Microbial D-Value, z-Value and Log Reduction

Decimal reduction time at a process temperature from a reference D and z-value, the log reductions in a given time, and the survivors from an initial count.

Method: First-order microbial death: N = N₀·10^(−t/D); D_T = D_ref·10^((T_ref − T)/z)

Input parameters

Unit system: SI

Parameter	Value	Unit
D-value at the reference temperature	0.20000	min
Reference temperature	121.10	°C
z-value	10.000	K
Process temperature	116.00	°C
Time at temperature	20.000	min
Initial count (per unit)	100,000	

Calculated results

Parameter	Value	Unit
D-value at T	0.64719	min
Log reductions	30.903	
Survivors per unit (below 1: chance of a survivor)	1.2504e-26	

Notes for this case

- Fewer than one survivor per unit: N is the probability that a unit still holds a survivor (about 1 in 8E+25).

Formula and method

$$D_T = D_{ref}\,10^{(T_{ref}-T)/z}, \quad \log\frac{N_0}{N} = \frac{t}{D_T}$$

Variables

D_{ref}	D-value at the reference temperature	s
T_{ref}	Reference temperature	K
z	z-value	K
T	Process temperature	K
t	Time at temperature	s
N_0	Initial count (per unit)	-
D_T	D-value at T	s
$\log(N_0/N)$	Log reductions	-
N	Survivors per unit (below 1: chance of a survivor)	-

Method and standards

First-order kinetics.

Assumptions and limits

- Log-linear survivor curves.
- A survivor count below 1 per unit is the probability that a unit still holds a surviving organism (for example 10^{-6} is one unit in a million).

References

- First-order microbial death: N = N₀·10^(−t/D); D_T = D_ref·10^((T_ref − T)/z)

Report details

Report reference	FCC-K7VB-H1FG (the same inputs always give the same reference)
Generated	17 November 2026, 19:46 UTC
Calculator	Microbial D-Value, z-Value and Log Reduction
Method last reviewed	13 November 2026
Software release	FireCAD Calc, release of 17 November 2026
Release checks	2 reference cases of this calculator, computed independently, are checked on every release

Results are for engineering estimation. Verify critical designs against the referenced standards and your own data.

This calculator online

https://calc.firecad.com/chemical/food-dairy/d-value-log-reduction

Open this case on calc.firecad.com →

Reopens the calculator with the inputs of this report.