- Mentored 1 lakh+ Students
- 10 Yrs Teaching experience
- Content Partner in MHRD DIKSHA Project

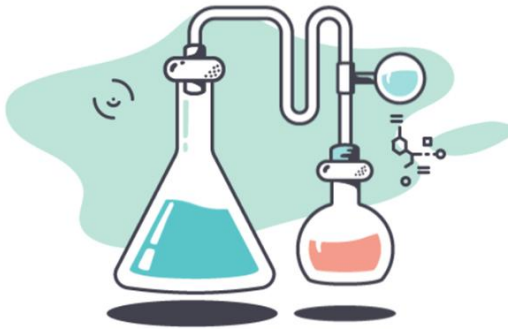
jee LIVE daily

Paaras Thakur

unacademy

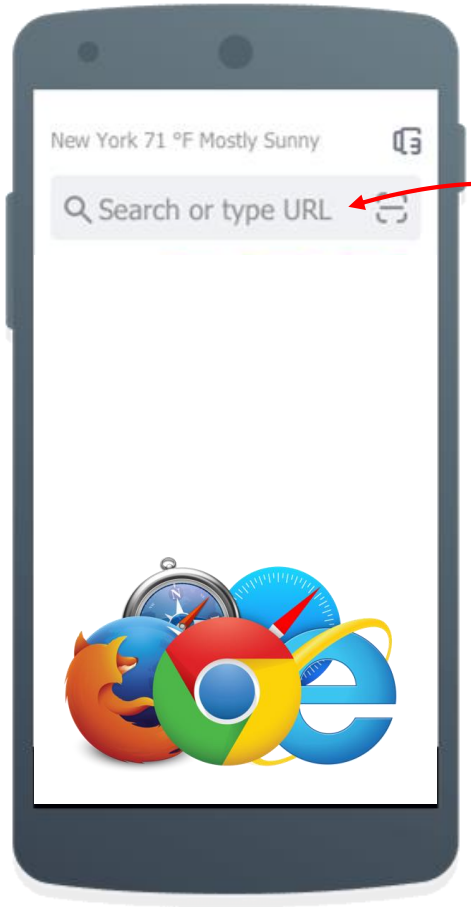
Thermodynamics

Lecture 1



Topics we will learn today

- Scope of Thermodynamics
- Limitations of Thermodynamics
- System, surrounding & Boundary
- Thermodynamic Equilibrium
- System Variables & Processes



Telegram
APP

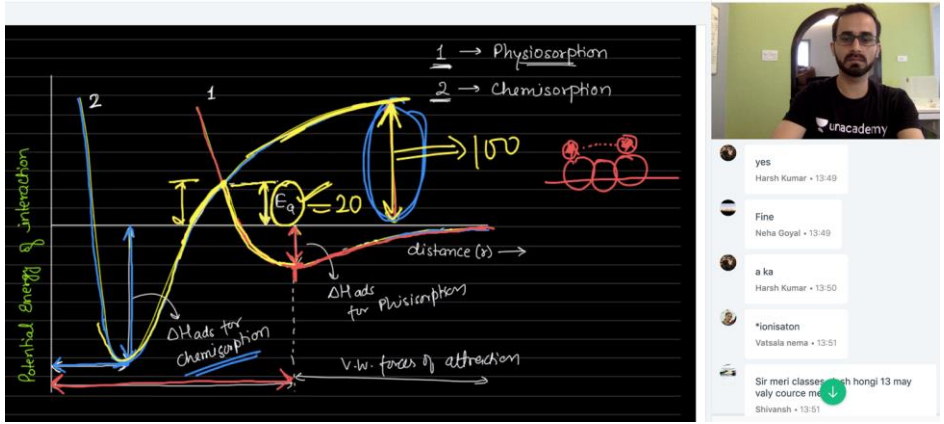
jee

TALK TO US

tinyurl.com/**jeelivechat**

plus

- **LIVE** Plus Classes
- Test Series / Quizzes
- **Doubt Clearing** Sessions
- Most Personalized



Learn IIT JEE from India's Best Educators

Structured courses, test series, live doubt clearing sessions and more!

Paaras Thakur

Teaching Batches and Year Long Courses **LIVE** on Plus

EVOLVE for Class 12 (JEE Main/Advanced 2020) Batch C - Aug

Started on

Aug 1

1 month	3 months	RECOMMENDED 12 months	6 months	
₹5,000 per month	₹4,167 per month	₹2,083 per month	₹3,333 per month	GET SUBSCRIPTION

The easiest way to learn IIT JEE online

⏰ Flexible schedule

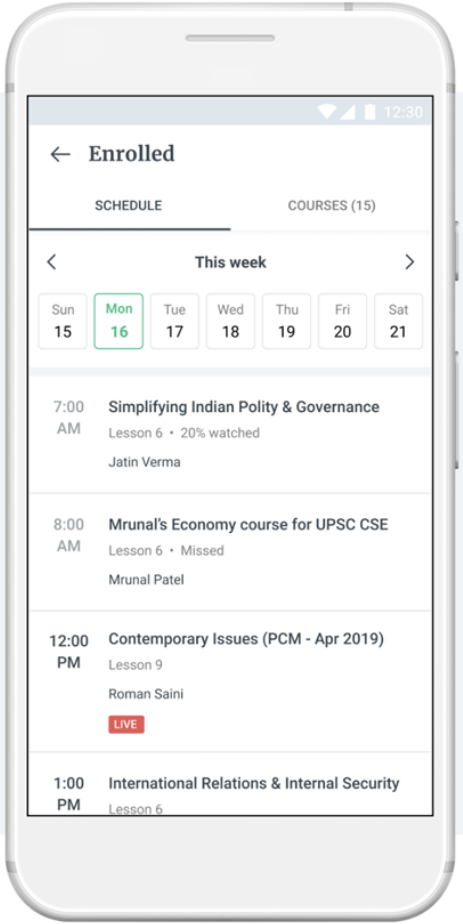
Enroll in courses and make your own daily time table to keep track of your learning

🌏 Language of your choice

Educators teach in English, Hindi, Malayalam, Tamil and many more languages

✍️ Unlimited Practice

Re-take quizzes and watch recorded sessions as many times as you need to. You can also download videos to watch later, even offline



A subscription that's more than just classes

📝 Concept based quizzes

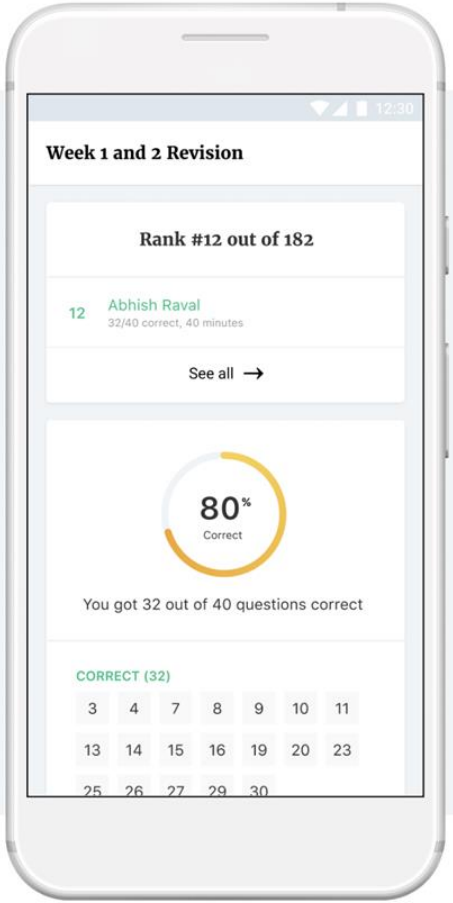
Take quizzes on various concepts to help you identify strengths & areas for improvement

❓ Live doubt clearing sessions

Every course includes live doubt clearing sessions with the educator to ask questions and discuss

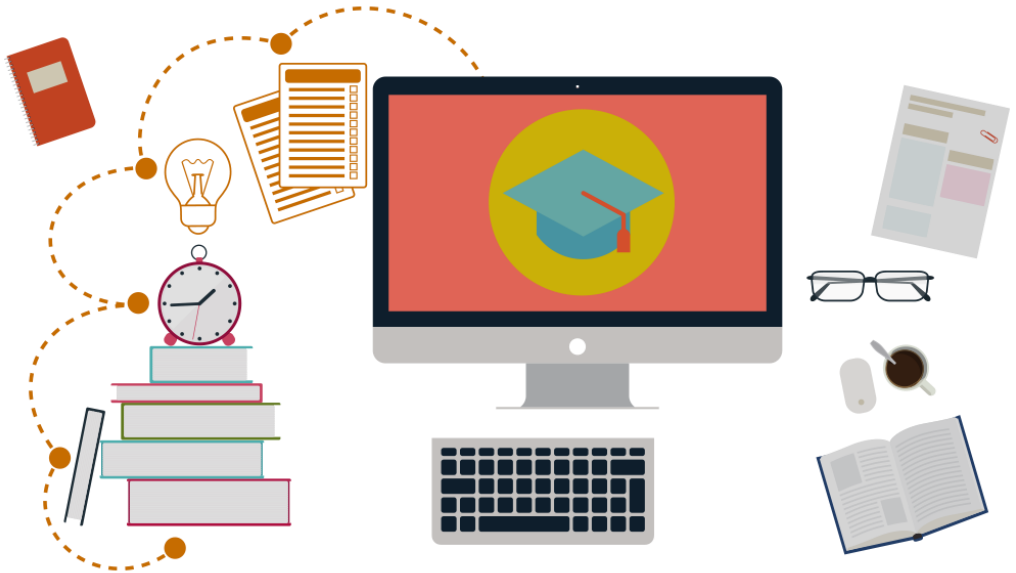
✍️ Detailed test series

All India live test series to test your knowledge, compare progress and know which areas to improve

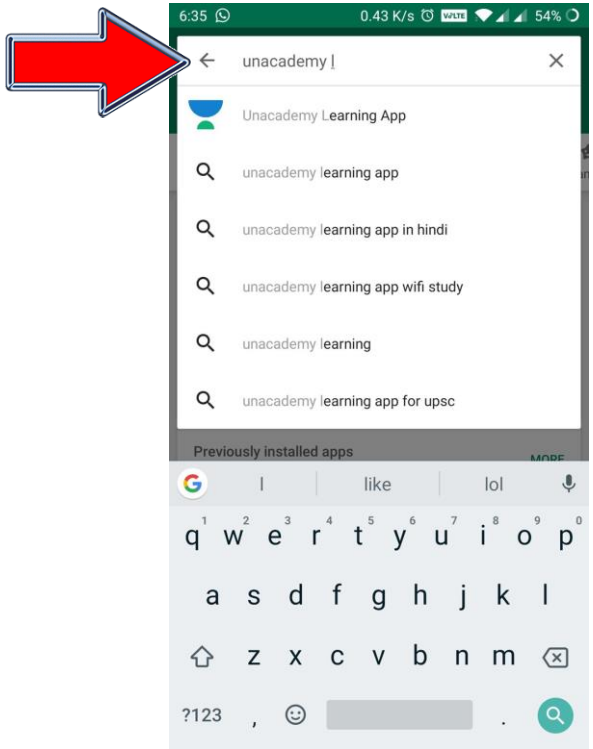


plus

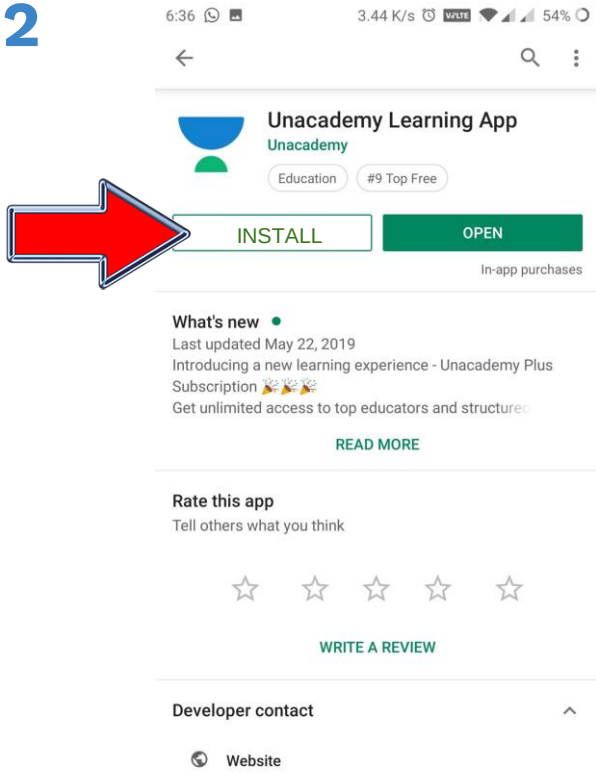
“Learn **Anytime** Anywhere”



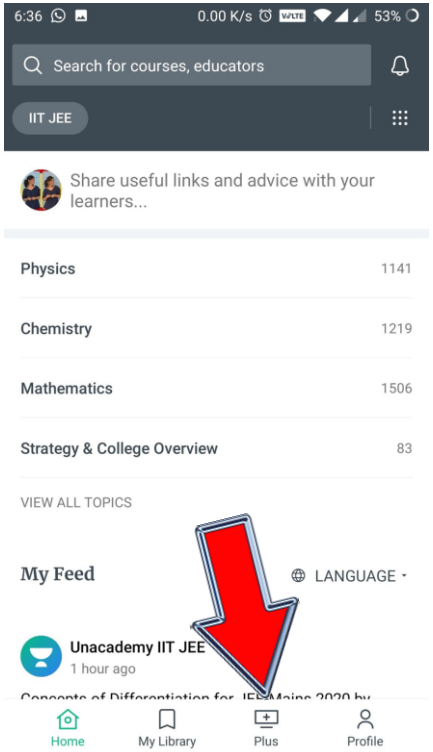
Step 1


6:35
0.43 K/s
54%
unacademy
Unacademy Learning App
unacademy learning app
unacademy learning app in hindi
unacademy learning app wifi study
unacademy learning
unacademy learning app for upsc
Previously installed apps
I
like
lol

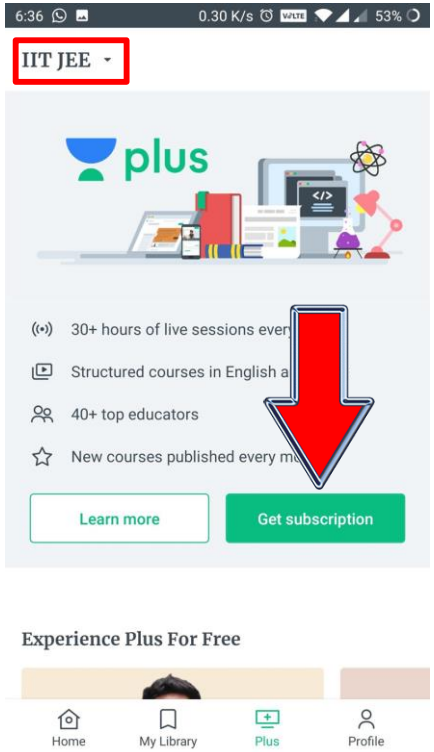
Step 2


6:36
3.44 K/s
54%
Unacademy Learning App
Unacademy
Education
#9 Top Free
INSTALL
OPEN
In-app purchases
What's new
Last updated May 22, 2019
Introducing a new learning experience - Unacademy Plus Subscription
Get unlimited access to top educators and structure
READ MORE
Rate this app
Tell others what you think
WRITE A REVIEW
Developer contact
Website

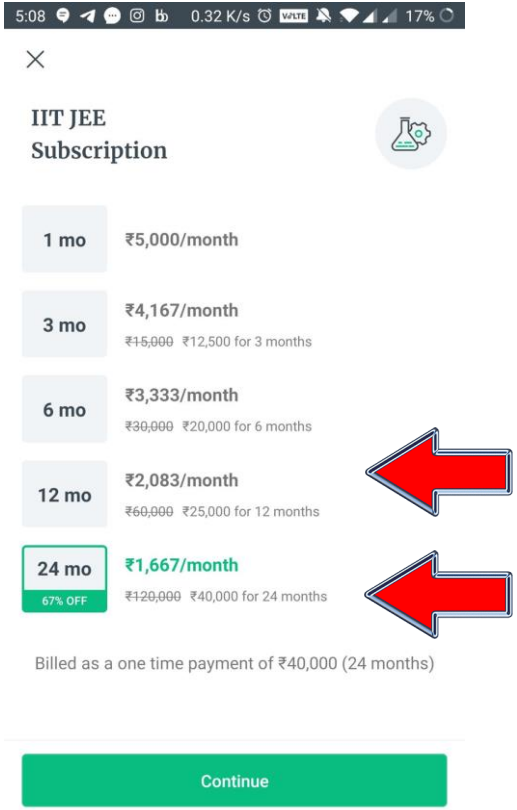
Step **3**


6:36
0.00 K/s
53%
Search for courses, educators
IIT JEE
Share useful links and advice with your learners...
Physics 1141
Chemistry 1219
Mathematics 1506
Strategy & College Overview 83
VIEW ALL TOPICS
My Feed
LANGUAGE
Unacademy IIT JEE
1 hour ago
Home
My Library
Plus
Profile

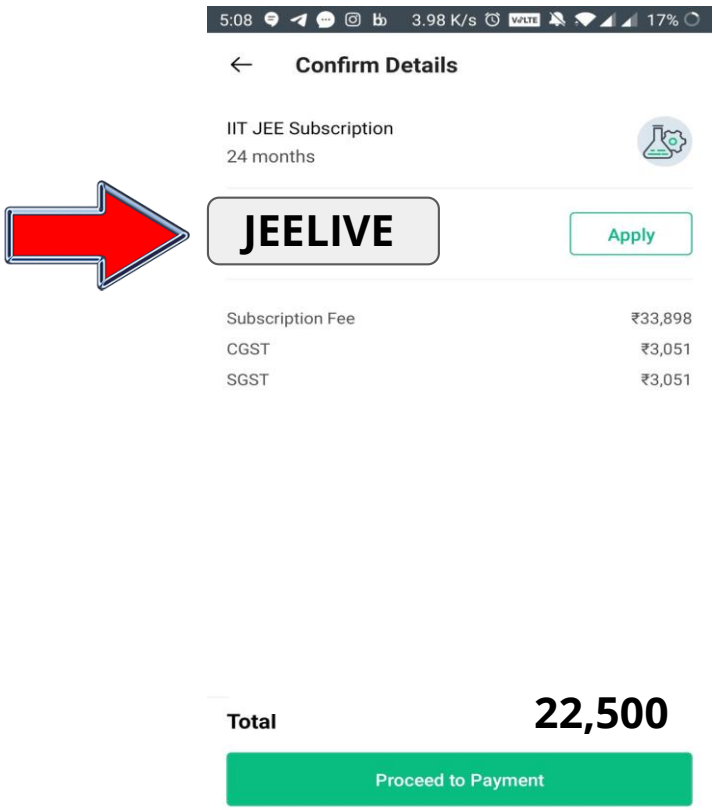
Step **4**


6:36
0.30 K/s
53%
IIT JEE
plus
30+ hours of live sessions ever
Structured courses in English a
40+ top educators
New courses published every m
Learn more
Get subscription
Experience Plus For Free
Home
My Library
Plus
Profile

Step **5**


5:08 0.32 K/s 17%
IIT JEE
Subscription
1 mo
₹5,000/month
3 mo
₹4,167/month
₹15,000 ₹12,500 for 3 months
6 mo
₹3,333/month
₹30,000 ₹20,000 for 6 months
12 mo
₹2,083/month
₹60,000 ₹25,000 for 12 months
24 mo
67% OFF
₹1,667/month
₹120,000 ₹40,000 for 24 months
Billed as a one time payment of ₹40,000 (24 months)
Continue

Step **6**


5:08 3.98 K/s 17%
Confirm Details
IIT JEE Subscription
24 months
JEELIVE
Apply
Subscription Fee ₹33,898
CGST ₹3,051
SGST ₹3,051
Total 22,500
Proceed to Payment

jee

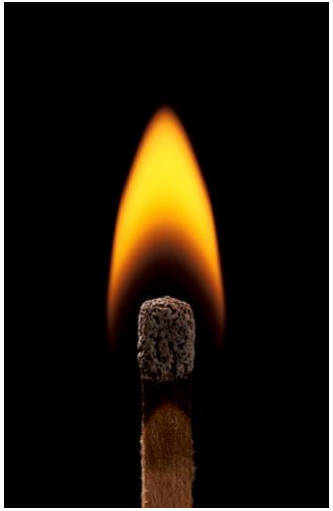
Use Referral Code

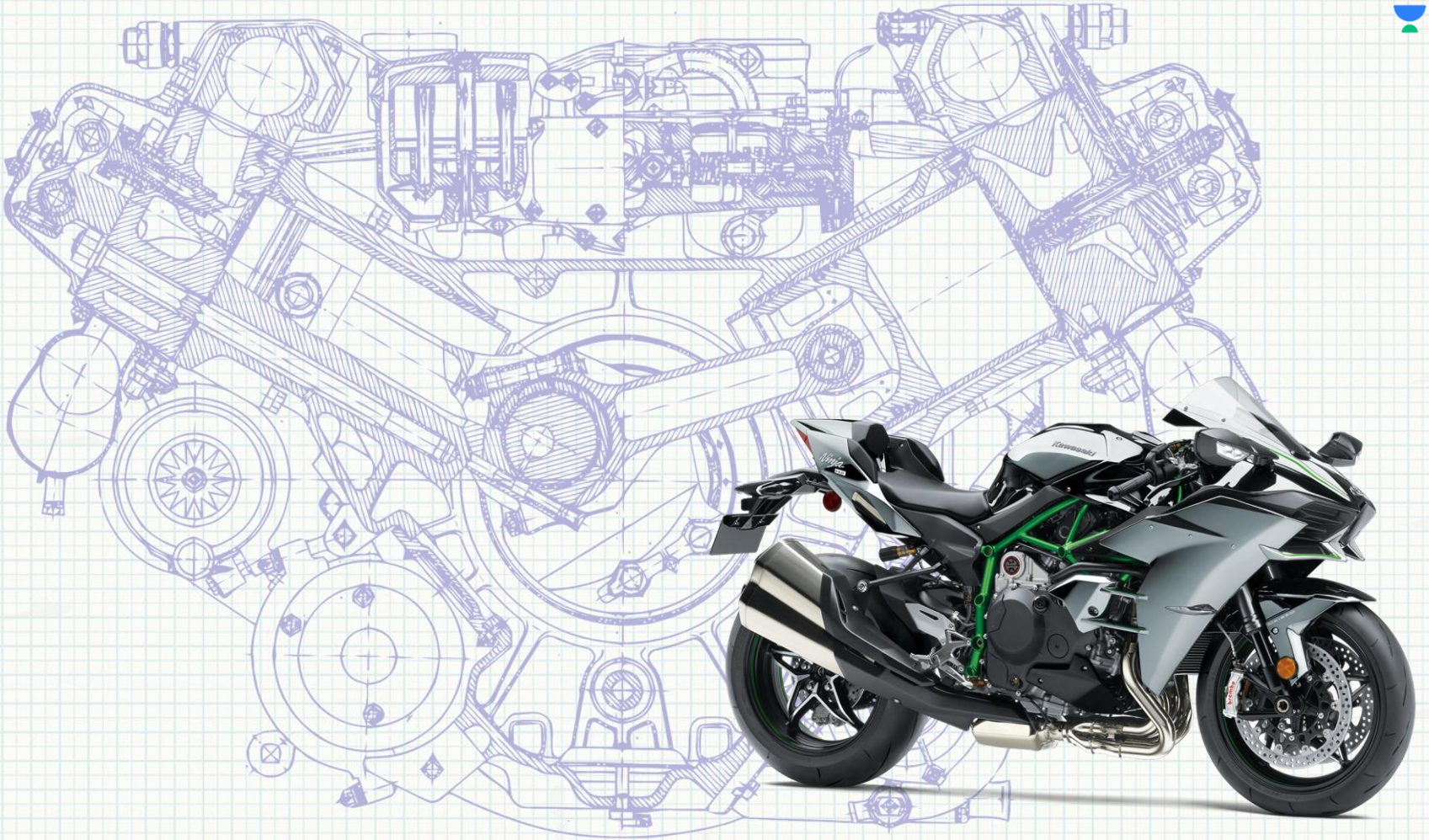
plus

jeelive

on your next **Unacademy Plus Subscription**

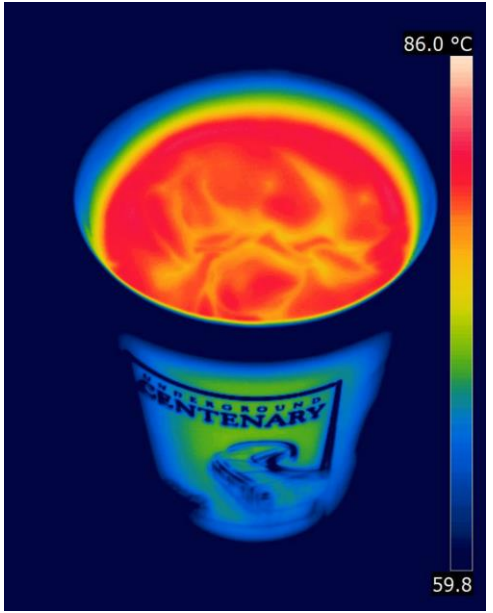
unacademy





Introduction

It’s the study of energy and interaction of energy with matter.



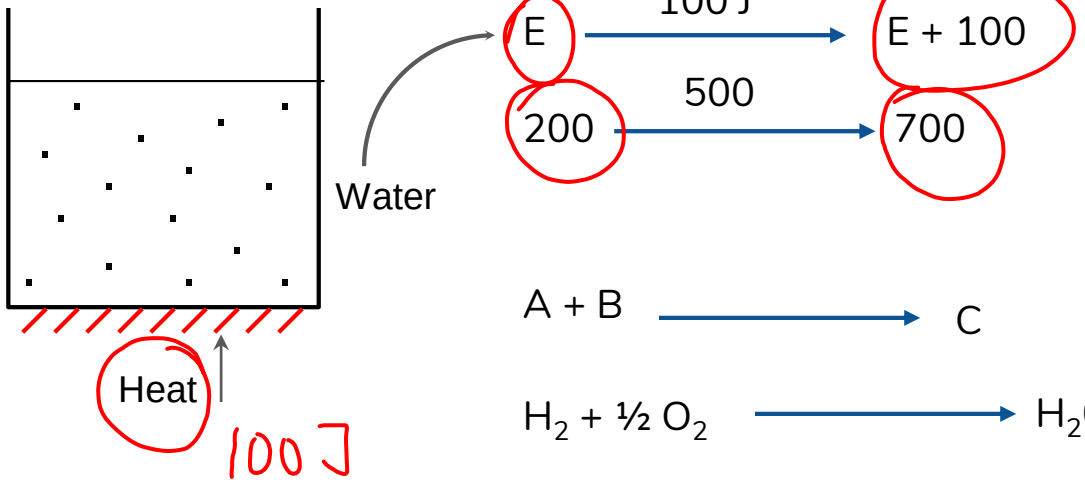
Scope of thermodynamics

- Predict the feasibility of a reaction
- Calculate the energy changes if the ~~rxn~~ does take place
- Calculating the extent to which a chemical reaction proceeds

$$A + B \longrightarrow C$$

Limitations of thermodynamics

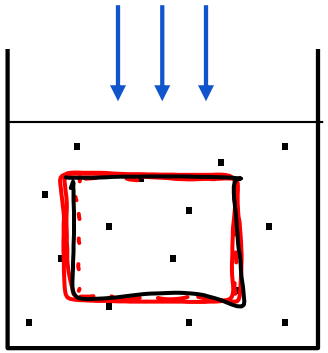
- Applicable to macroscopic systems and not to microscopic
- Can't predict the speed of the reaction or time taken to reach equilibrium



$A + B \longrightarrow C$

$H_2 + ½\ O_2 \longrightarrow H_20$

How to proceed?



Boundary

↳ Real, imaginary

Rigid, flexible

Diathermal, Adiabatic

System: That part of the universe in which observations are made

Surroundings: Rest of the universe

Boundary: Anything that separates systems and surroundings

Types of System

	Mass Exchange	Energy Exchange
OPEN	✓	✓
CLOSED	✗	✓
ISOLATED	✗	✗

Example

Cup of tea

Open

Human Body

Mobile Phone

Closed

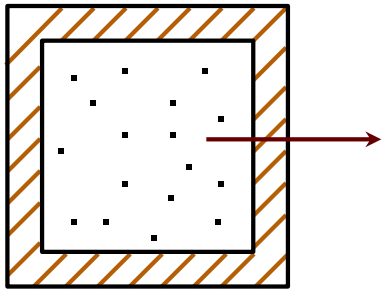
Laptop

Equilibrium

An isolated system is in equilibrium when its **macroscopic properties** remain **constant** with time.

Thermodynamic Equilibrium

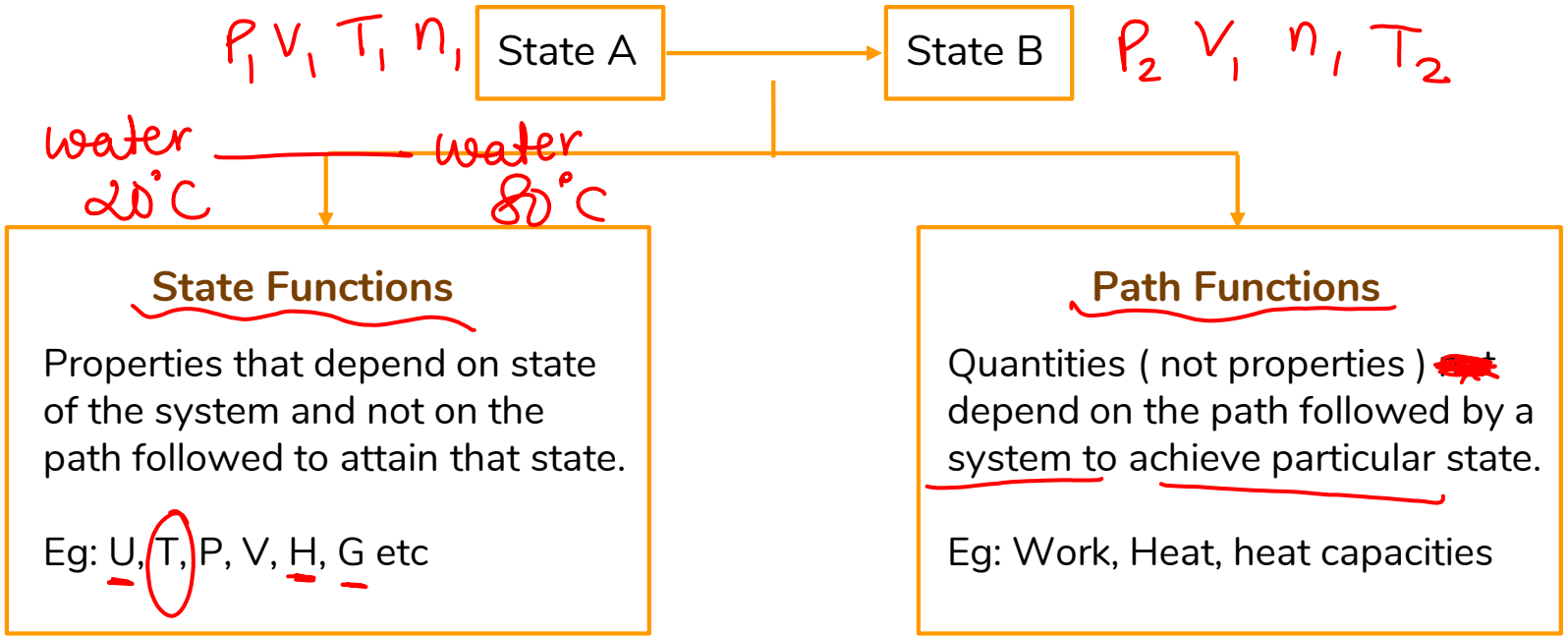
- **Mechanical Equilibrium** — $\Sigma \text{Force} = 0$
- **Material / Chemical Equilibrium** — $A \rightleftharpoons B$, $\text{Rate}_f = \text{Rate}_b$
- **Thermal Equilibrium** — No temp gradient

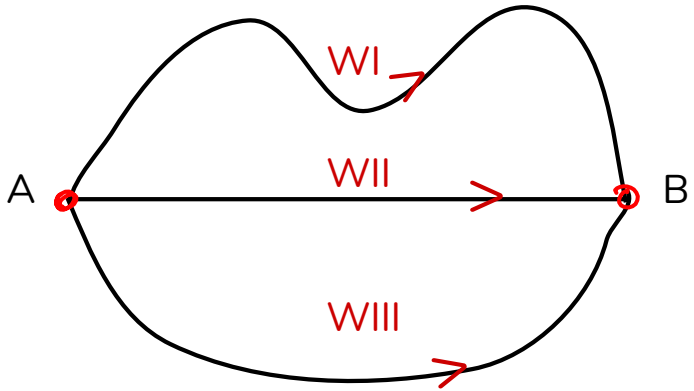


P
T
V.

State of a System

It is the condition in which the system is present and it can be defined by specifying some observable properties of the system.




WI
WII
WIII
A
B

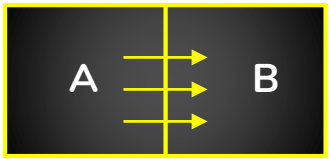
Intensive and Extensive Properties

Intensive Properties	Extensive Properties
Which don't depend on amount or bulk of matter. These are **non-additive** Eg: T, P, C_m, density, Concentration, refractive index, V.P, Molar volume, molar energy, molar entropy, molar enthalpy, molar mass	Which depend on amount or bulk of matter. These are **additive** Eg: Mass, Volume, Internal energy, Enthalpy, Gibbs energy, Entropy

All specific & molar quantities are intensive.

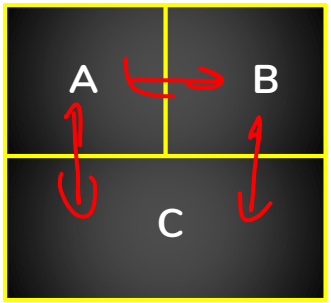
$$\frac{\text{Extensive Property}}{\text{Mass}} = \text{Intensive Property}$$

Zeroth law of Thermodynamics



80^0 20^0

T = same in both thermal equilibrium



A	B	$T_A = T_B$
B	C	$T_B = T_C$
A	C	$T_A = T_C$

Zeroth law of Thermodynamics

If two systems are separately in thermal equilibrium with a third system, then the two systems are also in thermal equilibrium.

Temperature is an abstract property and it's not measured directly

$V \propto T$

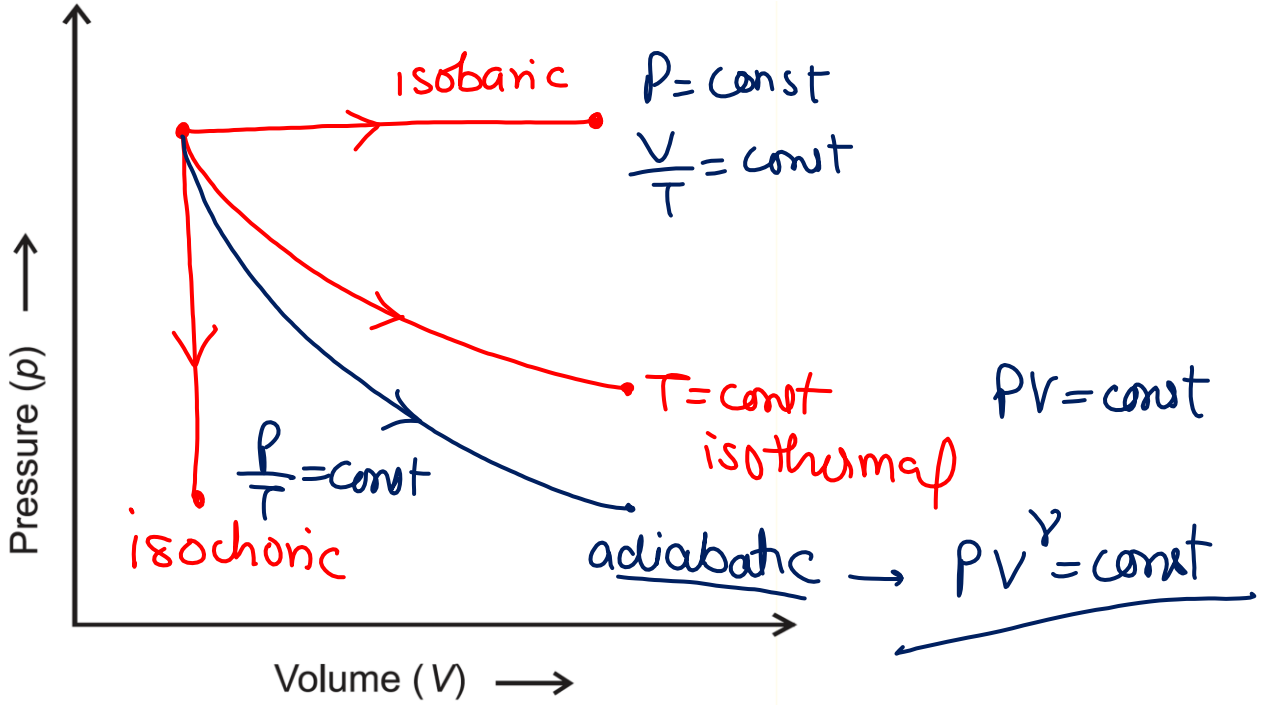
Thermodynamic Process

- Isothermal process —— $T = \text{const}$, $\Delta T = 0$
- Isochoric process —→ $V = \text{const}$, $\Delta V = 0$
- Isobaric process —— $P = \text{const}$, $\Delta P = 0$
- Adiabatic process —— No heat exchange , $q = 0$

Thermodynamic Process

Boyle's law

$P \propto \frac{1}{V}$ $T = \text{const}$



Thermodynamic Process

PV^n = constant ⟶ Polytropic Process