

CAP Model Rocketry

Titan Phase Notes

Laws That Govern Rocket Science

- _____ (1643-1727), an English scientist, discovered and recorded the _____ laws of motion:

- 1) A body in a state of _____ and a body in _____ tend to remain at rest or in uniform motion unless acted upon by _____.
- 2) The rate of change in the _____ of a body is proportional to the force acting upon the body and is in the _____ of that force.
- 3) For every _____ there is an equal and opposite _____.

Newton's _____ Law

A body in a state of rest and a body in motion tend to remain at rest or in uniform motion unless acted upon by some outside force.

- **Rest:** the state of an object when it _____ in relation to its surroundings.
- **Motion:** the state of an object when it _____ in relation to its surroundings.

- An object will change from one state to another when acted upon by one or more _____.

- If there are no forces present, or all forces present are in balance, then the state of the object _____.

Newton's _____ Law

The rate of change in the momentum of a body is proportional to the force acting upon the body and is in the direction of that force.

- This statement can be expressed mathematically as _____ where
 - F = Force exerted on an object
 - M = Mass of the object

- $A = \underline{\hspace{2cm}}$ (the rate of change in $\underline{\hspace{2cm}}$ with respect to $\underline{\hspace{2cm}}$)

Newton's $\underline{\hspace{2cm}}$ Law

For every $\underline{\hspace{2cm}}$, there is an equal and opposite $\underline{\hspace{2cm}}$.

In a rocket launch, the rule works like this:

- Fuel is ignited in the rocket motor
- The rocket exerts a force on the gas, pushing it out the exhaust nozzle ($\underline{\hspace{2cm}}$)
- The resulting burning gas expands and exerts a force on the rocket, pushing it upward ($\underline{\hspace{2cm}}$)

Rocket Aerodynamics

- Like an airplane, all of a rocket's mass is balanced at a point called the $\underline{\hspace{2cm}}$.
- Also like an airplane, a rocket moves about three axes that are centered at the center of gravity. These axes are called $\underline{\hspace{2cm}}$, $\underline{\hspace{2cm}}$ and $\underline{\hspace{2cm}}$.
- **Longitudinal axis:** runs from $\underline{\hspace{2cm}}$. Movement about this axis is called $\underline{\hspace{2cm}}$.
- **Lateral axis:** runs from $\underline{\hspace{2cm}}$. Movement about this axis is called $\underline{\hspace{2cm}}$.
- **Vertical axis:** runs from $\underline{\hspace{2cm}}$. Movement about this axis is called $\underline{\hspace{2cm}}$.
- There also exists another center, the $\underline{\hspace{2cm}}$. This is the point at which all $\underline{\hspace{2cm}}$ are concentrated.
- The center of pressure must always be between the $\underline{\hspace{2cm}}$ and $\underline{\hspace{2cm}}$.

- If the center of pressure is too close to the center of gravity, the rocket will _____ and will not fly correctly.

- To ensure a rocket is stable for flight, the rocket is loaded with its _____, _____ and _____ (if it will be carrying one).

- A string is tied to the rocket at the center of gravity and taped into place. It is then swung around a person's head in a _____.

- If the rocket is very stable, the nose will _____ into the wind created by its _____.

- If the rocket _____ the swing test, it can be made stable using either of two methods:

- The _____ can be moved forward by _____.

- The _____ can be enlarged by either _____ with larger ones, or by _____ behind the center of gravity.