Basic Concepts

NEDHER SÁNCHEZ RAMÍREZ, PhD
NAUDY LOPEZ, Msc

Thermodynamic_2026-1

23/03/2026

Instructores del curso y coordinador

hmanrique@utec.edu.pe

nlopez@utec.edu.pe

nsanchezr@utec.edu.pe

squispe@utec.edu.pe

Guidelines for virtual sessions:

Tiempo aproximado de la sesión 100 minutos

Silenciar su micrófono.

Realizar preguntas a través del chat, habrá un profesor y/o un asistente atento a las dudas planteadas

Levantar la mano si desea hacer uso del micrófono y exponer alguna duda

La grabación de la sesión se cargará a Canvas.

2026

MARZO

	Lu.	Ma.	Mi.	Ju.	Vi.	Sá.	Do.
							1
	2	3	4	5	6	7	8
	9	10	11	12	13	14	15
	16	17	18	19	20	21	22
1	23	24	25	26	27	28	29
2	30	31					

ABRIL

	Lu.	Ma.	Mi.	Ju.	Vi.	Sá.	Do.
2			1	2	3	4	5
3	6	7	8	9	10	11	12
4	13	14	15	16	17	18	19
5	20	21	22	23	24	25	26
6	27	28	29	30			

MAYO

	Lu.	Ma.	Mi.	Ju.	Vi.	Sá.	Do.
6					1	2	3
7	4	5	6	7	8	9	10
8	11	12	13	14	15	16	17
9	18	19	20	21	22	23	24
10	25	26	27	28	29	30	31

JUNIO

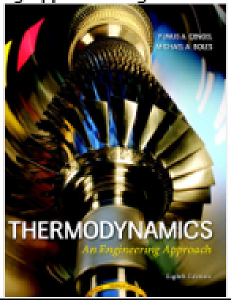
	Lu.	Ma.	Mi.	Ju.	Vi.	Sá.	Do.
11	1	2	3	4	5	6	7
12	8	9	10	11	12	13	14
13	15	16	17	18	19	20	21
14	22	23	24	25	26	27	28
15	29	30					

JULIO

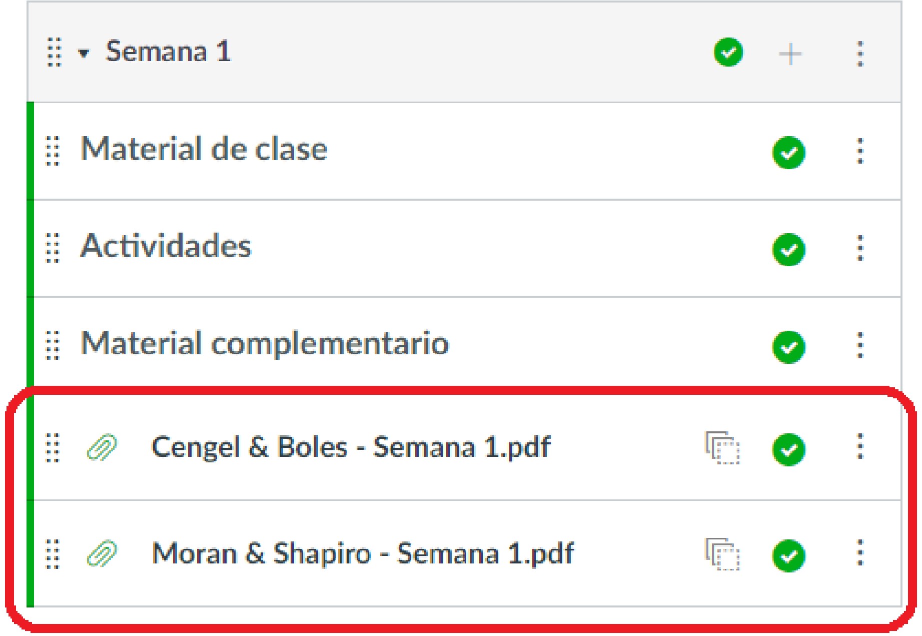
	Lu.	Ma.	Mi.	Ju.	Vi.	Sá.	Do.
15			1	2	3	4	5
16	6	7	8	9	10	11	12
	13	14	15	16	17	18	19
	20	21	22	23	24	25	26
	27	28	29	30	31		

Actividades	Inicio		Fin	
	Día	Fecha	Día	Fecha
Inicio de clases UTEC	Lunes 23 de marzo 2026			
Exámenes parciales	Lunes 11 de mayo 2026		Sábado 16 de mayo 2026	
Último día de clases	Sábado 4 de julio 2026			
Exámenes finales	Lunes 6 de julio 2026		Sábado 11 de julio 2026	
Exámenes de rezagados	Jueves 16 de julio 2026		Lunes 20 de julio 2026	

TEMAS SEMANA X SEMANA

Semana	Moran M.J. & Shapiro H.N. (2004). Fundamentos de la termodinámica Técnica. 2da edición (español).	Cengel, Y.A. & Boles, M.A. (2015). Thermodynamics: An Engineering Approach. Eighth Edition (inglés).
		
1	Capítulo 1: secciones 1.1 – 1.6 Ejercicios: 1.1 – 1.28	Capítulo 1: 1.3 – 1.9
2	Capítulo 3: secciones 3.1 – 3.2, 3.3.1 – 3.3.2, 3.3.6 Ejercicios: 3.1 – 3.26	Capítulo 3: 3.1 – 3.5 Capítulo 4: 4.1, 4.5
3	Capítulo 3: 3.3.5, 3.4 – 3.8 Ejercicios: 3.40 – 3.51	Capítulo 3: 3.6 – 3.7 Capítulo 4: 4.4
4	Capítulo 12: 12.1 – 12.4 Ejercicios: 12.1 – 12.6	Capítulo 13: 13.1 – 13.3
5	Capítulo 2: 2.1 – 2.6	Capítulo 2: 2.1 – 2.5
6	Capítulo 3: ejemplos 3.2 – 3.4, 3.8 – 3.11 Ejercicios: 2.1 – 2.10, 2.12 – 2.13, 2.21 – 2.40, 3.27 – 3.39, 3.52 – 3.58, 12.7 – 12.8, 12.10, 12.16 – 12.19	Capítulo 2: 2.6 Capítulo 4: 4.1 – 4.2
7 8	Capítulo 4: 4.1 – 4.4 Ejercicios: 4.1 – 4.33	Capítulo 5: 5.1 – 5.5
9	Capítulo 5: 5.1 – 5.4 Ejercicios: 5.1 – 5.11, 5.14 – 5.33	Capítulo 6: 6.1 – 6.4, 6.6
10	Capítulo 5: 5.2, 5.6 – 5.7 Ejercicios: 5.14 – 5.33	Capítulo 6: 6.7 – 6.8, 6.10 – 6.11
11	Capítulo 6: 6.1 – 6.5 Ejercicios: 6.1 – 6.31	Capítulo 7: 7.1 – 7.10
12	Capítulo 6: 6.6 Ejercicios: 6.32 – 6.43	Capítulo 7: 7.13
13 14	Capítulo 6: 6.7 – 6.8 Ejercicios: 6.44 – 6.56	Capítulo 7: 7.12

Importante: Las lecturas señaladas en este documento deben ser leídas antes de la semana indicada, en preparación para la tarea semanal de dicha semana. Ambos libros cubren aproximadamente el mismo contenido, pero con enfoques y niveles de profundidad distintos. Los estudiantes podrán alcanzar la comprensión del curso empleando solo una de las referencias. Sin embargo, se invita a contrastar semanalmente los temas en ambos textos, como método para alcanzar la compresión máxima del contenido. Tener en cuenta que los subcapítulos indicados en esta guía corresponden a las ediciones de los libros especificadas.



Horas de atención - Jhordy Manrique
(Dudas del curso-Tareas - notas)
LUNES 11-1 PM - Oficina P311

Horas de atención - Prof. Naudy Lopez
nlopez@utec.edu.pe
Previa coordinación con el profesor

Horas de atención - Jhordy Manrique
(Dudas del curso-Tareas - notas)
JUEVES 10-12 AM - Oficina P311

Horas de atención - Prof. Nedher Sánchez Ramírez

JUEVES: 9-12 pm….1-2pm - Oficina P311

Hora	Horas de asesoría 2026-1						Hora
	Lunes	Martes	Miércoles	Jueves	Viernes	Sábado	
7AM - 8AM		Clases		Clases			7AM-8AM
8AM - 9AM		Clases		Clases			8AM - 9AM
9AM - 10AM		Clases	Clases				9AM - 10AM
10AM - 11AM		Clases	Clases				10AM - 11AM
11AM - 12PM			Clases				11AM-12PM
12PM - 1PM			Clases				12PM-1PM
1PM - 2PM			Clases				1PM - 2PM
2PM - 3PM			Clases	CT: https://utec.zoom.us/j/97371427800			2PM - 3PM
3PM - 4PM	Clases					FR: https://utec.zoom.us/j/95953412067	3PM - 4PM
4PM - 5PM	Clases						4PM - 5PM
5PM - 6PM	Clases	Clases	Clases				5PM - 6PM
6PM - 7PM	Clases	Clases	Clases				6PM - 7PM
7PM - 8PM							7PM - 8PM
8PM - 9PM	ASESORÍA DE DUDAS: https://utec.zoom.us/j/97136492520	JG: https://utec.zoom.us/j/92301579107		RV: https://utec.zoom.us/j/92982722393			8PM - 9PM
9PM - 10PM							9PM - 10PM

RV: Rosario Vidal		Todas las sesiones serán grabadas.
CT: Cristian Tobias		*Varia según disponibilidad
FR: Franklin Rosas		
JG: Jose Gamero		

Link de WhatsApp de Termodinámica:

https://chat.whatsapp.com/Iu3b3wnWFuY2Zvamn89NNa

Thermodynamics _ Evaluation

	COMPONENTE	%
S8	EXAMEN PARCIAL	20
S16	EXAMEN FINAL	30
	C	50
	APROBACIÓN: 11/20	

EXÁMENES	FECHAS
EXAMEN PARCIAL	(MAYO 8)
EXAMEN FINAL	(JULIO 6)

EXAMEN 1: Todos los temas vistos hasta la semana 6.
EXAMEN 2: Todos los temas vistos hasta la semana 15

Thermodynamics _ Evaluation

COMPONENTE	%
EXAMEN PARCIAL	20
EXAMEN FINAL	30
C	50
APROBACIÓN: 11/20	

EVALUACIÓN CONTINUA (C) :

La evaluación continua vale un 50% de la nota final

-5 % corresponde a **tareas virtuales ..**Son de corrección automática

-10 % corresponde a **tareas individulales** (ejercicios que los alumnos hacen y suben a la plataforma gradescope) …. ..Ver rúbrica

-17 % corresponde a una **tarea grupal** (proyecto)…..Ver rúbrica

-18% restante corresponde **actividades en aula** (quizes de 20 min aprox)..Ver rúbrica

Thermodynamics _ Evaluation

COMPONENTE	%
PARCIAL	20
FINAL	30
C	50
APROBACIÓN: 11/20	

SEMANA 1	TAREA VIRTUAL	SE CALIFICA AUTOMATICO NO NECESITA PROCEDIMIENTO
SEMANA 2	TAREA VIRTUAL	
SEMANA 3	TAREA VIRTUAL	.
SEMANA 4	**TAREA INDIVIDUAL 1** + EVALUACION_ AULA1	TAREA INDIVIDUAL: Esta parte incluye subir un archivo con la solución EVALUACION_ AULA: SEMANAS 1-2
SEMANA 5	TAREA VIRTUAL+ EVALUACION_ AULA2	EVALUACION_ AULA: SEMANAS 1-3
SEMANA 6	TAREA VIRTUAL+**TAREA INDIVIDUAL 2**	
SEMANA 7	TAREA VIRTUAL+ EVALUACION_ AULA3	EVALUACION_ AULA: SEMANAS 1-6
SEMANA 8	**PARCIAL**	
SEMANA 9	EVALUACION_ AULA4+**TAREA INDIVIDUAL 3** **+Tarea grupal 1**	EVALUACION_ AULA: SEMANAS 1-8
SEMANA 10	TAREA VIRTUAL	
SEMANA 11	TAREA VIRTUAL	
SEMANA 12	TAREA VIRTUAL+ EVALUACION_ AULA5	EVALUACION_ AULA: SEMANAS 1-11
SEMANA 13	TAREA VIRTUAL+**TAREA INDIVIDUAL 4** **+ Tarea grupal 2**	
SEMANA 14	TAREA VIRTUAL+EVALUACION_ AULA6	EVALUACION_ AULA : SEMANAS 1-13
SEMANA 15		
SEMANA 16	**FINAL**	

***LAS TAREAS VIRTUALES O LOS GRADESCOPE (TAREA INDIVIDAL) se abren lunes 2pm y se cierran sábado media noche. La tarea virtual se presenta hasta un máximo de 3 veces.**

EVALUACION_ AULA: es un quiz de 20 min aprox. en aula.

Thermodynamics _ Evaluation

EVALUACIÓN CONTINUA (C) :

COMPONENTE	%
C	50

25 %
- 3 actividades en aula→ 9 %
- 2 tareas individuales→ 5 %
- ½ tareas virtuales → 2.5 %
- 1ra entrega tarea grupal → 8.5 %

25 %
- 3 actividades en aula→ 9 %
- 2 tareas individuales→ 5 %
- ½ tareas virtuales → 2.5 %
- 2da entrega tarea grupal → 8.5 %

Se subirá al EDU En dos bloques de 25% c/u

Thermodynamics _ Evaluation

Tarea grupal (proyecto)…..

La actividad consta del análisis de una sistema, dicho análisis puede requerir elementos de programación.

Fechas de entrega del laboratorio:
1ra entrega - 18/05/2026 a las 9 am (jueves de la semana 9)
2da entrega - 15/06/2026 a las 9am (lunes de la semana 13)
coevaluación - 16/06/2026 a las 11:59pm (martes de la semana 13)

Link con toda la información de la tarea grupal :

https://docs.google.com/spreadsheets/d/1DMrZjoEaRlHfZPbrFa5q84ha0ElWJQS1zmyLanvjGcw/edit?gid=0#gid=0

Thermodynamics _ Evaluation

Link con las rubricas de actividad de aula y tarea individual:

https://docs.google.com/spreadsheets/d/1iLMFoTAZiUBYuD8fGZFW4d0pF0-UBt8f/edit?gid=85594443#gid=85594443

NOTA IMPORTANTE 1: Ver con detalle las fechas de entrega, haga todo con antecedencia y entregue a tiempo las actividades. Verifique antes de enviar que todo esta correcto. Es responsabilidad de los estudiantes verificar que todo los archivos son los correctos y se entregan la fechas correspondientes.

Session 1:

- Explain the basic concepts of thermodynamics such as system, state, equilibrium, process, cycle, state property, among others.

Thermodynamics?

Thermo_ heat _ dynamics _ movement

BETTER TO SAY

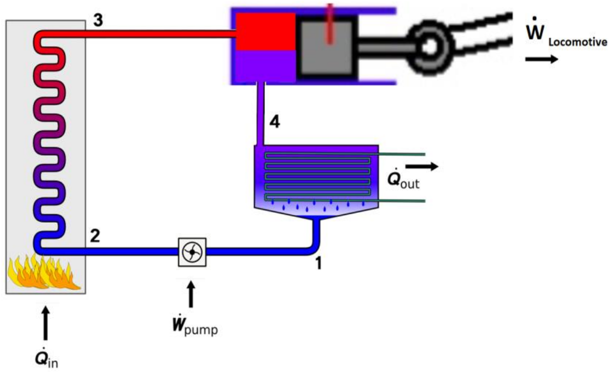
Science of *energy* (ability to cause changes)

Thermodynamics_Beginning

1804

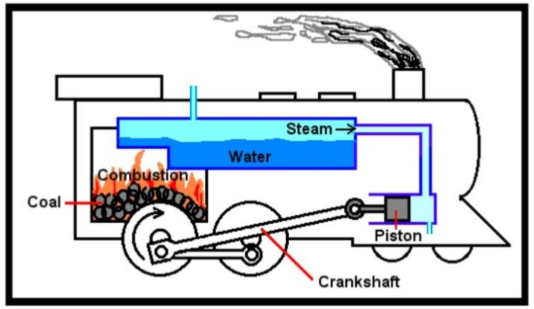
https://www.youtube.com/watch?v=lyuwBW9lNa8

Power cycle



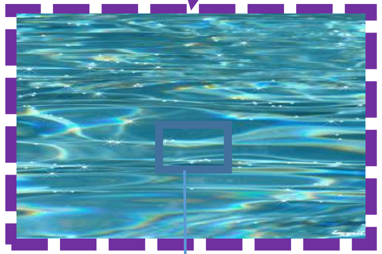
W= TRABAJO, Q= CALOR

Thermodynamics?



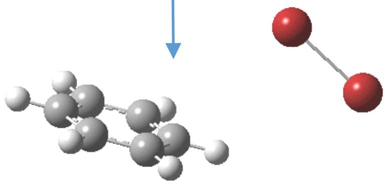
Thermodynamics involves the storage, transfer ,transformation of energy of a system .

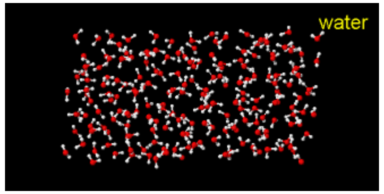
Q

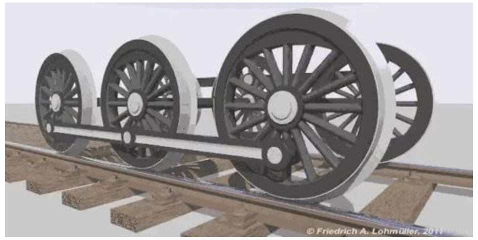


W (Surroundings)

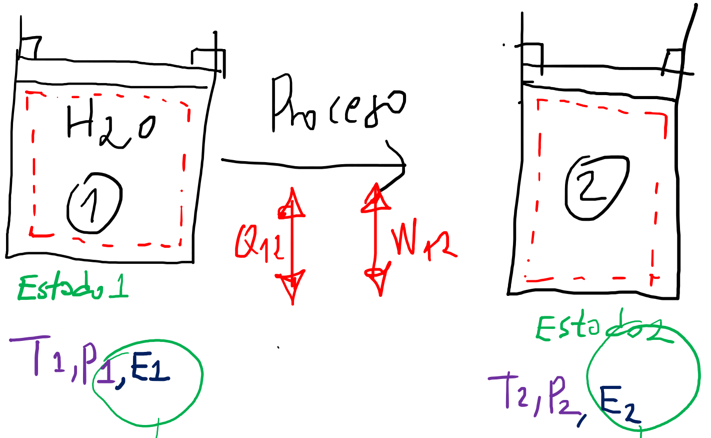
E_K OF WHEELS







Para cuantificar todo lo que pasa en mi sistema me apoyo en
Las Leyes de la termodinámica.



Los estados 1 y 2 deben
Estar en equilibrio

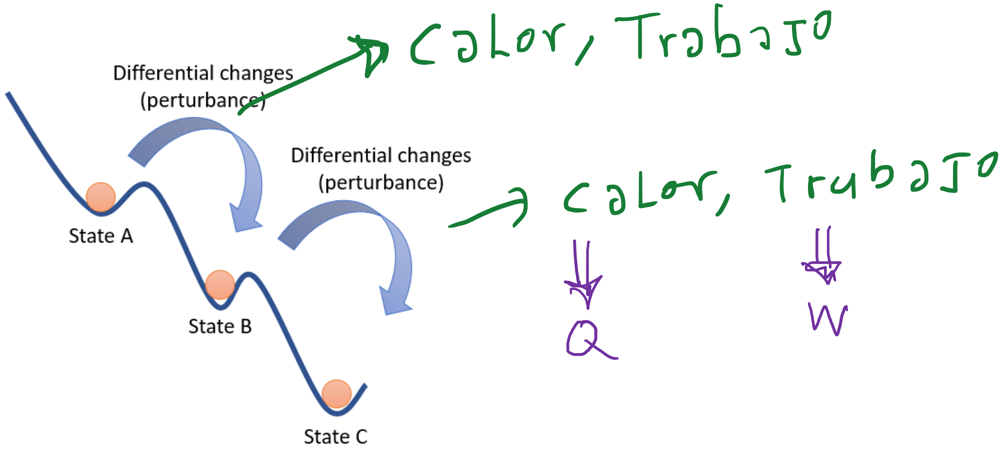
0 : T y Equilibrio Termico

1 : E, Conservación de la energía

2 : S, dirección de los procesos y La calidad de La Energía

AL tener que calcular : Q, W, E $\longrightarrow$ Conversión de unidades y sistema internacional de unidades }

Thermodynamics: studies the states of equilibrium and the processes between them.



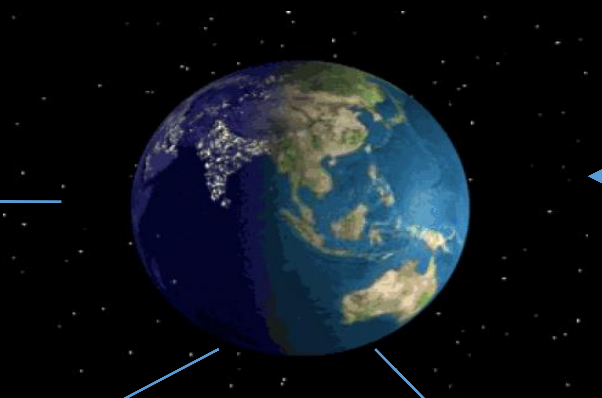
In the processes there are energy exchanges in the form of:

-Work (W)

- Heat (Q)

https://www.youtube.com/watch?v=RLq8LlVydGs

Thermodynamics: studies the states of equilibrium and the processes between them.



Reflected solar energy

Input solar energy

Carbohydrates, proteins, fats

Wind energy

Hydrocarbons

Electrical energy

Mechanical energy

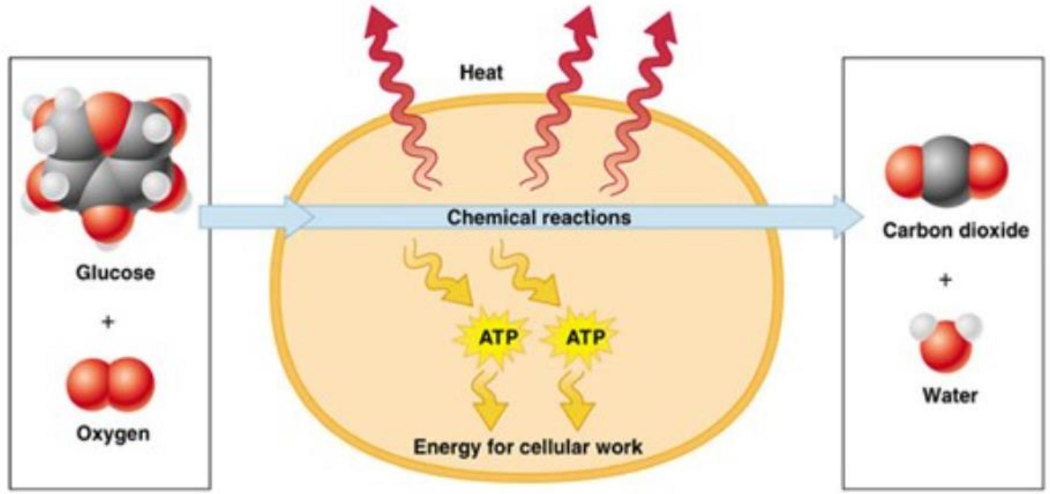
https://es.quora.com/Por-qu%C3%A9-se-dice-que-Jap%C3%B3n-es-el-pa%C3%ADs-del-sol-naciente-D%C3%B3nde-se-hace-de-d%C3%ADa-antes-en-Barcelona-o-en-Madrid

https://bestanimations.com/Earth&Space/Sun/Sun.html

Thermodynamics around us

1.Various energy conversions occur in trillions of body cells, and the body heat generated is constantly rejected to the environment.

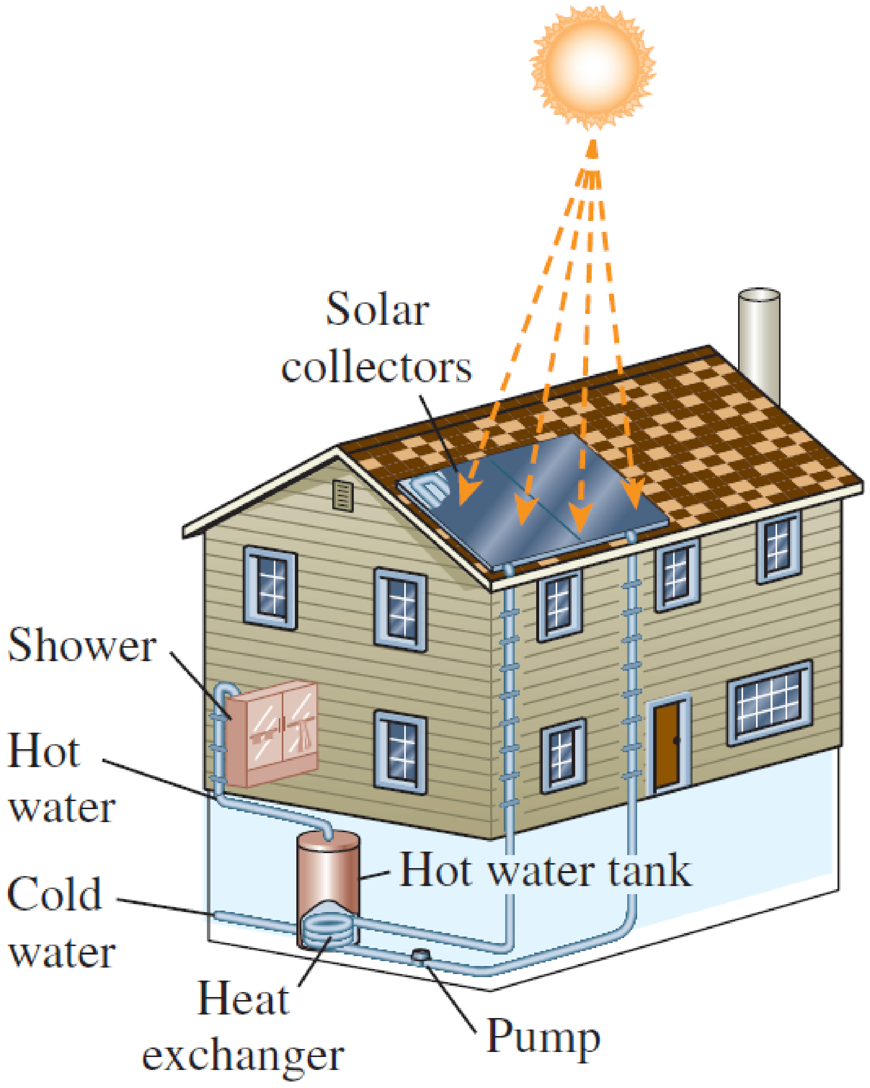
Metabolism: Energy Transformations in Cells



The food we eat has chemical bond energy, which is converted into ATP bond energy, then it may be used for the metabolic work of the cell. Some energy is always lost as Entropy (heat).

Thermodynamics around us

2.The design of many engineering systems, such as this solar hot water system, involves thermodynamics.



Thermodynamics around us

shutterstock.com · 1798160611

shutterstock.com · 413388886

3. Many ordinary household utensils and appliances are designed, by using the some principles of thermodynamics:

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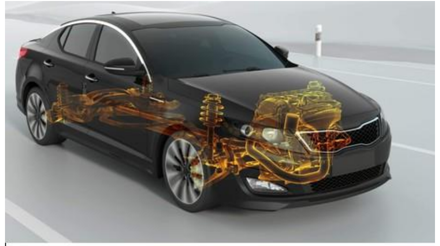
shutterstock.com · 394765957



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shutterstock.com · 1685909200

shutterstock.com · 728233795

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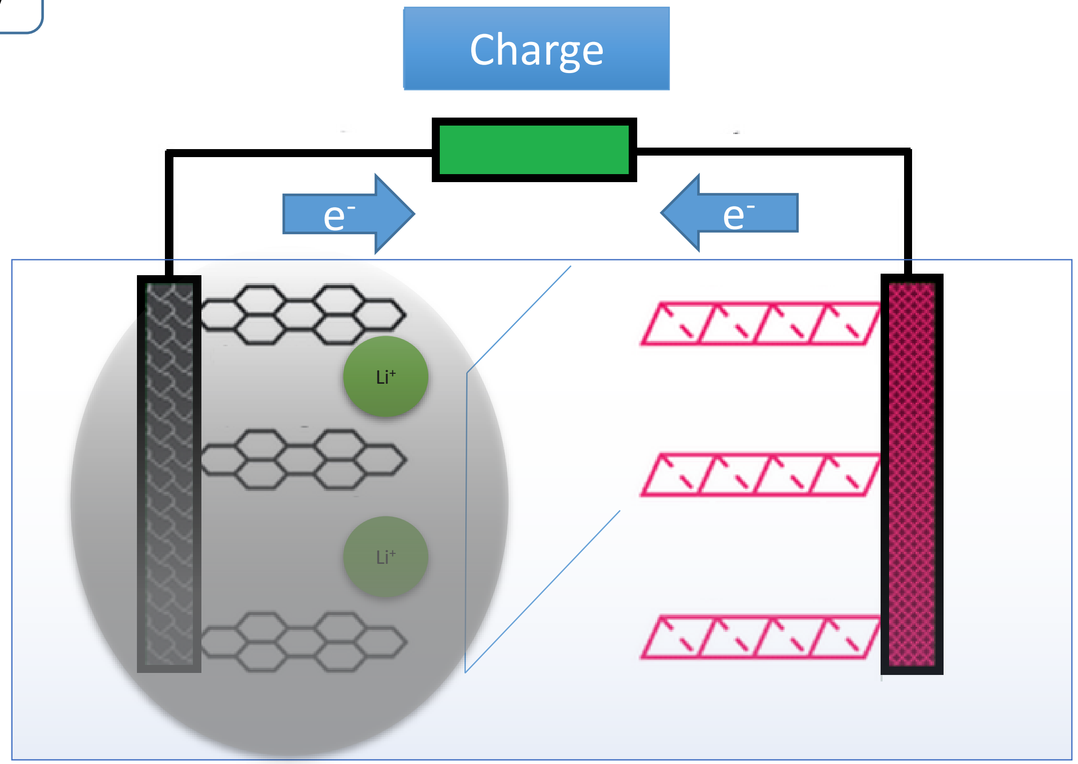
shutterstock.com · 1209490888

Thermodynamics around us

Lithium Ion Battery

Li_xC_6

Graphite



$Li_{1-x}AB$

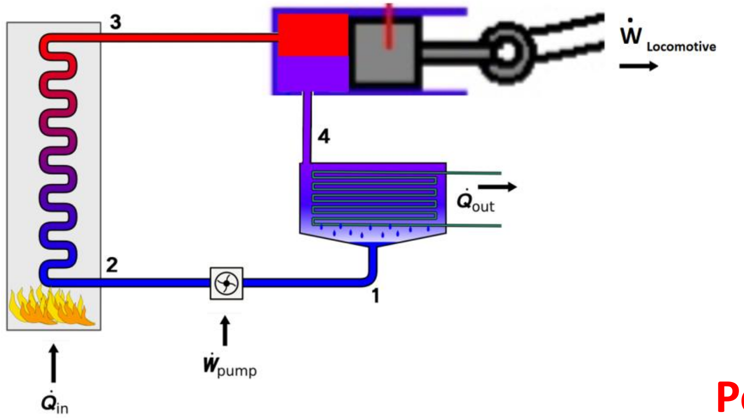
AB: Transition metal oxide.

Organic solvents,
$LiPF_6$, EC, DEC, Additives

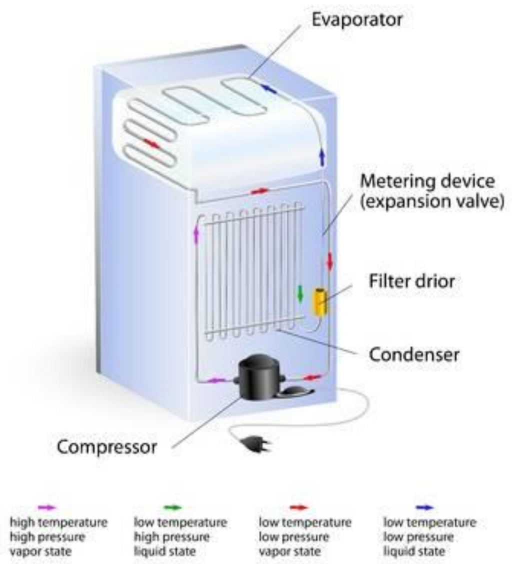
[1] Sanchez-Ramirez N, Assresahegn BD, Torresi RM, Bélanger D. Producing high-performing silicon anodes by tailoring ionic liquids as electrolytes. Energy Storage Mater 2020;25:477–86.

Thermodynamics?

Power cycle_ Rankine cycle (ideal)

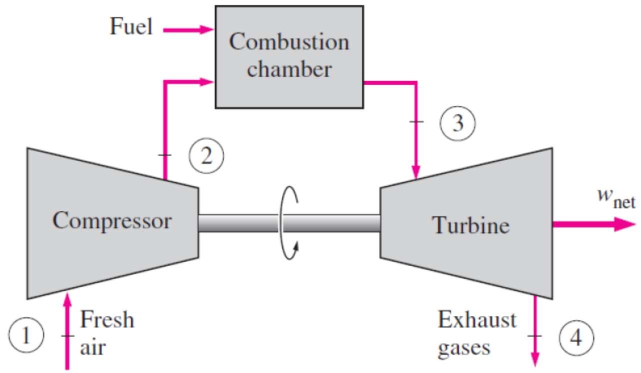


Refrigeration cycle_ Vapor-Compression Refrigeration Cycle



https://www.123rf.com/photo_21930696_typical-refrigeration-cycle-diagram.html

Power cycle_ Brayton cycle (ideal)



Why power cycles?

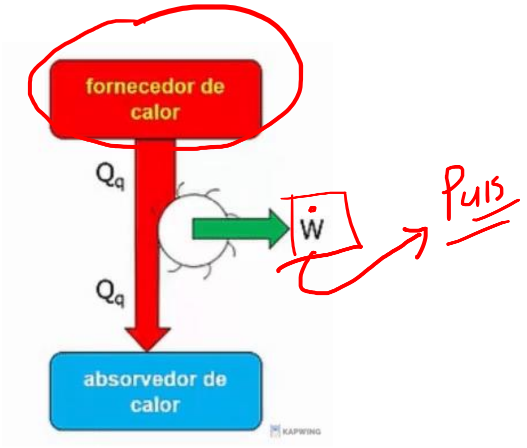


TABLE 8.1

Current U.S. Electricity Generation by Source

Coal	37.4%
Natural gas	30.6%
Nuclear	19.0%
Hydroelectric	6.7%
Other renewables[a]	5.4%
Petroleum (oil)	0.6%
Others	0.3%

TABLE 8.2

Large-Scale Electric Power Generation through 2050 from Renewable and Nonrenewable Sources[a]

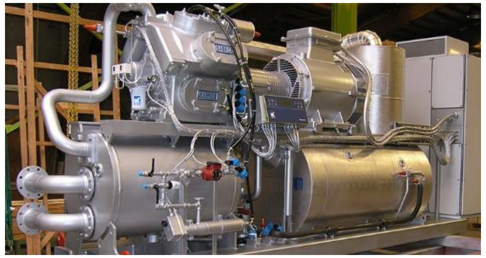
Power Plant Type	Nonrenewable Source	Renewable Source	Thermodynamic Cycle
Coal-fueled	Yes		Rankine
Natural gas–fueled	Yes		Brayton[b]
Nuclear-fueled	Yes		Rankine
Oil-fueled	Yes		Rankine[c]
Biomass-fueled		Yes	Rankine
Geothermal		Yes	Rankine
Solar-concentrating		Yes	Rankine
Hydroelectric		Yes	None
Wind		Yes	None
Solar-photovoltaic		Yes	None
Fuel cells	Yes		None
Currents, tides, and waves		Yes	None

Future!!!

https://www.youtube.com/watch?v=UyM4Ksu49uA&list=PLmho8Rcnd60eNsMCeKI9jn2jArgy6xBBq&index=12

Why refrigeration cycles?

*Air conditioning systems, heating and cooling systems are everywhere. Even more so in countries with seasons.



https://www.scantec.com.au/technologies/air-conditioning-with-ammonia-fact-or-fiction

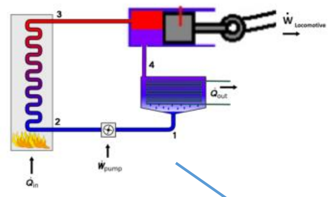
*Fridges and refrigerator are in all houses and supermarkets.

https://es.123rf.com/

www.shutterstock.com · 561902914

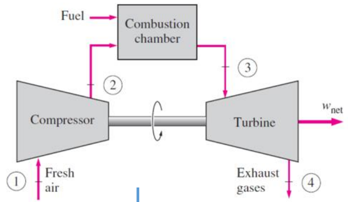
What tools do we need to understand these cycles?

Power cycle_ Rankine cycle (ideal)



Refrigeration cycle_ Vapor-Compression Refrigeration Cycle

Power cycle_ Brayton cycle (ideal)



Pure substance: Water, refrigerants…

Pure substance: Ideal gas

1. Calculation of properties

Tables: Like those that are tabulated for some pure substances in the book appendices. Week 2

Models: As the ideal gas equation, or other relationships or approximations that allow calculating properties of liquids, solids or gases that are not tabulated. Weeks 3-4

2. Law of Thermodynamics

First Law of Thermodynamics: Energy Balance

Second Law of Thermodynamics: Entropy Balance

As thermodynamics is an empirical science, it is built on fundamental blocks, let's see!

NOTA IMPORTANTE 2: Hay alumnos que captan todo inmediatamente, aun así, para entender los conceptos expuestos en clase se debe leer con cuidado el texto previo a las clases.

What is a thermodynamic system?
And what is a control volume?

THERMODYNAMIC SYSTEMS

CLOSED SYSTEM OR CONTROL MASS

- Fixed amount of mass
- Mass CANNOT cross the boundaries
- Energy can cross the boundaries (W,Q)
- If energy cannot cross the boundaries, the system is called **ISOLATED SYSTEM**

OPEN SYSTEM OR CONTROL VOLUME

- Region of the space
- Mass CAN cross the boundaries
- Its boundaries are called control surfaces
- Energy can cross the C. surface (W,Q)

Boundaries: real or imaginary

Rigid or flexible

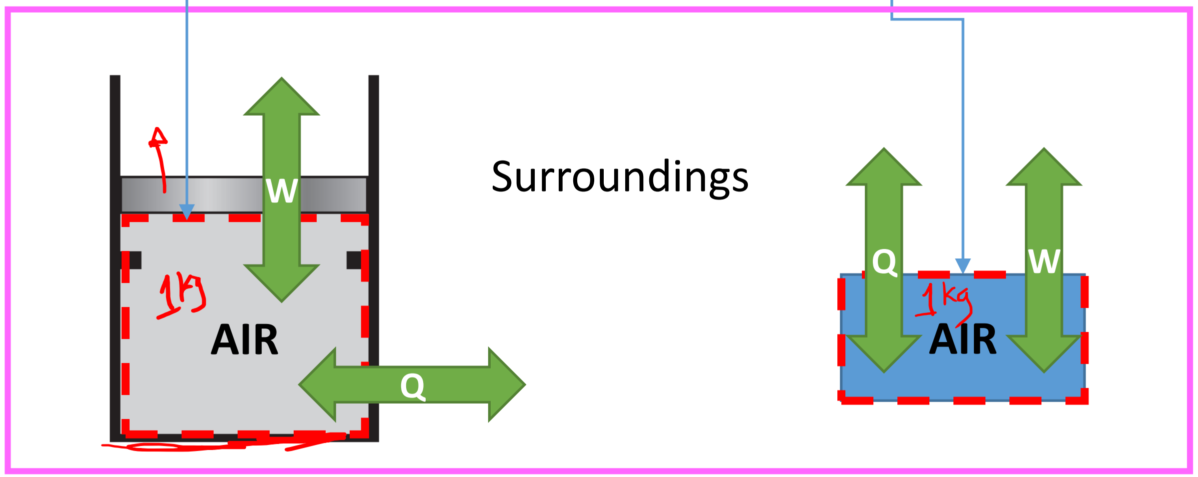
THERMODYNAMIC SYSTEMS

CLOSED SYSTEM OR CONTROL MASSS

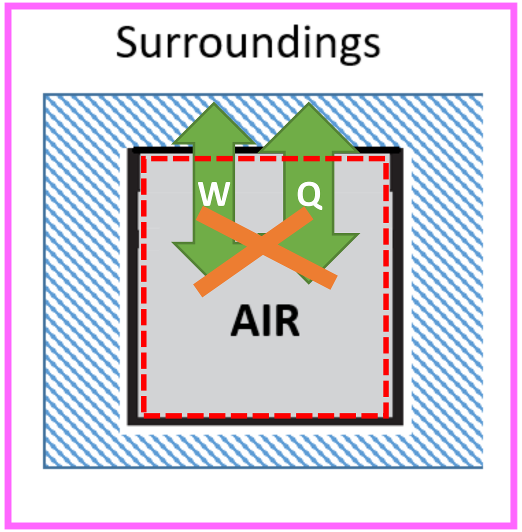
- Fixed amount of mass
- Mass CANNOT cross the boundaries
- Energy can cross the boundaries (W,Q)
- If energy cannot cross the boundaries, the system is called **ISOLATED SYSTEM**

OPEN SYSTEM OR CONTROL VOLUME

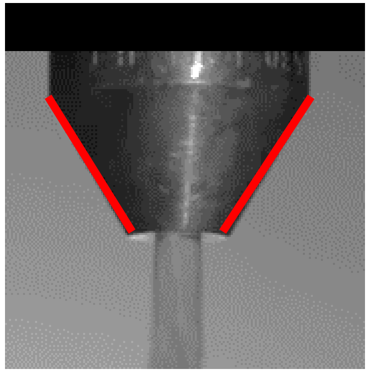
- Region of the space
- Mass CAN cross the boundaries
- Its boundaries are called control surfaces
- Energy can cross the C. surface (W,Q)

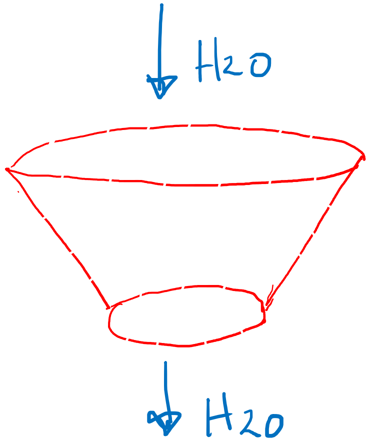


Surroundings + System =	Universe



ISOLATED SYSTEM




H2O
H2O

Open system

THERMODYNAMIC SYSTEMS

CLOSED SYSTEM OR CONTROL MASSS

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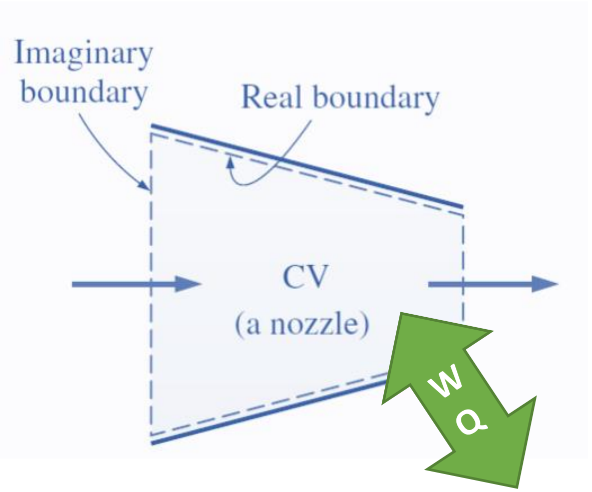
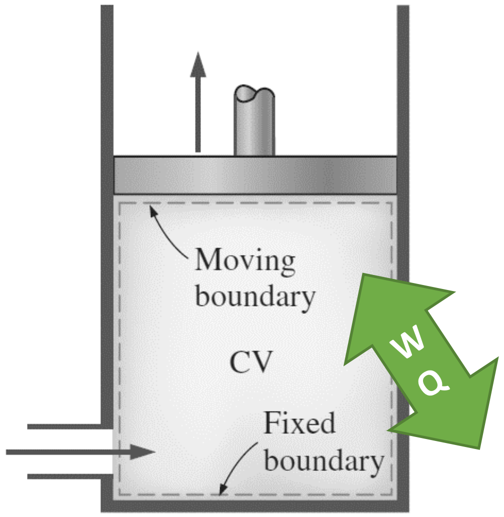


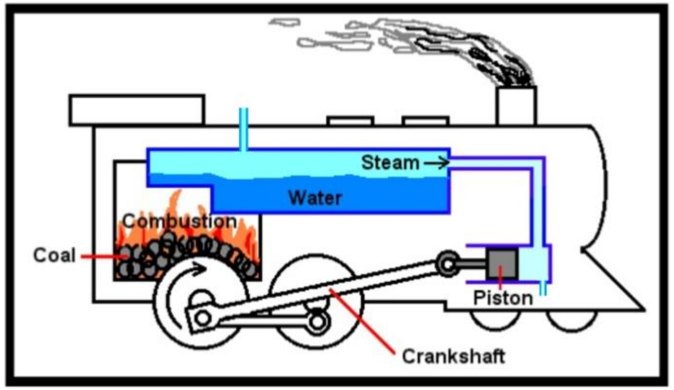
A control volume (CV) with real and imaginary boundaries

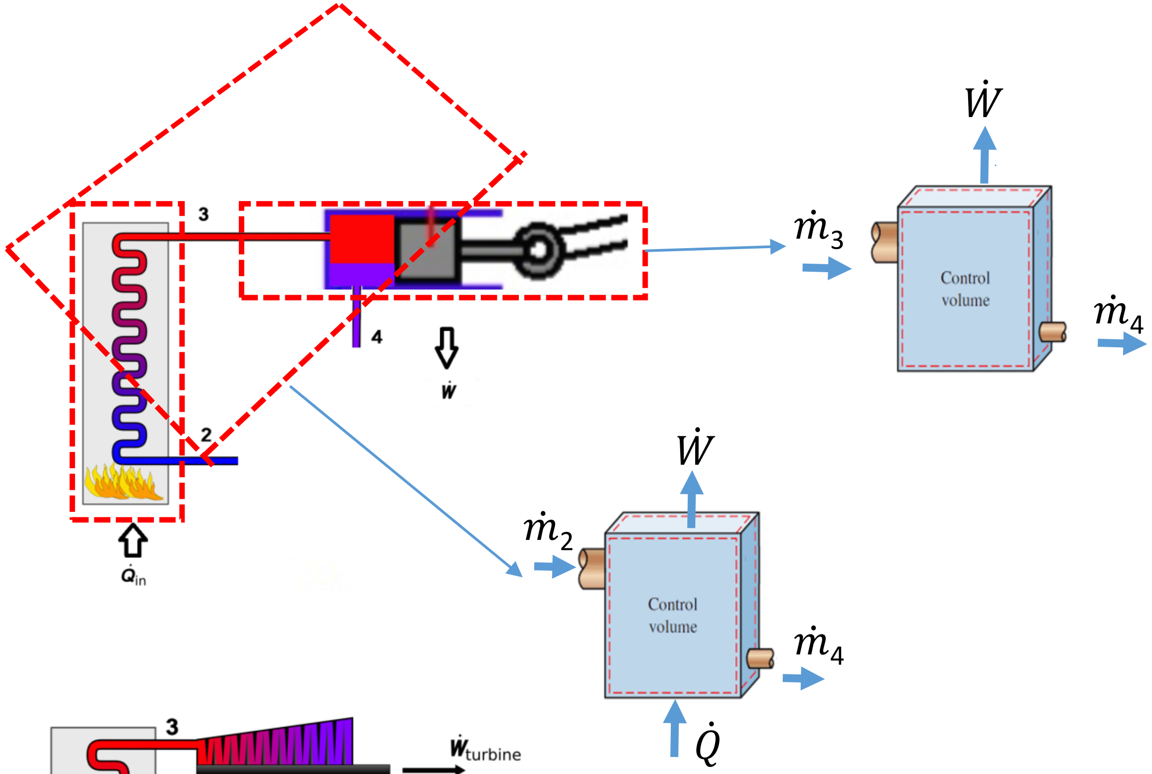
Surroundings + System =	Universe

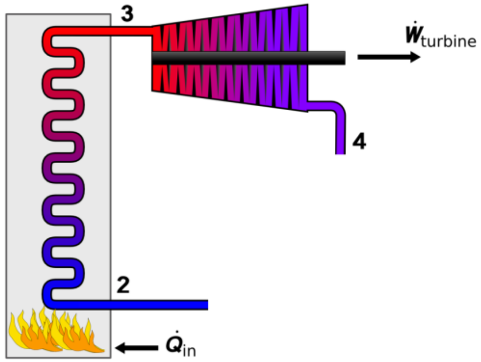


A control volume (CV) with fixed and moving boundaries as well as real and imaginary boundaries

Open System: Many Options

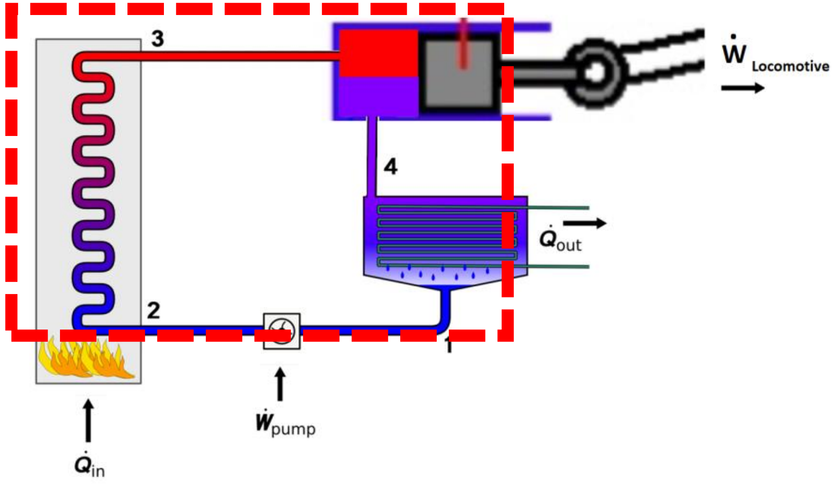


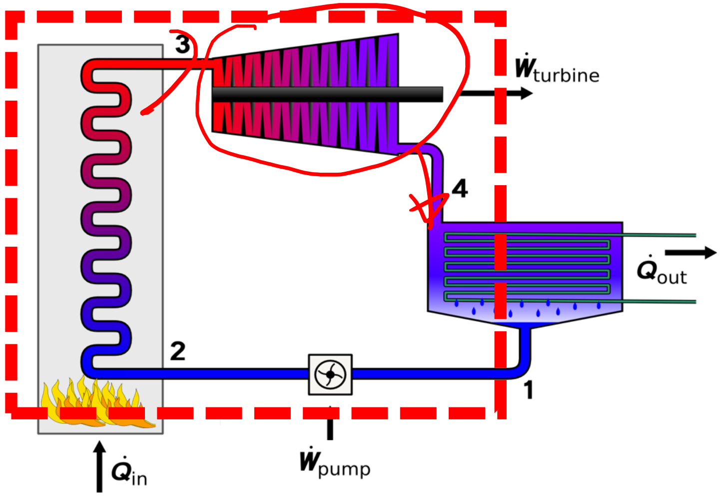


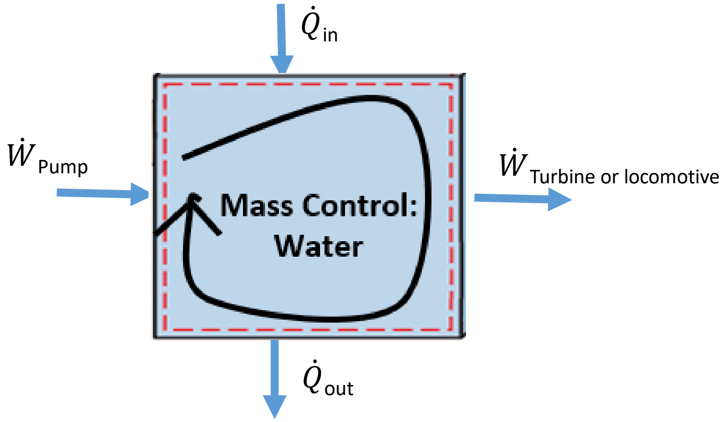


Is this figure(Termodynamic cycle) an <u>open or closed system</u>?

Let's choose only water (which runs through a cycle)





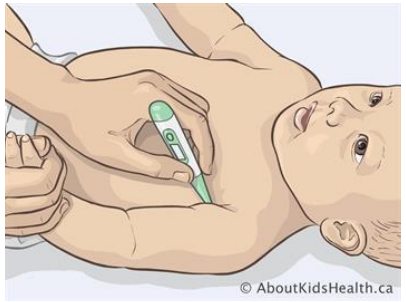


NOTA IMPORTANTE 3 En un análisis de ingeniería, defina claramente el sistema que está estudiando. Puede parecer trivial cuando el sistema es simple, pero en otros casos, elegir el sistema adecuado puede simplificar enormemente el análisis. El ingeniero debe tener la habilidad de seleccionar el sistema más apropiado.

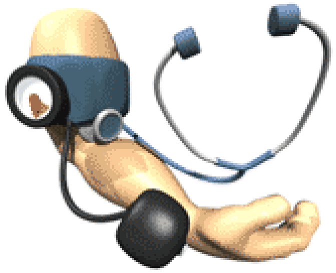
How to characterize a thermodynamic system?

How can a doctor save lives without sophisticated technology tools?

- **Temperatures (T)**



- **Pressure (P)**



Macroscopic view of a system:

- **Temperatures (T)**
- **Pressure (P)**
- v
- h
- u

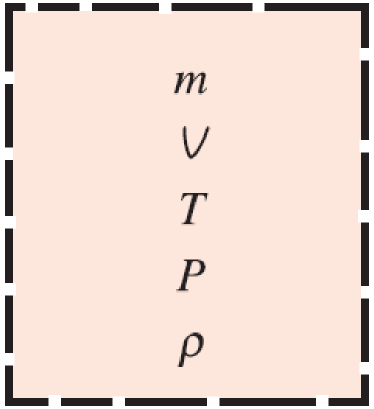
Kind of properties

Extensive

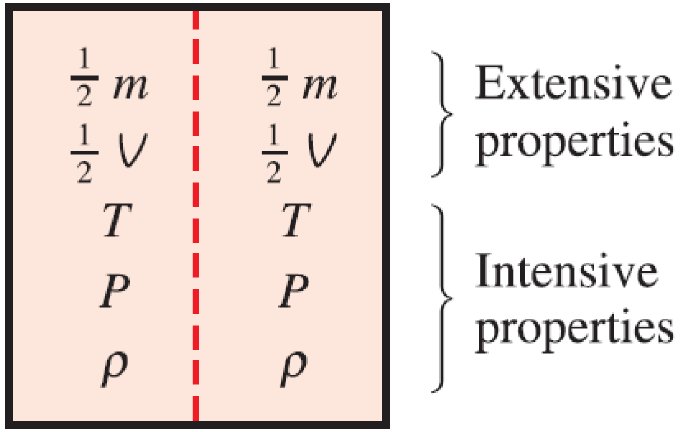
Vary directly with the mass:

Intensive

Independent of the amount of mass:



A way to determine whether a property is intensive or extensive is to divide the system into two equal parts with an imaginary partition:



Kind of properties

Extensive

Vary directly with the mass:
volume , energy……

Intensive

Independent of the amount of mass:
specific volume, specific energy…..

Do you notice anything?

CAPITAL LETTER:,
V (m^3), **E** (kJ)

LOWER CASE:
v (m^3/kg), e (kJ/kg),

U (kJ), **H** (kJ)…

u (kJ/kg), h (kJ/kg)…

Two ways to look at thermodynamics

Classical

Macroscopic view of a system:

- Temperatures (T)
- Pressure (P)
- m
- v (V)
- h (H)
- u(U)
- s (S)

This course!

They are the result of

Statistical

Microscopic view:

- Atoms
- Molecules
- Molecular interactions

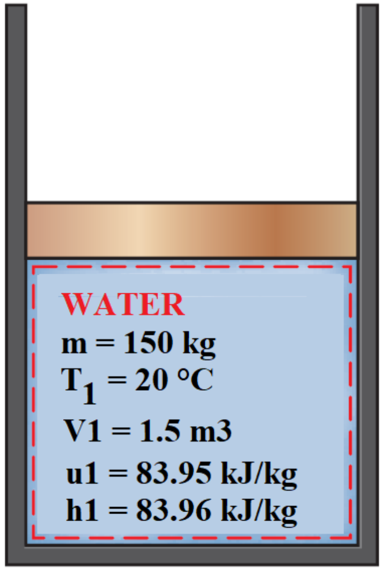
For classical thermodynamics, the properties described in the box are the keys to describe processes with W and Q, and therefore are used to define the equilibrium states.

State Properties and State

State Property

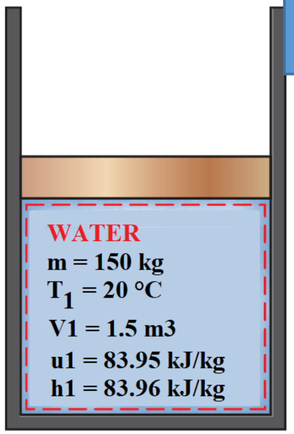
- Is any quantity that serves to describe a thermodynamic system: m, T, V….

- A state property is uniform throughout the entire system and does not change over time (equilibrium)



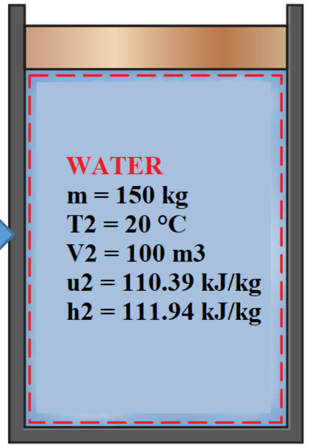
State

In equilibrium all properties have fixed values, these values define the state of the system.



(*a*) State 1

If the value of even one property changes, the state will change to a different one.



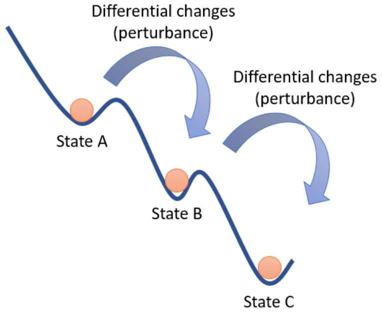
(*b*) State 2

CONCEPTS

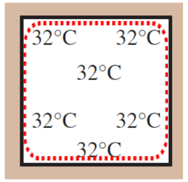
Equilibrium

A condition of balance characterized by the absence of driving potential within the system.

Thermodynamics deals with *equilibrium* states!!!



Thermal equilibrium: If the temperature is the same throughout the entire system

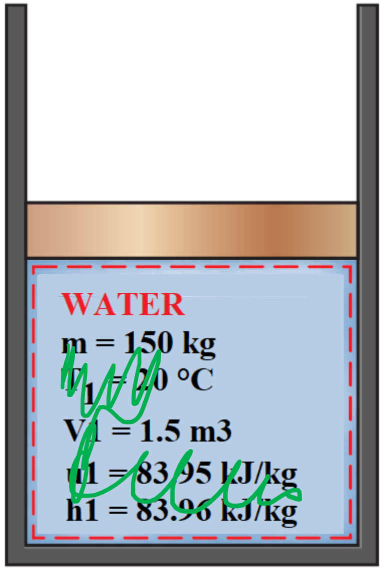


Mechanical equilibrium: If there is no change in pressure at any point of the system with time.

Chemical equilibrium: If its chemical composition does not change with time, that is, no chemical reactions occur.

The State Postulate

The state of a simple compressible system, **the state**, is completely specified by two independent, intensive properties



$P_1 = 1$ bar

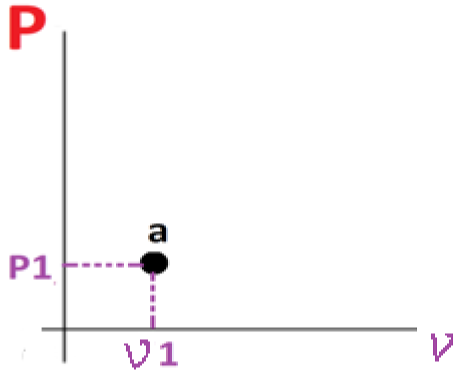
$$v_1 = \frac{V_1}{m}$$

IF I Know $P_1, v_1 \Rightarrow u_1 = F(P_1, v_1)$

$h_1 = F(P_1, v_1)$ or $h_1 = fn(P_1, u_1)$

$\vdots$

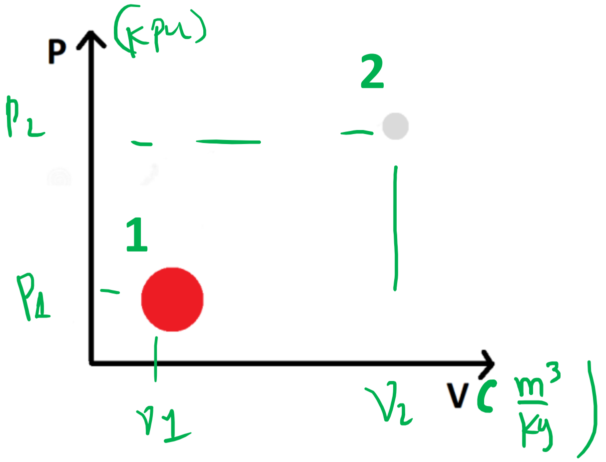
Alternative definition to the postulate: **It is a condition that can be represented on a plane**



CONCEPTS

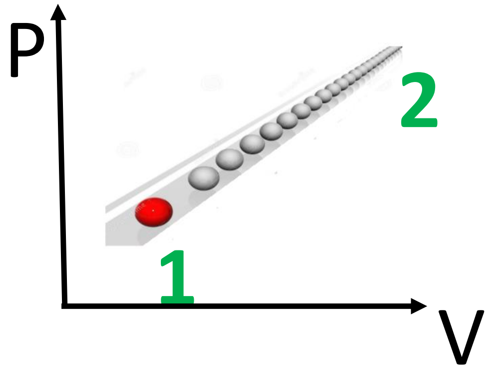
Process

A transition from one state to another.

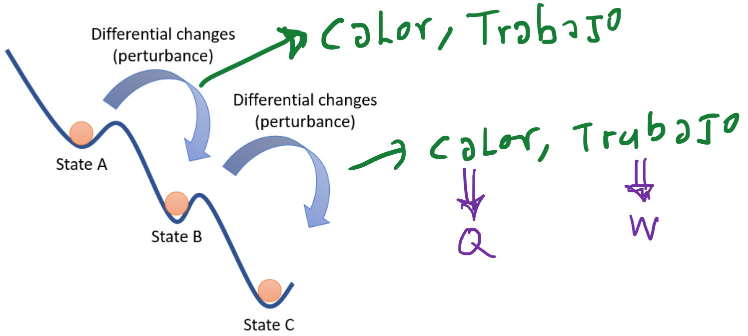


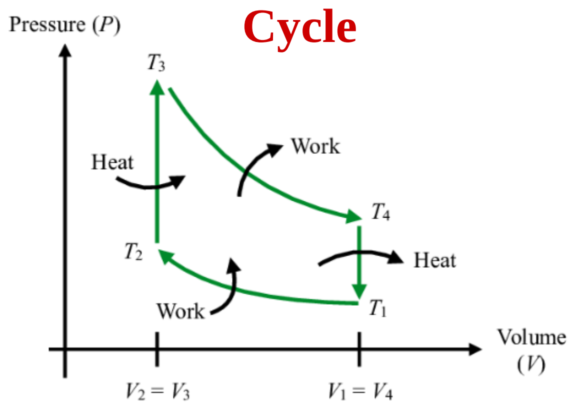
Process path

The succession of states during a process.

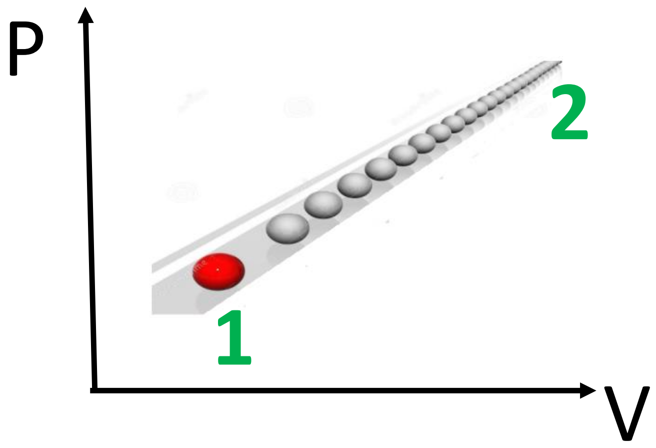


Normally in thermodynamics we are interested….





https://www.researchgate.net/publication/318670917_MBL-mobile_Many-body-localized_engine/figures?lo=1

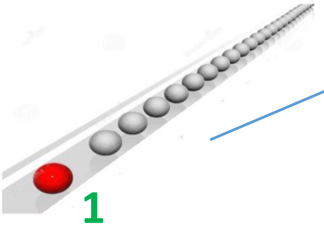


P, V and T are the typical state properties used to represent states and processes.

CONCEPTS

Process path

The succession of states during a process*.

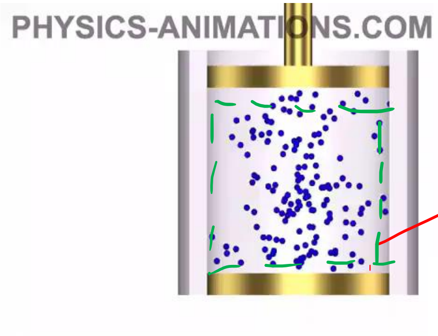


1

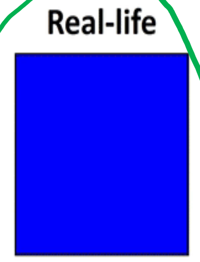
2

Quasi-equilibrium

A process in which each intermediate state is only infinitesimally removed from equilibrium.



T (°c)



CONCEPTS

Quasi-equilibrium, Why?

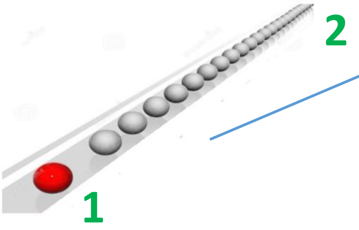
- Work producing devices deliver the most work when in quasi-equilibrium. It serves as standard to compare actual processes.

- Easy to calculate.

CONCEPTS

Process path

The succession of states during a process*.

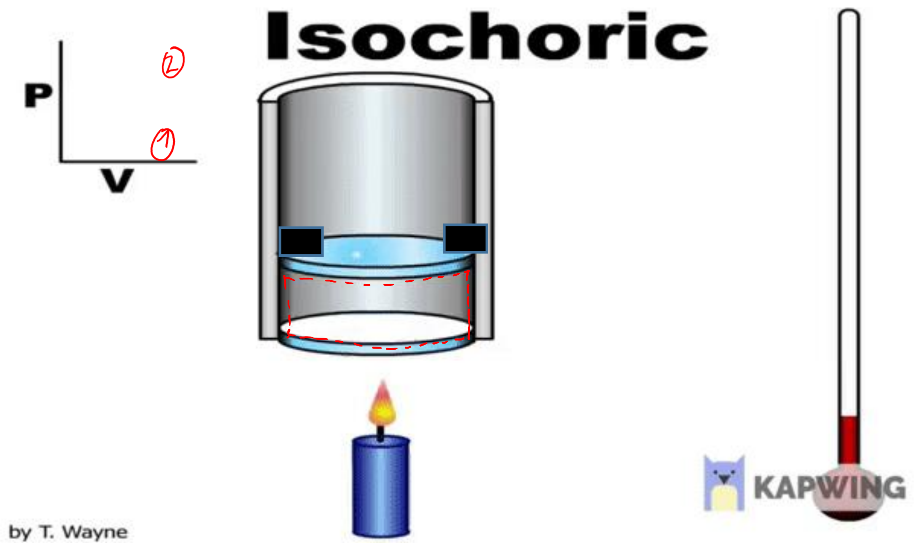


Kind of process?

- Isothermal.
- ..
- ..

Isochoric Process (Constant Volume Process)

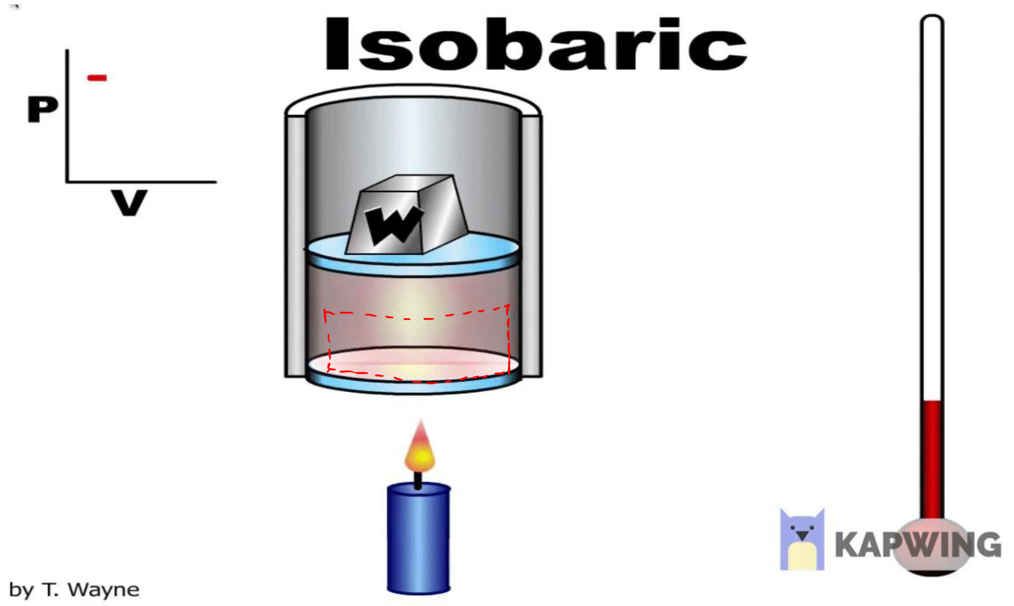
An **Isochoric process** is a thermodynamic process during which the volume of the system undergoing such a process remains constant.



$V_1 = V_2$

Isobaric Process (Constant Pressure Process)

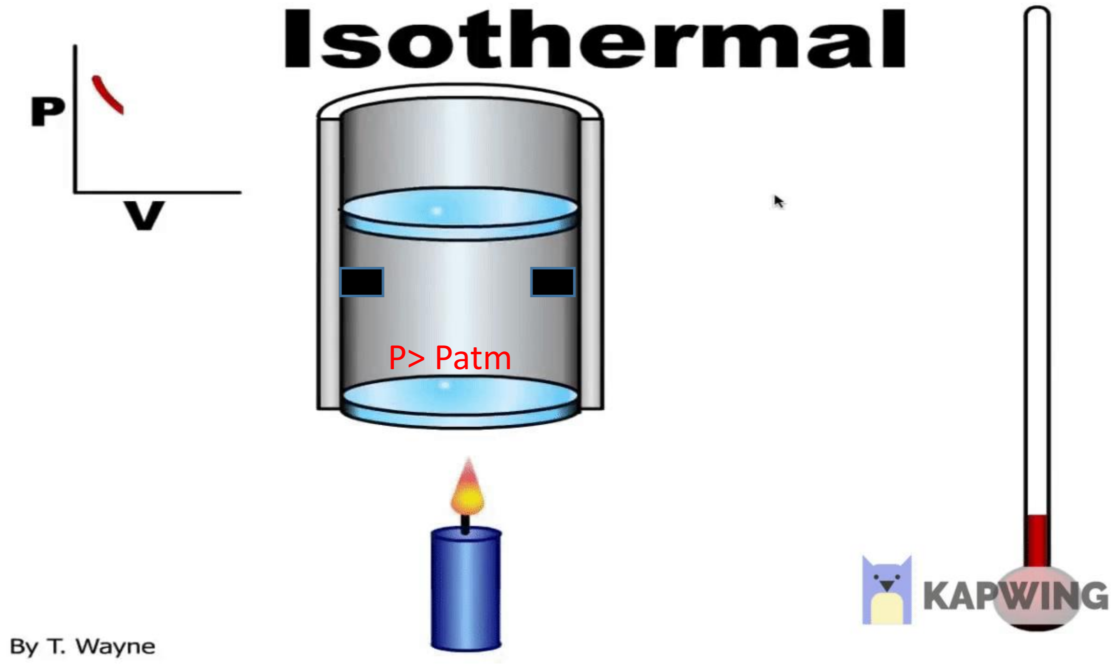
An **Isobaric process** is a thermodynamic process in which the pressure stays constant: $\Delta P = 0$.



$P_1 = P_2$

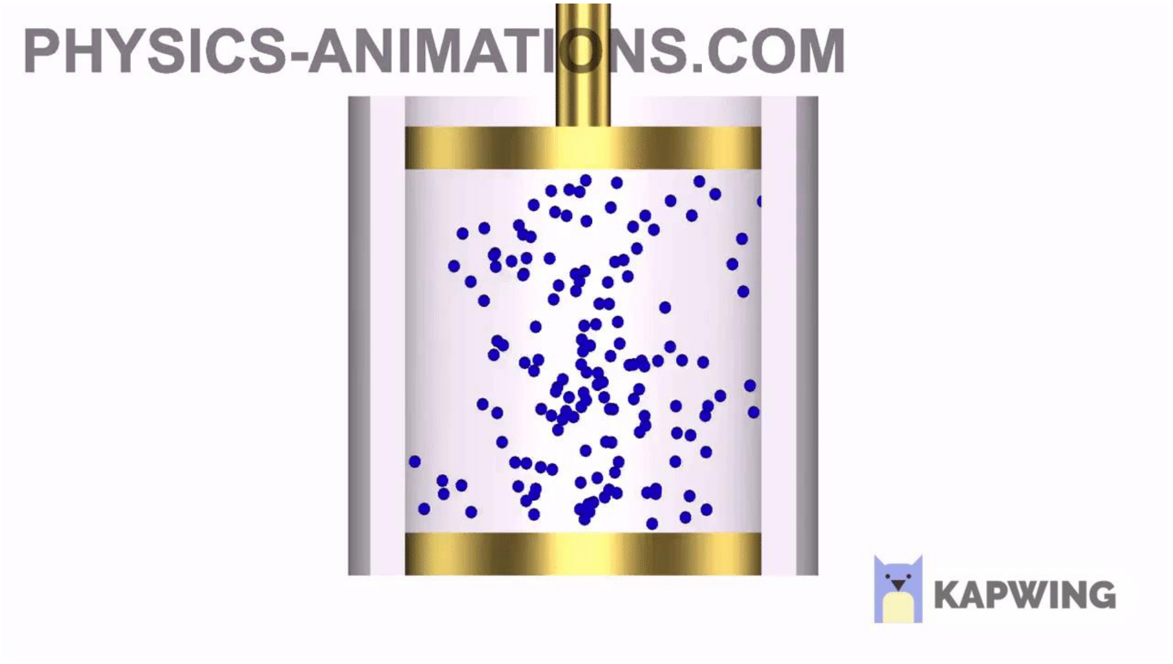
Isothermal Process

This will happens when the working substance remains in a perfect thermal contact with the surroundings.



Adiabatic Process

A process, in which the working substance neither receives nor gives out heat to its surrounding, during its expansion or compression is called an **adiabatic process**.



International units system

Sr. No.	Physical Quantity	SI - Unit	Symbol
1	Length	meter	m
2	Mass	kilogram	kg
3	Time	second	s
4	Electric Current	ampere	A
5	Temperature	kelvin	K
6	Intensity of Light	candela	cd
7	Amount of Substance	mole	mol

SI derived units

Name	Symbol	Quantity	Expression in terms of other units	Expression in terms of SI base units
hertz	Hz	frequency	1/s	s^{-1}
radian	rad	angle	$m \cdot m^{-1}$	dimensionless
steradian	sr	solid angle	$m^2 \cdot m^{-2}$	dimensionless
newton	N	force, weight	$m \cdot kg/s^2$	$m \cdot kg \cdot s^{-2}$
pascal	Pa	pressure, stresss	N/m^2	$m^{-1} \cdot kg \cdot s^{-2}$
joule	J	energy, work, heat	$N \cdot m = C \cdot V = W \cdot s$	$m^2 \cdot kg \cdot s^{-2}$
watt	W	power, radiant flux	$J/s = V \cdot A$	$m^2 \cdot kg \cdot s^{-3}$
coulomb	C	electric charge or electric flux	$s \cdot A$	$s \cdot A$
volt	V	voltage, electrical potential difference, electromotive force	$W/A = J/C$	$m^2 \cdot kg \cdot s^{-3} \cdot A^{-1}$
farad	F	electric capacitance	C/V	$m^{-2} \cdot kg^{-1} \cdot s^4 \cdot A^2$
ohm	Ω	electric resistance, impedance, reactane	V/A	$m^2 \cdot kg \cdot s^{-3} \cdot A^{-2}$
siemens	S	electrical conductance	$1/\Omega$	$m^{-2} \cdot kg^{-1} \cdot s^3 \cdot A^2$
weber	Wb	magnetic flux	J/A	$m^2 \cdot kg \cdot s^{-2} \cdot A^{-1}$
tesla	T	magnetic field strength, magnetic flux density	$V \cdot s/m^2 = Wb/m^2 = N/(A \cdot m)$	$kg \cdot s^{-2} \cdot A^{-1}$
henry	H	inductance	$V \cdot s/A = Wb/A$	$m^2 \cdot kg \cdot s^{-2} \cdot A^{-2}$
degree Celsius	°C	temperature	$K - 273.15$	$K - 273.15$
lumen	lm	luminous flux	$lx \cdot m^2$	$cd \cdot sr$
lux	lx	illuminance	lm/m^2	$m^{-2} \cdot cd \cdot sr$
ecquerel	Bq	radioactivity	1/s	s^{-1}
gray	Gy	absorbed dose of ionizing radiation	J/kg	$m^2 \cdot s^{-2}$
sievert	Sv	equivalent dose of ionizing radiation	J/kg	$m^2 \cdot s^{-2}$
katal	kat	Catalytic activity	mol/s	$s^{-1} \cdot mol$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Thanks!