

①

A 20.0 kg space probe fires an ion engine for 10.0 s during which time it experiences a force given by

$F(t) = (6.00 \frac{N}{s^2}) t^2 \vec{i}$ . If it was originally moving at 40.0 m/s in the x-direction, what is its velocity at  $t = 5.00$  s?

$$J = \int F(t) dt = \Delta p = m(v - v_0)$$

$$\int_0^{5.00s} (6.00 \frac{N}{s^2}) t^2 dt$$

$$\frac{6.00 \frac{N}{s^2} t^3}{3} \Big|_0^{5.00s}$$

$$2.00 \frac{N}{s^2} (5.00s)^3 = 250 Ns$$

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$$250 \text{ N s} = 20.0 \text{ kg} (V - 40.0 \text{ m/s})$$

$$\frac{250 \text{ N s}}{20.0 \text{ kg}} + 40.0 \text{ m/s} = V$$

$$\boxed{52.5 \text{ m/s} = V}$$