

## STEP III, 1999, Q10

- 10 A chain of mass  $m$  and length  $l$  is composed of  $n$  small smooth links. It is suspended vertically over a horizontal table with its end just touching the table, and released so that it collapses inelastically onto the table. Calculate the change in momentum of the  $(k + 1)$ th link from the bottom of the chain as it falls onto the table.

Write down an expression for the total impulse sustained by the table in this way from the whole chain. By approximating the sum by an integral, show that this total impulse is approximately

$$\frac{2}{3}m\sqrt{(2gl)}$$

when  $n$  is large.



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