

95 % A

OH TUES 2:30 - 3:30 , WED 4:30 - 5:30

→ MARK exams on calendar

open book open note open HW exams

2 free late homeworks

VALUES

Molecular mass of air, $\bar{M}_{AIR} = 29 \text{ Kg/Kmol}$

$$1 \text{ kmol} = 6.022 \times 10^{26} \text{ molecules}$$

$$1 \text{ atm} = 760 \text{ mm Hg} = 1.013 \times 10^5 \text{ Pa}$$

$$1 \text{ bar} = 10^5 \text{ Pa}$$

$$\rho_{AIR} \Big|_{1 \text{ atm}}^{20^\circ\text{C}} = 1.21 \text{ Kg/m}^3$$

WHY ROCKETS?
- TO DELIVER A PAYLOAD $\left\{ \begin{array}{l} \text{OF DESIRED MASS} \\ \text{TO DESIRED "HEIGHT" (POSITION)} \\ \text{W/ DESIRED VELOCITY} \end{array} \right.$

TYPICAL SCENARIOS: $\left\{ \begin{array}{l} \text{EARTH TO ORBIT} \\ \text{ORBIT TRANSFER} \end{array} \right.$

DESIRED MASS, POSITION, VELOCITY

DETERMINED BY MISSION REQUIREMENTS (EM/550/642)

ACHIEVABLE POSIT, VELOCITY,

DETERMINED BY $\left\{ \begin{array}{l} 1. \text{ THRUST} \\ 2. \text{ THRUST DURATION} \\ 3. \text{ EJECTION VELOCITY} \end{array} \right.$

MOST IMPORTANT ELEMENT

- 4. MASS PROPORTIONS (PAYLOAD, FUEL, STRUCTURAL)
- 5. GRAVITY FIELD
- 6. DRAG (MEDIUM, GEOMETRY, VELOCITY)

WE'LL STUDY 1, 2, 3, 4

I. THERMODYNAMICS

A DESCRIPTION OF THE ENERGY CONTAINED IN A SYSTEM
AND OF THE DIFFERENT WAYS TO CHANGE IT

DESCRIBE A "THERMODYNAMIC STATE" WITH "VARIABLES OF STATE"

E.G. $T, P, \rho, v = \frac{1}{\rho}$

VARIABLE OF STATE \equiv INDEPENDENT OF PROCESS USED TO
REACH THAT STATE

INTERNAL ENERGY = e LOWER CASE: OF UNIT MASS

UPPER: OF ENTIRE SYSTEM

$$[e] = \frac{J}{kg}$$

e MEASURES ENERGY IN A SYSTEM DUE TO KINETIC ENERGY
OF THE RANDOM MOTIONS OF MOLECULES
(OR ATOMS DEPENDING ON TEMPERATURE)

e DOES NOT ACCOUNT FOR ANY BULK MOTION

e CHANGES IF:

i) HEAT IS SUPPLIED TO OR REMOVED FROM OUR
SYSTEM

$dq > 0$ IF SUPPLIED TO THE SYSTEM

ii) WORK IS EXCHANGED BETWEEN SYSTEM &
SURROUNDINGS