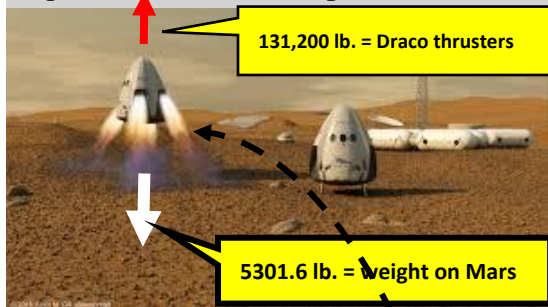


NEWTON'S 2ND LAW

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1212 Rio Grande St., Austin Tx. 78701, jpcise@austincc.edu & New York Times, April 28, 2016 by Kenneth Chang

SpaceX Says It Plans to Send a Probe to Mars



INTRODUCTION: At left is seen the Red Dragon (14,000 lb. on earth) spacecraft landing on Mars using its 8 super Draco thrusters. Each thruster produces 16,400 lb. thrust.

QUESTIONS: (a) Find mass (in slugs) of Red Dragon spacecraft? (b) Find Red Dragon's mass on Mars? (c) Find Dragon's weight on Mars? (d) Find Dragon's deceleration while descending to a safe zero velocity at Mar's Surface? (e) Dragon turned on its Draco thrusters 30 seconds before landing, Find v_0 then?

An artist's rendering of a SpaceX capsule landing on Martian surface, a project planned for 2018.

In December, Space Exploration Technologies Corporation of Hawthorne, Calif., better known as SpaceX, [landed a rocket on Earth](#), flying a booster stage of one of its Falcon 9 rockets back to Cape Canaveral. This month, the company repeated the feat even more impressively, setting the booster down on [a floating platform in the Atlantic](#).

Now SpaceX, Elon **Musk's rocket company, has its sights set farther away: It aims to land one of its capsules on the surface of Mars in May 2018**, the company announced in a Twitter message on Wednesday.



QUESTIONS(CONTINUED): (f) When the Dragon Spacecraft turned on its Draco Thrusters how high above the Martian surface was it? , (g) Find height thrusters were turned on in units of miles?

HINTS: weight = mass X gravity = mg , g on earth = 32 ft./s.^2
 g on Mars = 12.12 ft./s.^2 , $F_{\text{NET}} = ma$, $v = v_0 + at$, $x = v_0 t + \frac{1}{2} a t^2$
 1 mile = 5280 ft., assume mass of Red Dragon Capsule is constant.

ANSWERS: (a) 437.5 slugs , (b) 437.5 slugs , (c) 5301.6 lb. ,
 (d) $a = + 287.77 \text{ ft./s.}^2$, (e) $v_0 = 8633.1 \text{ ft./s.}$, (f) 129,497 ft.
 (g) 24.53 miles above Martian surface

Mr. Musk has said that SpaceX's long-term goal is to colonize Mars, and he has talked of an ambitious schedule to get people there in the mid-2020s. But before that happens, Mr. Musk, not to mention any would-be colonists, have to make sure that the technology for getting to Mars in one piece actually works. In an announcement on Wednesday, **SpaceX said it planned to send an unmanned Dragon capsule to Mars in 2018 and land it on the surface about six months later. (Mars and Earth line up only once every 26 months.)** NASA also plans to send people to Mars, although not as quickly, aiming for the mid-2030s. On Wednesday afternoon, a couple of hours after the SpaceX Twitter message, Dava J. Newman, NASA's deputy administrator, wrote: "We are closer than ever before to [sending American astronauts to Mars](#) than anyone, anywhere, at any time has ever been. A new consensus is emerging around NASA's plan and timetable for sending astronauts to the Red Planet in the **2030s** **Landing on Mars is tricky. The atmosphere is thick enough that the energy of the arriving spacecraft slamming into the air molecules heats its outside to thousands of degrees, but it is too thin for parachutes to provide a gentle landing.** A team at NASA's Ames Research Center in California proposed **SpaceX's Dragon capsule as a cheaper way to land on Mars, using rocket engines.** SpaceX liked the idea enough to start working on it as well, signing an agreement to tap into NASA expertise.