

1.1.1 Parameters 1

Parameters

Name	Expression	Value	Description
Text	293[K]	293.00 K	
lw	0.1[W/m/K]	0.10000 W/(m·K)	
thickness	30[cm]	0.30000 m	
k	10[W/m ² /K]	10.000 W/(m ² ·K)	
k_tot	1/(2/k + thickness/lw)	0.31250 W/(m ² ·K)	
k2	50*k	500.00 W/(m ² ·K)	

2 Component 2

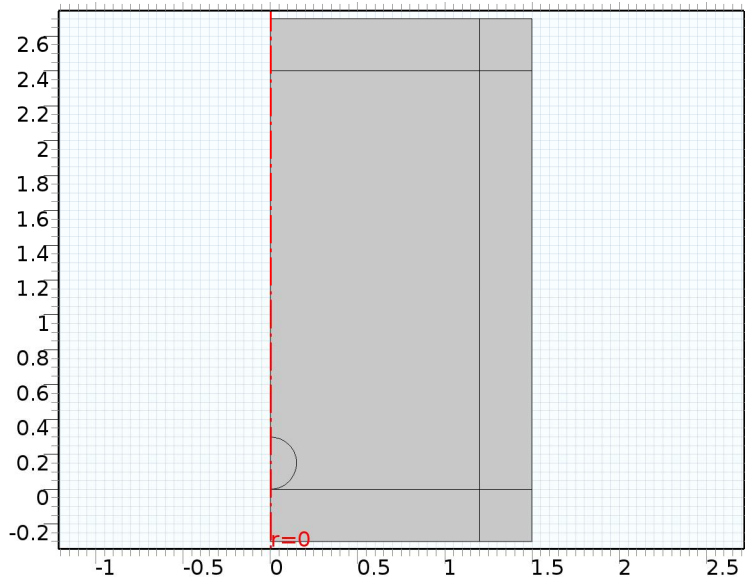
2.1 Definitions

2.1.1 Coordinate Systems

Boundary System 2

Coordinate system type	Boundary system
Tag	sys2

2.2 Geometry 2



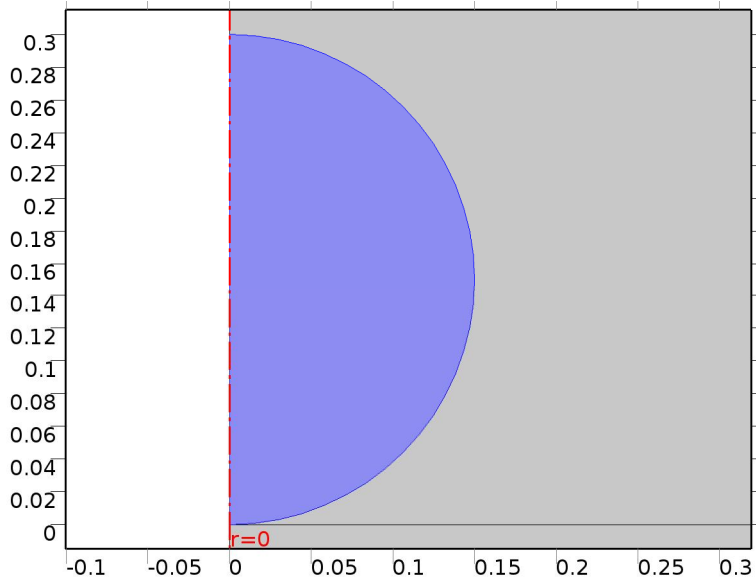
Geometry 2

Units

Length unit	m
Angular unit	deg

2.3 Materials

2.3.1 Gold [solid] (2)



Gold [solid] (2)

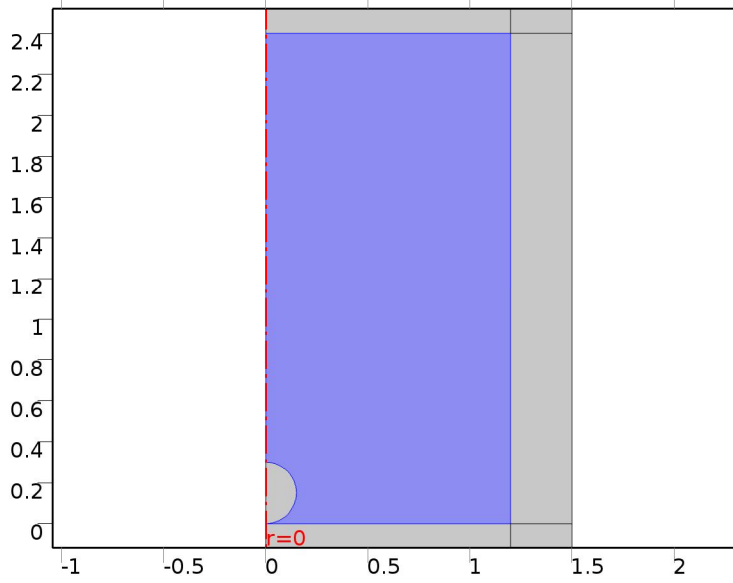
Selection

Geometric entity level	Domain
Selection	Domain 2

Material parameters

Name	Value	Unit
Thermal conductivity	$k_{\text{solid}_1}(T[1/K])[W/(m \cdot K)]$	$W/(m \cdot K)$
Heat capacity at constant pressure	$C_{\text{solid}_1}(T[1/K])[J/(kg \cdot K)]$	$J/(kg \cdot K)$
Density	$\rho(T[1/K])[kg/m^3]$	kg/m^3

2.3.2 Air (2)



Air (2)

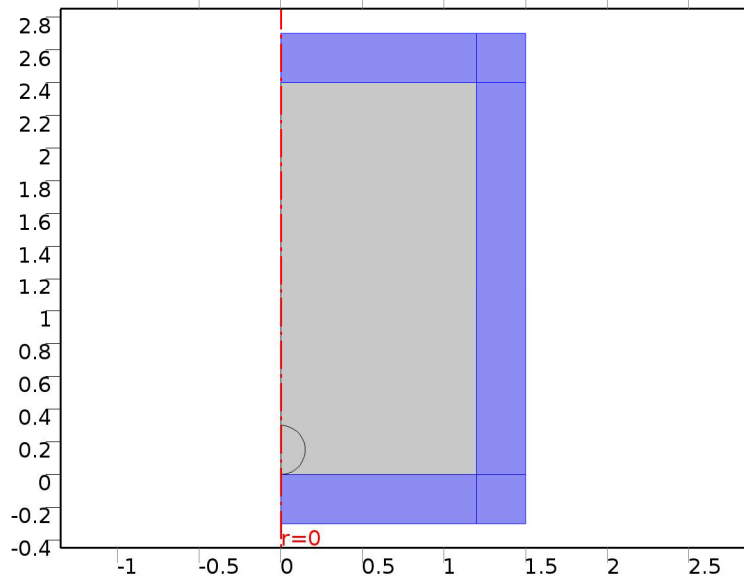
Selection

Geometric entity level	Domain
Selection	Domain 3

Material parameters

Name	Value	Unit
Ratio of specific heats	1.4	1
Heat capacity at constant pressure	$C_p(T[1/K])[J/(kg \cdot K)]$	$J/(kg \cdot K)$
Density	$\rho(p_A[1/Pa], T[1/K])[kg/m^3]$	kg/m^3
Thermal conductivity	$k(T[1/K])[W/(m \cdot K)]$	$W/(m \cdot K)$

2.3.3 Kingwood [solid] 1



Kingwood [solid] 1

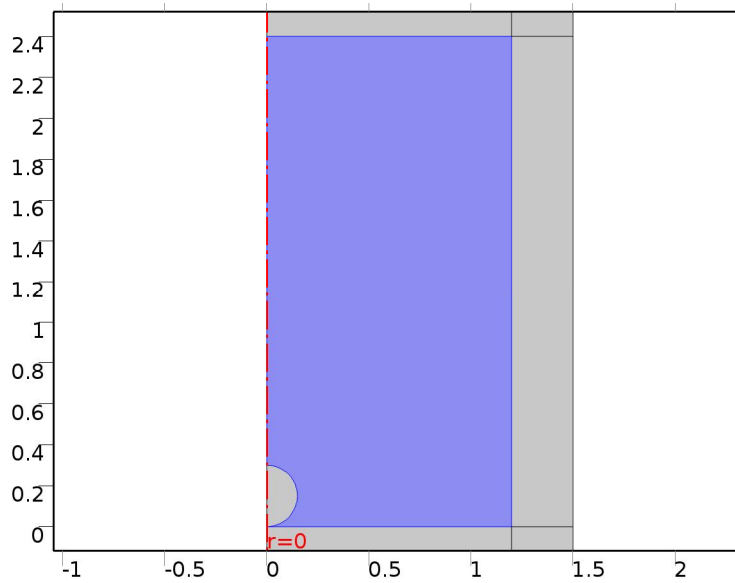
Selection

Geometric entity level	Domain
Selection	Domains 1, 4-7

Material parameters

Name	Value	Unit
Density	$\rho(T[1/K])[\text{kg}/\text{m}^3]$	kg/m^3
Thermal conductivity	0.1	$\text{W}/(\text{m}\cdot\text{K})$
Heat capacity at constant pressure	1700	$\text{J}/(\text{kg}\cdot\text{K})$

2.4 Heat Transfer in Fluids



Heat Transfer in Fluids

Selection

Geometric entity level	Domain
Selection	Domain 3

Equations

$$\rho C_p \frac{\partial T}{\partial t} + \rho C_p \mathbf{u} \cdot \nabla T = \nabla \cdot (k \nabla T) + Q + Q_{vd} + Q_p$$

Settings

Features

Heat Transfer in Fluids 1
Initial Values 1
Axial Symmetry 1
Thermal Insulation 1
Heat Flux 1
Heat Flux 2

2.4.1 Heat Transfer in Fluids 1

Equations

$$\rho C_p \frac{\partial T}{\partial t} + \rho C_p \mathbf{u} \cdot \nabla T = \nabla \cdot (k \nabla T) + Q + Q_{vd} + Q_p$$

2.4.2 Initial Values 1

Variables

Name	Expression	Unit	Description	Selection
ht.Tinit	297	K	Temperature	Domain 3

2.4.3 Thermal Insulation 1

Equations

$$-\mathbf{n} \cdot (-k\nabla T) = 0$$

2.4.4 Heat Flux 1

Equations

$$-\mathbf{n} \cdot (-k\nabla T) = q_0$$

Variables

Name	Expression	Unit	Description	Selection
ht.hf1.q0	$k_{tot} \cdot (T_{ext} - T)$	W/m ²	Inward heat flux	Boundaries 4, 8, 12

2.4.5 Heat Flux 2

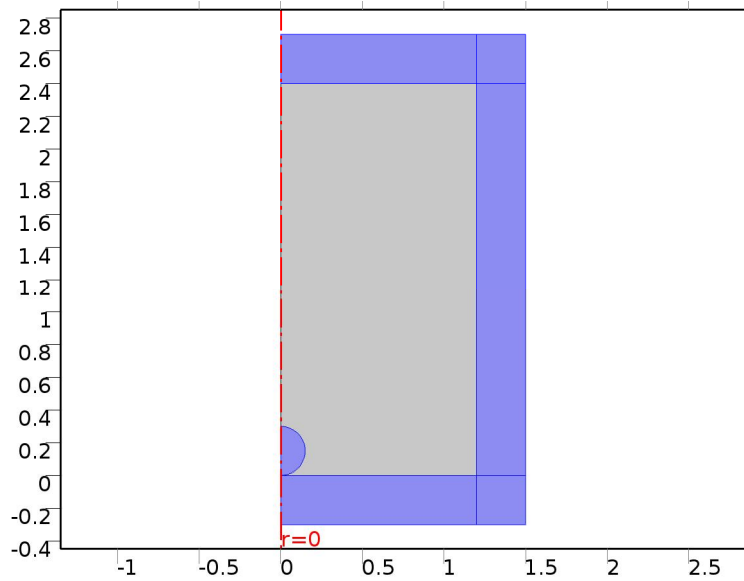
Equations

$$-\mathbf{n} \cdot (-k\nabla T) = q_0$$

Variables

Name	Expression	Unit	Description	Selection
ht.hf2.q0	$k_2 \cdot (T_2 - T)$	W/m ²	Inward heat flux	Boundaries 20-21

2.5 Heat Transfer in Solids 2



Heat Transfer in Solids 2

Selection

Geometric entity level	Domain
Selection	Domains 1–2, 4–7

Equations

$$\rho c_p \frac{\partial T_2}{\partial t} + \rho c_p \mathbf{u} \cdot \nabla T_2 = \nabla \cdot (k \nabla T_2) + Q$$

Settings

Variables

Features

Heat Transfer in Solids 1
Initial Values 1
Axial Symmetry 1
Thermal Insulation 1
Initial Values 2
Heat Flux 1
Heat Flux 2
Heat Flux 3

2.5.1 Heat Transfer in Solids 1

Equations

$$\rho C_p \frac{\partial T_2}{\partial t} + \rho C_p \mathbf{u} \cdot \nabla T_2 = \nabla \cdot (k \nabla T_2) + Q$$

Variables

2.5.2 Initial Values 1

Variables

Name	Expression	Unit	Description	Selection
ht2.Tinit	293.15[K]	K	Temperature	Domains 1, 4–7

2.5.3 Thermal Insulation 1

Equations

$$-\mathbf{n} \cdot (-k \nabla T_2) = 0$$

2.5.4 Initial Values 2

Variables

Name	Expression	Unit	Description	Selection
ht2.Tinit	350	K	Temperature	Domain 2

2.5.5 Heat Flux 1

Equations

$$-\mathbf{n} \cdot (-k \nabla T_2) = q_0$$

Variables

Name	Expression	Unit	Description	Selection
ht2.hf1.q0	$-k^*(T_2 - T)$	W/m ²	Inward heat flux	Boundaries 20–21

2.5.6 Heat Flux 2

Equations

$$-\mathbf{n} \cdot (-k \nabla T_2) = q_0$$

Variables

Name	Expression	Unit	Description	Selection
ht2.hf2.q0	$k^*(T - T_2)$	W/m ²	Inward heat flux	Boundaries 4, 8, 12

2.5.7 Heat Flux 3

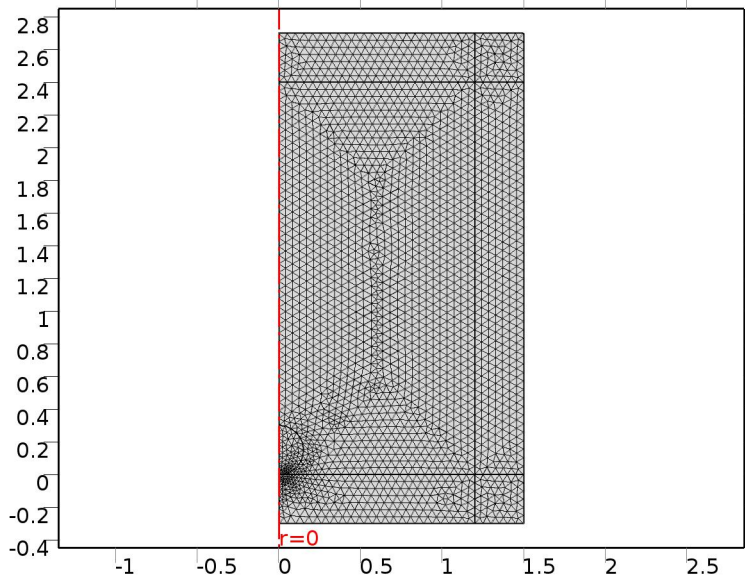
Equations

$$-\mathbf{n} \cdot (-k \nabla T_2) = \underline{q_0}$$

Variables

Name	Expression	Unit	Description	Selection
ht2.hf3.q0	$-k \cdot (T_2 - T_{ext})$	W/m ²	Inward heat flux	Boundaries 2, 9, 11, 16–19

2.6 Mesh 2



Mesh 2

3 Study 1

3.1 Time Dependent

Study settings

Property	Value
Include geometric nonlinearity	Off

Times	Unit
$10^{\{\text{range}(0,0.05,5)\}}$	s

Physics and variables selection

Physics interface	Discretization
Heat Transfer in Fluids (ht)	physics
Heat Transfer in Solids 2 (ht2)	physics

Mesh selection

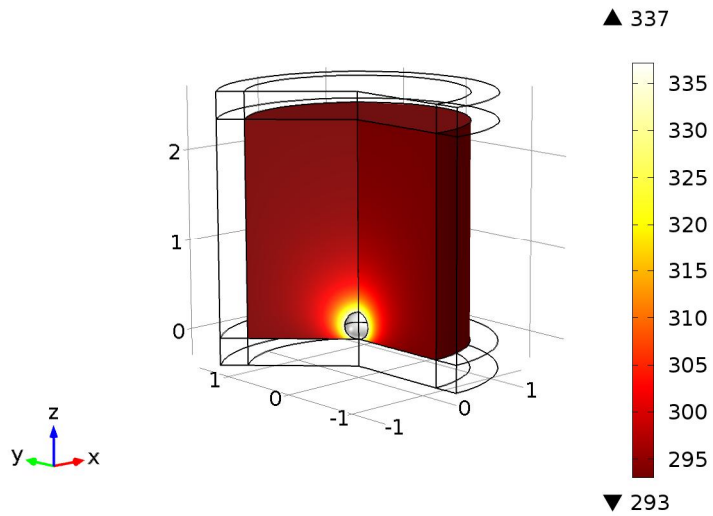
Geometry	Mesh
Geometry 2 (geom2)	mesh2

4 Results

4.1 Plot Groups

4.1.1 Temperature, 3D (ht)

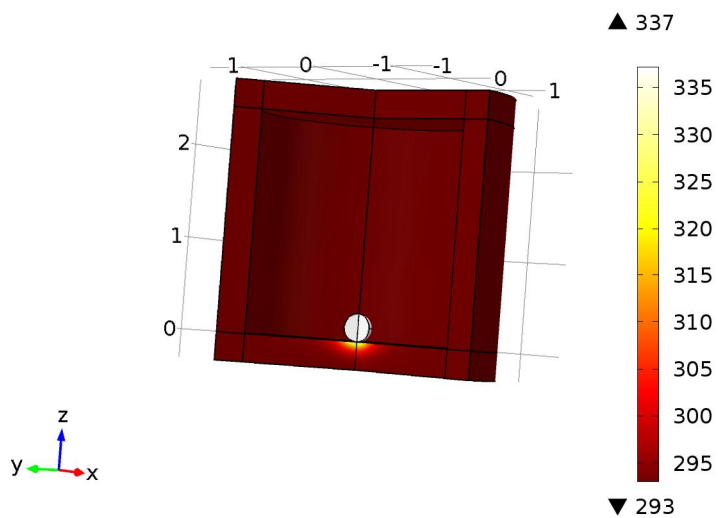
Time=1.0000E5 s Surface: Temperature (K)



Time=1.0000E5 s Surface: Temperature (K)

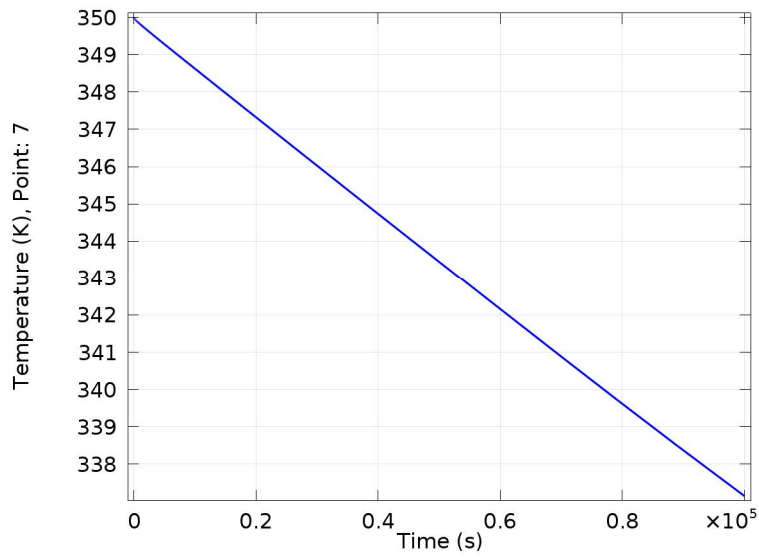
4.1.2 Temperature, 3D (ht2)

Time=1.0000E5 s Surface: Temperature (K)



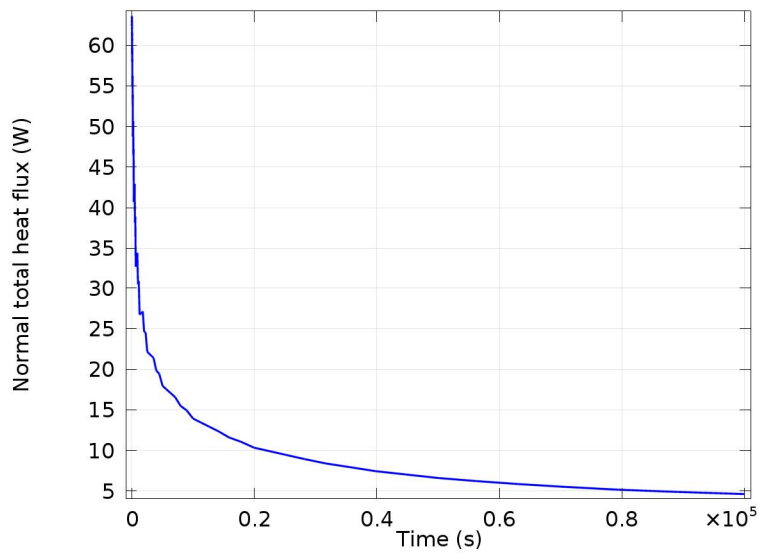
Time=1.0000E5 s Surface: Temperature (K)

4.1.3 1D Plot Group 5



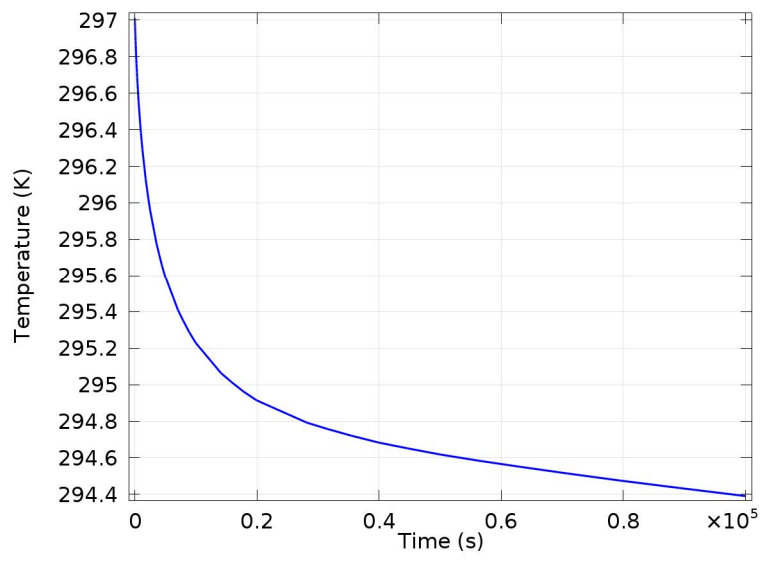
Gold average temperature

4.1.4 1D Plot Group 6



Heat flux across outer boundaries

4.1.5 1D Plot Group 7



Air average temperatute