Shipping Cargo to the International Space Station

It takes a lot of supplies to keep the International Space Station going!

On February 21, 2014, NASA asked commercial launch services, such as SpaceX, to figure out what they would charge to deliver cargo to the Station. NASA plans to buy this service for between $1 billion and $1.4 billion each year from 2017 to 2024.

Groups 'did the math' to figure out how many launches would be needed to deliver the required materials to the Station. On return flights, trash such as discarded equipment and garbage, will be brought back home.

For each year, NASA will need up to 16,750 kilograms of pressurized cargo delivered to the Station. This amount of cargo will fill about 30 lockers. Another 4,000 kg of unpressurized cargo will be included in each launch. This amount of cargo will fill about 8 lockers. There will be 5 flights per year.

Problem 1 – What is the total mass of the pressurized and unpressurized cargo?
A) per year? B) per flight?

Problem 2 – For each flight, 800 kg of fresh drinking water will be delivered to the Station. If 1 gallon of water has a mass of 3.8 kg, how many gallons of drinking water are transported to the Station every year? Round your answer to the nearest gallon.

Problem 3 – Each pressurized locker requires continuous power of 120 watts at 28 volts. Each unpressurized locker requires continuous power of 250 watts at 28 volts. What is the total electrical watts used by both the pressurized and unpressurized lockers for each flight?

Problem 4 – If it costs $4,500 per kg to place items in orbit, what is the cost for each launch?

NASA Seeks U.S. Industry Feedback on Options for Future Space Station Cargo Services
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http://www.nasa.gov/content/nasa-seeks-us-industry-feedback-on-options-for-future-space-station-cargo-services/index.html

Problem 1 – What is the total mass of the pressurized and unpressurized cargo? A) per year? B) per flight?

Answer:

A) Pressurized cargo = 16,750 kg; Unpressurized cargo = 4,000 kg.
16,750 kg + 4,000 kg = **20,750 kg per year**.

B) There are 5 flights. Total mass (20,750 kg)/5= **4,150 kilograms**.

Problem 2 – If 1 gallon of water has a mass of 3.8 kg, how many gallons of drinking water are transported to the Station every year? Round your answer to the nearest gallon. rounded to the nearest gallon?

Answer: Each flight brings 800 kg to the Station. For 5 flights there would be 4000 kg of water. Then 4,000 kg x (1 gallon/3.8 kg) = **1053 gallons per flight**.

Problem 3 – What is the total electrical watts used by both the pressurized and unpressurized lockers for each flight?

Answer: There are 30 powered lockers brought to the Station each year with 120 watts/locker. The total power is 30 x 120 watts = 3,600 watts per year. There are 8 unpressurized lockers brought to the Station each year at 250 watts/locker for a total of 2,000 watts. The total per year is 5,600 watts in 5 flights or **1120 watts/flight**.

Problem 4 – If it costs $4,500 per kg to place items in orbit, what is the cost for each launch?

Answer: 4,150 kg cargo per launch x $4,500/kg = **$18,675,000 for the cargo**.