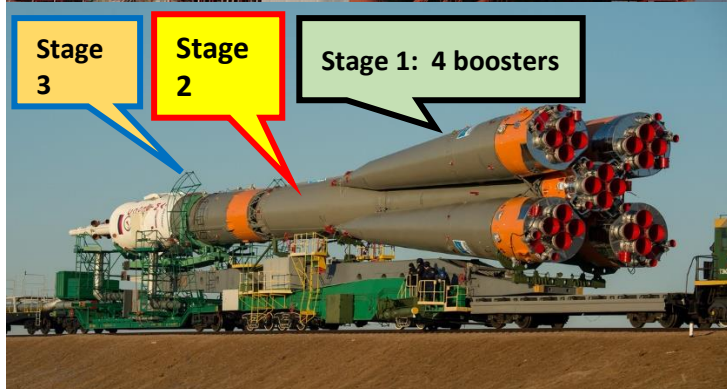
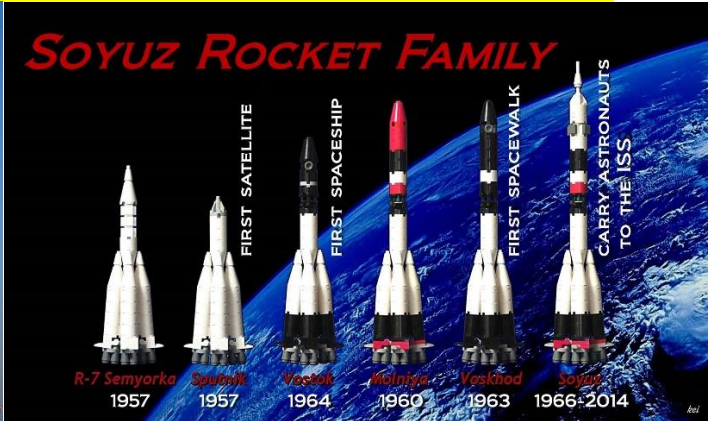


NEWTON'S 2ND LAW

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Russian Spacecraft Carrying Supplies Burns Up in Flight



The Progress 65 spacecraft in Kazakhstan on Tuesday. No astronauts were aboard when it failed to reach orbit on Thursday and largely burned up in the atmosphere as it fell back down. **CreditRSC Energia A Russian spacecraft carrying 2.6 tons of food, fuel and supplies — but no astronauts — to the International Space Station failed to reach orbit on Thursday and largely burned up in the atmosphere as it fell back down.**

Roscosmos, the Russian space agency, reported that a Soyuz rocket carrying the Progress 65 cargo ship successfully lifted off from Kazakhstan. The first six minutes and 22 seconds of the flight proceeded normally. But shortly after the upper stage separated from the core booster, flight telemetry stopped, leaving ground controllers confused about what had happened. Roscosmos later confirmed that the Progress 65 and its cargo had been destroyed, with the The six astronauts at the space station — three Russian, A Japanese cargo ship is scheduled to launch and head to the space station on Dec. 9.

INTRODUCTION: The Soyuz rocket has had 785 missions since 1967(49 years of service). It has three stages. Stage 1: 4 boosters (see pictures) at 43,500 kg. mass each producing 838,500 N of thrust each. Stage 2&3(with 4 boosters strapped on to sides of stage 2.....see picture above) have a total mass of 99,500 kg. Stage 2 has a thrust of 792,500 N.

QUESTIONS: (a) Find total mass of three stages? (b) Find total weight of three stages ? (c) Find net thrust due to 4 boosters(stage 1)+ stage 2 rocket?, (d) Find F_{NET} on Soyuz at launch?,(e) Find acceleration of Soyuz at launch?,(f) Find speed ten seconds after ignition of rockets?,(g) How far has Soyuz gone in first ten seconds?

HINTS: $F_{NET} = m a$, $g = 9.8 \text{ m./s.}^2$, $v = v_0 + a t$, $x = v_0 t + \frac{1}{2} a t^2$, weight = mass x gravity = $m g$

ANSWERS: (a) 273,500 kg., (b) 2,680,300 N , (c) 4,146,500 N , (d) 1,466,200 N , (e) 5.36 m./s.² , (f) 53.6 m./s., (g) 268 m.