2009 F=ma Exam: Problem 1

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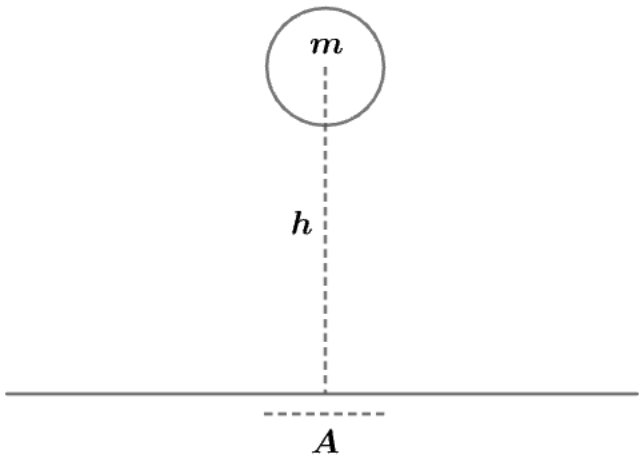

By conservation of energy, the velocity of the apple right before it hits the ground is

$$mgh = \frac{1}{2}mv^2$$
$$v = \sqrt{2gh}$$

By Newton's 2nd law, the average force exerted on the apple is

$$F = \frac{\Delta p}{\Delta t} = \frac{mv}{\Delta t}$$

since the apple comes to rest. The average pressure is then

$$P = \frac{F}{A} = \frac{m\sqrt{2gh}}{A\Delta t} = \frac{(0.3\,\text{kg})\sqrt{2(10\,\text{m/s}^2)(0.4\,\text{m})}}{(0.0004\,\text{m}^2)(0.1\,\text{s})} = 21000\,\text{Pa}$$

so the answer is $\boxed{\text{B}}$.