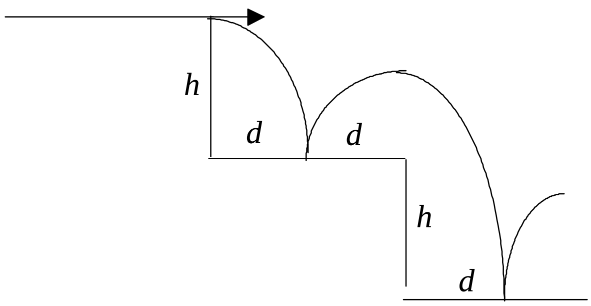
12.



Let time to first bounce be T then $h=\frac{1}{2}gT^2 \Rightarrow T=\sqrt{\frac{2h}{g}}$
vertical velocity just before first bounce is $gT=\sqrt{2gh}$ so immediately after bounce it is $egT=e\sqrt{2gh}$
the horizontal velocity is constant so since horizontal distance between first and second bounce is twice the distance from start to first bounce then time between first and second bounces is $2T$
so we will now have $-h=(egT)2T-\frac{1}{2}g.4T^2 \Rightarrow e=\frac{2gT^2-h}{2gT^2}=\frac{4h-h}{4h}=\frac{3}{4}$

In order for the particle to continue to land in the middle of every step, each bounce must be identical to the second one so time between bounces must be constant.
Let vertical velocity after second bounce be v_2 then just before it must have been $e^{-1}v_2$ where e is the coefficient of restitution for the subsequent bounces.
using $v^2=u^2+2as$ we thus have from first to second bounce $\left(e^{-1}v_2\right)^2=v_1^2+2gh=\frac{9}{8}gh+2gh=\frac{25}{8}gh$
so $e^{-1}v_2=\frac{5\sqrt{2gh}}{4}$ and since we want $v_2=v_1=\frac{3}{4}\sqrt{2gh}$ it follows that the particle can only continue hitting the middle of each step if $e=\frac{3}{5}$ for the second and subsequent steps.
