

プレチャレンジ2014年11月の解答

重力は常に地球の中心の方向に働きますが、摩擦力は運動の方向（速度）に対し逆の方向に働きます。そのことを考慮して考えて下さい。

問題

In English, answer the following and give a reason.

When a player hits a high fly ball, which is assumed to be in vertical direction, how does the time the ball takes to reach its maximum height, t_1 , compare to the time the ball takes to return to the height at which it was hit, t_2 ?

Choose an answer for each case:

- (i) there is no air resistance.
- (ii) there is air resistance.

(a) $t_1 > t_2$

(b) $t_1 = t_2$

(c) $t_1 < t_2$

解答

Ans. (i) (b), (ii) (c)

If the force of air resistance can be neglected, the motion of the ball is reversible. Then, the time for a ball to reach the maximum, t_1 , is equal to the time to return back, t_2 . But, when the force of air resistance is taken into account, it is always in the opposite direction to the velocity. When the ball rises, both air resistance and gravity exert downward forces, and so the downward acceleration is greater than if air resistance were absent. When the ball is falling, air resistance acts upwards and the downward acceleration is less than if air resistance were absent. Since the distance up is equal to the distance back down, the smaller acceleration on the way back down will lead to a larger time compared to the way up, i.e. $t_1 < t_2$.