# Fluid Mechanics

## Density and Pressure

Density

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Pressure

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## Fluids at Rest

Pressure of fluid at height (absolute pressure)

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(Tính áp suất dựa trên độ cao của cột chất lỏng, **xuống cộng, lên trừ**)

Gauge pressure

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Pascal’s principle

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Archimedes' Principle (Buoyant force)

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## Moving Fluid

Equation of continuity

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Volume flow rate

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| --- | --- | --- |
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Mass flow rate

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| --- | --- | --- |
|  |  |  |

Bernoulli’s equation

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| --- | --- | --- |
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# Heat, Temperature and the Zero-th Law of Thermodynamics

## Thermal expansion

Coefficient of Linear expansion (Hệ số giãn nở tuyến tính):

Linear expansion

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| --- | --- | --- |
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Area expansion

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| --- | --- | --- |
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Volume expansion

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| --- | --- | --- |
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## Heat

Heat transfer

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| --- | --- | --- |
|  |  |  |

Phase change

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| --- | --- | --- |
|  |  |  |

Thermal equilibrium equation

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## Heat Transfer Mechanisms

Assume that heat is transferred form high temperature side to low temperature side by uniform rod of length cross sectional area with thermal conductivity , the **conduction power** is given by

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| --- | --- | --- |
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For a compound slab containing several materials of thicknesses and thermal conductivities the **conduction power** becomes

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| --- | --- | --- |
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# Heat, Work and the First Law of Thermodynamics

## First Law of Thermodynamics

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Note that:

* For a closed cycle , if gas goes clockwise direction and vice versa.
* Gas which goes following positive direction of -axis leads to and vice versa.
* Heat if it releases and if it absorbs.

## Work

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(Nếu đồ thị biểu diển quá trình biến đổi của chất khi mà tạo thành vòng kín cùng chiều kim đồng hồ thì , ngược chiều )

Isobaric

|  |  |  |
| --- | --- | --- |
|  |  |  |

Isochoric

|  |  |  |
| --- | --- | --- |
|  |  |  |

Isothermal

|  |  |  |
| --- | --- | --- |
|  |  |  |

Adiabatic

|  |  |  |
| --- | --- | --- |
|  |  |  |

# The Kinetic Theory of Gases

## Ideal Gas

Ideal gas equation

|  |  |  |
| --- | --- | --- |
|  |  |  |

Where:

* : pressure , volume , temperature of the gas, respectively.
* : number of moles of the gas.
* : number of molecules of the gas
* : universal gas constant .
* : Boltzmann constant.
* : Avogadro constant.

(Số phân tử trong 1 mol chất khí)

This equation leads to

## Kinetic Theory of Gases

Assuming that the ideal gas is a monatomic gas (individual atom as Ar, Ne, He)

The mean free path for a gas molecule

|  |  |  |
| --- | --- | --- |
|  |  |  |

(Khoảng cách trung bình giửa các nguyên tử)

Root-mean-square speed

|  |  |  |
| --- | --- | --- |
|  |  |  |

Average speed

|  |  |  |
| --- | --- | --- |
|  |  |  |

Most probable speed

|  |  |  |
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|  |  |  |

The mean free time (average time between collisions)

|  |  |  |
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|  |  |  |

(Thời gian trung bình giữa các lần va chạm)

Average translational kinetic energy

|  |  |  |
| --- | --- | --- |
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(Động năng trung bình của một chất khí ở nhiệt độ , nếu xét 1 nguyên tử thì , nếu xét 1 mol thì )

## Molar Specific Heats of an Ideal Gas

Classifying the ideal gases into three types:

* Monatomic: *.*
* Diatomic: *.*
* Polyatomic: *.*

Isochoric

|  |  |  |
| --- | --- | --- |
|  |  |  |

Isobaric

|  |  |  |
| --- | --- | --- |
|  |  |  |

## Sate Conversion of an Ideal Gas

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Isobaric

|  |  |  |
| --- | --- | --- |
|  |  |  |

Isochoric

|  |  |  |
| --- | --- | --- |
|  |  |  |

Isothermal

|  |  |  |
| --- | --- | --- |
|  |  |  |

Adiabatic

|  |  |  |
| --- | --- | --- |
|  |  |  |

## Heat and First law of Thermodynamics

First law of Thermodynamics

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|  |  |  |

Heat

|  |  |  |
| --- | --- | --- |
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## Summary

|  |  |  |  |
| --- | --- | --- | --- |
| Process | State Conversion | Work | Heat |
| Common |  |  | |
| Isobaric |  |  |  |
| Isochoric |  |  |  |
| Isothermal |  |  |  |
| Adiabatic |  |  |  |

Isobaric

|  |  |  |
| --- | --- | --- |
|  |  |  |

Isochoric

|  |  |  |
| --- | --- | --- |
|  |  |  |

For a particular process

|  |  |  |
| --- | --- | --- |
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# Entropy and the Second Law of Thermodynamics

## Change in Entropy

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## Second Law of Thermodynamics

The Second Law of Thermodynamics states that the change in entropy of an isolated system always non negative, and for a system with all processes are reversible the change in entropy equals to zero.

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## Entropy in Ideal gas

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Isobaric

|  |  |  |
| --- | --- | --- |
|  |  |  |

Isochoric

|  |  |  |
| --- | --- | --- |
|  |  |  |

Isothermal

|  |  |  |
| --- | --- | --- |
|  |  |  |

Adiabatic

|  |  |  |
| --- | --- | --- |
|  |  |  |

## Entropy in Liquid and Solid

Cooling or heating

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Phase change

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Un-changing temperature process

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