Answer on Question #58110, Physics / Mechanics

18 The exhaust gas of a rocket is expelled at the rate of 1300 kg/s, at the velocity of 50 000 m/s. Find the thrust on the rocket in newtons

6.5×10^7

3.5×10^7

7.6×10^7

5.7×10^7

Solution:

Newton's second law of motion can be expressed as:

$$F = ma = m\frac{dv}{dt} = \frac{dp}{dt}$$

For the rocket:

$$\frac{dp}{dt} = v\frac{dm}{dt}$$

Hence:

$$F = v\frac{dm}{dt} = \left(50000\frac{m}{s}\right)\cdot\left(1300\frac{kg}{s}\right) = 6.5\cdot10^7\ N$$

Answer: $6.5\cdot10^7\ N$

19 A force of $2\vec{i}+7\vec{j}$ N acts on a body of mass 5kg for 10 seconds. The body was initially moving with constant velocity of $\vec{i}-2\vec{j}$ m/s. Find the final velocity of the body in m/s, in vector form.

$5\vec{i}+12\vec{j}$

$12\vec{i}-5\vec{j}$

$10\vec{i}-7\vec{j}$

$7\vec{i}+10\vec{j}$

Solution:

Newton's second law of motion can be expressed in equation form as follows:

$$\vec{F}=m\vec{a}$$

where m is mass of the body, F is force, a is acceleration.

The acceleration is

$$\vec{a}=\frac{\vec{F}}{m}$$

Velocity equals:

$$\vec{v}=\overrightarrow{v_0}+\vec{a}t$$

Substituting:

$$\vec{v}=\vec{\imath}-2\vec{\jmath}+\frac{2\vec{\imath}+7\vec{\jmath}}{5}\cdot 10=\vec{\imath}-2\vec{\jmath}+4\vec{\imath}+14\vec{\jmath}=5\vec{\imath}+12\vec{\jmath}$$

Answer: $5\vec{\imath}+12\vec{\jmath}$