Chute: Sliding Velocity and Minimum Angle

Velocity of material sliding down an inclined chute from the entry velocity, chute length and angle and the friction coefficient, with the minimum angle for flow.

Method: Particle dynamics on an inclined plane with Coulomb friction (definitions)

Input parameters

Unit system: SI

Parameter	Value	Unit
Entry velocity	1.0000	m/s
Chute length	6.0000	m
Chute angle from horizontal	44.977	°
Friction coefficient (material on liner)	0.50000	

Calculated results

Parameter	Value	Unit
Minimum angle for sliding	26.565	°
Acceleration along the chute	3.4630	m/s²
Exit velocity	6.5235	m/s
Time on the chute	1.5950	s

Notes for this case

• Sliding-block model with Coulomb friction; it ignores air drag and impact losses. Wet or sticky material can need 10–15° more than the dry friction angle.

Formula and method

$$a = g(\sin\theta - \mu\cos\theta), \quad v^2 = v_0^2 + 2aL, \quad \theta_{min} = \arctan\mu$$

Variables

v_0	Entry velocity	m/s
L	Chute length	m
θ	Chute angle from horizontal	rad
μ	Friction coefficient (material on liner)	-
θ_{min}	Minimum angle for sliding	rad
a	Acceleration along the chute, in m/s²	m/s²
v	Exit velocity	m/s
t	Time on the chute	s

Method and standards

Inclined-plane dynamics.

Assumptions and limits

- Sliding as a block.
- The acceleration is always shown in m/s², whatever the unit system.

References

• Particle dynamics on an inclined plane with Coulomb friction (definitions)

Report details

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

This calculator online

https://calc.firecad.com/mechanical/material-handling/chute-sliding-velocity

Open this case on calc.firecad.com →

Reopens the calculator with the inputs of this report.