

PH 203

P R O J E C T

**THROUGHPUT AND PUMPING
SPEED IN A VACUUM CHAMBER**

**FARHAAN ALAM
2001ME25**

**GAURAV GARG
2001CS83**

**SHIVAM YADAV
2001ME70**

THEORY

THROUGHPUT

Rate of Gas Flow

Quantity of gas $d(pV)$ crossing a plane along a duct in unit time dt . From the ideal gas law written per unit time, we see that this is a energy flow rate.

It's Unit is given by: $\text{Pa} \cdot \text{m}^3 \cdot \text{s}^{-1}$

PUMPING SPEED

Pumping speed is formally defined as the ratio of the throughput of a given gas to the partial pressure of that gas at a specific point near the inlet port of the pump.

It's unit is given by: $\text{m}^3 \cdot \text{s}^{-1}$

FORMULAE (SUCTION CHAMBER)

$$\text{Throughput}(Q) = q.pV$$

$$\text{Throughput}(Q) = N(V_s * P_{in} - V_{D.S} * P_{out})$$

$$\text{Pumping Speed}(S) = (Q / P_{in})$$

N = Rotational Speed

V_s = Suction Chamber Volume

P_{in} = Input Pressure

V_{D.S} = Dead Space Volume

P_{out} = Output Volume

FORMULAE (GAS EQUATION)

$$\text{Throughput}(Q) = P \cdot (dV / dt) = nRT / t$$

$$\text{Pumping Speed}(S) = (Q / P)$$

n = Moles of Gas

P = Pressure

T = Temperature

t = Time



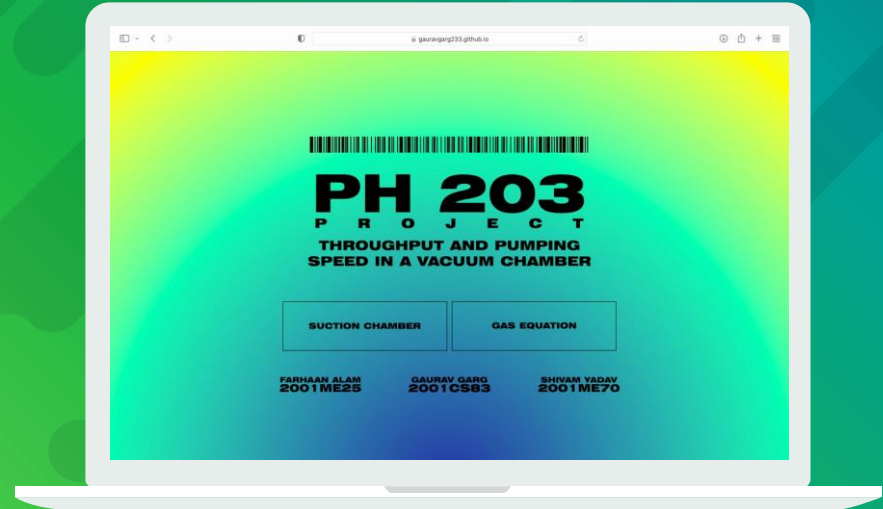
PROJECT DISPLAY

Code (VacuumProject.html) and all the necessary files are attached with the mail.
Website Link is given on the next page.

Project Link: <https://gauravgarg233.github.io/vacuumproject/>

Instructions for Usage:

1. Click on the above link (or) Copy paste the link in any web browser
2. After opening you will be able to see a home page which looks something like this:

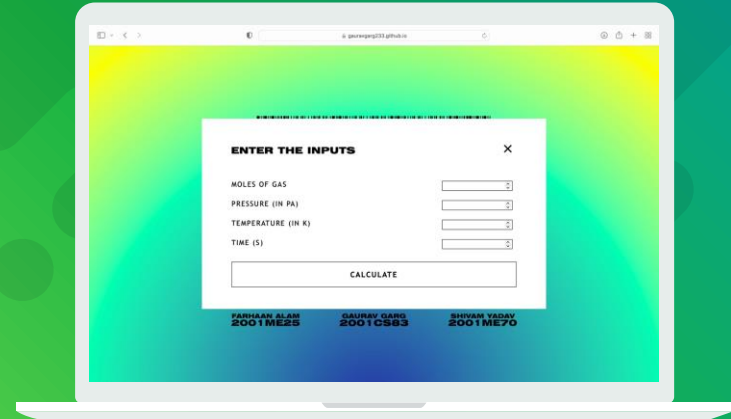
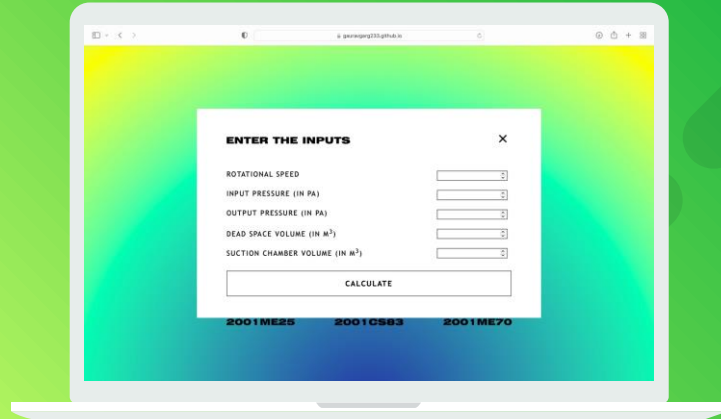


Project Link: <https://gauravgarg233.github.io/vacuumproject/>

3. There are two ways of calculation:

- Suction Chamber
- Gas Equation

4. Click on any of these two text to open the calculation dialogue box. The calculation dialogue box looks like:



Project Link: <https://gauravgarg233.github.io/vacuumproject/>

TEST CASE FOR SUCTION CHAMBER

Enter your values for calculation.

For Example:

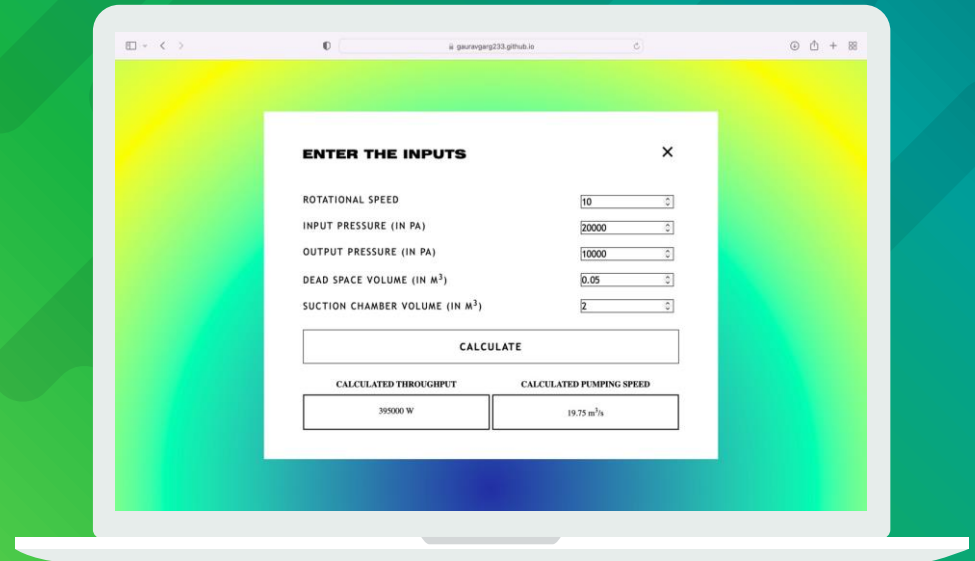
$N = 10, V_s = 2$

$P_{in} = 20000, V_{D.S} = 0.05$

$P_{out} = 10000$

Now click on Calculate.

The Calculated values are shown
along side.



The screenshot shows a web browser window displaying a form titled "ENTER THE INPUTS". The form contains five input fields with the following labels and values:

Parameter	Value
ROTATIONAL SPEED	10
INPUT PRESSURE (IN PA)	20000
OUTPUT PRESSURE (IN PA)	10000
DEAD SPACE VOLUME (IN m^3)	0.05
SUCTION CHAMBER VOLUME (IN m^3)	2

Below the input fields is a "CALCULATE" button. Underneath the button, there are two calculated values:

CALCULATED THROUGHPUT	CALCULATED PUMPING SPEED
395000 W	19.75 m^3/s

Project Link: <https://gauravgarg233.github.io/vacuumproject/>

TEST CASE FOR GAS EQUATION

Enter your values for calculation.

For Example:

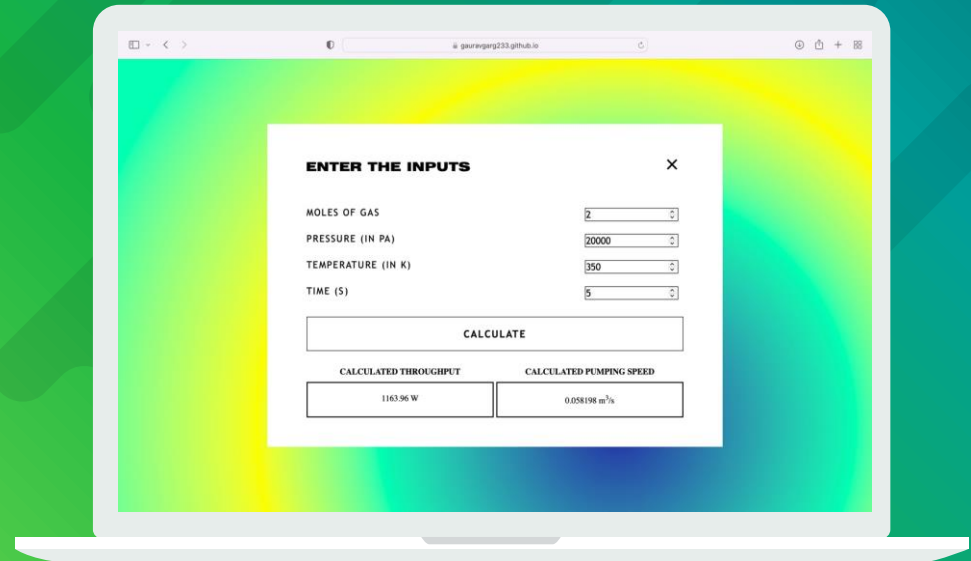
$$n = 2$$

$$P = 20000, T = 350$$

$$t = 5$$

Now click on Calculate.

The Calculated values are shown
along side.



The screenshot shows a web browser window with the URL gauravgarg233.github.io. The main content is a modal window titled "ENTER THE INPUTS" with a close button (X). The modal contains four input fields: "MOLES OF GAS" (value: 2), "PRESSURE (IN PA)" (value: 20000), "TEMPERATURE (IN K)" (value: 350), and "TIME (S)" (value: 5). Below these fields is a "CALCULATE" button. At the bottom of the modal, there are two output boxes: "CALCULATED THROUGHPUT" showing "1163.96 W" and "CALCULATED PUMPING SPEED" showing "0.05198 m³/s".

CONTRIBUTIONS

FARHAAN ALAM
2001 ME25

"I contributed towards the UI/UX design of the website and the overall design of the project."

GAURAV GARG
2001 CS83

"I understood the question given and acquired the desired results and contributed towards the making of the project report."

SHIVAM YADAV
2001 ME70

"I contributed towards the development of the website whose purpose is to give us the desired output when provided with appropriate inputs."

THANK YOU!

FARHAAN ALAM
2001ME25

GAURAV GARG
2001CS83

SHIVAM YADAV
2001ME70

