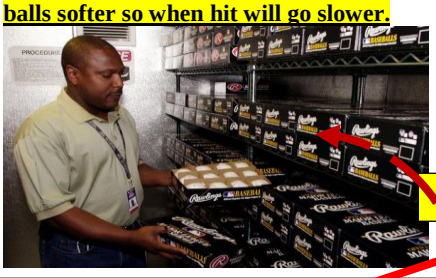
PROJECTILES

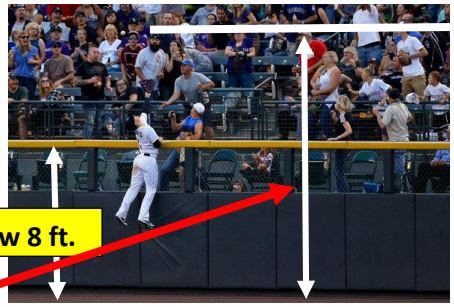
Unit 9 Dr.John P. Cise, Professor of Physics, Austin Com. College, 1212 Rio Grande St., Austin Tx., 78701 jpcise@austincc.edu & New York Times, April 1, 2016 by Rob Neyer

Thin Air Equals High Pressure, at Least for Rockies Pitchers

Albert Pujols of the Angels hitting a three-run homer at Coors Field in July. There have been 570 home runs at the park over the last three seasons.

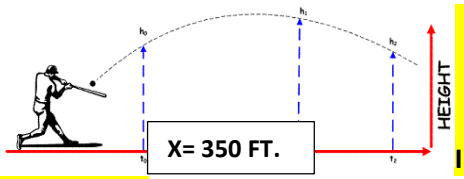


Tony Cowell, an engineer at Coors Field, inspected a dozen baseballs stored in a walk-in humidor in 2002, the year the Rockies installed it to counteract Denver's dry air. Purpose is so to make balls softer so when hit will go slower.



The team is raising parts of Coors Field's outfield wall this season. This right of center wall is only 8 ft. tall now going up to 16.5 ft.

Shortly into spring training, the Colo[illegible] fences. Well, some of them, anyway: From right-center field to straightaway right field, **the height of the wall is nearly doubling, to 16 ½ feet;** down the left-field line, it is going to 13 feet from 8 feet. So what took them so long? Before the Rockies installed a humidor in 2002 — ***the humidor keeps the baseballs relatively moist, counteracting the dry air in Denver that would otherwise lead to a higher-than-normal coefficient of restitution, or more "bounciness"*** — Coors Field featured ***immense numbers of home runs, including a major-league-record 303 in 1999.*** Home runs, as well as scoring, dropped significantly after the humidor was installed. Just not enough to make Coors Field anything like a normal ballpark. ***Even with the humidor, Coors Field has had more home runs over the last three seasons (570) than any other National League ballpark.*** But as Rockies General Manager Jeff Bridich told The Denver Post, "The goal is to raise the wall heights to make it potentially more playable and more fair — for pitchers." ***Everybody knows that baseballs travel farther in Denver's thinner air.*** So even with a relatively spacious outfield and the humidor, Coors Field has been a friendly place for power hitters. But the altitude affects far more than just the flight of batted balls. It also affects the flight of pitched balls. A typical curveball or slider, for example, will not move as much in Denver — will not have as much "stuff" — as it would anywhere else in the majors. ***A pitcher's curveballs, sliders, changeups and cutters just do not work as well in Denver as they should, which means more hits and walks, which means more pitches per inning, which means more fatigue, which means even worse pitches.*** After 23 seasons, though, it is fair to doubt whether anything would work. Short of Dodge City, anyway. And it is difficult to imagine that raising the fences by a few feet — turning a few home runs into doubles, basically — is going to make any real difference.



INTRODUCTION: Maximum distance is achieved when hit at 45°.

QUESTIONS: (a)Find speed ball must be hit at when the ball must go over the older fence at 8 feet? (b) Now find the speed the ball must be hit at to clear the "new" 16.5 ft. fence? (c) How much larger is the ball speed when hit by the batter to clear the new 16.5 ft. fence?

HINTS: Break solution into vertical and horizontal parts. No acceleration exists in horizontal direction. Acceleration exists in the vertical direction = g. , $x = V_H t$, $Y = V_{Ov} t + ½ a t^2$, write down initial vertical and horizontal components of velocity in terms of V,

ANSWERS: (a) $V_{for\ 8'\ fence}$ = ~107.08 ft./s. , (b) $V_{for\ 16.5'\ fence}$ = ~108.35 ft./s. , (c) ΔV = ~+ 1.27 ft./s. MORE to clear 16.5 ft.