

Useful physical constants

Thermal conductivity

Ingredient	State/temp.range	W/m°C (SI unit)	BTU/h ft°F (IMP unit)	Source
Cocoa mass	60°C (140°F)	0.21	0.123	[a]
Cocoa butter	Liquid 43°C (110°F)	0.12	0.07	[b]
Chocolate	40°C (104°F)	0.26	0.15	[c]
	35°C (95°F)	0.26	0.15	[c]
	30°C (86°F)	0.27	0.16	[c]
	27°C (80°F)	0.28	0.16	[c]
	15°C° (60°F)	0.22	0.13	[c]

^aMeasurement complicated by the long crystallization process and the associated heat of crystallization.

Sources:

[a] A. Dodson (1975) *Thermal Conductivity of Foods*. BFMIRA, Leatherhead, UK

[b] *The Manufacturing Confectioner*. August 1991.P.43.

[c] S.M. Clegg (2001) *Thermal Conductivity of Chocolate*: Summary Report Scientific & Technical Note 203, Leatherhead Food International. July 2001.

Specific heat

Ingredient	State/temp.range	J/kg°C (SI unit)	BTU/lbs°F (IMP unit)	Source
Cocoa butter	Solid/15–21°C (60–70°F)	2010	0.48	[a]
	Liquid/32–82°C (90–180°F)	2090	0.50	[a]
Chocolate	Liquid/solid 15–40°C (60–120°F)	1590	0.38	[a]
	Liquid/40–60°C (104–140°F)	1670	0.40	
Cocoa mass	Solid/4–25°C (39–77°F)	1970	0.47	
	Liquid/30–59°C (86–131°F)	1420	0.34	

Source: [a] *The Manufacturing Confectioner*, August 1991.p.43

Latent heat

Ingredient	J/g (SI unit)	BTU/lbs (IMP unit)
Cocoa butter	157	67.6
Dark chocolate	46	20.0
Milk chocolate	44	19.0

Source: J. Chevaley *et al.* (1970) A study of the physical properties of chocolate. *Reviews in international chocolate* **25** (Jan.) 4.

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ERH

Ingredient	Moisture content (%)	a_w range	ERH (%)
Chocolate	0.1–0.5	0.4	35–40

Source: *The Manufacturing Confectioner*, January 1987, p. 65.

Density

Ingredient	State/temp.range	g/cm^3 (SI unit)	lb/ft^3 (IMP unit)
Cocoa butter	Solid/15°C (59°F)	0.96–0.99	60
	Liquid	0.88–0.90	55
Chocolate	Solid	1.3	80
	Liquid/40°C (104°F)	1.2	76
Cocoa mass	Solid	1.1	68

Source: *The manufacturing confectioner*, July 1969, p. 49.

Flash point of Cocoa butter (with 1 % free fatty acid (FFA)) is 315°C (600°F). It will however be lower if more FFA or solvent extracted butter is present. (Rossell. J.B.(1998) Leatherhead Food RA, private communication.)