

From Space to Earth: Meteor Crater

www.barringercrater.com

Teacher Key B: What If...? Experimenting with Impact Scenarios

Impact Velocity

Earth Impact Effects Program: Go to <http://www.lpl.arizona.edu/impacffects/>

Impact Velocity	Barringer Crater - 20km/sec	Trial 1 – 35km/sec	Trial 2- 45km/sec	Trial 3- 65km/sec
Energy in MegaTons Before Atmospheric Entry	7.63 x 10 ¹⁶ Joules = 1.82 x 10 ¹ MegaTons TNT	5.59 x 10 ¹ MegaTons TNT	9.23 x 10 ¹ MegaTons TNT	1.93 x 10 ² MegaTons TNT
Major global change- Describe briefly.	Earth is not strongly disturbed; no noticeable change in the tilt of the axis; does not shift the orbit noticeably	Earth is not strongly disturbed; no noticeable change in tilt of axis (<5 hundredths of a degree); doesn't shift orbit noticeably	Earth is not strongly disturbed; no noticeable change in tilt of axis (<5 hundredths of a degree); doesn't shift orbit noticeably	Earth is not strongly disturbed; no noticeable change in tilt of axis (<5 hundredths of a degree); doesn't shift orbit noticeably
What happens to the projectile when it enters the atmosphere? At what velocity does it hit the Earth? Impact Energy in MegaTons	Begins to break up at an altitude of 16800 meters = 54900 ft ; reaches the ground in a broken condition. strikes the surface at velocity 12.1 km/s = 7.52 miles/s The impact energy is 2.80 x 10¹⁶ Joules = 6.68 MegaTons.	Begins to breakup at an altitude of 25700 meters = 84400 ft; reaches the ground in a broken condition; strikes the surface at velocity 14.8 km/s = 9.2 miles/s 4.19 x 10 ¹⁶ Joules = 1.00 x 10 ¹ MegaTons	Begins to breakup at an altitude of 29800 meters = 97600 ft; reaches the ground in a broken condition; strikes the surface at velocity 16.7 km/s = 10.4 miles/s 5.33 x 10 ¹⁶ Joules = 1.27 x 10 ¹ MegaTons	Begins to breakup at an altitude of 35600 meters = 117000 ft; bursts into a cloud of fragments at an altitude of 336 meters = 1100 ft; residual velocity of the projectile fragments after the burst is 22.8 km/s = 14.2 miles/s Energy of the airburst is 7.07 x 10 ¹⁷ Joules = 1.69 x 10 ² MegaTons.
Final Crater dimensions- Diameter: Depth:	1.41 km (= .873 miles) 299 meters (= 982 feet)	1.54 km (= 0.954 miles) 327 meters (= 1070 feet)	1.62 km (= 1.01 miles) 345 meters (= 1130 feet)	Large fragments strike the surface and may create a crater strewn field; more information needed to estimate size/frequency of fragments and craters formed.

Type of crater formed	simple	simple	simple	NA
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Thermal Radiation – yes /no	No	No, at this impact velocity (< 15 km/s), little vaporization occurs; no fireball is created, therefore, there is no thermal radiation damage.	Yes	No - no singular impact with a shower of fragments; more information needed to assess thermal radiation
If yes, Time for Maximum radiation: Fireball radius: Effects of thermal radiation:			45 milliseconds after impact 721 meters (= 2370 feet) None listed	NA
Seismic Effects Richter Scale: Mercalli:	5.1 VI. Felt by all, many frightened. Some heavy furniture moved; a few instances of fallen plaster. Damage slight. VII. Damage negligible in buildings of good design and construction; slight to moderate in well-built ordinary structures; considerable damage in poorly built or badly designed structures; some chimneys broken.	5.3 VI. Felt by all, many frightened. heavy furniture moved; a few instances of fallen plaster; Damage negligible in buildings of good design; slight to moderate in well-built; considerable damage in poorly built; some chimneys broken.	5.3 VI. Felt by all, many frightened. heavy furniture moved; a few instances of fallen plaster; Damage negligible in buildings of good design; slight to moderate in well-built; considerable damage in poorly built; some chimneys broken.	NA

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Ejecta: Average thickness: Mean diameter:	Most ejecta is blocked by Earth's atmosphere	Most ejecta is blocked by Earth's atmosphere	Most ejecta is blocked by Earth's atmosphere	NA
Air Blast Maximum wind Velocity: Damage description:	Max wind velocity: 18.2 m/s = 40.6 mph Glass windows will shatter.	22 m/s = 49.3 mph Glass windows will shatter.	24.8 m/s = 55.5 mph Glass windows will shatter.	98.8 m/s = 221 mph Multistory wall-bearing buildings will collapse. Wood frame buildings will almost completely collapse. Glass windows will shatter. Up to 90 percent of trees blown down; remainder stripped of branches and leaves.

