

- 3** A light elastic string has natural length  $a$  and modulus of elasticity  $12mg$ . One end of the string is attached to a fixed point  $O$ . The other end of the string is attached to a particle of mass  $m$ . The particle hangs in equilibrium vertically below  $O$ . The particle is pulled vertically down and released from rest with the extension of the string equal to  $e$ , where  $e > \frac{1}{3}a$ . In the subsequent motion the particle has speed  $\sqrt{2ga}$  when it has ascended a distance  $\frac{1}{3}a$ .

Find  $e$  in terms of  $a$ .

[6]

[illegible]