

January 15, 2008

IAP 2008 12.091 Assignment 4

1. A meteorite of 30 meters in diameter, made of iron (density = 8 g/cm³), impact velocity of 20 km/sec hits the Earth. What is the kinetic energy of this impact?

(Note: Be careful of units of dimensions)

2. Calculate the impact kinetic energies for impactors of diameters 1km, 10km, 100 km and 200 km, for the same density of 8 g/cm³ and same velocity of 20 km/sec.

3. Convert the values of energies to joules (J). (1 J = kg x m²/s²)
Convert those values to gigajoules (GJ). (1 GJ = 10⁹ J)

4. 1 million tons of dynamite is equivalent to 4 x 10¹⁵ J.
Calculate the above impact energy in equivalent million tons (Mt) of dynamite.

5. Provide the results of questions 1), 2), 3) and 4) in tabular form and give your conclusion.

Table: Meteorite diameter vs energy of impact

Meteorite Diameter	Meteorite density	Meteorite velocity	Impact Energy	Impact Energy	Impact Energy
	g/cm ³	km/s	kg m ² /s ²	GJ	Mt
30 m	8	20			
1 km	8	20			
10 km	8	20			
100 km	8	20			
200 km	8	20			
350 km	8	20			

6. (Optional) Now vary the values of density and velocity within some realistic ranges, determine the impact energies and provide your understanding.

Due: End of the course (Last date Feb 4, 2008)

Dr. P. Ila

*Dept. of Earth, Atmospheric & Planetary Sciences
Massachusetts Institute of Technology
Cambridge, MA 02139*