From Space to Earth: Meteor Crater

Teacher Key A: What If…? Experimenting with Impact Scenarios
Projectile Diameter

Earth Impact Effects Program: Go to *http://www.lpl.arizona.edu/impacteffects/*

Projectile Diameter	Barringer Crater- 45 m	Trial 1 – 55m	Trial 2 – 70m	Trial 3 – 100m
Energy in MegaTons Before Atmospheric Entry	7.63×10^{16} Joules = 1.82×10^1 MegaTons TNT	1.39×10^{17} Joules = 3.33×10^1 MegaTons TNT	2.87×10^{17} Joules = 6.86×10^1 MegaTons TNT	$.38 \times 10^{17}$ Joules = 2.00×10^2 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 the tilt of the axis; does not shift the orbit noticeably	Earth is not strongly disturbed; no noticeable change in the tilt of the axis (< 5 hundredths of a degree);does not shift the orbit noticeably	Earth is not strongly disturbed; no noticeable change in the tilt of the axis (< 5 hundredths of a degree);does not shift the 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 **2.80×10^{16} Joules = 6.68 MegaTons**.	Begins to break up at an altitude of 16700 meters = 54900 ft; reaches the ground in a broken condition; strikes the surface at 15 km/sec 7.85×10^{16} Joules = 1.88 $\times 10^1$ MegaTons	Begins to break up at an altitude of 16700 meters = 54900 ft ; reaches the ground in a broken condition; strikes the surface at 17.2 km/sec-= 10.7 miles/s 2.12×10^{17} Joules = 5.08 $\times 10^1$ MegaTons.	Begins to break up at an altitude of 16800 meters = 55000 ft ; reaches the ground in a broken condition strikes the surface at velocity 18.8 km/s = 11.7 miles/s 7.39×10^{17} Joules = 1.77 $\times 10^2$ MegaTons.
Final Crater dimensions- Diameter: Depth:	1.41 km (=.873 miles) 299 meters (= 982 feet)	1.81 km (= 1.12 miles) 385 meters (= 1260 feet)	2.32 km (= 1.44 miles) 493 meters (= 1620 feet)	3.18 km (= 1.98 miles) 677 meters (= 2220 feet)
Type of crater formed	simple	simple	simple	simple

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Thermal Radiation – yes /no	no	Yes	Yes	Yes
If yes, Time for Maximum radiation: Fireball radius: Effects of thermal radiation:		57.1 milliseconds after impact 825 meters (= 2710 feet) None listed	69.4 milliseconds after impact 1.16 km (= 0.722 miles) None listed	96.3 milliseconds after impact 1.78 km (= 1.1 miles) Much of the body suffers second degree burns Newspaper ignites Deciduous trees ignite
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.	5.4 VI. Felt by all, many frightened. Damage slight. VII. Damage negligible in buildings of good design; slight to moderate damage in well-built structures; considerable damage in poorly built	5.7 VI. Felt by all, many frightened. Damage slight. VII. Damage negligible in buildings of good design; slight to moderate damage in well-built structures; considerable damage in poorly built	6.1 VII. Damage negligible in buildings of good design; slight to moderate damage in well-built structures; considerable damage in poorly built; some chimneys broken VIII. Considerable damage in ordinary structures; damage great in poor structures; chimneys, factory stacks, columns fall; heavy furnishings overturn

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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	At your position there is a fine dusting of ejecta with occasional larger fragments. 1.32 cm (= 0.518 inches) 99.6 cm (= 39.2 inches)	At your position there is a fine dusting of ejecta with occasional larger fragments 4.68 cm (= 1.84 inches) 1.38 meters (= 4.53 feet)
Air Blast Maximum wind Velocity: Damage description:	Max wind velocity: 18.2 m/s = 40.6 mph Glass windows will shatter.	30.1 m/s = 67.4 mph Glass windows will shatter.	50.6 m/s = 113 mph Interior partitions of wood frame buildings will be blown down. Roof will be severely damaged. Glass windows will shatter. About 30 percent of trees blown down; remainder have some branches and leaves blown off.	99 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.