Science Virtual Learning

MPI Physics 210
Thermodynamics 8: Calorimetry 2
May 18, 2020

Lesson: MPI Thermodynamics 8 – Calorimetry 2
May 18, 2020

Objective: To be able to solve calorimetry problems including phase changes

This video how to solve calorimetry problems when there is a phase change.

https://youtu.be/HN99geGpUtc

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Video: Calorimetry 2

A McDonald's employee adds 0.184 kg of ice at -12.0 °C to a 0.500 kg cup of soda (which is mostly water) at 20.0°C. Some, but not all, of the ice melts, creating a mixture of ice and water at the melting point, 0°C. How much ice is left in the cup?

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Example from Video

TABLE 19.2 Latent Heats of Fusion and Vaporization

Substance	Melting Point (°C)	Latent Heat of Fusion (J/kg)	Boiling Point (°C)	Latent Heat of Vaporization (J/kg)
Helium[a]	−272.2	5.23×10^3	−268.93	2.09×10^4
Oxygen	−218.79	1.38×10^4	−182.97	2.13×10^5
Nitrogen	−209.97	2.55×10^4	−195.81	2.01×10^5
Ethyl alcohol	−114	1.04×10^5	78	8.54×10^5
Water	0.00	3.33×10^5	100.00	2.26×10^6
Sulfur	119	3.81×10^4	444.60	3.26×10^5
Lead	327.3	2.45×10^4	1 750	8.70×10^5
Aluminum	660	3.97×10^5	2 450	1.14×10^7
Silver	960.80	8.82×10^4	2 193	2.33×10^6
Gold	1 063.00	6.44×10^4	2 660	1.58×10^6
Copper	1 083	1.34×10^5	1 187	5.06×10^6

[a]Helium does not solidify at atmospheric pressure. The melting point given here corresponds to a pressure of 2.5 MPa.

Latent Heat Table

TABLE 19.1 Specific Heats of Some Substances at 25°C and Atmospheric Pressure

Substance	Specific Heat (J/kg · °C)	Substance	Specific Heat (J/kg · °C)
Elemental solids		*Other solids*	
Aluminum	900	Brass	380
Beryllium	1 830	Glass	837
Cadmium	230	Ice (−5°C)	2 090
Copper	387	Marble	860
Germanium	322	Wood	1 700
Gold	129		
Iron	448	*Liquids*	
Lead	128	Alcohol (ethyl)	2 400
Silicon	703	Mercury	140
Silver	234	Water (15°C)	4 186
		Gas	
		Steam (100°C)	2 010

Note: To convert values to units of cal/g · °C, divide by 4 186.

Specific Heat Table

Homework 1

- Try to solve the problem yourself, then watch the solution video:
- https://youtu.be/fAuZn2T4bp8

1. A coppersmith pours 0.349 kg of molten copper at its melting point (1083°C) into 1.50 kg of water at 20.8°C. The copper solidifies, and cools. What is the final temperature of the copper and water?

Homework 2

- Try to solve the problem yourself, then watch the solution video:
- https://youtu.be/CFboP4DDOlI

2. In the previous problem, what if the smith had poured 3.49 kg of molten copper into the water? This time, some (not all) of the water would have boiled away at 100°C. How much water boiled off?

That's it!