

Answer on Question #64094, Physics / Mechanics | Relativity

What are factors that affect the acceleration due to gravity in projectile motion? I have a project about angry birds and but I can't find the exact acceleration due to gravity in angry birds world. I experimented, and it keeps on changing. I m wondering whether the horizontal range is affecting it. Also, air resistance is negligible.

Solution:

International Gravity Formula:

$$g = 9.780327 \times (1 + 0.0053024 \sin^2 \phi - 0.0000058 \sin^2 2\phi) \quad (1),$$

where ϕ is the geographical latitude of terrain in degrees, g is measured in m/s^2

The gravity acceleration g at anywhere near our planet's surface is calculated using of formula: $g = 980.6160 - 2.5928 \cos 2\phi + 0.0068 \cos^2 2\phi - 0.0003h \quad (2)$, where ϕ is the geographical latitude of terrain in degrees, h is the height of terrain above sea level in meters, g is measured in cm/s^2 .

Note: these formulas makes it impossible to take into account the dependence g from the rocks density in upper layers of the Earth.

Values of gravitational acceleration g according to the formula (2): Quito ($g_{\text{Quito}} \approx 8.94 \text{ m/s}^2$), Stockholm ($g_{\text{Stockholm}} \approx 9.82 \text{ m/s}^2$). Valid real values of gravitational acceleration are following: $g_{\text{Quito}} = 9.7724 \text{ m/s}^2$, $g_{\text{Stockholm}} = 9.8244 \text{ m/s}^2$.

What are factors that affect the acceleration due to gravity in projectile motion?

Geographical latitude of terrain, height of terrain above sea level, the rocks density in upper layers of the Earth.

I am wondering whether the horizontal range is affecting it

No effect.

Location	Quoted Value	Widget 01/25/2016	Value Measured Value 1970*
Amsterdam	9.813	9.80563	NA
Athens	9.800	9.80037	NA
Auckland	9.799	9.79936	9.79962
Bangkok	9.783	9.77958	NA
Brussels	9.811	9.8152	NA
Buenos Aires	9.797	9.79689	NA

Calcutta	9.788	9.78548	9.78816
Cape Town	9.796	9.79616	9.79659
Chicago	9.803	9.80444	NA
Copenhagen	9.815	9.82057	9.81559
Frankfurt	9.810	9.81412	NA
Greenwich	9.802	9.81597	9.81188
Havana	9.788	9.78587	NA
Helsinki	9.819	9.82519	NA
Istanbul	9.808	9.80386	NA
Jakarta	9.781	9.77669	NA
Kuwait	9.793	9.79175	NA
Lisbon	9.801	9.80131	NA
London	9.812	9.81599	9.81188 (derived from Greenwich)
Los Angeles	9.796	9.79607	NA
Madrid	9.800	9.80138	NA
Manila	9.784	9.78002	NA
Mexico City	9.779	9.77628	NA
Montréal	9.789	9.80906	9.80652
New York City	9.802	9.8036	9.80267
Nicosia	9.797	9.79709	NA
Oslo	9.819	9.825	NA
Ottawa	9.806	9.80888	9.80607
Paris	9.809	9.81289	9.80943
Rio de Janeiro	9.788	9.78575	NA
Rome	9.803	9.80491	9.80347
San Francisco	9.800	9.80035	9.79965

Singapore	9.781	9.77584	NA
Skopje	9.804	9.80444	NA
Stockholm	9.818	9.82436	NA
Sydney	9.797	9.79607	9.79683
Taipei	9.790	9.78757	NA
Tokyo	9.798	9.79805	NA
Vancouver	9.809	9.81339	NA
Washington D.C.	9.801	9.80165	9.80080 (absolute)
Wellington	9.803	9.80431	9.80292
Zurich	9.807	9.81007	9.80673

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