



มหาวิทยาลัยราชภัฏนครปฐม Nakhon Pathom Rajabhat University

### Chapter 1

# Units, physics and vector quantity. Kittipong Siengsanoh, Ph.D.(Physics)

Physics, Science and Technology Department Nakhon Pathom Rajabhat University **Content 1** Understand the physics of physics quantity and measurement process, Straight motion, Force and Newton's laws of motion, Global gravitation law, Friction balance mechanical of objects, Work and the rules of energy conservation, Momentum and momentum conservation laws, Bending motion. Include the knowledge to use.

#### Learning Outcome

1. Search and explain the search for knowledge in physics history ,Including the development of the principle and physics concepts that result in new knowledge acquisition and technology development.

2. Measure and report results measurement of physics is correct and appropriate bring the expectation of measurement into consideration. Including experimental results in the graph ,analysis and interpretation of direct graphs.





	ts and vector ntity.	Measurement and record
<ul> <li>→ Research guide</li> <li>→ F</li> <li>→ Development and</li> <li>-,</li> </ul>	Physics Experiment	
	→ Reporting Error	-Base units -Derived units
	-Average -Average error	→ Scientific Notation
→ Vector	→ Results Analysis	<ul> <li>→ Prefixes</li> <li>→ Significant Number</li> </ul>
	-Table	
	-Graph	
	Clara	

-Slope





# Nature of Physics.





#### Nature Phenomena.



Nature phenomena.[online]. Available: https://www.thairath.co.th/content/1144912

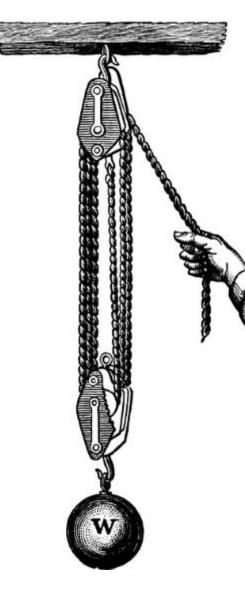
ปรากฏการณ์ธรรมชาติ (ออนไลน์). สืบค้นจาก: <u>http://www.trueplookpanya.com/learning/detail/30092-</u> 042662[1 ธันวาคม 2561]

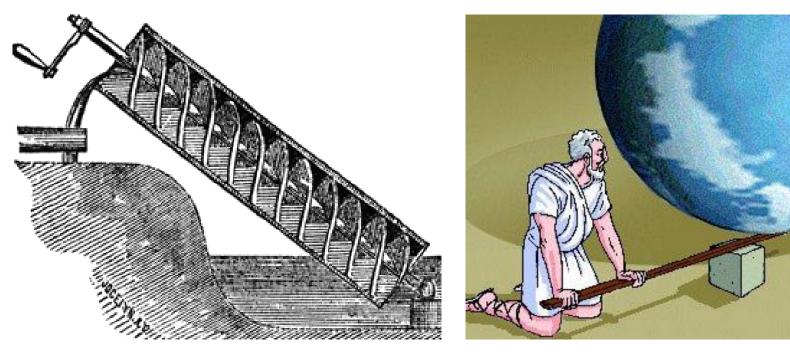


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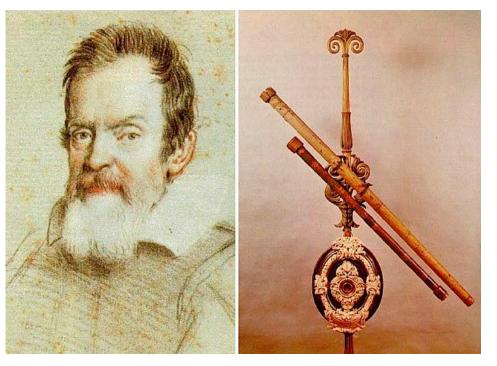


Simple machines.[online]. available: http://ceiinsstt.blogspot.com/2016/08/archimedes.html





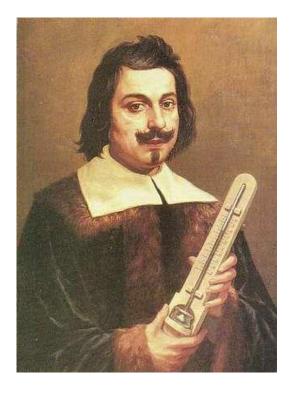
#### Nature Phenomena



### Galileo Galilei :Telescope

Sciencetist. [online]. available:

https://yoknoiwong5657.files.wordpress.com/2014/02/galileoandtelescopes cc.jpg

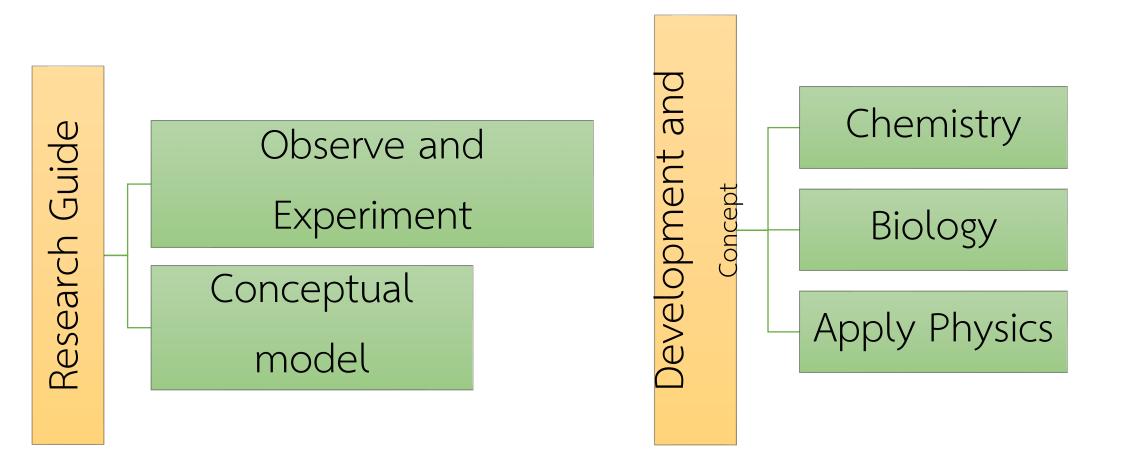


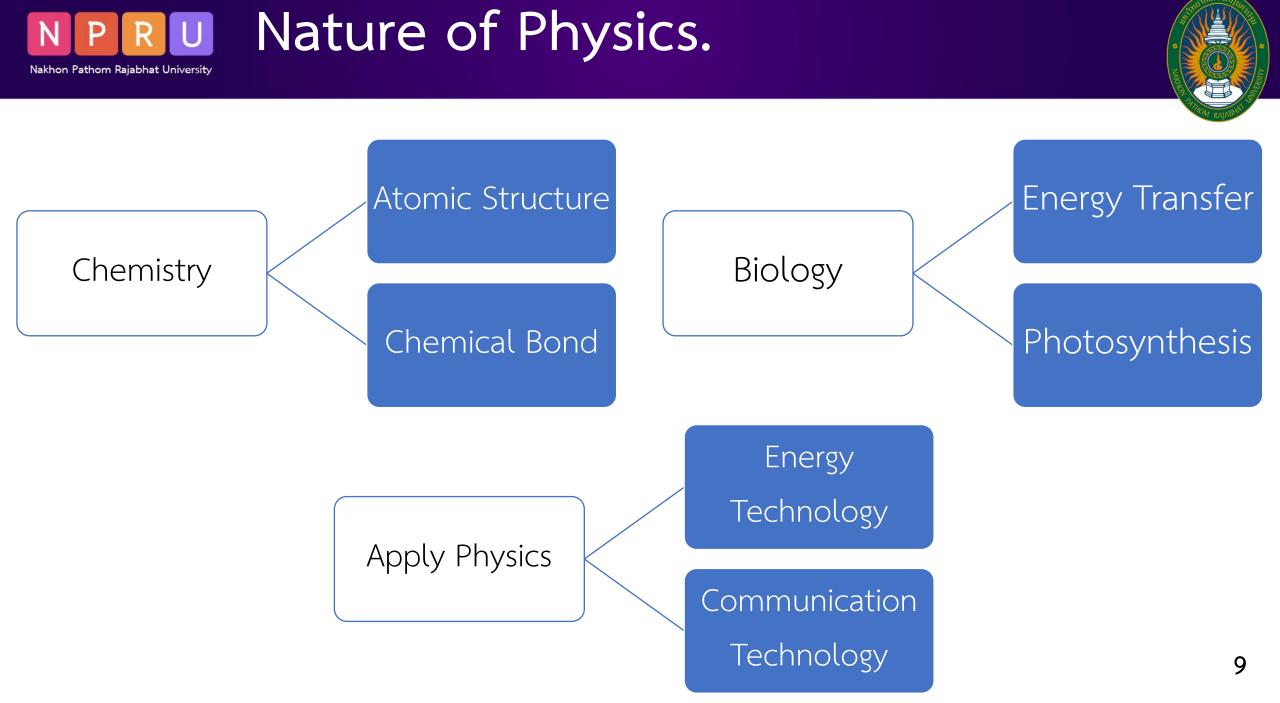
### Evangelista Torricelli: Barometer

Sciencetist. [online]. Available:

https://web.ku.ac.th/schoolnet/snet3/physician/torricel.htm













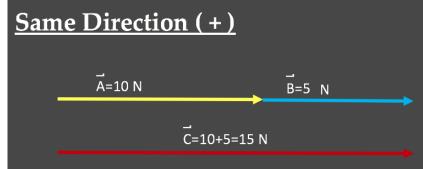
### "Vectors are quantities that are fully described by both a magnitude and a direction."



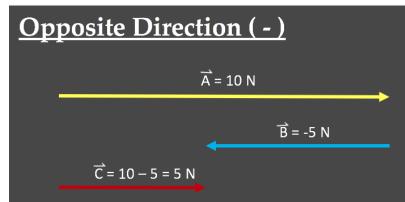
# Nature of Physics.

### **Resultance Vector**

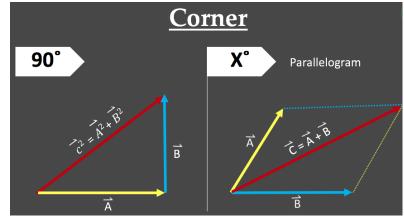
### - Same direction (+)



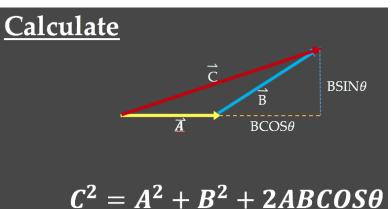
### - Opposite direction ( - )



#### - Corner



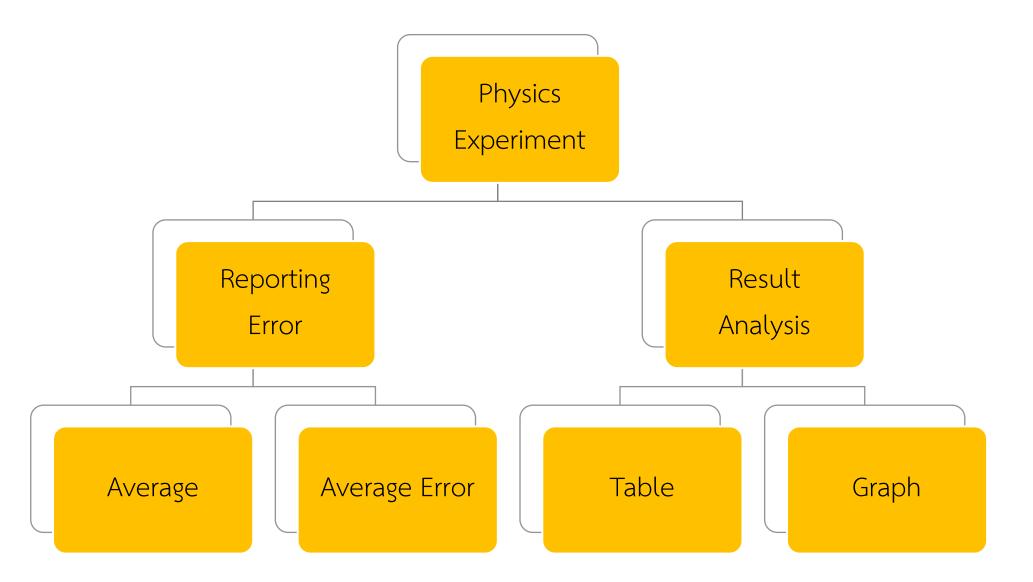
- Calculate





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- Reporting Error
- Average

$$-X = \frac{X_1 + X_2 + X_3 + \dots + X_n}{N}$$

where

X = Average

- $X_n = \mathbf{X}$ at any number
- N = All test results



### Physics Experiment

- Reporting Error
- Average Error

$$\Delta X = \frac{X_{max} - X_{min}}{2}$$

Where

 $\Delta X$  = Average error

- $X_{max} = Maximum number$
- $X_{\min} = M$ inimum number



### Physics Experiment



Reporting Error

EX. x = 21, 23.5, 23.75, 24.10, 24.78, 25.05 Average = ? Average error = ?



• Reporting Error

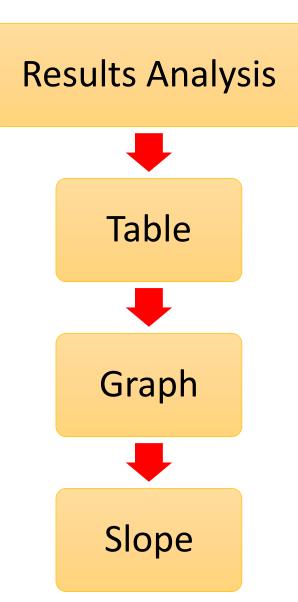
Sol<sup>n</sup> Average = 
$$\overline{\mathbf{X}} = \frac{X_1 + X_2 + X_3 + \dots + X_n}{N}$$

$$=\frac{21+23.5+23.75+24.10+24.78+25.05}{_{6}}$$
  
= 23.70 #

Error average = 
$$\Delta X = \frac{X_{max} - X_{min}}{2}$$
  
=  $\frac{25.05 - 21}{2}$   
= 2.025 #



**Results Analysis** 

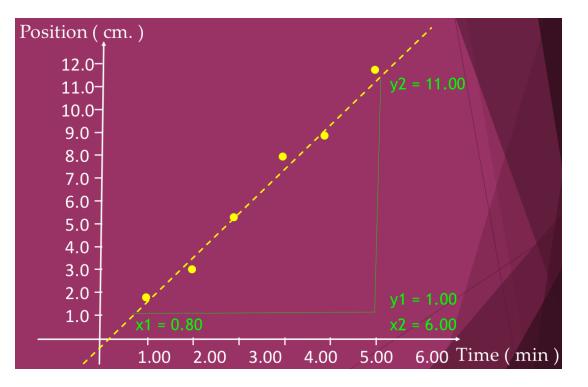




• Results Analysis

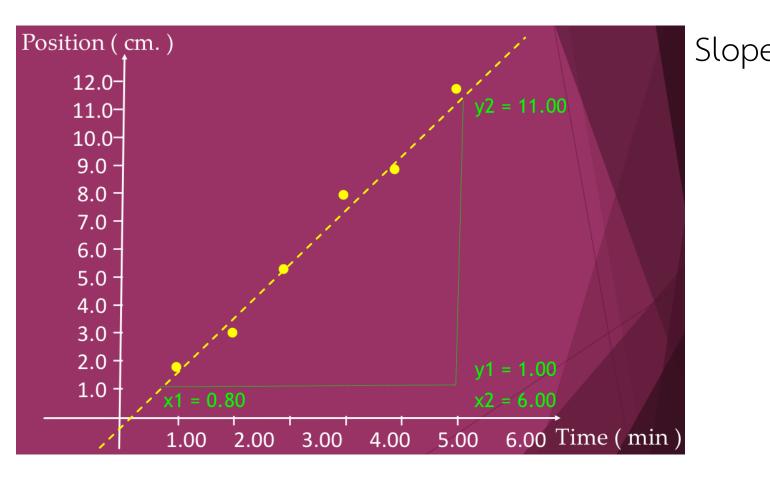
Time ( min )	Position ( cm. )
1.00	1.9 <b>±</b> 0.2
2.00	3.1 ± 0.2
3.00	5.5 <b>±</b> 0.2
4.00	8.2 ± 0.2
5.00	9.0 ± 0.2
6.00	11.8 <b>±</b> 0.2

### Ex. Rectilinear motion of a snail.





• Results Analysis



$$= = \frac{\Delta y}{\Delta x} = \frac{y_2 - y_1}{x_2 - x_1}$$

# $=\frac{11.00 \text{ cm} - 1.00 \text{ cm}}{6.00 \text{ min} - 0.80 \text{ min}}$

= 1.92 cm/min#







# Measurement

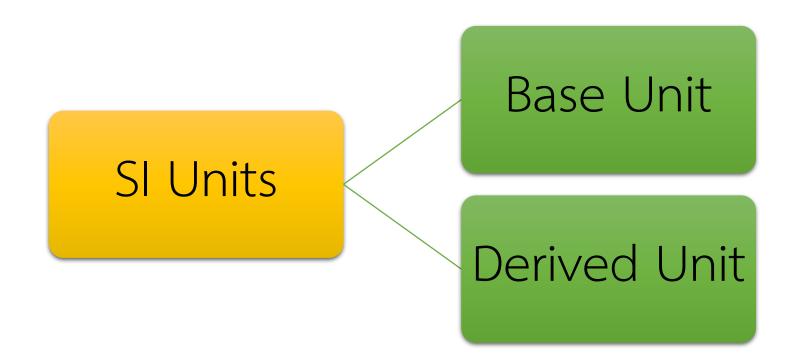
# and

# Record.





• International System of Units (S.I.)





• International System of Units (S.I.)

**Base Unit** 

Base quantities	units	symbol
Length	meter	m
Mass	kilogram	kg
Time	second	S
Electric current	Ampere	A
Thermodynamic temperature	Kelvin	К
Amount of substance	mole	mol
Luminous intensity	candela	cd



# NPRU Measurement and Record

- International System of Units (S.I.)
- Derived Unit
  - EX. N (Newton)

from 
$$F = ma$$
  
 $F(N), m(kg) and a=?$   
 $a : m/S^2$   
so  $N = kg.m/S^2$ 





- International System of Units (S.I.)
- Derived Unit

Quantity	Unit	Derived units
Force	Newton ( N )	kgms <sup>2</sup>
Acceleration	ms <sup>2</sup>	ms <sup>2</sup>
Energy	Joule ( J )	kgm²s¯²
Power	Watt ( W )	kgm²s¯³





Scientific Notation

 $\mbox{\ensuremath{\mathsf{A}}} \times 10^n$  ;  $1 \le A \le 10$ 

EX.  $0.000000000001 = 1 \times 10^{-12}$  $1,000,000,000 = 1 \times 10^{12}$ 

### Measurement and Record

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N

R

#### Prefixes

Prefixs	symbol	
pico-	р	10 <sup>-12</sup>
nano-	n	<b>10<sup>-9</sup></b>
micro-	μ	<b>10</b> <sup>-6</sup>
milli-	m	<b>10</b> <sup>-3</sup>
centi-	С	$10^{-2}$
deci-	d	<b>10<sup>-1</sup></b>
deca	da	10 <sup>1</sup>
hecto	h	<b>10</b> <sup>2</sup>
kilo-	k	<b>10</b> <sup>3</sup>
mega-	Μ	<b>10</b> <sup>6</sup>
giga-	G	<b>10</b> <sup>9</sup>
tera-	Т	<b>10</b> <sup>12</sup>





Prefixes

EX. Convert the following quantity units.

1)  $7.0 imes 10^{15}(m$  ) Change to nanometer (nm)

2)  $5.4 imes 10^8$ (W) Change to megawatt (MW)



1) From  $1nm = 10^{-9}m$  so that  $1m = 10^9$  nm  $Sol^n$   $7.0 \times 10^{-15}m$  = ? nm

Prefixes

=  $7.0 \times 10^{-15} \times 10^{9}$ nm =  $7.0 \times 10^{(-15+9)}$ nm =  $7.0 \times 10^{-6}$ nm ##





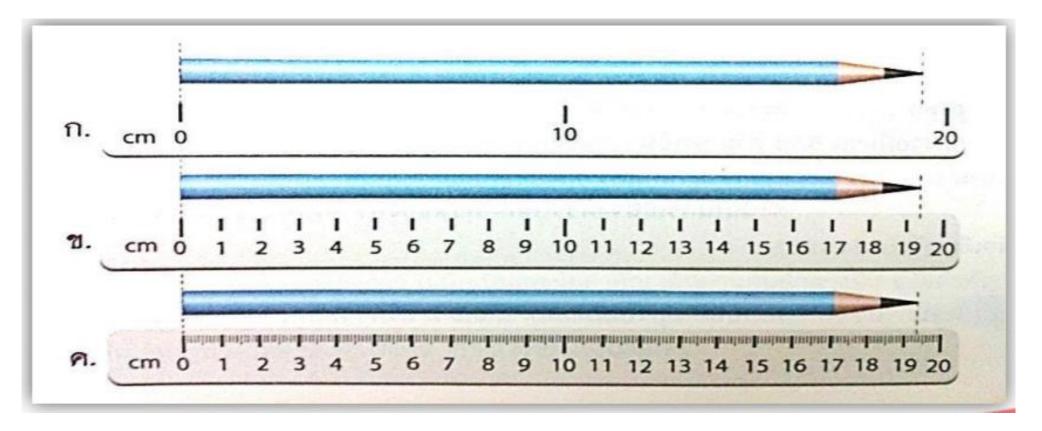
# 2) From $1 \text{ MW} = 10^6 \text{W}$ so that $1 \text{ W} = 10^{-6} \text{ MW}$ Sol<sup>n</sup> $5.4 \times 10^8 \text{W} = ? \text{ MW}$

- $= 5.4 \times 10^8 \times 10^{-6} MW$
- $= 5.4 \times 10^{(8-6)}$ MW
- $= 5.4 \times 10^{2}$  MW ##





### Significant Number



เลขนัยสำคัญ (ออนไลน์). สืบค้นจาก: <u>www.trueplookpanya.com/new/download/tv\_file/493/ [1</u> ธันวาคม 2561]



- NPRU Measurement and Record
  - Significant Number
    - 1. Numbers 1-9 are significant figures all.



- Significant Number
- 2. Number 0

2.1 Number 0 is in front of other numbers do not count. EX. 0009 = 1 significant figures 2.2 Number 0 is between other numbers do count. EX. 1005 = 4 significant figures 2.3 Number 0 is behind the decimal numbers do count. EX. 0.50 = 2 significant figures 2.4 The number 0 after the integer may be counted or not depending on the resolution of the tool.

> EX. 1899 = 4 significant figures  $1.89 \times 10^4$  = 3 significant figures





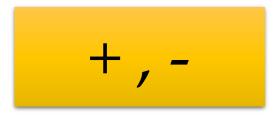


- Significant Number
- 3. Constants such as  $\pi$  e and 2 in  $2\pi R$  are not significant figures.

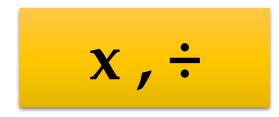
EX.  $\pi$  = 0 significant figures



#### Significant Number



#### EX. 250.4 – 75.25 = 175.15 ≈ 175.2



EX. 26.5  $\div$  4.0 = 6.62  $\approx$  6.6







### The End !!!