2016 F=ma Exam: Problem 11

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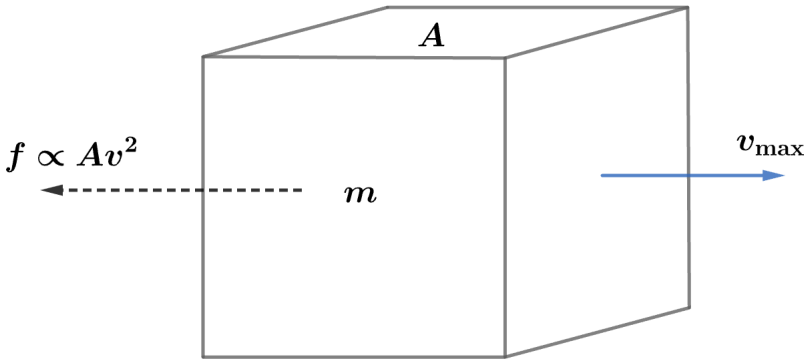

To travel at velocity v in the presence of air friction f, we need power

$$P = fv$$

We are given $P \propto m$ and $f \propto Av^2$ so

$$m \propto Av^3$$

It remains to express A in terms of m. For a fixed density, $m \propto L^3$ where L is the side length of the cube. Since $A = L^2$,

$$A \propto m^{2/3}$$

Substituting this into the previous equation,

$$m \propto m^{2/3}v^3$$

Finally we solve for v,

$$v^3 \propto m^{1/3}$$

$$v \propto m^{1/9}$$

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