Impact Crater Lab

Will Wrathall

June 24, 2015

Abstract

The impact crater of a small metal ball of 63.7 grams (0.0637kg) is dropped from 8 different heights, ranging from 0.20m to 0.90m was observed. A mean was measured for the craters diameter. Using the equation E=mgΔh given that we have m, and g is a constant of 9.81 we can find the kinetic energy of the ball on impact. The relationship between crater diameter, D, and impact energy, E, is given by D=kE^n where K is constant and n is found by the gradient of the graph and is also constant. This can be modified to give $\log D = n \log E + \log k$.

1 Introduction

In this experiment we measured the effect of dropping a metal ball bearing in to a sandbox in order to measure the diameter of the resultant crater and therefore measure the kinetic energy of the ball on impact. This required the use of a meter stick, metal ball bearing, sand, container and ruler. We could then plot a graph of D against E or in this case $\log D$ against $\log E$ and find the gradient, which is the constant n. Therefore using the D=kE^n we can find k.

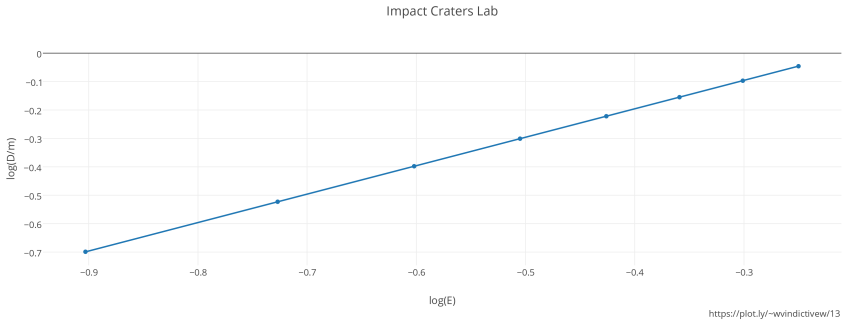
2 Data

. .

Height/m	Diameter/m	2	3	Mean	E	logE	log(D/m)
0.20	0.068	0.059	0.064	0.064	0.125	-0.903	-0.699
0.30	0.071	0.070	0.068	0.070	0.188	-0.727	-0.523
0.40	0.076	0.076	0.070	0.074	0.250	-0.602	-0.398
0.50	0.070	0.084	0.075	0.076	0.312	-0.505	-0.301
0.60	0.077	0.087	0.070	0.078	0.375	-0.426	-0.222
0.70	0.081	0.082	0.081	0.081	0.437	-0.359	-0.155
0.80	0.089	0.083	0.077	0.083	0.500	-0.301	-0.097
0.90	0.092	0.093	0.089	0.091	0.562	-0.250	-0.046

Table 1: Impact Crater.

3 Graph



Therefore gradient(n)=1

4 Uncertainty

Min Height	Max Height	E_min	E_max	logE_min	logE_max
0.199	0.201	0.124	0.126	-0.907	-0.900
0.299	0.301	0.187	0.188	-0.728	-0.726
0.399	0.401	0.250	0.251	-0.602	-0.600
0.499	0.501	0.312	0.313	-0.506	-0.504
0.599	0.601	0.374	0.376	-0.427	-0.425
0.699	0.701	0.437	0.438	-0.361	-0.360
0.799	0.801	0.499	0.501	-0.302	-0.300
0.899	0.901	0.562	0.563	-0.250	-0.249

Uncertainty	Percentage Uncertainty
0.0035	0.39
0.0010	0.14
0.0010	0.17
0.0010	0.20
0.0010	0.23
0.0005	0.14
0.0010	0.33
0.0005	0.20

$\log D_{min}$	$\log D_{max}$	Uncertainty for logD	log(mean D)	Percentage U in logD
0.059	0.068	0.0045	-0.699	-0.64
0.068	0.071	0.0015	-0.523	-0.29
0.070	0.076	0.0030	-0.398	-0.75
0.070	0.084	0.0070	-0.301	-2.33
0.070	0.087	0.0085	-0.222	-3.83
0.081	0.082	0.0005	-0.155	-0.32
0.077	0.089	0.0060	-0.097	-6.19
0.089	0.093	0.0020	-0.046	-4.35