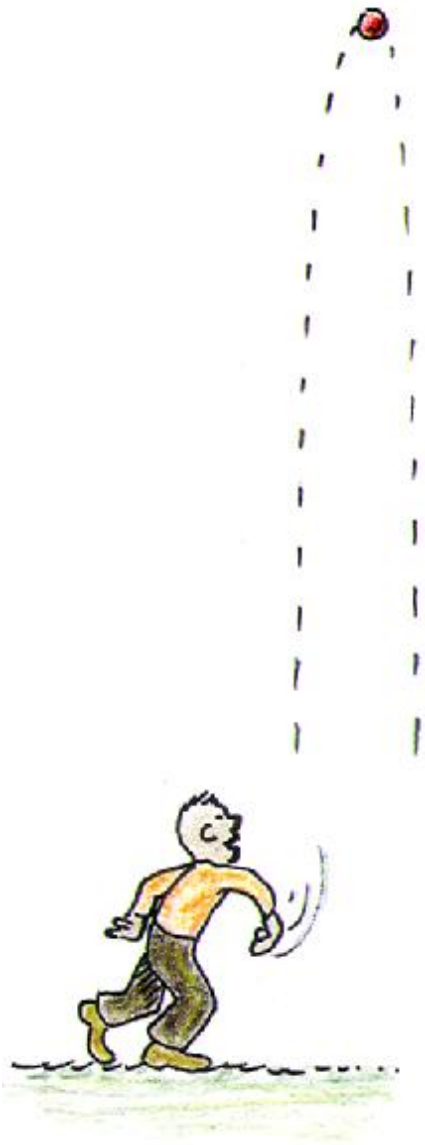
NEXT-TIME QUESTION

Toss a ball straight upward and the time it spends going up equals the time it takes to return to its starting level

a) only when air resistance is absent or negligible.

b) whether or not air resistance is present.

The ball encounters just as much air when ascending as when descending!



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Answer: a

Without air resistance, acceleration of the ball is *g* whether going up or down. Hence the change in speed each second is the same either way. For the same distance traveled each way, time up equals time down.

Although the ball meets just as much air going up and coming down, the *air resistance* it encounters each way is *not* the same. Air resistance depends not only on how much air must be "plowed through," but on the *speed* of doing so. Air resistance is greater at higher speed. To better understand this, consider tossing a feather upward (perhaps launching it from a slingshot for greater initial speed). It quickly reaches the top of its path. So time going up is short compared with time down that begins with zero speed. Coming down, air resistance quickly equals the small weight of the feather, which then "floats" downward at a low terminal speed. So the feather takes more time to fall from the top of its trajectory than it initially took getting there. Likewise for a ball, though not as much.

It's easier to imagine the different speeds of a feather than a ball. For any greater-than, same-as, or less-than problem, exaggerate the circumstance and the answer is more obvious!

CONCEPTUAL Physics

ARBOR SCIENTIFIC
TOOLS THAT TEACH.

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