Answer on Question 59239, Physics, Mechanics, Relativity

Question:

The exhaust gas of a rocket is expelled at the rate of $1300\ kg/s$, at the velocity of $50000\ m/s$. Find the thrust on the rocket in newton.

a) $6.5 \cdot 10^7\ N$

b) $3.5 \cdot 10^7\ N$

c) $7.6 \cdot 10^7\ N$

d) $5.7 \cdot 10^7\ N$

Solution:

We can find the thrust on the rocket from the definition of the impulse:

$$F_t \Delta t = m \Delta v,$$

here, F_t is the force of the thrust on the rocket, Δt is the amount of time in which the force is acting, m is the mass of the expelled gas, Δv is the rate of change of exhaust gas velocity.

Let's look at our equation. We can see, that in $1\ s$, $1.3 \cdot 10^3\ kg$ of the exhaust gas leaves the rocket at the velocity of $5 \cdot 10^4\ m/s$:

$$F_t \cdot 1\ s = 1.3 \cdot 10^3\ kg \cdot 5 \cdot 10^4\ \frac{m}{s}.$$

Then, we can calculate the force of the thrust on the rocket:

$$F_t = \frac{1.3 \cdot 10^3\ kg \cdot 5 \cdot 10^4\ \frac{m}{s}}{1\ s} = 6.5 \cdot 10^7\ N.$$

Answer:

a) $6.5 \cdot 10^7\ N$