

# Interaction between Art & Science

## Through Chemical Engineering



MonStein = 1/2 Mona + 1/2 Einstein



LeMonStein = Leonardo + Mona + Einstein



MoNardo = 1/2 Mona + 1/2 Leonardo

## art & science

Cheng-Dau Lee, Nobel laureate in physics, said: "Science and Art are not separated from each other. They assist us in observing nature. With the help of Science we can discover the routines of nature. Through Art we can describe the emotions of nature."

The major aim of this exhibition is to bring to the attention of the observer the fact that Science can also be observed through the "eyes" of Art. In this way, an additional dimension is given to Art, to demonstrate Science via Art.

The following subjects in Chemical Engineering are demonstrated in this exhibition through Art: Newton laws, Thermodynamic functions, Laws and behaviour of solutions, Fluid Flow, Processes and Biotechnology.

The interaction between the two "cultures", Art & Science, is demonstrated in this poster by different combinations of the faces of Mona Lisa, Albert Einstein and Leonardo Da Vinci. As seen, each combination creates one totality, as the interaction between Art & Science.

The creator of this exhibition is Abraham Tamir, a Professor in Chemical Engineering at Ben-Gurion University of the Negev, Beer-Sheva, Israel. In 1998 he founded in his university the Museum of Art & Science, the first of his kind in the world. He is also setting up exhibitions on Art & Science in Israel and abroad. He is the Associate Editor for Art & Science in the Canadian Journal of Chemical Engineering and co-Editor for Art & Science in the Research Journal of Chemistry and Environment.

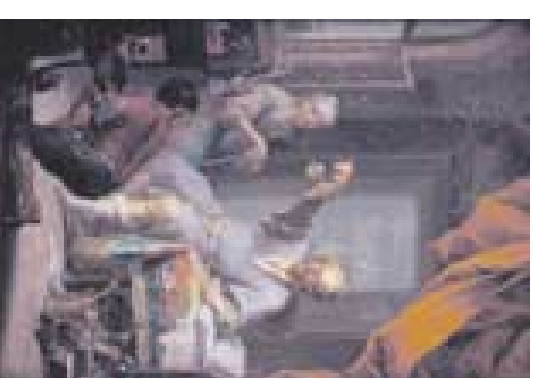
# What is Chemical Engineering?

The scientific discipline engaged with transformation of laboratory achievements to manufacture of a product in a chemical plant



Charles Sheeler

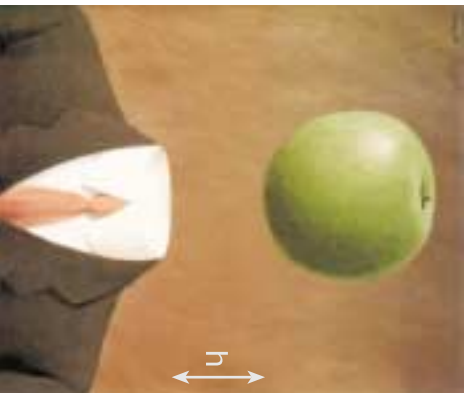
The chemical plant



Franz C. Janneck

The laboratory

# Thermodynamic Functions



$$\text{Potential energy} = mgh > 0$$

René Magritte



Pressure P

Hanoch Piven



$$\text{Kinetic energy} = mv^2/2$$

René Magritte



Temperature T

Leonardo Da Vinci



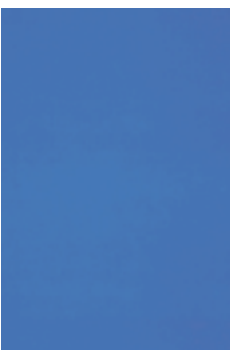
Enthalpy H

René Magritte



Damien Hirst

$S = S_{\text{max}}$   
maximum disorder



Yves Klein

$S = 0$   
maximum order

Entropy S

*Thermodynamic Functions*

## Newton's First Law



René Magritte



Jacek Yerka

“A body in motion at a constant speed in a straight line tends to stay at that constant speed in a straight line, like in Yerka’s artwork. If the body is at rest, it will remain at rest, like in Magritte’s artwork”

*Newton's First Law*

## Newton's Second Law



Franz Von Stuck

$F$



Fernando Botero

$m$



Fernando Botero

$g$

"A force  $F$  acting on a body of mass  $m$  accelerates it with an acceleration  $a$ .  
When a body falls in vacuum, the force acting on it is its weight; this force will accelerate the body at an acceleration of  $g=9.8 \text{ m/sec}^2$ "

# The Zeroth Law of Thermodynamics

“When two systems are independently found to be in thermal equilibrium with a third system,  $T_1=T_3$  and  $T_2=T_3$ , they are also in thermal equilibrium with each other,  $T_1=T_2$ ”



René Magritte

# Newton's Third Law

Botero's couple is transposed on Ron Miller's view



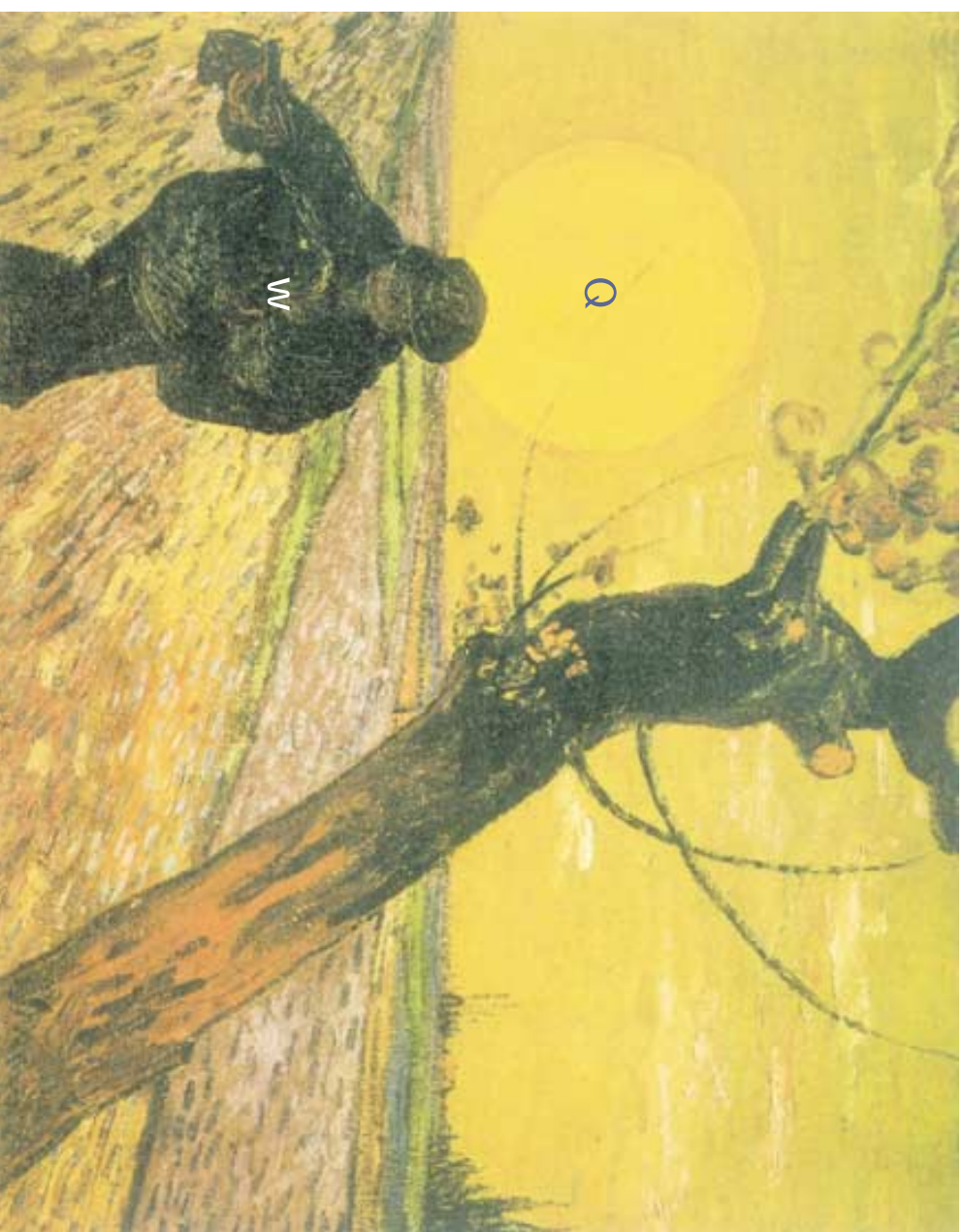
“For every action there is an equal and opposite reaction”

Einstein's special relativity: "Laws of nature are equal in all systems moving one relative to the other at the same speed." Consequently, Newton's 3rd Law is valid on Callisto and Jupiter



Fernando Botero

# What is Thermodynamics ?



Vincent Van Gogh

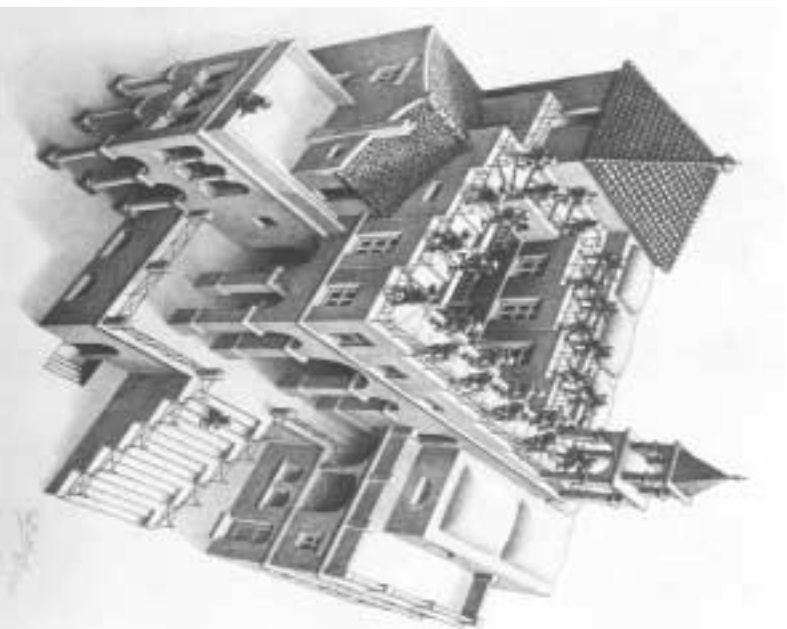
The science of the transformation of heat  $Q$  to work  $w$

*What is Thermodynamics ?*



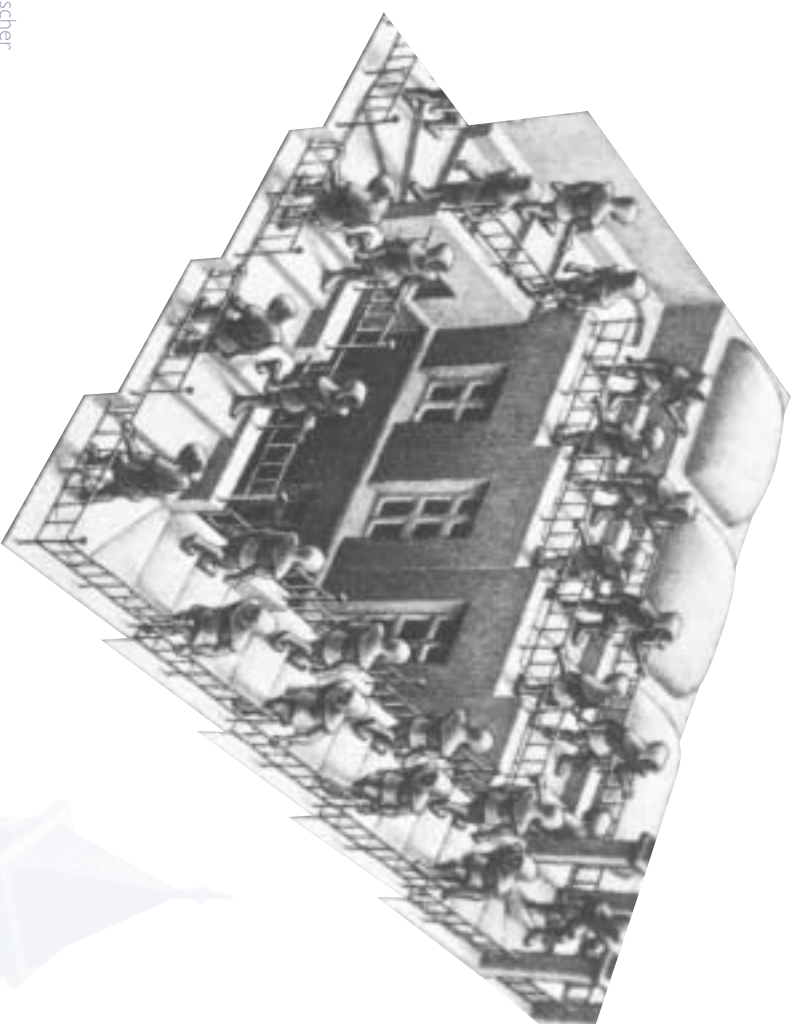
# The Third Law of Thermodynamics:

“The absolute zero  $T=0$  K is unattainable”



M.C. Escher

“Ascending Descending”



The endless staircase

The above statement of the third law is demonstrated in Escher’s sophisticated staircase on which monks are descending (or ascending) endlessly and the end of the staircase is never achieved, like the absolute zero

*The Third Law of Thermodynamics*

## Vortices and Flow Over and Around Bodies

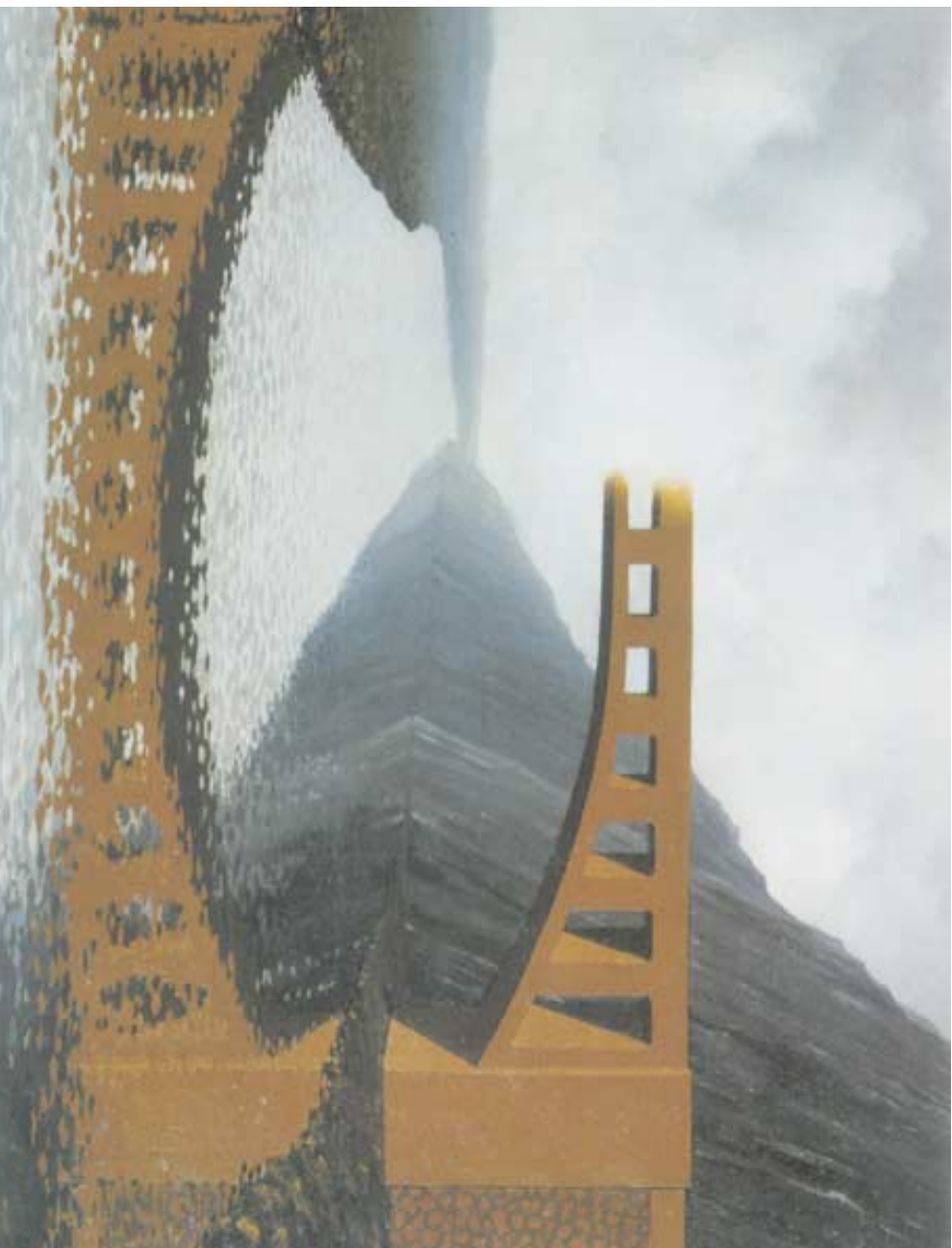


Vincent Van Gogh

The picture of Van Gogh, who was not a fluid flow man, demonstrates the characteristics of the following kinds of flow: flow around bodies – 11 moons, vortices in the center of the picture, and boundary flow over a sleeping village

*Flow Over Bodies*

## Sublimation Processes

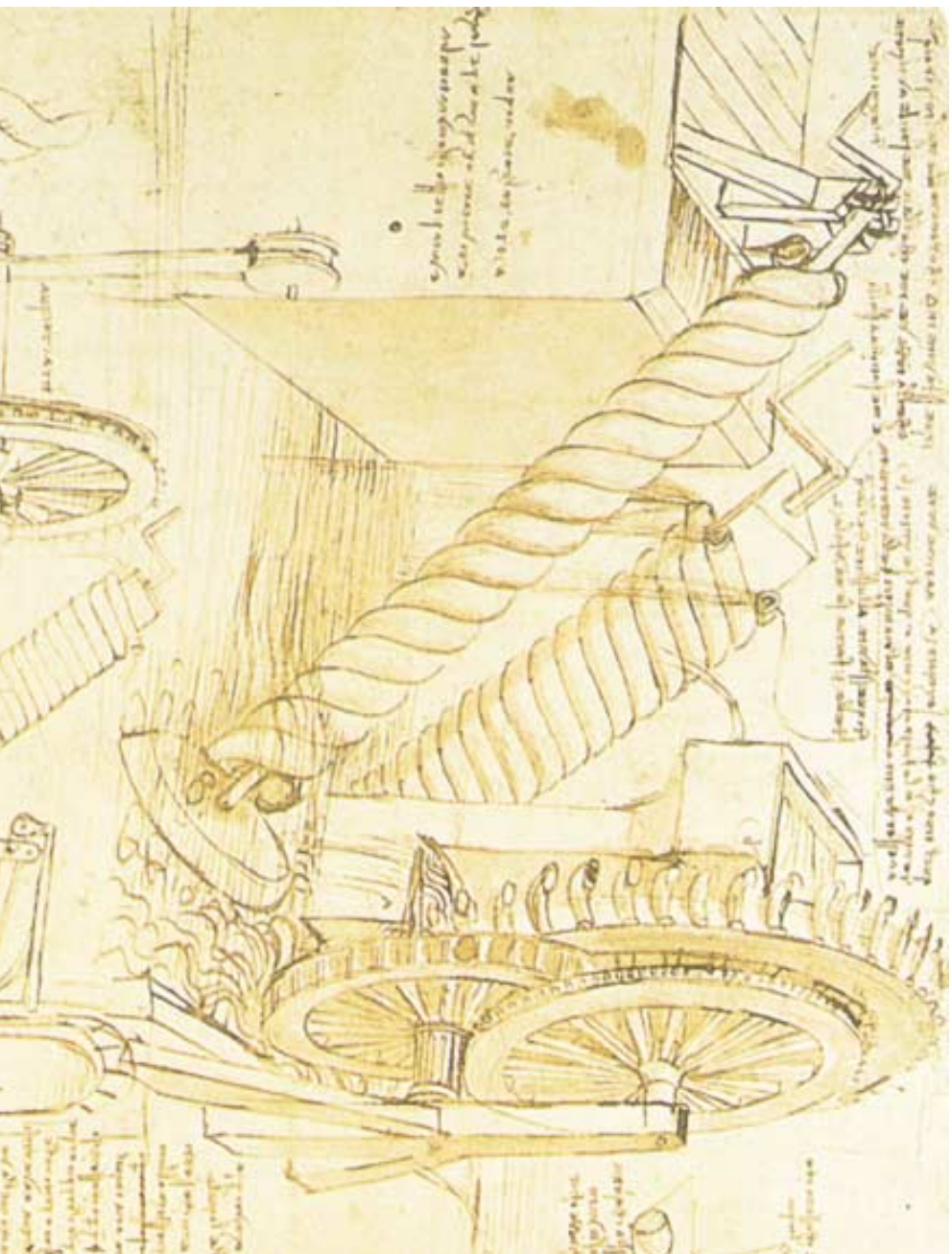


René Magritte

A sublimation process is characterized by the direct transition from a solid to gas phase. Magritte's artwork demonstrates this process where half of the bridge sublimates. However, a deep observation reveals that the artist created an illusion of a sublimation process by covering half of the bridge by a cloud

*Sublimation Processes*

# Pumping Processes



Leonardo Da Vinci

Pumping processes are used to transfer fluids from one place to the other by an appropriate device. Leonardo's artwork of 1480 describes a combination of "Archimedes Screw" developed about 2000 years ago and a pump, as device for transferring water upwards

*Pumping Processes*