

# { SM<sup>64</sup>-Map : บกน้า }

## 1 นั่งสำดับ

i) บบ

1-9 ✓

นำน้ำ X

ตัดกลาง ✓

0 ตามน้ำ

เลขอื่นๆ ✓

จํานวนเต็ม เล็กๆ ก็ได้รึไม่ได้

ex. 0.00120900 m ( $= 1.20900 \times 10^{-3}$  m)

ii) + - × ÷

+ - ~> ควรตามกันให้เข้าใจกันดีๆ

ex. 12.31 + 1.5 \* cm = 13.81 cm = 13.8 \* cm

× ÷ ~> ควรบุกามตามๆ กันให้เข้าใจกันดีๆ

ex. 3.25 \* 4.000 = 13.0  
\* \* \*

\* หมายความว่า  $\pi$  รอบปีก็ไม่ต้องนับการบานนั่งสำดับ

## 2 รวมความน่าเดาเรื่อง

$$C = A + B \rightsquigarrow \Delta C = \Delta A + \Delta B$$

$$C = A - B \rightsquigarrow \Delta C = \Delta A + \Delta B$$

$$C = A \times B \rightsquigarrow \frac{\Delta C}{C} = \frac{\Delta A}{A} + \frac{\Delta B}{B} \quad \therefore C = A^2 \rightsquigarrow \frac{\Delta C}{C} = 2 \frac{\Delta A}{A}$$

$$C = \frac{A}{B} \rightsquigarrow \frac{\Delta C}{C} = \frac{\Delta A}{A} + \frac{\Delta B}{B}$$

หมายความว่า  $\Delta C$  ก็เป็น เปอร์เซนต์ความคลาดเคลื่อน

# [ SM<sup>64</sup>-Map : လျှပ်စာမျက်နှာ ]



@pgreatondemand



Teacher Great

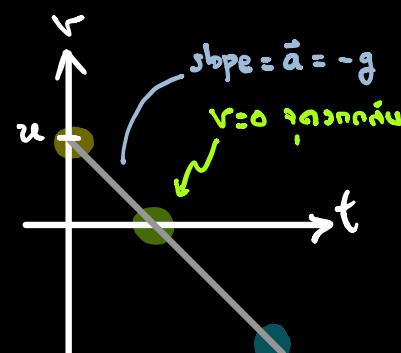
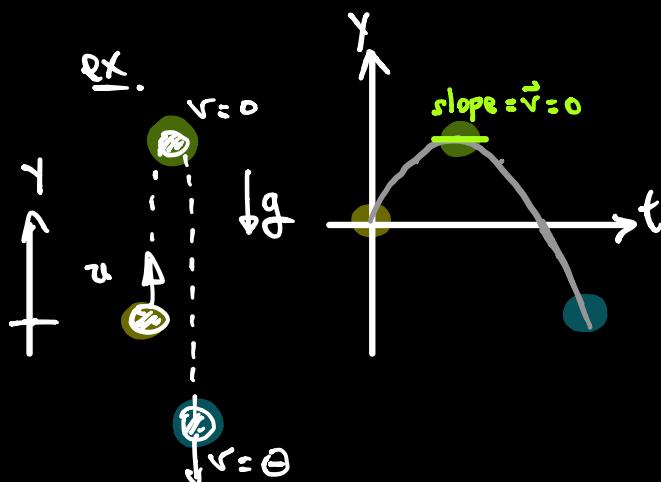
1

ဂုဏ်  $s-t$   $v-t$   $a-t$

slope  $v$   
အကိုယ်ရေ  $-$

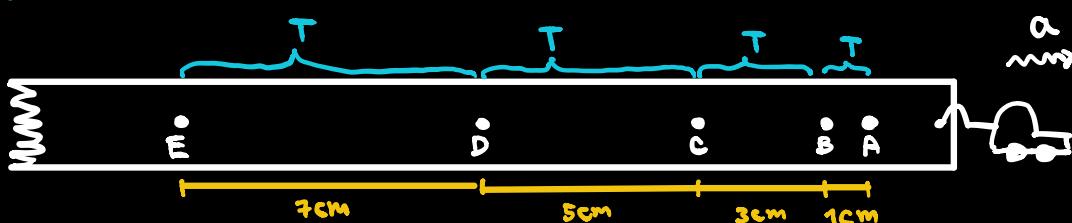
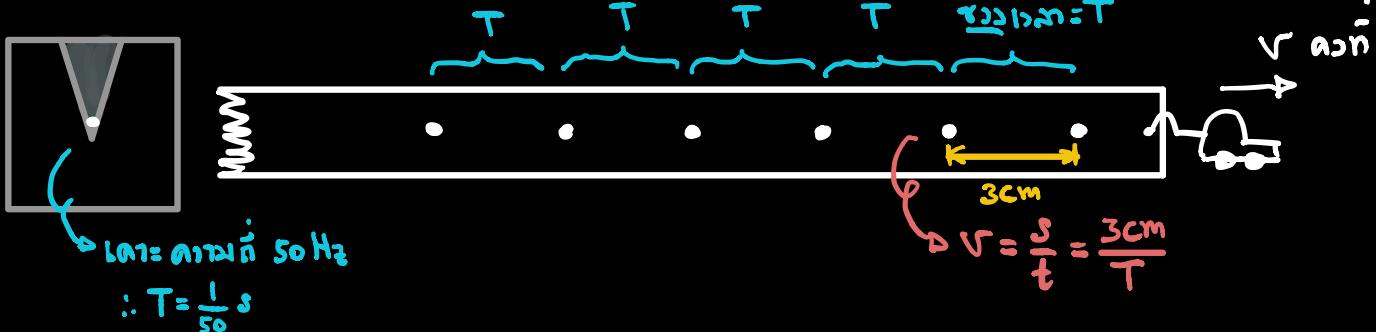
$a$   
 $s, \bar{s}$   
 $\Delta \vec{v} = \vec{v} - \vec{u}$

၂၈။ ပုံပြန် = ပါတ်ပုံ



2

ပေးသော်လေ့လာ = အုပ်လုပ်များ  $\rightarrow$  မျှော်လုပ်များ  $\rightarrow$  မျှော်လုပ်များ

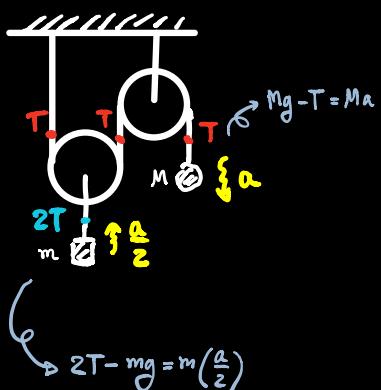
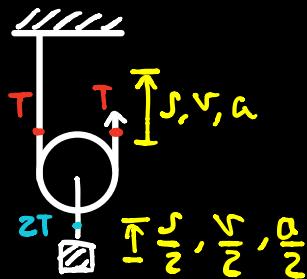
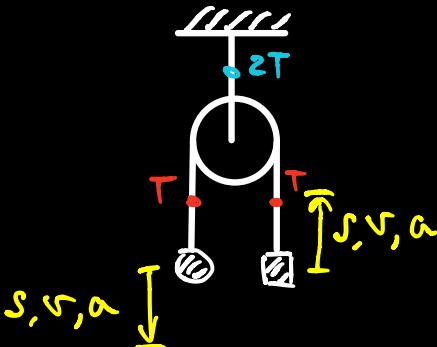


ex. A  $\rightarrow$  C  $V_{ave} = \frac{S_{AC}}{t_{AC}} = \frac{4cm}{2T} \approx V_B$       B  $\rightarrow$  D  $a_{ave} = \frac{V_D - V_B}{t_{BD}} \approx \frac{(12cm) - (4cm)}{2T} = \frac{2cm}{T^2} = \frac{0.02m}{\left(\frac{1}{50}s\right)^2} = 50m/s^2$

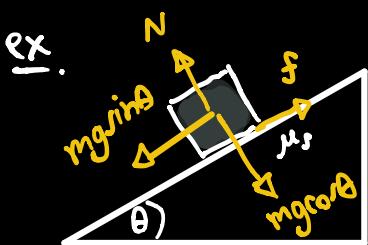
C  $\rightarrow$  E  $V_{ave} = \frac{S_{CE}}{t_{CE}} = \frac{12cm}{2T} \approx V_D$

# [ SM<sup>64</sup>-Map : Newton ]

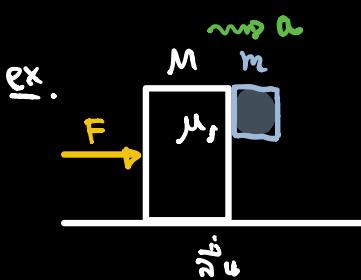
- 1 ระบบรวม < i) เส้น直角เดียวคือ  $T$  เก่ารับทั้งเส้น  
 ii)  $\sum \vec{F}$  ทั้งหมด = 0 เส้นเดียว (ระบบฯ)  
 iii) ถูกดึงเพิ่มขึ้นผ่านรูปแบบ  $s, v, a$  สมมติฐานเดียวกัน



- 2 แรงต้านทาน < สลับ (ไข่ไก่)  $\rightarrow$   $f_s = F = 0 \rightarrow \max, f_{s,\max} = \mu_s N$   
 จลน์ (ไข่ไก่)  $\rightarrow$   $f_k = \mu_k N$



$$\theta = ? \text{ เช่น: โคลนจะ } \sim \text{ เมื่อ } F_{\min} = mg \sin \theta \text{ เช่น: } f_{s,\max} = \mu_s N \\ mg \sin \theta = \mu_s N \\ mg \sin \theta = \mu_s mg \cos \theta \\ \tan \theta = \mu_s$$

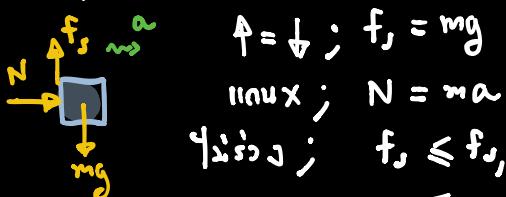


F ยุ่งๆ นั่งๆ = ? งาน W มีจ. ไม่รู้

Step 1: คิดทั้งหมด แบบ  $M+m$

$$F = (M+m)a$$

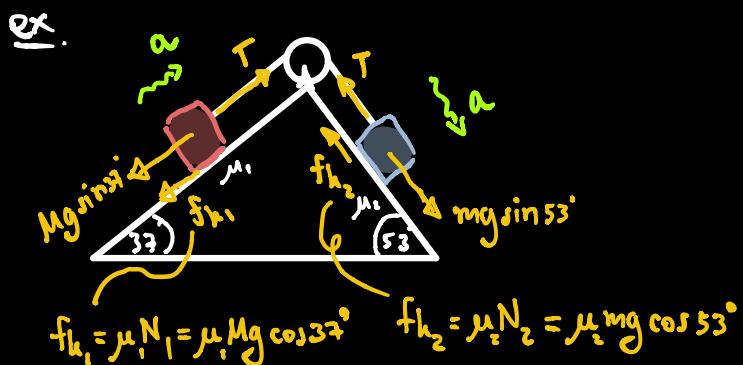
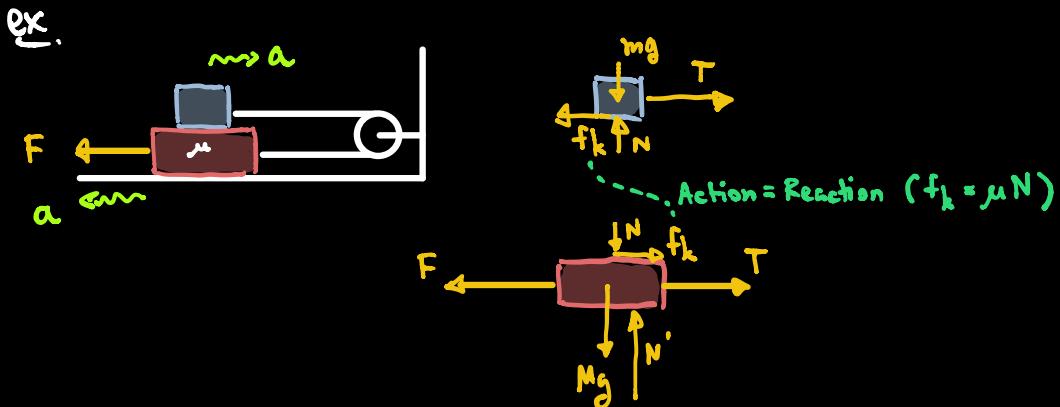
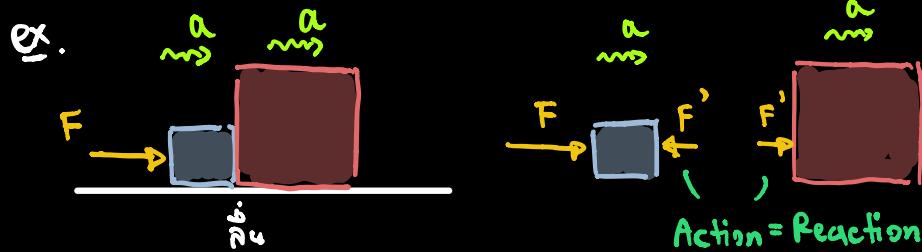
Step 2: คิดที่ m



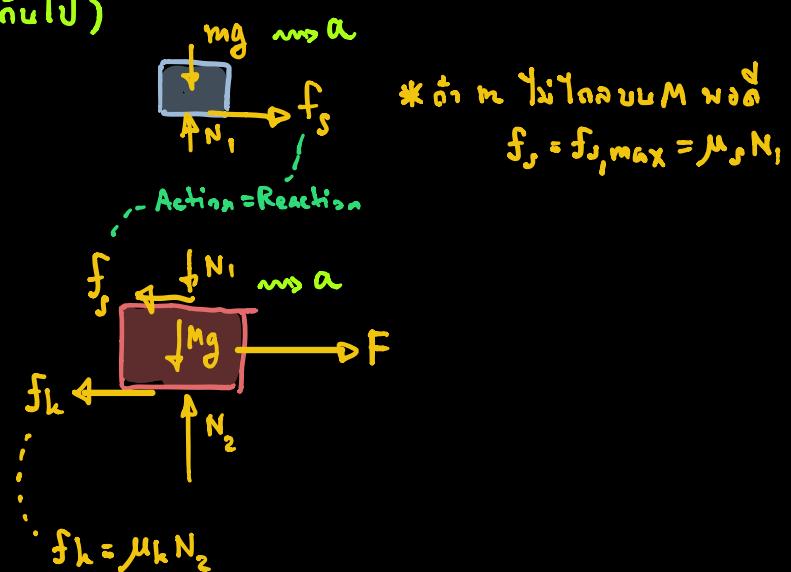
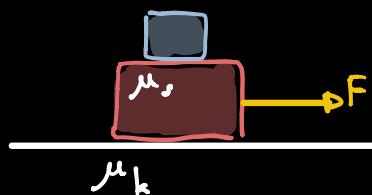
$$\uparrow = \downarrow ; f_s = mg \\ \text{โดย } X ; N = ma \\ \text{ไม่รู้ } ; f_s \leq f_{s,\max} = \mu_s N \\ mg \leq \mu_s ma$$

$$a \geq \frac{g}{\mu_s} \quad \therefore F = (M+m)a \geq (M+m) \frac{g}{\mu_s}, \\ F_{\min} = (M+m) \frac{g}{\mu_s}$$

### 3 វិបែកអាណាព → វគ្គុទេនីងហ៊ូវតែងសរុប a មានភាពពេញ



ex.  $\rightsquigarrow a$  (រវាងចំណែកថ្មី)



# [ SM<sup>64</sup>-Map : សមូល ]

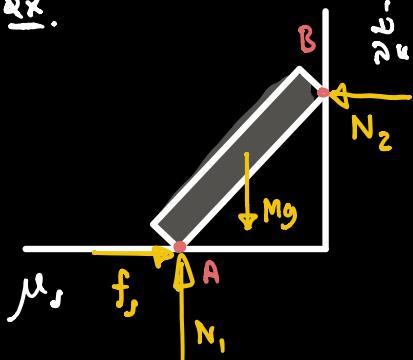
1 ចិត្តបន្ថែករប = នឹងបានអាមេរិក  $\times$  នៅក្នុងរដ្ឋបាន



$$\sum M_c = F \cdot \frac{d}{2} + F \cdot \frac{d}{2} = F \cdot d \quad \sum M_c = F \cdot D$$

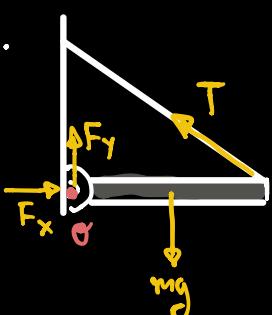
2 សមតុល្យចិត្តបន្ថែក នៅលើកណ្តាលទេរីក និងការប្រើប្រាស់ប្រព័ន្ធផ្លាមៗ

ex.



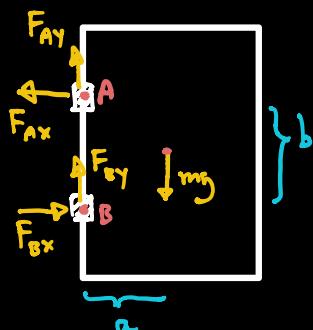
A នៅក្នុងតួនាទីចិត្តបន្ថែក និង f\_s, N\_1

ex.



$\Rightarrow$  ផ្តល់ឱ្យម៉ោងគំនិតចិត្តបន្ថែក  $F_x, F_y$

ex.



A ផ្តល់ឱ្យម៉ោងគំនិតចិត្តបន្ថែក  $F_{Ax}, F_{Ay}$  និង  $F_{By}$  (ឱ្យក្នុងរដ្ឋបាន A)

$$mg \cdot a = F_{Bx} \cdot b$$

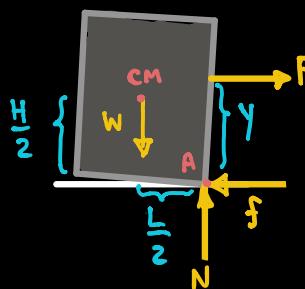
ទាក់ទងក្នុង  $\uparrow = \downarrow$   $\leftarrow = \rightarrow$

នៃការប្រើប្រាស់  $F_{Ay}$  និង  $F_{By}$  មានឯង

3

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## ៥) ទំនាក់ទំង្វើប្រចាំប្រាប់



$$\text{F.y} = W \cdot \frac{L}{2}$$

\* ကရင်းမှု၊ ပန်မြော်သွေ ၏=စာကဲ အောက် A ပြီးချေမှုပါ

$$\text{សំណុះដែលមានចាប់ពី } F \cdot y = W \cdot \frac{L}{2}$$

\* ក្រសួងគោរក តែនៅប៉ុណ្ណោះទៀត តែងតាំង CM ដែលជាមុនក្នុងការងារ

កំណត់ចំណាំក្នុងការងារ  $\sum M_{\text{ក្នុង}} = \sum M_{\text{ក្នុង}} \text{ ទៅ?}$

$$\text{ລັບນັດ: } F(y - \frac{h}{z}) + f(\frac{h}{z}) = N\left(\frac{1}{z}\right)$$

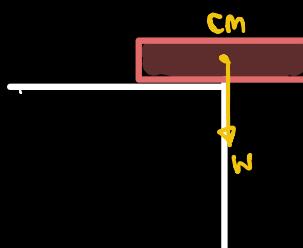
$$\sum F_x = ma$$

$$\uparrow = \downarrow ; \quad N = mg$$

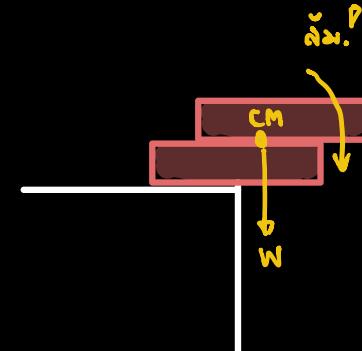
ii) ພັດທະນາ ໂດຍໄດ້ແຈ້ງຢູ່ໃນເວລືອນກົມ (ກໍາທົງລາຍ/ຕຣ) ແລະ ຊະບຽບ

8

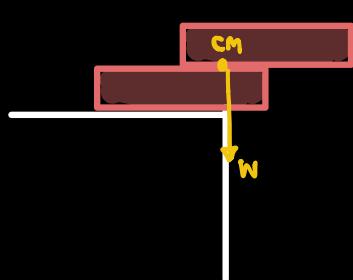
ព្រះសំងាល់



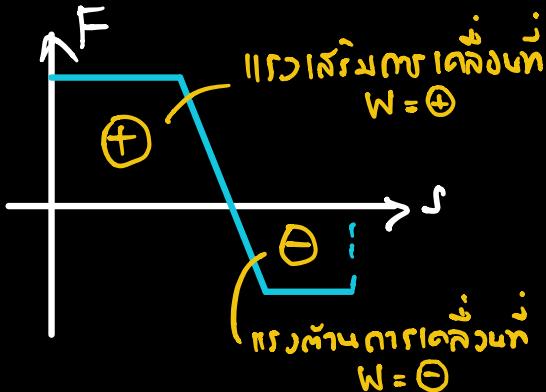
ੴ ਪ



ព្រះរាជាណាចក្រ



# 1 | በዚህ F-s (ሁኔታዎች) የF ከኩስ ስራ



$$W = F \cdot s ; \quad S = \text{ນກ.ໄຕຕອນ} F \cdot s$$

## ២ ក្រុងការ

The diagram shows a pulley system. A horizontal line at the top represents a ceiling. A pulley is attached to the ceiling by a string. A vertical line extends downwards from the pulley. Two masses, labeled  $m$ , are suspended from the vertical line by strings. The left mass has a dashed vertical line extending downwards from it, ending in a small box. The right mass has a solid vertical line extending downwards from it, ending in a small box. A person is shown pulling the string attached to the right mass upwards. A yellow arrow points upwards next to the person's hand.

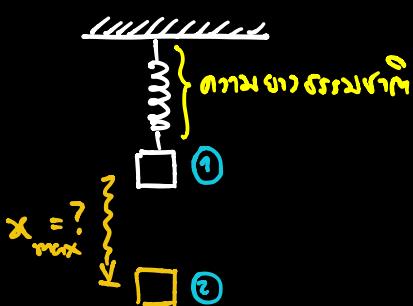
Trick:  $E_{\text{final}} = E_{\text{initial}} \Rightarrow \Delta E = E_{\text{final}} - E_{\text{initial}} = 0$

$$\therefore (\Delta E_k + \Delta E_p)_{\text{กล้อง}} + (\Delta E_k + \Delta E_p)_{\text{ตัว}} = 0$$

$$\left( +\frac{1}{2}Mv^2 + (-Mgh) \right) + \left( +\frac{1}{2}mv^2 + (+mgh) \right) = 0$$

ପ୍ରତିକ୍ରିୟା କାମନା ନିର୍ମାଣ  $\Rightarrow E_p$  ଲାଭ

ឧ. \* សំណើរាយ នានាចិនក្រុង ទោរយ៉ាវីមិនីតីមិនី ហារេបចុងមាននៅក្នុងទំនាក់ទំនង

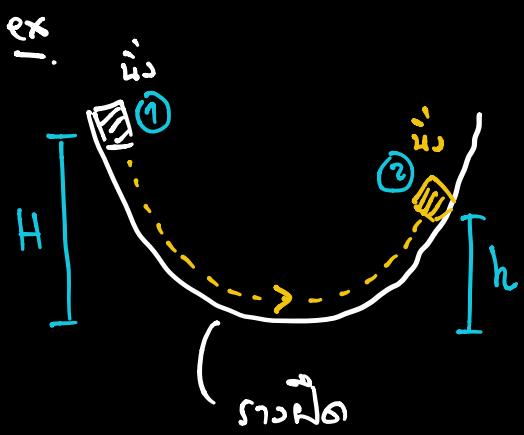


$$E_{\textcircled{1}} = E_{\textcircled{2}}; \quad mg x_{\max} = \frac{1}{2} k x_{\max}^2$$

$$x_{\max} = \frac{2mg}{k}$$

\* ຕ່າງໝາຍເນື່ອບໍ່ມາກັນດີກົບໄຕ້ງລັບ ປູ້ໃຫຍ່ ຕ່າງໝາຍ

ନେମାନିର୍ଦ୍ଦିତ କାହାର ପାଇଁ କାହାର କାହାର କାହାର ? (କାହାର କାହାର କାହାର ? )



$$W_{\text{รวมทั้งหมด}} = ?$$

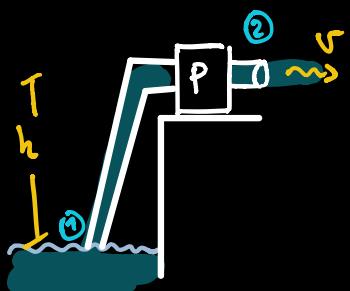
$$E_{②} = E_{①} + W$$

$$mg h = mg H + W_f$$

$$W_f = -mg(H-h)$$

↑  
เส้นงาน

ex. เครื่องสูบน้ำด้วยมอเตอร์



$$\text{กำลัง} = P = \frac{W}{t} = \frac{E_{②} - E_{①}}{t} = \frac{\left(\frac{1}{2}mv^2 + mgh\right) - 0}{t}$$

$$\therefore P = \frac{m}{t} \left( \frac{1}{2}v^2 + gh \right)$$

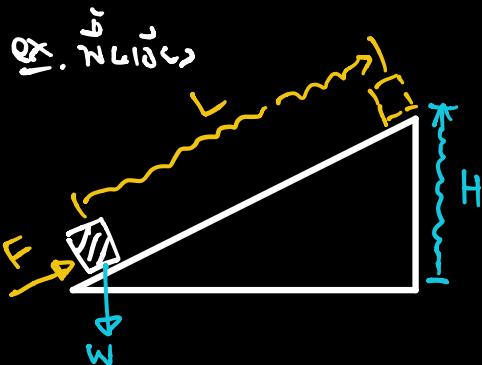
### 3 เครื่องบิน

\* กรณีดีไปรษณีย์ (M.A.) = ผ่อนแรงดึงเท่าไร =  $\frac{\text{น้ำหนักที่หักได้}}{\text{แรงทางเดียว}}$

\* ปรับสิ่งของ (Eff)  $\Rightarrow$  งานที่ รวมๆ บุคคลที่เป็นงาน คือ % ?

$$W_{\text{รวมทั้งหมด}} = (\text{Eff} \%) \times W_{\text{รวมทางเดียว}}$$

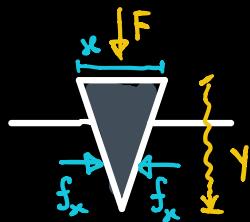
( ถ้า Eff = 100%  $\rightarrow$   $W_{\text{รวมทั้งหมด}} = W_{\text{รวมทางเดียว}}$  )



$$M.A. = \frac{W}{F}$$

$$\text{ถ้า } W \times H = (\text{Eff} \%) F L$$

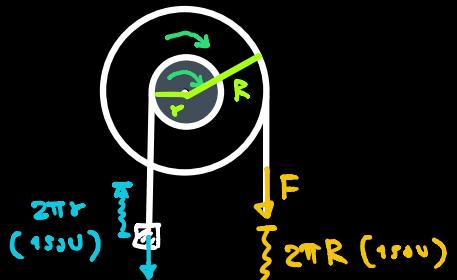
ex. ตอกกระซิบ



$$M.A. = \frac{f_x}{F}$$

$$\text{ถ้า } f_x \times x = (\text{Eff} \%) F \times y$$

ex. ลังเมล็ด

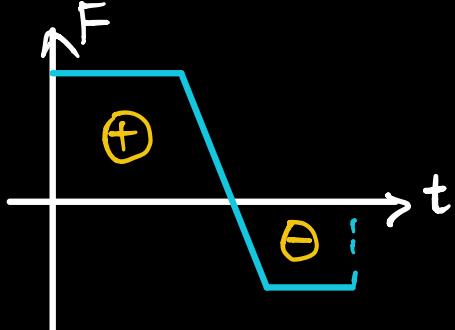


$$M.A. = \frac{W}{F}$$

$$\text{ถ้า } W \times 2\pi r = (\text{Eff} \%) F \times 2\pi R$$

# [ SM<sup>64</sup>-Map : խախնուն ]

## 1 กราฟ $\vec{F} \cdot t$ և սմագրություն



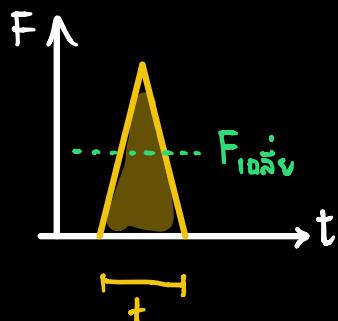
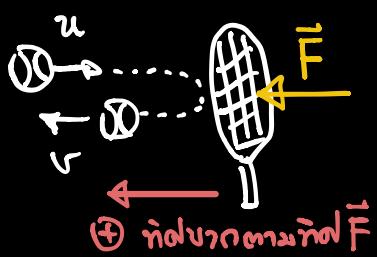
սմագրություն = վայելման վայելու պահանջման աճացում

$$\Delta \vec{P} = \vec{F}_{\text{սմագ}} \times t = N \cdot t \cdot \vec{F} \text{ ըստ գրաֆ } \vec{F} \cdot t$$

$$\sum \vec{F}_{\text{սմագ}} \times t = \vec{P}_{\text{սմագ}} - \vec{P}_{\text{սկզբ}}$$

\* au vector

օք.

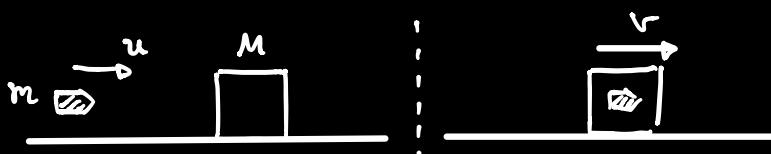


$$\begin{aligned} \vec{F}_{\text{սմագ}} \times t &= m \cdot \Delta = \vec{P}_{\text{սմագ}} - \vec{P}_{\text{սկզբ}} \\ &= (+mv) - (-mu) \end{aligned}$$

\* սմագ \* \*

## 2 դաշտ

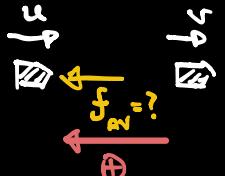
օք. բնածին վայելու ( $\sum E_k$  օճառ)



$$* սնրություն  $\vec{P} ; m u = (M+m)v$$$

\* գագաթի համարական  $t$  դիրքություն "աղջ" ըստ սահմանափակությունների  $f_{AV} = ?$

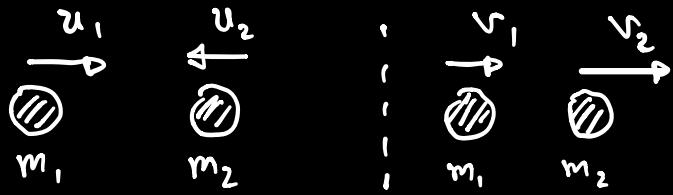
$$\rightarrow \text{ձևակերպություն} ; \sum \vec{F} \times t = \vec{P}_{\text{սմագ}} - \vec{P}_{\text{սկզբ}}$$



$$f_{AV} \times t = (-mv) - (-mu)$$

$$f_{AV} = \frac{m(u-v)}{t}$$

Ex. បុរិចំណែង (  $\sum E_k$  ទាំងពី)



\* ឈុរិចំណែង  $\vec{P}$ ;  $m_1 u_1 + m_2 (-u_2) = m_1 v_1 + m_2 v_2$

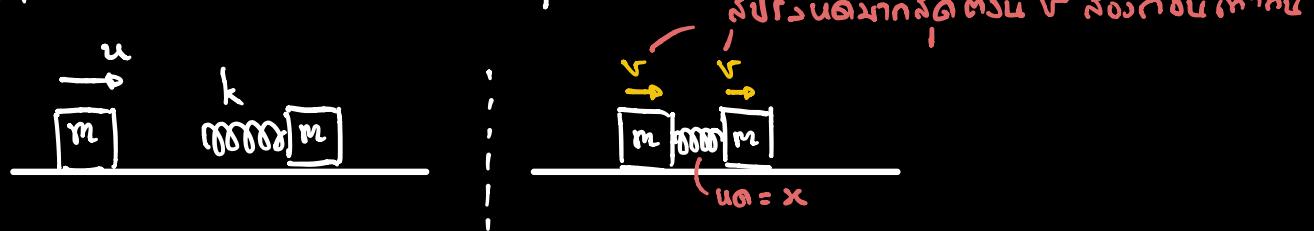
\* ចំណែងការ វិទ្យាល័យ 1942 សមារាប់

(i)  $\sum E_k$  ទាំងពី :  $\frac{1}{2}m_1 u_1^2 + \frac{1}{2}m_2 u_2^2 = \frac{1}{2}m_1 v_1^2 + \frac{1}{2}m_2 v_2^2$

(ii) ឯ៉ាងឱ្យ 1 នៃខាងលើ :  $\vec{u}_1 + \vec{v}_1 = \vec{u}_2 + \vec{v}_2$

$$u_1 + v_1 = (-u_2) + v_2$$

Ex. ទូទៅនៃវិសាវិជ្ជកម្មសរុប = ?

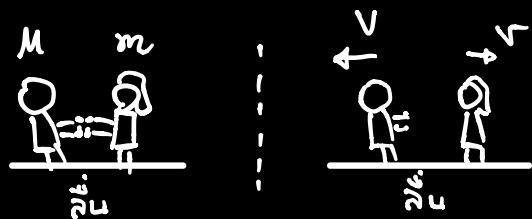


\* ឈុរិចំណែង  $\vec{P}$ ;  $mu = mv + m\bar{v} \Rightarrow \bar{v} = \frac{u}{2}$

\* ឈុរិចំណែង  $E$ ;  $\frac{1}{2}mu^2 = \frac{1}{2}mv^2 + \frac{1}{2}m\bar{v}^2 + \frac{1}{2}kx^2 \Rightarrow u = x\sqrt{\frac{k}{m}}$

(បានឈុរិចំណែងប៉ុណ្ណោះ)

Ex. បុរិចំណែង (កិត្តិយោប់បែង.)

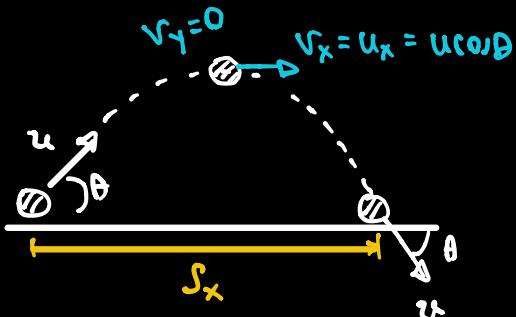


\* ឈុរិចំណែង  $\vec{P}$ ;  $0 = (-Mv) + (mv)$

# { SM<sup>64</sup>-Map : Projectile }

1

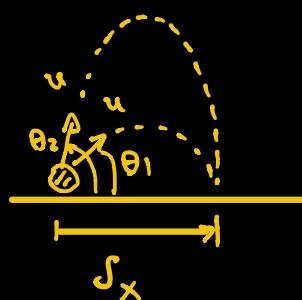
ជំនួយណា



\* វិវាទការណ៍, ដូច  $\vec{a} = \vec{a}_y = g \neq 0$

$$* s_x = \frac{u^2 \sin(2\theta)}{g}$$

$s_x$  ធានាដែល  $\theta = 45^\circ$

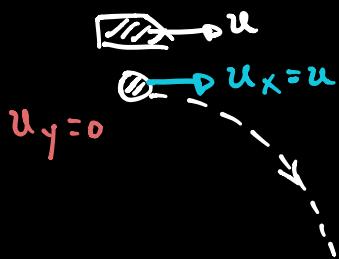


តាត  $\theta_1 + \theta_2 = 90^\circ$   
ប៉ុន  $\theta_1 = 30^\circ, \theta_2 = 60^\circ$   
នេះឱ្យ  $s_x$  ពេញ

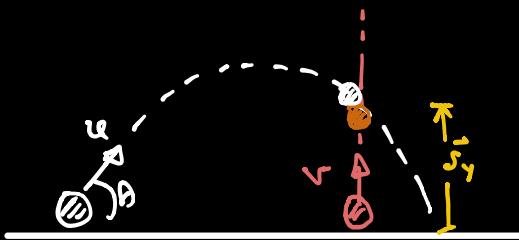
2

ឃាងវិកទាំងនៅសង្កែ

ex. បន្ទាប់ចាប់ឡាក់កែវិញបើ



ex. ចុះរឿងរាល់ ឱ្យវិទ្យាជាត់



វិត  $v_y$  ពេញនិយាយតាត ពេញនិយាយ និង  $\vec{a}_y = g$  និងចំណេះ

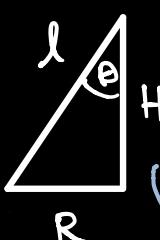
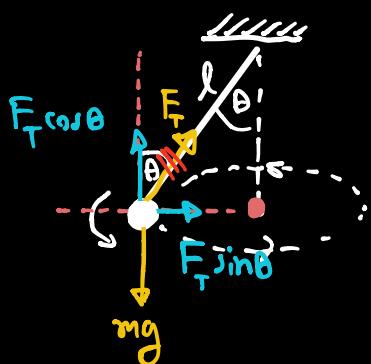
តាត  $s_y = u_y t + \frac{1}{2} a_y t^2$   $\therefore u_y$  ពេញនិយាយ

ចុះឱ្យ  $v = u_y \theta = u \sin \theta$

# [ SM<sup>64</sup>-Map : ຈົດນິມ ]

1 ຈົດນິມ ຮະບາບ ຢາບ ພົມຕາໂຮງ ວ ດັກ

Ex. ໄກສ່ວດກົງສ



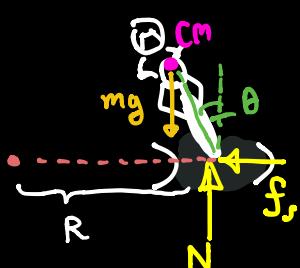
$$F_c = ma_c; \quad F_T \sin \theta = m \omega^2 R \quad | \div$$

$$\uparrow = \downarrow; \quad F_T \cos \theta = mg$$

$$\frac{R}{H} = \tan \theta = \frac{\omega^2 R}{g}$$

$$\therefore \omega = \sqrt{\frac{g}{H}} = \frac{2\pi}{T} = 2\pi f$$

Ex. ຂອບເຂດທີ່ໄດ້ເຫັນດີ



$$F_c = ma_c; \quad f_s = \frac{mv^2}{R}$$

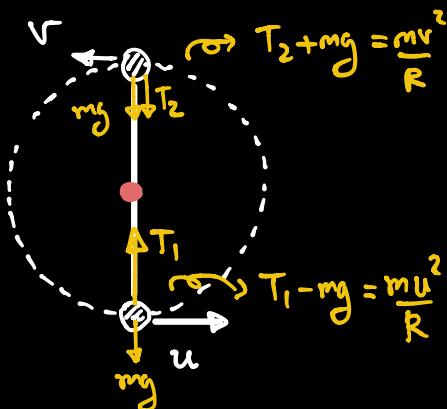
$$\uparrow = \downarrow; \quad N = mg$$

ກົງລັກດີ;  $\sum \vec{M}_{CM} = 0$  ໂດຍໃຫຍ້  $f_s + N$  ລົງຈະ CM ນຳດັບ.

$$CM \quad f_s \quad \rightarrow \tan \theta = \frac{f_s}{N} = \frac{\frac{mv^2}{R}}{mg}$$

$\tan \theta = \frac{v^2}{Rg} \Rightarrow$  ຖະກິດຕັ້ງເພື່ອ ດີວາກ  
ຈົງ = ປົກລັກດັບ.

2 ຈົດນິມ ຮະບາບ ຕົ້ນ ວ ຜົມຕາໂຮງ



\* ດັບຮັບຜົນ E;  $\frac{1}{2}mu^2 = \frac{1}{2}mv^2 + mg(2R)$

\* ດັກຮັບ  $\bigcirc$  ດຽວຮັບມາຄື

$\Rightarrow T_2 = 0$  (ເຫັນກັບນັງນັດຕີ່ກັບຄະນຸນັດ)

[ANS:  $u = \sqrt{5Rg}$  ແລ້ວ  $\bigcirc$  ດຽວຮັບ ນຳດັບ]

### 3) ॥ រូបន័យ ទំនាក់

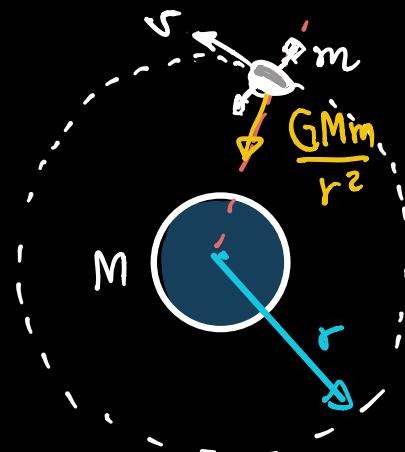
i) ពេលបានការណ៍  $mg = \frac{GMm}{r^2} \Rightarrow g = \frac{GM}{r^2}$

Ex.

$$g_1 = \frac{GM}{(4R)^2} = \frac{1}{16} g$$

$$g_2 = \frac{G(2M)}{(2R)^2} = \frac{1}{2} g$$

ii) តារាងការណ៍លទ្ធផល



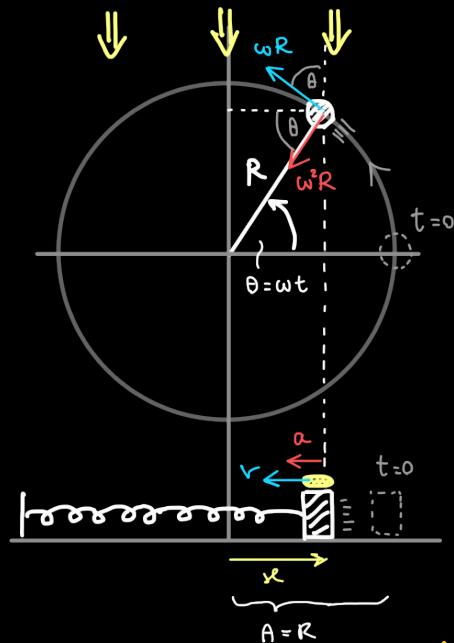
$$F_c = ma_c ; \quad \underbrace{\frac{GMm}{r^2}}_{v = \sqrt{\frac{GM}{r}}} = \frac{mv^2}{r} = m\omega^2 r$$

តើវាទីនៅលើនៅក្នុង?

# SM<sup>64</sup>-Map : Simple Harmonic Motion (SHM)



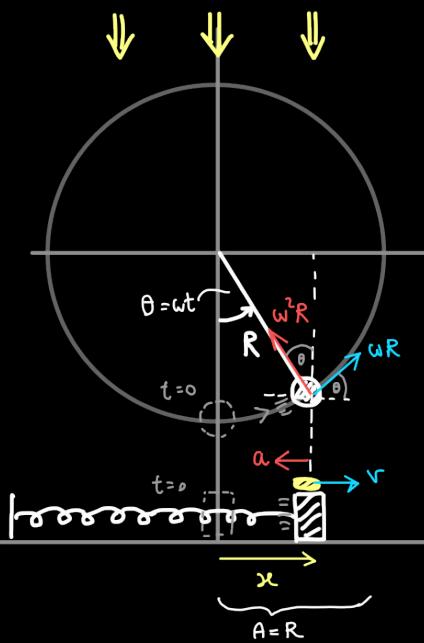
1 ເກີບເວັບດຸເລື່ອນທີ່ງການສັບກາຮັບແບບ Simple Harmonic  
ມຽນ 1: ທີ່  $t=0$  ດູກ  $x=A$



ຈາກນີ້:

$$x = R \cos \theta = A \cos(\omega t)$$

ມຽນ 2: ທີ່  $t=0$  ດູກ  $x=0$



$$x = R \sin \theta = A \sin(\omega t)$$

$$v = -\omega R \sin \theta = -\omega A \sin(\omega t)$$

$$v = \omega R \cos \theta = \omega A \cos(\omega t)$$

$$a = -\omega^2 R \cos \theta = -\omega^2 A \cos(\omega t)$$

$$a = -\omega^2 R \sin \theta = -\omega^2 A \sin(\omega t)$$

Trick: ລວມໄຫວ່າ  $t=0$  ດູກ  $x, v, a$  ຕາມເງິນໄຂຕັ້ງຕັບໄປນີ້ບໍ່?

ເຊັ່ນ  $x = A \cos(\omega t)$  ລວມໄຫວ່າ  $t=0$  ອີ່  $x = A$  ດ້ວຍຮັບ ມຽນ 1

Notes: i)  $\ddot{a} = -\omega^2 \ddot{x}$  ໃສນດ້ວຍຮັບ SHM

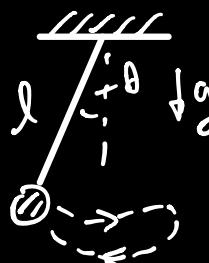
$$\text{ii)} \quad v^2 = \omega^2 (A^2 - x^2)$$

iii) ເຊັ່ນ  $\omega$  ຂີ່ "ຄວາມດີໃຈນັ້ນ"

$$\omega = 2\pi f = \frac{2\pi}{T}$$

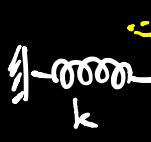
2

## ດាបការសំបុត្រ



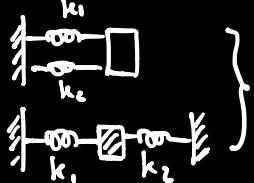
$$T = 2\pi \sqrt{\frac{l}{g}}$$

\* វិនិច្ឆ័យសំរាប់  
\* វិទ្យាដែលអារ៉ា រាល់  
θ លើក (≤ 10°)



$$T = 2\pi \sqrt{\frac{m}{k}}$$

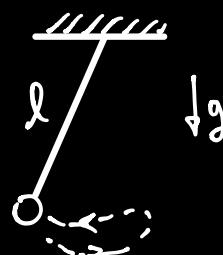
$$\frac{1}{k_{\text{សរុប}}} = \frac{1}{k_1} + \frac{1}{k_2}$$



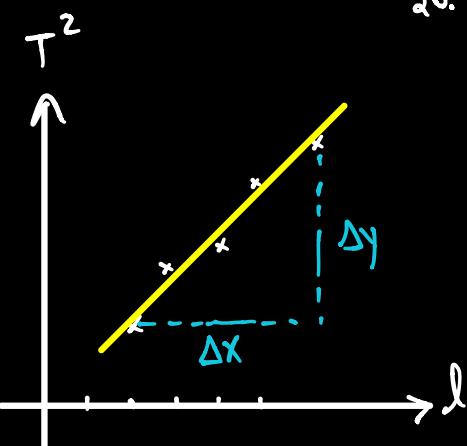
$$k_{\text{សរុប}} = k_1 + k_2$$

ឧ. ការសរុប និងការសម្រាប់ នាម g ដាក់ ការងារការណី

ចំណាំ 10T និង error ម៉ោង  $\frac{1}{10}$



$l (\text{cm})$	$\pm 0.4 \text{ cm}$	$\pm 0.04 \text{ s}$	$T$	$T^2$
10.0				
12.0				
...				
20.0				



$$\text{ជាសម្រាប់ } T = 2\pi \sqrt{\frac{l}{g}}$$

$$T^2 = \frac{4\pi^2}{g} l$$

Y      slope      X

$$\therefore \text{slope} = \frac{\Delta y}{\Delta x} = \frac{4\pi^2}{g}$$

នូវ slope នឹងម៉ោង?

☞ Note : ឃើញសំនួរការងាររួម

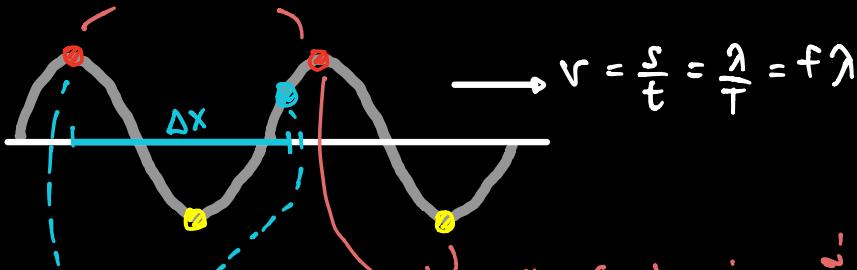
$$T = \frac{2\pi}{\sqrt{g}} \sqrt{l}$$

នូវការសរុបនៃការងារ  
T ជាមុន

នៅក្នុងការងារ នឹង  
 $\sqrt{l}$  ដើម្បីរាយការណី ?  
(មិនមែនសំនួរការងារ នឹង  $x = \sqrt{l}$  ទេ ?)

1 ດົມກາໂຮງດລົບ ແລະ ດາວວ່າເກີ

ຝນຕົວດູກ (  $\Delta\phi = \pm 45^\circ$  ແລ້ວ  $\pi = 0, 2\pi, 4\pi, \dots = 0^\circ, 360^\circ, 720^\circ \dots$  )



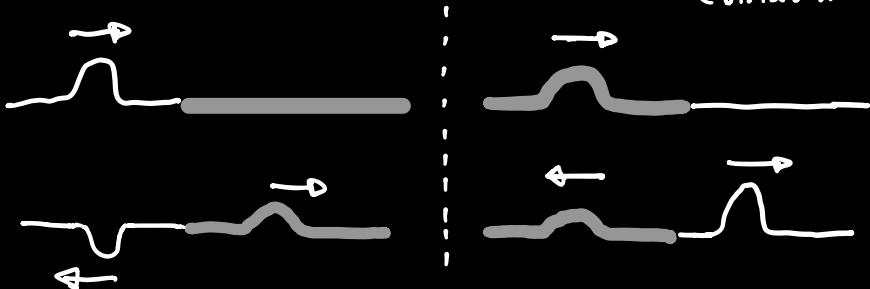
$$\text{ຄວາມທ່າງໜັນ } \Delta\phi = \frac{2\pi}{\lambda} \Delta x = \frac{360^\circ}{\lambda} \Delta x$$

$$184 \quad \Delta\phi = 2.5\pi = 2\pi + 0.5\pi \text{ အားလုံး } \Delta\phi = 0.5\pi = 90^\circ$$

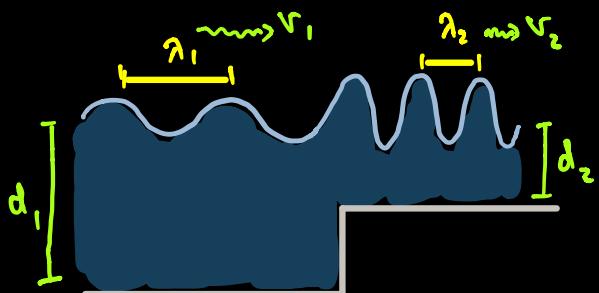
$$\Delta\phi = 7\pi = 6\pi + \pi \quad \text{ແກ່ມີມາ } \Delta\phi = \pi = 180^\circ \quad ]$$

๒ การบังคับใช้ ตั้งแต่เดือนธันวาคม พ.ศ.๒๕๖๔ เป็นต้นไป

i)  $\text{ເຮັດ} \rightsquigarrow \text{ໄລ້ແຍເສັນ}$  (Note :  $V_{\text{ເຮັດ}} = \sqrt{\frac{\text{ໄລ້ຕົ້ນເຫຼັກ}}{(\frac{\text{ນາລ}}{\text{ດາມຈຸງ})}}$ )



ii) น้ำ ๒) เป็นแรงโน้มถ่วง (Note:  $V_{\text{น้ำ}} \approx \sqrt{gd} \propto \sqrt{\text{ความลึก}}$ )



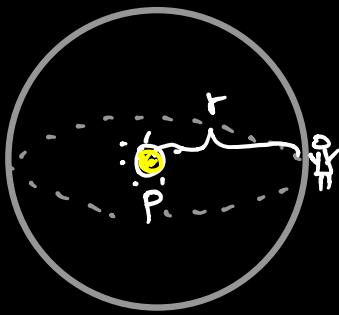
$$V_1 = f \lambda_1 = \sqrt{gd_1} \quad \text{and}$$

$$\frac{\sigma_1}{\sigma_2} = \frac{\lambda_1}{\lambda_2} = \sqrt{\frac{d_1}{d_2}}$$

$$d_1 \text{ גור} \rightarrow d_2 \text{ נושא} \Rightarrow \forall_1 \text{ גור} \rightarrow \forall_2 \text{ נושא} \Rightarrow \lambda_1 \text{ גור} \rightarrow \lambda_2 \text{ נושא}$$

# { SM<sup>64</sup>-Map : ເນັ້ນ }

## 1 ດາວມເຂັ້ມ (I) ວ. ລະດັບດາວມໄສລ (dB)



$$\text{ດາວມໄສລ} : I = \frac{P}{4\pi r^2}$$

$$\text{ລະດັບດາວມໄສລ} : dB = 10 \log \left( \frac{I}{I_0} \right) \quad (\text{ເລີຍເປົ່າ})$$

$I_0 = 10^{-12} W/m^2$

Notes: i) ເກື່ອນ dB 2 ຕ່າງແນວ  $dB_2 - dB_1 = 10 \log \left( \frac{I_2}{I_1} \right) - 10 \log \left( \frac{I_1}{I_0} \right)$

$$dB_2 - dB_1 = 10 \log \left( \frac{I_2/I_0}{I_1/I_0} \right) = 10 \log \left( \frac{I_2}{I_1} \right)$$

ii)  $\log a + \log b = \log(ab)$      $\log a^x = x \log a$   
 $\log a - \log b = \log \left( \frac{a}{b} \right)$

## 2 ປ្រາගුග්ගර්ල ດາວມເນລංචර් ແລ້ວ ໄທນໍ້າກාເນີຕາຕ්‍රේන්හේ ເກື່ອນ ຜຸ້ນັດ

$$f_L = \frac{(V_L + V_R)}{(V_L - V_R)}$$

$$f_L = \frac{(V_L + V_R)}{(V_L - V_R)}$$

$\begin{cases} \oplus & L \text{ ນໍາຂາວເວົາ } \\ \ominus & L \text{ ນໍາຂາວພື້ນ } \end{cases}$

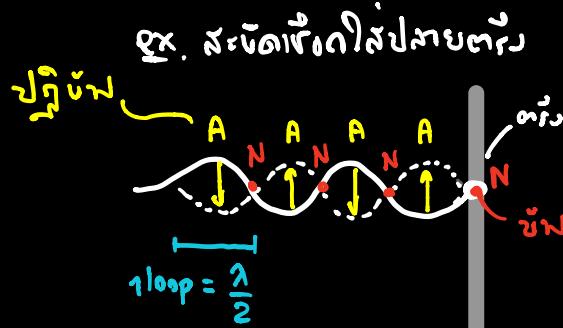
Trich: "ເຫັນຫາ"  $f_L$  ມາດ (ແທນນ)

"ນັ້ນຫາ"  $f_L$  ນັ້ນ (ຖືນ)

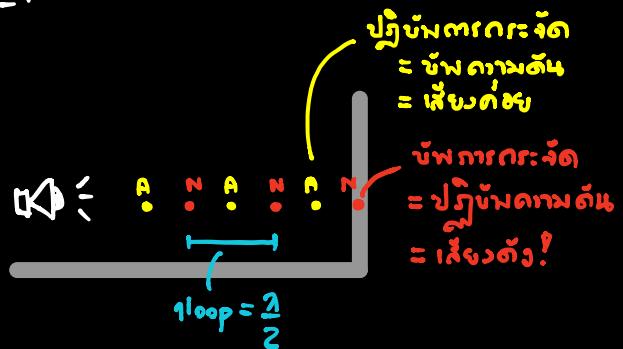
$\begin{cases} \oplus & L \text{ ນໍາຂາວພື້ນ } \\ \ominus & L \text{ ນໍາຂາວໄກ້ນາ } \end{cases}$

3

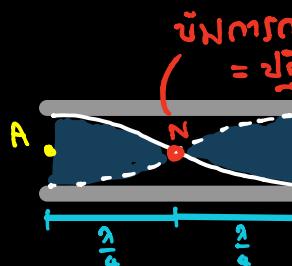
### 3. คลื่นบั่น



Ex. เปิดเส้นเชือกค้ำแข้ง

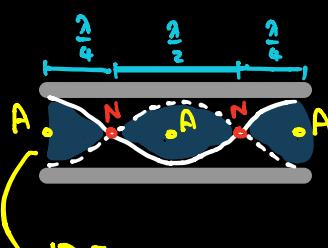


Ex. ถนนค้ำทึบ



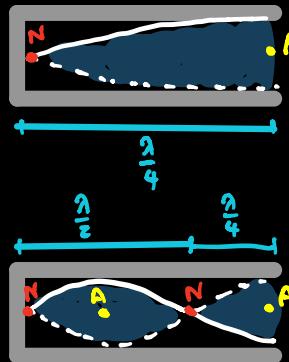
$$f_1 = \frac{v}{\lambda} = \frac{v}{2L}$$

$(L = \frac{\lambda}{2} \Rightarrow \lambda = 2L)$



$$f_2 = \frac{v}{\lambda} = \frac{v}{L} = 2f_1$$

$(L = \lambda)$



$$f_1 = \frac{v}{\lambda} = \frac{v}{4L}$$

$(L = \frac{\lambda}{4} \Rightarrow \lambda = 4L)$



$$f_3 = \frac{v}{\lambda} = 3\left(\frac{v}{4L}\right) = 3f_1$$

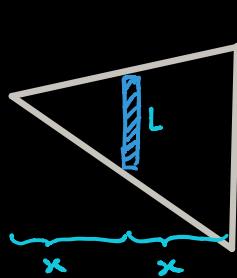
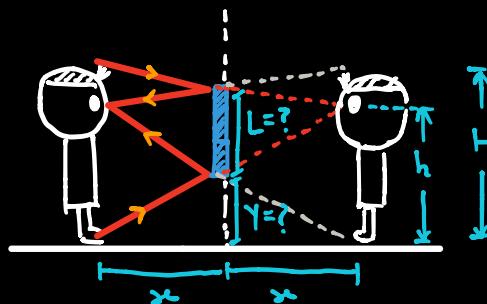
$(L = \frac{2\lambda}{6} \Rightarrow \lambda = \frac{4L}{3})$

\* ถนนปลาดุก 1 ตัว

มีอีก  $f_2, f_4, \dots$

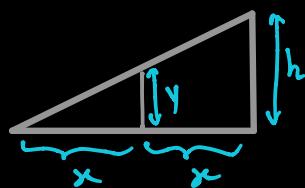
# [ SM<sup>64</sup>-Map : ເສດວິທີ ເຮັດວຽກ ]

## 1 ດາວໂຫຼນຕັ້ງເປົາ/ກົມຄຣະຈົກໄດ້ນັດ



Δກັບຍຸ

$$\frac{L}{H} = \frac{x}{2x} \rightsquigarrow L = \frac{H}{2}$$



Δກຳລັງ

$$\frac{y}{h} = \frac{x}{2x} \rightsquigarrow y = \frac{h}{2}$$

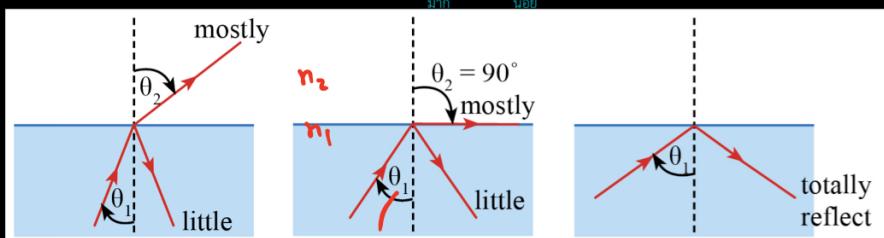
ດ້າຕາງໆຢູ່ຂັ້ນ ກົບ ຮະໂຣ = x

∴ ກົມຄຣະຈົກ L ສັນໄປ  
ແລະ /ນີ້ອ່ານວ່າມີຢູ່ສູງ/ຕໍ່ໄປ  
ຕໍ່ອີນເພີ່ມ x ກົມມີມັງ,  
ເນື່ອໄວ່ເຕັມຕັ້ງ

## 2 ດາວັດໃດເນີນ ( $\text{Snell} : \frac{n_2}{n_1} = \frac{\sin \theta_1}{\sin \theta_2} = \frac{v_1}{v_2} = \frac{\lambda_1}{\lambda_2}$ ; f ລວມເດີນ)

① ສ້າ  $\theta_{\text{ທຶກຮະບົບ}} > \theta_{\text{ວິກຊຸດ}}$  → ສະຫຼອນກັບໜົມຄຣະຢ່າງໃນ

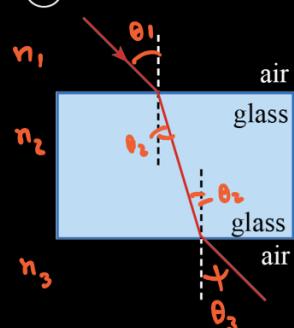
\*\*\*ເກີດໄດ້ເພາະກຣົນແສງ move ຈາກ  $n_1$  ມາໄໝ →  $n_2$



$\theta_1 = \theta_c \sim$  ຂູນວິກຄົນ

$$\frac{n_2}{n_1} = \frac{\sin \theta_2}{\sin \theta_1}$$

② ແສງຜ່ານທົກລາງທ່າຍຂັ້ນທີ່ມີວິຂະນານກັນ



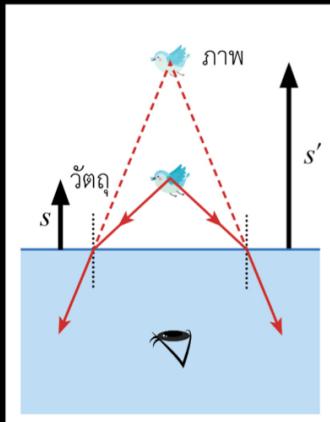
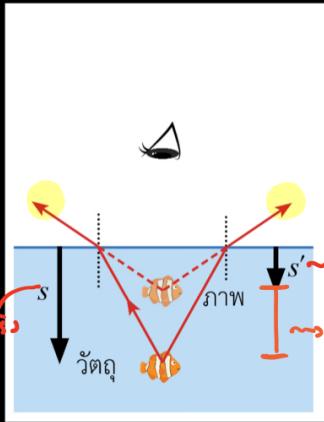
$$\frac{n_2}{n_1} = \frac{\sin \theta_1}{\sin \theta_2} \quad \text{ໄລຍະ} \quad \frac{n_3}{n_2} = \frac{\sin \theta_2}{\sin \theta_3}$$

$$\therefore n_1 \sin \theta_1 = n_2 \sin \theta_2 = n_3 \sin \theta_3$$

Note ດ້ວຍ  $n_1 = n_3$

$\theta_1 = \theta_3 \rightsquigarrow$  ຕັ້ງ ຂະນາຍ

3 ลีกจริง/ลีกป่ากุ้ง



กฎ  
ลีก  $\frac{s'}{s} = \frac{n_{\text{น้อย}}}{n_{\text{มาก}}} \rightarrow \text{บวก}$   
"ปานะน้ำตื้น"

กฎ  
ลีก  $\frac{s'}{s} = \frac{n_{\text{มาก}}}{n_{\text{น้อย}}} \rightarrow \text{บวก}$   
"น้ำปานะโลก"

### 3 กรณีเลนส์

$$m = \frac{I}{O} = \frac{s'}{s} = \frac{s' - f}{f} = \frac{f}{s - f}$$

$|m| > 1$  ภาพขยาย  
 $|m| < 1$  ภาพย่อ

+		วัตถุจริง ด้านแสงเข้า	ภาพจริง - หักกระจาก - หลังเลนส์
-		วัตถุเสมือน ตรงข้าม ด้านแสงเข้า	ภาพเสมือน - หักกระจาก - หน้าเลนส์

บล็อกสูตรเก่า ที่  $m = \frac{s'}{s}$

ถ้า  $s' = \Theta$  (กรณีสั้น)  $\rightarrow m = \Theta$  ด้าน

บล็อกสูตรใหม่ ที่  $m = -\frac{s'}{s}$

ถ้า  $s' = \Theta$  (กรณีสั้น)  $\rightarrow m = \Theta$

\* รากฐานสั้น หา เลนส์ไว้

$f = \Theta$   
รากด  
 $\frac{1}{s'} = \Theta / (f - s')$   
 $s' = \Theta / (f - \Theta)$

รากฐานยาว หา เลนส์คุ้ม

$f = \Theta$   
รากด  
 $\frac{1}{s} = \Theta / (f + \Theta)$   
 $s = \Theta / (\Theta - f)$

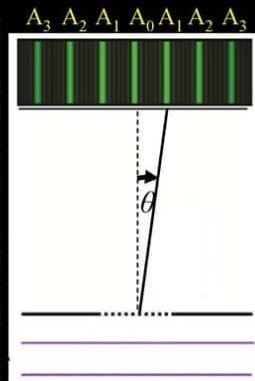
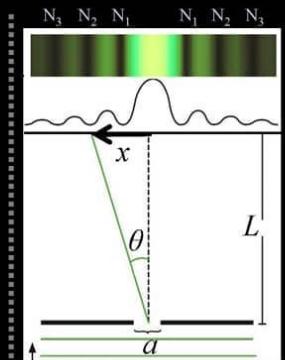
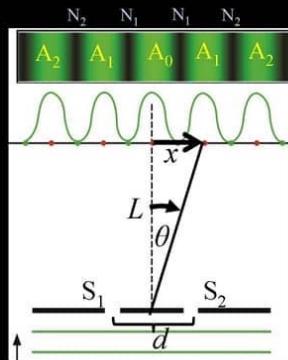
# { SM<sup>64</sup>-Map : ເສັ່ນເຫັນລົງ }

1

ສລົມດູ

ສລົມເດືອນ

ເກຣມົກ



$$\text{Path Diff (PD)} = |S_1 P - S_2 P| = d \sin \theta \approx d \frac{x}{L}$$

ໄດ້ບສ່ວງ (A)  $d \sin \theta = n \lambda$

ໄດ້ບມືດ (N)  $d \sin \theta = (n - \frac{1}{2})\lambda$

\*หากແລ້ວພິສຕຽນຂັ້າມ ສູດທາ A ກັບ N ລັບກັບ

\*ກາງຈານວະແບບແກນ  $\theta = 90^\circ$  ອ່າສັນຍາ-ຂວາ & A<sub>0</sub>

ໄດ້ບມືດ (N)

$$a \sin \theta = n \lambda$$

\*ຫາຄວາມກວ້າງໄດ້ບສ່ວງ  
ຈາກຮະຍະ N ກີ່ຕິດກັນໄດ້

ໄດ້ບສ່ວງ (A)

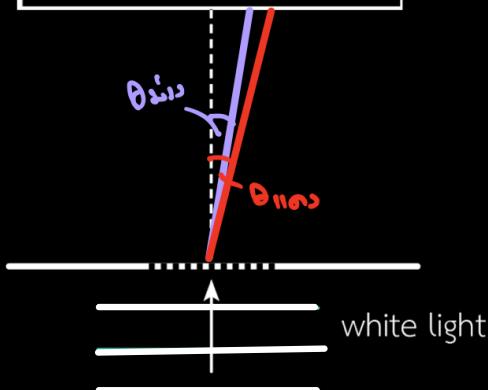
$$d \sin \theta = n \lambda$$

ຄວາມກວ້າງ 1 ຊ່ອງຍ່ອຍ

\*ເກຣຕີຕັງໄຢັດແສງຫາວ

ເປັນສະເປົດຮັນຮຸງໄດ້

i) ດາວໂຫຼນ ຂາຍໃນເກຣມົກ  $\rightarrow$  ໄບກັນ ມີ spectrum ຖີ



$$d \sin \theta_{\perp} = n \lambda_{\perp}$$

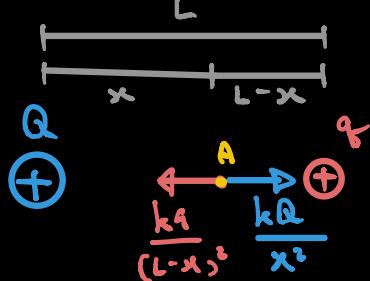
$$d \sin \theta_{\parallel} = n \lambda_{\parallel}$$

ii) ສລົມດູ ມີ ຂາດຊັ້ນໃຫຍ່ກ່າວ ກ  $\rightarrow$  ເກີດຮັນຮຸນສິຫາເດືອນ "ຕຽບ" ສລົມດູ

# [SM<sup>64</sup>-Map : ឯកសារណ៍]

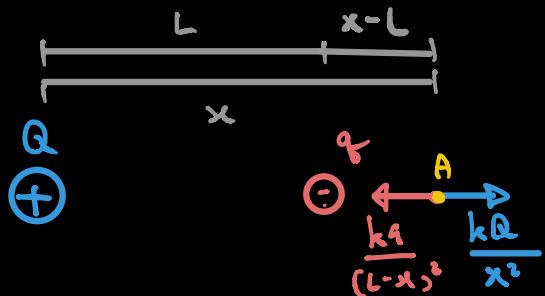
## 1 បានបានឯកសាររុវ / ឥន្ទំឯកសាររុវ

ex. ឧបនេះទិន្នន័យ = ទិន្នន័យ  $\vec{E}_{\text{ext}}$  បែងចុះ



$$\text{ឧបនេះទិន្នន័យ} \quad \frac{kq}{(L-x)^2} = \frac{kQ}{x^2}$$

$$V_A = \frac{k(+q)}{(L-x)} + \frac{k(+Q)}{x}$$



$$\text{ឧបនេះទិន្នន័យ} \quad \frac{kq}{(x-L)^2} = \frac{kQ}{x^2}$$

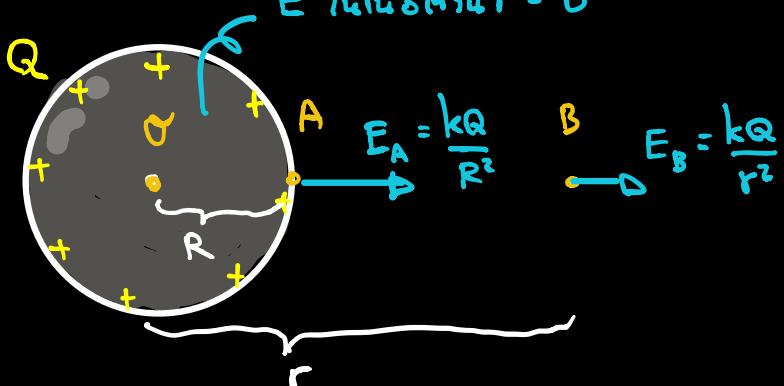
$$V_A = \frac{k(-q)}{(x-L)} + \frac{k(+Q)}{x}$$

Trick: ឧបនេះទិន្នន័យ ឱ្យលើ ប្រាងទីន៍មួយ ឯកសារលើកក់រា

(តើក៏  $|q| < |Q|$  ឧបនេះទិន្នន័យ (ពាណិជ្ជ) នៃប្រឈឺក់ នូវមានការងារ  $Q$ )

## 2 គុណវិវត្ថិភាព

$$\vec{E}_{\text{ជួលិំចុះ}} = 0$$



$$* V_B = V_A = \frac{k(+Q)}{R} * \quad V_B = \frac{k(+Q)}{r}$$

### 3 ក្រោរោងទេសចរណ៍

Ex. អាជីវិតនៃការ  $A \rightarrow B$  ពីរបាល = ?



$$E = \Delta V/d$$

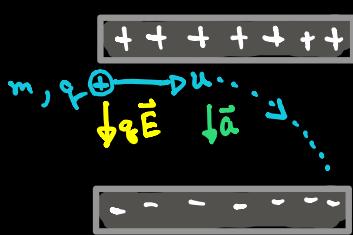
$$q_B = q_A + W$$

$$W = q_F(V_B - V_A) = q_F \Delta V = q_F E d$$

(ដែលបានបង្កើតឡើងនៅក្នុងការគារ)

[Note:  $W_{\text{រក្សាសម្រាប់}} = -W_{\text{បានរក្សាសម្រាប់}}$ ]

Ex. ក្រោរធម៌រ៉ូប៊ី Projectile



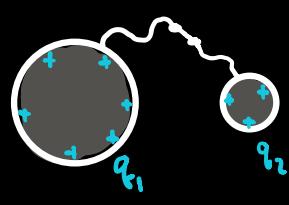
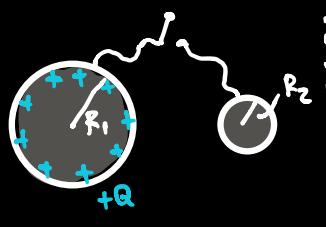
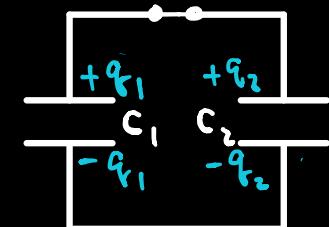
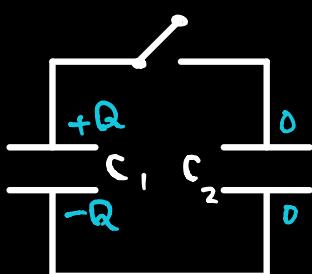
$$\sum \vec{F} = m\vec{a}; \quad q_F \vec{E} = m\vec{a} \Rightarrow \vec{a} = \frac{q_F \vec{E}}{m}$$

ទៅនេះថា Projectile នឹងបាន  $a_y = g$  ជាលើស

(ដូចនេះ  $\frac{q_F}{m}$  នឹងធ្វើឱ្យភាព នៅក្នុងក្នុងផ្ទាល់រួម)

ចរណ៍នេះបានបង្កើតឡើងនៅក្នុងក្នុងផ្ទាល់រួម  $= 10^9 \text{ N/C}$

### 4 រូបរាងក្នុងក្នុងក្នុង



ឈូរិបីប្រជុំ:  $Q = q_1 + q_2 \rightarrow (1)$

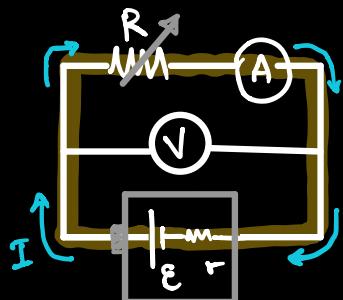
ផ្ទាត់ខ្លួន:  $V_1 = V_2$   
 $\frac{q_1}{C_1} = \frac{q_2}{C_2} \rightarrow (2)$

ឈូរិបីប្រជុំ:  $Q = q_1 + q_2 \rightarrow (1)$

ផ្ទាត់ខ្លួន:  $V_1 = V_2$   
 $\frac{kq_1}{R_1} = \frac{kq_2}{R_2} \rightarrow (2)$

# [SM<sup>64</sup>-Map : ຝັ້ນົມກະຕິໄລຍະ]

1 ເບີໂຫຼວງ ຂໍຕາມດ້ວຍການນອບໃບ

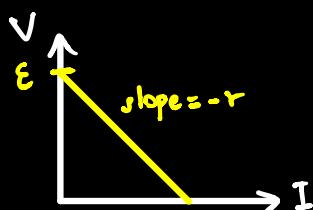


ກູ່ສອງ 0 Ohm;

$$\epsilon = I R_{\text{series}} = I(R+r)$$

$$\epsilon = (IR) + Ir = V + Ir$$

ເຕັມໆ  $V$  ອໍານົດ

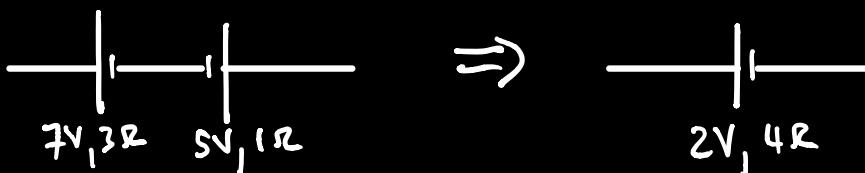
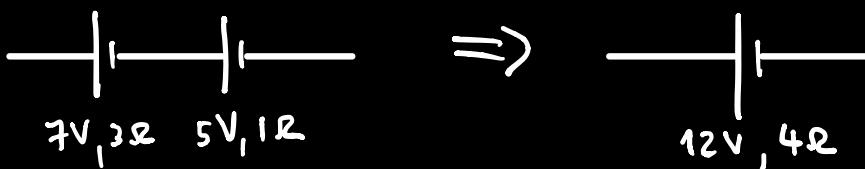


$$\therefore V = -rI + \epsilon$$

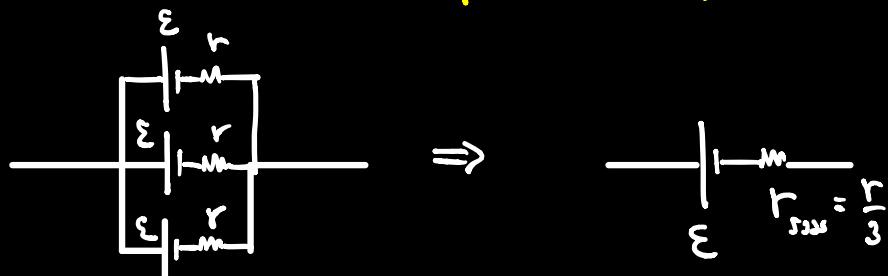
$V$  (slope)  $\times$  (ຈຸດຕະຫຼາດຍ)

2 ຢົມໄປໄຫຼວງ ບລາຍດັບ

i) ນັບການ



ii) ຂະແໜນ ແລ້ວ ເປັນຕົ້ນໃຫຍ່ລົກງົດ ແຕ່ລະດົງນ 3, 2 ຕັ້ງກ່າວກັນ



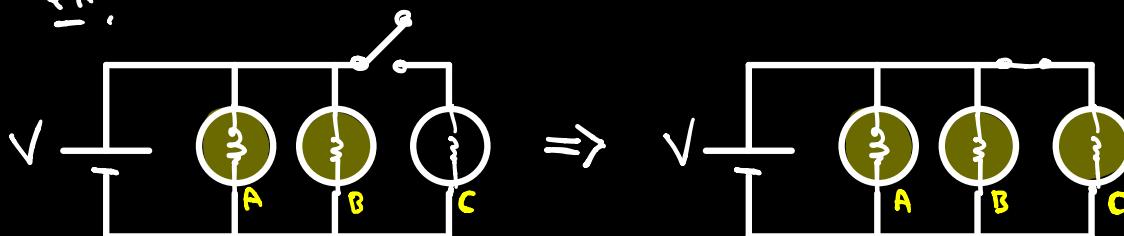
$$\left( \frac{1}{R_{\text{series}}} = \frac{1}{r} + \frac{1}{r} + \frac{1}{r} = \frac{3}{r} \Rightarrow R_{\text{series}} = \frac{r}{3} \right)$$

### 3 กាល្បីអង្គ

i) ឱ្យនេសតុល្យ ~ ការងារងារ  $\propto P = I^2 R = \frac{V^2}{R}$

(បន្ទាន់ពេលវេលាដែលក្នុងរ៉ាការ  $\propto R$  ឱ្យ)

នៅ.



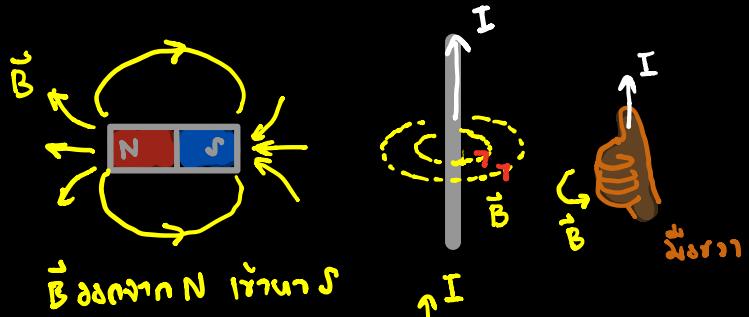
\* លេងទៅ A, B សង្ឃោះថាកំណែងសំបន់ទៅ  
នៅ:  $V = V_{\text{ប្រភេទ}} : (3 \text{ រ៉ាក})$  នៅរៀង.

ii) ស្របតាមទីតាំងអង្គ នៃ តម្រូវតិច R តើដឹងជាកំណែង V នៅនី

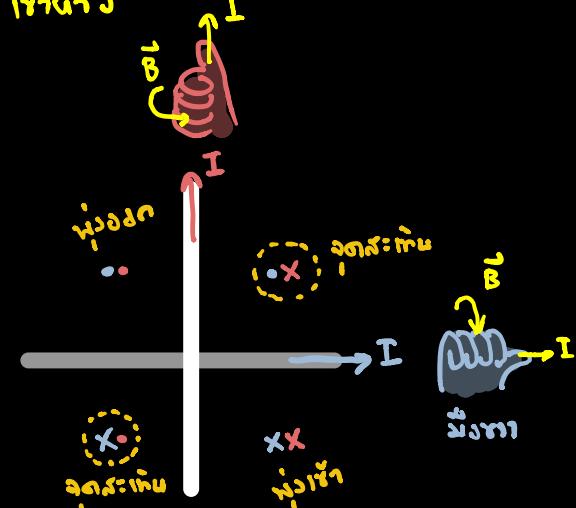
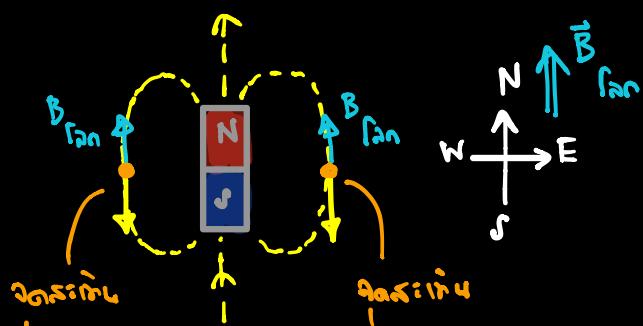
$$\text{នាម R នៅ } P_{\text{spec}} = \frac{V_{\text{spec}}^2}{R}$$

{ $\text{SM}^{64}$ -Map : នីតុវក្ស }

## 1 ບານນາມໄມ່ເກົ່າສັນຍະ

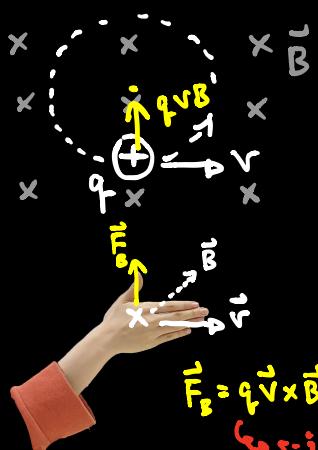


$$\text{Ex. } \text{ຈົດສະໜຸມ } \tilde{B}_{5,2} = 0$$



2 ປະຈຸບັນໄຟຟ້າ ດີ ເຕັມບໍ່ ໄກສຍາມມູນເຫດດ ປ

i) එහි ප්‍රතිඵලීය වාසුදේව ප්‍රතිඵලීය මූල්‍ය නොවා ඇත.



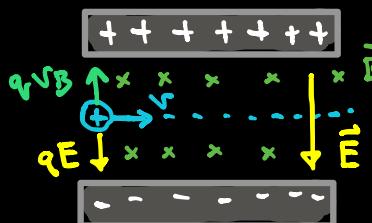
$$F_c = m a_c; \quad q_r v B = \frac{mv^2}{R} \quad \text{so} \quad R = \frac{mv}{q_B}$$

$$\text{मग्नीटिक दूरी } T = \frac{S_{\text{एसडी}}}{V} = \frac{2\pi R}{V} = \frac{2\pi m}{qB} \quad \text{जहाँ } q \text{ चुम्बकीय वर्गमूल}$$

$$\vec{F}_B = q \vec{v} \times \vec{B}$$

ମୁହଁରାଜୁଙ୍କ! ଗର୍ବ ପ୍ରଦାନ ହେଉଥିଲା ଗନ୍ଧନ୍ତି, ଫିରୁ ହେଠାଂ ଉଲ୍ଲଙ୍ଘିତ କମ୍ବାର୍ଜନ ରାଜସ୍ବ!

ii) ປະຈຸດັ່ງທີ່ໃຫຍ່ໄວ້ນິກົມ ແລະ ບໍ່ໄດ້ເປັນເວັບໄວ້



$$\sqrt{100} \approx 10$$

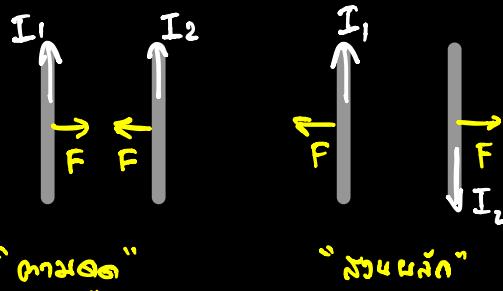
$$qV\beta = qE$$

$$V = \frac{E}{B}$$

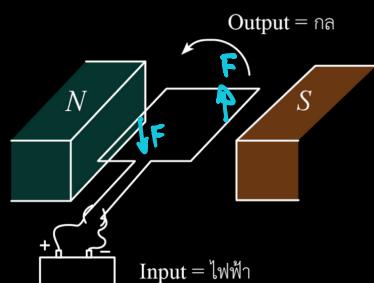
3

### ឧបត្ថម្ភ

i) លាកសារដែលបាន



ii) Motor

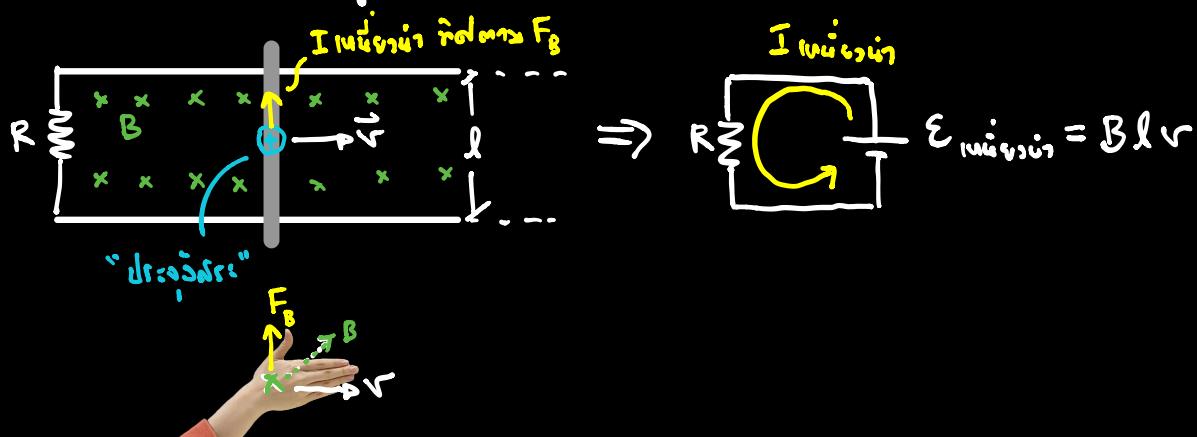


$$M_{\text{ការ}} = NIAB \cos \theta$$

ការបង្រុងការនៃទេសចរណ៍  
ការនៃ ស្វែងរកដែល  
"ដោយ ទេសចរណ៍"  
(សម្រាប់ទេសចរណ៍  
ដីអេឡិចត្រូនុក)

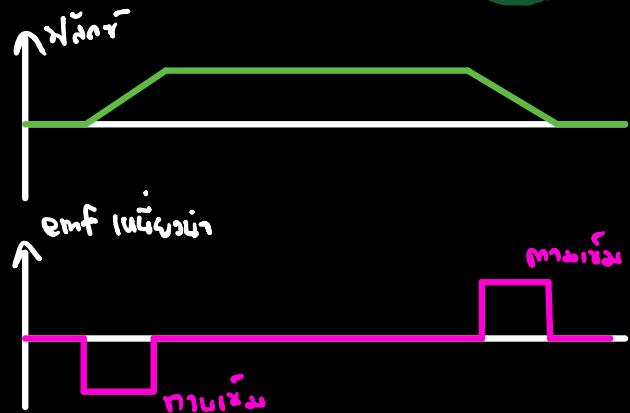
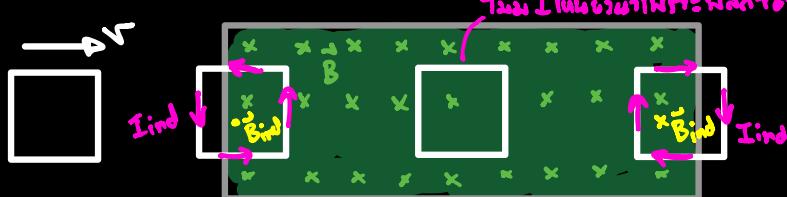
ស្វែងរកដែល  
ដីអេឡិចត្រូនុក

iii) តុលធម៌លីដៃប្រារាំងដែលបាន



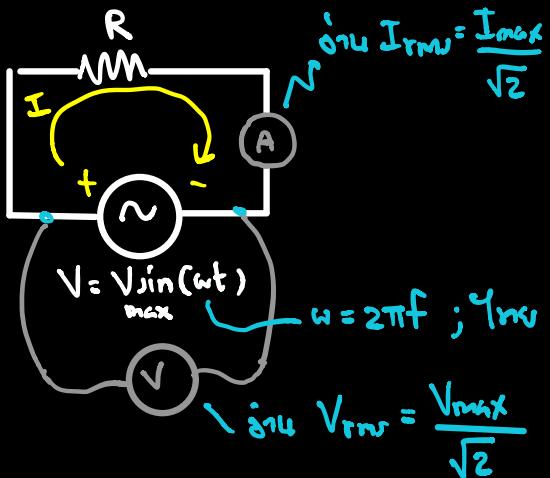
iv) ទូរសព្ទការផ្តល់ប្រាក់នៃហាម ឬ អេឡិចត្រូនុក

មួយតុលធម៌លីដែលមានការផ្តល់ប្រាក់



# [SM 64] Mag : [ฟังก์ชัน และ วัสดุ]

1 ดำเนินกระแส = ดำเนินไฟ ?



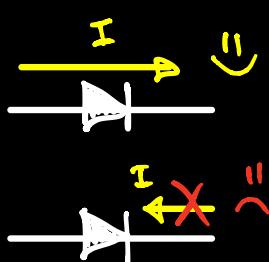
$$\text{กฎ Ohm: } I = \frac{V}{R} = \frac{V_{max} \sin \omega t}{R}$$

$$I = I_{max} \sin \omega t$$

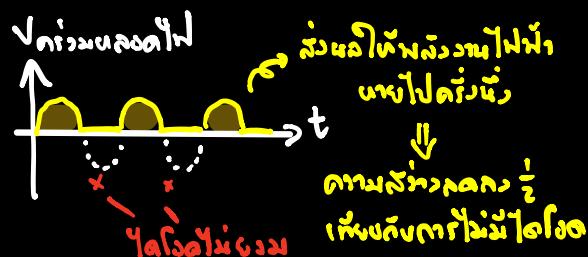
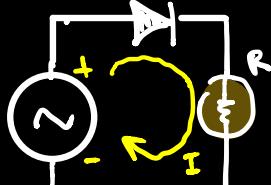
คำนวณไฟฟ้า :  $P = I_{rms} V_{rms}$  (ตัวปั๊บ กับ ค่าไฟฟ้า)

ถ้า  $V_{rms}$  และ  $R$   
แล้ว  $I_{rms} = 1$

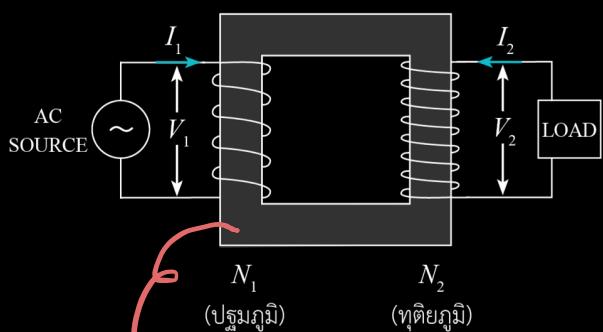
2 วงจรไฟฟ้า



ex. วงจรเรียบไฟ



3 匝数比 ไฟฟ้า ไฟฟ้า  $V$



เส้นสัมภาระภายในเหล็ก  
เนื่องจาก "กรานิต" (eddy current)

$$* V \propto N$$

$$\frac{V_2}{V_1} = \frac{N_2}{N_1}$$

$$* \text{ถ้า Eff} = 100\%$$

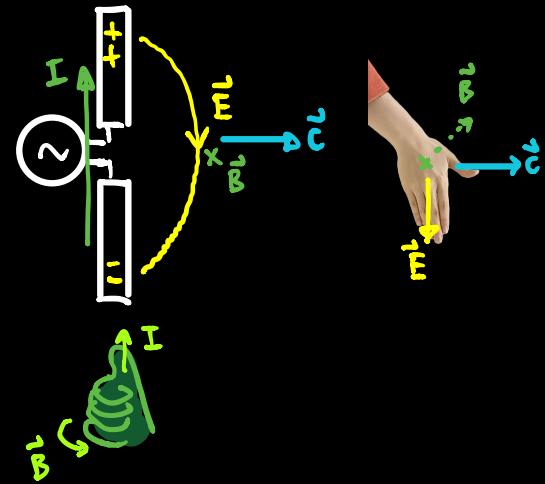
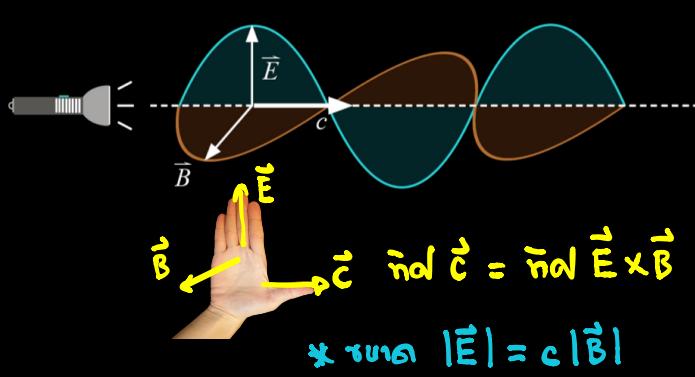
$$I_1 V_1 = I_2 V_2$$

$$* \text{ถ้า Eff} \neq 100\% \quad (\text{ถ้า Eff} = 80\%)$$

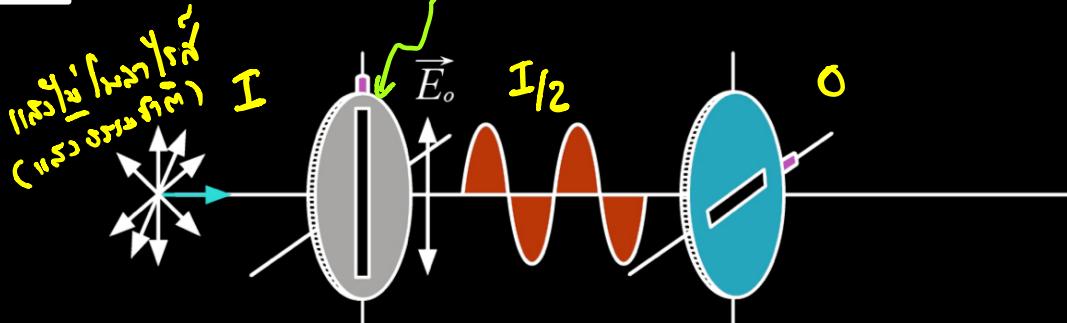
$$I_2 V_2 = \frac{80}{100} I_1 V_1$$

# [SM<sup>64</sup>-Map : ດາວໂຫຼນເຫັນເຫດກຳມັນ]

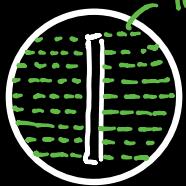
1 ດາວສົມັນນີ້ກ່ອນການຄົບປະກິດຕື່ມີ ກັບ ກົດສະນາ  $\vec{E}$  ແລະ  $\vec{B}$



2 ແຜນໂນຫາຮູບສັດ



ແນວດີເອົາຮັບຕັ້ງໂນໂລຢູ່ທີ່ອຸດຫັນ ສາວີມັນ  $\vec{E}$



3 Spectrum

Gamma Ray



ຈັດງົງ  $f$  ສູງ

X-Ray



violet  $\lambda \sim 400nm$   
red  $\lambda \sim 700nm$

Ultraviolet



Light



Infrared



Microwave



Radio waves



\* WiFi = ດາວໂຫຼນກູມຄາມດັ່ງນັ້ນ ( $2.4GHz$ ,  $5GHz$ )  
ອາຈັດເປັນເບັນໄວໂຄຣອັນກົດ

\* AM vs FM

AM

ປົວ Amplitude

FM

ປົວ Frequency



ສົ່ງໄສໄກລາເທຣະ:  
ສະກັນຍອດເຫັນໄດ້  
ໄຕດູກົບການງານ  
ກົມໄດ້

ດູກອນໄດ້ຫາກ  
ແຕ່ສະກັນຍອດ  
ກົມໄດ້

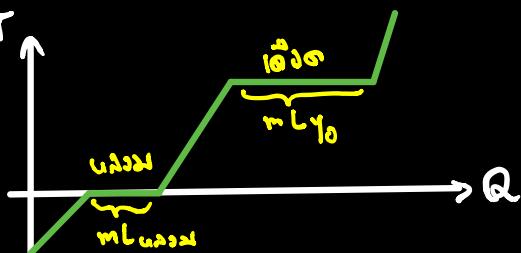
$\left. \text{SM}^{64}\text{-Map} : \text{ດາມວັນນະກົດ} \right\}$



$$\boxed{1} \text{ תגבורת (Q)} \begin{cases} \Delta T \sim Q = mc\Delta T = cAT \\ \Delta \text{טמפרטורה} \sim Q = mL \end{cases}$$

$$\text{i) சுடப்பு } Q_{T_{\text{நீண்ட}} \text{மு} = Q_{T_{\text{கிடைக்கிற}}} \text{விவ}$$

ii)  $\Delta H$  vs. Q



iii)  $E_{\text{g}} \approx Q$  (Resonant Unit Energy =  $E_{\text{g}}$  សមដូច J)

四

$$m \quad \begin{matrix} u \\ \rightarrow \end{matrix} \quad - \quad \boxed{\begin{matrix} f \\ f \end{matrix}}$$

గండులు లేని  $E_k$  ఏమి కిలోగ్రాములు

๒ | ॥ กัฟ

i) Before - After  $\Rightarrow$  የጊጌዎች የሚታወቁ በኋላ

Ex.

$P_i = 6 \text{ atm}$

$T_i = 27^\circ\text{C}$

$P_i$

$T_i = 127^\circ\text{C}$

$$PV = nRT \quad \text{and}$$

as  
also

ການດັນສູງບ່ຽນ ?  
kelvin ?

$$\frac{P_2}{P_1} = \frac{T_2}{T_1}$$

$$\frac{P_2}{6 \text{ atm}} = \frac{400 \text{ K}}{300 \text{ K}} \Rightarrow P_2 = 8 \text{ atm}$$

Note:  $P_{\text{inj}} = P_{\text{gas in CN}} - P_{\text{surround}}$

$$\text{ex. } P_{\text{in}_2} = P_2 - P_{\text{surround}} = 8 \text{ atm} - 1 \text{ atm} = 7 \text{ atm}$$

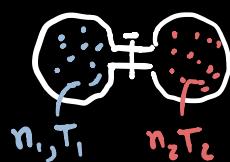
ex. ॥ଗୁରୁଜାଗଗୁରୁ ॥ ଶିତ୍ତଃପ = ॥ଗୁରୁପେଣ୍ଠିଗଲୁ

A hand-drawn diagram illustrating a chemical reaction or equilibrium. It shows two separate containers, each containing a dark grey square representing a molecule and several small black dots representing atoms. The left container is labeled  $n_1$  above it and has the equation  $T_1 = 72^\circ\text{C}$  below it. The right container is labeled  $n_2$  above it and has the equation  $T_2 = 172^\circ\text{C}$  below it. An arrow points from the left container to the right one, indicating a process where molecules from the left container move to the right container, as shown by small black dots appearing near the right container's base.

$$PV = nRT \quad \text{and} \quad n_1 T_1 = n_2 T_2$$

প্রমুণ অবস্থা

ii) ແກ້ນົມ ໂດຍ ດ້ວຍເປົ້າໄຟ້/ໄຟ້ເສັງ ໂດຍຮະບູນໃໝ່ ຈາກ/ແຕ່



$$\sum U_{\text{ດ້ວຍເປົ້າ}} = \sum U_{\text{ແຕ່}}$$

$$\frac{3}{2}n_1RT_1 + \frac{3}{2}n_2RT_2 = \frac{3}{2}(n_1+n_2)RT_{\text{ຮະບູນ}}$$

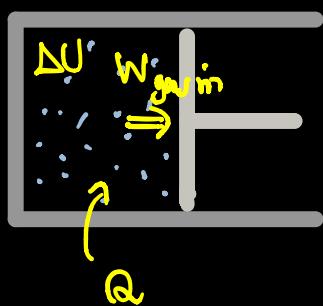
\* ເພີ້ມທີ່ກຳນົມຮູບແບບໄດ້ມາ ແກ້ນົມຈະເຄື່ອງເສັງເສີມໃຫ້  $U = \frac{3}{2}nRT$  ໄດ້

3

ນິຍົມທີ່ 1 ແກ້ໄຂ ມີໄດ້ມີກົດ

ກຳລັງດ້ວຍເປົ້າ

$$U = \frac{3}{2}PV = \frac{3}{2}nRT \rightsquigarrow \Delta U = \frac{3}{2}nR\Delta T$$



$$Q = \Delta U + W$$

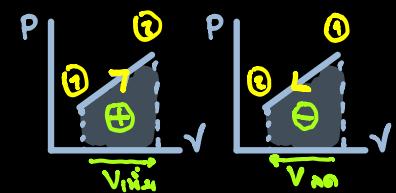
ແກ້ນົມທີ່

$\oplus$ ໃກ້	$\oplus$ $T \uparrow$	$\oplus$ $V \uparrow$
$\ominus$ ໂດຍ	$\ominus$ $T \downarrow$	$\ominus$ $V \downarrow$

ກຳປົດທີ່  $W = P\Delta V$

ກຳປົມທີ່

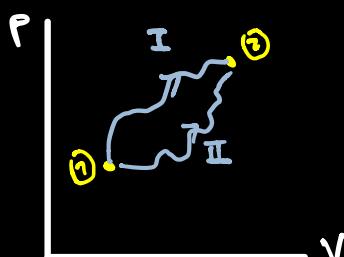
$W = \text{ມາດີຕັກການ } P \cdot V$



$$* W_{\text{ຂະນະກົດ}} = -W_{\text{ແກ້ນົມທີ່}} *$$

ດົກການ P-V

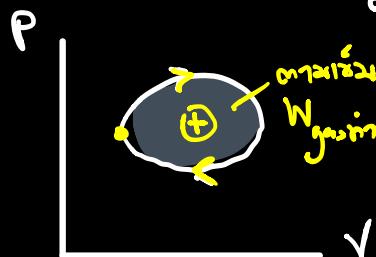
i) ເສັກການ ດຣະນາບໂກ



ກຳ ①  $\rightarrow$  ②

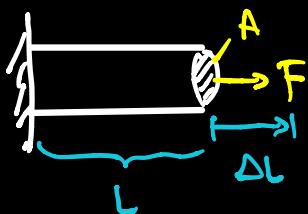
- $\Delta U_I = \Delta U_{II} = U_{\text{②}} - U_{\text{①}}$  ບໍ່ມີຮັບສິນໄສເບີກ
- $W_I \neq W_{II}$  (ເນກະມາດີຕັກການຢູ່ແກ້ນົມ)
- ຄູ່ນີ້  $Q_I \neq Q_{II}$  ຈົດ  $Q = \Delta U + W$

ii) ເສັກການຫ້າກູງເປັນວົງຈົກ



# Ե SM<sup>64</sup>-Մագ : Շահակա Շատեր Հօնիքներ

## 1 Young's Modulus.

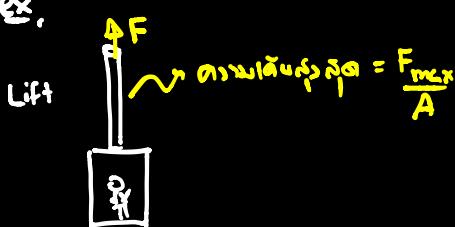


$$\frac{F}{A} = Y \frac{\Delta L}{L}$$

$$\Rightarrow \Delta L = \frac{FL}{YA} = \frac{F}{Y_A}$$

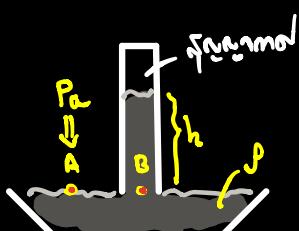
61

Ex.



## 2 Դաշտը և ջաւառա թերմա յանակը յանաւանդության վեցունկություն

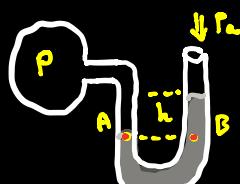
Ex. Երկարություն



$$P_A = P_B$$

$$P_A = \rho g h$$

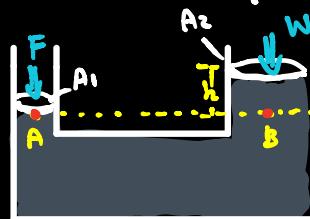
Ex. Առաջնական



$$P_A = P_B$$

$$P = P_0 + \rho g h$$

Ex. Կրույս պարունակ (Հյուսնածն)

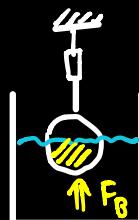


$$P_A = P_B$$

$$P_A + \frac{F}{A_1} = P_B + \frac{W}{A_2} + \rho g h$$

## 3 Ուղարկող լուսա յանառներ

i) Եթե յանառն առ ուղարկություն



$$F_B = \rho_{\text{լուս}} V \rho g$$

ii) Տաք ջաւառն առ ուղարկություն  $F = \gamma L$



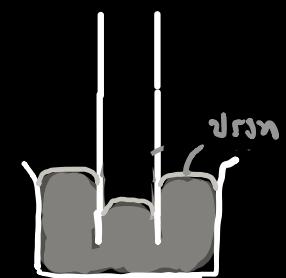
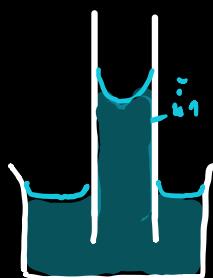
$$L_{\text{տաք}} = 2(a+b)$$



$$L_{\text{տաք}} = 2a + 2b$$

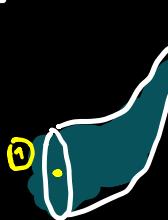


$$L_{\text{տաք}} = 2a + 2b$$



4

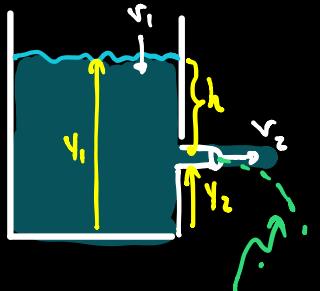
## ຈຸດປະນົດ



\* ສົມຕາຮັດຕາມເຖິງ:  $\frac{V}{t} = A_1 v_1 = A_2 v_2$

\* ໄບຮົບໜີລື່ມ:  $P_1 + \rho g y_1 + \frac{1}{2} \rho v_1^2 = P_2 + \rho g y_2 + \frac{1}{2} \rho v_2^2$

## ຂໍ. ກາໂຮຣ່າໝວດ



\*  $A_1 v_1 = A_2 v_2$  ໂດຍ  $A_2 \ll A_1$

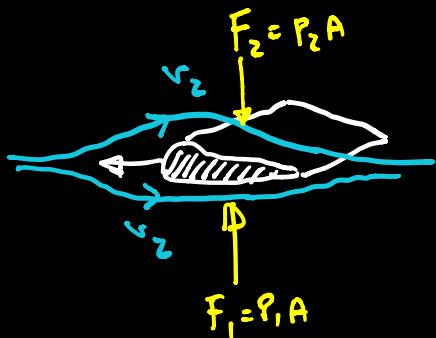
$\downarrow \uparrow$  ປະເມີນ  $v_1 = 0$  ໃຫຍ້  $P_1 = P_a$

\*  $P_1 + \rho g y_1 + \frac{1}{2} \rho v_1^2 = P_2 + \rho g y_2 + \frac{1}{2} \rho v_2^2$

ດັ່ງນີ້  $v_1 \approx 0$  ໂດຍ  $v_2 = \sqrt{2gh}$

ຄ່າ projectile ຕົ້ນດີ

ຂໍ. ເກົ່າງຂົບປົງ (Note: ຈະຕູງ ມັຕະນາຍ ອລາງໄຫ້ ເກົ່າງແລ້ວ ດັ່ງນີ້)

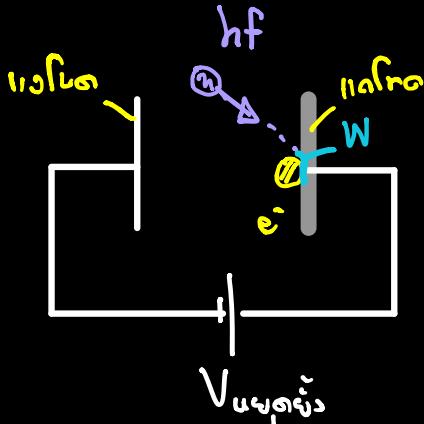


~~$P_1 + \rho g y_1 + \frac{1}{2} \rho v_1^2 = P_2 + \rho g y_2 + \frac{1}{2} \rho v_2^2$~~

ດ້ວຍ  $v_2 > v_1 \rightarrow P_1 > P_2$  ເກົ່າງຢັດ

# [ SM<sup>64</sup>-Map : វិនិកសេរី = លាន ]

1 ប្រភពភាពសំណង់អំពីការរៀបចំសេរី ( Note:  $E_{\text{Energy}} = hf = \frac{hc}{\lambda} = \frac{1240 \text{ eV} \cdot \text{nm}}{\lambda \text{ nm}}$  )



Key: 1 photon  $n=1$  = 1 electron

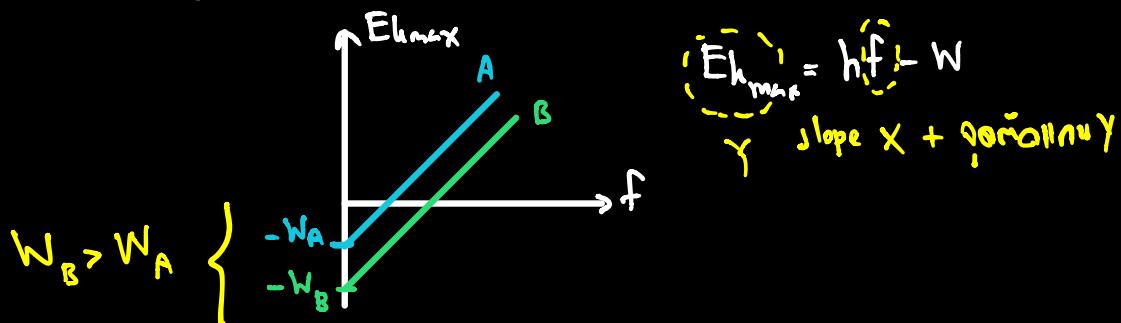
តើ  $hf < W \rightarrow e^-$  មិនបាន

តើ  $hf = W \rightarrow e^-$  បានបែងចែក ឬបី  $E_k = 0$   
[f ខ្លួនខ្លួន]

តើ  $hf > W \rightarrow e^-$  បានបែងចែក  $E_k$  ឡើង

$$eV_{\text{ឱ្យទូទៅ}} = E_{k_{\text{max}}} = hf - W$$

Notes i) របាយ  $E_{k_{\text{max}}} \text{ vs. } f$

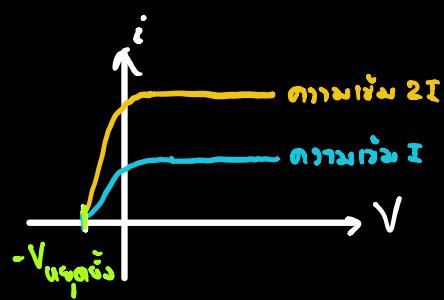
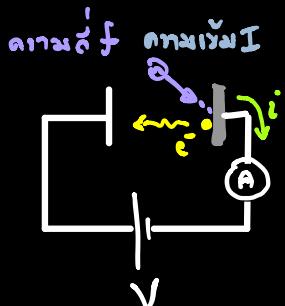


ii) ដំឡើងការងារ ឬស = ដំឡើង សំណង់សំណង់  
ទៅ

\* តើ  $f < f_{\text{ខ្លួនខ្លួន}}$  នៅក្នុង  $e^-$  មិនបានបែងចែក

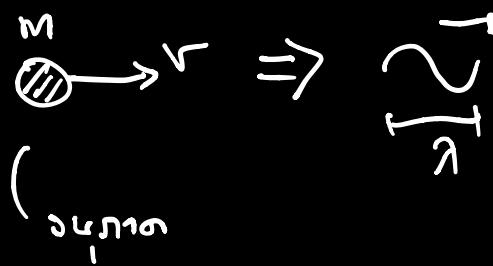
\* តើ  $f > f_{\text{ខ្លួនខ្លួន}}$  នៅក្នុង  $e^-$  មិនបានបែងចែក ឬបី  $E_k = 0$

PAT2 តាមទី → iii) របាយការងារ ឬ សំណង់សំណង់



2

## ការបង្ហាញលើនៃបរិស្ថាន



$$\lambda = \frac{h}{p} = \frac{h}{mv}$$

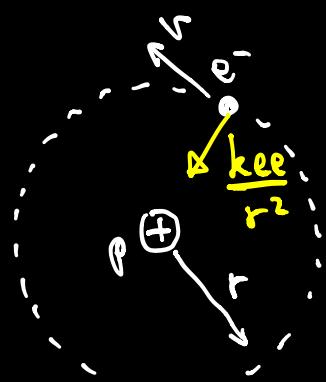
$v_{\text{ឈូរ}} \neq v_{\text{តុលា}}$  ?

\* លទ្ធផល (ឈូរតុលាការ)  $\lambda = \frac{h}{p}$  || នៃ  $E = \frac{hc}{\lambda} = p \cdot c$

$$p = \frac{h}{\lambda}$$

3

## បេងចាយនីតិវិធី $\rightarrow$ Hydrogen Atom



$$F_c = ma_c ; \frac{ke^2}{r^2} = \frac{mv^2}{r} \rightarrow (1)$$

$$\text{ឡើង} ; z\pi r = n\lambda_e = n\frac{h}{mv} \rightarrow (2)$$

$\downarrow n=1,2,3,\dots$

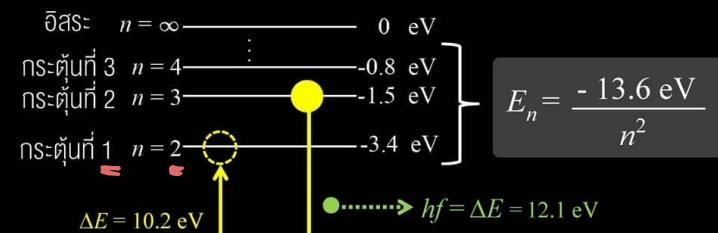
(ព័ត៌មានការ ឯកមិត្តភាពក្នុង L = mv\pi r = n\frac{h}{2\pi} = n\hbar )

$$E_{\text{រួម}} ; E = \frac{1}{2}mv^2 + \frac{k(e+e)}{r} \rightarrow (3)$$

នៅ (1), (2), (3) យើត :  $r_n = n^2 r_1 , v_n = \frac{v_1}{n} , E_n = \frac{E_1}{n^2} = -\frac{13.6 \text{ eV}}{n^2}$

Note: Spectrum ខ្សោយការណ៍ | ការបង្ហាញ

\* \* \*



តាមរយៈ  $\rightarrow$  UV

បាលេអីតុលាការ  $\rightarrow$  ផែតាមឈូរ  
មាសិចិប, ឃុំគេត់, ឃុំប៊ែត  $\rightarrow$  ឈូរទាន់

•  $hf$  ឬ  $\Delta E$  ឬ  $\Delta E$   
ex.  $hf = 10.2 \text{ eV}$

\* \* ការការណ៍ ឬ ឈូរ ឬ បេងចាយ នឹង  $n = \infty$  ដើម្បីរកចំណាំនៃបរិស្ថាន

[ $S^{M^{64}}\text{-Map}$  : វិស័យបង្ហាញលម្អិត និងវិស័យបង្ហាញ]



## 1 | ນມຄຣ ນ່າໄລເນີຣ

ମୁଦ୍ରଣ

$$\alpha = {}_2^4 \text{He} \quad \bar{\beta} = {}_{-1}^0 e \quad \beta^+ = {}_{+1}^0 e \quad \gamma = {}_0^0 \gamma \quad n = {}_0^1 n \quad p^+ = {}_1^1 H$$

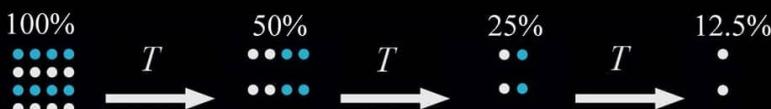
$(J\tau: 2 + 2e)$      $(\sqrt{r\omega} - e)$      $(J\tau\omega + e)$

ለኋይ በኋይ ስምምነት ነው

\* ຜະກົດໄຫວ້ານີ້ “ບົດຍາ” ລັບ ।



ମରାଜିକା



$$A = \frac{N_{\text{ສາຍັດ}}}{t} = \lambda N_{\text{ແຂວດ}}$$

$$\frac{N_{\text{نهائي}}}{N_0} = \frac{m_{\text{نهائي}}}{m_0} = \frac{A}{A_0} = \frac{1}{2^{t/T}} = e^{-\lambda t}$$

$$\lambda T = \ln 2 = 0.693$$

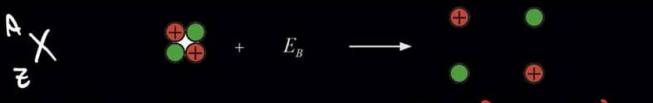
ໜົວໂຈກຢ່າສນໃຈ

- คิดการสลายตัวเป็นจำนวนเก่าของ  
ครึงซัต  $T$
  - คิดกับมันต่อไป จาก  $A = \lambda N$
  - การทอยลูกเต๋า  $a$  ตัวบน กำسี  $b$  ตัวบน  
คิดด้านที่กำสีออกในการทอยแต่ละครั้ง

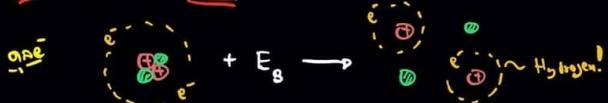
$$\lambda = \frac{b}{a}$$

๓ พลังงานยืดเหด្ឋីយេ

≡ พัฒนาที่ใช้ในการแยกprotoonและนิวตรอนออกจากกัน



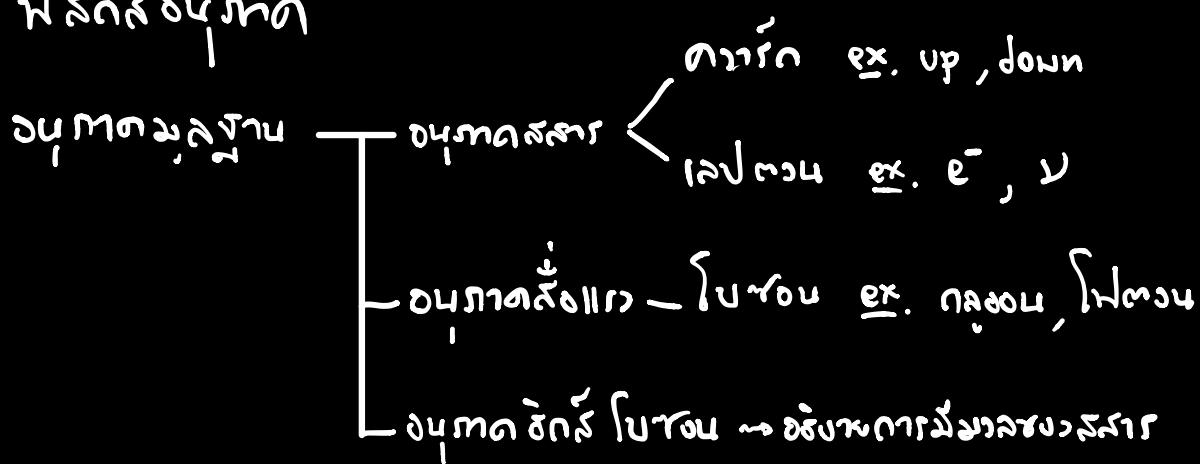
例 8. 求  $\sin \theta$  与  $\cos \theta$  的值，已知  $e^{-\theta} = 0.5$ 。



$$m_{\frac{\delta^2 m}{\delta c^2}} c^2 + E_B = \sum_m c^2 + N_m c^2$$

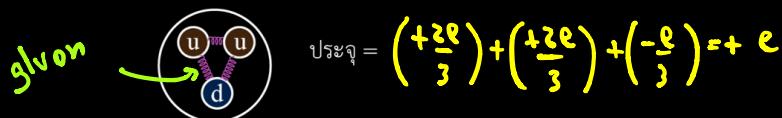
$$\text{มวลพร่อง } \Delta m = \frac{E_B}{c^2} \quad \text{★ ระหัสทางด้าน } E_B \text{ ตั้งนิเวศลือ鼎 = } \frac{E_B}{\text{รากชี้ } p + q \text{ ที่บ่ายเบน}}$$

## 4 ເນັດວຽກ

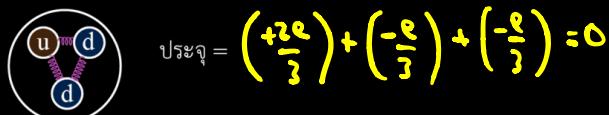


## Notes

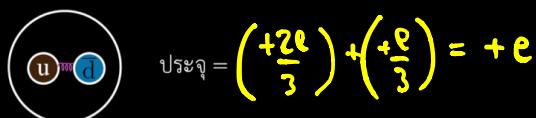
1. นักพิสิกอลยังไม่เจอความรากเดี่ยว ๆ แต่ออยู่รวมกันเป็น ธาตุรอง▶ ควร์ก 3 ตัว รวมกัน = แบเรียต ( ดาว์กัตต้า)  
★ ex. up-up-down (uud) = proton



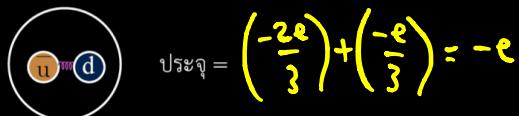
 ex. up-down-down (udd) = neutron



- ▶ ควรรัก 2 ตัว รวมกัน = มีชื่อน (การ์ด ดู๊ต้า)
   
ex. up-antidown ( $u\bar{d}$ ) = โพ่อนบวก ( $\pi^+$ )



ex. antiup-down ( $\bar{u}d$ ) = ໄພອອນລຸບ ( $\pi^-$ )



2. ปัจจุบันแบบจำลองมาตรฐานของอนุภาค อธิบายแรงในธรรมชาติได้ 3 แรง  
จากทั้งหมด 4 แรง

