

*EPISTEME 9 SUBMISSION NO 7*

# *INTEGRATION OF STEAM IN CHEMISTRY*

## *CLASSROOM*

*TOPICS:*

*GAS LAWS*

*STRUCTURE OF ATOM*



*DR. PUNEETA MALHOTRA*

*SOCIETY FOR THE ADVANCEMENT OF EDUCATION,  
DELHI, INDIA*

# TEACHING GAS LAWS USING STEAM

## SIMULATIONS

Using online platforms like PhET to collect data for experiments which are not possible in school lab.

## TECHNOLOGY

361 K

Pressure 32.9 atm

5.2 nm

Hold Constant

- Nothing
- Volume (V)
- Temperature (T)
- Pressure  $\uparrow$ V
- Pressure  $\uparrow$ T

Width  $\leftarrow$   $\rightarrow$

Stopwatch

Collision Counter

Particles

- Heavy
- Light

121

0

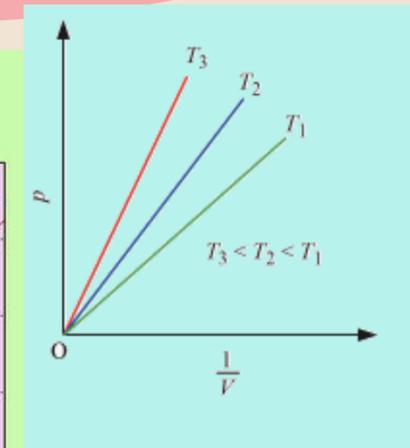
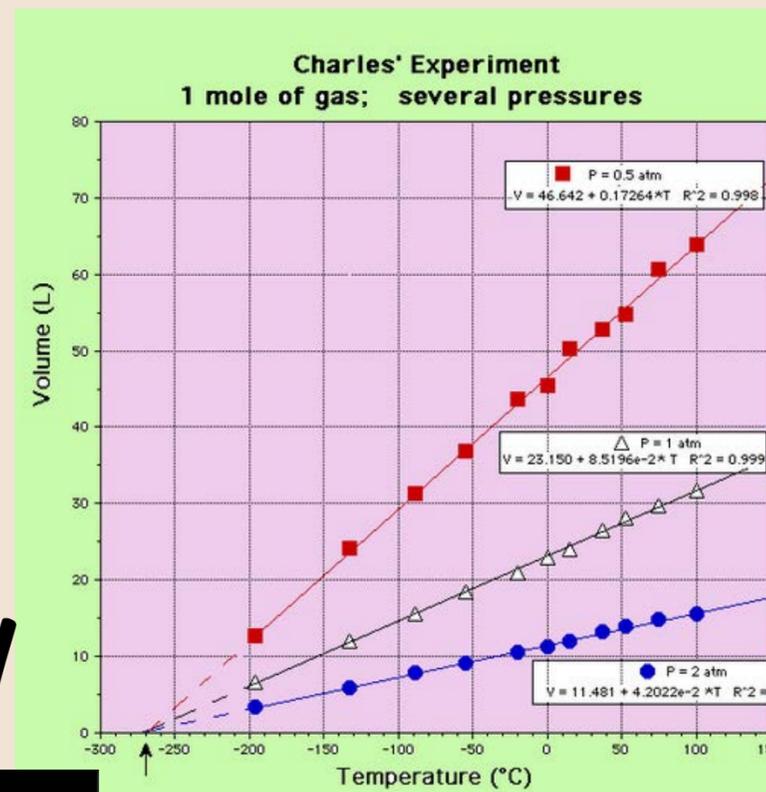
TEMP. CONSTANT

361 K

Pressure 16.0 atm

10.7 nm

2



## MATHS

Temp goes up  
Volume goes up

Volume goes down  
Pressure goes up

VOLUME

Pressure

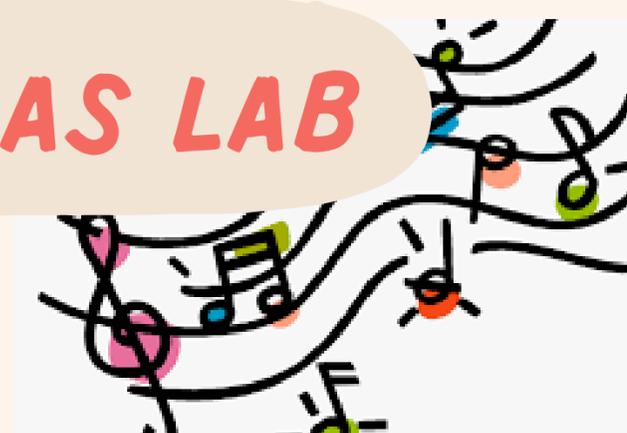
## INTERPRETING DATA

Analysis of data collected using simulations, graphical representation of data and arriving at the gas laws.

## LAB WORK



## PLAYGROUND AS LAB



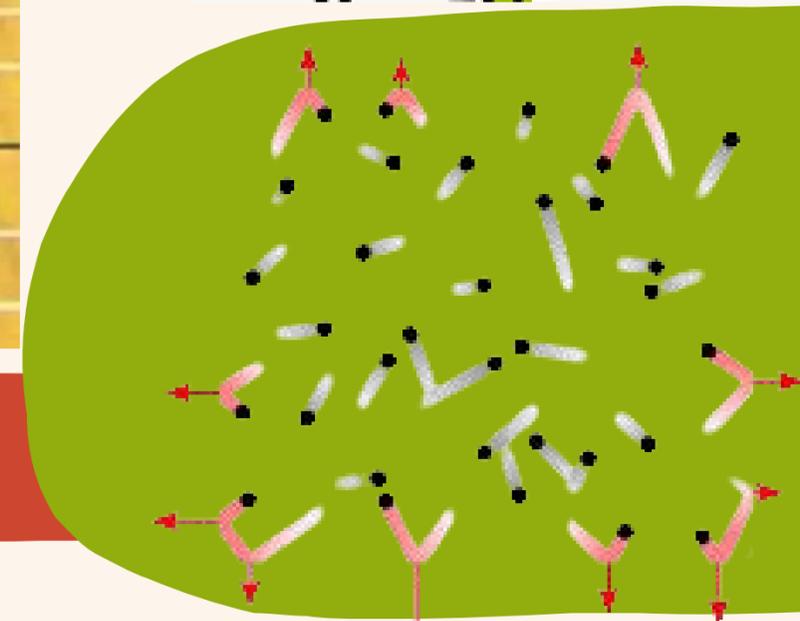
Apply gas laws and stoichiometry to design an air bag in the lab.



## ENGINEERING



## ARTS



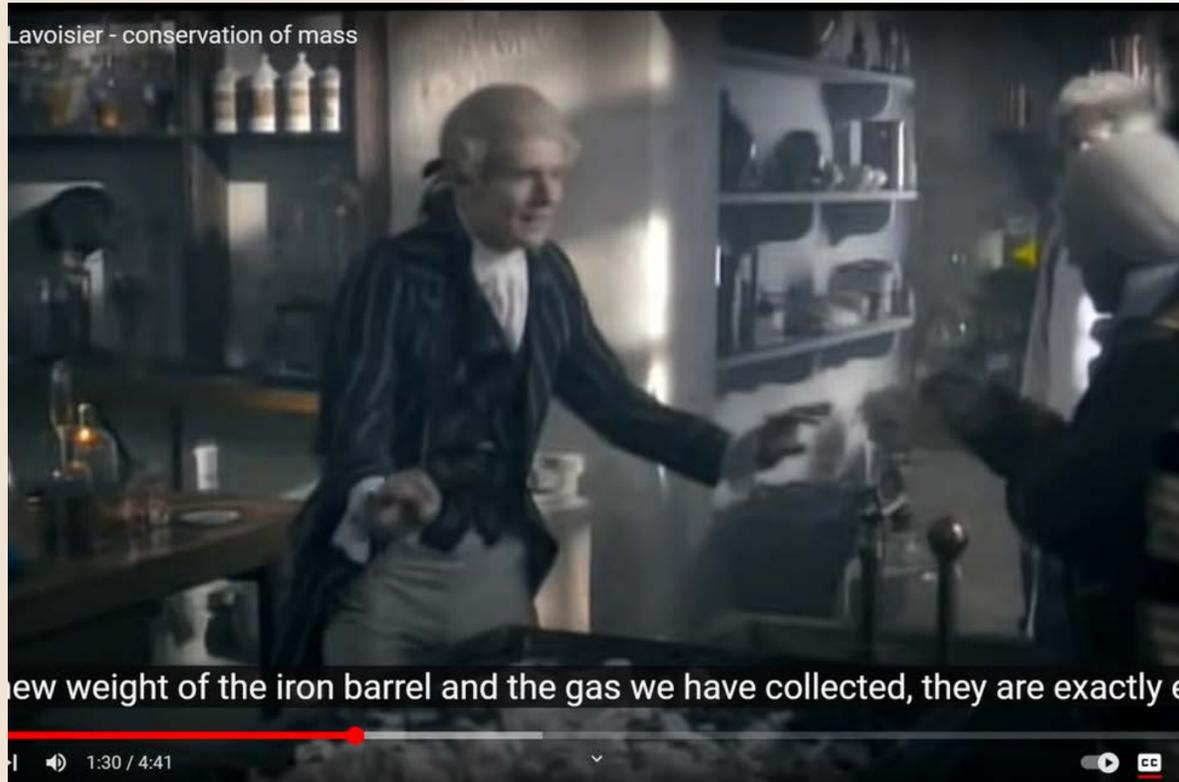
"Fit into the circle" game in the playground to arrive at Kinetic Gas Theory

**STUDY OF BEHAVIOUR OF GASES (SCIENCE) USING SIMULATIONS (TECHNOLOGY) TO CREATE AN AIRBAG REPLICA (ENGINEERING) USING MATHEMATICAL CALCULATIONS (MATH). MUSIC AND DANCE WAS INTEGRATED TO UNDERSTAND COLLISIONS BETWEEN PARTICLES.**

# TEACHING STRUCTURE OF ATOM USING STEAM

HISTORY AND PHILOSOPHY OF SCIENCE

ARTS



Historical reconstruction of events that led to present day understanding of structure of atom.

Engaging students in philosophical debates

Ok. What is the colour of carbon atom?

black.

colour of oxygen atom?

colourless, as oxygen is colourless.

and carbondioxide molecule?

it is colourless

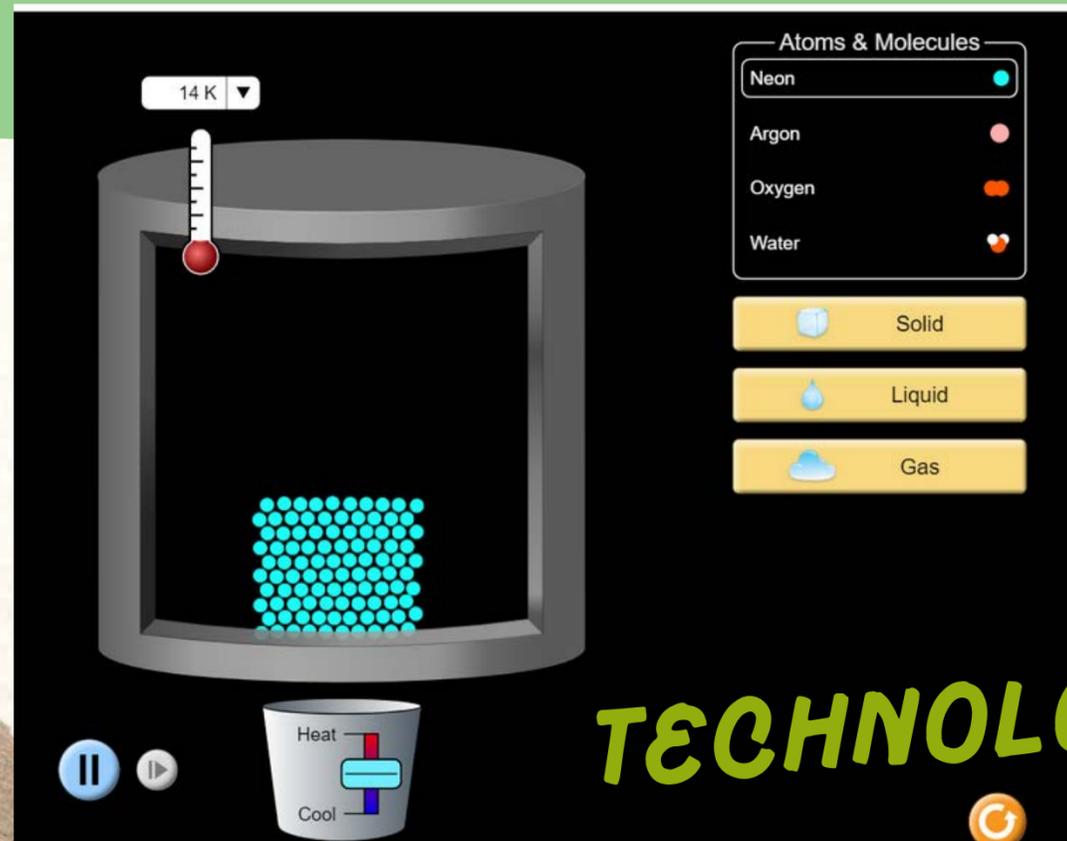
Why?

as carbon di oxide is colourless.

but carbon atom is black , so how can one black carbon atom and two colourless oxygen atoms give a colourless carbon di oxide molecule?

# SIMULATIONS

Use of technology to visualize what happens at atomic/ molecular level.



**TECHNOLOGY**

# PLAYGROUND AS LAB



## Energy levels: Bohr Atom

n=∞	0.00eV
n=5	-0.51eV
n=4	-0.85eV
n=3	-1.51eV
n=2	-3.40eV
n=1	-13.6eV



Understanding energy levels through games

**MATH & ARTS**

**THE TEACHING-LEARNING PROCESS INVOLVED HISTORY AND PHILOSOPHY OF SCIENCE, SCIENCE, MATHEMATICS AND THE LONG-JUMP GAME.**

## ***CONCLUSION***

The lesson planning was very time-consuming but the two examples show that an integrated approach is possible even while teaching chemistry at the senior school level.

## ***EDUCATIONAL IMPLICATIONS***

1. Extend STEAM to other concepts/ content in Chemistry
2. Understand the process of science through HPS approach

***PUNEETA\_KRM@YAHOO.CO.IN***