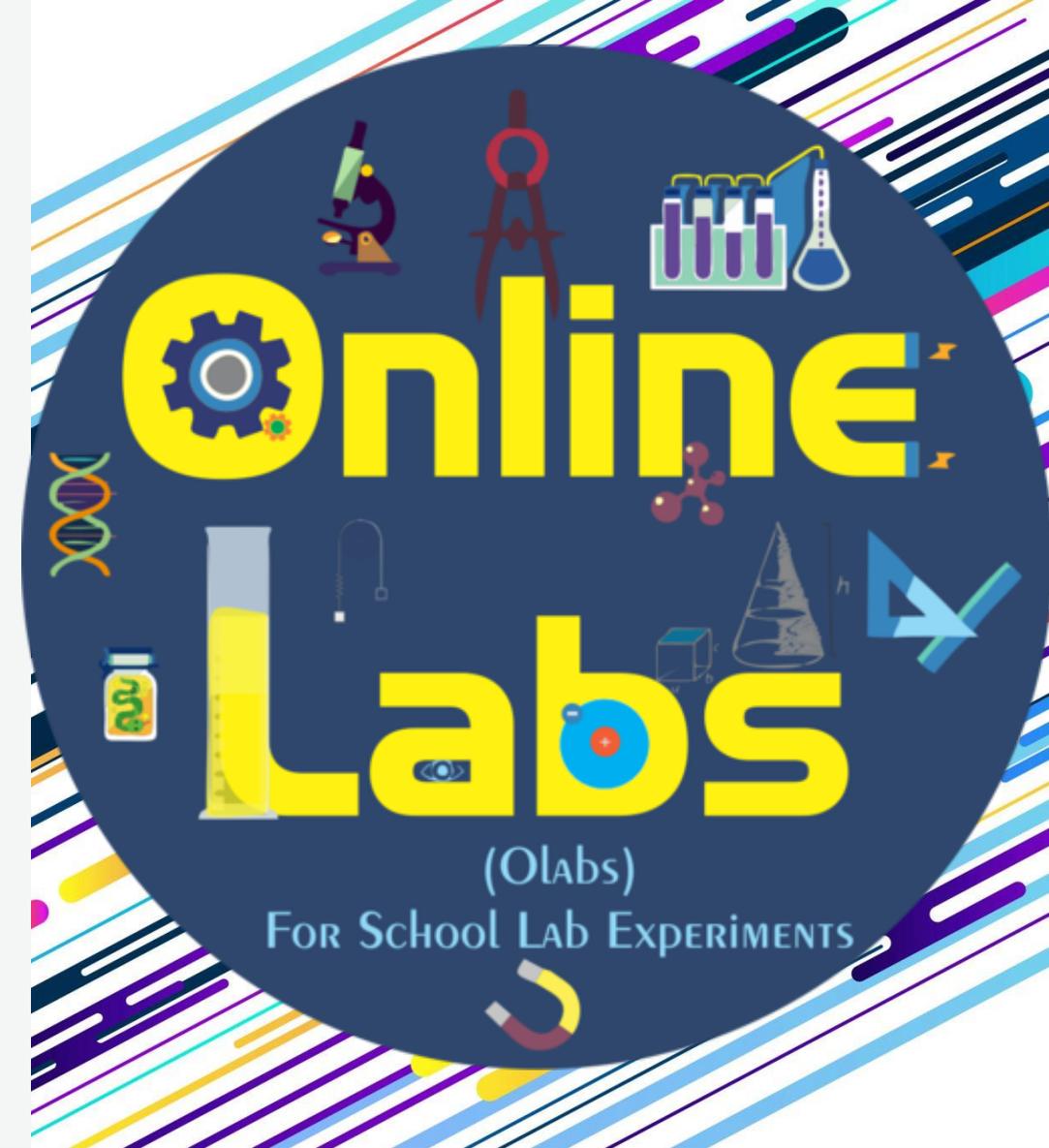


Learning Physics through Online Labs (Virtual Labs)

Archana Rane,

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archana@cdac.in



Need for Virtual Labs

- **Problems with Physical Labs**
 - Limited Infrastructure
 - No/minimal lab session
 - Limited lab access
 - Safety constraints, expensive and fragile equipment.
- **Others**
 - Inadequate 'higher order thinking skills'
 - Assessment of experiments difficult
 - Lack of quality teachers
 - Support for divyang students
- Not all activities amenable to physical labs



Virtual labs

Virtual labs and remote labs to the rescue?...

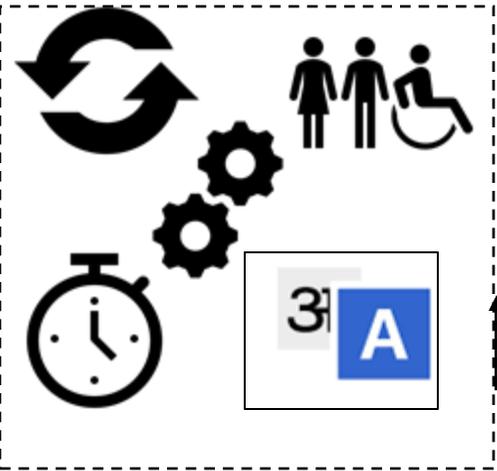
Virtual labs: simulation labs. Usually computer simulation of important aspects of the lab.

One of the recommendations in the NEP 2020

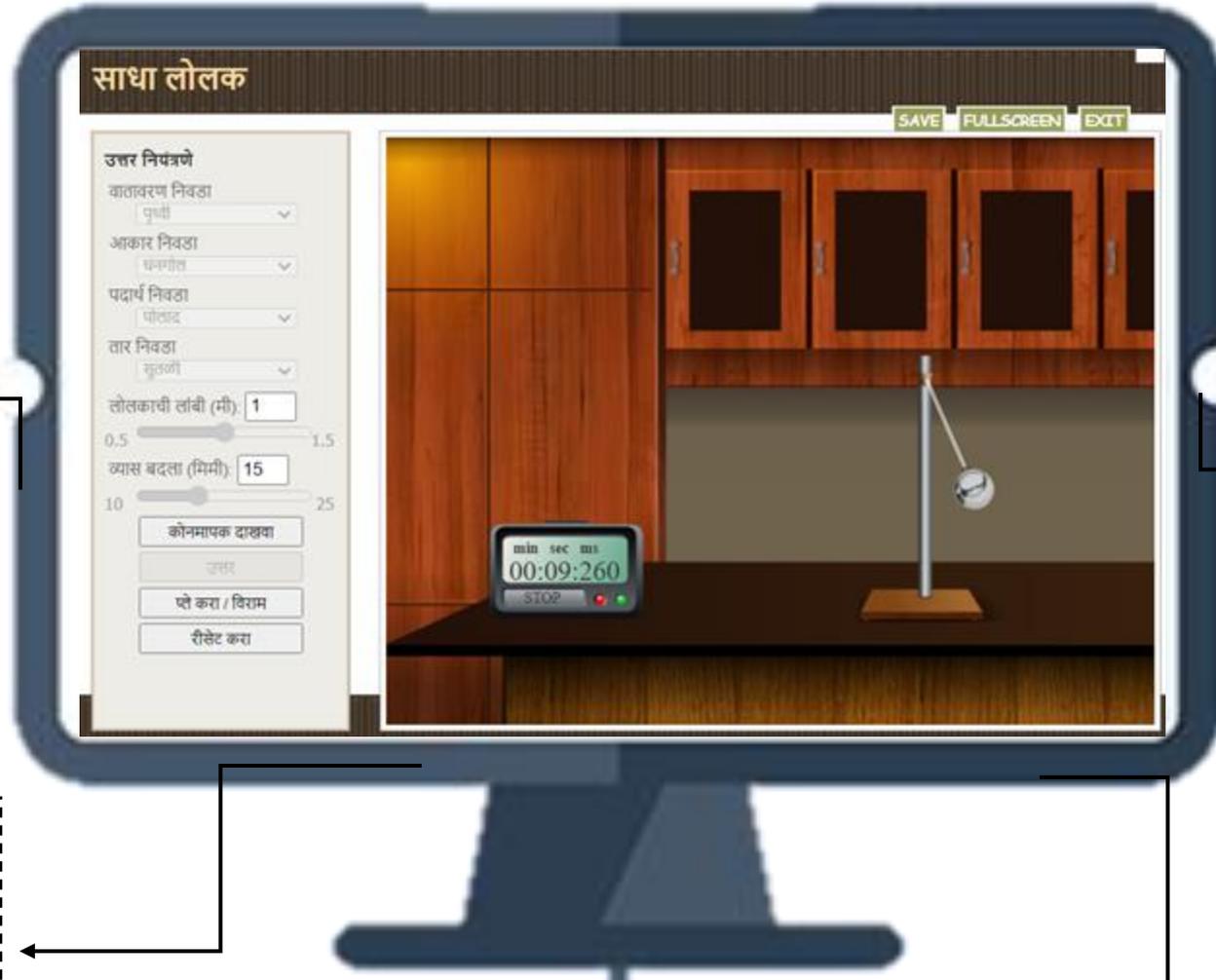
Remote labs: expensive equipments can be manipulated remotely; enables sharing of such resources.

Virtual Labs (Simulation-based)

Affordances

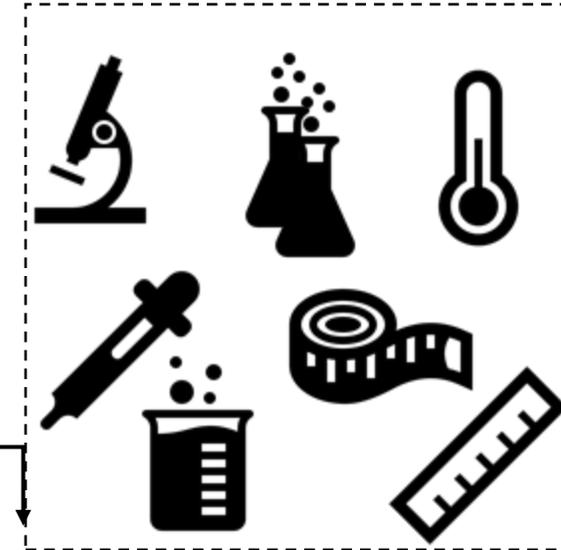


Accessibility & Flexibility



Can go beyond boundaries of a traditional Lab

Features



Lab Operations online



Observations & Analysis online

What is OLabs?

- Online Labs (OLabs) for school lab experiments are simulation-based labs
- Interactive simulations with real world behaviour
- Students can Explore, Conduct and Repeat at their own pace.
- Available for free web-based access on www.olabs.edu.in
- Offline version available
- Not meant to replace physical labs!
 - But augment and amplify them.



olabs.edu.in
(soon to be under Diksha)

OLabs at present

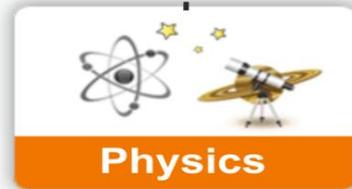
Classes:

- IX
- X
- XI
- XII

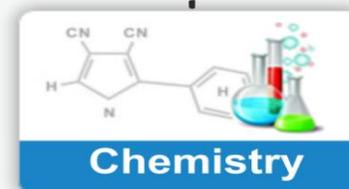
Available in

- English
- हिंदी
- മലയാളം
- मराठी

Experiment/Lab Details



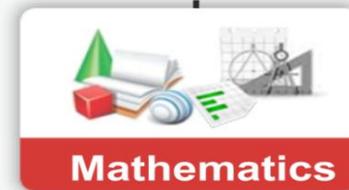
54



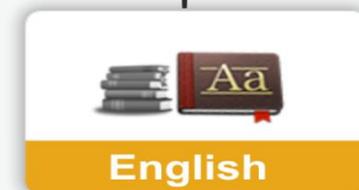
46



36



25



12

Total Experiments :

173

Why OLabs?

- Compared to the many simulators available online, OLabs provide a **complete eco-system** for the lab.
- **Consistency** in terminology across the tabs
- Compliance with the **NCERT curriculum**.
- Content **reviewed and approved** by CBSE teachers.
- **High degree of interactivity** for the learner and multiple affordances.

OLabs is ready
for use...

OLabs Home page



OLABS

Funded by MeitY
Ministry of Electronics and
Information Technology



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PHYSICS

CHEMISTRY

BIOLOGY

MATHS

ENGLISH

**Olabs Training
Registration Form**

Featured Simulation

Pythagoras theorem

OLabs

The OLabs is based on the idea that lab experiments can be taught using the Internet, more efficiently and less expensively. The labs can also be made available to students with no access to physical labs or where equipment is not available owing to being scarce or costly. This helps them compete with students in better equipped schools and bridges the digital divide and geographical distances. The experiments can be accessed anytime and



OLabs eco-system

Theory relevant to the lab

Understanding of the process and its implications

The core simulator

Auxiliary requirements:
plot, measurement and
recording, etc

Review questions,
references

OLabs Physics - Lab specific affordances

- In each lab, a set of affordances are provided.
- These are chosen based on the expectation and requirements of the lab.
- **Lab tools** such as Timer, measuring scale, protractor, calculator, thermometer, equipment that can be manipulated, etc
- **Support Tools** such as Play, Pause, Support, Help, etc
- **Variants** for various parameters
 - E.g. For simple pendulum, you can change - wire length, value of 'g', material of bob, atmosphere, etc.
 - E.g. In Ohms law - resistance of rheostat, diameter of the wire, metal of the wire, etc
- **Observation Tables** to record data, where there is multiple iterations of the experiment is required.
- Graph Plotting provision where applicable.
- Click to perform, where fine grained mouse control may be difficult. E.g. Connectors in electric circuits.

OLabs: A view of a lab

you are here-> home-> physics-> class 12-> ohm's law and resistance

Ohm's law and resistance



Theory



Procedure



Animation



Simulator



Video



Viva Voce



Resources



Feedback

Ohm's Law

HELP

Select the metal:

Silver

Length of the wire: 10cm

10 100

Diameter of the wire: 0.2mm

0.2 1

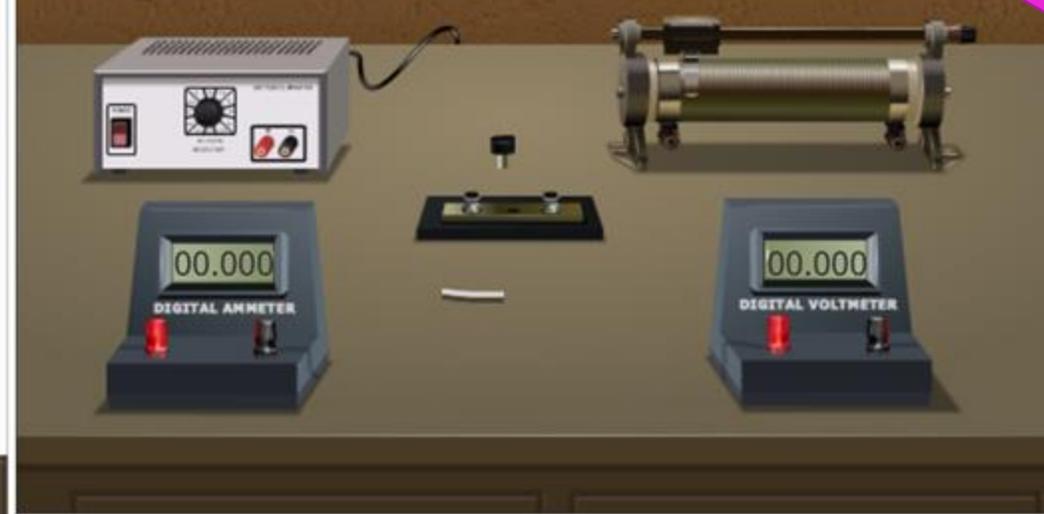
Resistance of the rheostat: 1

1 100

Show result

Reset

Show circuit diagram



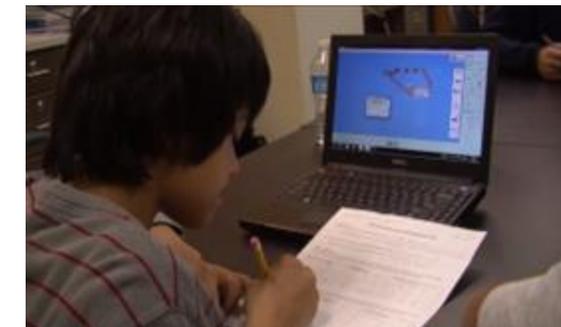
Affordances

Lab Tools

Virtual Labs: Settings & Use cases

Virtual Labs should be flexible enough to be adapted in diverse educational/learning environments and use-cases i.e.

- classroom & virtual classroom (formal education),
- in physical labs (revision or reflection),
- in computer rooms & at home (self-learning),
- in informal education, etc.



Usage mode-1 - Before the physical lab

- Usually students have no idea of what to expect in the lab, till they reach there.
- Being prepared will help to use the limited lab time more effectively.
- OLabs mimics the experimental setup with high fidelity.
- Use the virtual lab as a preparatory ground before the lab.

Usage mode-2 - After the physical lab

- Physical labs provide limited options to explore..
 - due to resource constraints
 - and time constraints.
- In the lab environment, adequate time to reflect may not be there.
- Ask the learner to explore the virtual lab in more detail and try out more scenarios.
- Use reflection in the class, with specific scenarios.

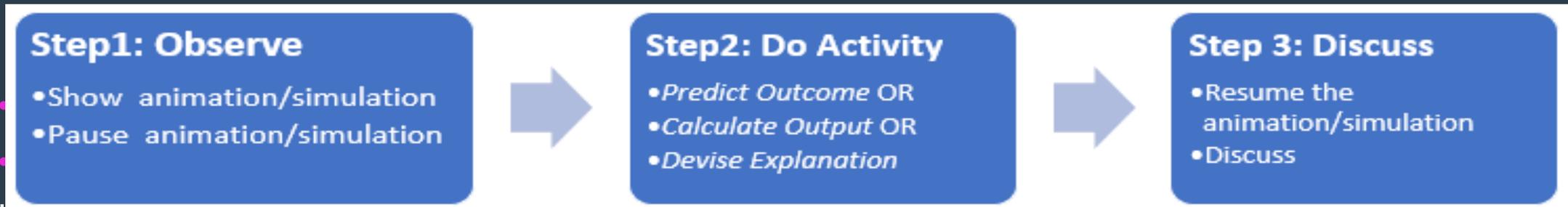
Usage mode-3 - As an instructional device...

- Explaining concepts like hooke's law, focal length of a lens, etc hard without a lab setup.
- OLabs can function as a replica of lab setup for this purpose.
- Demonstrate the intended behaviour using OLabs.
- Use affordances provided to try select use cases.
- Encourage the learners to try them out on their own.

Usage mode-4 - For active learning strategies...

- Active learning strategies like flipped classroom require mechanisms to engage a class without lectures.
- A lab setup replicated in the classroom can provide a fertile ground...
- Stop the experiment arbitrarily and ask learners to predict what happens?

Click to add text



- Choose activity based on pedagogical purpose and learning objective of the Lab
- Deepens learning and encourages reflection.

Usage mode-5

- In absence of physical lab
 - When there is no physical lab – e.g. pandemic, lack of infra.
 - Can also function as replacement of physical lab in
 - Performing the activities envisaged.
 - Maintain lab records.
 - Getting a feel of the lab activities
 - Only appearance and activities though.
- For Self-learning
 - As Homework – Give inquiry-based activities around lab
 - Encourage self-evaluation using “Viva-Voce” section of each lab.



Virtual Labs challenges



LACK OF
GUIDANCE



COLLABORATION



IMMERSIVE
EXPERIENCE



NON-STEM
SUBJECTS



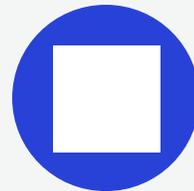
LEARNER
ENGAGEMENT



WORKING IN
ISOLATION



TRACKING



NO TOUCH AND
FEEL



Our plans for
future:
O Labs NG!

Physics Labs - Class IX

Class 9



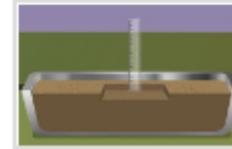
Bell Jar Experiment



Force Required to Move a
Wooden Block on a
Horizontal Table



Newton's Third law of
Motion



Pressure Exerted by a
Solid Iron Cuboid on Sand



Verification of Archimedes
Principle



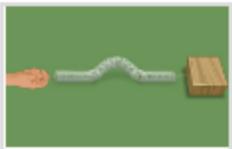
Laws of Reflection of
Sound



Determination of Density
of Solid



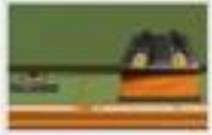
Newton's Second Law



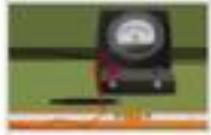
Velocity of a Pulse
Propagated Through a
Slinky

Physics Labs - Class IX

Class 10



Equivalent Resistance of Resistors (Series)



Equivalent Resistance of Resistors (Parallel)



To find focal length of a Concave Mirror



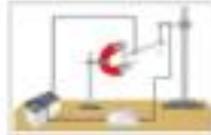
Verification of Ohm's Law



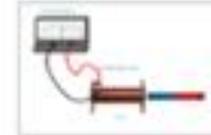
To study the field lines formed around a bar magnet



Verification of Hooke's Law



Force on a Current Carrying Conductor in a Magnetic Field



Electromagnetic Induction



To study refraction of light in rectangular glass slab



To study reflection in concave mirror



Ohm's law and resistance



The magnetic field lines around current carrying solenoid



Magnetic field lines around current carrying conductor

Physics Labs - Class XI

Class 11



Screw Gauge



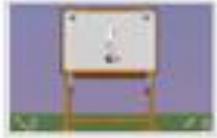
Vernier Calipers



Simple Pendulum



Beam Balance



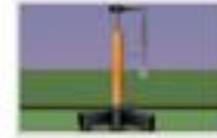
Parallelogram Law of Vectors



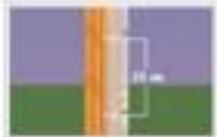
Spherometer



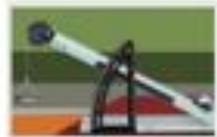
Friction



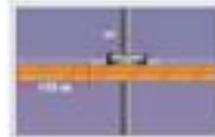
Helical Spring



Viscosity of a liquid - Stoke's method



Inclined Plane



Boyle's Law



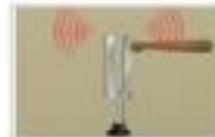
Surface Tension



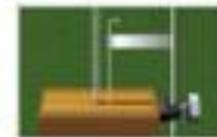
Young's Modulus



Resonance Column



Sonometer



Newton's Law of Cooling

Physics Labs - Class XII

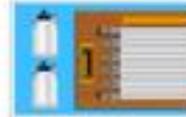
Class 12



Ohm's law and resistance



Potentiometer-Internal Resistance of a Cell



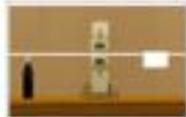
Potentiometer-Comparison of emf



Figure of Merit of a Galvanometer



Conversion of Galvanometer to Ammeter



AC Sonometer



Concave Mirror-Focal Length by u-v Method



Convex Mirror-Focal Length



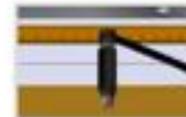
Concave Lens-Focal Length



Spectrometer-Prism



Refractive Index of Liquid



Metre bridge-Resistance of a wire



Metre Bridge-Law of Combination of resistors



Diode Characteristics



Zener Diode



Transistor Characteristics



Demo of OLabs Physics Labs

By Suman Ninoriya, CDAC Mumbai

Summary

- We are happy to bring [OLabs platform](#) you to add value to the school education, in significant ways.
- We are working on to bring you better and more labs soon in form [OLabs Next G](#)
- Do [share your feedback and suggestions](#); we certainly appreciate that.
- We do hope you will consider adopting it for your students and inform the students accordingly.
- You can also contribute – [Translate, Train, Give feedback, Share ideas for new labs, etc](#)

Important Links

- **OLabs website** - www.olabs.edu.in
- **OLabs FB page** - <https://www.facebook.com/onlinelabs/>
- **OLabs Email** - support@olabs.co.in / etu@cdac.in
- **Download Offline version** <http://www.olabs.edu.in/?pg=topMenu&id=289>
- **Are you using OLabs? Let us know** <http://www.olabs.edu.in/?pg=topMenu&id=288>

Thank you...

Archana Rane, CDAC Mumbai; Suman Ninoriya, CDAC Mumbai

archana@cdac.in, nsuman@cdac.in

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