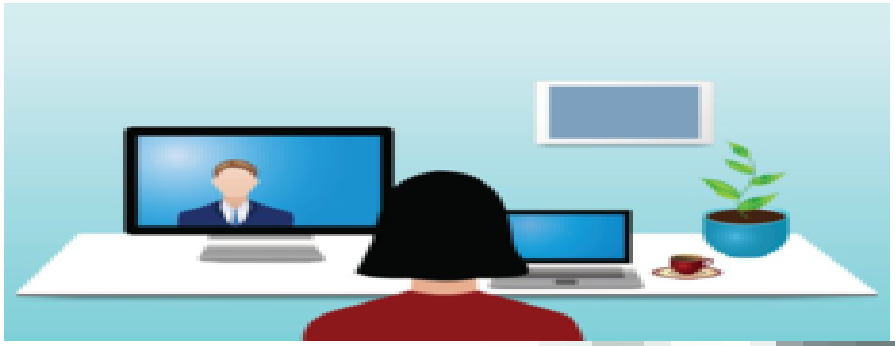
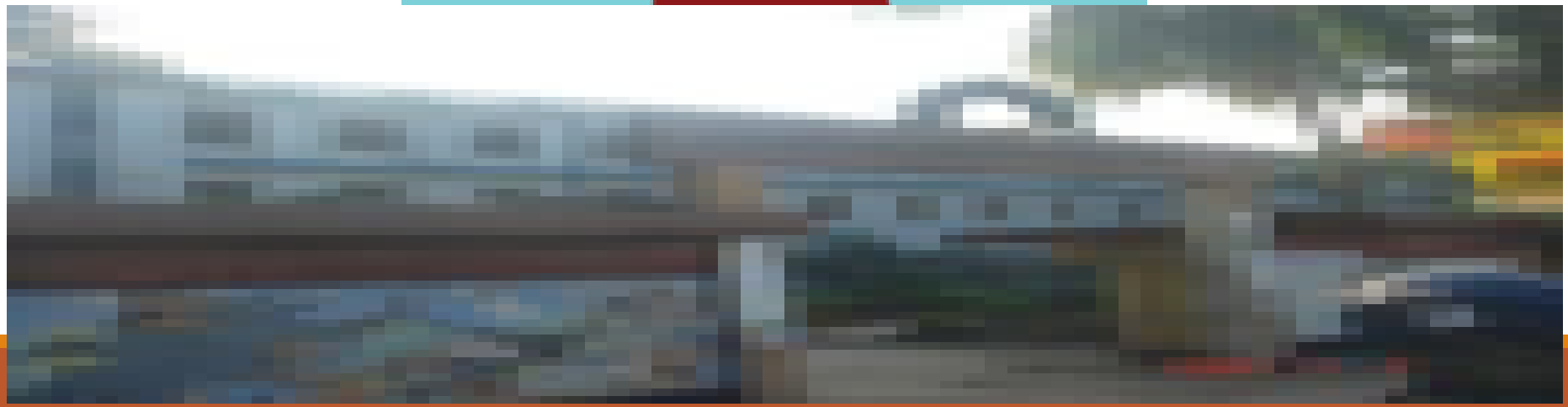
¯‹MZg

gqgbwmsn cwj‡UKwbK Bbw÷wUDU Abjv‡Bb Kv‡k cÿ ‡_‡K mKj 2q ce©QvÎQvÎx‡`i RvbvB Avš—iK ï‡f”Qv I Awfb›`b --------





cwiwPZ ce©

Dc¯'vcK:-

‡gvt iwdKzj Bmjvg

BÝUv¤^i (bb-‡UK)c`v_©

gqgbwmsn cwj‡UKwbK Bbw÷wUDU. gqgbwmsn

|

hvnv †Zvgvi I †Zvgvi †`‡ki Rb¨ Kj¨vY Ki,ZvB Zvg¯^cœ †`L I ev¯Íe iæcvšÍi Ki| GUvB †Zvgvi QvÎRxe‡b Av`k©| hviv cwikÖK‡i I mgq‡K gj¬¨ †`q ZvivB mZ¨ I mvÿ‡ii cRvix I evnK| †gvt iwdKzj Bmjvg

gmail- physics.mpi@gmail.com

‡gvevBj b¤^i t-01722917107

Av‡jvPbv welq ce©

Kwk bs-1

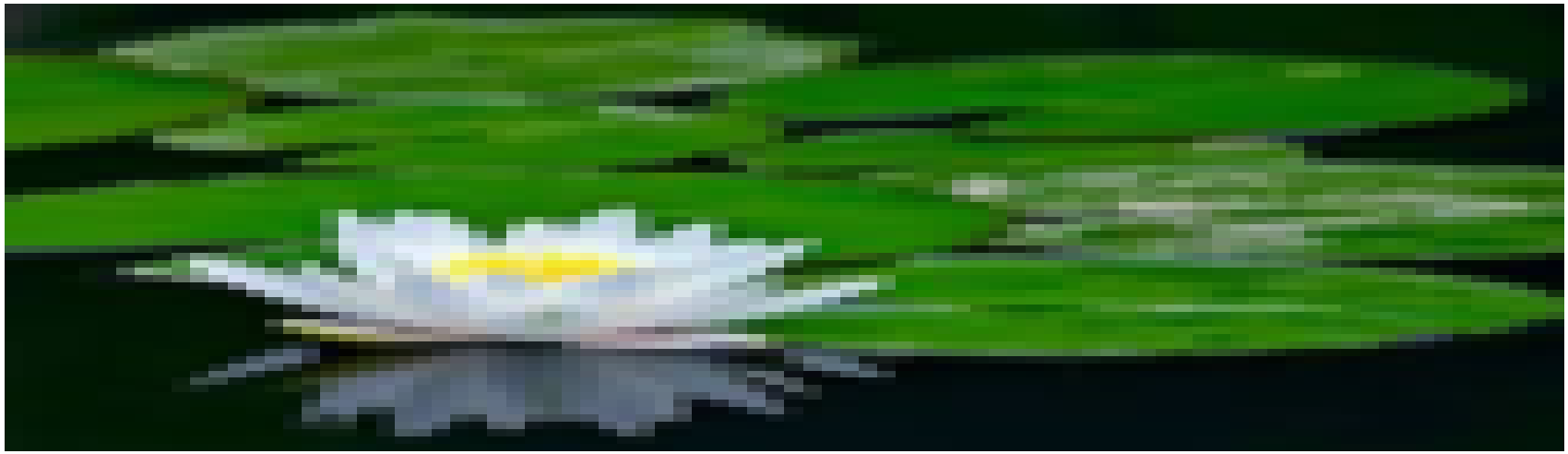
Zwi L -20-8-2023 wLª

mgq t- 2.30 Uv

ce©t- 2q

wkdU t- 2q wkdU

Av‡jvPbv welq QvÎQvÎx‡`i cwiwPZ ce©I ï‡fQv Kwk|



Pvi eQi †gqvw` cÖKvkj wW‡cvU© wkÿv µ‡gi Rb¨

wel‡qi bvg :- wdwR·-2,

welq †KvW :- 25922

†UK‡bvjwR t-g¨vKwbK¨vj| 2q ce©2q wkdU MÖn (G +we)

cÖKvb -200

T	P	C
3	3	4

ZËxq cwiÿv -90

ZËxq avivevwnK-60

e¨envwiK cwiÿv-25

e¨envwiK avivevwnK-25

ce©gvcwb ZËxq cwiÿvi (2022 cwËavb) cÖKvk -90

K we fv‡M

AwZmswÿZ 10 wU ckÖœ wK‡e 10wUB DËi w`‡Z n‡e| 2×10 =20

(‡hLv‡b msÁv, m¤ú„³ mgxKiY, welq ej‡Z wK eySe, GKK †ei Ki BZ¨vw`)

1| cigkb¨ Zvcgv‡Îv Gi msÁv wjL ev Av‡cwÿK Zvc Kv‡K e‡j?, 2| ZvcMwZwe`¨vi 1g m¤ú„³U wjL?,3| ‡jvnvi ^`N©cÖvi¼ 0.000012/‡Kjwfb ej‡Z wK eySe? 4| Gm AvB c×wZ‡Z Zvc cwienY ¸Yv‡¼i Gi GKK †ei Ki? BZ¨vw`|

Lwe fv‡M

mswÿZ 10wU cÖkœ_vK‡e 10wUB DËi w`‡Z n‡e| 3×10=30

(‡hLv‡b msÁv Gi eY©bv,e¨vL¨v, I mÍ Gi eY©bv, cÖZ©cv`b, ie©šÍ, ‡Kv‡bv we I‡q Gi cv_©K¨, ^ewkó¨ Ges MvwYwZK mgm¨v mgvavb BZ¨vw`)

1| Av‡jvi weciZ eM©m‡Îi eY©bv ev e¨vL¨v Ki| 2| `xcb gvÎv I `xcbÿgZvi Gi g‡a¨ m¤úK©©cb Ki ev cv_©K¨©wjL ? 3| ^`N©¨ cÖwiY ¸YvsK Gi mgxKiYwU cÖZôv Ki ev cÖZcv`b Ki? 4| G·‡i Gi ^ewkó¨ wjL ev e¨envi ¸‡jv wjL?

MvwYwZK mgm¨v ev c`v_©weÁvb Gi AsK _vK‡e| BZ¨vw`|

Mwefv‡M

iPbvg~jK 7wU ev 6wU cÖkœ _vK‡e 5wU DËi w`‡Z n‡e | 8×5=40

(‡hLv‡b †Kv‡bv welq, msÁv I mî Gi eY©bv, e¨vL¨v, cÖwZcv`b, iƒcvšÍi, MvwYwZK mgm¨v mgvavb BZ¨vw`)

1| wPÎmn Wv³vix _v‡gv©wgUvi Gi MVb Ges Kvh©cÖYvjx eY©bv Ki|
2| Av‡jvi weciZ eM©xq mîwU eY©bv ev e¨vL¨v Ki|
3| ˆ`N©¨ cÖmviY ¸YvsK Gi mgxKiYwU cÖwZôv Ki ev cÖwZcv`b Ki|
4| cÖgvY Ki †h, $6\alpha = 3\beta = 2\gamma$|
5| MvwYwZK mgm¨v ev c`v_©weÁvb Gi AsK _vK‡e| BZ¨vw`|

ZËxq avivevwnK cwiÿvi (2022 cwËavb) c¥g©b -60

ce©gaï cwiÿv c¥g©b -30

(‡hLv‡b AwZmswÿZ, mswÿZ, iPbvgj¨K ckÖœv‡K)

avivevwnK gj¨vqb -30

(Kwk †U÷- 5, KBR †U÷-9, G¨vmvBb‡g›U I †gŠwLK
cixÿv, AvPiY, Dcw¯’wZ BZ¨vw`)

dvBbvj e¨enwwiK cwiÿv (2022 cÖavb) -25

(cÖE cwiÿxZ cwiÿvi GKwU cÖkœcekÖ DËi w`‡Z n‡e| ‡hLv‡b 1| Re/G·‡cwi‡g›U GKwU, 2| Re/ G·‡cwi‡g›U wi‡cvU /†bvU ekÿK I 3| Re/ G·‡cwi‡g›U ev cwiÿv Pjv Kvjxb mg‡q †gŠwLK cwiÿv)

e¨enwwiK avivevwnK gÄ¨vqb (2022 cÖavb) -25

(‡hLv‡b Re/G·‡cwi‡g›U, ewoi KvR, Re/ G·‡cwi‡g›U wi‡cvU©cÖZKiY, Re/ G·‡cwi‡g›Ui Dci †gŠwLK cixÿv, AvPiY, Dcw¯’wZ)

wel‡qi bvg t- wdwR· -2
welq †KvW t- 25922

1g Aa¨vq t- _v‡gvwgwZ |
2q Aa¨vq t- c`v‡_©Dci Zv‡ci cÖe|
3q Aa¨vq t- Zv‡ci cÖZ.I hwš¿ mgZv |
4_©Aa¨vq t- ZvcMwZwe`¨vi 2q m¤ú|
5g Aa¨vq t- w¯’i Zwor|
6ô Aa¨vq t- ‡PŠ¤^KZ¡|
7g Aa¨vq t- Av‡jvi cwÖdjb|
8g Aa¨vq t- Av‡jvi cwÖmiY|

9g Aa¨vq t- ‡fŠZ Av‡jvKwe Ávb|

10g Aa¨vq t-Av‡jvK Zwor wµqv|

11 Zg Aa¨vqt- cigvYyi MVb|

12 Zg Aa¨vq t- wbDKxq c`v_©Ávb|

13 Zg Aa¨vqt- Avavbv K c`v_©Ávb|

14 Zg Aa¨vqt- Av‡cwÿK ZË¡I †R¨wZ©c`v_©Ávb|

wdwR· -2(25922) wel‡q e¨enwiK welqmgn¨

1| mvavi Y _v‡gvwgUv‡ii Kvh©c×wZ ev Zvcgv Î v Zzjbv KiY|
2| cwjÄv‡ii h‡šiÀ mvnv‡h¨ KwVb c`v‡_©`N¨©cÖiv¼ wbY©Ki|
3| wgkÖc×wZ‡Z KwVb c`v‡_©Av‡cwÿK Zvc I Zvc avivKZ¡wbY©Ki|
4| wgkÖc×wZ‡Z eid Mj‡bi mßZvc wbY©Ki|
5| K¨vjwiwgUv‡ii mvnv‡h¨ cwbmg wbY©Ki|

6| `wU Av‡jvK Drm ev `xcb kw³i Zzjbv Kiv|
7| wcb c×wZ‡Z mgZj `cÖvi Av‡jvi cwÎdj‡bi m‡Ši mZ¨Zv hvPvB|
8| j¤^b c×wZ‡Z AeZj `cÖvi †dvKvm `i“Z¡ wbY©q Ki|
9| wcb c×wZ‡Z AvqZKvi KvPdj‡Ki Dcv`v‡bi cwÎmiv¼ wbY©q Ki|
10| I-D †jLwP‡Îi mvnv‡h¨ wcÖ‡gi b¨vbZg weP¨vZ †KvY wbY©I Kv‡Pi cwÎmiv¼ wbY©q|

wdwR· - 2(25922) welq wkÿv MÖnY i D‡Ïk¨ t-

1| wkÿv_x©i cÖwgK weÁv‡bi GKwU cUf¸g weKvk Kiv|
cÖ³MZ welq¸wj †evSvi Rb¨ cÖvRb c`v_©Ávb|
2| mvaviYZ BwÄwbqwis Ges wk‡íi DcKiY¸wji GKwU KvhK©ix Ávb weKvk Kiv Ges cixÿv-wbixÿvi gva¨‡g GB RvZxq Dcv`vb¸wji ˆewkó¨ wbav©Y Ki‡Z mÿg Kiv|
3| †gŠwjK ˆeÁvwbK aviYvi †evSvi Rb¨ cixÿvi gva¨‡g weKvk Kiv|
4| mvaviYZ BwÄwbqwis Ges wkíRvZxq Dcv`v‡bi ˆewkó¨i GKwU cÖwgK Ávb Ges aviYv weKvk Kiv|

Av‡jvPbv welq ce©

Kvh© bs-2

Zvwi L -21-08-2023

mgq t- 45 wgwbU

ce©t- 2q MÖnxb-g¨vKvwbK¨vj MÖnxb-G

wkdU t- 2q wkdU

welq :-wdwR · -2(25922)

1g Aa¨vq t- _v‡gvwgwZ|

GB Aa¨vq cv‡Vi †k‡l Avgiv hv hv wkL‡Z cvie

Zvc I Zvcgv Îv wK, পরম শূন্য তাপমাত্রা, মৌলিক ব্যবধান,

wewfbœeKÖvi GK‡Ki msÁv `vI Ges Bnvi cv_©K¨ wjL|

Zvcgv Îvi wewfbœ‡ji g‡a¨ m¤úK©Kvcb Ki|

Wv³vix ev wKwbK¨vj _v‡gvwgUvi Gi MVb I KvhcÖjx eYb© Ki|

Zij _v‡gvwgUv‡ii cvi` e¨envi‡i mvye©av I Amvye©av ¸‡jv wjL|

c`v_©Áv‡bi †h kvLvq Zvc cwigvc msµvšÍAv‡jvPbv Kiv nq Zv‡K _v‡gvwgwZ e‡j|

†h hš¿Øviv Zvcgv‡Îv wbf©f~v‡e cwigvc Kiv nq Zv‡K _v‡gvwgUvi e‡j|

Zvc I Zvcgv‡Îv Gi msÁv

Zvc

Zvc GK cÖKvi kw³| Zv‡ci †Kv‡bv AvKvi, AvqZb, eY©v MÜ †bB hv Øviv Zvc‡K †Pbv ‡h‡Z cv‡i| Zv‡ci dj †`‡L Zvcgv‡K †Pbv hvq|
Zvc GK cÖKvi kw³ hv D”P Zvcgv‡Îvi e¯‘n‡Z wbb¥ Zvcgv‡Îvi e¯‡Z Zvcgv‡Îvi cv_©K¨i Kvi‡Y cwienb, cwiPjb Ges wewKiY c×wZ‡Z Mgb K‡i|

Zvcgv Îv

Zvcgv Îv e¯‘i GKwU Zvcxq Ae¯’vi hv H e¯‘n‡Z Ab¨ e¯‘‡Z Zvc cÖevn wbqš¿K‡i| Ab¨ K_vq ejv hvq, †Kv‡bv e¯‘KZUKz ZvÛv ev KZUKz Mig Zvcgv Îv w`‡q Zv eySvq| `ywU e¯‘i g‡a¨ Zvcxq ms‡hvM NU‡j Zv‡`i gv‡S Zv‡ci Av`vb cÖvb nq| Zv‡ci GB Av`vb cÖvb e¯‘ `ywUi Zvcgv Îvi Dci wbf©K‡i, Zv‡ci cwigv‡ci Dci bq|

cig kb¨ ZvcgvÎv

†h ZvcgvÎvq †h‡Kv‡bv M¨v‡mi AvqZb ZvwËK fv‡e kb¨ n‡q hvq Zv‡K cig kb¨ ZvcgvÎv e‡j|

‡gŠwjK e¨eavb ev †gŠwjK `i~Z¡

wbb¥ w¯'ivsK Ges Ea¨©¯'ivs‡Ki ga¨eZ©x `i~Z¡K ‡gŠwjK e¨eavb ev †gŠwjK `i~Z¡e‡j|

wm wR Gm c×wZ‡Z Zv‡ci GKK n‡jv K¨vjwi|

K¨vjwi

1 MÖg weï× cwbi Zvcgv Îv 1°C e„× Ki‡Z †h cwigvY Zv‡ci cÖqvRb nq Zv‡K 1 K¨vjwi e‡j| 1Cal

wK‡jvK¨vjwi

1 wK‡jvMÖg weï× cwbi Zvcgv Îv 1°C e„× Ki‡Z †h cwigvY Zv‡ci cÖqvRb nq Zv‡K 1 wK‡jv K¨vjwi e‡j| 1KCal

weªUk Zvcxq GKK

1 cvDÛ weï× cwbi Zvcgv Îv 1°F ew„× Ki‡Z †h cwigvY Zv‡ci cÖvRb nq Zv‡K 1 weªUk Zvcxq GKK e‡j| 1(B.Th.U)

_vg©

10^5 cvDÛ weï× cwbi Zvcgv Îv 1°F ew„× Ki‡Z †h cwigvY Zv‡ci cÖvRb nq Zv‡K 1 _vg© e‡j| 1Therm

†mjwmqvm Zvc GKK

1cvDÛ weï× cwbi Zvcgv Îv 1°C ew„× Ki‡Z †h cwigvY Zv‡ci cÖvRb nq Zv‡K 1 ‡mjwmqvm Zvc GKK e‡j| 1°C

Gg ‡K Gm c×wZ‡Z Zv‡ci GKK Rvgv|

1 Rvgv

$\frac{1}{4200}$ kg cwbi Zvcgv Îv 1 ‡Kjwfb ev¸× Ki‡Z †h cwigvY Zv‡ci cÖvRb Zv‡K 1 Rvgv Zvc e‡j|

cig kb¨ Zvcgv Îv

‡h Zvcgv Îvq †h †Kv‡bv M¨v‡mi AvqZb ZwËK f v‡e kb¨ n‡q hvq e‡j G‡K cig kb¨ Zvcgv Îv e‡j|

Mjbv¼

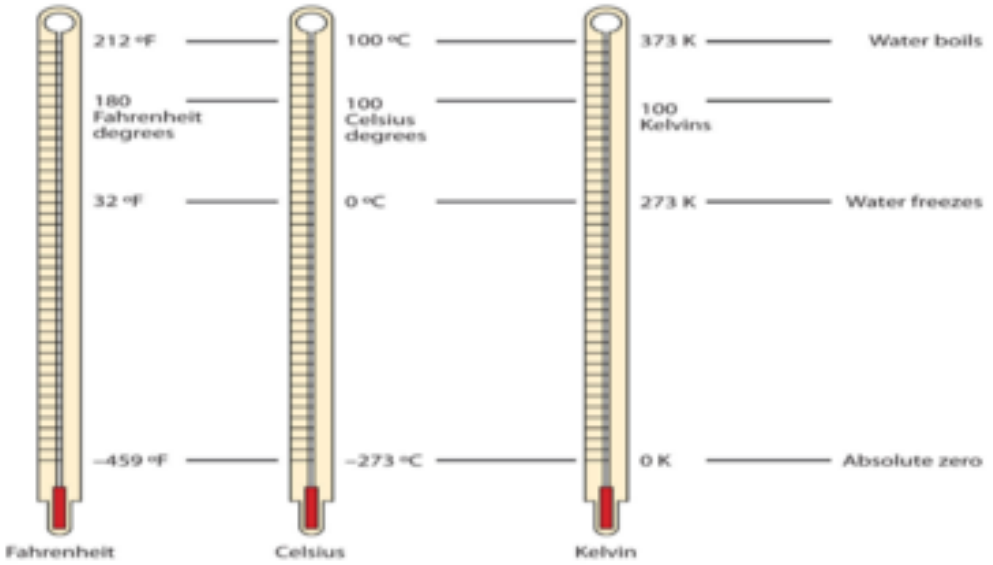
¯‹vfwweK Pv‡c †h Zvcgv‡Îvq eid Mj‡Z ïiæ K‡i Zv‡K eid we›`yev wbb¥ w¯’iv¼ ev Mjbv¼ e‡j|

ùzbv¼

¯‹vfwweK Pv‡c †h Zvcgv‡Îvq weï× cvwb dz‡Z ïiæ K‡i Zv‡K w÷g we›`yev Eaÿ©¯’iv¼ ev ùzbv¼ e‡j|

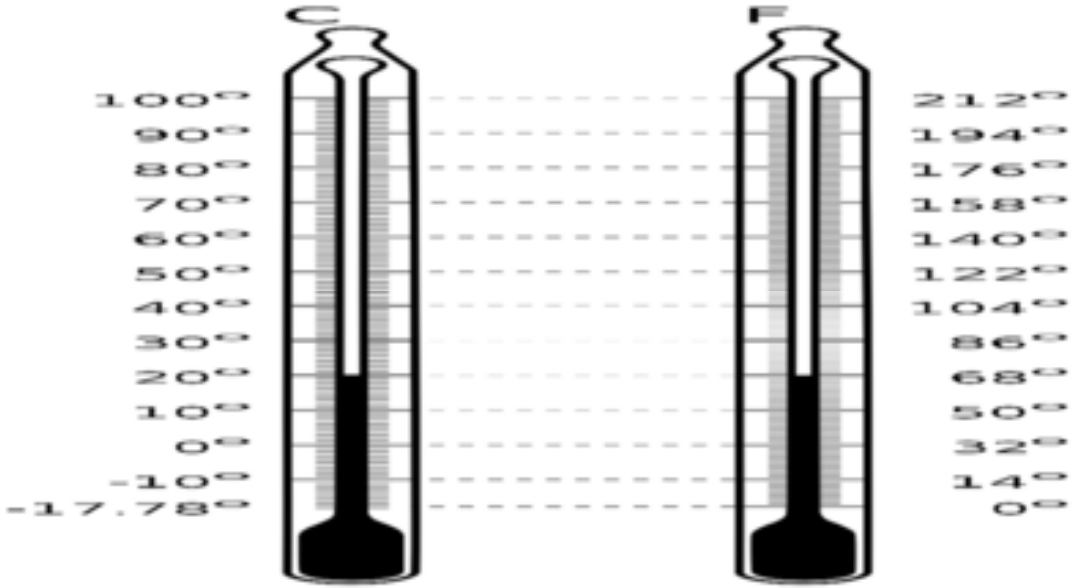
‡mjwmqvm †¯‹j

1742 wL.ª mB‡W‡bi †R¨wZwe©A¨vbWvm©mjwmqvm Zvcgv Îvi †¯‹j Awe®‹vi K‡i| GB †¯‹‡j 0° wbb¥ w¯'iv¼ Ges 100° Ea¨©¯'iv¼ aiv nq Ges Gi ga¨eZx©i‡Z‡K 100 Øviv fvM Kiv nq| cÖZ¨K fvM‡K 1°C ejv nq| GUv CGS c×wZ‡Z e¨envi Kiv nq|



dv‡ibnvBU †¯‹j

1720 mv‡j Rvgvb© `vkx©K wRwW dv‡ibnvBW Zvcgv Îvi †¯‹j Awe®‹vi K‡i| GB †¯‹‡j 32^0 wbb¥ w¯’i v¼ Ges 212^0 Ea¨Ÿ© w¯’i v¼ aiv nq Ges Gi ga¨eZx©i ¶Z‡K 180 Øviv fvM Kiv nq| cÖZ¨K fvM‡K 1°F ejv nq | GUv F.P.S c×wZ‡Z e¨envi Kiv nq|

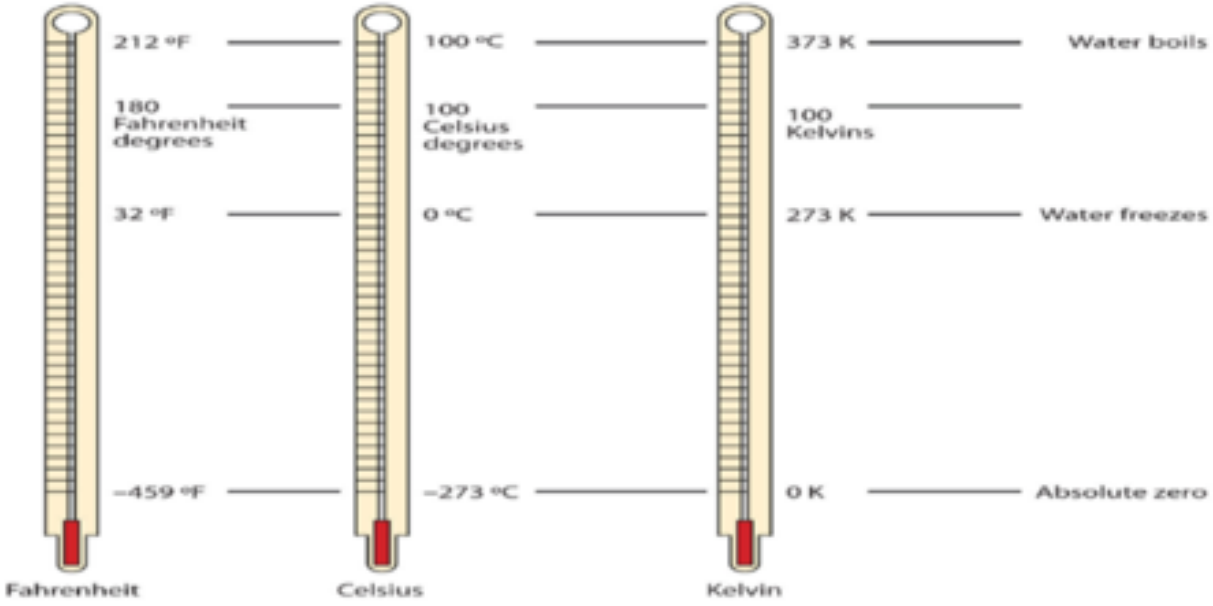


‡ivgvi ‡¯‹j

1720 mv‡j dv‡Ýi `vkv©K ‡ivgvi Zvcgv‡Îvi †¯‹j Awe®‹vi K‡i|
GB †¯‹‡j 0^{0} wbb¥ w¯’i¼ Ges 80^{0} Ea¨©¯’i¼ aiv nq Ges Gi
ga¨eZx©i¬Z¡K 80 Øviv fvM Kiv nq| cÖZ¨K fvM‡K 1R ejv nq|

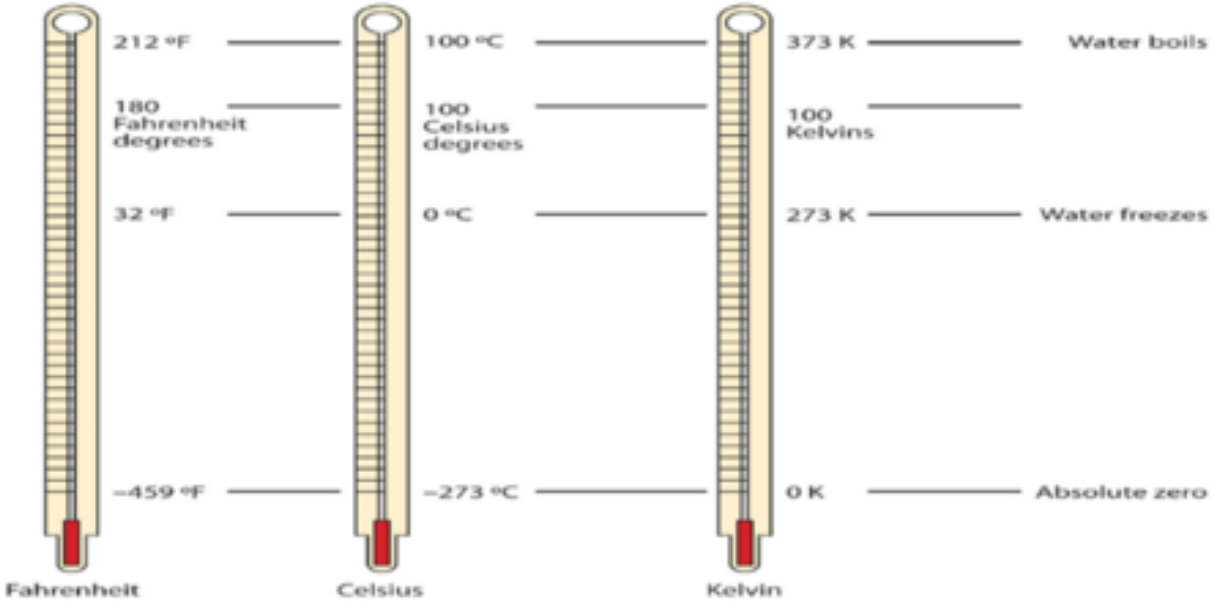
†Kjwfb †¯‹j

1850 mv‡j wewUk weÁvbx jW©Kjwfb Zvcgv Îvi †¯‹j Awe®‹vi K‡i|
GB †¯‹‡j 273⁰ wbb¥ w¯'i¼ Ges 373⁰ Ea¨©¯'i¼ aiv nq Ges Gi
ga¨eZx©i¬Z‡K 100 Øviv fvM Kiv nq | cÖZ¨K 1K fvM‡K ejv nq |
GUv S.I c×wZ‡Z e¨envi Kiv nq|



i¨vswKb †¯‹j

‰eÁvwbK i¨vswKb Zvcgv Îvi †¯‹j Avwe®‹vi K‡i| GB †¯‹‡j 492⁰ wbb¥ w¯'i¼ Ges 672⁰ Ea¨Ÿ©¯'i¼ aiv nq Ges Gi ga¨eZx©i÷Z‡K 180 Øviv fvM Kiv nq| cÖZ¨K 1Rn fvM‡K ejv nq i¨vswKb †¯‹j |

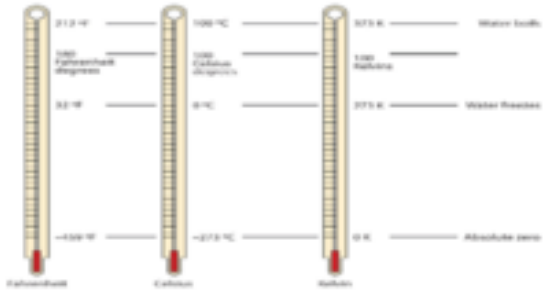


‡mjwmqvm (C), dv‡ibnvBU(F), †ivgvi(R) , †Kjwfb(K), I i¨vswKb(Rn)
†¯‹‡ji g‡a¨ Zzjbv wb‡P †`Iqv n‡jv

welq	‡mjwmqvm †¯‹j	dv‡ibnvBU †¯‹j	‡Kjwfb ‡¯‹j	‡ivgvi †¯‹j	i¨vswKb †¯‹j	Av`k© _v‡gvwgUv‡ii cvV
cÖKvk	C	F	K	R	Rn	M
wbb¥ w¯'i¼ ev eid we›`y	0	32	273	0	492	A
Eaÿ©¯'i¼ ev kxl©e›`y	100	212	373	80	672	B
cig kb¨ Zvcgvîv	-273	-460	-218	0	0	X
‡gŠwjK e¨eavb	100	180	100	80	180	-

Zvcgv Îv cwigv‡ci wewfbœ Ë‡ji gv‡S m¤úK© `LvI ?

‡mjwmqvm, dv‡ibnvBW, †ivgvi, ‡Kjwfb, i¨vswKb †¯‹‡ji gv‡S cvi¯úwiK m¤úK© c‡bi Rb¨ GKwU _v‡gwgUvi (BMA) wbB hvi eid we›`y Ges w÷g we›`yh_vµ‡g A I B `v‡Mi mv‡_ wg‡j hv‡e| GLb GB _v‡gwgUvi Gi cvkvcwk Dc‡ii cvPwU †¯‹j ¯’vcb Kwi| awi, †Kv‡bv GKwU Zvcgv Îvq cÖË _v‡gwgUvi BMA Gi cvi` kxl© hLb M Ae¯’v‡b Av‡m ZLb ‡mjwmqvm, dv‡ibnvBU, †ivgvi, ‡Kjwfb I i¨vswKb †¯‹‡ji Zvcgv Îv h_vµ‡g C,F , K , R, Rn| †h ‡Kv‡bv †¯‹j †bIqv †nvK bv †Kb `i‡Z¦I `i‡Zj Abyôv Z me© GKB _vK‡e|



†h †Kv‡bv _v‡gwgUv‡ii cvV = $\frac{\text{\_v‡gwgUv‡ii cvV–wbb¥ w¯'i v¼}}{\text{Ea¨©¯'i vsK–wbb¥ w¯'i v¼}}$

ev, $\frac{MA}{BA} = \frac{C-0}{100-0} = \frac{F-32}{212-32} = \frac{K-273}{373-273} = \frac{R-o}{80-0} = \frac{Rn-492}{672-492}$

ev, $\frac{C}{100} = \frac{F-32}{180} = \frac{K-273}{100} = \frac{R}{80} = \frac{Rn-492}{180}$

ev, $\frac{C}{5} = \frac{F-32}{9} = \frac{K-273}{5} = \frac{R}{4} = \frac{Rn-492}{9}$

$\therefore \frac{C}{5} = \frac{F-32}{9} = \frac{K-273}{5} = \frac{R}{4} = \frac{Rn-492}{9}$

cvi` _v‡gvwgUv‡i e¨envi‡ii mvgvav I Amvgvav ¸‡jv wjL?

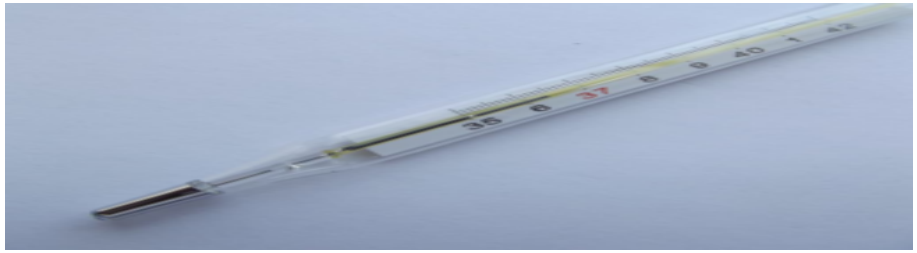
mvgvav t-

1| cvi` GKwU mgvwievnx c`v_©d‡j cvi` mn‡R cvi` Zvc MÖY K‡i Zv mÂwjZ K‡i †`q|

2| cvi` weï× Ae¯’vq cvIqv hvq Ges A¯’vQ I D¾j e‡j _v‡gvwgUvi Kv‡Pi b‡ji g‡a¨ Gi DVvbvgv Kivi mgq evB‡i †_‡K †`Lv hvq|

3| cvi` KvP b‡ji Mv‡q †j‡M _v‡K bv ZvB Zvcgv‡Îvi cwieZ©b mv‡_ mv‡_ Lvov mn‡RB b‡ji g‡a¨ DVvbvgv Ki‡Z cv‡i|

4| cvi‡`i Zvc avivYÿgZv Lvov Kg| Gi Rb¨ cvi` _v‡gvwgUvi Øviv †h e¯‘i Zvcgv‡Îv wbY©Kiv hvq Zv Lvov Kg ZvcB GwU †kvlY K‡i|



5| cvi‡`i ùvYbv¼ 357 °C Ges Mjbv¼ -39 °C| Gi cwim‡i cvi` Zij _v‡K e‡j cvi` _v‡gwgUvi w`‡q Gi ga¨eZx©h‡Kv‡bv Zvcgvîv wbY©Kiv hvq|

6| cvi‡`i cÖiY mylg| ZvB cvi‡`i AvqZb ew,× mgvb nq|

Amyeavt-

(1) GB _v‡gwgUvi w`‡q Gi wb‡Pi Zvcgvîv wbY©Kiv hvq bv|

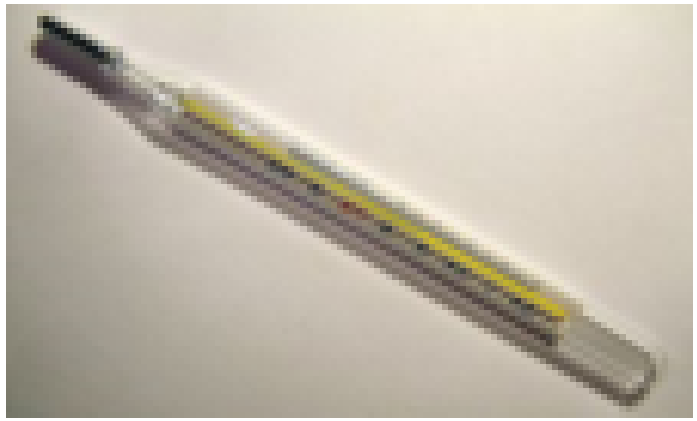
(2) Avevi GKB fv‡e Gi mvnv‡h¨ Gi AwaK Zvcgvîv wbY©Kiv hvq bv|

†h _v‡gwgUv‡ii mvnv‡h¨ mgvb Zvcgvîvi cv_©K¨ mylg fv‡e I mn‡R gvcv hvq Zv‡K mylg w` _v‡gwgUvi e‡j|

wKwbK¨vj ev Wv³vix _v‡gwgUvi Gi MVb Ges KvhcÖjx eYb© Ki

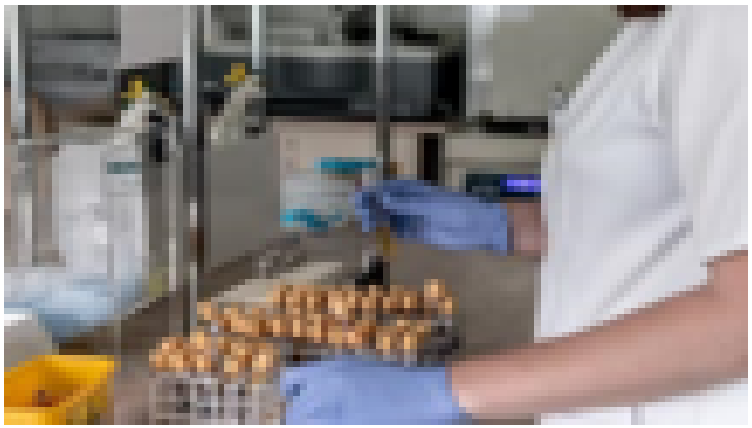
gvbyl i kix‡ii Zvcgv Îv gvcvi Rb¨ †h _v‡gwgUvi e¨envi Kiv nq Zv‡K wKwbK¨vj ev Wv³vix _v‡gwgUvi e‡j| GUv GKUv mÿgw` Pig _v‡gwgUvi |

mvaviYZ GB _v‡gwgUvi dv‡ibnvBU †¯‹‡j `vMv¼b Kiv _v‡K GB _v‡gwgUv‡ii MVb Gi‰c _v‡K ‡h kixi †_‡K †ei K‡i †blqvi cil G‡Z kix‡ii Zvcgv Îv mwVK fv‡e wbYq© Kiv hvq|



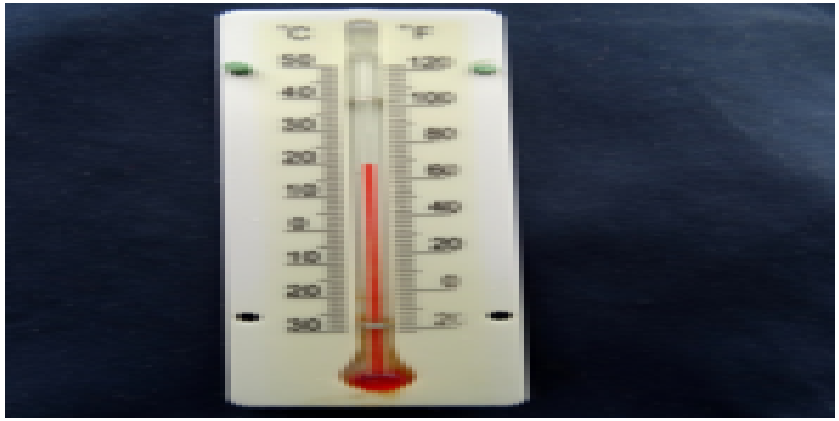
MVb

GB _v‡gvwgUv‡i GKwU ˆKwkK bj _v‡K hvi GK cÖKvíGKwU evj¦D Ges Aci cÖKvíeÜ _v‡K| ev‡j¦ wVK Dc‡i GKwU ms‡KvPb F _v‡K Ges GwU cvi` c¥©v‡K| ˆKwkK bjwU Aci GKwU KvPbj w`‡q XvKv _v‡K Ges †mB bjwU dv‡ibnvBU †¯‹‡j 95-110°F chÖ`vMv¼b Kiv _v‡K| cÖZ¨K Avevi cvPu fv‡M fvM Kiv _v‡K| mÿ¨ kix‡ii Zvcgvîv mvaviYZ 98.4°F nq| †mLv‡b GKwU we‡kl `vM _v‡K| †mjwmqvm †¯‹‡j 35°C - 45°C GB _v‡gvwgUvi †_‡K chÖ`vM KvUv _v‡K ¯’v‡b `vM KvUv _v‡K †hUv mÿ¨Zvcgvîv 37°C wb‡`©K‡i|



Kvh©cÖj x

cÖ‡g _v‡gvwgUvi wU‡K †Rv‡i SvuK‡q wb‡Z n‡e| G‡Z Dc‡ii cvi` evj‡e wd‡i Av‡m| GLb _v‡gvwgUvi wU‡K ki x‡ii ms¯ú‡k© hgb wRnŸvi wb‡P ivL‡j ki x‡ii Zv‡c evj‡ei cvi` cÖwiZ nq| d‡j evj‡ei wKQz cvi` bj w`‡q Dc‡i D‡V GK wU Ae¯v‡b wM‡q w¯’i nq| GLb _v‡gvwgUvi wU‡K ki xi †_‡K mwi‡q wb‡j F Gi wb‡Pi cvi` msKvPZ n‡q evj‡e wd‡i Av‡m| wKš‘F Gi Dc‡ii cvi` ms‡KvP‡bi Kvi‡Y evj‡e Avm‡Z cv‡i bv|



b‡ji cvi` ¯‡¤^i kxl©Ae¯’‡bi cvV kix‡ii ZvcgvÎv wb‡`©K‡i| GUv cÖvq e¨envi Kivi c‡e©vj e‡K wb‡Pi w`‡K †i‡L K‡qKevi SwuK‡q wb‡Z nq hv‡Z cvi` evj‡e cÖk Ki‡Z cv‡i| †h‡nZz GB _v‡gwgUvi Øviv kix‡ii m‡ev© ZvcgvÎv gvcv hvq ZvB G‡K GK ai‡bi Pig _v‡gwgUvi ejv hvq|

eZ©gv‡b wWwRUvj _v‡gwgUvi cvIqv hvq| GUv Kcv‡j mvg‡b ivL‡j ev ai‡j mv‡_ mv‡_ cvV cvIqv hvq|

Zvc I ZvcgvÎvi g‡a¨ cv_©K¨ wjL

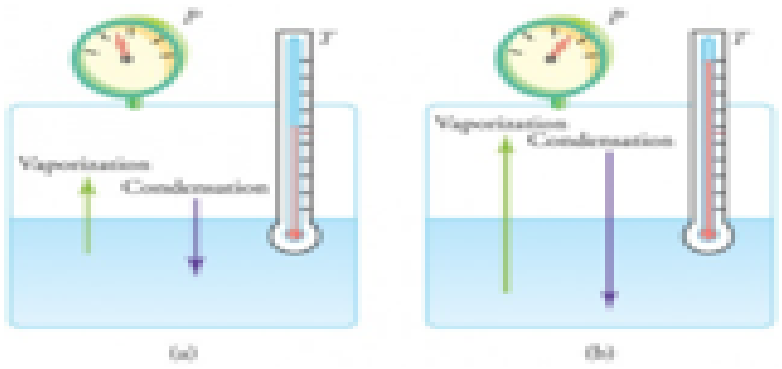
Zvc I ZvcgvÎvi g‡a¨ cv_©K¨¸‡jv wb‡P †`Iqv n‡jv-

Zvc	ZvcgvÎv
1| Zvc GK cÖKvi kw³ hv VvÛv ev Mig‡gi Ab~fywZ RvMvq |	ZvcgvÎv e¯'i ZvcxIq Ae¯'v hv H e¯'‡_‡K Ab¨ e¯‡Z Zvc cÖevn wbqš¿K‡i|
2| Zvc GK cÖKvi kw³ |	ZvcgvÎv Zv‡ci dj|
3| Zvc n‡"Q ZvcgvÎvi KviY|	3| ZvcgvÎv n‡"Q Zv‡ci dj|
4| c`v_©mÁv‡bi †h kvLvq Zvc cwigvc Kiv nq Zv‡K K¨vjwiwgwZ e‡j|	4| c`v_©mÁv‡bi †h kvLvq ZvcgvÎv cwigvc Kiv nq Zv‡K _v‡gv©wgwZ e‡j|
5| `yB e¯'i ZvcgvÎv GK n‡ji Zv‡`i Zv‡ci cwigvY wfbœ n‡Z cv‡i|	5| `yB e¯'i Zvc GK n‡ji Zv‡`i ZvcgvÎv cwigvY GK bvI n‡Z cv‡i|
6| Zv‡ci AvšÍR©vwZK GKK n‡jv Ryj |	6| ZvcgvÎvi AvšÍR©vwZK GKK n‡jv ‡Kjwfb |
7| Zv‡ci cÖevn Zv‡ci cwigv‡ci Dci wbf©i K‡i bv|	7| Zv‡ci cÖevn ZvcgvÎvi cwigv‡ci Dci wbf©iK‡i |

Zvcgv Îv cwigv‡ci Rb¨ wewfbœ ewKÖ‡i _v‡gvwgUvi Av‡Q| h_v Ñ

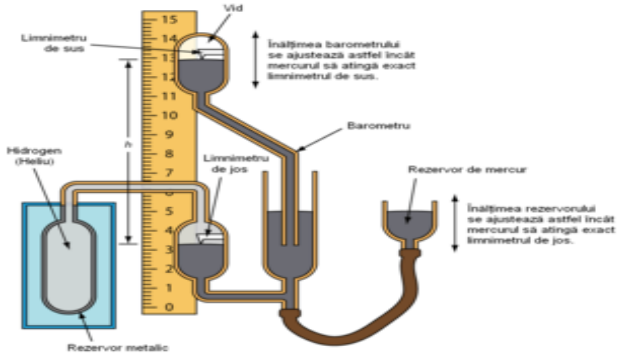
(1) Zij _v‡gvwgUvi t-

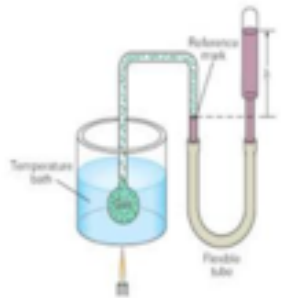
G _v‡gvwgUv‡i Zij‡K Zvcwgw ZK e¯‘ wn‡m‡e e¨envi Kiv nq| †hgb cvi` _v‡gvwgUvi, A¨vj‡Kvnj _v‡gvwgUvi |



(2) M¨vm _v‡gvwgUvi t-

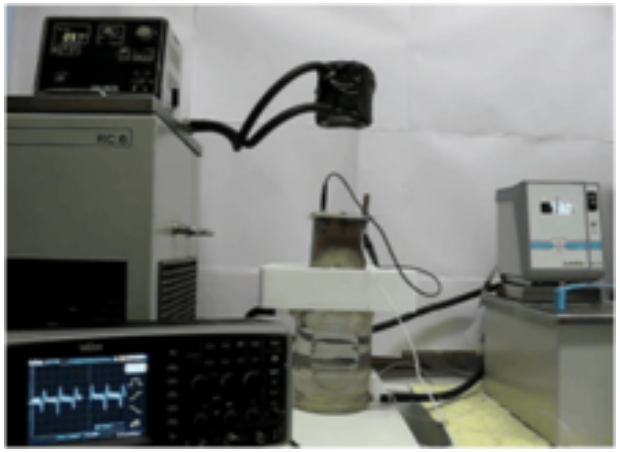
G _v‡gvwgUv‡i M¨vm‡K Zvcwgw ZK e¯‘ wn‡m‡e e¨envi Kiv nq| †hgb nvB‡Wv‡Rb _v‡gvwgUvi, evqy _v‡gvwgUvi|





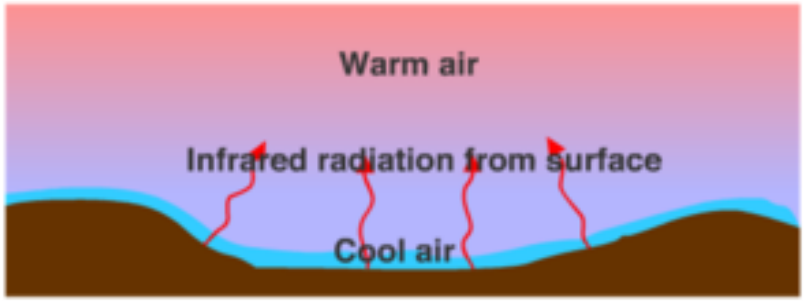
(3) Zvc Zwor _v‡gvwgUvi t-

hw` `yU c„K avZzi `B cÖKÍ†hvM K‡i cÖKí `yU‡K wewfbœ Zvcgv Îvq ivLv nq, Z‡e Zv‡ii ga¨ w`‡q we`¨yr cÖwnZ nq| G‡K Zvchy³ e‡j&Gi mvnv‡h¨ Zvcgv Îv cwigvc Kiv nq|



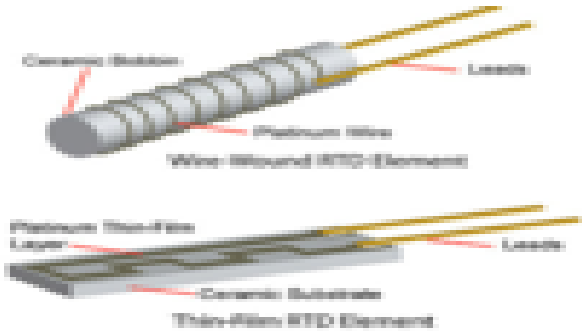
(4) wewKiY _v‡gvwgUvi t-

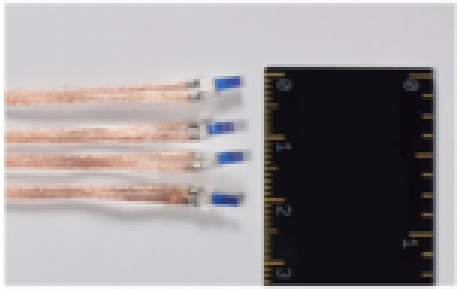
†Kvb e¯‡K DËß Ki‡j GUv n‡Z wewKiY wbMZ© nq| w÷dv‡bi Gi m‡e e¨envi K‡i Gi mvnv‡h¨ Zvcgv Îv Kiv nq|

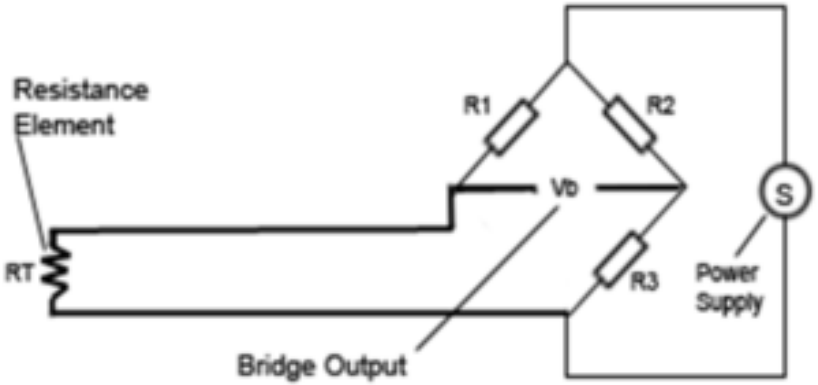


(5) †iva _v‡gvwgUvi t-

†Kvb we`¨yr cwievnxi †iva Zvi Zvcgv‡Îvi lci wbf©K‡i| we`¨yr cwievnxi Zvcgv‡Îv nvm e„w×‡Z cwievnxi †iva h_vµ‡g nvwm I e„w× cvq| cwievnxi GB ag©‡K wfwË K‡i GB _v‡gvwgUvi MwVZ n‡q‡Q| †hgb cvdUbvg †iva _v‡gvwgUvi|



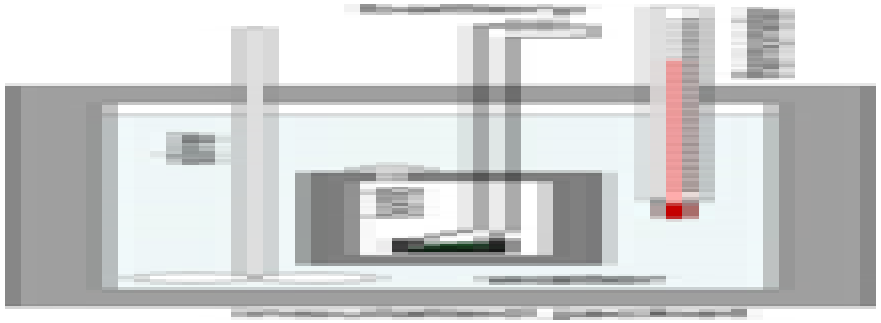




Zij ev cvi` _v‡gvwgUv‡ii wbb¥ w¯’i v¼ I EaŸ©¯’i v¼ wbY©qKiv|

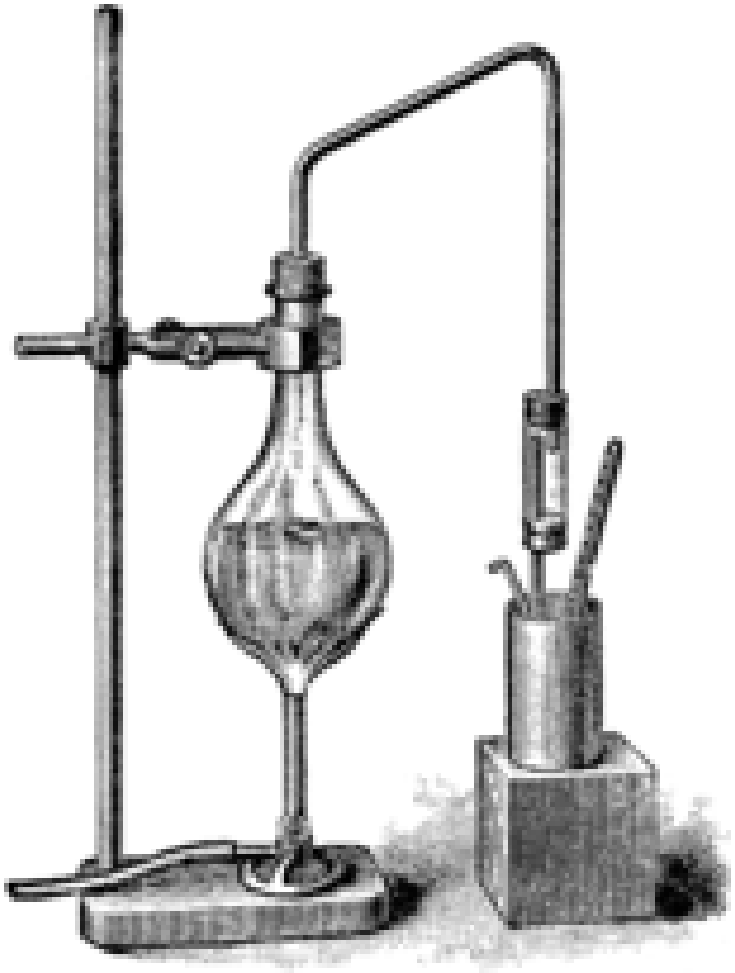
wbb¥ w¯’i v¼ wbY©q

wbb¥ w¯’i we›`y wbY©q Rb¨ GKwU eo dv‡b‡j ïK‡bv I we‡ï× ei‡di A‡bK¸‡jv UvKv iv †bIqv nq| cvi` _v‡gvwgUvi‡K GKwU ÷¨v‡bi mvnv‡h¨ Lvovfv‡e ¯’vcb Kiv nq hv‡Z _v‡gvwgUv‡ii evjvU ei‡di UvKvi g‡a¨ Wvgv‡bv _v‡K| wKQzÕY ci †`Lv hv‡e cvi` µgk msKvPZ n‡q wb‡Pi w`‡K bvg‡Z _vK‡e| b‡ji cvi‡`i ZvcgvÎv ei‡di ZvcgvÎv †cŠQ‡j cvi‡`i DcwiZj GK¯’v‡b G‡m w¯’i n‡e| cvi` kxlÖi GB ¯’v‡b GKwU `vM KvUv nq GUvB cvi` _v‡gvwgUv‡ii wbb¥ w¯’i we›`y

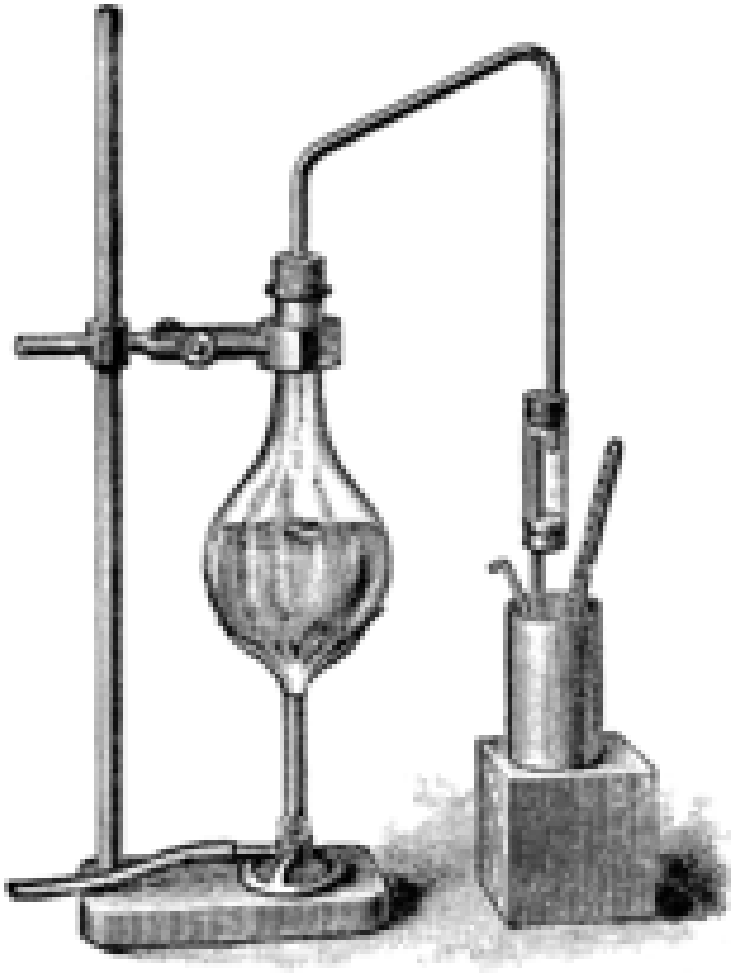


EaŸ©¯'iwe›`ywbY©

cvi` _v‡gwgUv‡ii EaŸ©¯'i we›`ywbY©qi Rb¨ wnc‡mwgUvi bvgK GKwU hš¿cvenvi Kiv nq| GUv GKwU wØ-‡`qvj wewkó Zvgvicv‡Î| wnm‡cwgUv‡ii evB‡ii †`qv‡j GKwU wbMgb bj _v‡K| Gi wecixZ w`‡K ev®ú Pvc wbY©qi Rb¨ GKwU g¨‡bwgUvi _v‡K| Dc‡ii gyLv wQwc w`‡q eÜ ivLv nq| wQwci g‡a¨ wQ`ªw`‡q _v‡gwgUvi wU XvKv‡bv nq| wnc‡mwgUv‡ii Zjvi cv‡Î cwb dbv‡bv nq|



Drcbœ Rjxqev®ú _v‡gvwgUv‡ii evj¨vU‡K DËß K‡i| GLv‡b jÿ ivL‡Z n‡e evj¨vU †hb wKQzZB dzšÍcwb‡K ¯úk©bv K‡i| ev‡j¨i cvi` cÖwiZ nq Ges †Kv‡bv GK ¯’v‡b G‡m w¯’i n‡q hv‡e| †hLv‡b b‡ji Mv‡q cvi` kx‡l©Ae¯’v‡b `vM KvUv nq| GwUB cvi‡`i Eaÿe›`y Eaÿ©¯’iwe›`y wbY©qi mgq g¨v‡bvwgUv‡ii `ßvi evûi D”PZv mgvb bv _vK‡j Pvc ms‡kvab Ki‡Z nq| ms‡kvab K‡i ¯’vfvweK Pv‡c cwbi mdzbv¼ a‡i Eaÿ©¯’i we›`y `vMv¼ Kiv nq|



GKwU wWwMÖmw›U‡MÖWmgvb Kq wWwMÖdv‡ibnvBU?

mgvavb, g‡bKwi, †mw›U‡MÖW†¯‹‡ji gvb =1°C

Avgiv Rvwb, $\frac{C}{5} = \frac{F-32}{9}$

ev, $\frac{1}{5} = \frac{F-32}{9}$

ev, $5(F-32)=9$

ev, $5F-160=9$

ev, $5F = 9 + 160$

ev, $F= \frac{169}{5} = 33.8$

$\therefore F= 33.8°\text{F}$

GKRb Amÿ”e¨vw³i kix‡ii Zvcgv Îv 40°C| Wv³vix _v‡gvwgUv‡i Gi gvb KZ n‡e|

mgvavb, ‡`Iqv Av‡Q, Zvcgv Îv = 40°C

Avgiv Rvwb, $\frac{C}{5} = \frac{F-32}{9}$

ev, $\frac{40}{5} = \frac{F-32}{9}$

ev, $(F - 32) = 9 \times 4$

ev, $F - 32 = 36$

ev, $F = 36 + 32$

ev, $F = 68$

$\therefore F = 68°F$

wb‡Y©cvV = 68°F

dv‡ibnvBU †¯‹‡ji †Kvb Zvcgv Îv †mw›U‡MÖW †¯‹‡ji cv‡Vi wØ¸Y?

mgvavb, g‡bKwi, †mw›U‡MÖW †¯‹‡j Zvcgv Îv, C=x

dv‡ibnvBU †¯‹‡j Zvcgv Îv, F=2x

Avgiv Rvwb, $\frac{C}{5} = \frac{F-32}{9}$

ev, $\frac{x}{5} = \frac{2x-32}{9}$

ev, $5(2x - 32)$=9x

ev, $10x - 160$=9x

ev, $10x - 9x$=160

ev, x=160

$\therefore C$=160

myZivs F=2x=2 160=320 [C I F Gi gvb ewm‡q]

∴ wb‡Y©Zvcgv Îv=320°F

GB Aa¨vq cv‡Vi †k‡l Avgiv hv hv wkL‡Z cvie|

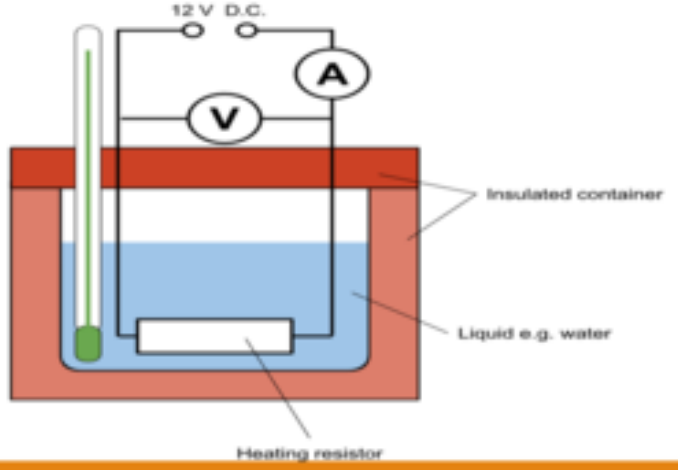
Av‡cwÿK Zvc, ZvcaviY ÿgZv ev Zvc avivKZ¡Ges
cwb-mg ev Zzj¨ Rjv¼ Gi msÁv `vl|
ZvcavivY ÿgZv I cwbmg Gi g‡a¨ cv_©K wjL?
K¨vjwiwgUv‡ii gj¬bxwZ wK ?
mßZvc ev jxbZvc wK Ges I KZ cÖvi wK, wK|
wKfv‡e Av‡cwÿK Zvc I ev®úxqfe‡bi Ges eid
Mj‡bi Av‡cwÿK mßZvc wbY©Kiv hvq Zv eY©Ki|

Av‡cwÿK Zvc

GKK f‡ii e¯‘i Zvcgv Îv 1 wWwMÖK jwfb evov‡Z hZUzKz Zv‡ci cÖvRb nq Zv‡K Av‡cwÿK Zvc e‡j| G‡K S Øviv cÖKvk Kiv nq|

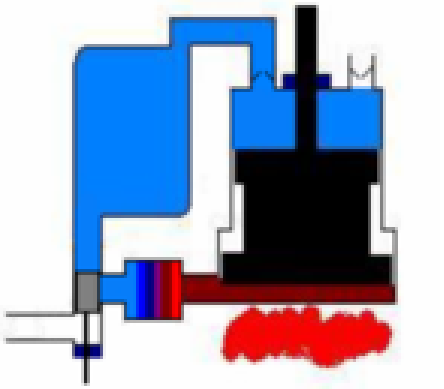
Av‡cwÿK Zvc Gi gv Îv t- $S = \frac{H}{m\Delta\theta} = [\frac{J}{kgK}]$

Gm AvB c×wZ‡Z Av‡cwÿK Zv‡ci GKK n‡iv- $Jkg^{-1}k^{-1}$



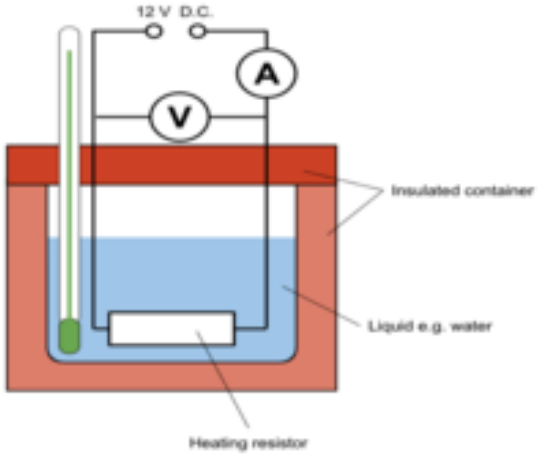
Zvc avi Y ÿgZv

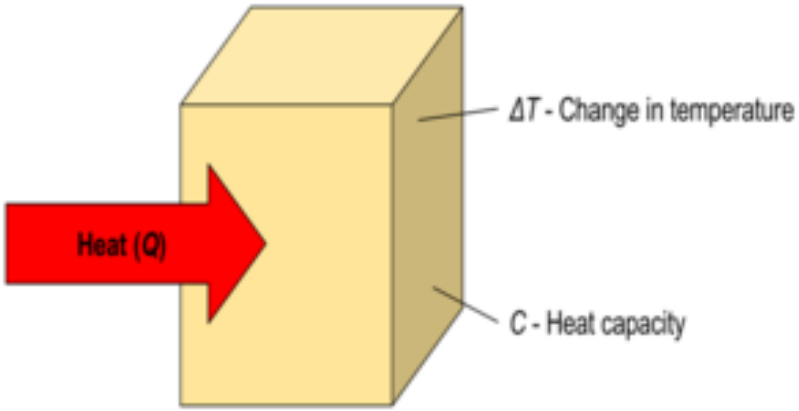
†Kv‡bv e¯‘i Zvcgv Îv ewµ× Ki‡Z †h cwigvY Zv‡ci cÖvRb nq Zv‡K H e¯‘i Zvcavi Y ÿgZv e‡j | G‡K C Øviv cÖKvk Kiv nq|



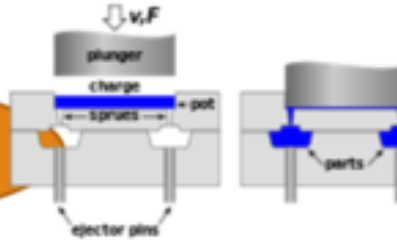
Zvc avi Y ÿgZv Gi gvÎv t- $C = \frac{H}{\Delta\theta} = [\frac{J}{K}]$

Zvc avi Y ÿgZv Gi GKK t- Jk^{-1}

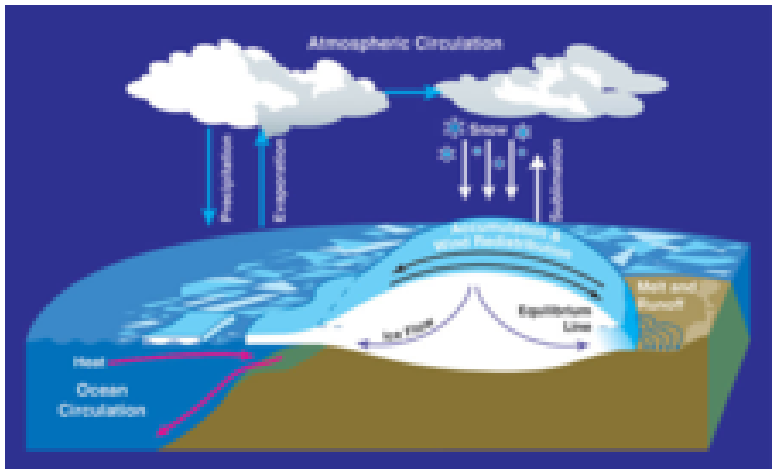


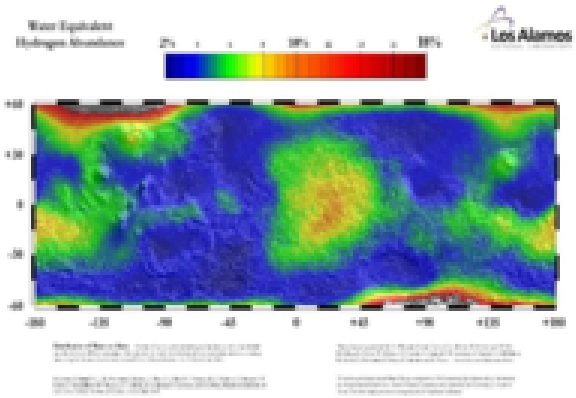


cwbmg ev Zzj¨ Rjv¼



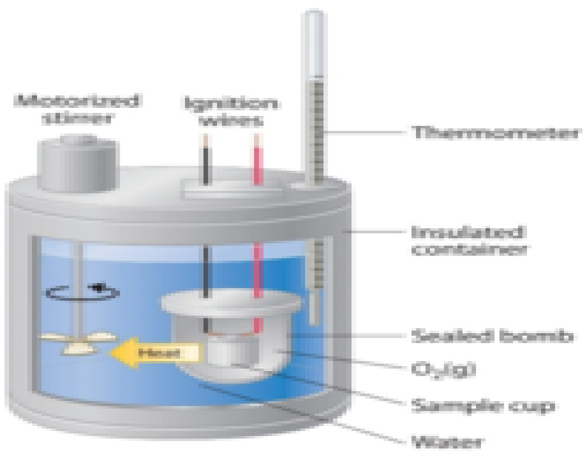
†Kv‡bv e¯‘i Zvcgv‡Îv 1 wWwMÖwigvY ew¸× Ki‡Z †h cwigvY Zv‡ci cÖvRb nq †mB cwigvY Zvc w`‡q hZUkyc wbi Zvcgv‡Îv 1 wWwMÖZvcgv‡Îv ew¸× Kiv hvq †mB cwigvY cwb‡K H e¯‘i cwbmg e‡j| G‡K W Øviv cÖk Kiv nq|

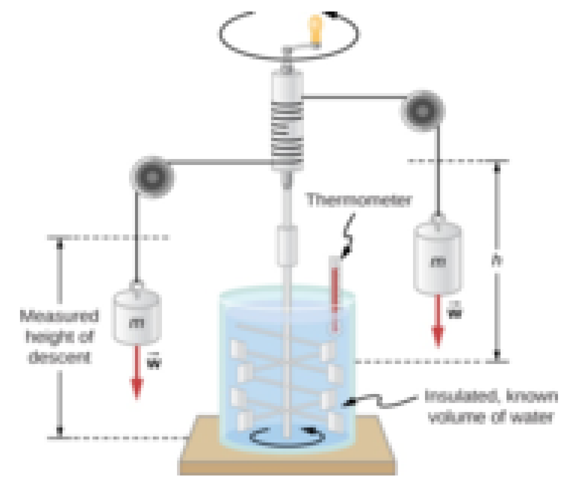




K¨vjwiwgUv‡ii gj~bxwZ

hw` GKwaK e¯'i g‡a¨ evB‡ii †_‡K †Kv‡bv Zvc bv Av‡m ev bv N‡U; Z‡e kw³ i wbZ¨Zvi m~Î Abyhvqx‡i, MÖnxZ Zvc = ewR©Z Zvc GwU K¨vjwiwgwZi gj~bxwZ|
wfbœ Zvcgvwÿvi `yB ev Z‡ZwaK e¯‘ci ¯ú‡ii ms¯ú‡k© Avm‡j Zv‡`i g‡a¨ Zv‡ci Av`vb cÖ`vb N‡U| †ewk Zvcgvwÿvi e¯‘¸‡jv Zvc nvivq Ges Kg Zvcgvwÿvi e¯‘¸‡jv Zvc MÖnY K‡i| GLv‡b ejv hvq †h e¯‘Zvc nvivq Ges Zvi cwi‡ki e¯‘ev Ae¯'v Zvc MÖnY K‡i|





Zvcavi Y ÿgZv I cwbmg Gi g‡a¨ cv_©K¬ wjL?

cv_©K¬i welq	Zvcavi Y ÿgZv	cwbmg
msÁv	1|GKK f‡ii e¯‘i Zvcgv‡Îv 1 wWwMÖ †Kj wfb evov‡Z hZUzKz Zv‡ci cÖvRb nq Zv‡K Av‡cwÿK Zvc e‡j|	1|†Kv‡bv e¯‘i Zvcgv‡Îv 1 wWwMÖ wigvY ew„× Ki‡Z †h cwigvY Zv‡ci cÖvRb nq †mB cwigvY Zvc w`‡q hZUzKz cwbi Zvcgv‡Îv 1 wWwMÖ Zvcgv‡Îv ew„× Kiv hvq †mB cwigvY cwb‡K H e¯‘i cwbmg e‡j|
¸Ydj	2| e¯‘i fi‡K Av‡cwÿK Zvc Øviv ¸Y Ki‡j Zvc avi Y ÿgZv cvlqv hvq|	2| e¯‘i fi I Av‡cwÿK Zv‡ci ¸Y dj‡K 4200 Øviv fvM Ki‡j ev cwbi Av‡cwÿK Zvc Øviv fvM Ki‡j cwb- mg cvlqv hvq|
cwigvc	3| GUv Øviv Zvc cwigvc Kiv nq|	3| GUv Øviv cwbi cwigvc e¨vq|
Ae¯’v	4| GUv †h †Kv‡bv e¯‘i n‡Z cv‡i|	4| GU mvavi YZ †Kv‡bv cv‡Îi e¨vq|
cÖK	5| G‡K c Øviv cÖk Kiv nq|	5| G‡K w Øviv cÖk Kiv nq|
GKK	6| Zv‡ci GKK Øviv Zvc avi Y ÿgZvi GKK cÖk Kiv nq|	6| f‡ii GKK Øviv cwb-mg GKK cÖk Kiv nq|

wewfbœekÖvi Av‡cwÿK mßZvc Gi msÁv

mßZvc ev jxbZvc

Zvcgv Îv cwieZb©(Mjbv¼ ev ùzbv¼) bv NwU‡q GKK f‡ii †Kv‡bv e¯‘GK Ae¯’vi ‡_‡K Ab¨ Ae¯’vq iæcvšÍiZ n‡Z †h Zvc Mnxnx ev ewRZ© nq Zv‡K H Ae¯’v cwieZ©bi Av‡cwÿK mßZvc ev jxbZvc e‡j| Bnv‡K L Øviv cÖKvk Kiv nq|

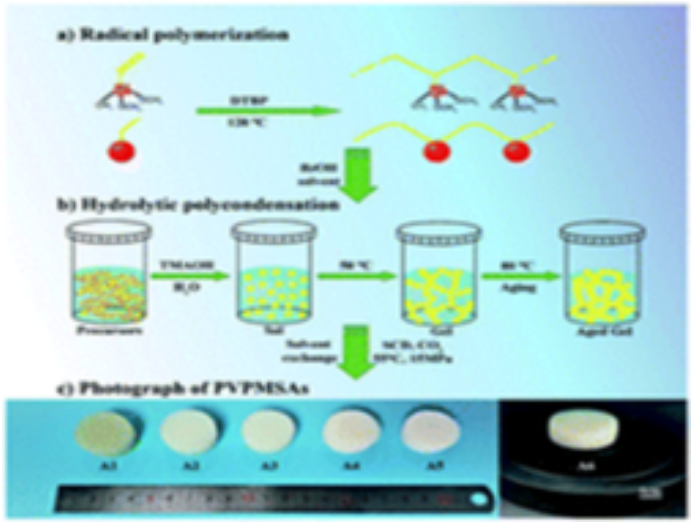
mßZvc mvaviYZ Pvi cÖvi h_v t-

(1) Mj‡bi mßZvc

(2) KwVbxfe‡bi mßZvc

(3) ev®úxfe‡bi mßZvc

(4) Nbxfe‡bi mßZvc



Av‡cwÿK Mj‡bi mßZvc

†Kv‡bv KwVb c`v‡_© GKK fi‡K Zvi Mjbv‡¼ †i‡L Zvcgv Îvi cwieZb© bv NwU‡q ïaygvÎ KwVb †_‡K Zij cwiYZ Ki‡Z †h cwigvY Zv‡ci cÖqvRb nq, Zv‡K H c`v‡_© Mj‡bi mßZvc e‡j| wm wR Gm c×wZ‡Z eid Mj‡bi mßZvc Cal/gm| D³ Dw³ Øviv Avgiv ewS, Zvcgv Îvi eid‡K D³ Zvcgv Îvi cwb‡Z cwiYZ Ki‡Z Zv‡ci cÖqvRb n‡e|

eid Mj‡bi mvßvwZ 80 Cal/gm ev 80 K¨vjwi/MÖg ej‡Z wK eySv ?

DËit-eid Mj‡bi mvßvwZ 80 Cal/gm ej‡Z eySvq 1 gm eid‡K Zvi Mjbv¼ ev 0°C †i‡L cwb‡Z cwiYZ Ki‡Z 80 Cal Zv‡ci cÖqvRb nq|

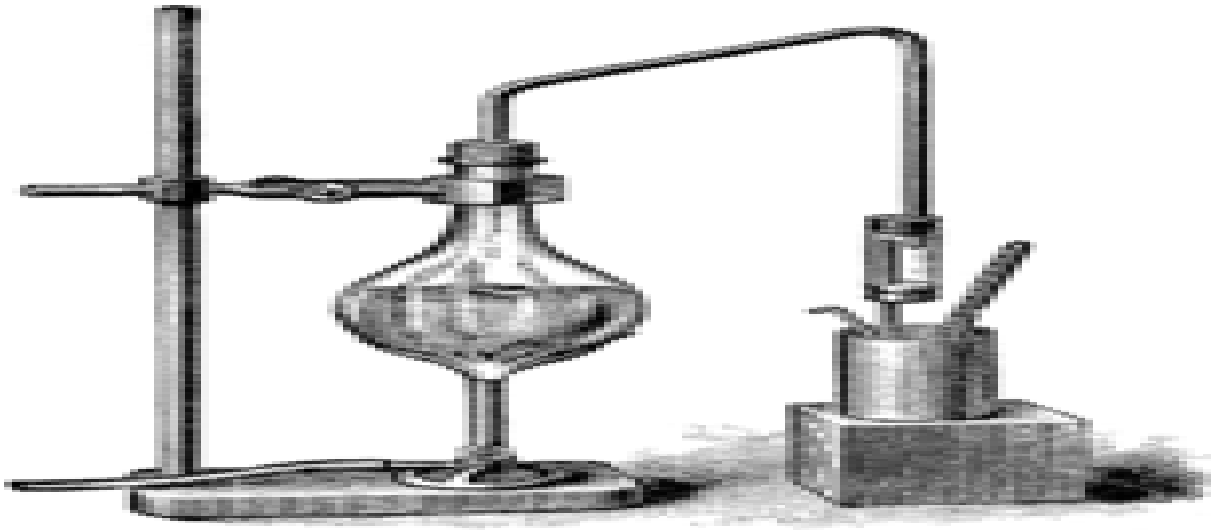
KwVbxfe‡bi mßZvc

GKK f‡ii †Kv‡bv Zij c`v_©K Gi Zvcgv‡Îvi cwieZ©bv NwU‡q ïaygvÎ Zij Ae¯’v †_‡K KwVb Ae¯’vq cwiYZ n‡Z †h cwigvY Zvc cwiZ¨³ nq Zv‡K H Zi‡ji KwVbxfe‡bi mßZvc e‡j|

cwbi KwVbxfe‡bi mßZvc ej‡Z wK eySv?

ev®úxqfe‡bi mßZvc

GKK f‡ii Zij c`v_©K Zvi ùzbv‡¼ †i‡L Zvcgv Îvi †Kv‡bv cwieZ©bv NwU‡q ïay Zij n‡Z ev‡®ú cwiYZ Ki‡Z †h cwigvY Zv‡ci cÖvRb nq Zv‡K H Zi‡ji ev®úxqfe‡bi mßZvc e‡j|



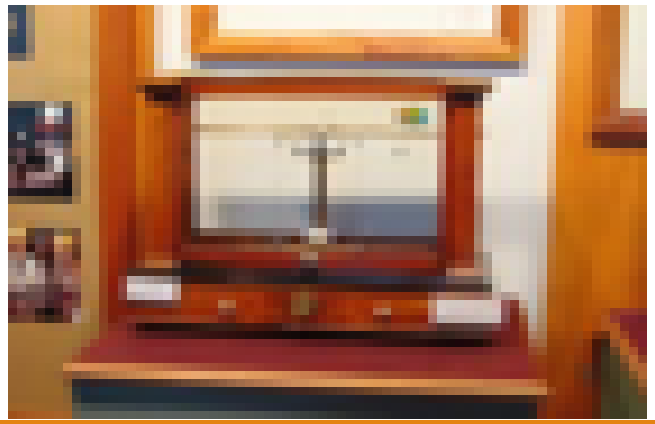
cwbi ev®úxqfe‡bi mßZvc 537Cal/gm ev
537 K¨vjwi/MÖ ej‡Z wK eyS ?
DËit-eid Mj‡bi myÉZvc 80 Cal/gm
ej‡Z eySvq 1 gm cwb‡K Zvi ùzbv¼ ev
100°C †i‡L ev‡®ú cwiYZ Ki‡Z 537 Cal
Zv‡ci cÖqvRb nq|

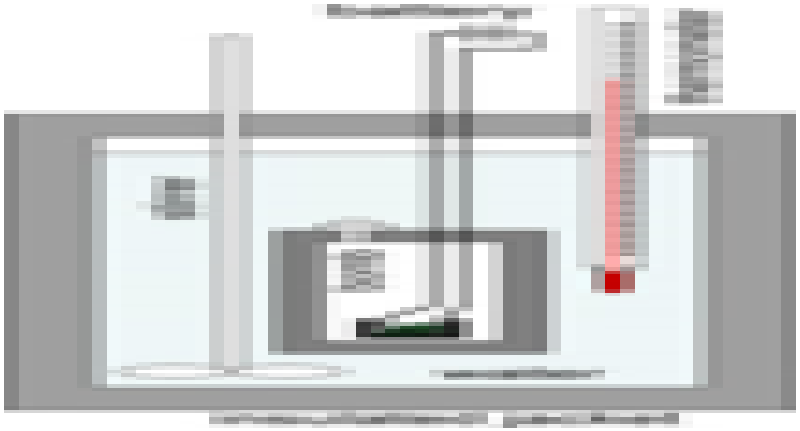
Nbxfe‡bi mßZvc

GKK f‡ii †Kv‡bv evqexq c`v_©K Zvi Zvcgv Îvi †Kv‡bv cwieZ©bv NwU‡q ïaygv Î evqexq Ae¯’v n‡Z Zi‡ji cwiYZ Ki‡Z †h Zv‡ci cÖvRb nq Zv‡K H evqexq c`v‡_©i Nbxfe‡bi mßZvc e‡j|

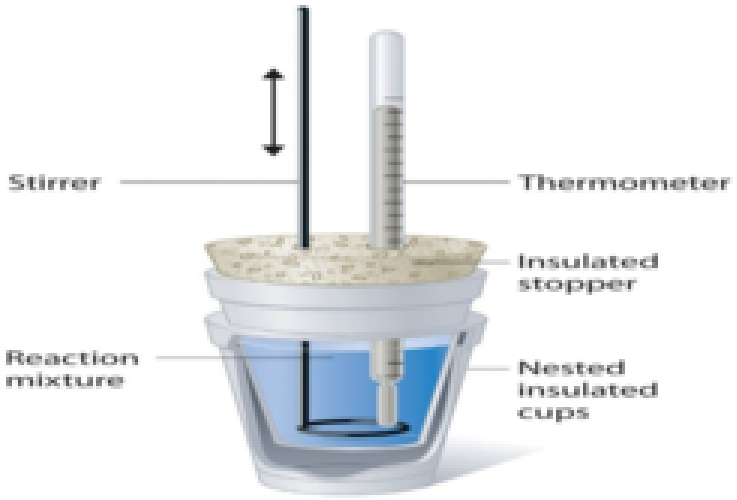
K¨vjwiwgUv‡ii mvnv‡h¨ KwVb e¯‘i Av‡cwÿK Zvc wbY©q

wgkÖcÖj x‡Z KwVb c`v‡_© Av‡cwÿK Zvc wbY©Ki t- Kvh©×wZ :-
cÖ‡g bvovbxmn GKwU cwi®‹vi Ges ïK‡bv K¨vjwiwgUvi †bB| Gi fi †ei
Kwi| Gici K¨vjwiwgUv‡ii GK ZZxqvsk cwb Øviv cY©Kwi Ges cwbi fi
†ei Kwi| bvovbxmn K¨vjwiwgUvi I cwbi Gi Zvcgv‡Îv wbY©Kwi| GKwU
KwVb e¯‘†bB Ges KwVb e¯‘i fi †ei Kwi| KwVb e¯‘U‡K Mig K‡i
e¯‘U‡K bvovbx Ges cwbi g‡a¨ †Q‡o †`B| Mig KwVb e¯‘U Zvc nvi‡e
Avi cwb Ges K¨vjwiwgUvi ‡mB Zvc MÖn¨Y Ki‡e| GKwU _v‡gvwgUvi w`‡q
wgkÖi me©kl Zvcgv‡Îv †ei Kwi|





wnmve



bvovbxmn K¨vjwiwgUv‡ii fi = m kg

cwbi fi = $m_1 kg$

KwVb e¯‘i fi =$m_2 kg$

bvovbx I K¨vjwiwgUv‡ii Dcv`v‡bi Av‡cwÿK Zvc = $s_1 \mathrm{J} kg^{-1} K^{-1}$

cwbi Av‡cwÿK Zvc = $s_2 \mathrm{J} kg^{-1} K^{-1}$

KwVb e¯‘i Dcv`v‡bi Av‡cwÿK Zvc = $s_3 \mathrm{J} kg^{-1} K^{-1}$

cwb, bvovbx Ges K¨vjwiwgUv‡ii cÖwgK Zvcgv Îv = t_1 K

KwVb e¯‘i m‡ev© Zvcgv Îv = t_2 K

wgkÖYi Zvcgv Îv= t_3 K

K¨vjwiwgwZi gj¬bxwZ Abyw‡i Avgiv Rwb,

Mnxn Zvc = ewRZ© Zvc

wgkÖc×wZ‡Z KwVb c`v‡_© Av‡cwÿK Zvc wbY©q i †ÿ‡Î cwbi Ges K¨vjwiwgUvi Zvc MÖn Ki‡e Ges KwVb e¯‘Zvc eRb© Ki‡e|

mÿZivs K¨vjwiwgUvi KZ©K MÖZ Zvc $H_1 = m_1 s_1 (t_3 - t_1)$ Joule

cwb KZ©K MÖZ Zvc $H_2 = m_2 s_2 (t_3 - t_1)$ Joule

Avevi KwVb e¯‘KZ©K ewRZ© Zvc $H_3 = m_3 s_3 (t_2 - t_3)$ Joule

ewRZ© Zvc = Mn„xZ Zvc

$H_3 = H_1 + H_2$

ev, $m_3 s_3 (t_2 - t_3) = m_1 s_1 (t_3 - t_1) + m_2 S_2 (t_3 - t_1)$

ev, $m_3 s_3 (t_2 - t_3) = (t_3 - t_1)\,(m_1 s_1 + m_2 s_2)$

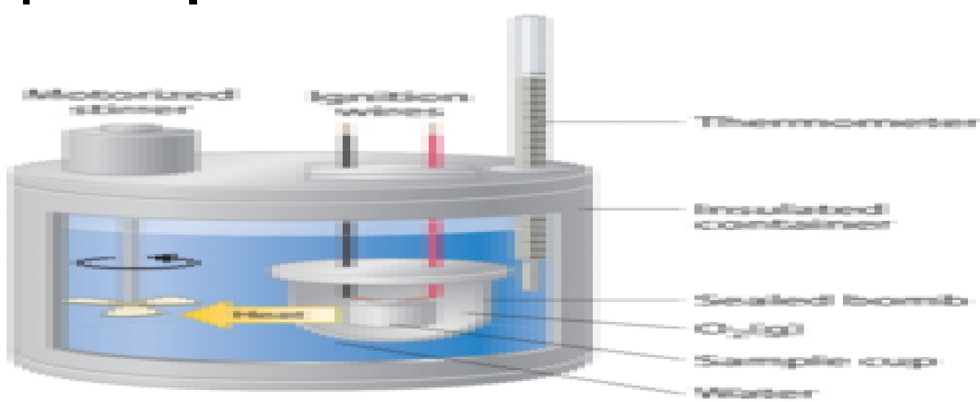
ev, $s_3 = \frac{(t_3 - t_1)(m_1 s_1 + m_2 s_2)}{m_3 (t_2 - t_3)}$

Dc‡ii mgxKi‡Yi Wvbcv‡k©iwk¸‡jvi gvb Rvbv _vK‡j Avgiv †Kvb KwVb c`v‡_©Av‡cwÿK Zvc Gi gvb †ei Ki‡Z cvie|

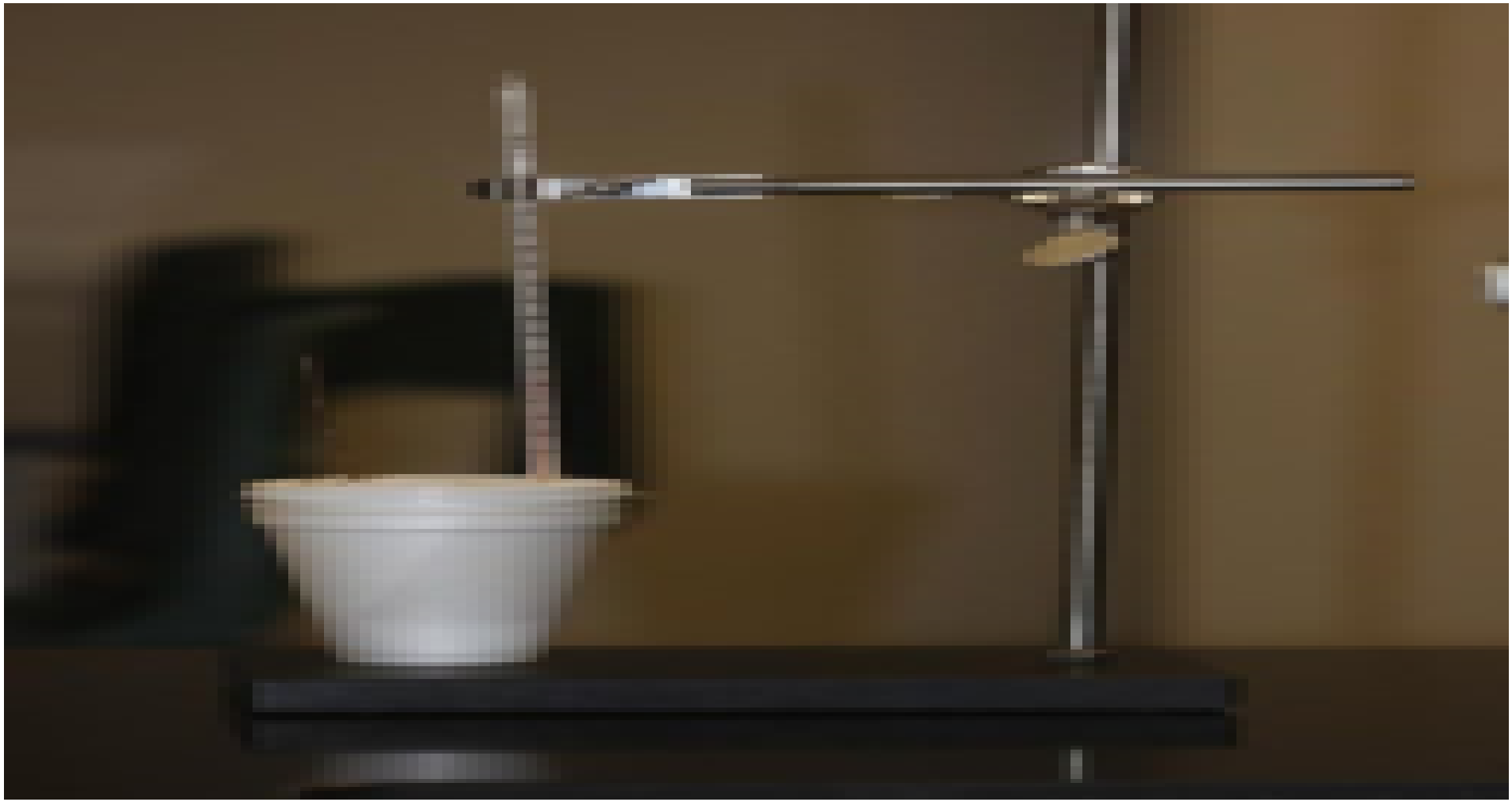
wgkÖcÖYvj‡Z eid Mj‡bi myßZvc wbY©q Ki|

Kvh©c×wZ

cÖ_‡g GKwU bvowbi wb‡Pi cv‡šÍ¯Œæ Zv‡ii GKwU Rvj hy³ Kwi Ges GKwU cwi®‹vi I ïK‡bv K¨vjwiwgUvi †bB| bvovbxmn Gi fi m_1 †ei Kwi| Zvici K¨vjwiwgUv‡ii `yB - ZZxqvsk cvwb Øviv c~Y© Kwi Ges cvwbi fi m_2 †ei Kwi| bvovbxmn K¨vjwiwgUvi I cvwbi Gi Zvcgvòv t_1°C wbY©q Kwi|



GLb K‡qK UKiv cwi®‹vi eid †Pvl KvMR Øviv ï® K‡i Zvov Zwo K¨vjwiwgUv‡ii cwb‡Z †d‡j w`B Ges Av‡jvo‡Ki Rvjøviv UKiv¸‡jv‡K me© cwbi wb‡P †i‡L Av‡¯ÍAv‡¯Íbvo‡Z _vwK| GB Ae¯’vq eid Mj‡Z _v‡K Ges cwbi Zvcgv Îv µgk Kg‡Z _v‡K| mg¯Íeid M‡j hvIqv ci _v‡gvwgUvi Øviv wgkÖYi Zvcgv Îv t°C wbY© Kwi| Gici cwbi Kÿ Zvcgv Îvq wd‡i Avm‡j cwbmn K¨vjwiwgUvi fi Kwi| ZZxq Ges wØZxq f‡ii cv_© n‡Z Mwj Z ei‡di fi m_3 †ei Kwi|



wnmve

g‡bKwi, K¨vjwiwgUv‡ii fi = m_1 MÖg

K¨vjwiwgUv‡ii Av‡cwÿK Zvc = s_1

cwbi fi = m_2 MÖg

cwbi Av‡cwÿK Zvc = s_2 = 1

K¨vjwiwgUvi I cwbi cÖwgK Zvcgv‡Îv = t_1°C

ei‡di fi = m_3 MÖg

ei‡di Av‡cwÿK mgZvc = L K¨vjwi/MÖg

wgkÖYi Zvcgv‡Îv = t°C

K¨vjwi wgUv‡ii nvi v‡bv Zvc = fi×Av‡c wÿK Zvc × Zvcgv Îvi cv_K©|

$= m_1 . s_1(t_1 - t)$

$= m_1 s_1(t_1 - t)$ K¨vjwi

Ges cwbi nvi v‡bv Zvc = $m_2 . s_2(t_1 - t)$ [∵ s_2=1]

$= m_2 . 1(t_1 - t)$

$= m_2(t_1 - t)$ K¨vjwi

0°C Zvcgv Îvi m_2 MÖg eid 0°C Zvcgv Îvi cwb‡Z cwiYZ n‡Z Mp„xZ Zvc = m_2L K¨vjwi

m_2 MÖg eid Mjb cwbi Zvcgv Îv 0°C n‡Z t°C ew„× †c‡Z Mp„xZ Zvc = $m_2 . s_2$(t-0) = $m_2 s_2$t= m_2t K¨vjwi|

[∵ s_2=1]

K¨vjwiwgwZi gj¨bxwZ Abyw‡i Avgiv Rwb,

Mnxn Zvc = ewRZ© Zvc

$$m_2 L + m_2 t = m_1 s_1 (t_1 - t) + m_2 (t_1 - t)$$

$$m_2 L = (t_1 - t)(m_1 s_1 + m_2) - m_2 t$$

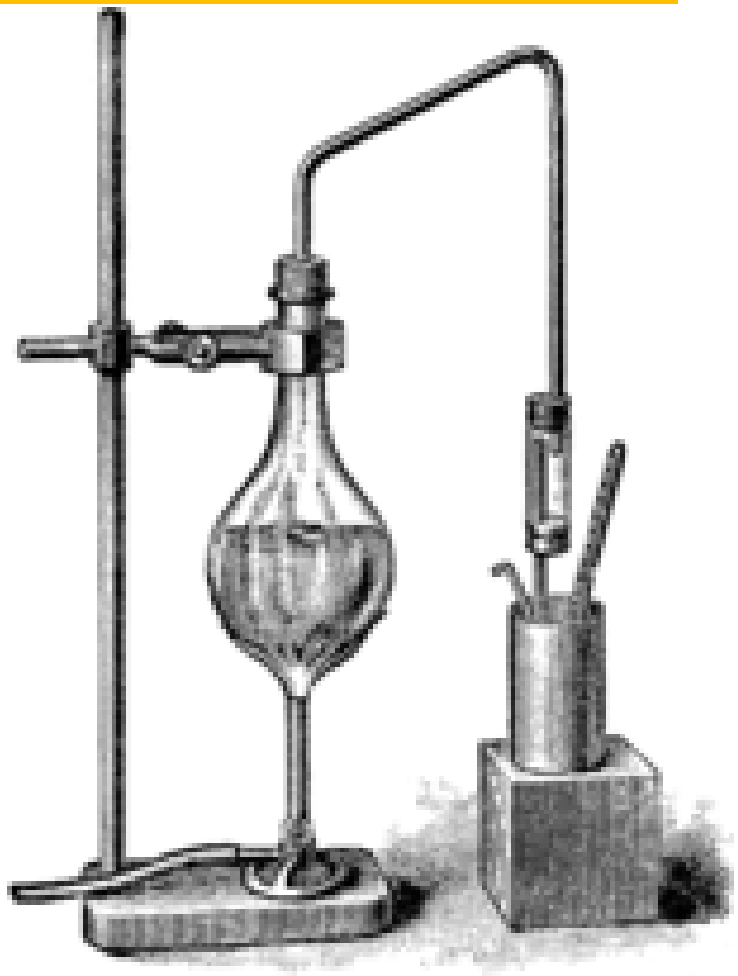
$$L = \frac{(t_1 - t)(m_1 s_1 + m_2) \quad m_2 t}{m_2}$$

Dc‡iv³ iwk t_1, t, m_1, s_1 ,m_2 Gi gvb †R‡b eid Mj‡bi mgZvc L wbY©Ki hvq|

wgkÖc×wZ‡Z cwbi ev®úxqfe‡bi mßZvc wbY©q|

Kvh©×wZ

cÖ‡g GKwU bvovwbi wb‡Pi cÖ‡šÍmiæ Zv‡ii GKwU Rvj hy³ Kwi Ges GKwU cwi®vi I ïK‡bv K¨vjwiwgUvi †bB| bvovbxmn Gi fi m_1 †ei Kwi| Zvici K¨vjwiwgUv‡ii `ßv - ZZxqvsk cwb Øviv cY©Kwi Ges cwbi fi m_2 †ei Kwi| bvovbxmn K¨vjwiwgUvi I cwbi Gi Zvcgvîv t_1°C wbY©Kwi|



K¨vjwiwgUvi‡K GKwU Acwievnx Z‡ji Dci †i‡L ùzb cv‡Îi cwb evbv©i mvnv‡h¨ dzU‡q ev‡®ú cwiYZ K‡i ev®ú K¨vjwiwgUv‡i iwÿZ cwbi g‡a¨ cÖk Kiv‡bv nq| cwbi ms¯ú‡k©e ev®ú cwb‡Z cwiYZ nq| Gfv‡e wKQzÿY ev®ú cÖwnZ nevi ci K¨vjwiwgUvi‡K mwi‡q Avbv nq| bvowbi mvnv‡h¨ K¨vjwiwgUv‡ii cwb DËgi‡c †b‡o Zvi Zvcgvîv t°C wbY©Kwi| K¨vjwiwgUviwU VvÛv K‡i cÖviv Gi fi wbY©Kwi| ZZxq I wØZxq IR‡bi cv_©K¨ n‡Z cwb‡Z cwiYZ ev‡®úi fi m_3 †ei Kwi|

wnmve

g‡bKwi, bvowbmn K¨vjwiwgUv‡ii fi =m_1 MÖg

K¨vjwiwgUv‡ii Av‡cwÿK Zvc = s_1

K¨vjwiwgUv‡ii g‡a¨ cwbi fi = m_2 MÖg

cwbi Av‡cwÿK Zvc = s_2 = 1

K¨vjwiwgUvi I cwbi cÖwgK Zvcgv Îv = t_1°C

ùzb cvÎ n‡Z AvMZ ev‡®úi Zvcgv Îv = 100°C

K¨vjwiwgUv‡ii Nbxf¿Z ev‡®úi fi = m_3 MÖg

cwbi ev®úxqfe‡bi Av‡cwÿK mßZvc = L K¨vjwi/MÖg

wgkÖi Zvcgv Îv = t°C

t_1°C Zvcgv‡Îv n‡Z t°C Zvcgv‡Îvq cwiYZ n‡Z K¨vjwiwgUv‡ii Mp¡nxZ Zvc = $m_1 s_1$(t- t_1) = $m_1 s_1$(t- t_1) K¨vjwi

t_1°C Zvcgv‡Îv n‡Z t°C Zvcgv‡Îvq cwiYZ n‡Z cwbi Mp¡nxZ Zvc = $m_2 s_2$(t- t_1)=m_2. 1.(t- t_1) = m_2(t- t_1) K¨vjwi

(‡h‡nZz K¨vjwiwgUv‡ii Zvc = fi× Av‡cwÿK Zvc × Zvcgv‡Îvi cv_©K¨)

[∵ s_2=1]

100°C Zvcgv‡Îvi Mvgvb ev®ú 100°C Zvcgv‡Îvi cwb‡Z cwiYZ n‡Z ev®ú KZ©K¨ ewRZ© Zvc = m_2L K¨vjwi

m_2 Mvgvb Nbxf‚Z cwbi Zvcgv‡Îv 100°C n‡Z t°C ew‚× †c‡Z ewRZ© Zvc = m_2 s_2(100-t) = m_2(100-t) K¨vjwi |

[∵ s_2=1]

K¨vjwiwgwZi gj¨bxwZ Abyw‡i Avgiv Rwb,

ewRZ© Zvc = Mnxn Zvc

$m_2 L + m_2(100 - t) = m_1 s_1(t - t_1) + m_2(t - t_1)$

$m_2 L = (t - t_1)(m_1 s_1 + m_2) - m_2(100 - t)$

$$L = \frac{(t - t_1)(m_1 s_1 + m_2) \quad m_2(100 - t)}{m_2}$$

Dc‡iv³ iwk t_1, t, m_1, s_1, m_2 Gi gvb †R‡b

ev®úxq fe‡bi mgZvc L wbY©Kiv hvq|

120°C Zvcgv Îvi 50 gm f‡ii GKwU e¯‡K 50 gm f‡ii GKwU A¨vjøgwbqv‡gi K¨vjwiwgUvi 20°C Zvcgv Îvi 150 gm cwbi g‡a¨ wb‡ÿc Kiv n‡j wgkÖ‡Yi Zvcgv Îv 30°C cvIqv †Mj| e¯wUi Dc`v‡bi Av‡cwÿK Zvc wbY©Ki | A¨vjøgwbqv‡gi Av‡cwÿK Zvc 900J$kg^{-1}K^{-1}$ |

GLv‡b,

e¯‘i fi m_1= 50 gm= 0.05kg

K¨vjwiwgUv‡ii fi m_2 = 50 gm = 0.05kg

cwbi fi m_3 = 150 gm= 0.15kg

Mig e¯‘i Zvcgvîv t_3 = 120°C = 120 k

K¨vjwiwgUv‡ii I cwbi Zvcgvîv t_1 = 20°C = 20 k

wgkÖY Zvcgvîv t_2 = 30°C = 30 k

A¨vjvgwbqv‡gi Av‡cwÿK Zvc s_2 = 900J$kg^{-1}K^{-1}$

cwbi Av‡cwÿK Zvc s_3 = 4200J$kg^{-1}K^{-1}$

e¯wUi Dc`v‡bi Av‡cwÿK Zvc= s_1

e¯wU K¨vjwiwgUv‡ii I cwbi Kv‡Q Zvc nvivq = 30 -20=10 k

K¨vjwiwgUvi I cwb e¯wUi Kv‡Q Zvc MÖn K‡i = 120 -30=90 k

mgvavb,

e¯wU ewRZ© Zvc Q_1 = fi × Av‡cwÿK Zvc × Zvcgv Îvi cv_K©

= $0.05 \times s_1 \times 90$

K¨vjwiwgUv‡ii Mp,nxZ Zvc Q_2 = fi× Av‡cwÿK Zvc × Zvcgv Îvi cv_K©

$0.05 \times 900 \times 10 = 450k$

cwbi Mp,nxZ Zvc Q_3 = fi × Av‡cwÿK Zvc × Zvcgv Îvi cv_K©

$0.15 \times 4200 \times 10 = 6300k$

Avgiv Rwb, ewRZ© Zvc = Mp,nxZ Zvc

$Q_1 = Q_2 + Q_3$

$0.05 \times s_1 \times 90 = 450 + 6300$

$s_1 = 1500\ Jkg^{-1}K^{-1}$

90°C Zvcgv Îvi 30 gm f‡ii GKwU ej‡K 70 gm f‡ii GKwU K¨vjwiwgUvi 20°C Zvcgv Îvi 90 gm cwbi g‡a¨ wb‡ÿc Kiv n‡j wgkÖY Zvcgv Îv 22.1°C cvIqv †Mj| avZe Dc`v‡bi e‡ji Av‡cwÿK Zvc wbY©Ki|

-10 wWwMÖmjwmqvm Zvcgv Îv 100 MÖg eid‡K 100 wWwMÖmjwmqvm Zvcgv Îvi ev‡®ú cwiYZ Ki‡Z KZ Zv‡ci `iKvi n‡e| [ei‡di Av‡cwÿK Zvc =0.5, eid Mj‡bi mgZvc =80 K¨vjwi/MÖg, cwbi ev®úxfe‡bi mgZvc =537 K¨vjwi/MÖg]

mgvavb,
g‡bKwi,
eid‡K ev‡®ú cwiYZ Ki‡Z cÖvRbxq Zv‡ci cwigvY H = K¨vjwi|
GB ‡ÿ‡Î Pvi chvqq Zvc MÖY Ki‡e|
(1) - 10 ℃ n‡Z 0 ℃ ei‡d cwiYZ n‡Z cÖvRbxq Zvc =mst
=100×0.5×{0-(-10)}=100×0.5×10=500 K¨vjwi

(2) 0 °C eid‡K n‡Z 0 °C Zvcgv‡Îvq cwb‡Z cwiYZ n‡Z cÖvqRbxq Zvc = mL

=100×80=8000 K¨vjwi

(3) 0 °C cwb‡K n‡Z 100 °C Zvcgv‡Îvq cwb‡Z cwiYZ n‡Z cÖvqRbxq Zvc = mst

= 100×1×{100-0}

=100×1×100=1000 K¨vjwi

(4) 100°C cwb‡K n‡Z ev‡®ú cwiYZ n‡Z cÖvqRbxq Zvc = mL

= 100×537= 53700 K¨vjwi

‡gvU cÖvqRbxq Zvc H = (500+8000+1000+53700)

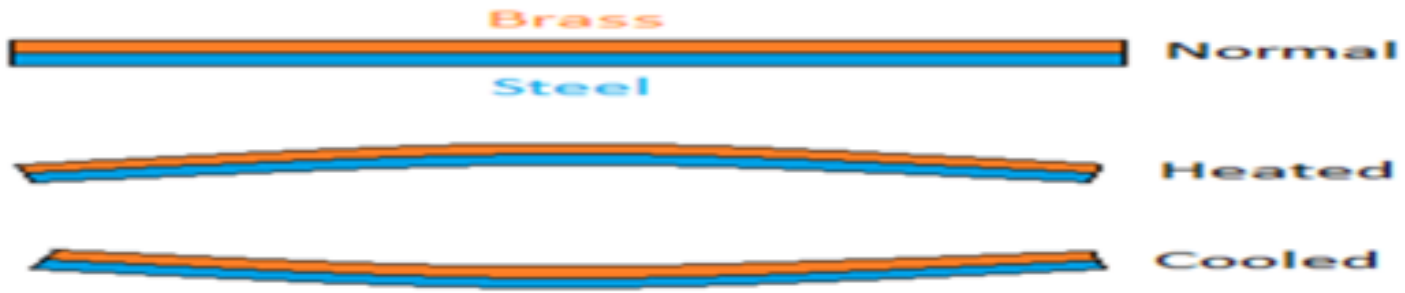
= 72200 K¨vjwi

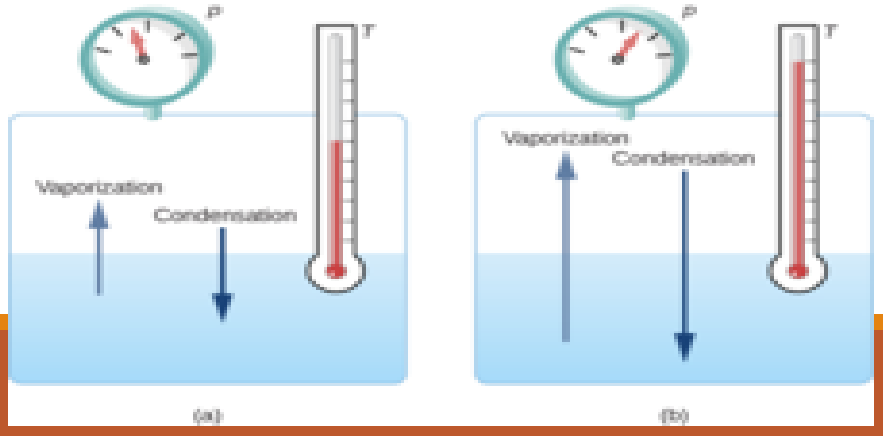
পাঠ ঘোষনা

KwVb c`v‡_© ‰`N¨©cÖiY, †ÿÎ cÖiY, AvqZb cÖiY wK Ges ‰`N¨©cÖiY, †ÿÎ cÖiY, AvqZb cÖiY ¸Yvs‡Ki g‡a¨ m¤úK©Av‡jvPbv Kie|

c‡e© Ávb hvPvB

c`v‡_©Dci Zv‡ci cÖe wK, cwiY wK, GKB Zv‡c wfbœe`v‡_©cwiY wfbœeq wK ev nq †Kb nq Ges K‡qKwU D`vniY I hš¿cvwZi bvg ej|





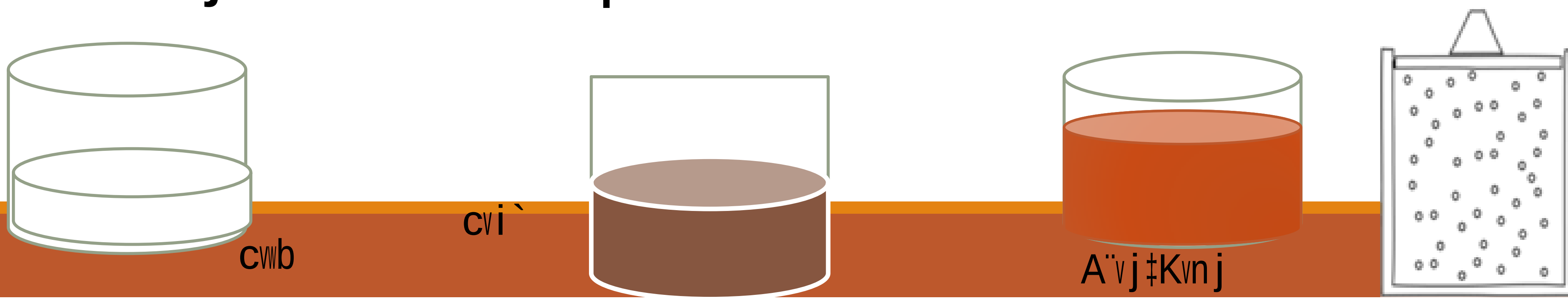
KwVb c`v‡_© cÖKiY

‡Uwj‡dvb, we`¨vZi jvB‡bi Zvi wXjv _v‡K ‡Kb?

M¨vm¨Kvj I kxZKv‡ji Zvcgv‡Îvi cwieZ©‡bi Kvi‡Y ‡Uwj‡dvb I we`¨vZi jvB‡bi Zvi cÖKiY Ges ms‡KvPb nq| G ai‡bi cÖKiY Ges ms‡KvP‡bi Zvi wQ‡o †h‡Z cv‡i| GB Amyeavb `i-Kivi Rb¨ `vwLj †cv‡ói gv‡Si Zvi wXjv ivLv nq| GKgvÎ ^`‡N¨©cÖKi‡Yi Rb¨|

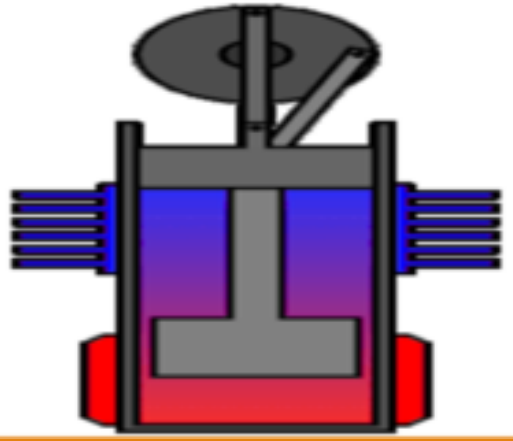
Zi‡ji cÖwiY

wewfbœ Zi‡ji †ÿ‡Î cÖwiY wewfbœ cÖKvi n‡q _v‡K| GKB cÖ‡¯’i`wewkó wZbwU Kv‡Pi b‡ji wZb ai‡bi Zij c`v_© †bIqv nq| awi, Zij ¸‡jv h_vµ‡g A¨vj‡Kvnj,cvwb , cvi`| cÖ_‡g GKB D”PZvq wZbwU bj‡K GKwU cvwbi iv‡L cv‡Î Wzev‡bv nq| GLb cvÎwU‡K DËß Kiv nq| GZ †`Lv †Mj A¨vj‡Kvnj me‡P‡q †ewk D”PZvq cvwb Zvi †P‡q Kg , cvi` me†P‡q Kg D”PZvq D‡V‡Q| G †_‡K ejv hvq, wewfbœ Zi‡ji cÖwiY wewfbœ|



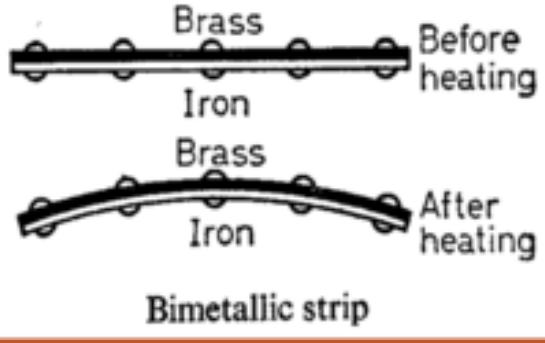
M¨v‡mi cÖKvi Y

M¨v‡mi †ÿ‡Î cÖKvi Y KwVb Ges Zi‡ji †P‡q †ewk nq| KwbK¨vj dv‡¯‹ wKQyi wOb cwb †blqv nq| gyLwU KK©`‡q eÜ K‡i Kv‡Pi bj ‡`lqv nq| GLb dv¯‹wUi Mv‡q Zvc cÖqvM Ki‡j †`qv hvq iwOb cwbi D”PZvq ew,× cv‡”Q| G ‡_‡K ejv hvq, Zv‡ci M¨v‡mi cÖwZ n‡”Q|

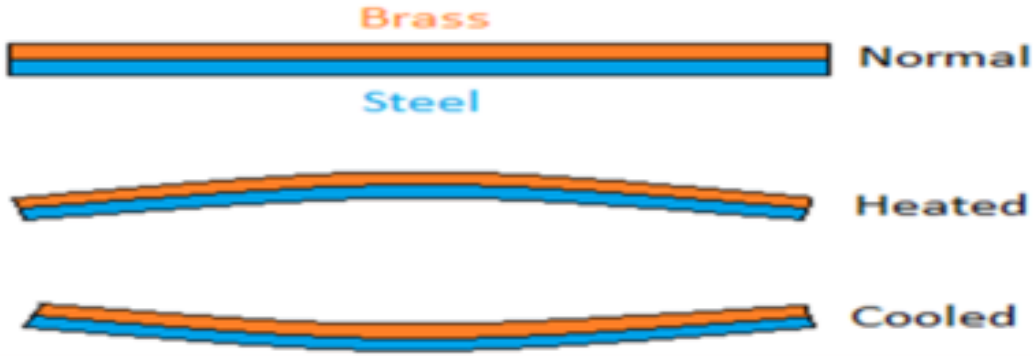


দ্বিধাতব পাত কি ?

wØavZe t- mvavi YZ GKB ^`‡N¨©`yU wfbœe`v‡_©cvZjv cvZ‡K `yc©ÍSvjvB K‡i †Rvov jwM‡q †`lqv nq| G‡KB wØavZe cvZ e‡j| GLv‡b cvZ `yU †jvnv I wcZ‡ji cvZ †blqv nq| Gfv‡e mó cvZwU mvavi Y Zvcgv Îvq †mvRv _v‡K| wKš‘D³ cvZ `yU‡K DËß Ki‡j ‡jvnv Ges wcZ‡ji cvZwU wfZ‡ii w`‡K †e‡uK †M‡Q| Zv‡c A‡cÿv †ewk cÖwiZ nq e‡j GwU †jvnvi cvZ‡K ewuK‡q †`q| D³ wØave cvZwU‡K VvÛv Ki‡j Zv Avevi wecixZ w`‡K †e‡uK hvq|

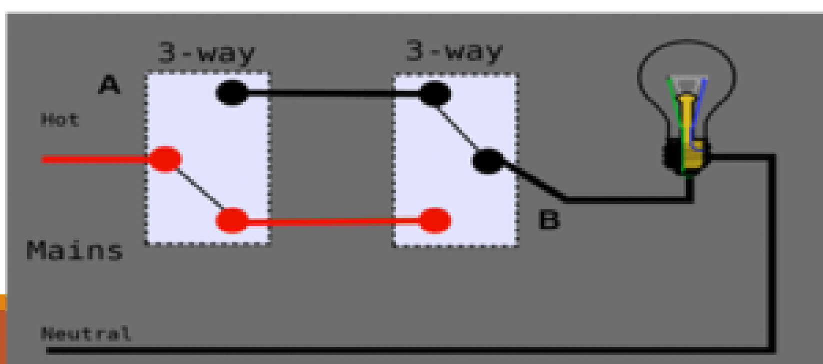


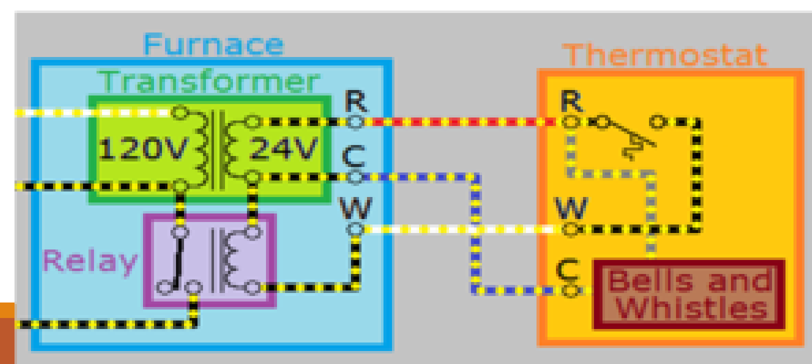
Bimetallic strip



থার্মোস্টাট কি ?

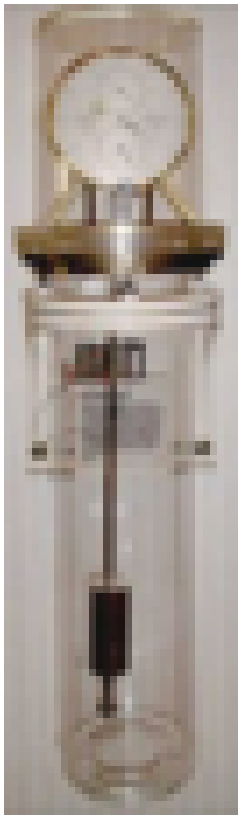
_v‡gv©vU t-‰e`ÿZK hš¿wZ‡Z Zvc wbqš¿Y Kiv we‡kl cÖqvRb ev `iKvi| †h e¨e¯’vi gva¨‡g ev †Kv‡bv c×wZ‡Z GKwU cwigvY ZvcgvÎv me© ivLv hvq ev nq Zv‡K _v‡gv©vU e‡j|
mvaviYZ _v‡gv©v‡U GKwU wØavZe cvZ e¨envi Kiv nq| Kÿ ZvcgvÎvq ˆe`ÿZK eZ©‡Z hLb GB cvZ †mvRv _v‡K ZLb Zv‡ci ˆe`ÿZK eZ© c¥©nq| d‡j we`ÿr cÖevn Pjv m¤¢ci nq| wKš‘ wKQz ÿY we`ÿr Pjvi ci hLb wØavZe cvZ DËß nq ZLb GUv †e‡K hvq d‡j ˆe`ÿZK eZ© wQbœ nq| G‡Z we`ÿr cÖevn Pjv eÜ n‡q hvq| _v‡gv©vU GB bxwZ†Z KvR K‡i mvaviYZ ˆe`ÿZK Bw¯¿B‡jKwUªK †gvUi, †iwdªRv‡iUi, ‰e`ÿZK †KZjx BZ¨vw`‡Z Gi eûj e¨envi †`Lv hvq|





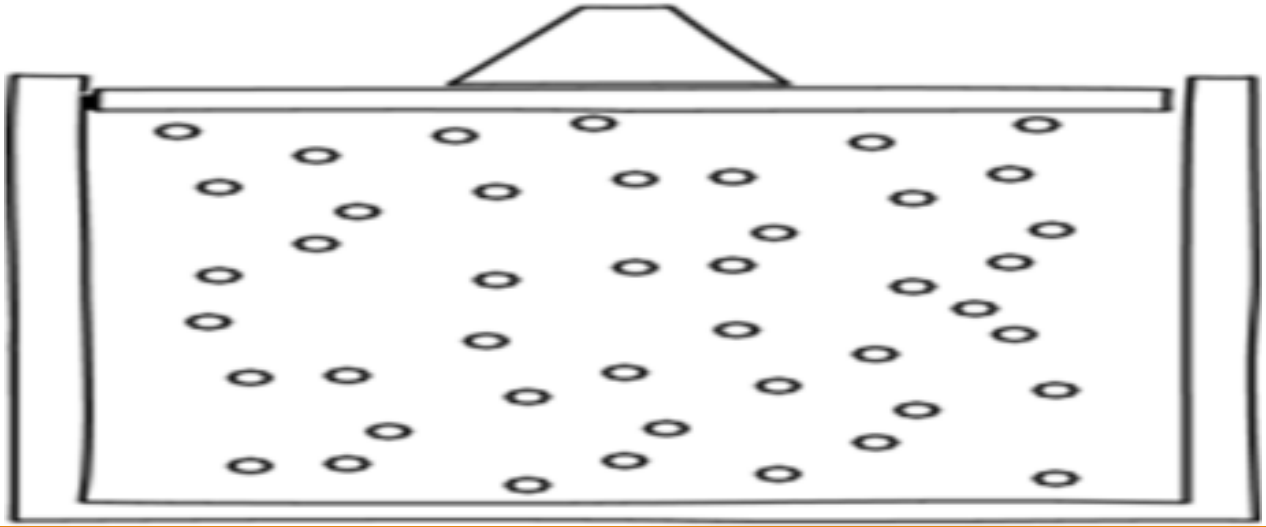
cÖZewnZ †`vjK

ZvcgvÎvi cwieZb©n‡j †`vj‡Ki ^`‡N¨©nvm ev ew,× nq| Avevi, ^`N©evo‡j †`vjbKvj ev‡o A_v©Nwo Av‡¯Íev ax‡i P‡j| Ab¨w`‡K ^`N¨©Kgv‡j †`vjbKvj K‡g hvq A_v©Nwo `ªZ P‡j| G Kvi‡Y MÖK®Kv‡j ax‡i P‡j Ges kxZKv‡j `ªZ P‡j| GB Amyeav `i~Kivi Rb¨ Ggb †`vjK Nwo e¨envi Kiv nq hv‡Z Nwo me©B mwVK mgq †`q| G mKj †`vj‡KiB cÖZwewnZ †`vjK e‡j|



AvqZb cwÖiY ¸bv¼ t-

0°C Zvcgv Îvi GKK AvqZbwewkó †Kv‡bv GKwU cv‡Îi Zvcgv Îv 1 wWwMÖ e„× Ki‡j Gi AvqZb †h cwigvY e„× cvq Zv‡K †mB cv‡Îi Dcv`v‡bi AvqZb cwÖiY ¸Yv¼ e‡j| G‡K γ_g Øviv cÖKvk Ki|



awi, 0°C Zvcgvîv †Kv‡bv Zi‡ji AvqZb = V_o

∴ t°C Zvcgvîvq H Zi‡ji AvqZb = V_t

cÖZ. AvqZb cwigvY = $V_t - V_o = \Delta V_r$ (awi)

Zvcgvîv e„w× = (t -0) = $\Delta\theta$°C

Zi‡ji cÖZ. cwigvY ¸Yv¼,

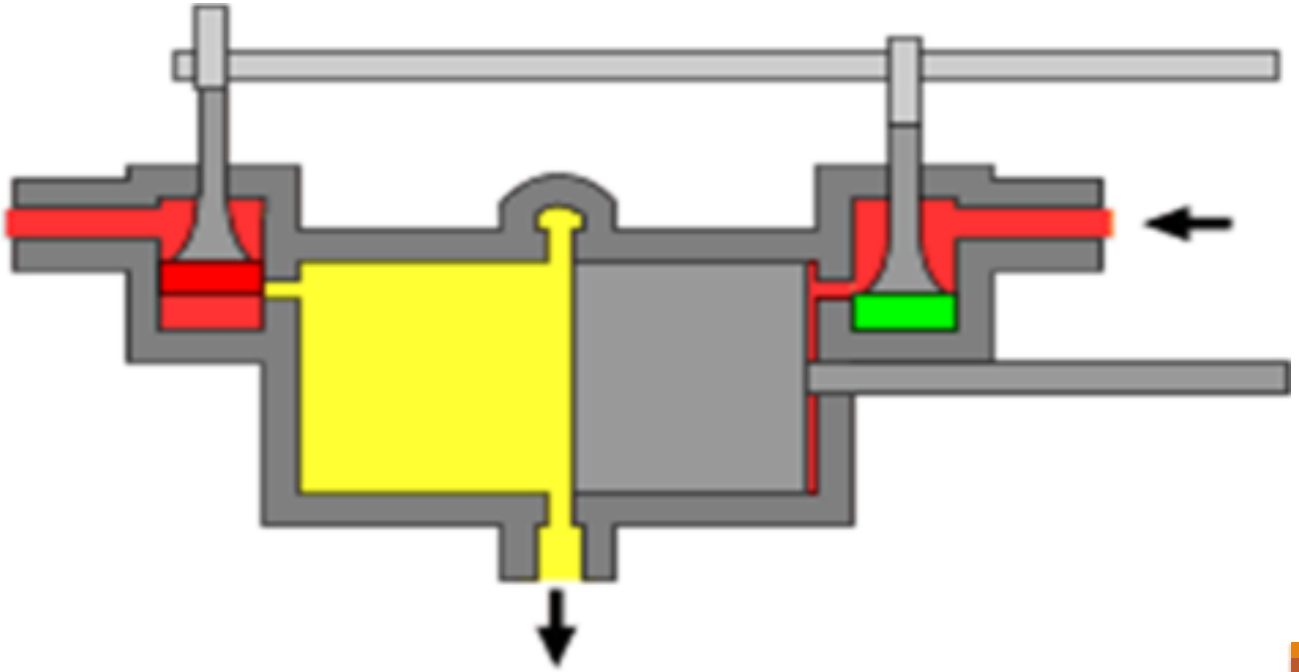
$$\gamma_r = \frac{\text{cÖZ. AvqZb cwigvY}}{0°\text{C Zvcgvîv †Kv‡bv Zi‡ji AvqZb} \times \text{Zvcgvîv e„w×}}$$

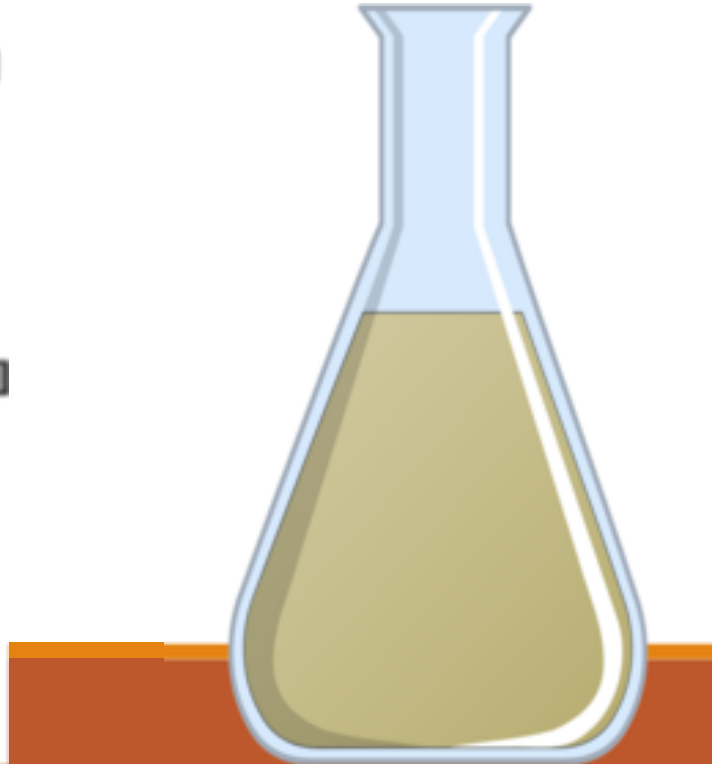
$$= \frac{V_t - V_o}{V_o \times \Delta\theta}$$

$$= \frac{\Delta V_r}{V_o \times \Delta\theta}$$

Zi‡ji AvcvZ cÖKvi¸Yvsk t-

0°C Zvcgv‡Îvi GKK Avq‡Z‡bi †Kv‡bv Zi‡ji Zvcgv‡Îv 1 wWwMÖe¨ Ki‡j †h cwigvY AvcvZ cÖKvi e¨ nq Zv‡K †mB Zi‡ji AvcvZ cÖKvi¸Yv¼ e‡j| G‡K γ_a Øviv cÖKvk Ki|





awi, 0°C Zvcgv Îv †Kv‡bv Zi‡j i AvqZb = V_o

∴ t°C Zvcgv Îvq H Zi‡j i AvqZb = V_t

cÖZ. AvqZb cwigvY = $V_t - V_o = \Delta V_a$ (awi)

Zvcgv Îv ewÂZ = (t -0) = $\Delta\theta$°C

Zi‡j i AvcvZ cwigvY ¸Yv¼,

$$\gamma_a = \frac{\text{cÖZ. AvcvZ cwigvY}}{\text{0°C Zvcgv Îv †Kv‡bv Zi‡j i AvqZb} \times \text{Zvcgv Îv ewÂZ}}$$

$$= \frac{V_t - V_o}{V_o \times \Delta\theta}$$

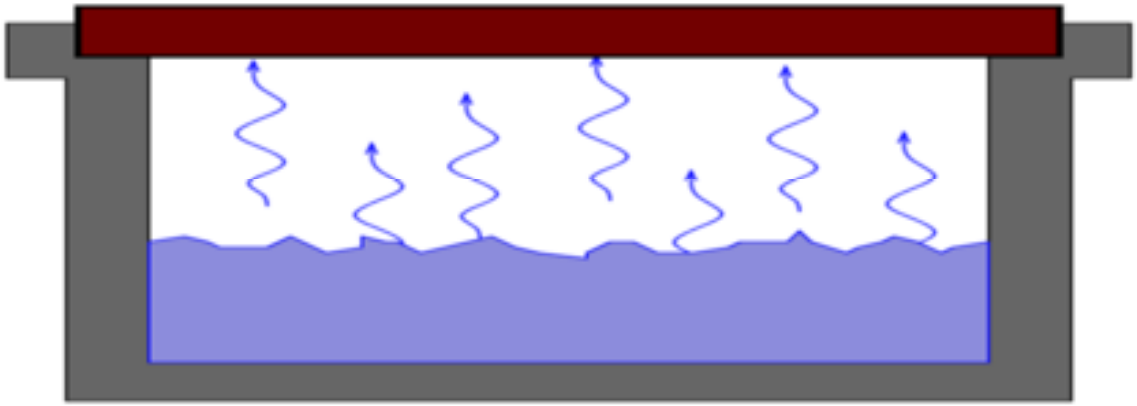
$$= \frac{\Delta V_a}{V_o \times \Delta\theta}$$

cÖZ.cÖi¼ I AvcvZ cÖi‡¼i gv‡S m¤úK© cb Ki?

Zi‡ji cÖiY `ªæ ai‡bi ZvB Gi cÖi¼i `ªæ cÖ‡ii cÖZ.cÖi‡Yi Rb¨ c¶Z.cÖi¼ Ges AvcvZ cÖi‡Yi Rb¨ AvcvZ cÖi¼|

Zi‡ji cÖZ.cÖiY ¸YvsK t-

0°C Zvcgv‡Îvi GKK AvqZ‡bi †Kv‡bv Zi‡ji Zvcgv‡Îv 1 wWwMÖe„× Ki‡j †h cwigvY cÖZ.AvqZb e„× nq Zv‡K †mB Zi‡ji cÖZ.cÖiY ¸Y¼ e‡j| G‡K γ_r Øviv cÖKvk Ki|



awi, 0°C Zvcgv Îv †Kv‡bv Zi‡j i AvqZb = V_o

∴ t°C Zvcgv Îvq H Zi‡j i AvqZb = V_t

cv‡Îi AvqZb cwigvY = $V_t - V_o = \Delta V_a$ (awi)

Zvcgv Îv ewY©Z = (t -0) = $\Delta\theta$°C

cv‡Îi Dcv`v‡bi cwigvY ¸Yv¼,

$$\gamma_g = \frac{\text{cv‡Îi cwigvY}}{\text{0°C Zvcgv Îv †Kv‡bv Zi‡j i AvqZb} \times \text{Zvcgv Îv ewY©Z}}$$

$$= \frac{V_t - V_o}{V_o \times \Delta\theta}$$

$$= \frac{\Delta V_g}{V_o \times \Delta\theta}$$

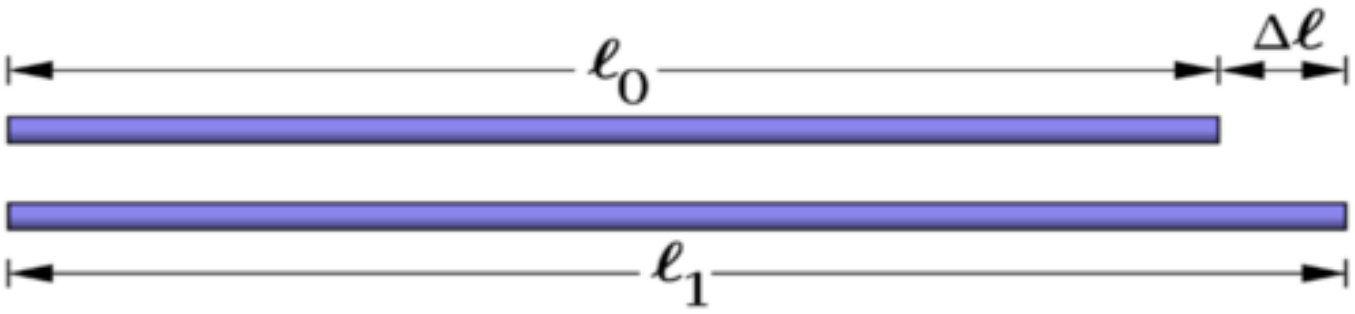
cÖZ.cÖiY I AvcvZ cÖiY Gi g‡a¨ cv_©K¨ wjL?

wb‡P cÖZ.cÖiY I AvcvZ cÖiY Gi g‡a¨ cv_©K¨ n‡jv

cÖZ.cÖiY	AvcvZ cÖiY
1| cv‡Îi cÖiY we‡ePbv K‡i Zi‡ji †h AvqZb cvIqv hvq A_© cÖZ.c‡¶ Zi‡ji †h AvqZb cwieZ©N‡U Zv‡K cÖZ.cÖiY e‡j|	1| cv‡Îi cÖiY we‡ePbv bv K‡i ‡h cÖiY cvIqv hvq Zv‡K AvcvZ cÖiY e‡j|
2| cÖZ.cÖiY= AvcvZ cÖiY+cv‡Îi AvqZb cÖiY|	2| AvcvZ cÖiY=cÖZ.cÖiY cv‡Îi AvqZb cÖiY
3| cÖZ.cÖiY ïaygvÎ Zi‡ji cÖZi Dci wbf©K‡i| cv‡Îi Dcv`v‡bi Dci wbf©K‡i bv| cÖZ.cÖiY	3| AvcvZ cÖiY Zi‡ji cÖZ.Ges cv‡Îi Dcv`v‡bi Dci wbf©K‡i| AvcvZ cÖiY|
4| GUv KLbI FYvZ¥K n‡Z cv‡i bv|	4| GUv FYvZ¥K I n‡Z cv‡i|

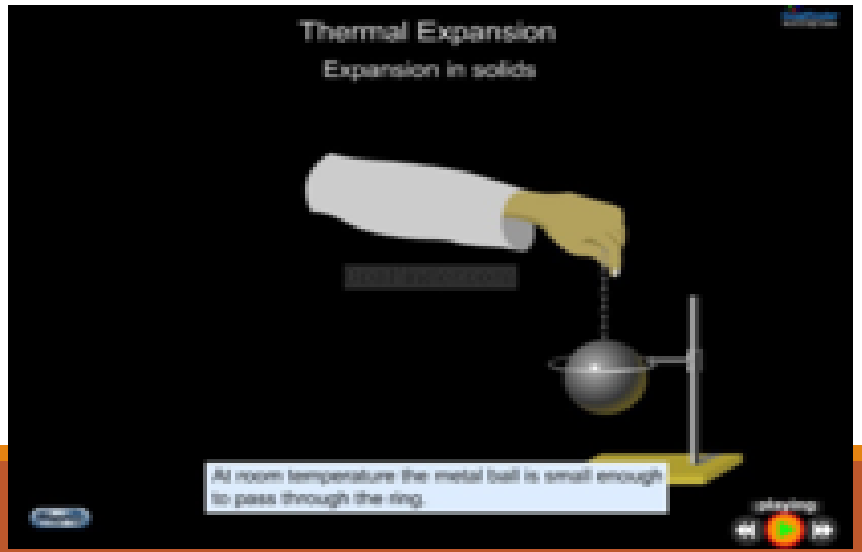
1| ^`N¨©cÖiY

Zvcgv Îv e¨¯×i mv‡_ mv‡_ KwVb c`v‡_© ^`‡N¨©†h e¨¯× N‡U Zv‡K ^`N¨©cÖiY e‡j | ‡hgb cvZjv I mi¤ avZe cvZ DËß Ki‡j Gi ^`‡N¨©cÖiY N‡U|



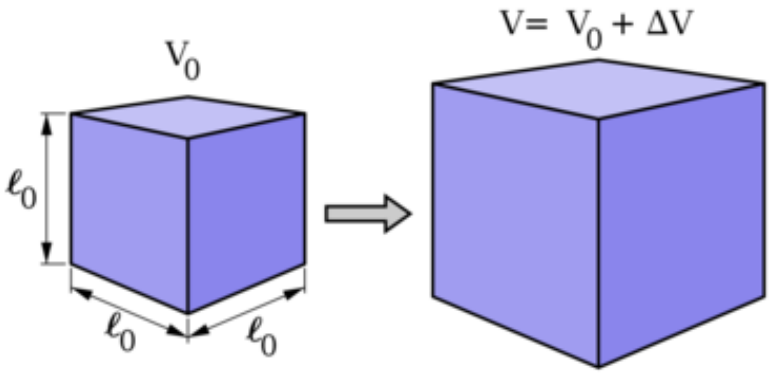
2| †ÿÎ cÖiY

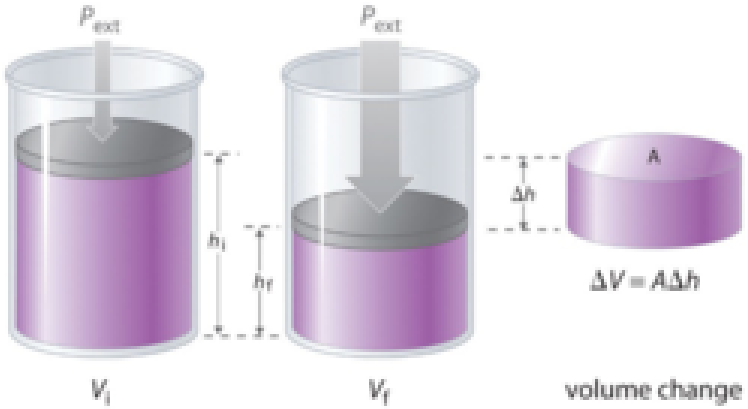
Zvcgv Îv e¨¸×i mv‡_ mv‡_ KwVb c`v‡_© ‡ÿÎ d‡j i †h e¨¸× N‡U Zv‡K ‡ÿÎ cÖiY e‡j| ‡hgb ‡Kv‡bv avZe cvZ DËß Ki‡j Gi ^`‡N¨© cÖevw DfqB cÖiY N‡U|

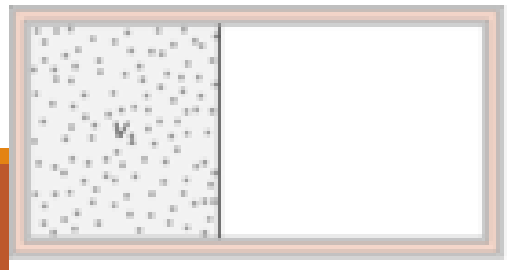


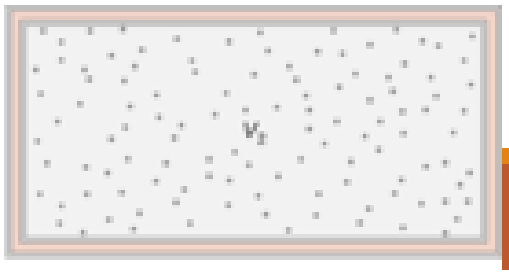
3| AvqZb cÖ`iY

Zvcgv Îv e¨vL¨× mv‡_ mv‡_ ‡Kv‡bv AvqZKvi Nb avZe KwVb c`v‡_© AvqZb †h e¨vL¨× N‡U Zv‡K AvqZb cÖ`iY e‡j| ‡hgb ‡Kv‡bv AvqZKvi Nb avZe c`v_©K DËß Ki‡j Gi ^`‡N¨©cÖGes D”PZv Gi cÖ`iY N‡U|









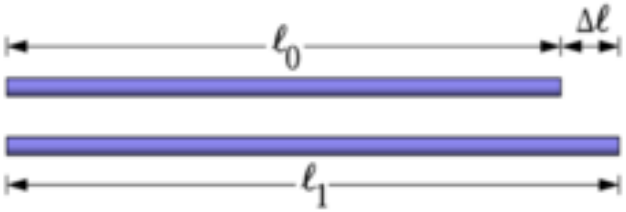
পাঠ ঘোষনা

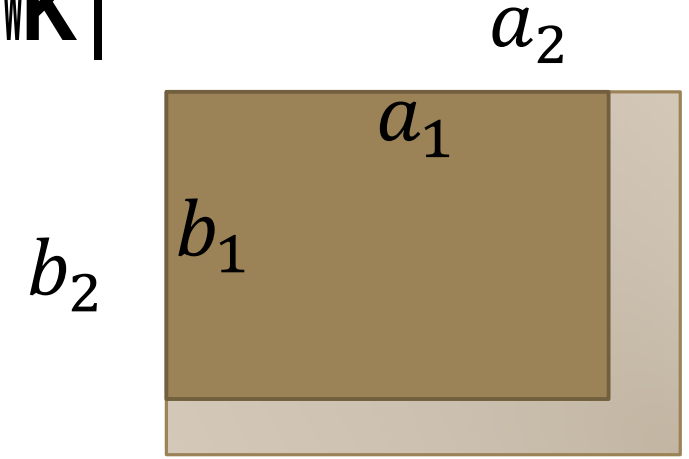
2q Aa¨vq t- c`v‡_©Dci Zv‡ci cÖfve|

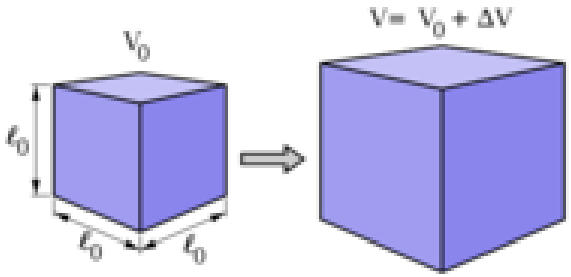
KwVb c`v‡_©‰`N¨©cÖiY, †ÿÎ cÖiY, AvqZb cÖiY Ges G‡`i ¸YvsK ej‡Z wK eSv Ges Gi ¸Yvs‡Ki m¤úK©Av‡jvPbv Kie|

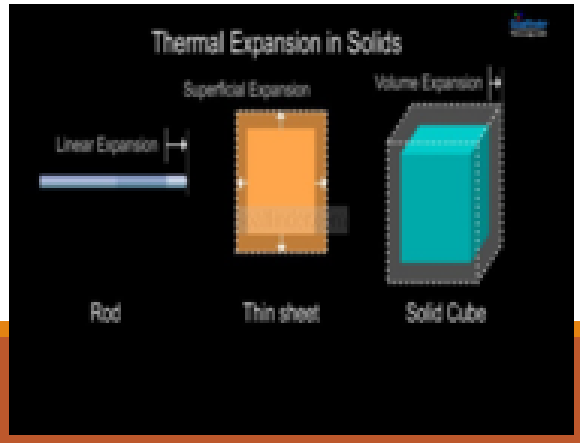
c‡e© Ávb hvPvB

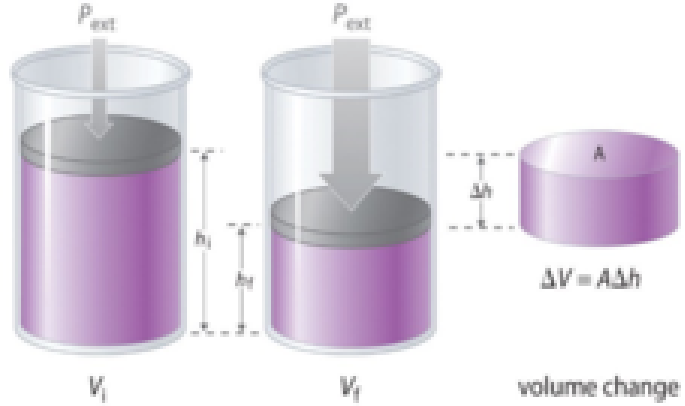
KwVb c`v‡_© ewfbœ cÖiY wK Ges G‡`i ¸Yvs‡Ki g‡a¨ m¤ú‡K© wK| Zi‡ji cÖKvk cÖiY I AvcvZ cÖiY m¤ú‡K© Av‡Q wK|











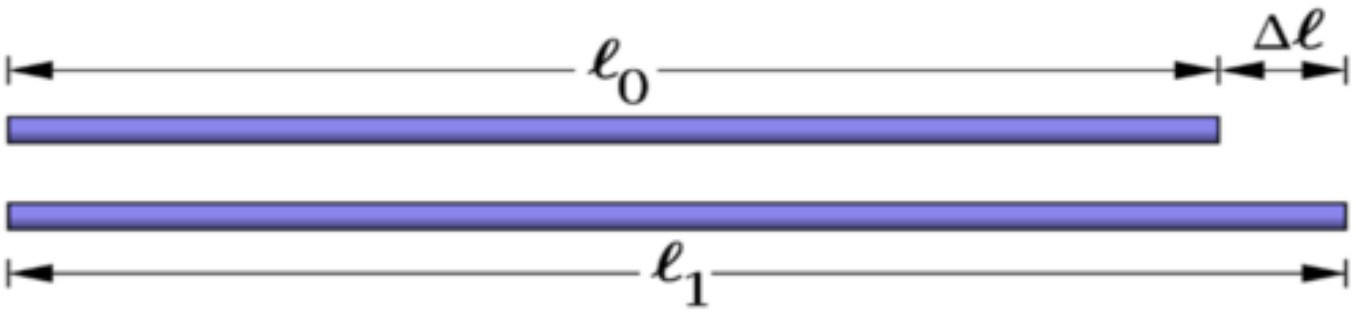
KwVb c`v‡_© cÖKvi

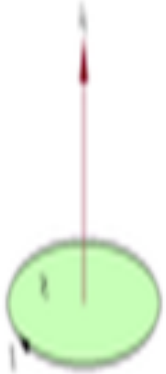
Zvc cÖqvM Ki‡j KwVb c`v‡_© me©`‡K cÖKvi N‡U| KwVb c`v‡_© cÖKvi wZb ai‡bi †hgb -

1| ^`N¨© cÖKvi
2| †ÿÎ cÖKvi
3| AvqZb cÖKvi

1| ^`N¨©cÖiY

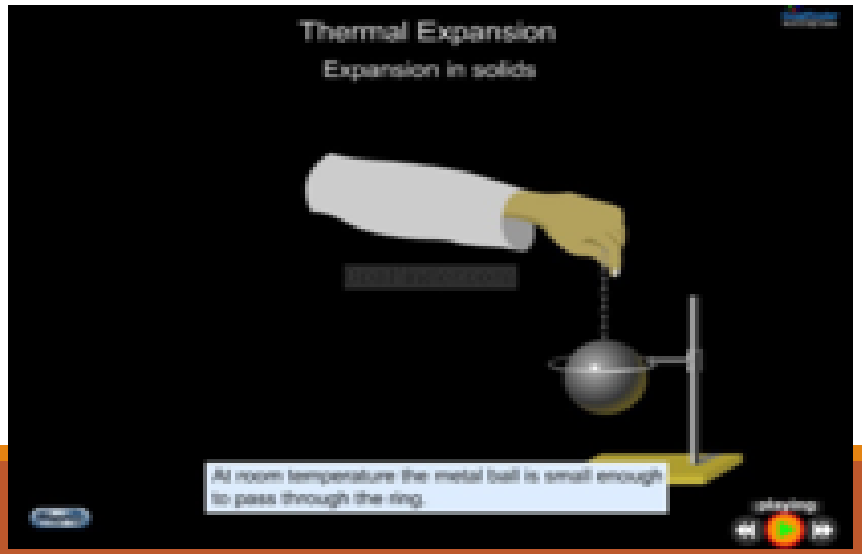
Zvcgv Îv e¨¯×i mv‡_ mv‡_ KwVb c`v‡_© ^`‡N¨©†h e¨¯× N‡U Zv‡K ^`N¨©cÖiY e‡j | ‡hgb cvZjv I mi¤ avZe cvZ DËß Ki‡j Gi ^`‡N¨©cÖiY N‡U|





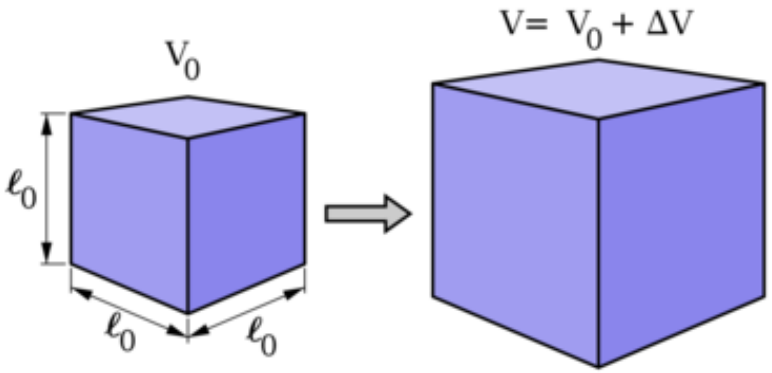
2| †ÿÎ cÖiY

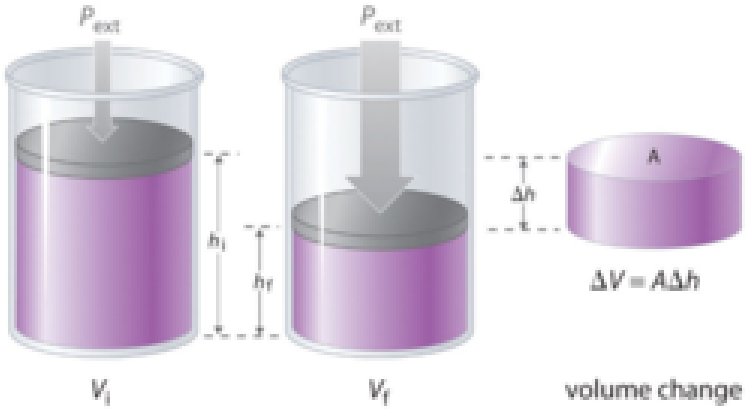
Zvcgv Îv e¨¸×i mv‡_ mv‡_ KwVb c`v‡_© ‡ÿÎ d‡j i †h e¨¸× N‡U Zv‡K ‡ÿÎ cÖiY e‡j| ‡hgb ‡Kv‡bv avZe cvZ DËß Ki‡j Gi ^`‡N¨© cÖevw DfqB cÖiY N‡U|

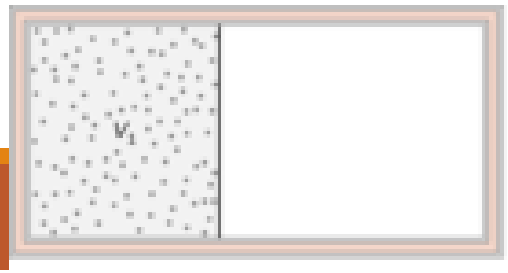


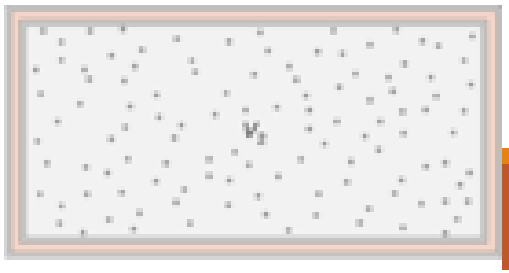
3| AvqZb cÖ`iY

Zvcgv Îv e¨vL¨× mv‡_ mv‡_ ‡Kv‡bv AvqZKvi Nb avZe KwVb c`v‡_© AvqZb †h e¨vL¨× N‡U Zv‡K AvqZb cÖ`iY e‡j| ‡hgb ‡Kv‡bv AvqZKvi Nb avZe c`v_©K DËß Ki‡j Gi ^`‡N¨©cÖGes D”PZv Gi cÖ`iY N‡U|





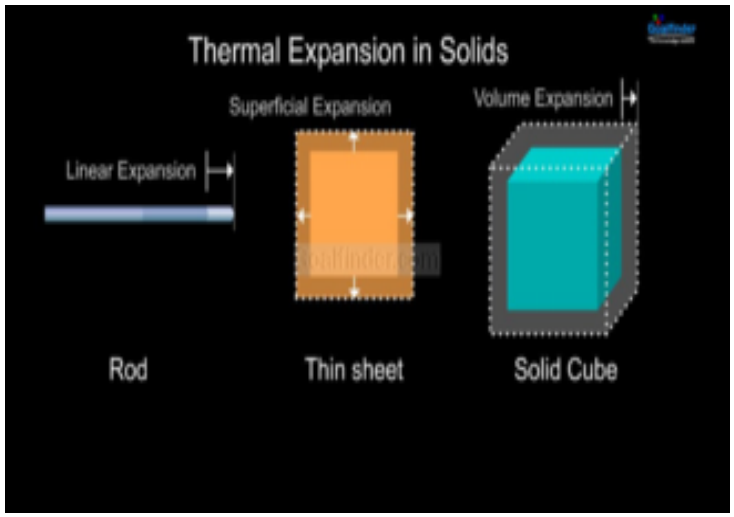




KwVb c`v‡_©cÖiY

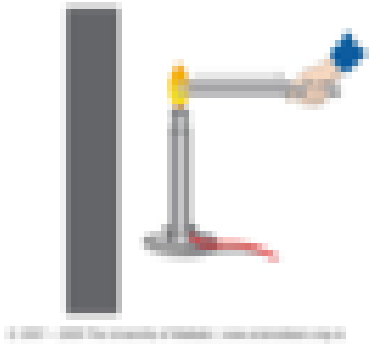
†Kv‡bv KwVb c`v‡_©Zvc cÖqvM Ki‡j wZb cÖKv‡i cÖiY N‡U| GB wZb cÖKvi cÖi‡Yi Rb¨ wZb cÖKvi cÖiY ¸Yv¼ Av‡Q|

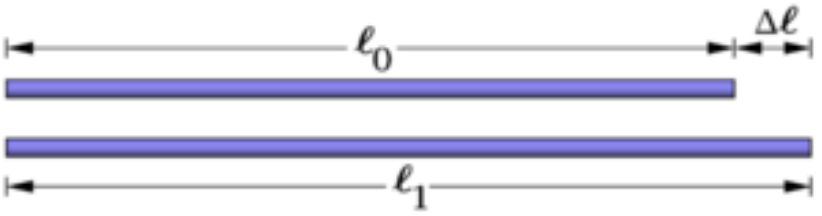
h_v- 1| ^`N¨©cÖiY ¸Yv¼|
2| †ÿÎ cÖiY ¸Yv¼|
3| AvqZb cÖiY ¸Yv¼|



^`N¨©cÖiY ¸Yv¼ Kv‡K e‡j?

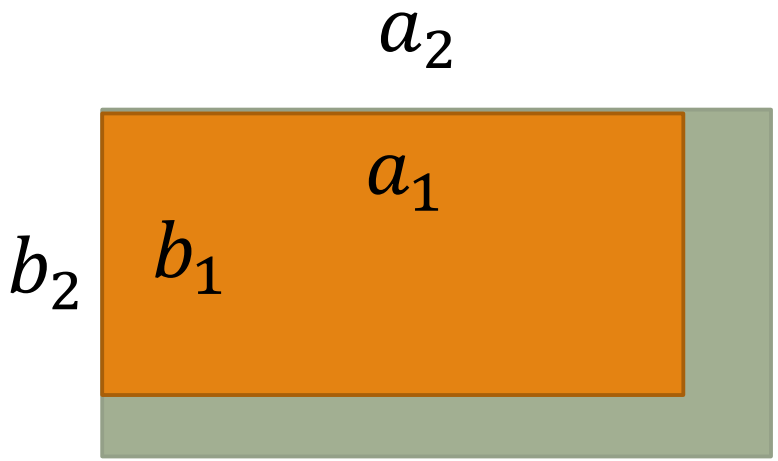
GKK ^`N¨©kó †Kv‡bv GKwU e¯‘i Zvcgvîv 1°C e„× Ki‡j Gi ^`N¨©ZvKz„× cvq Zv‡KB H c`v‡_©^`N¨©cÖiY ¸Yv¼ e‡j| G‡K α Øviv cÖKvk Kiv nq|





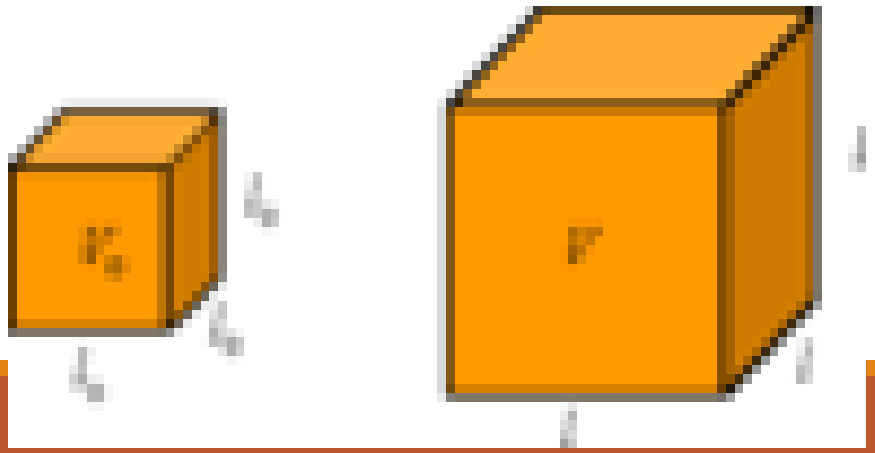
‡ÿÎ cÖPiY ¸Yv¼ Kv‡K e‡j?

GKK ‡ÿÎdj wewkó †Kv‡bv GKwU e¯‘i Z‡ji Zvcgvîv 1°C ewM× Ki‡j Gi ‡ÿÎdj hZUK Kæwb× cvq Zv‡KB H c`v‡_©‡ÿÎ cÖPiY ¸Yv¼ e‡j| G‡K β Øviv cÖKvk Kiv nq|



AvqZb cÖKiY ¸Yv¼ Kv‡K e‡j?

GKK AvqZbwewkó †Kv‡bv GKwU Nb‡Ki e¯‘i Z‡ji Zvcgv Îv 1°C e„w× Ki‡j Gi AvqZb hZUK Kæ„w× cvq Zv‡KB H c`v‡_© AvqZb cÖKiY ¸Yv¼ e‡j| G‡K γ Øviv cÖKvk Kiv nq|



1| ^`N¨©cmÖiY ¸Yv¼ wbY©Ki ev e¨vL¨v Ki

GKK ^`N¨©ewkó †Kv‡bv GKwU e¯'i 1°C Zvcgv‡Îv e„× Ki‡j Gi ^`N¨©ZvKzæ„× cvq Zv‡KB H c`v‡_©^`N¨© cmÖiY ¸Yv¼ e‡j| G‡K α Øviv cÖKvk Kiv nq| e¨vL¨v t- g‡bKwi, O°C Zvcgv‡Îvq GKwU `‡Ûi ^`N¨© l_o Ges `‡Ûi t °C Zvcgv‡Îv c‡qvM Ki‡j H `‡Ûi ^`N¨© e„× ‡c‡q l_t n‡jv|

t°C Zvcgv‡Îv e„× Kivq ^`N¨©wieZb© $= l_t - l_o$

A_vi©t°C Zvcgv Îv e¨„×‡Z l_o H `‡Ûi ^`‡N¨©^`N¨©e¨„× cvq = $l_t - l_o$

∴ 1°C ,, ,, l_o ,, ,, ,, ,, ,, ,, = $\frac{l_t - l_o}{t}$

∴ 1°C ,, ,, 1 ,, ,, ,, ,, ,, ,, = $\frac{l_t - l_o}{t \times l_o}$

‰`N¨©cÖiY ¸Yv¼, $\alpha = \frac{l_t - l_o}{t \times l_o}$ ----------(1)

$$\alpha = \frac{\text{‰`N¨©cÖiY}}{\text{Aww` ^`N¨©Zvcgv Îv e¨„×}}$$

mgxKiY (1) bs n‡Z cvB, $l_t - l_o = \alpha \times t \times l_o$

ev, $l_t = \alpha\, t l_o + l_o$

ev, $l_t = l_o + \alpha\, t l_o$

ev, $l_t = l_o(1 + \alpha t)$ ----------(2)

Dc‡iv³ msÁvq †mw›U‡MvÖ†¯‹‡j O°C n‡Z t°C Zvcgv‡Îv aiv nq wKš‘O°C n‡Z cÖiY wbY©Kiv Lvq KóKi| G Rb¨ †h †Kv‡bv `ÿZv Zvcgv‡Îv n‡Z ‰`N¨© cÖiY ¸Yv¼ wbY©Kiv nq|

awi, `ÿZv Zvcgv‡Îv h_vµ‡g $t_1$°C I $t_2$°C Ges D³ Zvcgv‡Îv †Kv‡bv GKwU `‡Ûi ^`N¨© h_vµ‡g l_1 I l_2 nq|

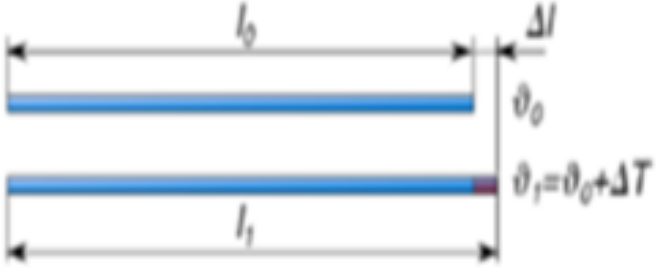
ZLb mgxKiY (2) bs Abyw‡i †jLv hvq -

$l_1 = l_o(1+ \alpha t_1)$ ----------(3)

$l_2 = l_o(1+ \alpha t_2)$ ----------(4)

†h‡nZz O°C Zvcgv‡Îvi `‡Ûi ^`N¨© l_o

Ges hw` $t_2 > t_1$ Z‡e $l_2 > l_1$



$$\frac{l_2}{l_1} = \frac{l_o(1+ \alpha t_2)}{l_o(1+ \alpha t_1)} \text{ev}, \frac{l_2}{l_1} = \frac{l_o(1+ \alpha t_2)}{l_o(1+ \alpha t_1)}$$

$=(1+ \alpha t_2)(1+ \alpha t_1)^{-1}$ [wØc`x m‡Ýi mvnv‡h¨]

$= (1+ \alpha t_2) (1- \alpha t_1 + \alpha^2 t_1 - \alpha^3 t_1$ ------$+ \alpha^n t_1)$

$= (1+ \alpha t_2) (1- \alpha t_1)$ [KwVb c`v‡_©i ^`N¨© cÖiY Lv‡Z Kg e‡j Gi D”P NvZ eRb¨ K‡i cvB]

$$\frac{l_2}{l_1} = (1 + \alpha t_2 - \alpha t_1 - \alpha^2 t_2 t_1)$$ [KwVb c`v‡_©ˆ``N¨©cÖniY Lye Kg e‡j Gi D”P NvZ eRb©K‡i cvB]

$$= (1 + \alpha t_2 - \alpha t_1)$$

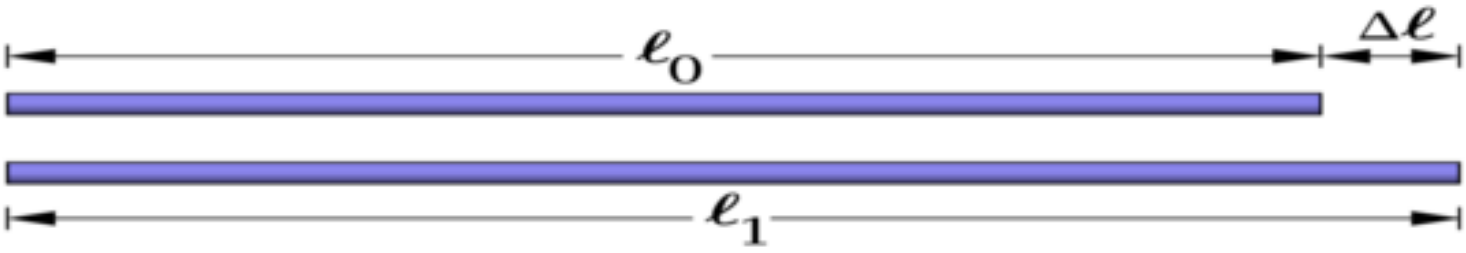
$$\therefore \frac{l_2}{l_1} = 1 + \alpha(t_2 - t_1)$$

$$l_2 = l_1[1 + \alpha(t_2 - t_1)]$$

$$= l_1 + \alpha l_1(t_2 - t_1)$$

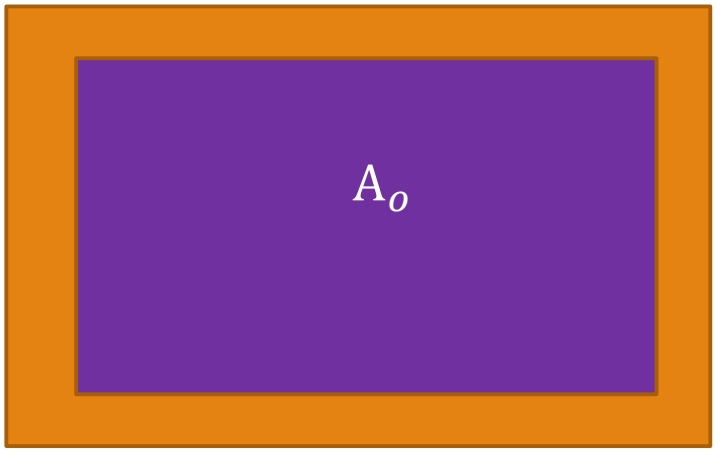
$$\therefore l_2 - l_1 = \alpha l_1(t_2 - t_1) \text{----------(5)}$$

A_vi©ˆ``N¨©cÖniY = ˆ``N¨©cÖniY ¸Yv¼ × Awa` ‰`N¨© Zvcgvîvi cwieZb©l



1| ‡ÿÎ cwÖiY ¸Yv¼ wbY©Ki ev e¨vL¨v Ki

GKK ‡ÿÎdj wewkó †Kv‡bv GKwU AvqZKvi e¯'i 1°C Zvcgv‡Îv e„× Ki‡j Gi ‡ÿÎdj hZUkZæ„× cvq Zv‡KB H c`v‡_© ‡ÿÎ cwÖiY ¸Yv¼ e‡j| G‡K β Øviv cÖKvk Kiv nq|



e¨vL¨v t- g‡bKwi, O°C Zvcgv‡Îvq GKwU AvqZKvi e¯‘i ‡ÿ‡Îdj A_oGes AvqZKvi e¯‘i t°C Zvcgv‡Îv cÖvq H AvqZKvi e¯‘i ‡ÿ‡Îdj e„× ‡c‡q A_t n‡jv|

t°C Zvcgv‡Îv e„× Kivq ‡ÿ‡Îdj cwieZb© = $A_t - A_o$

A_vq©

t°C Zvcgv‡Îv e„×‡Z A_o H e¯‘i ‡ÿ‡Îd‡ji ‡ÿ‡Îdj e„× cvq = $A_t - A_o$

∴ 1°C ,, ,, A_o ,, ,, ,, ,, ,, ,, = $\frac{A_t - A_o}{t}$

∴ 1°C ,, ,, 1 ,, ,, ,, ,, ,, ,, = $\frac{A_t - A_o}{t \times A_o}$

‰`N¨© cÖvq Y ¸Yv¼, $\beta = \frac{A_t - A_o}{t \times A_o}$ ----------(1)

$$\beta = \frac{\text{‰`N¨© cÖvq Y}}{\text{Avw` ^`N¨© Zvcgv‡Îv e„×}}$$

mgxKiY (1) bs n‡Z cvB, $A_t - A_o = \beta \times t \times A_o$

ev, $A_t = \beta t A_o + A_o$

ev, $A_t = A_o + \beta t A_o$

ev, $A_t = A_o(1 + \beta t)$ ----------(2)

Dc‡iv³ msÁvq †mw›U‡MVÖ †¯‹‡j O°C n‡Z t°C Zvcgv Îv ai v nq wKš‘O°C n‡Z cÖiY wbY©Kiv Lvq KóKi| G Rb¨ †h †Kv‡bv `wjU Zvcgv Îv n‡Z ‰`N¨©cÖiY ¸Yv¼ wbY©Kiv nq|

awi, `wjU Zvcgv Îv h_vµ‡g $t_1$°C I $t_2$°C Ges D³ Zvcgv Îv †Kv‡bv GKwU `‡Ûi ^`N¨© h_vµ‡g A_1 I A_2 nq|

ZLb mgxKiY (2) bs Abymv‡i †jLv hvq -

$A_1 = A_o(1+\beta\ t_1)$ -------------(3)

$A_2 = A_o(1+\beta\ t_2)$ --------------(4)

†h‡nZz O°C ZvcgvÎvi `‡Ûi ˆ`N©¨ = A_o

Ges hw` $t_2 > t_1$ Z‡e $A_2 > A_1$

$$\frac{A_2}{A_1} = \frac{A_o(1+\beta t_2)}{A_o(1+\beta t_1)} \text{ ev, } \frac{A_2}{A_1} = \frac{A_o(1+\beta t_2)}{A_o(1+\beta t_1)}$$

$=(1+\beta t_2)(1+\beta t_1)^{-1}$ [wØc`x m‡Îi mvnv‡h¨]

$= (1+\beta t_2)\ (1-\beta t_1 + \beta^2 t_1 - \beta^3 t_1$ ------$+ \beta^n t_1)$

$= (1+\beta t_2)\ (1-\beta t_1)$ [KwVb c`v‡_©i ˆ`N©¨ cÖmviY Lye Kg e‡j Gi D”P NvZ eR©b K‡i cvB]

$$\frac{A_2}{A_1} = (1+ \beta\ t_2 - \beta\ t_1 - \beta^2 t_2 t_1)$$ [KwVb c`v‡_© ^`N¨© cÖviY Lye Kg e‡j Gi D”P NvZ eRvq©K‡i cvB]

$$= (1+ \beta\ t_2 - \beta\ t_1)$$

$$\therefore \frac{A_2}{A_1} = 1+ \beta(t_2 - t_1)$$

$$A_2 = A_1[1+ \beta(t_2 - t_1)]$$

$$= A_1 + \beta\ l_1(t_2 - t_1)$$

$$\therefore\ A_2 - A_1 = \beta\ A_1(t_2 - t_1)$$

$$\therefore A_2 - A_1 = \beta\ A_1(t_2 - t_1)$$ ----------(5)

A_vq©‡ÿÎ cÖviY = ‡ÿÎ cÖviY ¸Yv¼ × Awa` ‡ÿÎ dj × ZvcgvÎvi cwieZb©|

GKB fv‡e Avgiv †ÿÎ cÖiY MÖn¼ I AvqZb cÖiY ¸Y¼ e¨vL¨v Ki‡Z cvie |

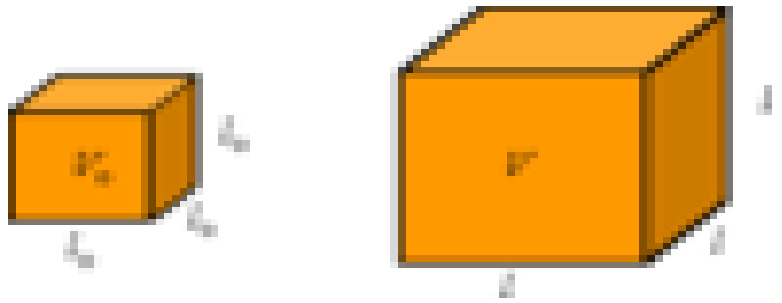
Avgiv ‡ei Ki‡Z cvie

$$S_2 - S_1 = \beta\, S_1 (t_2 - t_1)$$

A_©‡ÿÎ cÖiY = ‡ÿÎ cÖiY ¸Y¼ × Aw` ‡ÿÎdj × Zvcgv‡Îvi cwieZb©|

$$V_2 - V_1 = \gamma\, V_1 (t_2 - t_1)$$

A_©AvqZb cÖiY = AvqZb cÖiY ¸Y¼ × Aw` AvqZb × Zvcgv‡Îvi cwieZb©|



‰`N¨©cÖïv¼, ‡ÿÎ cÖïv¼ Ges AvqZb cÖïv‡¼i gv‡S m¤úK©wcb Kie| A_ev cÖY Ki †h, $\alpha=3\beta=2\gamma$

wZb cÖKvi cÖïY ¸Yv‡¼i m¤úK©t-

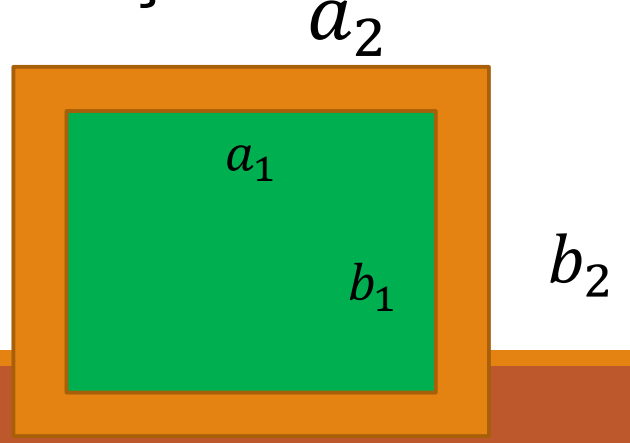
α Ges β Gi gv‡S m¤úK©t-

g‡bKwi, †Kv‡bv GK Zvcgvîvq GKwU eMvKvi cv‡Zi ^`N¨© cÖ h_vµ‡g a_1 I b_1| H Zvcgvîvi Gi †ÿÎdj, $A_1 = a_1b_1$
Avevi, g‡bKwi, t°C Zvcgvîv ew„× d‡j GB cv‡Zi ^`N¨© cÖew„× h_vµ‡g a_2 I $b_2$nq| Zvn‡j ‡ÿÎdj , $A_2 = a_2b_2$|
hw` cv‡Zi c`v‡_©^`N¨©cÖïY ¸Yv¼ I †ÿÎdj cÖïY ¸Yv¼ h_vµ‡g α I β nq,Z‡e

$\therefore a_2 = a_1(1+\alpha t)$ ---------- (1)

$\therefore b_2 = b_1(1+\alpha t)$ ---------- (2)

Ges $A_2 = A_1(1+\beta t)$ ---------- (3)



mgxKiY (1) bs †K (2) bs mgxKiY Øviv ¸Y K‡i cvB,

$a_2 b_2 = a_1 b_1(1+\alpha t)\times(1+\alpha t)$

ev, $A_2 = A_1(1+\alpha t)^2$ [∵‡ÿÎdj $A_1 = a_1 b_1$ Ges $A_2 = a_2 b_2$]

ev, $A_1(1+\beta t) = A_1(1+\alpha t)^2$ [∵$A_2 = A_1(1+\beta t)$]

ev, $1+\beta t = (1+\alpha t)^2$

ev, $1+\beta t = 1+2\alpha t+(\alpha t)^2$ [∴ α Gi gvb Lye Kg ZvB Gi D”P NvZ eRvq]

ev, $1+\beta t = 1+2\alpha t$

ev, $\beta t = 2\alpha t$

∴ $\beta = 2\alpha$ ---------- (4)

AZGe, c`v‡_©†ÿ‡Î cÖKiY ¸Yv¼ = 2× ``N¨©cÖKiY ¸Yv¼

α Ges γ Gi gv‡S m¤úK©-

g‡bKwi, †Kv‡bv GK ZvcgvÎvq GKwU AvqZKvi c`v‡_©i ^`N¨©cÖGes D”PZv h_vµ‡g a_1, b_1 I c_1 n‡jv| Zvn‡j AvqZb, $v_1 = a_1 b_1 c_1$

g‡bKwi, t°C ZvcgvÎv ew¸×i d‡j H AvqZKv‡ii ^`N¨©cÖGes D”PZv ew¸× †c‡q h_vµ‡g a_2, b_2 I c_2 n‡jv| Zvn‡j AvqZb, $v_2 = a_2 b_2 c_2$

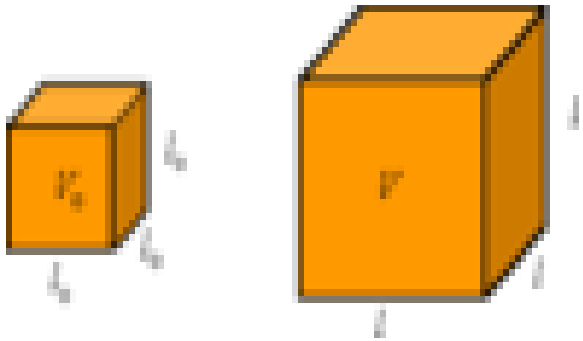
hw` AvqZKv‡ii NY‡Ki ^`N¨©cÖiY ¸Yv¼ I AvqZb cÖiY ¸Yv¼ h_vµ‡g α I γ nq, Z‡e

$$a_2 = a_1(1+\alpha t) \quad \text{---------- (5)}$$

$$b_2 = b_1(1+\alpha t) \quad \text{---------- (6)}$$

$$c_2 = c_1(1+\alpha t) \quad \text{---------- (7)}$$

Ges $v_2 = v_1(1+\gamma t)$ ---------- (8)



mgxKiY (5), (6) I (7) bs mgxKiY‡K ¸Y K‡i cvB,

$a_2b_2c_2 = a_1b_1c_1(1+\alpha t)\times(1+\alpha t)\times(1+\alpha t)$

ev, $v_2 = v_1(1+\alpha t)^3$ [∵ AvqZb $v_1 = a_1b_1c_1$ Ges $v_2 = a_2b_2c_2$]

ev, $v_1(1+\gamma t) = v_1(1+\alpha t)^3$ [∵ $v_2 = v_1(1+\gamma t)$]

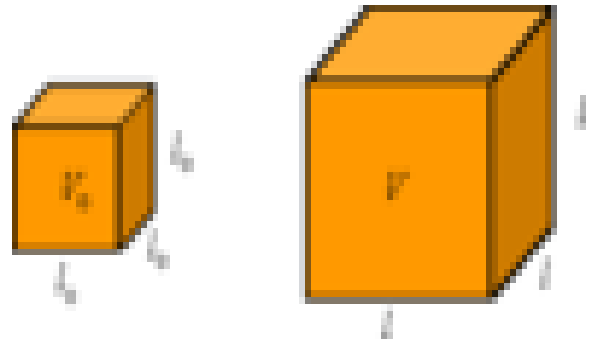
ev, $1+\gamma t = (1+\alpha t)^3$

ev, $1+\gamma t = 1+3\alpha t+3(\alpha t)^2+(\alpha t)^3$ [αGi gvb Lye Kg ZvB Gi D”P NvZ eRvq]

ev, $1+\gamma t = 1+3\alpha t$

ev, $\gamma t = 3\alpha t$

$\therefore \gamma = 3\alpha$----------(9)



AZGe, c`v‡_© AvqZb cÖiY ¸Yv¼ = 3× ^`N¨© cÖiY ¸Yv¼|

β Ges γ Gi g‡a¨ m¤úK©t-

mgxKiY (4) bs Ges (9) bs n‡Z †jLv hvq,

$\beta = 2\alpha$ ev, $\alpha = \frac{\beta}{2}$ ----(10)

$\gamma = 3\alpha$ ev, $\alpha = \frac{\gamma}{3}$ -------(11)

$\therefore \frac{\beta}{2} = \frac{\gamma}{3}$ ----------(12)

α , β Ges γ Gi g‡a¨ m¤úK©-

mgxKiY (10) bs Ges (11) bs n‡Z †jLv hvq,

$$\alpha = \frac{\beta}{2} = \frac{\gamma}{3}$$

ev, $6\alpha = \frac{6\beta}{2} = \frac{6\gamma}{3}$

ev, $6\alpha = 3\beta = 2\gamma$

$\therefore 6\alpha = 3\beta = 2\gamma$ (cÖvYZ)

AZGe, ‰`N¨©cÖKvi¸Yv¼, †ÿÎ cÖKvi¸Yv¼ Ges AvqZb cÖKvi¸Yv¼ Gi g‡a¨ m¤úK©`Lv‡bv n‡jv|

O°C Zvcgv Îvq GKwU wcZ‡ji `‡Ûi ^`N¨© 3wgUvi| 100°C Zvcgv Îvq Gi ^`N¨© 3.0057 wgUvi n‡j wcZ‡ji ^`N¨© cÖwiY ¸YvsK KZ?

mgvavb, Avgiv Rwb, ‰`N¨© cÖwiY ¸Yv¼, $\alpha = \frac{l_t - l_o}{\Delta t \times l_o}$

$$\alpha = \frac{3.0057 - 3}{100 \times 3}$$

$$= \frac{0.0057}{300}$$

$$= 1.9 \times 10^{-5} k^{-1}$$

GLv‡b,

l_t=3.0057 wgUvi

l_o=3 wgUvi

Zvcgv Îv ewY©, Δt = 100- 0

= 100k,

‰`N¨© cÖwiY ¸Yv¼, α =?

O°C Zvcgv Îvq GKwU B¯úv‡Zi Zv‡ii `‡Ûi ^`N¨© 100 wgUvi| 100°C Zvcgv Îvq Gi ^`N¨© 100.033 wgUvi n‡j B¯úv‡Zi Zv‡ii ^`N¨© cÖwiY ¸YvsK KZ?

O°C Zvcgv Îvq GKwU mxmvi e¨vj‡Ui AvqZb 5.5 Nb ‡mw›UwgUvi| 98°C Zvcgv Îvq Gi AvqZb 0.038 Nb ‡mw›UwgUvi †e‡o †Mj| mxmvi ^`N¨© cÖKvi ¸YvsK KZ?

mgvavb, Avgiv Rvwb, AvqZb cÖKvi ¸Yv¼, $\gamma = \frac{V_t - V_o}{\Delta t \times V_o}$

$\gamma = \frac{0.038}{98 \times 5.5}$

$= \frac{0.038}{539}$

$= 7.05 \times 10^{-5} k^{-1}$

Avevi Avgiv Rvwb, $\gamma = 3\alpha$

$3\alpha = \gamma$

$\alpha = \frac{\gamma}{3} = \frac{7.05 \times 10^{-5}}{3} = 2.35 \times 10^{-5} / °C$

GLv‡b,

V_o = 5.5 Nb ‡mw›UwgUvi

$V_t - V_o$ = 0.038 Nb ‡mw›UwgUvi

Zvcgv Îv e¨vL¨v, $\Delta t = (98 - 0)$

$= 98k,$

‰`N¨© cÖKvi ¸Yv¼, α =?

O°C Zvcgv Îvq GKLÛ †jvnvi AvqZb 200 Nb wgUvi| 40°C Zvcgv Îvq Gi AvqZb KZ n‡e? [‡jvnvi AvqZb cÖKvi ¸YvsK $\gamma = 34.8 \times 10^{-5} / °C$]

0°C Zvcgv Îvq cvi‡`i NbZ¡13.59 MÖg/Nb‡mw›UwgUvi |
80°C Zvcgv Îvq Gi AvqZb 0.038 Nb ‡mw›UwgUvi †e‡o
†Mj | mxmvi ^`N¨© cÖiY ¸YvsK KZ?

mgvavb, Avgiv Rwb, AvqZb cÖiY

¸Yv¼, $\gamma = \frac{V_t - V_o}{\Delta t \times V_o}$

$$\gamma = \frac{0.038}{80 \times 13.59}$$

$$= \frac{0.038}{1087.2}$$

$= 7.05 \times 10^{-5} k^{-1}$

Avevi Avgiv Rwb, $\gamma = 3\alpha$

$3\alpha = \gamma$

$$\alpha = \frac{\gamma}{3} = \frac{7.05 \times 10^{-5}}{3} = 2.35 \times 10^{-5} / °C$$

GLv‡b,

V_o = 13.59 Nb ‡mw›UwgUvi

$V_t - V_o$ = 0.038 Nb ‡mw›UwgUvi

Zvcgv Îv ewÂ×, $\Delta t = (80 - 0)$

$= 80k,$

‰`N¨© cÖiY ¸Yv¼, α =?

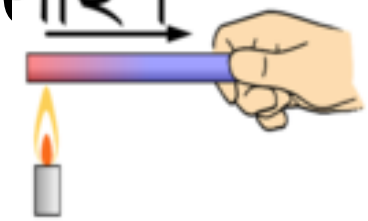
পাঠ ঘোষনা

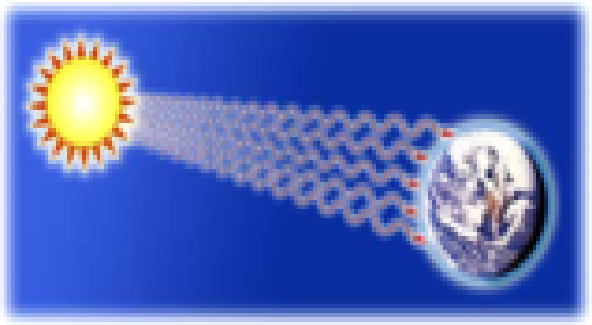
2q Aa¨vq t- Zvc mÂvjb

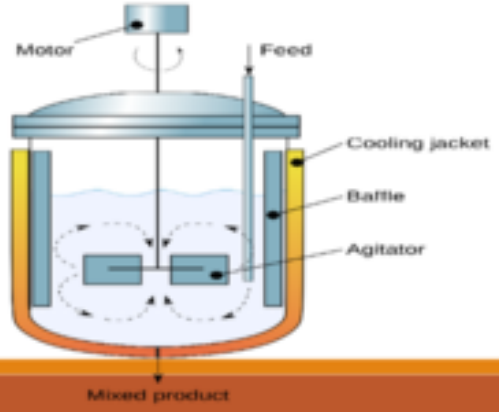
mÂvjb wK, wK c×wZ‡Z Zvc mÂvjb K‡i, wK wK wel‡qi Dci Zvc mÂvjb wbf©K‡i| GB cwieZ©b weÁvbxiv gZev` w`‡q‡Qb Ges Avgiv wK myj cvB Zvi m¤ú‡K© Av‡jvPbv Kie|

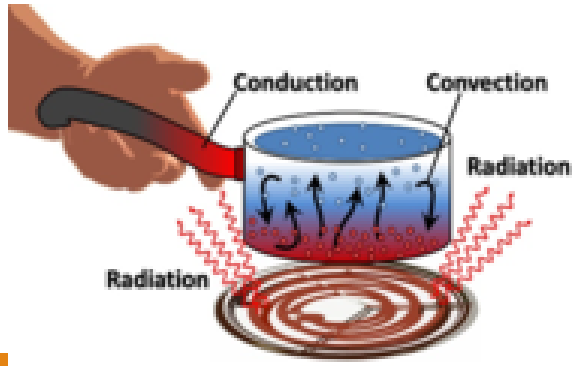
c‡e© Ávb hvPvB

mÂvjb wK, wK c×wZ‡Z Zvc mÂvjb K‡i, wK wK wel‡qi Dci Zvc mÂvjb wbf©K‡i| GB cwieZ©b weÁvbxiv wK, wK gZev` w`‡q‡Qb Ges Avgiv wK myj cvB|



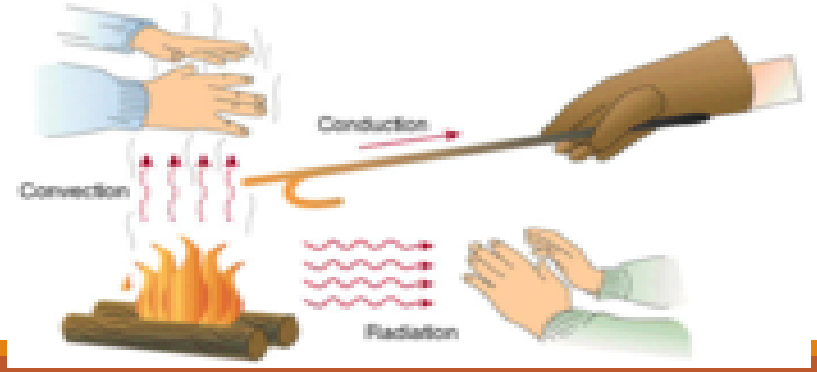






Zvc mÂvjb

GKwU Zvgvi LÛ ev †Kv‡bv avZe `‡Ûi GK cÖvß Av¸‡b cÖek Kiv‡j GKUz c‡iB Aci cÖvß Mig Abyf¨Z nq| Avevi hw` `ÛwU ei‡d cÖek Kiv‡bv nq Z‡e Aci cÖvß kxZj n‡q hvq ev VvÛv Abyf¨Z nq| Zij c`v_©Kv‡bv cv‡Î †i‡L †mB cv‡Î Zvc w`‡j †m†ÿ‡Î Zvc GK cvk †_‡K Ab¨ cv‡k hvq| Avevi Pj¨vi cv‡k `vuov‡jI ki‡i Mig Abyf¨Z nq|

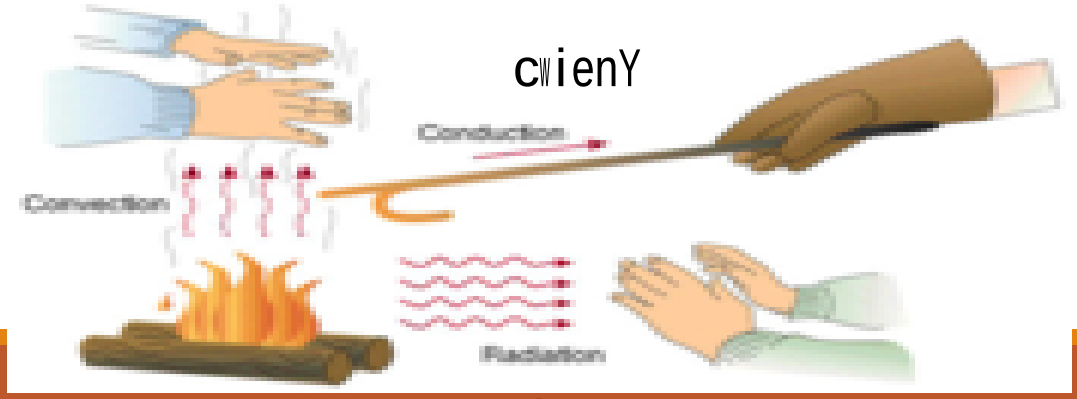


Gme D`vniY ‡_‡K evSv hvq †h, Zvc me©vB DËß As‡k †_‡K kxZjZi Ask ev †Kv‡bv D”P Zvcgv Îwewkó Ask †_‡K wbb¥ Zvcgv Îv ¯’v‡b cÖvwnZ nq Zvc cÖvwnZ nIqvi GB cwÖqv‡K Zvc mÂvjb e‡j|

wZb fv‡e Zvc mÂvwjZ nq - (1) cwienY ,
(2) cwiPjb I
(3) wewKiY|

cwienY

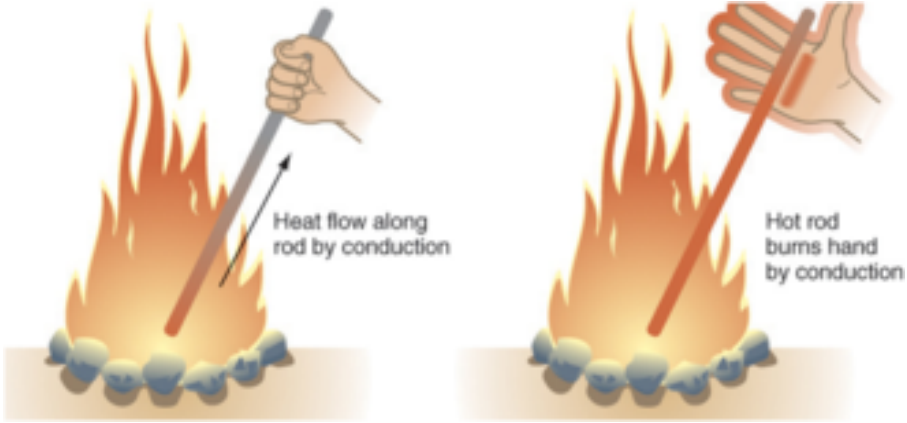
cwiPjb

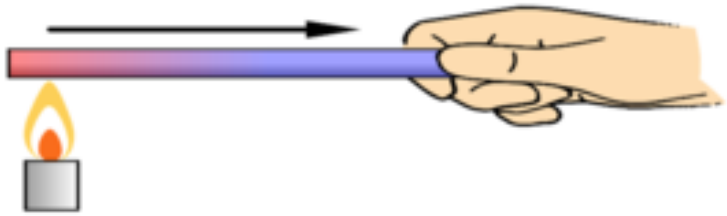


wewKiY

(1) cwienY

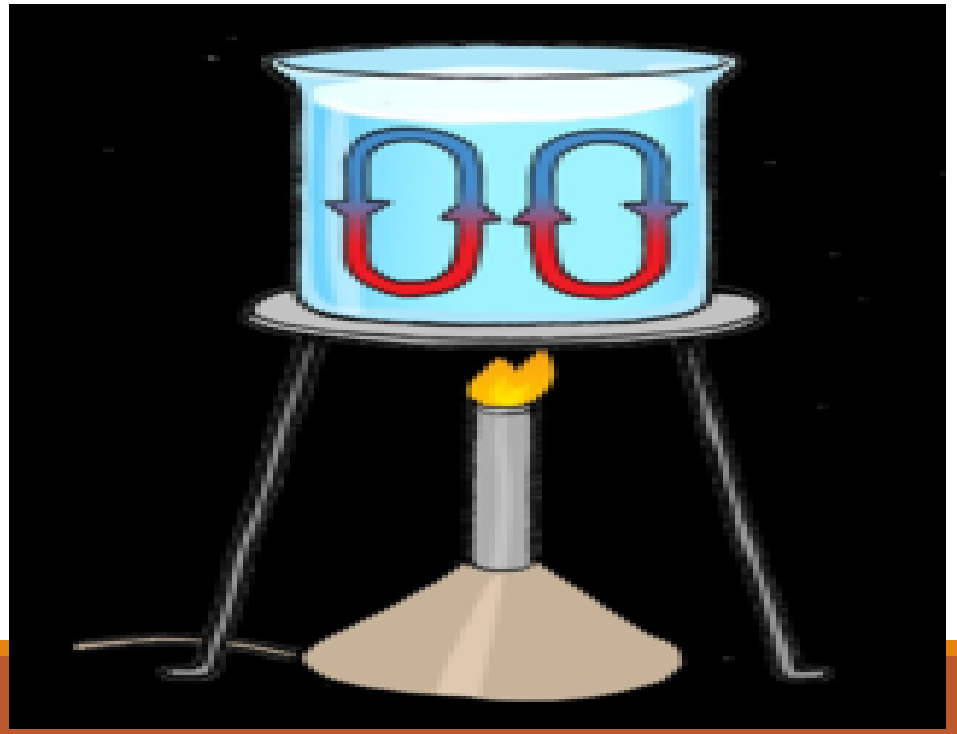
†h cÖqvq Zvc †Kv‡bv KwVb c`v‡_©DòZi Ask †_‡K kxZjZg As‡k mÂwjZ nq wKš‘c`v‡_© AYy‡jvi ¯’vbPz¤^Z N‡U bv A_v©AYy‡jvi ¯’vb cwieZb©K‡i bv †mB cÖqv‡K cwienb e‡j|





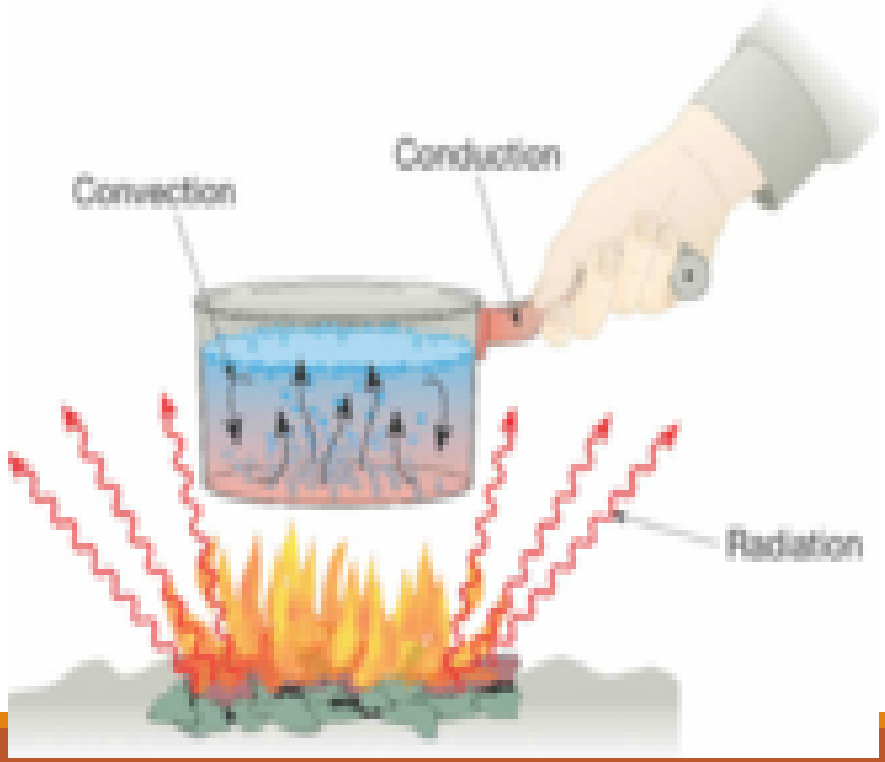
(2) cwiPjb

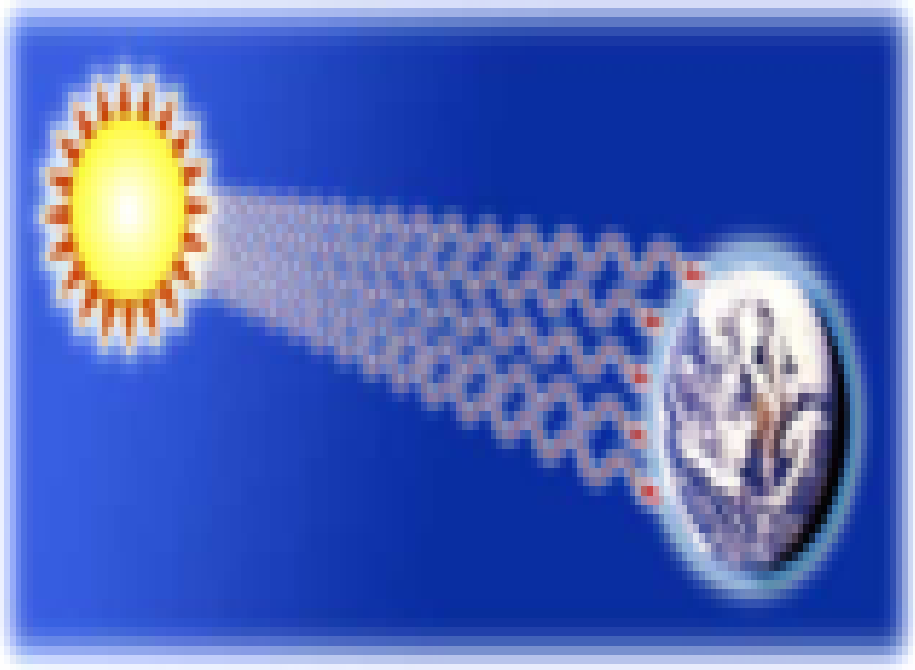
‡h cwÖqvi †Kv‡bv c`v‡_©KYv¸‡jvi PjvP‡ji gva¨‡g Zvc DòZi ¯’vb †_‡K kxZjZg ¯’v‡b mÂvwjZ nq †mB cwÖqv‡K cwiPjb e‡j|



(3) wewKiY

†h cwÖqvq Zvc †Kv‡bv Ro gva¨g Qvov we`¨yr PzKxq Zi‡½i AvKv‡i A‡c¨vKZ.DòZi ¯’vb n‡Z kxZj ¯’v‡b mÂwjZ nq Zv‡K wewKiY e‡j|





cwienY, cwiPjb Ges wewKiY gva¨‡gi gv‡S cv_©K¨ wjL ?

wb‡b¥ cwienY, cwiPjb Ges wewKiY gva¨‡gi gv‡S cv_©K¨ †`lqv n‡jv

cvV¨ welq	cwienY	cwiPjb	wewKiY
msÁv	1| †h cÖKvqvq Zvc †Kv‡bv KwVb c`v‡_©DòZi Ask †_‡K kxZjZg As‡k mÂwjZ nq wKš‘c`v‡_© AYy‡jvi ¯’vbPz¨Z N‡U bv †mB cÖKvq‡K cwienb e‡j|	1| ‡h cÖKvqvi †Kv‡bv c`v‡_©KYv¸‡jvi PjvP‡ji gva¨‡g Zvc DòZi ¯’vb †_‡K kxZjZg ¯’v‡b mÂwjZ nq †mB cÖKvq‡K cwiPjb e‡j|	1| †h cÖKvqvq Zvc †Kv‡bv Ro gva¨g Qvov we`¨yr PzÆKxq Zi‡½i AvKv‡i A‡cÿvKZ.¯’vb n‡Z kxZj ¯’v‡b mÂwjZ nq Zv‡K wewKiY e‡j|
gva¨g	2| Ro gva¨‡gi cÖKvRb nq|	2| Ro gva¨‡gi cÖKvRb nq|	2| gva¨‡gi cÖKvRb nq bv|
cÖKvq	3| GwU GKwU axi cÖKvq|	3| GwU GKwU axi cÖKvq|	3| GwU Zvc Av‡jvi †e‡M mÂwjZ nq|

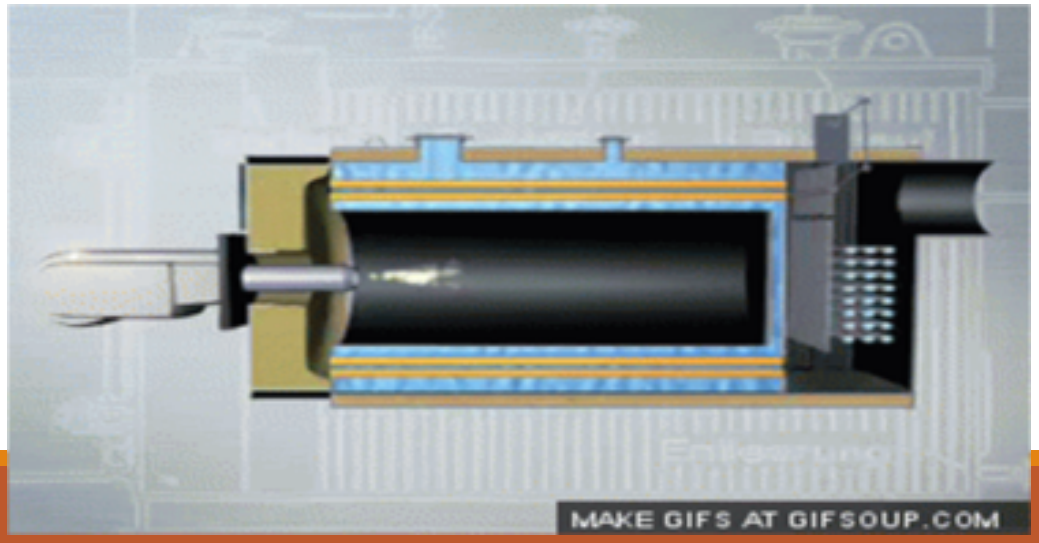
wb‡b¥ cwienY, cwiPjb Ges wewKiY gva¨‡gi gv‡S cv_©K †`Iqv n‡jv

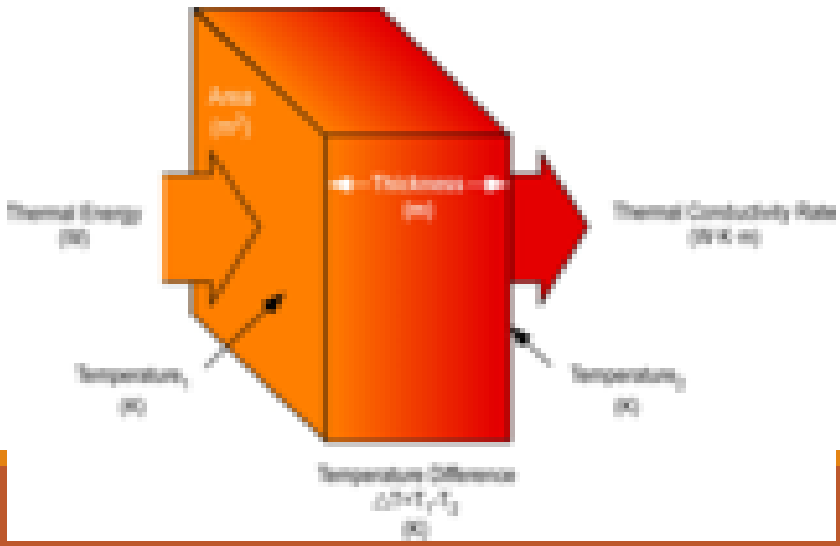
PjvP‡ji c_	4| †h‡Kvb c‡_ Zvc mÂvwjZ nq|	4| †h †Kvb c‡_ Zvc mÂvwjZ nq|	4| Zvc mij c‡_ mÂvwjZ nq|
c`v_©	5| GB c×wZ‡Z KwVb c`v‡_©gaïwb`‡q Zvc mÂvwjZ nq|	5| GB c×wZ‡Z Zij Ievqe×q c`v‡_©gaïwb`‡q Zvc mÂvwjZ nq|	5| evqy×q Ikïgva¨‡gi gaïwb`‡q Zvc mÂvwjZ nq|
AYyi ¯'vbvšÍi	6| gva¨‡gi KYv¸‡jvi ¯'vb PzwZ N‡U bv|	6| gva¨‡gi KYv¸‡jvi ¯'vbPzwZ N‡U|	6| Zvc Zi‡½i AvKv‡i mÂvwjZ nq|

Zvcxq cwiewnZv Ges Zvcxq cwiewnZvi ¸Yv¼ msÁv t-

Zvc cwiewnZv

c`v‡_©†h we‡kl a‡g©Rb¨ wfbœfbœe`v‡_©ga¨ w`‡q Zvc cwien‡bi nvi wewfbœeq c`v‡_©†mB ag©K Zvc cwiewnZv e‡j| `‡Ûi ^`N¨©eivei cwÖ GKK ^`‡N¨©Rb¨ ZvcgvÎvi †h cwieZb©nq Zv‡K ZvcgvÎvi bwZ ev ZvcgvÎvi Aeµg e‡j|





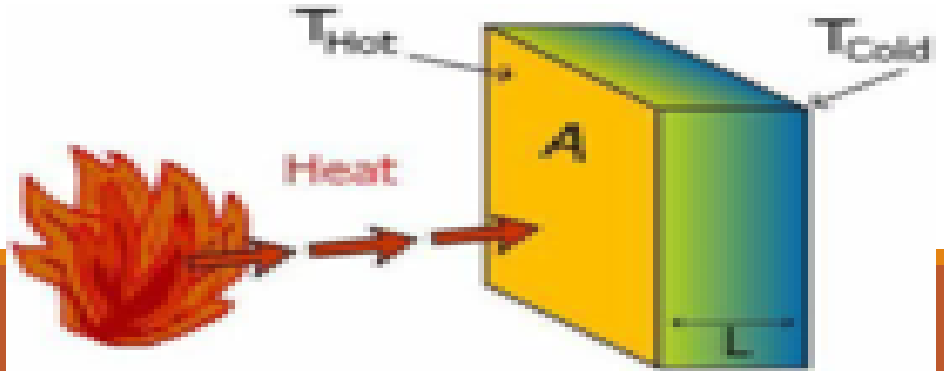
Zvc cwienY ¸Yv¼

GKK †ÿÎdj Ges GKK cÖvq‡Zi †Kv‡bv c`v‡_©`B wecixZ Z‡ji Zvcgv‡Îvi cv_©K GK wWwMÖn‡j cwÖ †m‡K‡Û Dò Zj ‡_‡K kxZj Z‡j †h cwigvY Zvc j¤^v‡e cwiewnZ nq Zv‡K H c`v‡_©Zvc cwienY ¸Yv¼ e‡j|

Zvc cwienY ¸Yv‡¼i gvÎv t- $[K] = [\frac{W}{LT}] = WL^{-1}T^{-1}$

Gm AvB c×wZ‡Z Zvc cwienY ¸Yv‡¼i

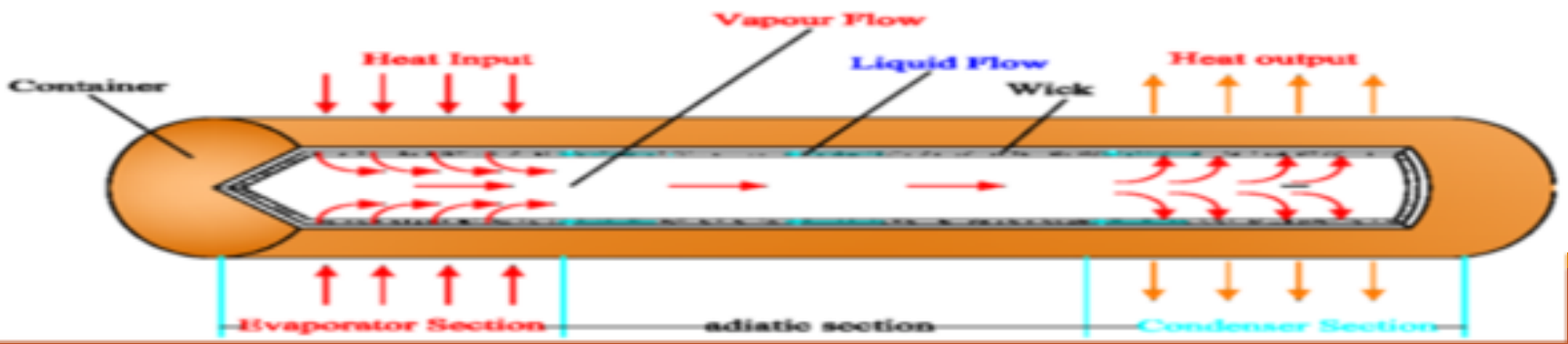
GKK t- $Wm^{-1}K^{-1}$



c`v‡_©ga¨ w`‡q cÖwnZ Zv‡ci cwigvY ‡h ‡h wel‡q wbf© K‡i Zv eY©v Ki|

mKj c`v‡_©Zvc cwievwnZv mgvb bq| GKwU †jvnv`‡Ûi gv_v Av¸‡b †i‡L Ab¨ cwÎ†ewkÿY nv‡Zi g‡a¨ ivLv hvq bv| Avevi GK LÛ Kv‡Vi GK cwÎAv¸‡b †i‡L A‡bKÿY chš©Ab¨ cwÎivLv hvq| mÿZivs †jvnvi hZ mn‡R Zvc cwienb Ki‡Z cv‡i, KvV ZZ mn‡RB Zvc cwienY Ki‡Z cv‡i bv| †h mKj c`v‡_©g‡a¨ Zvc cwievwnZ nq bv Zv‡K Zvc Kzcwievnx c`v_©e‡j|

‡h mKj c`v‡_©ga¨ w`‡q mn‡R Zvc cwievwnZ nq Zv‡K Zvc mÿcwievnx c`v_©e‡j| mKj avZe c`v_©Zvc mÿcwievnx|



Dò cô n‡Z kxZj cô t mg‡q †h cwigvY Zvc Q j¤^v‡e cÖwnZ nq Zv wb‡b¥ KZK¸‡jv wel‡qi Dci wbf©kxj| h_vt-

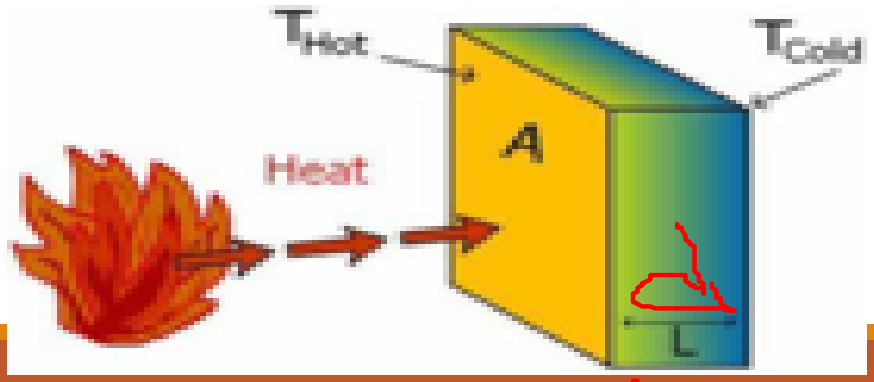
1| cwievwnZ Zv‡ci cwigvY wecixZ `ªæ c„ôi Zvcgv Îvi cv_©K¨i mgvbycvwZK|

2| cwievwnZ Zv‡ci cwigvY c„ôi †ÿÎd‡ji mgvbycvwZK|

3| cwievwnZ Zv‡ci cwigvY Zvc cÖnKv‡ji mgvbycvwZK|

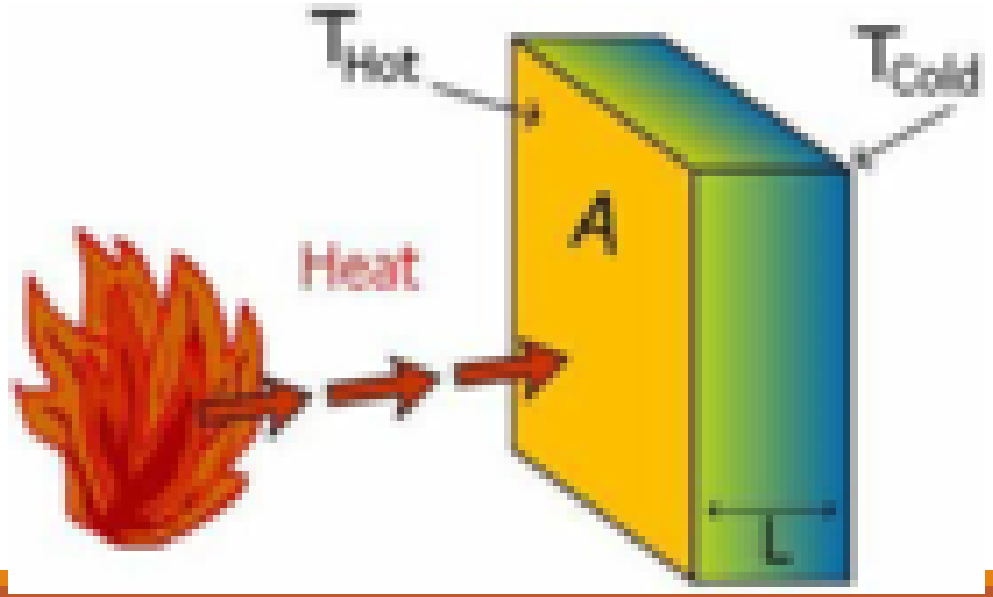
4| cwievwnZ Zv‡ci cwigvY `ªæ wecixZ c„ôi ga¨eZx© i‡Zi e¨¯Íbycvwz K|

5| cwievwnZ Zv‡ci cwigvY c`v‡_© cÖKvi Dci wbf©kxj| Z‡e GKwU wbw`© c`v‡_© ÿ‡Î cwievwnZ Zvc 5bs Qvov Ab¨ 4wUi Dci wbf©kxj|



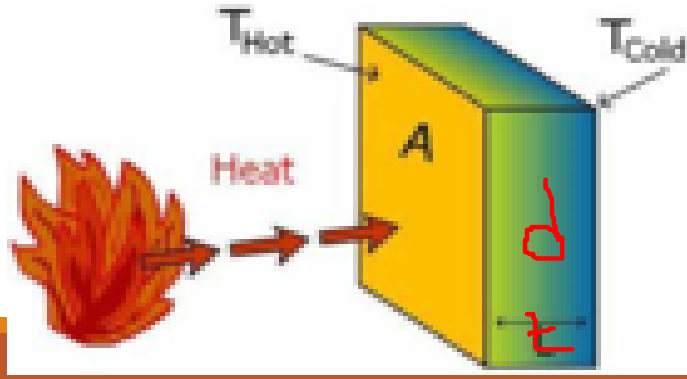
Zvgvi cwienY ¸Yv¼ K= 386 W m^{-1} K^{-1} ej‡Z wK eySv?

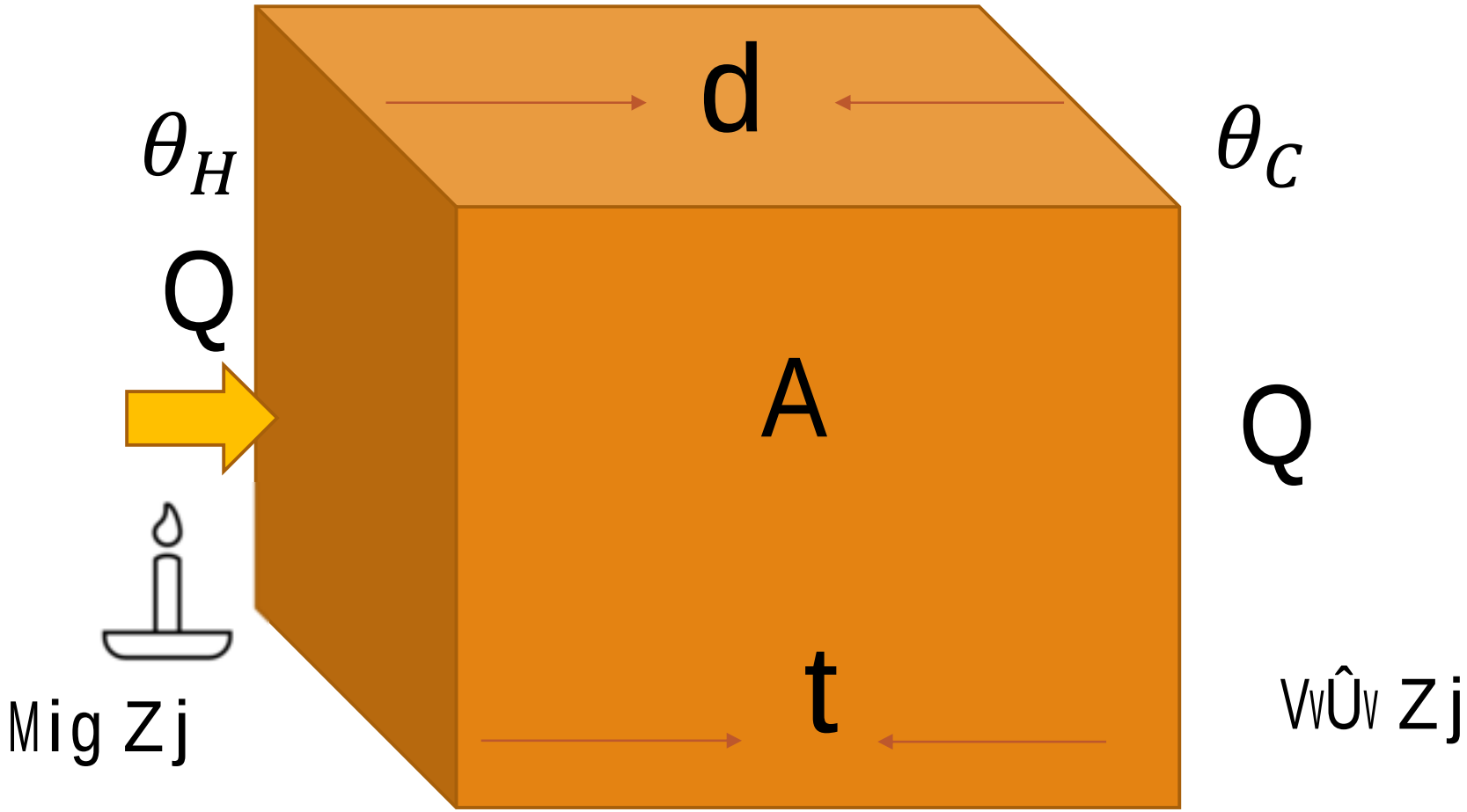
1m cyivZ¡Ges1m^2 cÖ”Q‡`i †ÿÎdj Zvgvi †Kv‡bv `‡Ûi `ßi wecixZ mgvšÍvj c‡ôi Zvcgv‡Îvi cv_©K 1K n‡j Gi DòZj †_‡K kxZj Z‡j j¤^v‡e 386Watt nv‡i (A_v© 1sec G 386 Joule) Zvckw³ cwievwnZ nq|



Zvc mÂvjb †h wel‡qi Dci wbf©i Kx‡j Ges cgÖY Ki †h, $Q = \frac{Kt(\theta_H - \theta_C)A}{d}$

awi, PQSR †Kv‡bv c`v‡_©i GKwU NbK| Gi PR I QS Z‡ji Zvcgv‡îi h_vµ‡g $\theta_H$ I $\theta_C$ (Mig cÖ‡šÍ Zvcgv‡îi $\theta_H$ Ges A‡cÿvKZ.VvÛv cÖ‡šÍ Zvcgv‡îi $\theta_C$)| Dfq Z‡ji gap¨eZx©i Z¡id Ges Z‡ji †ÿÎdj A| PR Zj †_‡K QS Z‡ji w`‡K j¤^v‡e †h cwigvY Zvc cwievwnZ n‡e Zv wbf©i K‡i (1) wecixZ `ßi Z‡ji Zvcgv‡îi cv_©K¨i ($\theta_H - \theta_C$) Dci, (2) `ßi cÖ‡šÍ d `i Z¡Dci, (3) †h †ÿÎdj w`‡q hv‡e Zvi Dci Gi Dci, (4) †h mgq t a‡i Zvc cwievwnZ n‡e Zvi Dci Ges (5) c`v‡_©i cÖKvi Dci|



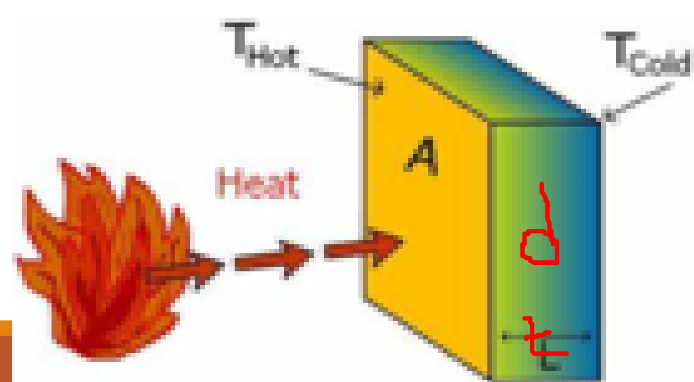

d
θ_H
θ_C
Q
A
Q
t
Mig Zj
VwÛv Zj

Z‡e GKwU wbw`©ó c`v‡_©i †ÿ‡Î cwievwnZ Zvc (5) bs ev‡`
Ab¨¸‡jvi Dci wbf©kxj| hw` (awi) Q cwigvY Zvc †Kv‡bv c`v‡_©i
ga¨ w`‡q cÖevwnZ nq Z‡e MvwYwZK fv‡e †jLv hvq -
Dò cô n‡Z kxZj cô t mg‡q †h cwigvY Zvc Q j¤^fv‡e cÖevwnZ
nq Zv wb‡bœ KZK¸‡jv wel‡qi Dci wbf©kxj| h_vt-

1| cwievwnZ Zv‡ci cwigvY wecixZ `yB c„‡ôi ZvcgvÎvi cv_©K¨i mgvbycvwZK| $Q \infty (\theta_H - \theta_C)$ ---------- (1) (hLb A, t ,d w¯'i)

2| cwievwnZ Zv‡ci cwigvY c„‡ôi †ÿÎd‡ji mgvbycvwZK|

$Q \infty A$ ------------- (2) (hLb (θ_H, θ_C) , t ,d w¯'i)



3| cwievwnZ Zv‡ci cwigvY Zvc cÖvmK v‡ji mgvbycvwZK|

$Q \propto t$ ----------(3) (hLb (θ_H, θ_C) A, d w¯’i)

4| cwievwnZ Zv‡ci cwigvY `ßi wecixZ c„ôi ga¨eZx© wb‡Zi e¨¯Íbycvwz K| $Q \propto \frac{1}{d}$ ---------- (4) (hLb $(\theta_H, \theta_C, A,$ t w¯’i) hLb mKj iwkB cwieZ©bxj, ZLb (1)bs,(2)bs, (3)bs Ges (4) bs mgxKiY n‡Z cvB, $Q \propto \frac{t(\theta_H - \theta_C)A}{d}$

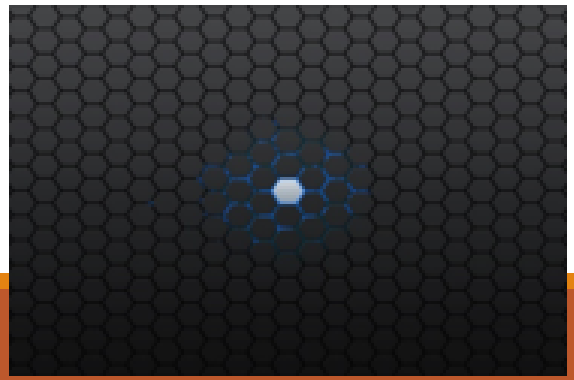
$$Q = \frac{Kt(\theta_H - \theta_C)A}{d} \quad \text{----------(5)}$$

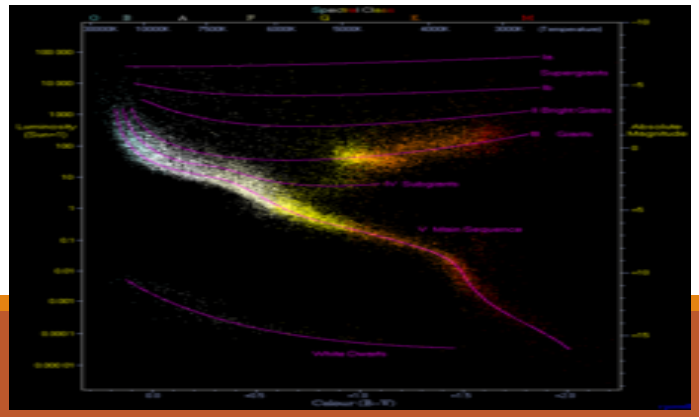
GLv‡b K GKUv aæeK hvi gvb c`v‡_© cÖZ‡ii Dci wbf©ikxj|

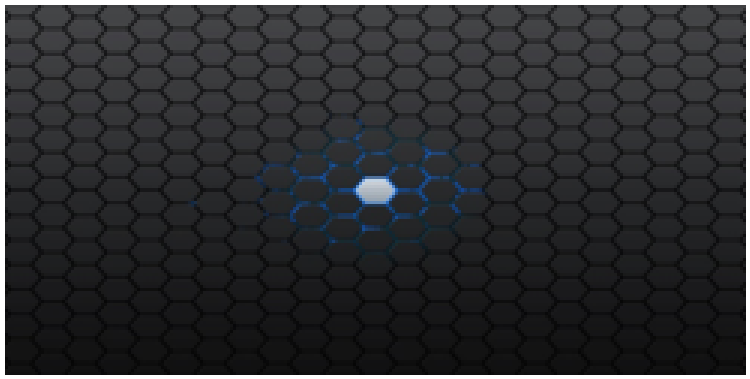
‡÷dvb-†evëRg¨vb Gi m‡Î wK Ges eY©bv Ki

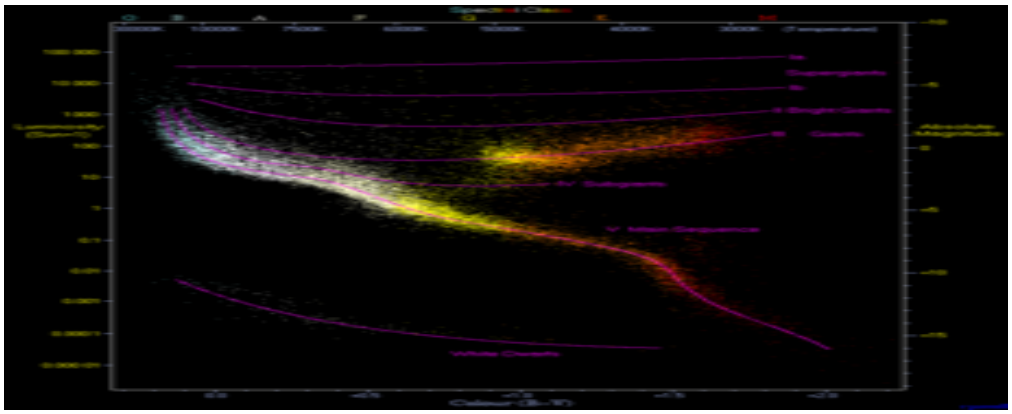
DËi t-1884 wLª †evëRg¨vb ZvcMwZwe`¨vi mvnv‡h¨ †÷dvb m‡Îi ZËxq cgÖY †`b Ges †`Lvb †h, Dc‡iv³ m‡Î GKgvÎ Av`k©Kxòe¯‘KZ©bxtmiY wewKi‡Yi †ÿ‡Î cÖvR¨| GRb¨ m‡Î wU‡K †÷dvb- †evëRg¨vb m‡Î ejv nq|

m‡Î t- †Kv‡bv Av`k©Kxòe¯‘i GKK †ÿÎdj n‡Z cÖ †m‡K‡Û weKxY©Zv‡ci cwigvY H e¯‘i cig Zvcgv‡Îvi PZz© Nv‡Zi mgvYxqwZK|









e¨vL¨v t- T cig Zvcgv‡Îvq †Kv‡bv Av`k©Kxq e¯‹i GKK †ÿÎdj n‡Z cwÖ †m‡K‡Û weKxY©Zv‡ci cwigvY E n‡j, GB m‡Ÿ n‡Z Avgiv cvB,

$$E \propto T^4$$

$$E = \sigma T^4 \text{---------- (1)}$$

GLv‡b, σ= mgvbycvwZK aæeK| G‡K †÷dvb- †evëRg¨vb aæeK ejv nq|

σ Gi gvb $\sigma = 5.67 \times 10^{-8}\ W\, m^{-2} K^{-4}$|

fxb- Gi miY mÎ Ges e›Ub mÎ ev cÂNvZ mÎ wK Gi eY© Ki|

miY mÎ

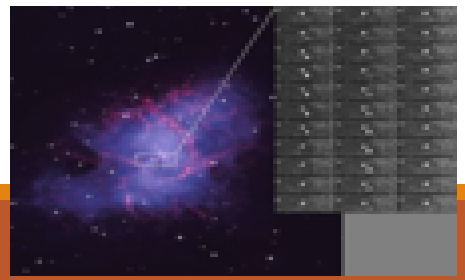
Kò.e¯‘†_‡K mevwaK weKxY©kw³i Rb¨ Zi½ ^`N¨©Ges cig ZvcgvÎvi e¨¯Íbyqvwe ZK|

e¨vL¨v t- hw` Kò.e¯Í†_‡K mevwaK weKxY©kw³i Rb¨ Zi½ ^`N¨© λ_m Ges cig ZvcgvÎv TK nq Z‡e, $\lambda_m \propto \frac{1}{T}$

ev, $\lambda_m = \frac{1}{T} \times$ a‡e msL¨v

ev, $\lambda_m \times T =$ a‡e msL¨v|

GLv‡b λ_m = mevwaK kw³i Rb¨ Zi½ ^`N¨©B a‡e‡Ki msL¨vi gvb = 28.98×10^{-6} mK



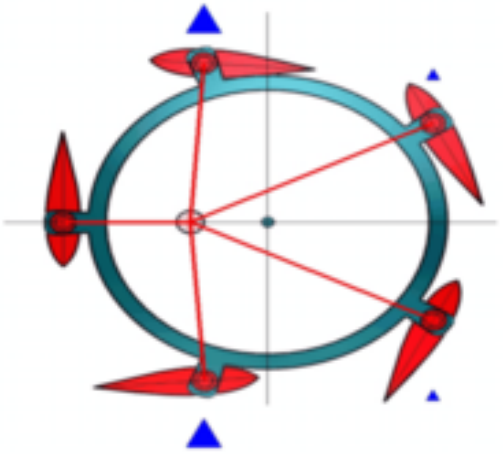
e›Ub m‡Ÿ ev cÂNvZ m‡Ÿ

mevwaK kw³ NbZ¡ev Kòe¯‘i mevwaK wewKiY ÿgZv Zvi cig ZvcgvÎvi cÂNv‡Zi mgvbycvwZK|

A_v©$E_m = T^5$

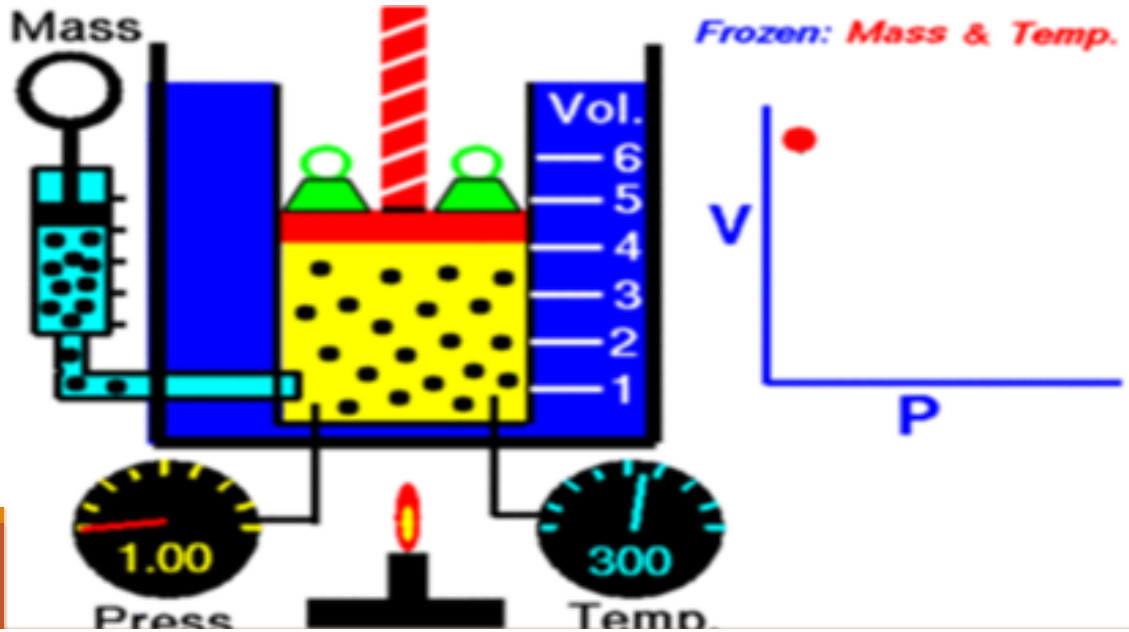
ev, $\frac{E_m}{T^5}$ = a‡y msL¨v

GB a‡e msL¨vi gvb 28.98×10^{-4} mK.



wbDU‡bi kxZjxKiY m¤ú

wbDU‡bi m¤úwUt-wewKi‡Yi d‡j †Kv‡bv DËß e¯‘†h nv‡i Zvc nvivq Zv H e¯‘i ZvcgvÎv I cwicv‡k©Zvcgv Îvi cv_©K¨i mgvbycwZK| wbDU‡bi m¤úwU Aí ZvcgvÎvi cv_©K¨i Rb¨ c©ÖvR¨|



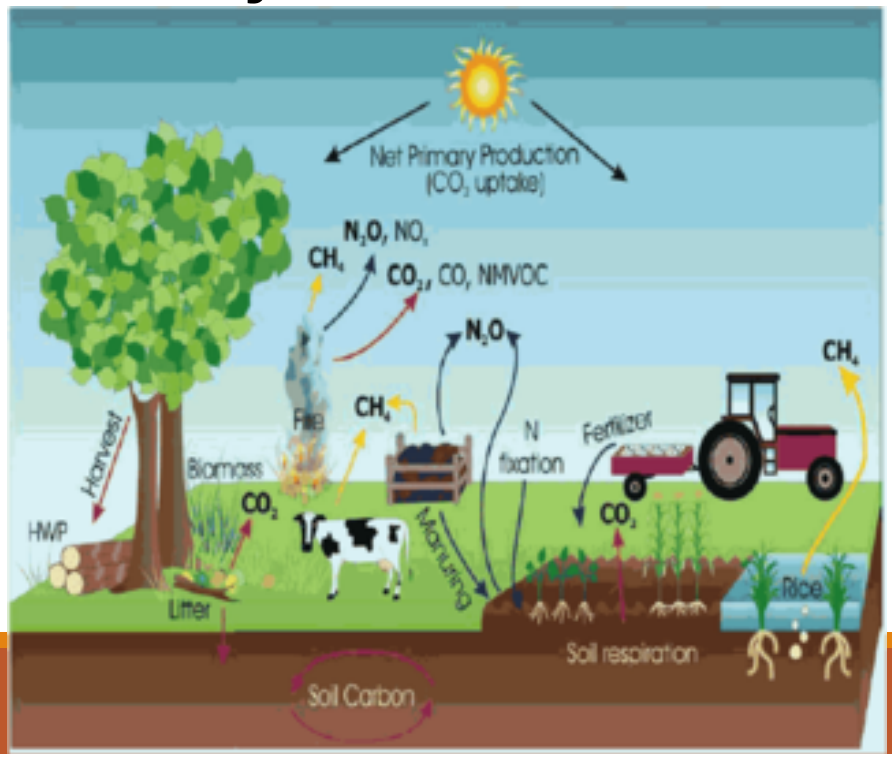
wbDU‡bi mÎ Abyµv‡i DËß e¯‘n‡Z Zvc nq&mi nvi $\frac{dQ}{dt}$ n‡j †jLv hvq, $-\frac{dQ}{dt} \propto (\theta_1 - \theta_2)$

ev $-\frac{dQ}{dt} = k\,(\theta_1 - \theta_2)$ ---------- (1)

mgxKiY (1) G θ_1 I θ_2 nj h_vµ‡g e¯‘i I cwi cv‡k©Zvcgv Ges k mgvbycvwZK a¨vK| k Gi gvb e¯‘i cÖ‡`‡ki †ÿÎdj Ges cÖKvi Dci wbf©K‡i| mgxKiY evg cv‡k©FYvZ¡K wPý e¯‘ Zvc nvivq wb‡`©K‡i| mgxKiY n‡Z e¯‘i Zvcgv‡Îv nq&mi nvi wbav©Y Kiv nq|

wMÖnvDm ev meR Ni

wMÖnvDm ev meR Ni GK ai‡bi Kv‡Pi ˆZwi Ni †hLv‡b GKwU wbw`©ZvcgvÎv eRvq †i‡L kvK- mewR, Dw™¢ BZ¨vw` Drcv`b I msÿiY Kiv nq| Gi¤c Ni‡K wMÖnvDm ev meR Ni e‡j| wb‡P wf‡bi m‡Ši mvnv‡h¨ wMÖnvDm cÖqv e¨vL¨v Kiv n‡jv-



fx‡bi m~Î Abymv‡i Avgiv Rvwb, ZvcgvÎv e„w× †c‡j DËß e¯‘ n‡Z wbtmiY KZ©…K Zi½‰`N©¨ n«vm cvq| Avevi ZvcgvÎv n«vm †c‡j wbtmiY KZ©…K Zi½‰`N©¨ e„w× cvq| Kv‡Pi ag©n‡jv Gi wfZi w`‡q A‡cÿvKZ. ÿz`ª ˆ`‡N©¨i Zvc mn‡R PjvPj Ki‡Z cv‡i, wKš‘ `xN© ˆ`‡N©¨i Zi½ evavcÖvß nq| m~‡h©i DËß Ae¯’vq Zvc wewKiY K‡i, d‡j †ewk nIqvq ÿz`ª nq| d‡j ÿz`ª ˆ`‡N©¨i Zi½ Kv‡Pi ga¨ w`‡q cÖ‡ek K‡i wfZ‡ii MvQcvjv, kvKmewR BZ¨vw`‡K Mig K‡i|

wKš‘Kv‡Pi N‡ii wfZ‡ii MvQcvjv gwU BZ¨vw` hLb Zvc wewKiY K‡i ZLb wfZ‡ii Zvcgv Îv Kg _vKvq wbtmiY KZ©Zi½ ``N¨©xN©q, d‡j Kv‡Pi wfZi w`‡q †ewi‡q Avm‡Z cv‡i bv e‡j wMbÖnvD‡mi wfZi h‡_ó Mig _v‡K| G Kvi‡Y wMÖnvD‡mi wfZi MvQcvjv, Dw™¢, kvKmewR BZ¨vw` Drcv`b I msiÿY mnR nq| Avgv‡`i GB cwi_ex‡Z wMbÖnvDm wµqv msNwUZ n‡”Q e‡j cwi_exi Zvcgv Îv LvBB ax‡i ax‡i ewi× cv‡”Q|

12cm cÖvß Ges $2m^2$ †ÿÎdjwewkó B‡Ui †`Iqv‡ji GK cv‡ki 28°C Zvcgv‡Îv Ab¨ cv‡ki Zvcgv‡Îv 8°C| B‡Ui Zvc cwienY ¸Yv¼ 0.84W $m^{-1}$ $K^{-1}$ n‡j †`Iqv‡ji ga¨w`‡q GK N›Uvq KZ Zvc mÂwjZ n‡e| GLv‡b Zvcgv‡Îv Aeµg KZ?

GLv‡b,

A= $2m^2$

d= 12cm =12× 10^{-2}m

t=1hr=60 ×60=3600s

K= 0.84W m^{-1} K^{-1}

θ_H = 28 ℃

θ_C=8 ℃

$\theta_H - \theta_C$=28-8=20 ℃=20K

Q=?

Zvcgv‡Îv Aeµg=?

Avgiv Rwb,Q = $\frac{Kt(\theta_H-\theta_C)A}{d}$

= $\frac{0.84\times3600\times2\times20}{12\times10^{-2}}$

=1008000J=1008KJ

Avgiv Rwb, Zvcgv‡Îv Aeµg = $\frac{(\theta_H-\theta_C)}{d}$

= $\frac{20}{12\times10^{-2}}$

=166.66K m^{-1}

4mm cÖvß Ges $4m^2$ †ÿÎdjwewkó B‡Ui †`Iqv‡ji GK cv‡ki 38°C Zvcgv‡Îv Ab¨ cv‡ki Zvcgv‡Îv 8°C| B‡Ui Zvc cwienY ¸Yv¼ $0.84W\ m^{-1}\ K^{-1}$ n‡j †`Iqv‡ji ga¨ w`‡q GK wgwb‡U KZ Zvc mÂvwjZ n‡e| GLv‡b Zvcgv‡Îv Aeµg KZ?

GLv‡b,

A= $4m^2$

d= 4mm =4×10^{-3}m

t=1min=60 sec=60s

K= $0.84W\ m^{-1}\ K^{-1}$

θ_H = 38 °C

θ_C=8 °C

$\theta_H - \theta_C$=38-8=30 °C=30K

Q=?

Zvcgv‡Îv Aeµg=?

Avgiv Rwb,$Q = \frac{Kt(\theta_H-\theta_C)A}{d}$

$= \frac{0.84\times60\times4\times30}{4\times10^{-3}}$

=1512000J=1512KJ

Avgiv Rwb, Zvcgv‡Îv Aeµg = $\frac{(\theta_H-\theta_C)}{d}$

$= \frac{30}{4\times10^{-3}}$

=7.5 K m^{-1}

L2

এই অধ্যায় আমরা যে বিষয় গুলি আলোচনা করব

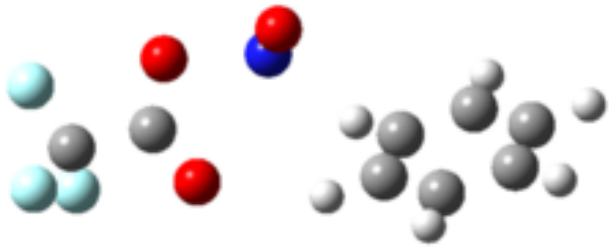
3q Aa¨vq t-Zv‡ci cÖKvk Ges Gi hvwšÍK mgZv

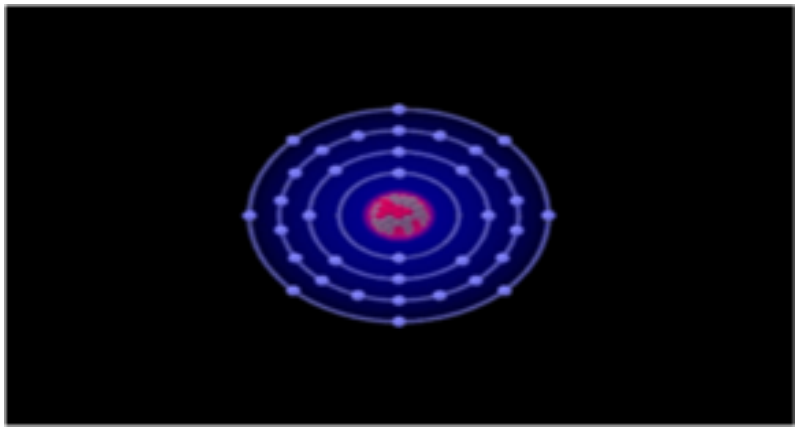
Zv‡ci K¨vjwiK gZev` I MwZZË¡Ges ÎæwU¸‡jv wjL, ZvcMwZwe`¨vi cÖavb m‡Ši, m‡gvò cwieZb©I iæ×Zvc cwieZb©wK Ges Gi kZKiæc¸‡jv wjL, iæ×Zvc cwieZ©‡bi Pvc I AvqZ‡bi g‡a¨ m¤úK©wPwýZ Kie ev cÖvY Ki †h, $PV^{\gamma} = a$ eK|

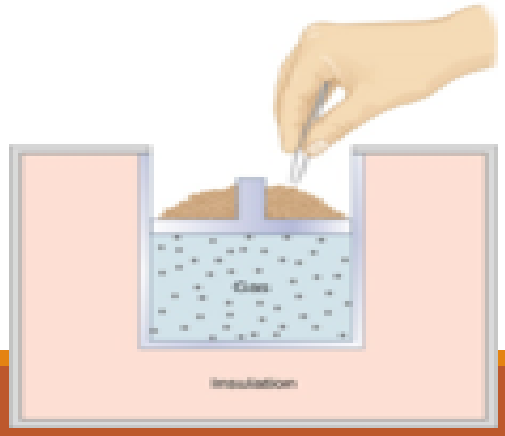
L2 Lotus, 8/27/2021

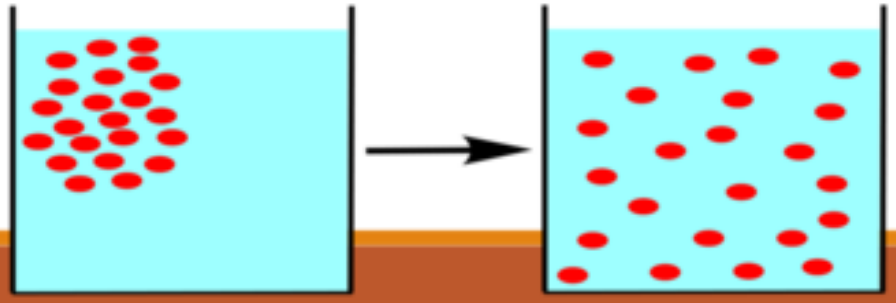
c‡e©Ávb hvPvB

Zv‡ci K¨vjwiK gZev` I MwZZË¡Ges ÎæwU¸‡jv Rvbv Av‡Q wKbv, ZvcMwZwe`¨vi cÖg mÎ wK, m‡gvò cwieZb© I iæ×Zvc cwieZb©wK Ges Gi kZ©gn¯ ¸‡jv wK|







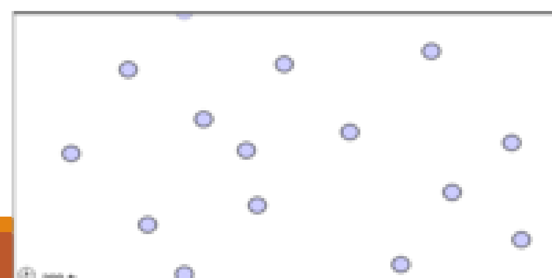


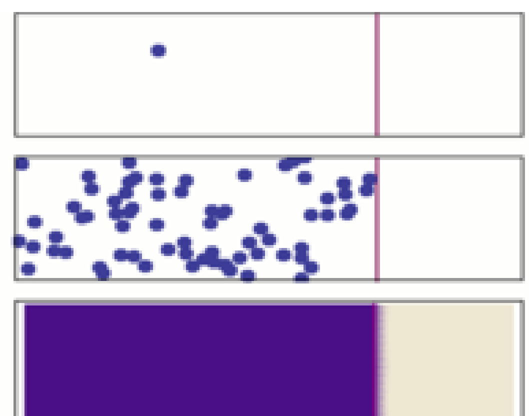
Zv‡ci K¨vjwiK gZev` Ges MwZZË¡

 Ebwesk kZvãxi ce©vaŸ©Rvbv wQj †h, Zvc MwZi GK cÖKvi eûntcÖvk wKš‘†m mg‡q K¨vjwiK gZev` bv‡g GK cÖKvi gZev` Pvjy wQj| Zvc m¤úwK©Z me©cÖ_g K¨vjwiK bvgK weÁvbx Av‡jvPbv K‡ib GBRb¨ Zv‡ci wm wR Gm c×wZ‡Z K¨vjwi| ZvB wb‡b¥ K¨vjwiK gZev` ¸‡jv Av‡jvPbv Kiv n‡jv -

1| Zvc K¨vjwiK bv‡g GK cÖKvi AwZ m~ÿè w¯’wZ¯’vcK c`v_©KYv hv AwZ mn‡R GK e¯‘†_‡K Ab¨ e¯‡Z cÖek Ki‡Z cv‡i Ges G‡K Aci‡K weKl©K‡i|

2| cÖZ¨K e¯‡Z Kg ev †ewk K¨vjwiK _v‡K| ‡h e¯‘i Zvcgv·v †ewk Zv‡Z Kg Zvcgv·vi e¯‘ ‡P‡q K¨vjwiK ‡ewk _v‡K|

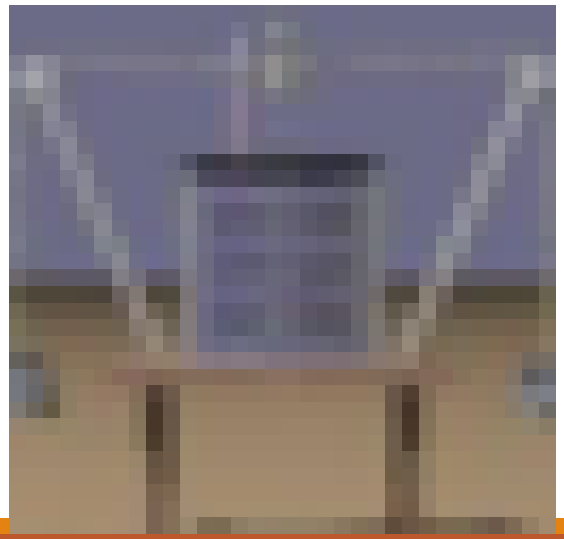


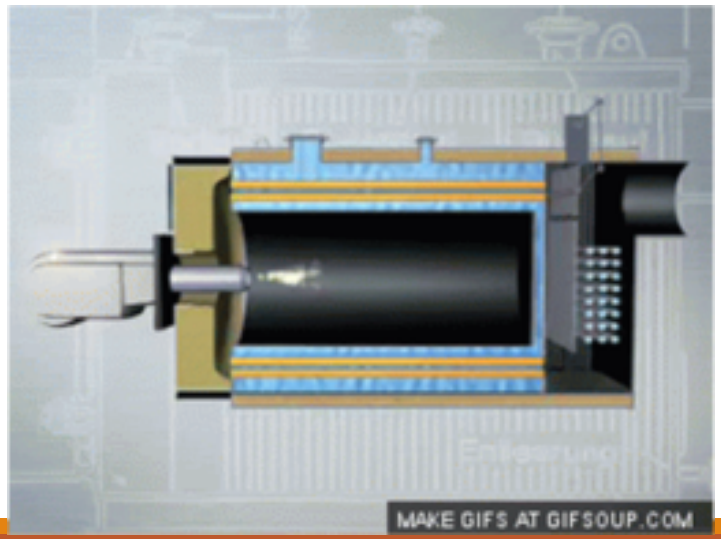


3| `ßv e¯‘i g‡a¨ Zvcxq ms‡hvM w`‡j Zv‡`i Zvcgv‡Îv mgvb bv chš—Dò Zvcgv‡Îvi e¯‘†_‡K wbb¥ Zvcgv‡Îvi e¯‡Z K¨vjwiK cëvwnZ nq| G‡Z Zv‡ci †Kvb cwieZb© nq bv|

4| e¯‘K¨vjwiK nvi v‡j kxZj I msKU PZ nq| Aciw`‡K K¨vjwiK jvf Ki‡j Zv DËß I cÖwiZ nq|

5| ùzHbv¼ ev Mjbv¼ e¯‘‡Z K¨vjwiK c`v_©cÖk K‡i Zvi Zvcgv‡Îv Acwiewa© iv‡L|



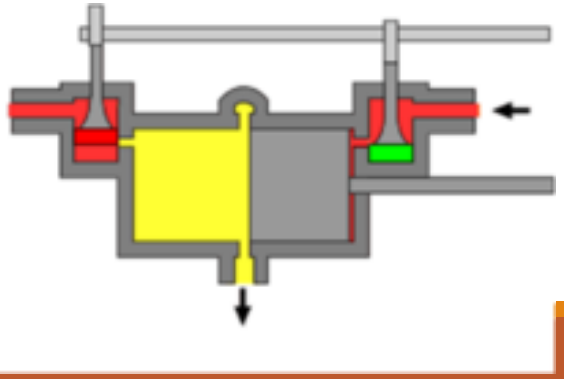


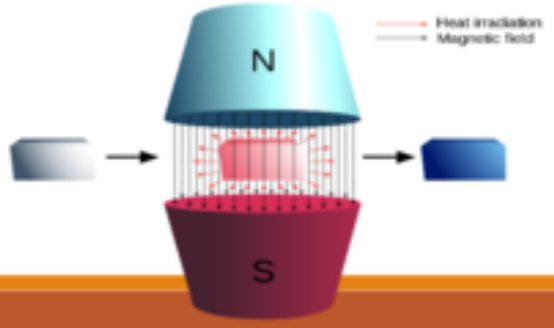
Zv‡ci K¨vjwiK gZev` ÎæwU¸‡jv wjL

wb‡Pi Zv‡ci K¨vjwiK gZev‡`i ÎæwU ¸‡jv n‡jv

(1) †h mKj e¯‘KYvi g‡a¨ AvKl©ej A‡cÿv weKl©ej †ewk Zv‡`i w¯’wZ¯’vcKZv Kg| †m Kvi‡Y D”P w¯’wZ¯’vcK ¸Ym¤úbœK¨vjwiK GKwU Kíbvi e¯‘gvÎ|

(2) K¨vjwi‡Ki fi hZB Kg †nvK bv †Kb Gi Av`vb cÖ‡b e¯‘i f‡ii Kg‡ewk †Kv‡bv cwieZ©n‡e| wKš‘GB gZev‡` GiKg †Kv‡bv cwieZ©bv nIqvi K_v ejv n‡q‡Q|

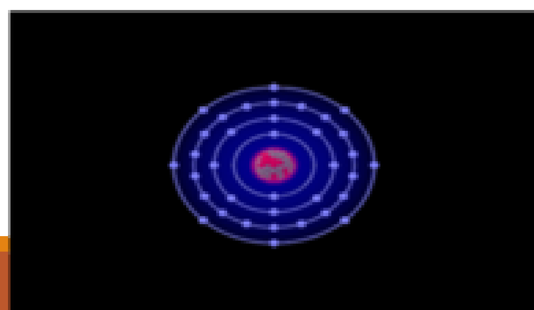


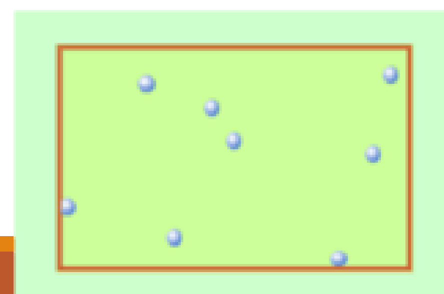


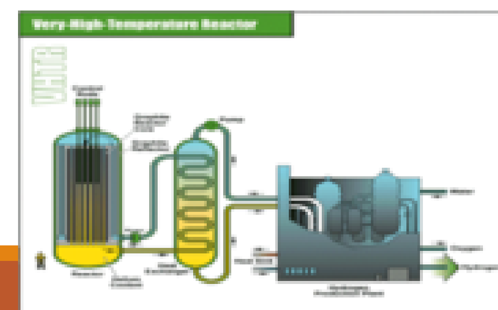
(3) G gZev‡` e¯‘i Zvc avi Y ÿgZv Nl©Y n«vm cvq| wKš‘
ciÿvq †`Lv †M‡Q Nl©Y e¯‘i Zvc avi Y ÿgZvi †Kv‡bv
cwieZ©b nq bv|
(4) Zvc GK cÖKvi kw³ Ges Gi iƒcvšÍi Av‡Q| G gZev‡`
Zvc‡K KYv i æ‡c aiv n‡q‡Q, wKš‘KYv †_‡K wKfv‡e Zvc
kw³ i D™¢e n‡e Zvi †Kv‡bv mwVK e¨vL¨v †`Iqv nqwb|
(5) wKfv‡e K¨vjwiK c`v_© cÖek K‡i Mjb‡¼ ev ùzUb‡¼
ZvcgvÎv aªæe iƒ‡c Zvi †Kv‡bv e¨vL¨v GB gZev‡` †bB|

Zv‡ci MwZ gZev`

1847 mv‡j weÁvbx †Rgm †cÖmKU Ryj cÖ_g Zvc I hvwš¿K kw³i g‡a¨ m¤úK© wbY©q K‡ib| GB gZev` Abyhv‡i cÖ‡Z¨K e¯‘i AYy‡jv Kg‡ewk MwZkxj Ges Zvc AYy‡jvi K‡qK cÖKvi MwZiB iƒcvšÍi| †Kv‡bv e¯‘i Zvcgv‡Îv G‡Z AYyi Mo MwZkw³i mgvbycvwZK| e¯‘i AYyi MwZkw³ Nl©Y AvNvZ cÖf„wZ †h †Kv‡bv Dcv‡q e„w× †c‡j Zvi Zvcgv‡Îv e„w× cvq| Zv‡ci MZxq gZev` Abyhv‡i †Kv‡bv e¯‘i Zv‡ci cwigvY H e¯‘i ga¨w¯’Z AYy‡jvi MwZkw³i mv‡_ m¤úK©hy³| hLb `yÙ e¯‘‡K ci¯ú‡ii mv‡_ Nl©Ye AvNvZ Kiv nq ZLb e¯Ø‡qi ga¨Kvi AYy‡jvi D‡ËRbv m„ó nq| G‡ÿ‡Î hvwš¿K Zvckw³‡Z iƒcvšÍiZ nq|







ZvcMwZ we`¨v

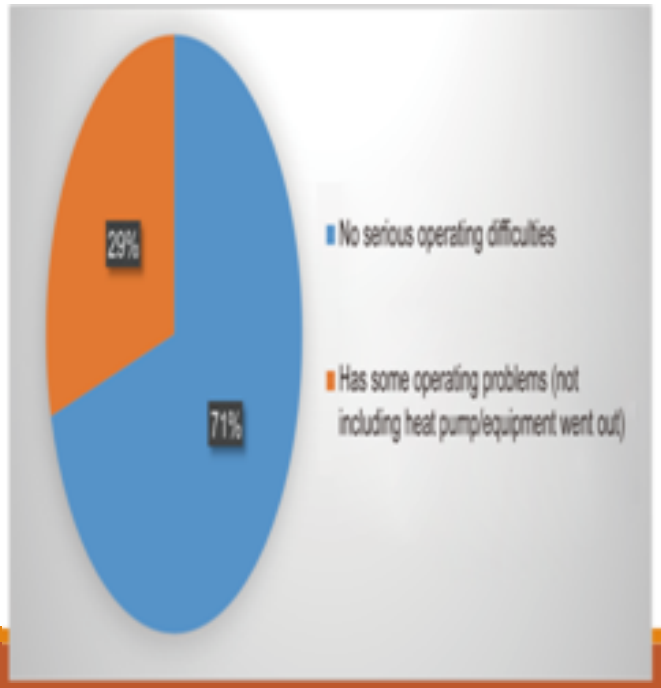
c`v_© wÁv‡bi †h kvLvq Zvc I hwšÍ kw³i cvi¯úwiK iƒcvšÍ m¤ú‡Ü Av‡jvPbv Kiv nq Zv‡K ZvcMwZ we`¨v e‡j| ZvcMwZ we`¨vi cÖ_g mÎ eSv‡Z n‡j wm‡÷g ev e¨e¯’v m¤ú‡K© avi Yv_vKv Avek¨K| cixÿv wbixÿv Rb¨ †Kv‡bv e¯‘i hZUzKz Ask we‡ePbv Kiv nq ZvB wm‡÷g ev e¨e¯’v| e¨e¯’v ev‡` e¯‘i ev` ewKu Ask‡K cwicvk©e‡j|

e¨e¯’v wZb cÖKvi h_v t-

1| gy³ e¨e¯’v

2| e× e¨e¯’v

I 3| i¶×Zvcxq e¨e¯’v



1| gy³ e¨e¯’v t- G †ÿ‡Î e¨e¯’v I cwicv‡k©g‡a¨ kw³ I e¯‹i KYv wewbgq NUv‡Z cv‡i| †hgb Kvc Mig Pv (XvKbvwenxb)

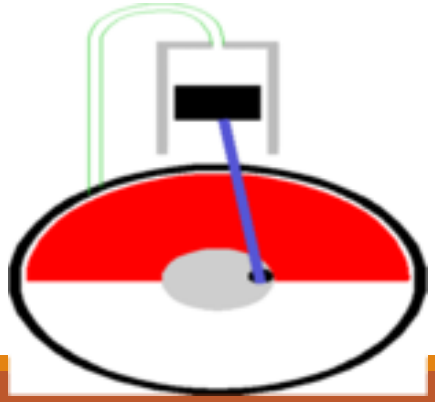
2| e× e¨e¯’v t- G †ÿ‡Î e¨e¯’v I cwicv‡k©g‡a¨ kw³ wewbgq NUv‡Z cv‡i| ‡hgb Dchy³ Pv‡qi Kvc XvKbv w`‡q †X‡K w`‡j ïaygvc †ei n‡Z cv‡i wKšÍev®ú †ei n‡Z cv‡i bv|

3| i¤×Zvcxq e¨e¯’v t- G †ÿ‡Î e¨e¯’v I cwicv‡k©g‡a¨ kw³ I e¯‹i KYv wewbgq NUv‡Z cv‡i bv| ‡hgb Pv dv‡· ‡i‡L gIjv e× K‡i w`‡j Zvi wfZi †_‡K Zvc I ev®ú †ei n‡Z cv‡i bv|

ZvcMwZwe`¨vi cÖg m‡e¨vL¨v Ki

ivg‡dvW© es Rvjy civÿv †_‡K cÖ djvd‡ji wfwË‡Z Zvc I Kv‡Ri m¤ú‡K© ZvcMwZwe`¨vi cÖg m‡e¨ev Rvjyi m‡e¨ bv‡g cÖwôZ nq| GB m‡e¨ n‡Z hLb †Kv‡bv KvR m¤úv©‡c Zv‡c ev Zvc m¤úv©‡c Kv‡R i¨cvš—i Z nq, ZLb Zvc me© Kv‡Ri mgvbycvwZK n‡e|

hw` W cwigvY KvR m¤úv©‡c Zv‡c cwiYZ nIqvq H cwigvY Zvc Drcbœ nq Z‡e,



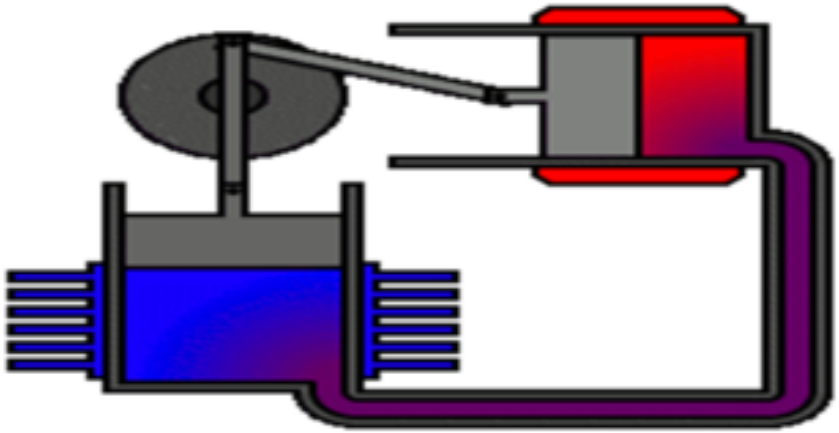
Rxeb mÎ g‡Z Avgiv cvB, $W \propto H$

$$W = JH$$

$$JH = W$$

$$J = \frac{W}{H}$$

GLv‡b J GKwU aæeK hv‡K Zv‡ci hvwšÍK mgZv ev Rxeb aæeK e‡j| GUv Drcbœvc Ges icvšÍiZ Kv‡Ri g‡a¨ mgZv iÿv K‡i|



Zv‡ci hvwšÍK mgZv Gi e¨vL¨v (Rvgvj i m‡Î i e¨vL¨v Ki)

Rvgvj i m‡Î wU n‡jv -

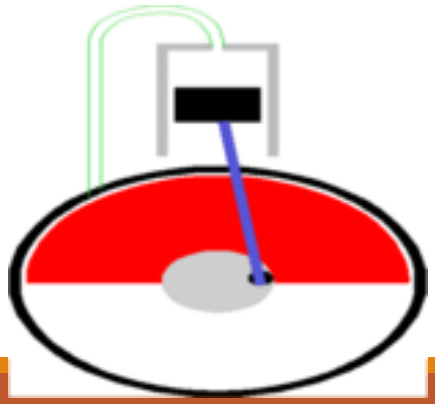
hLb †Kv‡bv KvR m¤úY©‡c Zv‡c ev Zvc m¤úY©‡c Kv‡R i¨cvšÍiZ nq, ZLb Zvc me©¨ Kv‡Ri mgvb¨vwZK n‡e|

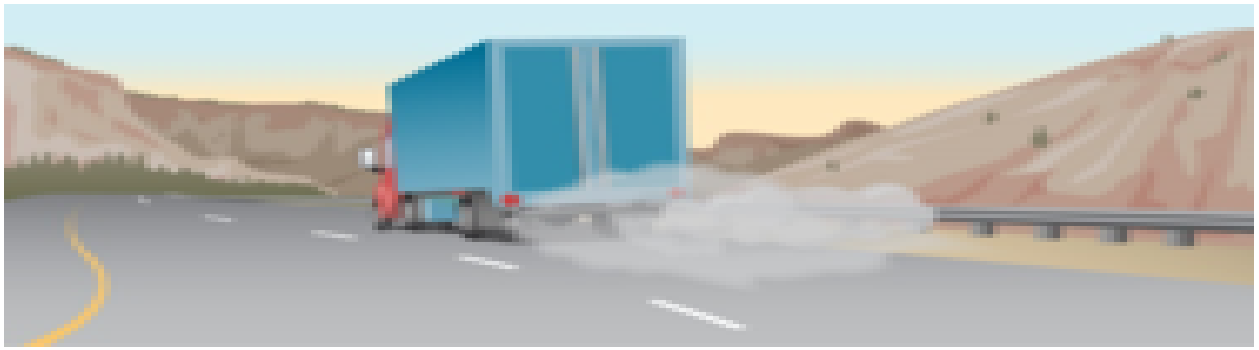
hw` W cwigvY KvR m¤úY©‡c Zv‡c cwiYZ nIqvq H cwigvY Zvc Drcbœ nq Z‡e, Rvgvj i m‡Î g‡Z Avgiv cvB, W∝ H.

$$W = JH$$

$$JH = W$$

$$J = \frac{W}{H}$$





GLv‡b J GKwU aæeK hv‡K Zv‡ci hwšÍ mgZv ev Ryjvi aæeK e‡j| GUv Drcbœvc Ges icvšÍiZ Kv‡Ri g‡a¨ mgZv iÿv K‡i|

AZGe †h cwigvY KvR m¤úY©‡c Zv‡ci cwiYZ n‡j GK GKK Zvc Drcbœe Zv‡K Zv‡ci hwšÍ mgZv e‡j|

msÁv t- Dc‡ii mgxKiY n‡Z H=1, J=W|

Kwnmqvm Gi ZvcMwZwe`¨v cÖg mÎ wU eYb© Ki

Kwnmqvm Gi ZvcMwZwe`¨v cÖg mÎ t-

†Kv‡bv e¨e¯’v KZ©K Mnxn Z Zv‡ci wKQz Ask Gi Aš—¯’kw³ ew„× K‡i Ges ewK Ask ewnt¯’Kv‡R e¨q nq|

†Kv‡bv ms¯’v‡K ΔQ cwigvY Zvc w`‡j hw` H ms¯’vi Aš—¯’kw³ ΔU nq Ges ΔW cwigvY ewn¯’KvR nq,

Z‡e $\Delta Q = \Delta U + \Delta W$

ÿz`ªcwieZ©bi †ÿ‡Î mgxKiY †_‡K †jLv hvq|

$$dQ = dU + dW$$

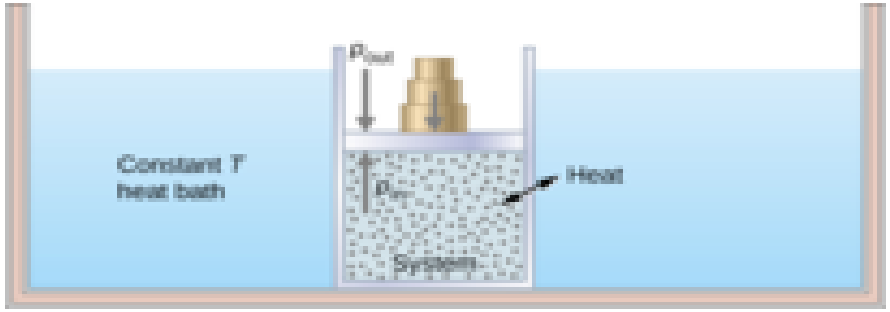
w¯’i ewnt¯’Pvc P Gi wei“‡× dv Gi AvqZ‡bi cÖwi‡Yi Rb¨ †h ewnt¯’KvR K‡i Zvi cwigvY dW=Pdv

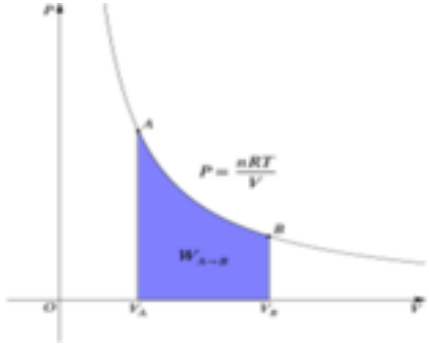
[ΔW=F. Δx=PA.Δx=P.dv]

$$dQ = dU + Pdv$$

m‡gvò cwieZ©b wK I Gi kZ©gn¯ ‚‡jv wjL

†h cwieZ©‡b †Kv‡bv M¨v‡mi Pvc I AvqZ‡bi cwieZ©nq, wKš‘ Zvcgv‡Îv w¯’i _v‡K †mB cwieZ©‡K m‡gvò cwieZ©e‡j| Ges †h c×wZ‡Z GB cwieZ©msNwUZ nq Zv‡K m‡gvò cÖwµqv e‡j| m‡gvÂ cÖwµqvq M¨v‡mi Pvc I AvqZ‡bi m¤úK©e‡q‡ji m~‡Î †g‡b P‡j| A_©p$p \propto \frac{1}{v}$ ev, pv=aygK





m‡gvò cwieZ©b i kZ©gn¨t-

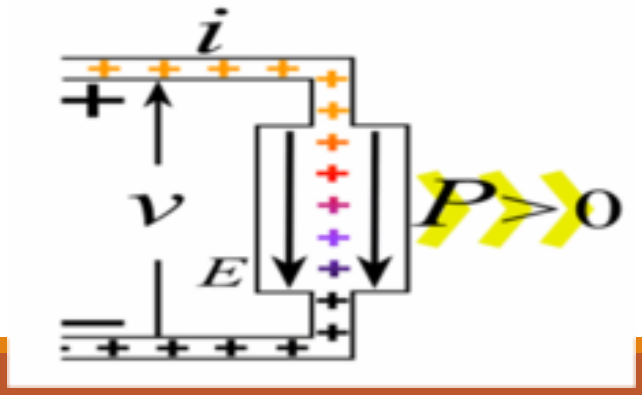
m‡gvÂ cwieZ©b Rb¨ wb¤œgvbeLZ kZ©g¨ni cÖ‡qvRb;

1| M¨vm‡K GKwU mvgvwicvnx cv‡Î ivL‡Z n‡e|

2| cv‡Îi PZz©úvk©gva¨‡gi ZvcMÖZv ev Zvc avivYygZv D”P n‡Z n‡e|

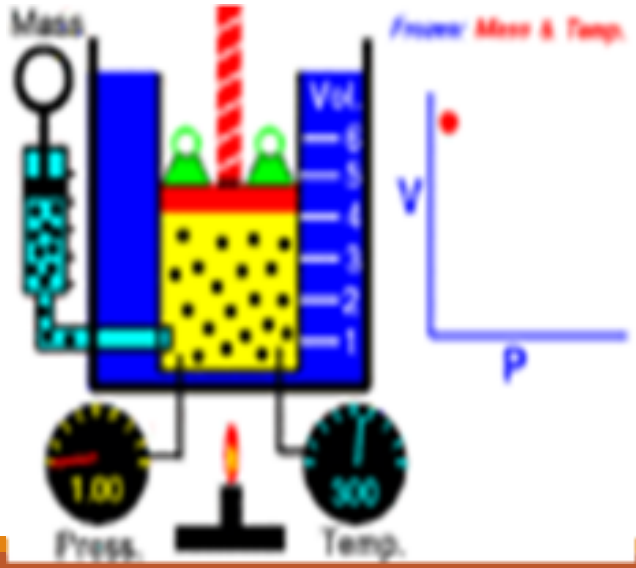
3| Pv‡ci cwieZ©bax‡i ax‡i msNwUZ Ki‡Z n‡e|

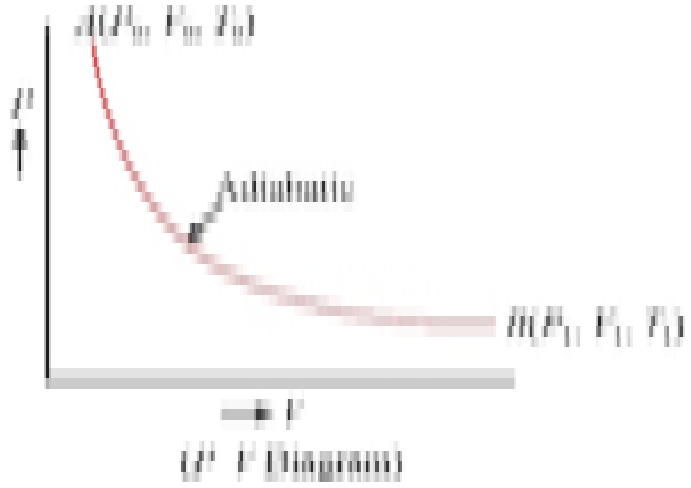
4| cÖ‡qvRbxq Zvc MÖY ev eR©b i Øviv Zvcgv‡Îv w¯’i _vK‡e|



iæ×Zvc cwieZb©Gi msÁv `vI I kZ©‡jv wjL

†h cwieZ©b †Kv‡bv Zvc evwni n‡Z mieivn Kiv nq bv ev M¨vm n‡Z Acmviv Kiv nq bv A_P M¨v‡mi Pvc Ges AvqZ‡bi cwieZb©N‡U Zv‡K iæ×Zvc cwieZb©ejv nq| ‡h cÖqvq wm‡÷g Zvc MÖnY K‡i bv ev eRb© K‡i bv iæ×Zvcxq cÖqvq e‡j|





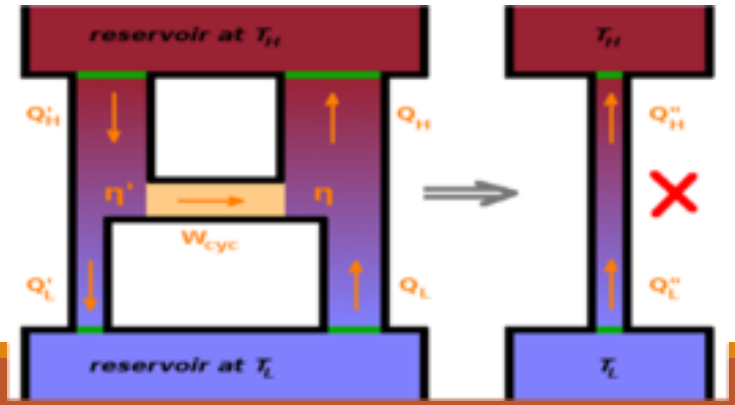
i¤×Zvc cwieZ©b i kZ©gnt-

i¤×Zvc cwieZ©b i Rb¨ wb¤œgvÎv kZ©g‡ni cÖvRb;

1| M¨vm‡K GKwU Kz‡wievnx cv‡Î ivL‡Z n‡e|

2| cv‡Îi PZz©úvk©gva¨‡gi ZvcMÖZv Kg n‡Z n‡e|

3| Pv‡ci cwieZ©bLvevi `¤Z msNwUZ Ki‡Z n‡e hv‡Z evB‡ii mv‡_ Zvc Av`vb- cÖvb †Kv‡bv mgvavM bv _v‡K|



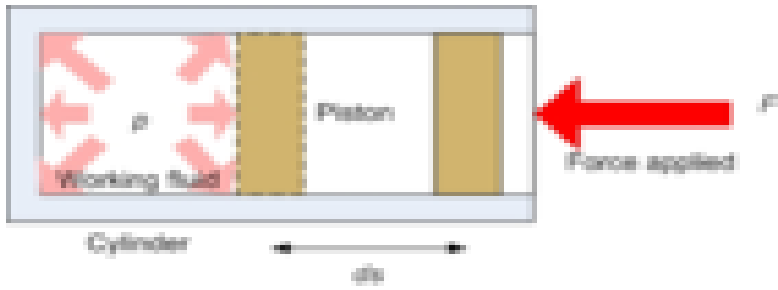
i¤×Zvc cwieZ©b Pvc I AvqZ‡bi g‡a¨ m¤úK© PV^{γ} = a¯eK|

g‡bKwi, wmwjÛvi Gi g‡a¨ GK †gvj Av`k©M¨vm Av‡Q Ges wc÷b Øviv &vUKv‡bv Av‡Q| GB M¨v‡mi dQ cwigvY Zvc cÖ`vM Kwi| G‡Z M¨v‡mi Zvcgv‡Îv e„× cv‡e Ges †mB m‡½ M¨vm wKQzKvR Ki‡e A_v©cÖ`Ë Zvc `yfv‡e e¨wqZ n‡e| awi, AvqZ‡bi cwieZ©bdV Ges Zvcgv‡Îvi cwieZ©bdT.

ZvcMwZwe`¨vi cÖ_g m‡¤§j n‡Z cvB,

$$dQ = du + dw$$

$$dQ = C_v dT + PdV \text{ ---------- (1)}$$



GLv‡b,

$du = C_v dT$ = w¯’i AvqZ‡b M¨v‡mi Av‡cwÿK Zvc I M¨v‡mi Zvcgv‡Îv cwieZ©bnq hv AšÍ’kw³‡K e„× cvq Ges $dw = PdV$ = wbw`©ó Pv‡c M¨v‡mi AvqZb cÖvi‡Yi Rb¨ KZ…Kv‡Ri cwigvY|

Avgiv Rwb, i¤×Zvc cÖqvq evB‡ii mv‡_ M¨v‡mi Zv‡ci †Kv‡bv Av`vb cÖb N‡U bv|

AZGe, dQ = 0 ------(2)

(1) bs I (2) bs mgxKiY n‡Z cvB,

C_vdT+PdV= 0 ----------(3)

cÖgvi, Av`k©M¨v‡mi †ÿ‡Î, PV=nRT ev, PV=1.RT

ev, PV=RT ---------(4)

[GLv‡b 1 ‡gvj Av`k©M¨v‡mi †ÿ‡Î R †gvjvi M¨v‡mi aæeK]

D³ (4) bs mgxKiY‡K AšÍfxKiY ev e¨eKjb K‡i cvB,

PdV+VdP=RdT+TdR dR=0

ev, RdT = PdV+VdP

$$\text{ev, } dT = \frac{PdV+VdP}{R}$$

$$\text{ev, } C_v\left(\frac{PdV+VdP}{R}\right) + PdV = 0$$

[(3) bs mgxKi‡Y dT Gi gvb ewm‡q cvB]

ev, $\frac{C_v(PdV+VdP)+RPdV}{R}=0$

ev, $C_v(PdV+VdP)+RPdV=0\ (\because R=C_P-C_V)$

ev, $C_v(PdV+VdP)+(C_P-C_V)PdV=0$

ev, $(C_vPdV+C_vVdP)+C_PPdV-C_VPdV=0$

ev, $C_vVdP+C_PPdV=0$

ev, $\frac{C_vVdP}{C_v}+\frac{C_PPdV}{C_v}=0$ (Dfqc‡ÿ C_v Øviv fvM K‡i cvB)

ev, $VdP+\gamma PdV=0$ (†h‡nZz $\frac{C_P}{C_v}=\gamma$)

$\frac{VdP}{PV}+\frac{\gamma PdV}{PV}=0$ (Dfqc‡ÿ PV Øviv fvM K‡i)

ev, $\frac{dP}{P} + \frac{\gamma dV}{V} = 0$ ---------- (5)

GLb (5) bs mgxKiY Gi Dfqc‡ÿ mgvKjb K‡i cvB

$\int \frac{dP}{P} + \gamma \int \frac{dV}{V} = 0$ $\because \int \frac{dx}{x} = \log_e x$

ev, $\log_e P + \gamma \log_e V = a$gvK $\because (\log_e K = a$gvK)

ev, $\log_e P + \log_e V^{\gamma} = \log_e K$

ev, $\log_e (P \times V^{\gamma}) = \log_e K$

ev, $PV^{\gamma} = K$

$\therefore PV^{\gamma} = K$

AZGe, i¤×Zvc cwieZ©b Pvc I AvqZ‡bi g‡a¨ m¤úK© $PV^{\gamma} = a$eK|

i¤×Zvc cwieZ©b Zvcgvîv I AvqZ‡bi g‡a¨ m¤úK©

$TV^{\gamma-1}$ = aæeK|

Avgiv Rwb, Av`k© M¨v‡mi †ÿ‡Î, PV = nRT

ev, PV =1.RT

ev, PV = RT

$$ev,\ P = \frac{RT}{V} \text{ ----------(6)}$$

cÖvq i¤×Zvc cwieZ©b Pvc I AvqZ‡bi g‡a¨ m¤úK© Avgiv cvB,

PV^{γ} = aæeK

$$ev,\ \frac{RT}{V} \times V^{\gamma} = a\text{æ}eK \text{ [P Gi gvb ewm‡q cvB]}$$

$$ev,\ \frac{T}{V} \times V^{\gamma} = \frac{a\text{æ}eK}{R}$$

$$ev,\ TV^{-1}V^{\gamma} = a\text{æ}eK$$

$$\therefore TV^{\gamma-1} = a\text{æ}eK$$

GKwU Av`k©M¨v‡mi †ÿ‡Î C_p I C_v Gi g‡a¨ cv_©K ‡ei Ki|
A_ev cÖgvY Ki †h, $C_p - C_V = R$

Avgiv Rwb M¨v‡mi `vwU Av‡cwÿK Zvc Av‡Q, GKwU $C_p$ Ges AciwU $C_V$ | G‡`i g‡a¨ cv_©K ‡ei Ki‡Z n‡e| GKwU Av`k©M¨v‡mi `vB Av‡cwÿK Zv‡ci g‡a¨ cv_©K Ki‡Z wM‡q Zvc Kmgwievnx c`v‡_©GKwU Ave× †PvO wbB| g‡bKwi, †PvO C | ‡Pv‡Oi g‡a¨ GKwU nvjKv Nl©kb¨ I evqybi¤× wc÷b webv evavq PjvPj Ki‡Z cv‡i| g‡bKwi, wc÷bwU D | wc÷bwUI Kmgwievnx c`v‡_©^Zix| GB Ave× †Pv‡O 1 †gvj cwigvY M¨vm wbB| GLb M¨vmwUi AvqZb w¯’i †i‡L Gi ZvcgvÎv dT cwigvY ew„× Kwi|

hw` w¯’i AvqZ‡b M¨v‡mi Av‡cwÿK Zvc C_V nq Z‡e M¨vm KZ©K.Mp,nxZ Zvc = fi × Av‡cwÿK Zvc × Zvcgv‡îv

cv_©K =$1\times C_V\times dT= C_V dT$

M¨v‡mi Zvcgv‡îv ew,×i cwigvY GK †Kjwfb n‡j M¨vm KZ©K.

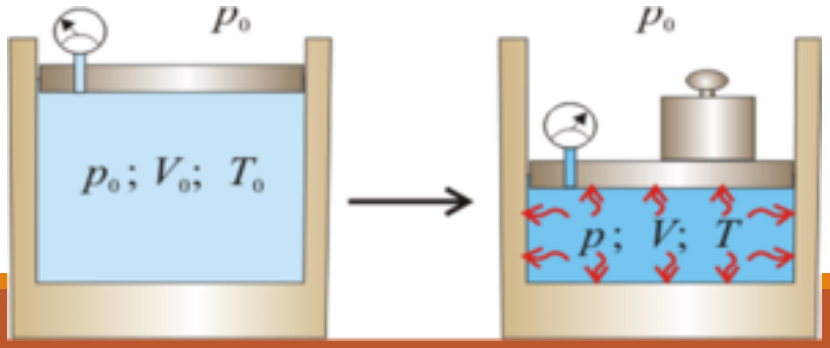
Mp,nxZ Zvc = $C_V\times 1= C_V$ Rvby

g‡bKwi, w¯’i Pv‡c M¨v‡mi ‡gvjvi Av‡cwÿK Zvc C_pA_©

w¯’i Pv‡c 1 †gvj †Kv‡bv GKwU M¨v‡mi Zvcgv‡îv 1 wWwMÖ

‡Kjwfb ew,×‡Z $C_p$cwigvY Zv‡ci cÖvRb n‡e, M¨v‡mi

mieivnKZ.GB Zvc `ßvi fv‡M e¨wqZ n‡e|



Gi GKwU Ask M¨v‡mi Zvcgvîv evo‡e Ges Aci Ask ewn¨K Pvc Gi wei‡× M¨v‡mi AvqZb e„w× KvR K‡i| awi, Pv‡ci wei‡× M¨v‡mi AvqZb e„w×i d‡j wc÷bwU cwigvY `i-Z¡evB‡i m‡i †Mj| AZGe Kv‡Ri cwigvY = ej × miY

=Pvc × †ÿÎdj × miY [ej = Pvc × ‡ÿÎdj]

= P×A × x ; GLv‡b dV= M¨v‡mi cÖwZ AvqZb = A . X

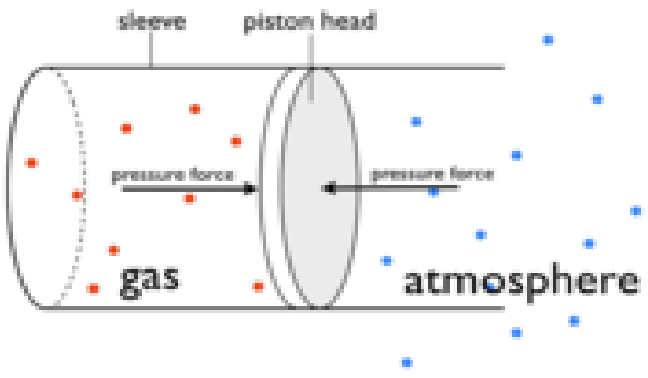
AZGe Kv‡Ri cwigvY = PdV

AZGe C_p = C_V + Kv‡Ri cwigvY

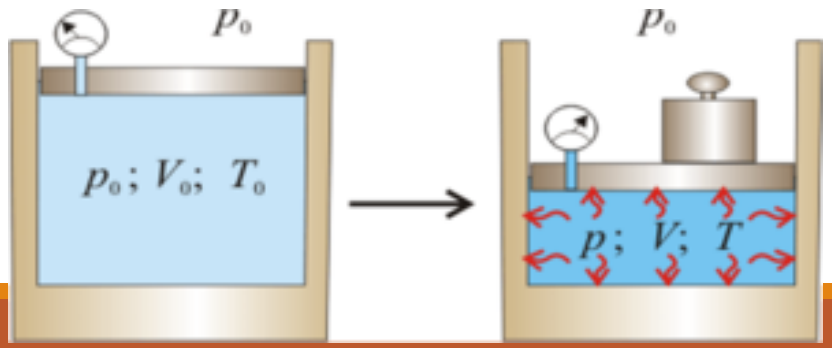
ev, C_p = C_V + P.dV ..... (1)

Avgiv Rwvb, Av`k© M¨v‡mi †ÿ‡Î

PV = RT .....(2)



hw` Pvc w¯'i _v‡K, Z‡e (2) mgxKiY †K AšÍxKiY ev
e¨eKjb K‡i cvB, P.dV+V.dP =R.dT+ T.dR
ev P.dV +V.0= R.dT+ T.0
ev P.dV= RdT = R .....(3)
(1) I (3) bs mgxKiY n‡Z cvB,
C_p = C_V+ P. dV
ev C_p = C_V+ RdT
∴ C_p - C_V = R
A_vq©M¨v‡mi `ßi Av‡cwÿK Zv‡ci cv_K© ev AšÍ dj
M¨vm aæeK Gi mgvb|



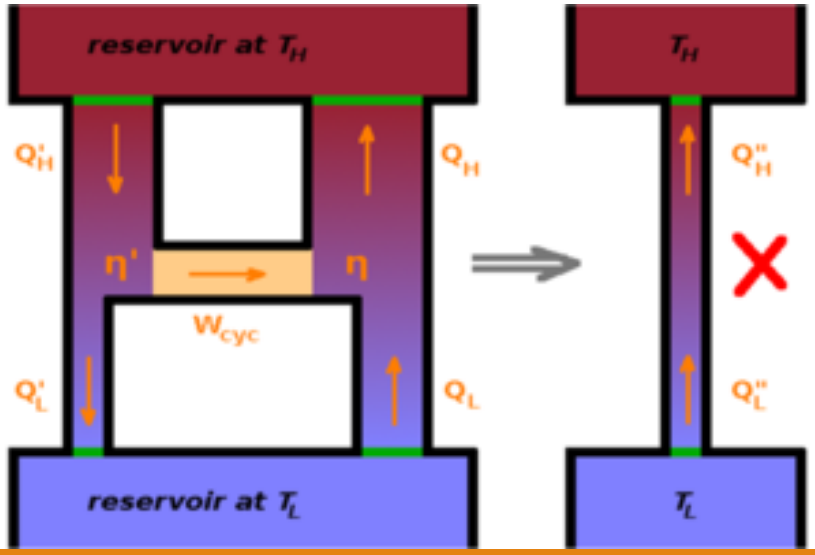
এই অধ্যায় আমরা যে বিষয় গুলি আলোচনা করব

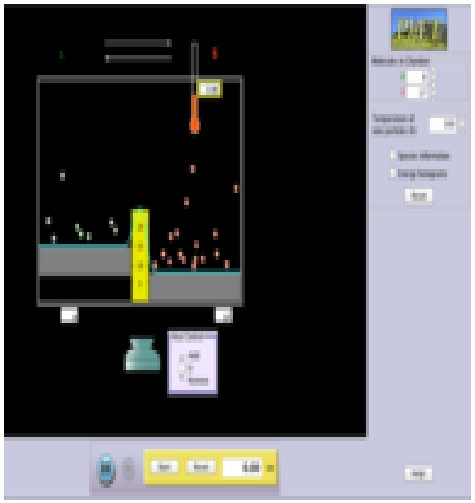
4_©Aa¨vq t-ZvcMwZwe`¨vi 2q m¤^‡Ü|

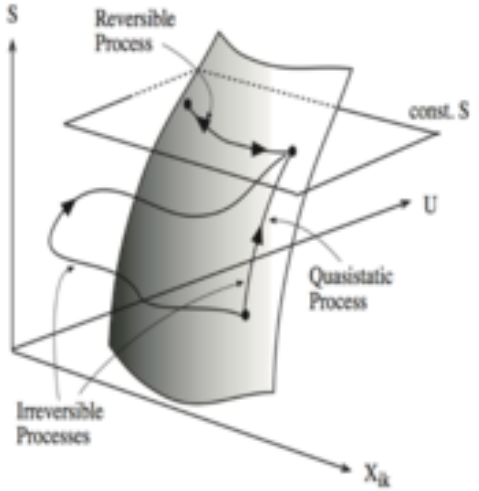
cÖvMvgx Ges AcÖvMvgx cwÎqv wK I G‡`i cv_©K¨ †`Lvl| ZvcMwZwe`¨vi 2q m¤^‡Ü wjL| GbUwÎc wK I Zvi Zvrch©`Lvl| C_p I C_v wK I cÖgvY Ki †h, C_p-$C_V = R$|

c‡e©Ávb hvPvB

M¨v‡mi Av‡cwÿK Zvc I †gvjvi Av‡cwÿK Zvc ev †gvjvi Zvcavi Y ÿgZv wK, cÖvMvgx Ges AcÖvMvgx cÖqv wK, C_p I C_v wK I Bnv w`‡q wK K‡i Ges wK cÖY Kiv hvq|







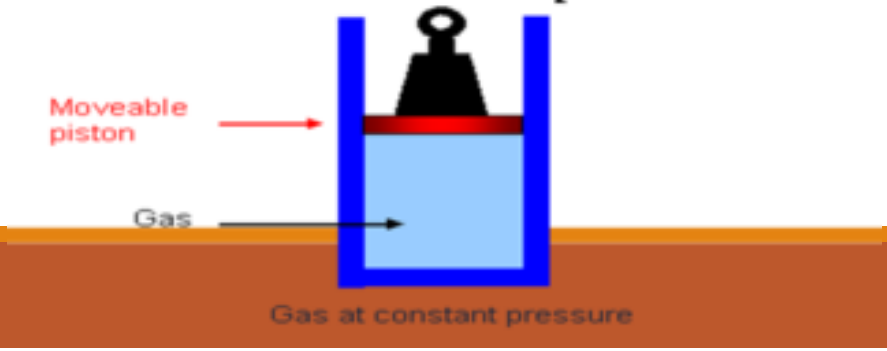
M¨v‡mi Av‡cwÿK Zvc

Avgiv Rwwb, M¨v‡m Zvc cÖ`vM Ki‡j Zvcgv Î v e„× mv‡_ mv‡_ Gi AvqZb I Pvc e„× cvq| wKš‘KwVb I Zij c`v‡_© †ÿ‡Î Gi¤c nq bv ej‡jB P‡j | myZivs M¨v‡mi Av‡cwÿK Zv‡ci msÁvq AvqZb I Pv‡ci D‡jø_vKv GKvšÍcÖ`vRb| AvqZb I Pv‡ci g‡a¨ KLbI AvqZb‡K Avevi KLbI Pvc‡K w¯’i ivLv nq e‡j M¨v‡mi `ywU Av‡cwÿK Zvc Av‡Q ;

h_v t-

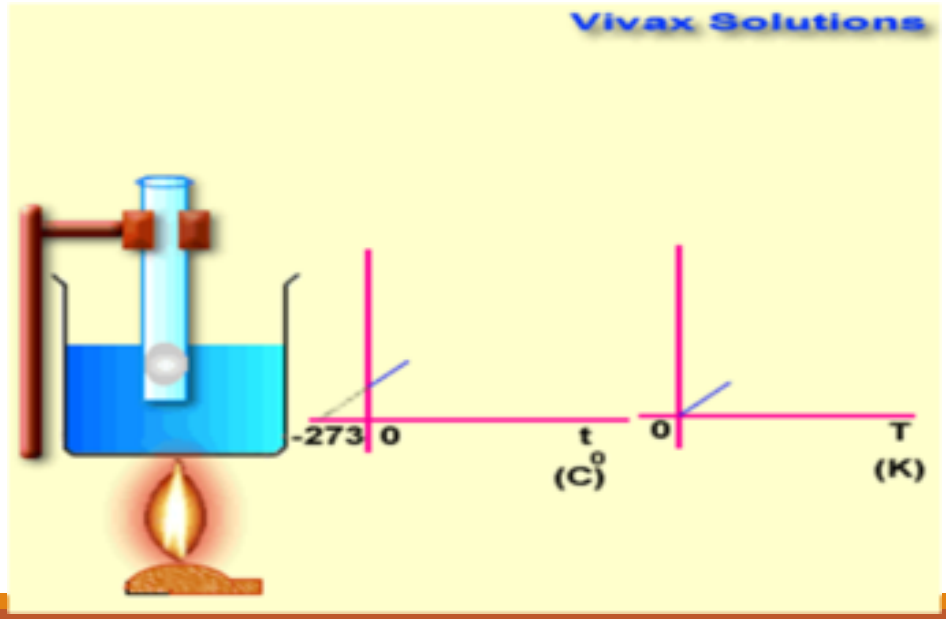
(1) w¯’i AvqZ‡b M¨v‡mi Av‡cwÿK Zvc (C_v)

(2) w¯’i Pv‡c M¨v‡mi Av‡cwÿK Zvc (C_p)



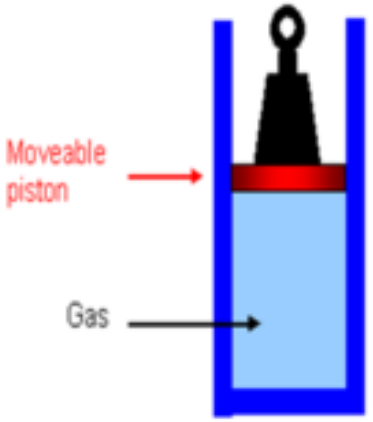
(1) w¯’i AvqZ‡b M¨v‡mi Av‡cwÿK Zvc(C_v) t-

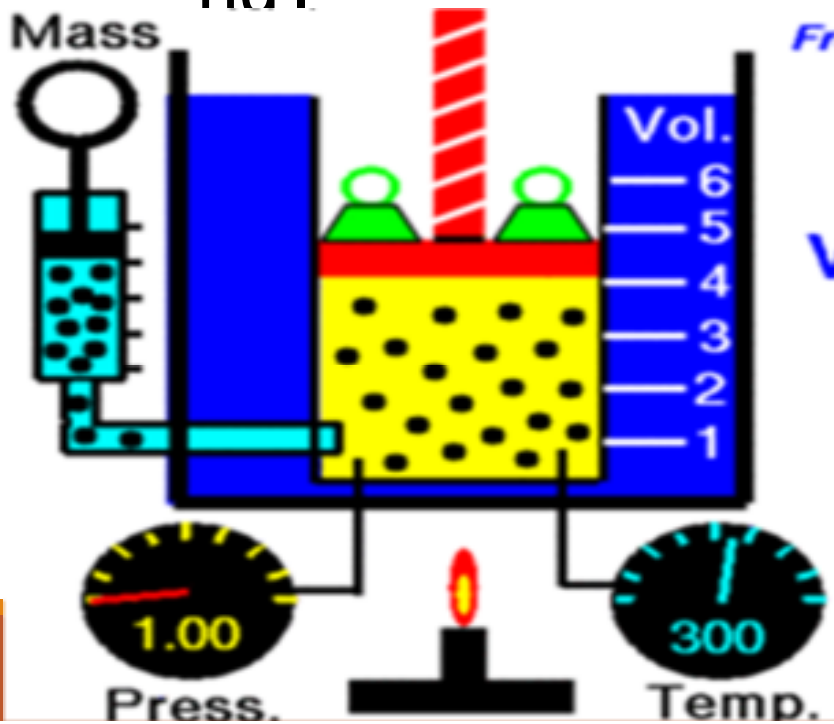
AvqZb w¯’i †i‡L GKK f‡ii †Kv‡bv GKwU M¨v‡mi Zvcgv Îv 1 wWwMÖ„×‡Z †h cwigvY Zv‡ci cÖ‡qvRb nq, Zv‡K w¯’i AvqZ‡b M¨v‡mi Av‡cwÿK Zvc e‡j| Bnv‡K C_v Øviv cÖKvk Kiv nq|

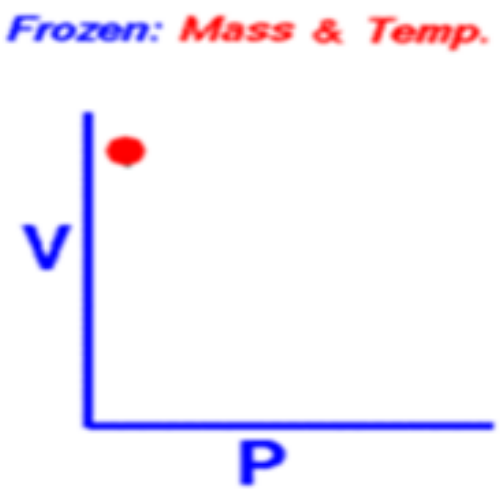


(2) w¯’i Pv‡c M¨v‡mi Av‡cwÿK Zvc(C_p) t-

Pvc w¯’i †i‡L GKK f‡ii †Kv‡bv GKwU M¨v‡mi Zvcgv Î v 1 wWwMÖ, ×‡Z †h cwigvY Zv‡ci cÖ‡qvRb nq, Zv‡K w¯’i Pv‡c M¨v‡mi Av‡cwÿK Zvc e‡j| Bnv‡K C_p Øviv cÖKvk Kiv nq|

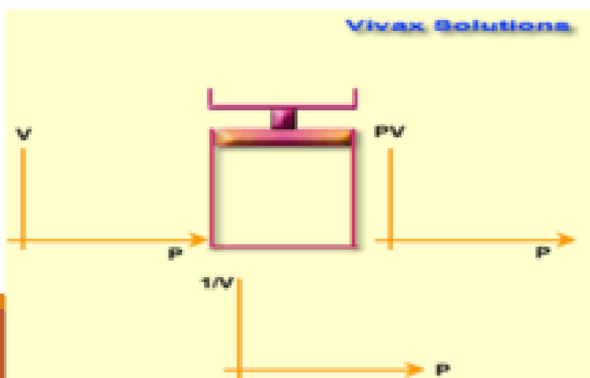


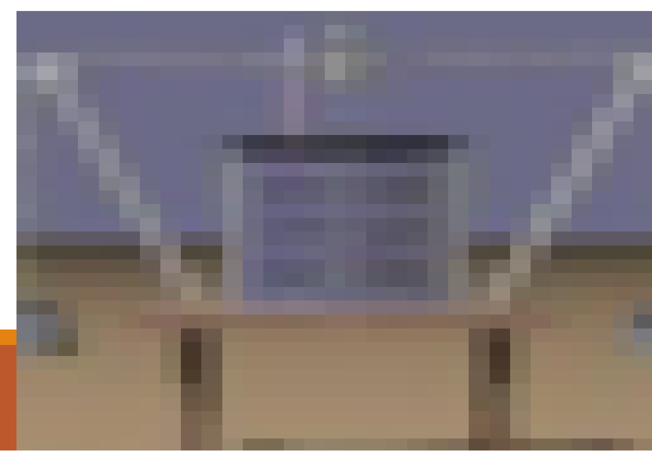




†gvjvi Av‡cwÿK Zvc ev †gvjvi ZvcaviY ÿgZv t-

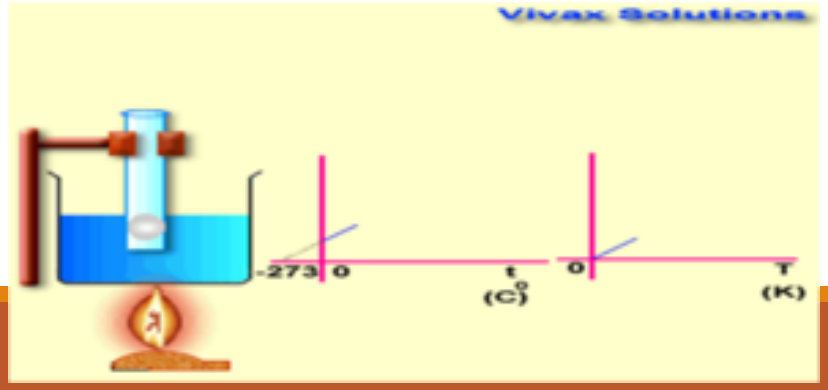
1 †gvj Av`k©K‡bv GKwU M¨v‡mi Zvcgvîv 1 wWwMÖ e„w×‡Z †h cwigvY Zv‡ci cÖ‡qvRb nq, Zv‡K †gvjvi Av‡cwÿK Zvc ev †gvjvi ZvcaviY ÿgZv e‡j | G‡K C Øviv cÖKvk Kiv nq| m †gvj M¨v‡mi Zvcgvîv ΔT evov‡Z hw` Rȳj ΔQ Zv‡ci cÖ‡qvRb nq, Z‡e msÁvbymv‡i $C = \frac{\Delta Q}{m\Delta T}$ Gi `yU †gvjvi Av‡cwÿK Zvc I i‡q‡Q; h_v:-





(1) w¯’i Pv‡c M¨v‡mi †gvjvi Av‡cwÿK Zvc(C_p) t-

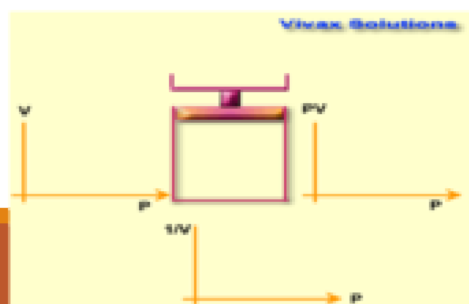
Pvc w¯’i †i‡L 1 †gvj †Kv‡bv GKwU M¨v‡mi Zvcgv Îv 1 wWwMC‡Ki jwfb e¨vL¨v‡Z †h cwigvY Zv‡ci cÖ‡qvRb nq, Zv‡K w¯’i AvqZ‡b M¨v‡mi †gvjvi Av‡cwÿK Zvc e‡j| Bnv‡K C_p Øviv cÖKvk Kiv nq| Pvc w¯’i †i‡L m †gvj M¨v‡mi Zvcgv Îv ΔT evov‡Z hw` Rvbv¨ ΔQ Zv‡ci cÖ‡qvRb nq, Z‡e msÁvbyv‡i $C_p = \frac{\Delta Q}{m\Delta T}$



(2) w¯’i AvqZ‡b M¨v‡mi ‡gvjvi Av‡cwÿK Zvc(C_v) t-

AvqZb w¯’i †i‡L 1 †gvj †Kv‡bv GKwU M¨v‡mi ZvcgvÎv 1 wWwMÖ‡K jwfb e„×‡Z †h cwigvY Zv‡ci cÖ‡qvRb nq, Zv‡K w¯’i AvqZ‡b M¨v‡mi ‡gvjvi Av‡cwÿK Zvc e‡j| Bnv‡K C_v Øviv cÖKvk Kiv nq| AvqZb w¯’i †i‡L m †gvj M¨v‡mi ZvcgvÎv ΔT evov‡Z hw` Rýj ΔQ Zv‡ci cÖ‡qvRb nq, Z‡e msÁvbymv‡i $C_v = \frac{\Delta Q}{m\Delta T}$

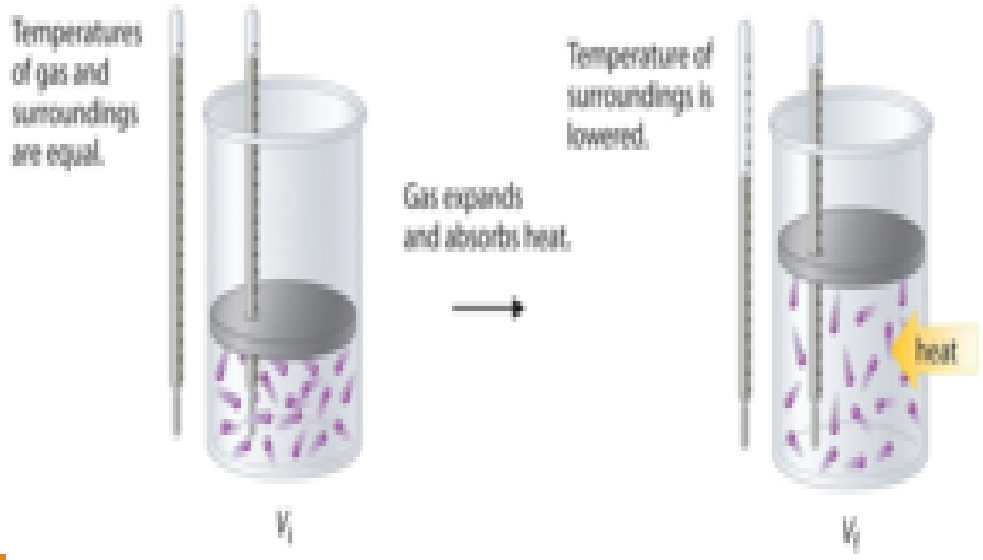
cixÿvq †`Lv †M‡Q C_p Gi gvb C_v A‡cÿv †ewk nq|

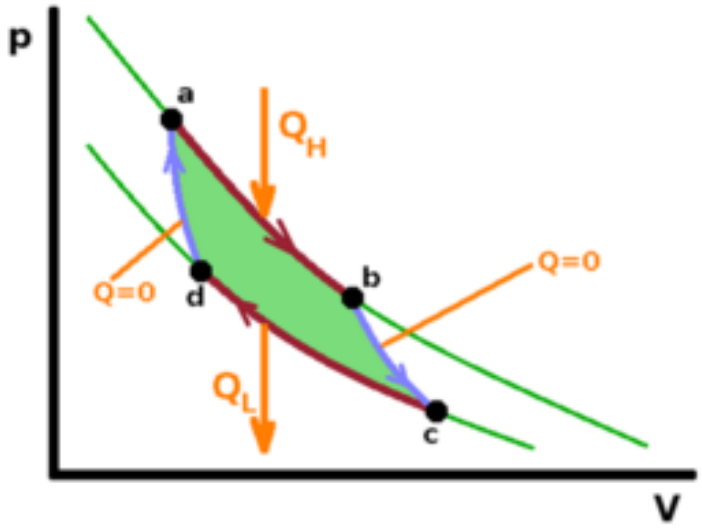


cÖvMvgx Ges AcÖvMvgx cÖqv

†Kv‡bv ms¯’v ev wm‡÷g hLb GK Ae¯’v n‡Z Ab¨ Ae¯’vq hvq, ZLb Ae¯’vi GB cwieZ©b`Bj cÖqvq msNwUZ nq, h_v t- (1) cÖvMvgx Ges

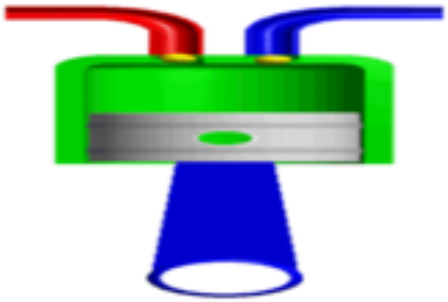
(2) AcÖvMvgx|

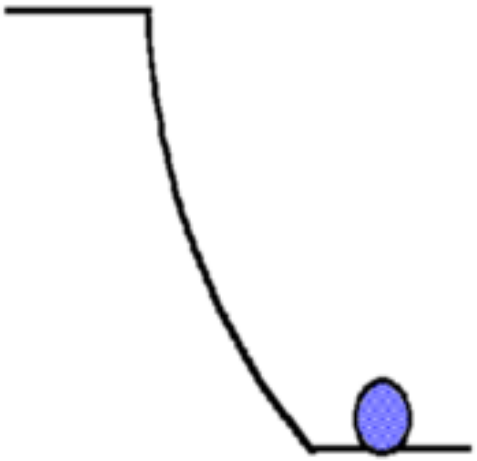




cÖvMvgx cÖqv t-

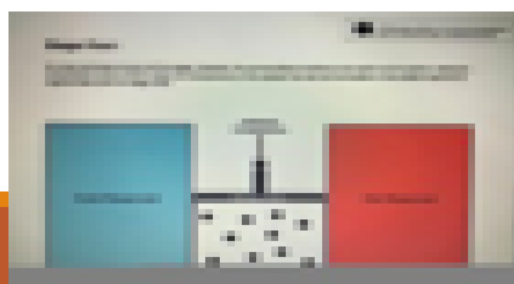
ZvcMwZwe`¨vi `¨ó‡KvY n‡Z Avgiv †mB cÖqv‡K cÖvMvgx ej‡ev hv m¤§Lgx cwieZ©i ci wecixZgx n‡q cÖveZ©Ki‡Z cv‡i Ges m¤§L I wecixZgx cwieZ©i cÖ¯Íi Zvc I Kv‡h©djvdj mgvb I wecixZgx nq|

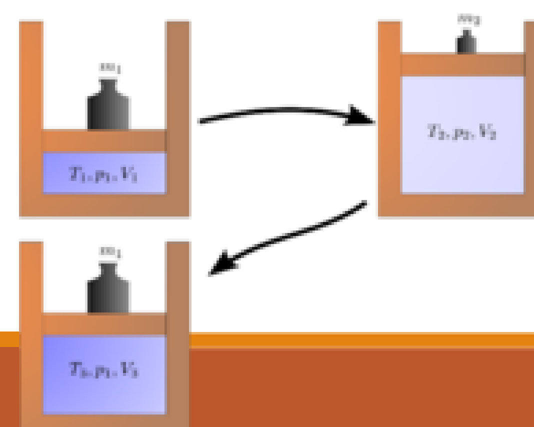




D`vniY t- ev¯Íe †ÿ‡Î m¤ú~Y© cÖZ¨vMvgx cÖwµqvi D`vniY †`Iqv m¤¢e bq| Z‡e wKQzwKQz cÖwµqv Av‡Q hv‡`i‡K AvcvZfv‡e cÖZ¨vMvgx cÖwµqv ejv †h‡Z cv‡i|

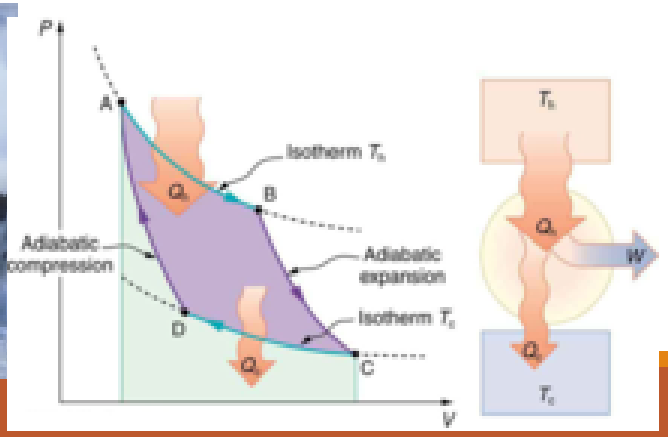
(1) Lye ax‡i ax‡i msNwUZ Ki‡j m‡gvò Ges i“×Zvc cwieZ©b cÖZ¨vMvgx n‡e| KviY G‡ÿ‡Î N‡l©Yi b¨vq Aeÿqx ej bv _vKvq Ges cÖwµqvwU Lye ax‡i ax‡i msNwUZ nIqvq cwienY, cwiPjb I wewKi‡Yi `iæY Zvc ev kw³ ÿq nq bv|

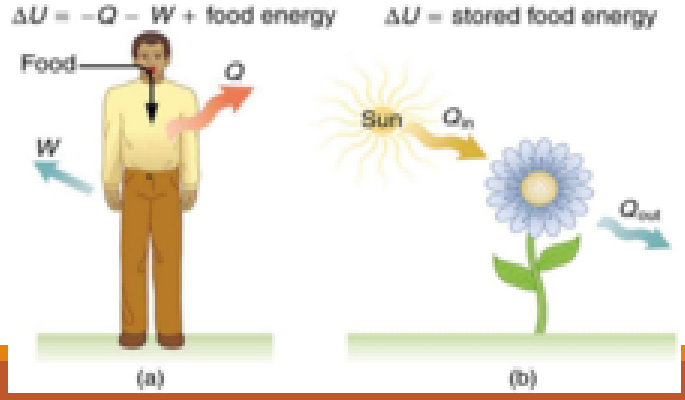




AcÖvMvgx cÖqv t-

‡h cÖqv m¤§yLvMvgx nIqvi ci wecixZgÈx n‡q cÖveZ©Ki‡Z cv‡i bv, Zv‡K AcÖvMvgx cÖqv e‡j| AcÖvMvgx cÖqv nVvr Ges ¯ZztùZ©v‡e msNwUZ nq| cÖZ‡Z me cÖqv ¯ZztùZ©v‡e N‡U _v‡K| myZivs cÖwZK cÖqv gvÎB AcÖvMvgx| GB cÖqvq ms¯’v KLbB Zvi cÖwgK Ae¯’vq wd‡i hvevi cÖYZv †`Lv hvq bv|

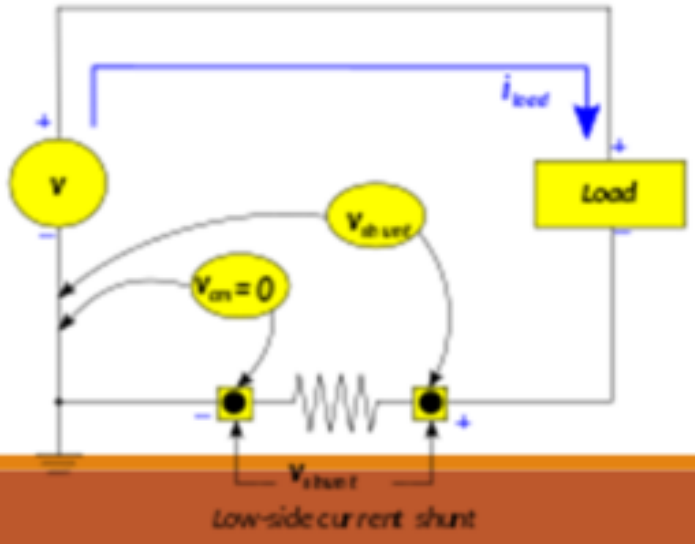




D`vniY t-

(1) ^e`ÿwZK †iv‡ai ga¨ w`‡q we`ÿr cÖvwnZ n‡j Zvc mwó nq| GwU GKwU AcÖvMvgx cwQ‡qv|

(2) e›`ÿx n‡Z ¸wj Qø‡j evi‡`i we‡ùvwiY N‡U| GB we‡ùvwiY AwZ `ªæZ msNwUZ nq| GB cwQ‡qv AcÖvMvgx|



Zvc BwÄb:- Zvc kw³‡K w`‡q KvR Kiv‡Z n‡j cÖKvRb GKwU hwšÍ e¨e¯’vi , GB hwšÍ e¨e¯’v‡KB Zvc BwÄb| R¡jwb †cvov‡bvi e¨e¯’vi Dci wbf©K‡I BwÄb‡K cÖKvZ `vwf‡e fvM Kiv hvq h_v;- 1| ewn`©BwÄb 2| AšÍ©BwÄb

1| ewn`©BwÄb t- †h BwÄ‡b R¡jwbi `nb wµqv BwÄ‡bi gj¬ As‡ki evB‡i N‡U, Zv‡KB ewn`©BwÄb e‡j| ev®úxq BÄb GKwU ewn`©BwÄb|

2| AšÍ©BwÄb t- †h BwÄ‡b R¡jwbi `nb wµqv BwÄ‡bi gj¬ As‡ki wfZ‡i N‡U, Zv‡KB AšÍ©BwÄb e‡j| ‡c‡Uªj BwÄb, wW‡Rj BwÄb GKwU ewn`©BwÄb|

cÖvMvgx I AcÖvMvgx cÖqvi gv‡S cv_©K wjL ?

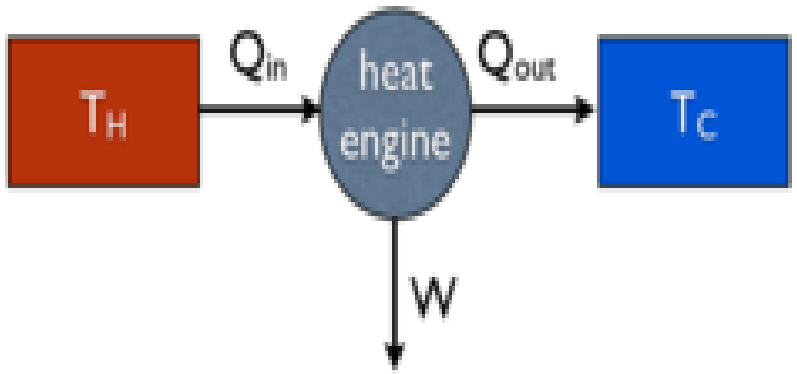
cÖvMvgx I AcÖvMvgx cÖqvi gv‡Si cv_©K¸‡jv wb‡P †`Iqv n‡jv -

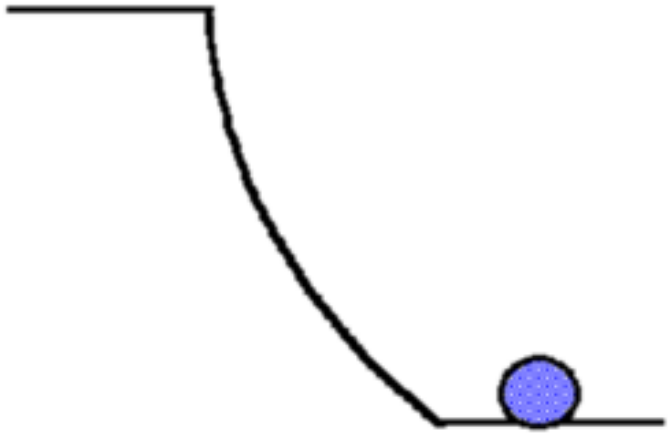
cÖvMvgx	AcÖvMvgx
(1) †h cÖqv wecixZgL¥x n‡q cÖveZ©K‡i Ges m¤§L¥eZx© wecixZgL¥x cÖqvi cÖ¯‹i Zvc I Kv‡Ri djvdj mgvb I wecixZ nq †mB cÖqv‡K cÖvMvgx e‡j|	(1) †h cÖqv wecixZgL¥x n‡q cÖveZ©i Ki‡Z cv‡i bv Zv‡K AcÖvMvgx cÖqv e‡j|
(2) Kg©j ms¯’v cÖ_gK Ae¯’vq wd‡i Av‡m|	(2) Kg©j ms¯’v cÖ_gK Ae¯’vq wd‡i Av‡m bv|
(3) GwU AwZ axi cÖqv|	(3) GwU AwZ `ªæZ cÖqv|
(4) ms¯’v ZvcMZxq mvg¨ve¯’v eRvq iv‡L|	(4) ZvcMZxq mvg¨ve¯’v eRvq iv‡L bv|
(5) GB cÖqvq Aeÿqx djvdj `ó nq bv|	(5) GB cÖqvq Aeÿqx djvdj `ó nq|

ZvcMwZwe`¨vi 2q m‡Ît-

Avgiv Rwb †h, hwšÍkw³,kãkw³,Av‡jvK kw³ cÖZ.wewfbœ cÖvi kw³ AwZ mn‡R Zvckw³‡Z iæcvšÍiZ nq| wKš‘ Zvckw³‡K AwZ mn‡R Ab¨kw³‡Z iæcvšÍ Kiv hvq bv| Z‡e Zvc kw³‡K Ab¨ kw³‡Z iæcvšÍ Ki‡Z n‡j h‡šÍ¿ cÖvRb| GB hš¿cvZvc BwÄb bv‡g cwiwPZ|

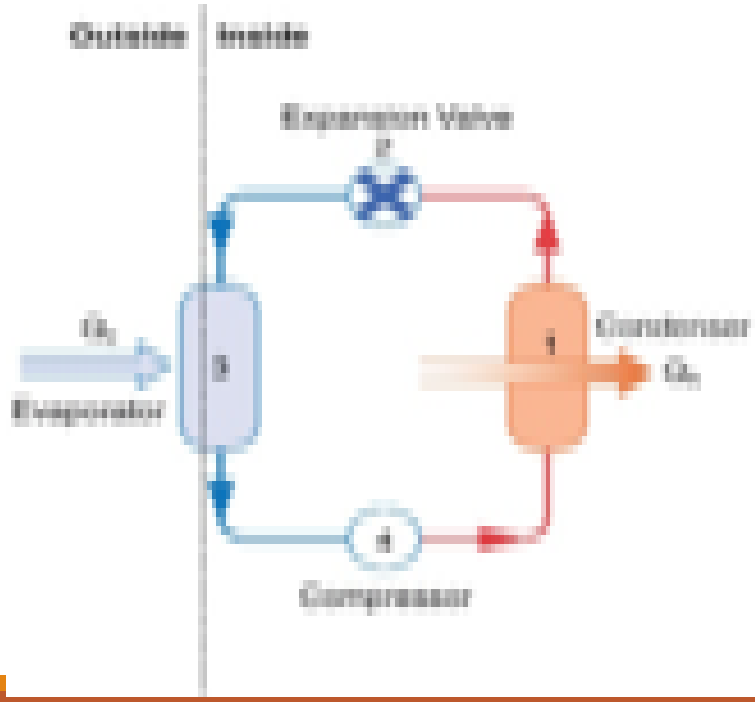
weÁvbx Kv‡YvcÖ‡B wm×všÍAv‡m †h Zvc‡K KLbB m¤úv‡Ûy c Kv‡R iæcvšÍ Kiv m¤¢eci bq|





Kwmqv‡mi weeeyZ t- evB‡ii †Kv‡bv kw³i mvnv‡h¨ e¨wZ‡i‡K †Kv‡bv ¯^qswµq h‡šÍi c‡ÿ wbb¥ Zvcgv Îvi †Kv‡bv e¯‘n‡Z D”P Zvcgv Îvi †Kv‡bv e¯‡Z Zv‡ci ¯’vbvšÍi mx¶c bq|

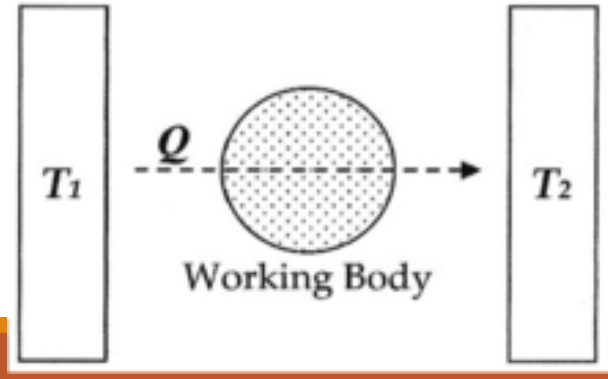
cøsK Gi weeeyZ t- †Kv‡bv Zvc Drm n‡Z AbeiZ Zvc †kvlY Ki‡e Ges mxúY© c‡ÿ Kv‡R iæcvšÍiZ n‡e Giæc GKwU Zvc BwÄb ˆZwi Kiv mx¶c bq|

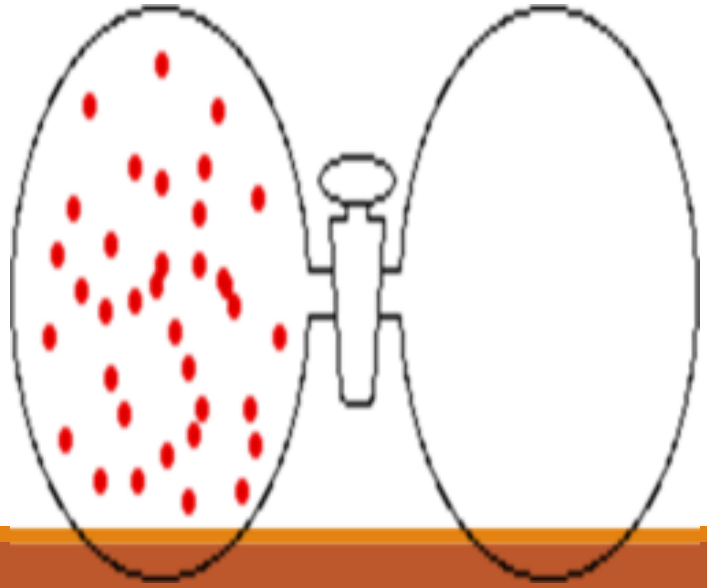


GbUwc wK Ges Gi Zvrch©‡jv wjL

iæ×Zvc cÖqvq e¯‘i †h Zvcxq ag©¯‘i _v‡K, Zv‡K GbUwc e‡j|

Ab¨fv‡e, GbUwc n‡jv e¯‘i Ggb GKwU †fŠZ ag©v iæ×Zvc cÖqvi w¯‘i _v‡K|





GbUªc Zvrch©

ZvcMwZwe`¨vq GbUªci ¸iæZ¡Acwimxg| Gi wbb¥wjwLZ Zvrch©‡q‡Q -

(1) GbUªc GKwU cÖKvZK iwk hvi gvb Zvc I cig Zvcgv‡Îvi Abyev‡Zi mgvb|

(2) GwU e¯‘i GKwU Zvcxq ag©v Zvc mÂvj‡bi w`K wb‡`k©K‡i|

(3) GwU e¯‘i ZvcMZxq Ae¯’v wbav©Y mnvqZv K‡i|

(4) GwU Zvcgv‡Îv, Pvc,AvqZb, Aš—ÍbwnZ© kw³, PzÆKxq Ae¯’vi b¨vq †Kv‡bv e¯‘Ae¯’v cÖKvk Kiv nq|

(5) Zvcgv‡Îv I Pv‡ci b¨vq G‡K Abyfve Kiv hvq bv|

GKwU mxmvi e¨vjU †Kv_vI evavcwÖ n‡q Zvcgv Îv 150K e„× †cj, hw` Ab¨ †Kv‡bv f v‡e Zvc bó bv nq Z‡e e¨vjU ‡Ui †eM KZ? mxmvi Av‡cwÿK Zvc S=126 J $kg^{-1}k^{-1}$.

mgvavb,

awi, e¨vjU ‡Ui †eM = v ms^{-1}

Ges e¨vjU ‡Ui f i = mkg

GLv‡b e¨vjU KZK©.KZK.KvR = e¨vjU ‡Ui MwZkw³ = Drcbœ Mnxz Zvc Q= $ms\Delta\theta$

KZK.KvR w mwÂZ MwZkw³ wn‡m‡e _v‡K Zvc

w= $E_k = \frac{1}{2}mv^2$= Drcbœ Mnxz Zvc Q

$\frac{1}{2}mv^2 = ms\Delta\theta$

$v^2 = 2\ s\ \Delta\theta$

$= 2\times126\times150$

$v^2 = 37800$

$V=\sqrt{37800}$

$=194.42\ ms^{-1}$

GLv‡b,

Av‡cwÿK Zvc,

S=126J $kg^{-1}k^{-1}$

Zvcgv Îv e„×,

$\Delta\theta$ =150K

e¨vjU ‡Ui †eM, V=?

‡Kv‡bv e¨e¯’v 1200J Zvc †kvlY K‡i Ges e¨e¯’vi Dci 400J KvR m¤úv`b K‡i| e¨e¯’vi Aš—t¯’ kw³i cwigvY wbY©q Ki|

mgvavb,

ZvcMwZwe`¨vi 1g m~Î †_‡K

Avgiv cvB, dQ=du+dw

dQ - dw =du

du= dQ - dw

=1200- (- 400)

=1200 +400

=1600J

GLv‡b, Zvc †kvlY K‡i, dQ=1200J

e¨e¯’v Dci KvR m¤úv`b K‡i,

dw = - 400J

[∵ e¨e¯’v(e¯‘) Øviv KvR m¤úvw`Z n‡j abvZ¥K Ges e¨e¯’vi Dci KvR m¤úvw`Z n‡j FbvZ¥K n‡e]

e¨e¯’vi Aš—t¯’ kw³, du=?

‡Kv‡bv e¨e¯’v 0.01kg cwb‡K 0°C n‡Z 10°C Zvcgv Ît q DËß Kiv n‡jv| GbUªci cwieZb© wbY©q Ki|

mgvavb, g‡bKwi, GbUªci cwieZb© = ds

Avgiv cvB, $ds = \int_{T_1}^{T_2} \frac{dQ}{T}$

$= \int_{T_1}^{T_2} \frac{msdT}{T}$

$= ms \int_{T_1}^{T_2} \frac{dT}{T}$

$= [\log T]_{T_1}^{T_2} ms$

$= ms[\log T_2 - \log T_1]$

$= ms[\log \frac{T_2}{T_1}]$

$= 0.01 \times 4200 \times [\log \frac{283}{273}]$

$= 0.01 \times 4200 \times [\log_{10} 283 - \log_{10} 273]$

$= 0.01 \times 4200 \times [2.4527 - 2.4361]$

$= 1.509 \text{ J } k^{-1}$

GLv‡b, $m = 0.01\text{kg}$

$S = 4200 \text{ J } kg^{-1}k^{-1}$

$T_1 = 0°\text{C} = (0 + 273)K$

$= 273K,$

$T_2 = 10°\text{C} = (10 + 273)K$

$= 283K,$

GbUªci cwieZb©, ds=?

এই অধ্যায় আমরা যে বিষয় গুলি আলোচনা করব

5g Aa¨vq t- w¯'i Zwor

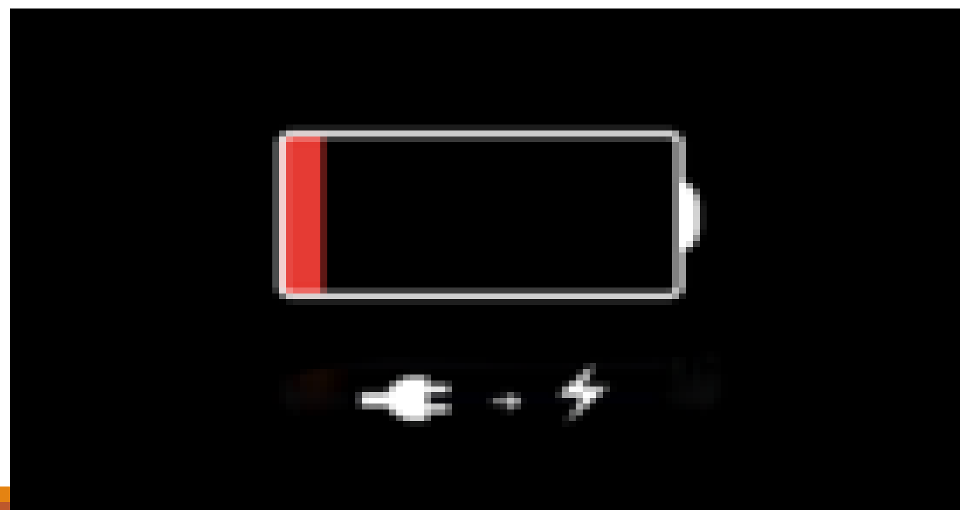
Avavb I Avav‡bi cÖK…wZ, Kzj‡¤^i m~Î, Zwor‡ÿÎ, Zwor wefe, Zwor cÖvej¨, Zwor ZxeªZv ev cÖvej¨ I Zwor wefe Gi g‡a¨ m¤úK©, Zwor †ÿ‡Îi †Kv‡bv we›`y wefe‡ei iwkgvjv wbY©q|

Avavb ev PvR©msÁv t-

c`v_©@wóKvix †gŠwjK Kyng‡ni †gŠwjK ˆewkó¨g‡a¨ ag©KB Avavb ev PvR©@‡j| †cÖv‡bi Avavb n‡jv abvZ¥K Ges B‡jKUªb Avavb‡K FbvZ¥K aiv nq| wbDUª‡bi ‡Kvb Avavb †bB|

Avav‡bi cÖZxK t-

Avgiv Rwb, Nl©Y PvR© Drcbœ nq| Nl©‡Yi d‡j weweafbœ ¯‡Z Drcbœ PvR© cÖZxK GK iKg nq bv| GKwU‡Z m„ó PvR© cÖZxK Aci wU‡Z m„ó PvR© cÖZx‡Ki wecixZ| cÖZxK Abyhv‡i PvR© `y cÖKvi h_v t- 1| abvZ¥K PvR© 2| FbvZ¥K PvR©|



wb‡b¥i cixÿv †_‡K Avgiv Pv‡R©cÖZ.wbY©Ki‡Z cwi-
GKwU KvP `Û wbB| GwU‡K GK Uªvwiv ïK‡bv †ikgx Kvco
w`‡q Nl©Kwi Ges `ÛwU‡K wm‡éi mÿZv w`‡q Sv‡j‡q w`B|
G‡Z KvP`ÛwU PvR©Z Ae¯’vq _vK‡e| GLb Aci GKwU
KvP`ÛwU‡K Abyôvcfv‡e ‡ikwg Kvco Øviv N‡l Sz‡šÍ
KvP`ÛwUi wbKU awi| †`Le Sz‡šÍKvP`ÛwU LwbKUv m‡i
wM‡q‡Q ev Gi ci¯úi weKl©Ki‡Q|

Gevi GKwU B‡ebvBU `Û‡K GK LÛ d¨v‡bj Kvco ev ckwg Kvco Øviv NlY©Kwi Ges SjšÍKvP`‡Ûi wbK‡U Awb| †`Le KvP`ÛwU B‡ebvB‡Ui w`‡K m‡i Avm‡Q, ev ci¯úi‡K AvKl©Ki‡Q| Avevi GKwU B‡ebvB‡Ui `Û‡K d¨v‡bj ev ckwg Kvco Øviv N‡l c‡ei© B‡ebvBU `‡Ûi wbK‡U Szj‡q w`B| †`Le Giv ci¯úi‡K weKl© Ki‡Q|

Dc‡ii cixÿv n‡Z cÖwYZ nq †h, †ik‡gi NlY© KvP`‡Û Drcbœ PvR©d¨v‡bj NlY© B‡ebvB‡U Drcbœ P‡R©i wecixZ agx©ZvB ejv hvq , NlY©i d‡j `yB wecixZ cÖK…Zi PvR© Drcbœ nq|

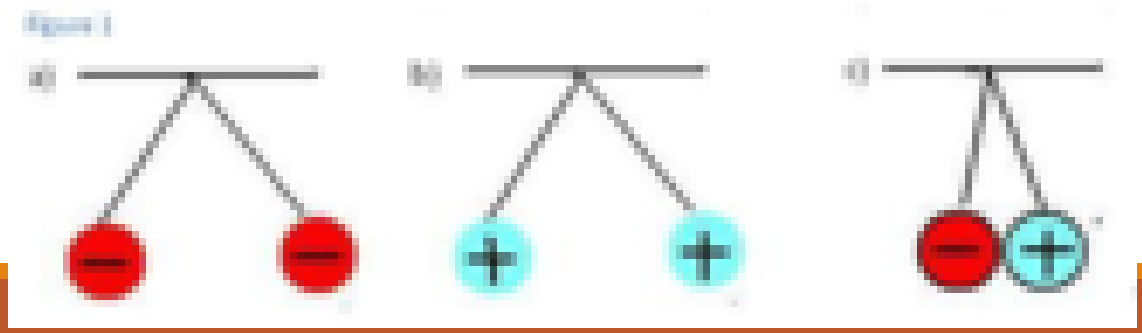
Avav‡bi AvKl©I weKl©m¤ú~-

1| AvKl©m¤ú~ t-

wecixZ agx©PvR©ci¯úi‡K AvKl©K‡i, Zv‡K AvKl© m¤ú~ e‡j| ‡hgb ab PvR© FY PvR©ci¯úi‡K AvKl© K‡i|

2| weKl©m¤ú~ t-

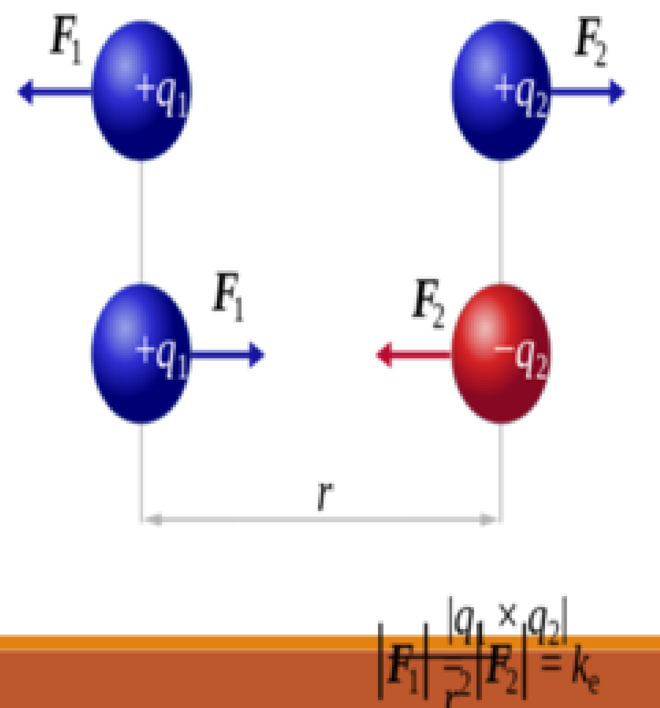
mgagx©PvR©ci¯úi‡K weKl©K‡i, Zv‡K weKl©m¤ú~ e‡j| ‡hgb ab PvR© ab PvR©ci¯úi‡K weKl© K‡i|



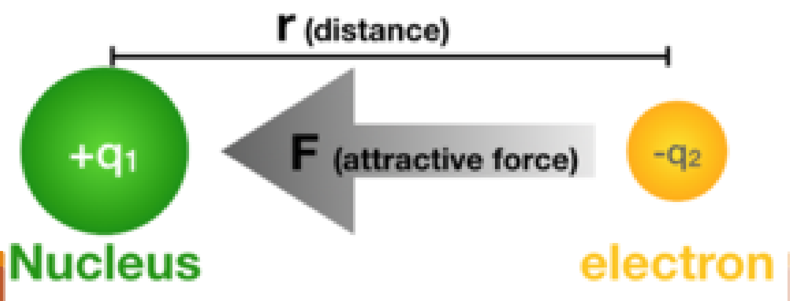
Kzj¤^ m~Î t- Avgiv Rvwb, `yBwU weciZ RvZxq Avavb ci¯úi AvKl©K‡i, Avi mgRvZxq Avavb ci¯úi‡K weKl©K‡i| `yU Avav‡bi ga¨eZx©G AvKl©ev weKl©e‡ji gvb wbf©K‡i|

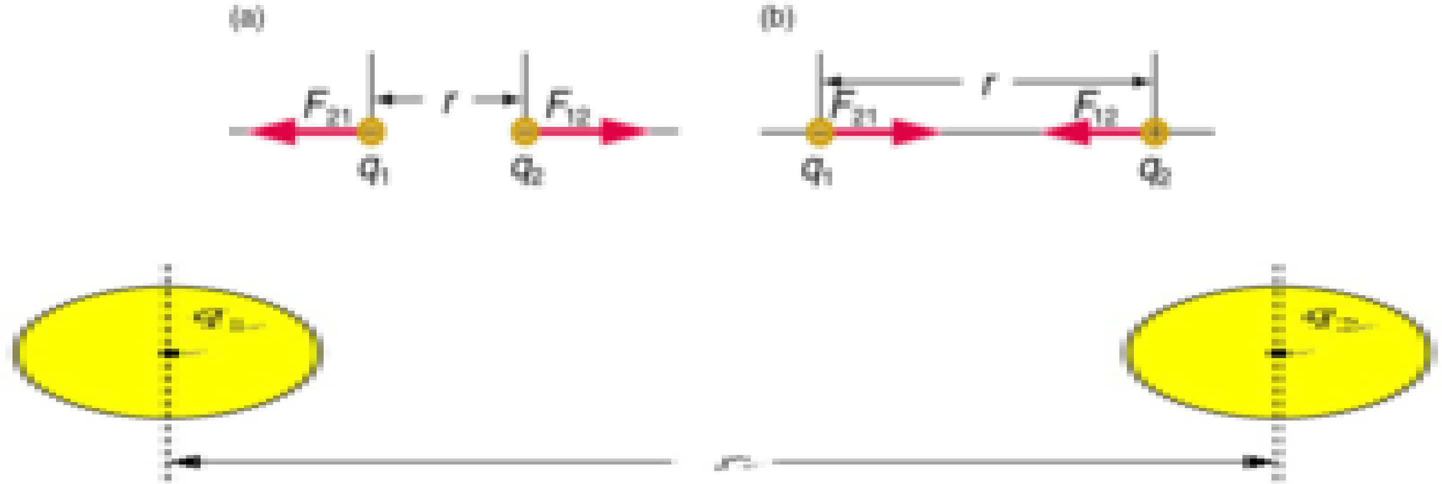
m~Î t-

wbw`ó gva¨‡g `yU we›`yAvav‡bi g‡a¨ wµqvkxj AvKl©ev weKl© e‡ji gvb Avavb؇qi ¸bd‡ji mgvbycvwZK| G‡`i ga¨eZx©`i‡Z¡i e‡M©e¨¯Íbycv wZK Ges GB ej Avavb؇qi ms‡hvRK mij †iLv eivei wµqv K‡i|



$$F = k\frac{q_1 q_1}{r^2}$$





aivhvK, A I B `yÕwU Ae¯'vb `yÕwU Avavb‡bi cwigvY h_vµ‡g q_1 Ges q_2 G‡`i gaÿeZx©
`~iZ¡ d G‡`i g‡a¨ wµqvgvb AvKl©Y ev weKl©Y ej‡K w¯'i Zwor ej e‡j Ges G e‡ji
gvb n‡j F, Kzj‡¤^i m~Îvbyhvqx‡i,

F α $q_1 q_2$ hLb, d w¯'i _v‡K|

F α $\frac{1}{d^2}$ hLb, q_1 Ges q_2 w¯'i _v‡K|

d, q_1 Ges q_2 mKj iwkB cwieZ©bkxj iwk ZLb,

F α $\frac{q_1 q_2}{d^2}$

F = C $\frac{q_1 q_2}{d^2}$ GLv‡b GKwU mgvbycvwZK aªæeK, hvi gvb iwk¸‡jvi GKK Ges wb`y
AvavbØ‡qi gaÿeZx© gva¨‡gi cÖK…wZ Dci wbf©i K‡i| G aªæeK‡K A‡bK mgq Kzj‡¤^i aªæeK
ejv nq|

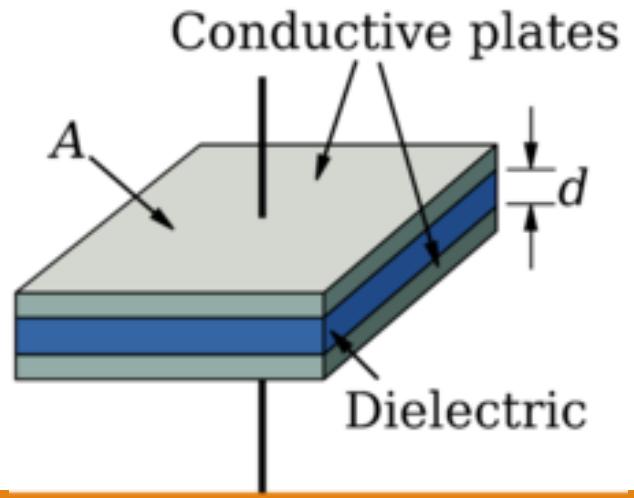
Zwor gva¨gv‡¼i msÁv t- †h †Kv‡bv `ywU Avav‡bi g‡a¨ w`wkó `i‡Z¡kb¨¯’v‡b wµqvkxj ej Ges H `ywU Avav‡bi g‡a¨ H GKB `i‡Z¡Ab¨ gva¨‡g wµqvkxj e‡ji Abycv‡Z GKwU aæe msL¨v nq| G aæe msL¨v‡K H gva¨‡gi Zwo gva¨gv¼ e‡j| G‡K K Øviv cÖKvk Kiv nq|

aiv hvK F = kb¨¯’v‡b `ywU Avav‡bi ga¨Kvi ej,

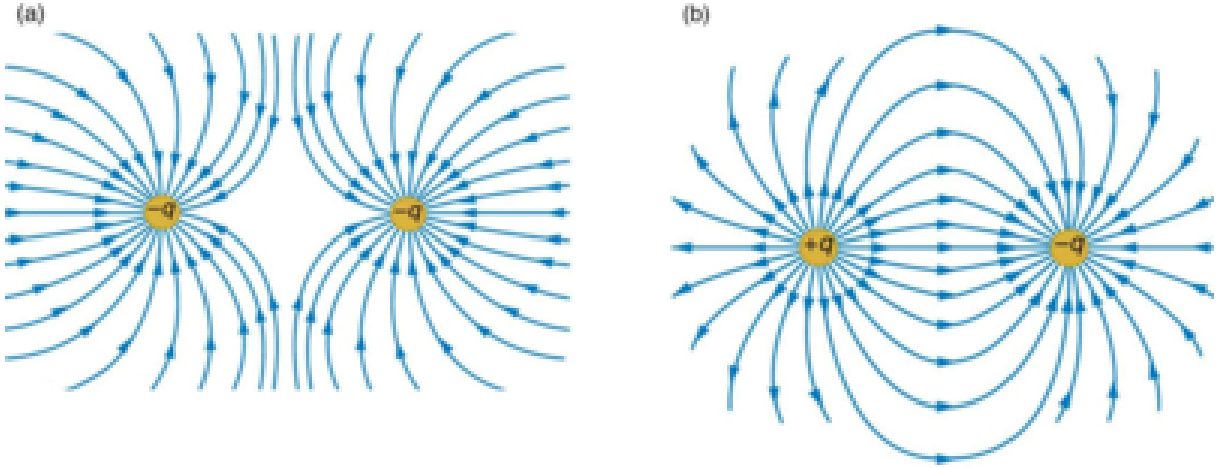
F_m = ‡h †Kvb gva¨‡g GKB `i‡Z¡`ywU Avav‡bi ga¨Kvi ej

H gva¨‡gi Zwor gva¨gv¼ K

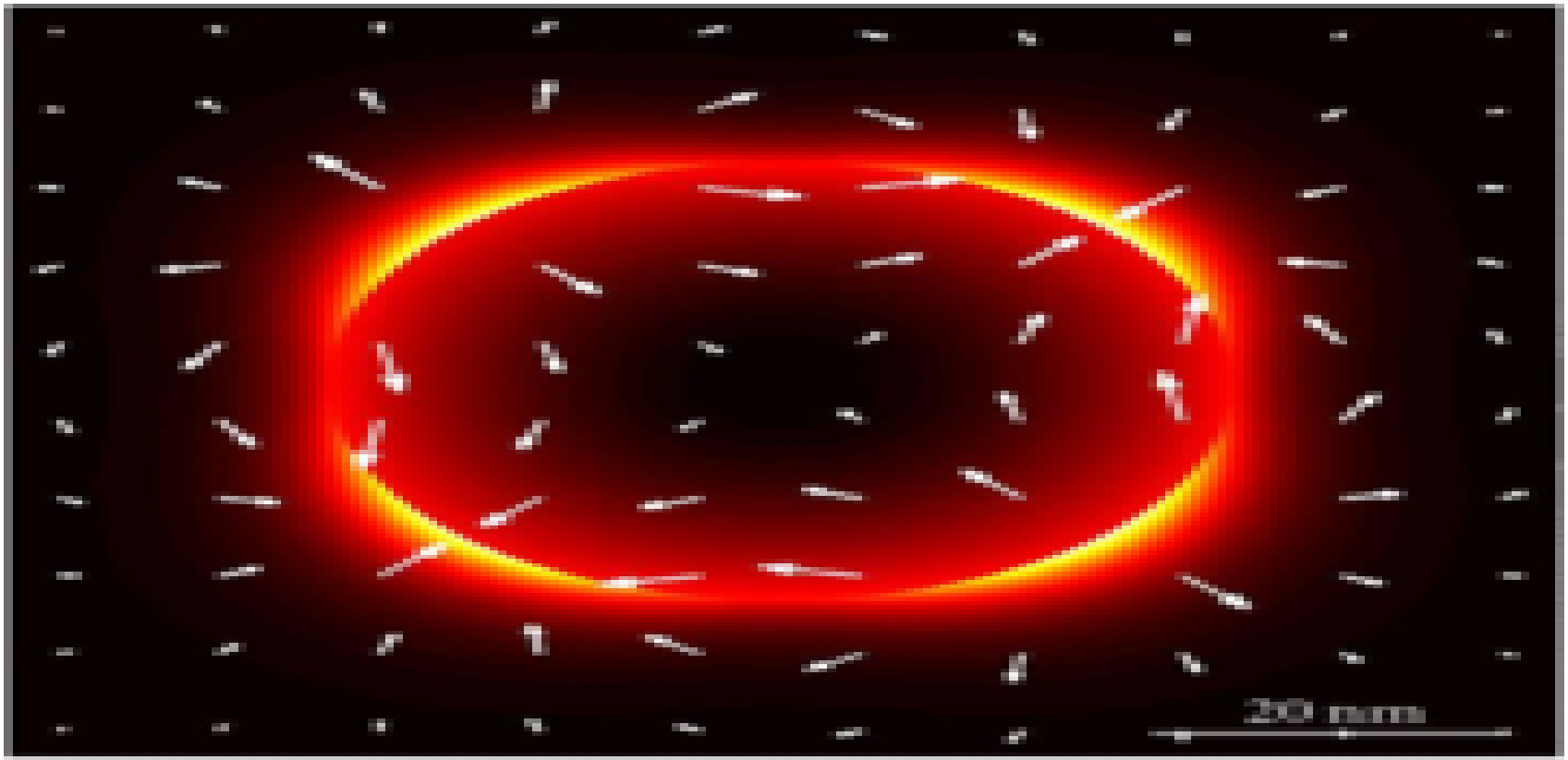
$$\therefore K = \frac{F}{F_m}$$



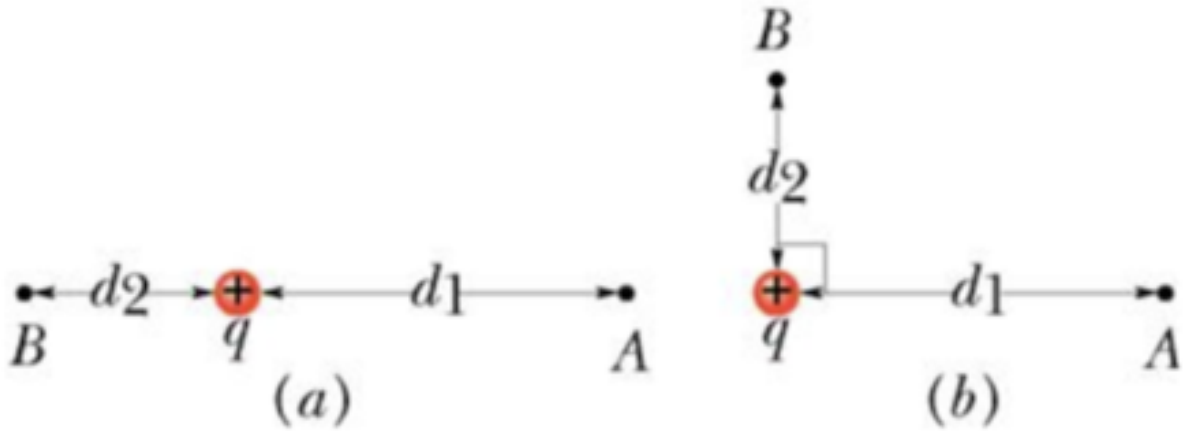
Zwor †ÿÎ t- GKwU AwnZ e¯‘i Pvi w`‡K †h AÂje¨vcx Zvi cÖe eRvq _v‡K A_v©Ab¨ †Kv‡bv AwnZ e¯‘i Avbv n‡j ‡mwU AvKl©ev weKl©ej jvf K‡i †mB AÂj‡K H AwnZ e¯‘i ej‡ÿÎ ev Zwor‡ÿÎ e‡j| ZwËKfv‡e GKwU ZworMÖe¯‘i Zwor‡ÿÎ Amxg chš—we¯Í|



Zwor cÖj¨ t- Zwor‡ÿ‡Îi †Kv‡bv we›`ÿZ GKwU GKK abvZ¥K ciL Avavb ¯’vcb Ki‡j †mwU †h ej Abyfve K‡i, Zv‡K H we›`ÿy Zwor cÖj¨ e‡j| †Kv‡bv ZworMÖe¯’i Zwor †ÿ‡Îi g‡a¨ me©Gi cÖe mgvb _v‡K bv| wewfbœ we›`ÿZ Gi cÖe wewfbœq|



Zwor wefe t- Amxg †_‡K cwÖ GKK abvZ¥K Avavb‡K cwievn‡Ki Lye wbK‡U Avb‡Z Zwor ej Øviv ev Zwor e‡ji weiæ‡× †h cwigvY KvR m¤úbœ nq , Zv‡KB H cwievn‡Ki Zwor wefe e‡j| †Kv‡bv AwnZ e¯‘i Zwor‡ÿ‡Îi g‡a¨ GKwU Avavb‡K GK we›`yi_‡K Ab¨ we›`yZ ¯’vbvšÍi Ki‡Z n‡j wKQz KvR m¤úbœ nq|



Zwor cÖj¨ ev Zwor ZxeZv I Zwor wf‡ei m¤úK© e-
aŸwi, A Ges B Zwor‡ÿ‡Îi g‡a¨ Aew¯Z wbKeZx©vU we›`y
Avevi aŸwi, A we›`yi wefe hw` V_A , B we›`yi wefe hw` V_B nq,
Z‡e wefe cv_©K nq‡e = V_A - V_B
GLb Ges we›`yi KvQvKwQ nIqvq we›`y`vU‡Z Zwor cÖj¨i gvb
cÖvq GKB aiv hvq| aŸwi, GB cÖj¨i gvb=E

GLb GKK abvZ¥K Avavb‡K †_‡K we›`ªvZ Avb‡Z †h KvR Ki‡Z n‡e Zvi cwigvY = cÖ‡j¨×`i~Z¡&

E×AB

wKš‘GKK abvZ¥K Avavb‡K †_‡K we›`ªvZ Avb‡Z †h KvR Kiv jv‡M †mB Kv‡Ri cwigvY H we›`y`ªvUi wefe cv_©K¨i mgvb¡ mgvb Zvn‡j

wefe cv_©K¨ = Kv‡Ri cwigvY ev,

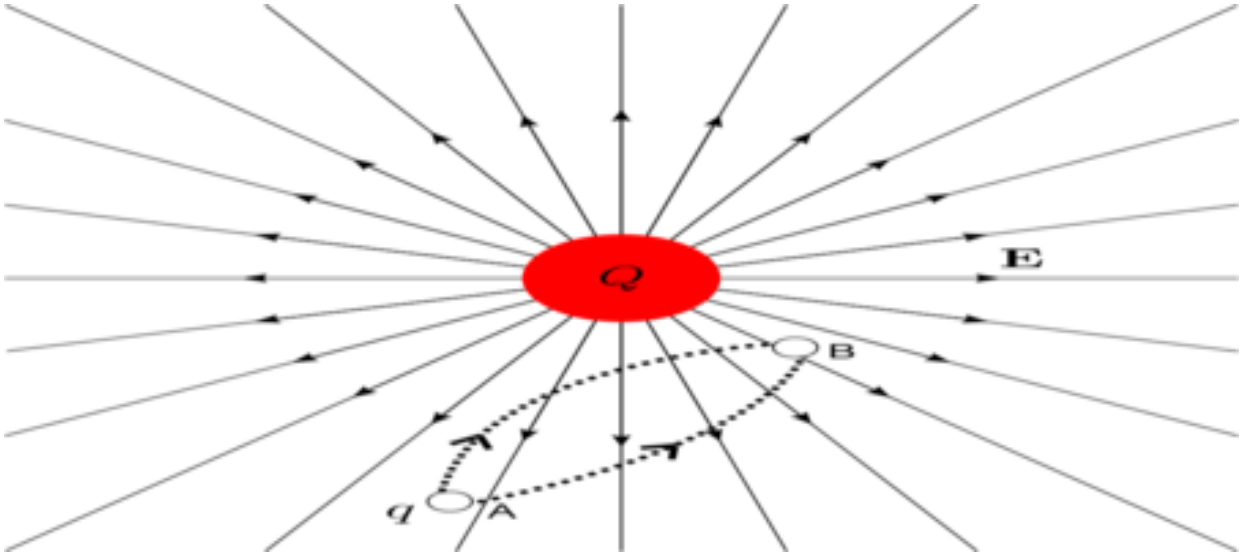
A_vq© $V_A - V_B$ = E×AB

ev, E×AB= $V_A - V_B$

ev, E×r = $V_A - V_B$

$\therefore E = \frac{V_A \quad V_B}{r}$

Zwor †ÿ‡Îi †Kv‡bv we›`ÿ wef‡ei iwkgvjv t-
aiv hvK, K gva¨gv¼ewkó †Kv‡bv gva¨‡g A we›`ÿZ +q cwigvY Avavb ¯’wcZ Av‡Q| A we›`ÿ‡_‡K r `i¥‡Zi B we›`ÿZ wefe wbY©Ki‡Z n‡e|
A we›`ÿZ +q ¯’wcZ Avav‡bi Rb¨ B we›`ÿZ GKK abvZ¥K Avav‡bi Dci ej Z_¨ Zwor cÖ‡Ëj¨ n‡e| $E=\frac{1}{4\pi\epsilon_0 K}\frac{q}{r^2}$----------(1)



Zwor cÖ‡j¨i w`K BC eivei|

GLb GB GKK abvZ¥K Avavb‡K BA eivei AwZ ÿz`ªdr `i~Z¡ cwigvY mwi‡q D we›`y‡Z Avb‡Z m¤úbœ kvR‡Ri cwigvY GB `y‡we›`y wefe cv_©K dV Gi mgvb|

dV = GKK abvZ¥K Avav‡bi Dci ej × e‡ji w`‡K mi‡Yi Dcvsk

$dV = E \times dr.\cos 180^0$

$dV = E \times dr.(-1)$

$dV = -E \times dr.$

$$dV = -\frac{1}{4\pi \in_0 K}\frac{q}{r^2}dr$$

myZivs Amxg `i-Zi¡†_‡K GKK abvZK Avavb‡K B we›`ÿZ Avb‡Z †gvU Kv‡Ri cwigvY n‡e| $\int_{\infty}^{v} dv = \int_{\infty}^{r} -\frac{1}{4\pi\in_0 K}\frac{q}{r^2} dr$

ev, $[v]_{\infty}^{v} = -\frac{q}{4\pi\in_0 K}\int_{\infty}^{r}\frac{1}{r^2}dr$

ev, $V-0 = -\frac{q}{4\pi\in_0 K}\int_{\infty}^{r} r^{-2} dr$

ev, $V = -\frac{q}{4\pi\in_0 K}[-\frac{1}{r}]_{\infty}^{r}$

ev, $V = -\frac{q}{4\pi\in_0 K}[-\frac{1}{r}+\frac{1}{\infty}] \because \frac{1}{\infty} = 0$

ev, $V = -\frac{q}{4\pi\in_0 K}[-\frac{1}{r}+0]$

ev, $V = -\frac{q}{4\pi\in_0 K}.-\frac{1}{r}$

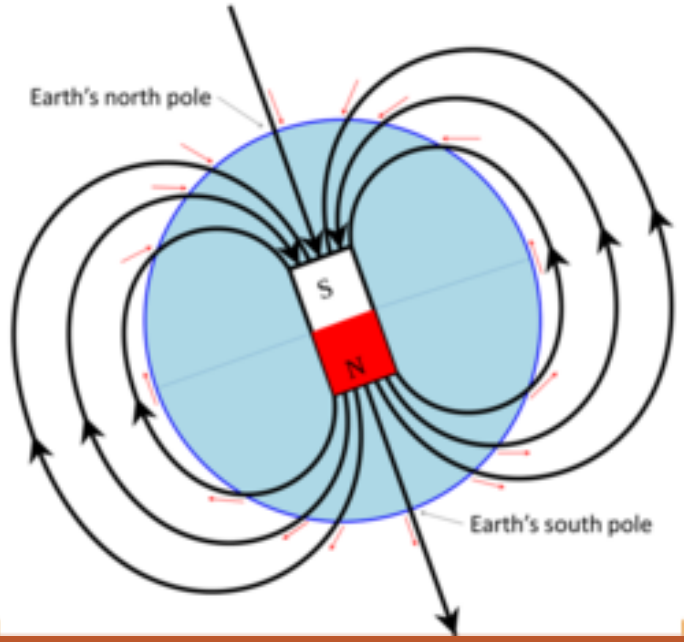
$\therefore V = \frac{1}{4\pi\in_0 K}.\frac{q}{r}$ ----------(2)

এই অধ্যায় আমরা যে বিষয় গুলি আলোচনা করব

6ô Aa¨vq t-‡PŠ¤ÆKZ¡

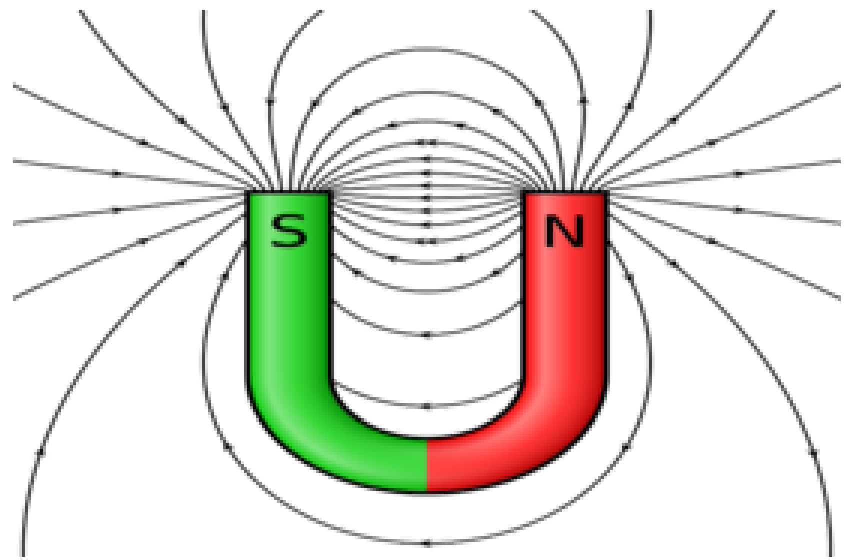
Pµ¥K, †PŠ¤ÆK c`v_©A‡PŠ¤ÆK c`v_©†PŠ¤ÆK †gi¤^,‡Pg‡Š¤ÆK‡ÿÎ, †Pg‡Š¤ÆK ZxeZv, cwi_exi Dcv`vb, †PŠ¤ÆK c`v‡_©†kÖwe fvM

‡Kv‡bv PzqK kjvKv ev`Û PzqK‡K Abyfwg Kfv‡e Gi fvi‡K‡›`a gy³ Ae¯’vq ¯’vcb Ki‡j GwU me mgqB †gvUv‡gvwU Dëi `wÿY w`K eivei Ae¯’vb K‡i| Gi ‡_‡K e‡Ü hvq †h, fçô GKwU †PŠ¤K‡ÿÎ we`¨gvb| cw_ex GKwU PzqKi b¨vq AvPiY K‡i| PzqK kjvKvi Aÿ Ges Abyfwg‡Ki AšÍf©†KvY fçô‡ôi wewfbœ‡b wewfbœeq| GgbwK H~c‡ôi wewfbœ‡b jwä †PŠ¤K‡ÿ‡Îi w`K wewfbœeq



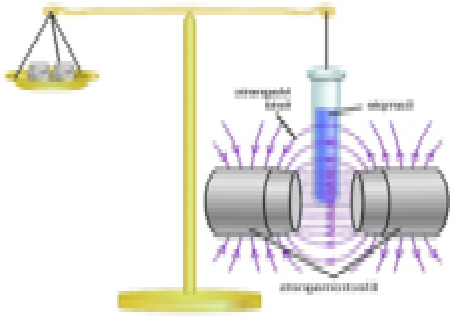
cÖ_‡ex †PŠ¤K †giæ `ywUi ms‡hvRK miij †iLv Ges †fŠ‡MvwjK †giæ `ywUi ms‡hvRK miij †iLvi AšÍM©Z †KvY A_©vr cÖ_‡exi †PŠ¤K Aÿ Ges †fŠ‡MvwjK A‡ÿi AšÍM©Z †KvY cÖvq 11.5 wWwMÖ cÖ_‡exi †PŠ¤K `wÿY †giæ Ges †fŠ‡MvwjK DËi †giæ AšÍM©Z †KvY cÖvq 1750 wKwg cwð‡g Ges †PŠ¤K †giæ †fŠ‡MvwjK `wÿY †giæi c‡e© Aew¯'Z|

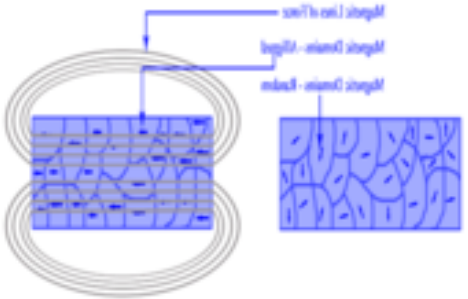
PzÁK t- †h me c`v‡_©i AvKl©Y ev weKl©Y I w`K wb‡`©k Kivi ag© i‡q‡Q, †mB me c`v_©‡K PzyK e‡j| Gme †PŠ¤K c`v_©‡PŠ¤K‡Z¡ ÿ‡Î mywó K‡i Ges Ab¨ †Kvb Pz¤^‡Ki Dci ej cÖ‡qvM K‡i|



‡PŠ¤K c`v_©-

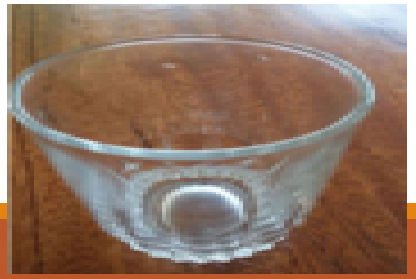
†h me c`v_©K PzK AvKl©K‡i Ges hv‡`i‡K Pz‡K cwiYZ Kiv hvq, Zv‡`i‡K †PŠ¤K c`v_©‡j| †hgb, †jvnv, wb‡Kj, †Kvevë B¯úvZ BZ¨vw`|



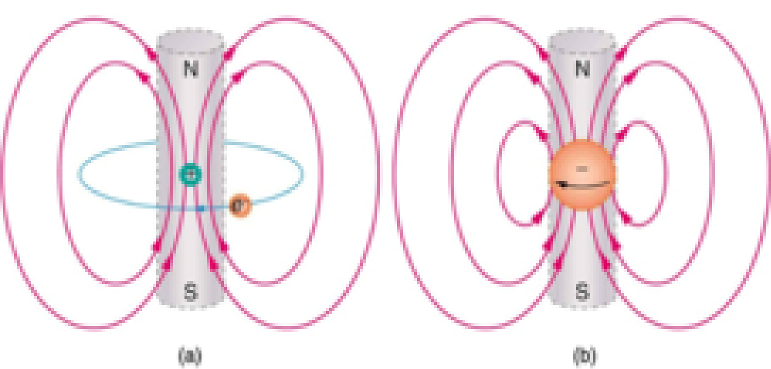


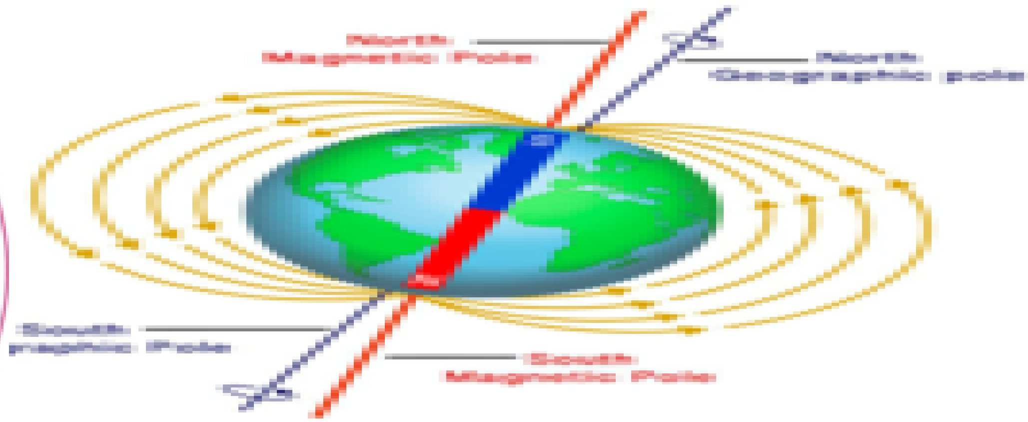
A‡PŠ¤K c`v_©-

†h me c`v_©K PzK AvKl©K‡i bv Ges hv‡`i‡K Pz‡K cwiYZ Kiv hvq bv Zv‡`i‡K A‡PŠ¤K c`v_©‡j| †hgb, KvV, KvMR, Zvgv BZ¨vw`|

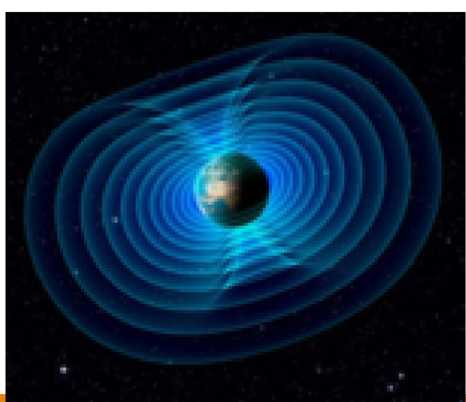


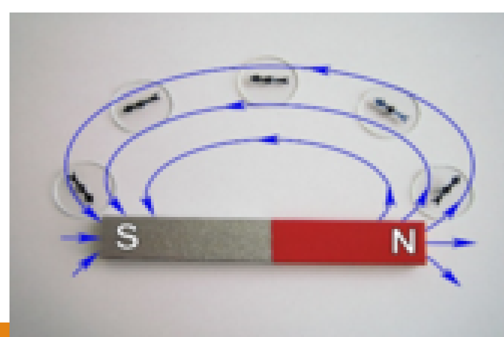
‡PŠ¤K †giæ t- †Kv‡bv Pz¤^‡Ki `yB cÖv‡šÍ KvQvKvwQ †h AÂ‡j AvKl©Y ÿgZv †ewk, Zv‡`i‡K †PŠ¤K †giæ e‡j| †giæ kw³ i Gm AvB GKK A¨vw¤úqvi - wgUvi

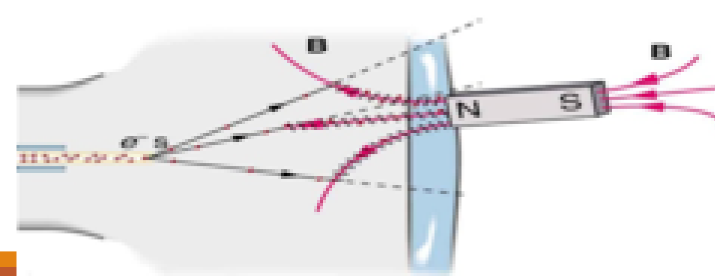




‡PŠ¤K‡ÿÎ t- GKwU MwZkxj Avavb ev ¯’vqx Pz¤^K Zvi Pvicv‡k †h AÂj Ry‡o Gi cÖfve Abyf~Z nq, Zv‡KB Pz¤^‡Ki †PŠ¤K‡ÿÎ e‡j|

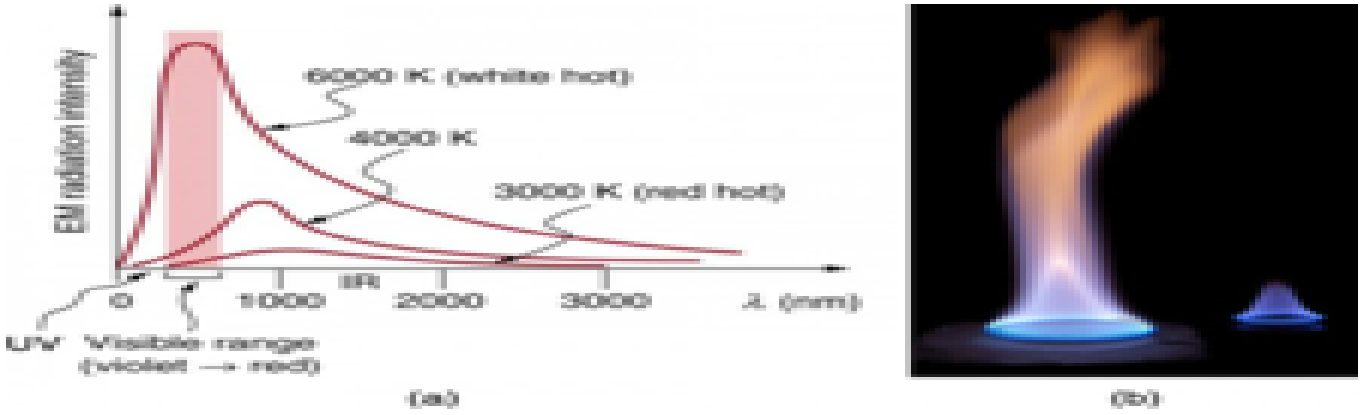




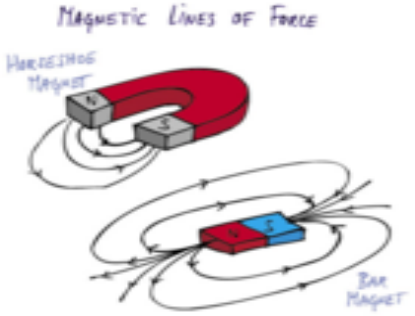


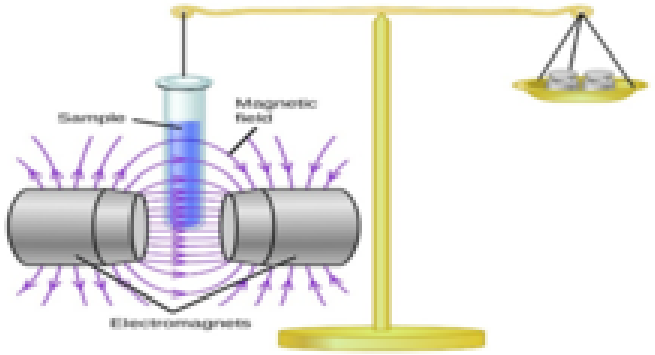
‡PŠ¤K cÖj¨ t-

†Kv‡bv Pz¤^Ki †PŠ¤K‡ÿ‡Îi †Kv‡bv we›`yZ GKwU GKK kw³i DËi †gia¨vcb Ki‡j H †gia¨h ej Abyf~Z K‡i Zv‡K D³ †PŠ¤K‡ÿ‡Îi Rb¨ H we›`yZ †PŠ¤K cÖj¨ e‡j | †Kv‡bv we›`y †PŠ¤K‡ÿ Î Ges †PŠ¤K cÖk¨Zvi Abyf~ZB n‡jv †PŠ¤K Zxe~Zv e‡j |



‡PŠ¤K MwÖZv t- †Kv‡bv c`v‡_©Af¨šÍi P¤^vqb ZxeZv I cÖ¯Í
†PŠ¤K‡ÿ‡Îi ZxeZvi Abyc‡Z H c`v‡_©†PŠ¤K MwÖZv e‡j| G‡K
X_m Øviv cÖKvk Kiv nq|





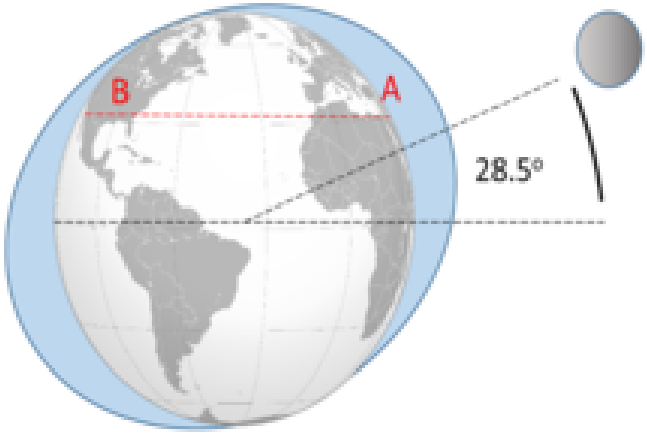
cw„_ex ‡PŠ¤K Dcv`vb t- †Kv‡bv ¯’vw‡b cw„_exi †PŠ¤K‡ÿ Î‡K m¤úY© i¤‡c eYbv Kivi Rb¨ mvaviY wb‡¤œewk wZbwU wbYq¨ Kiv hvq|

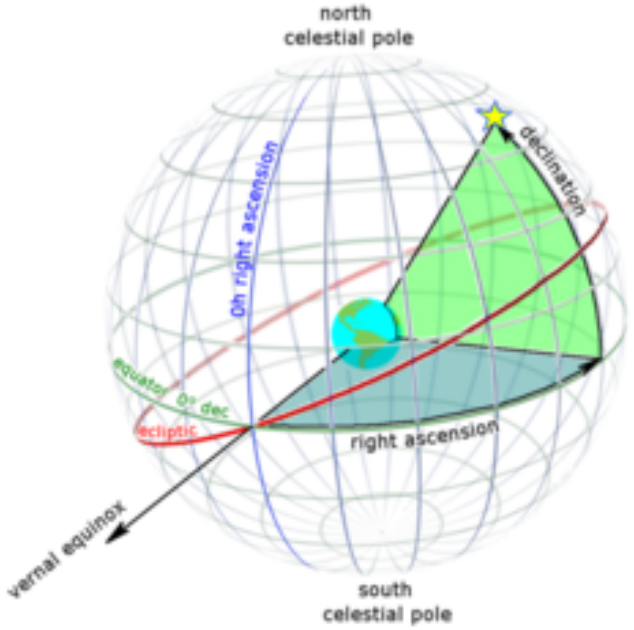
1| wePÏzwZ,

2| webwZ,

3| f„- †PŠ¤K‡ÿ‡Îi Abyf„wgK Dcvsk|

wePzwZ t- †Kv‡bv ¯’v‡b gy³ fv‡e ¯’wcZ PzK kjvKv †fŠ‡Mwj K DËi-`wÿY †_‡K †h †Kv‡Y wePzZ nq, H ¯’v‡bi wePzwZ e‡j| †Kv‡bv ¯’v‡bi wePzwZ mvavi Y θ Øviv cÖKvk Kiv nq|





webwZ t- †Kv‡bv ¯’v‡b f;-‡PŠ¤^K †ÿ‡Î Abyfwg‡Ki mv‡_ †h †KvY Drcbœ K‡i Zv‡K H ¯’v‡bi webwZ e‡j| †Kv‡bv ¯’v‡b webwZ‡K δ Øviv cÖKvk Kiv nq|

f-‡PŠ¤^K‡ÿ‡Îi Abyfwg‡K Dcvsk t- ‡Kv‡bv ¯’v‡b Abyfwg‡K eivei f;-‡PŠ¤^K †ÿ‡Îi †h DcvOk _v‡K, Zv‡K f;-‡PŠ¤^K †ÿ‡Îi Abyfwg‡K Dcvsk e‡j| f;-‡PŠ¤^K †ÿ‡Îi Abyfwg‡K Dcvsk B_H ev H w`‡q cÖKvk Kiv hvq|

‡PŠ¤ÆK c`v‡_© †kÖwefvM t- †PŠ¤ÆK AvPi‡Yi Dci wfw³ K‡i c`v_©gn‡K Wvqv‡PŠ¤ÆK, c¨vivi †PŠ¤ÆK, †d‡iv‡PŠ¤ÆK c`v_©m‡e †kwYwefvM Kiv nq|

1| Wvqv‡PŠ¤ÆK t-

†h-me c`v_©K †PŠ¤ÆK †ÿ‡Î ¯’vcb Kiv n‡j P¤ÆKvqbKvix †ÿ‡Îi wecixZ w`‡K mvgvb¨ P¤ÆKZ¡jvf K‡i, Zv‡`i‡K Wvqv‡PŠ¤ÆK e‡j|

‡hgb, Zvgv, `¯Íi, wmmv, †mvbv,KvP BZ¨vw`|

2| c¨vi v‡PŠ¤úK t-

†h-me c`v_©K †PŠ¤úK †ÿ‡Î ¯’vcb Kiv n‡j PzqvKvqbKvix †ÿ‡Îi w`‡K mvgvb¨ PzqvKZ¡jvf K‡i, Zv‡`i‡K c¨vi v‡PŠ¤úK e‡j| †hgb,‡mvwWqvg, A¨vjvgwbqvg, A¨vw›UgwbBZ¨vw`|

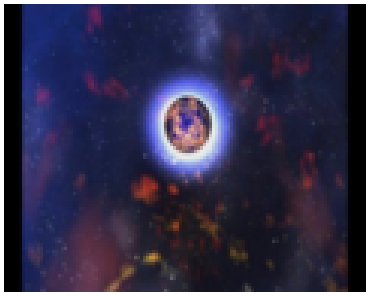
‡d‡i v‡PŠ¤úK t-

†h-me c`v_©K †PŠ¤úK †ÿ‡Î ¯’vcb Kiv n‡j PzqvKvqbKvix †ÿ‡Îi w`‡K kw³kvjx PzqvKZ¡jvf K‡i, Zv‡`i‡K ‡d‡i v‡PŠ¤úK e‡j| ‡hgb, †jvnv, wb‡Kj, †Kvevë BZ¨vw`|

Wvqv‡PŠ¤^K, c¨vi v †PŠ¤^K, †d‡ir‡PŠ¤^K c`v‡_©i g‡a¨ Zzjbv KiY

Wvqv‡PŠ¤^K	c¨vi v‡PŠ¤^K	‡d‡ir‡PŠ¤^K
1| †h-me c`v_©K †PŠ¤^K †ÿ‡Î ¯’vcb Kiv n‡j PzK¦vqbKvix †ÿ‡Îi wecixZ w`‡K mvgvb¨ PzK¦Z¡jvf K‡i, Zv‡`i‡K Wvqv‡PŠ¤^K e‡j |	1| †h-me c`v_©K †PŠ¤^K †ÿ‡Î ¯’vcb Kiv n‡j PzK¦vqbKvix †ÿ‡Îi w`‡K mvgvb¨ PzK¦Z¡jvf K‡i, Zv‡`i‡K c¨vi v‡PŠ¤^K e‡j |	1| †h-me c`v_©K †PŠ¤^K †ÿ‡Î ¯’vcb Kiv n‡j PzK¦vqbKvix †ÿ‡Îi w`‡K mvgvb¨ PzK¦Z¡jvf K‡i, Zv‡`i‡K c¨vi v‡PŠ¤^K e‡j |
2| ‡hgb, Zvgv, `¯Í, wmmv, †mvbv,KvP BZ¨vw` |	2| †hgb, ‡mvwWqvg, A¨vjywgwbqvg, A¨vwš¿Ugwb BZ¨vw` |	2| ‡hgb, †jvnv, wb‡Kj, †Kvevë BZ¨vw` |
3| Zvcgv‡Îvi cwieZ©‡b Gi AvPi‡Yi †Kv‡bv cwieZ©‡bnq bv |	3| Zvcgv‡Îvi e„×‡Z mv‡_ Gi PzK¦Z¡nvi v‡Z _v‡K |	3| Kzix we›`yi ci Gi †Kv‡bv PzK¦Z¡_v‡K bv |
4| Wvqv‡PŠ¤^K c`v‡_© Af¨šÍi †PŠ¤^K‡ÿ‡Î kb¨ ¯’‡b †PŠ¤^K †ÿ‡Î A‡cÿv Kg |	4| c¨vi v‡PŠ¤^K c`v‡_© Af¨šÍi †PŠ¤^K‡ÿ‡Î kb¨ ¯’‡b †PŠ¤^K †ÿ‡Î A‡cÿv ‡ekx |	4| Wvqv‡PŠ¤^K c`v‡_© Af¨šÍi †PŠ¤^K‡ÿ‡Î kb¨ ¯’‡b †PŠ¤^K †ÿ‡Î A‡cÿv A‡bK

পাঠ ঘোষনা

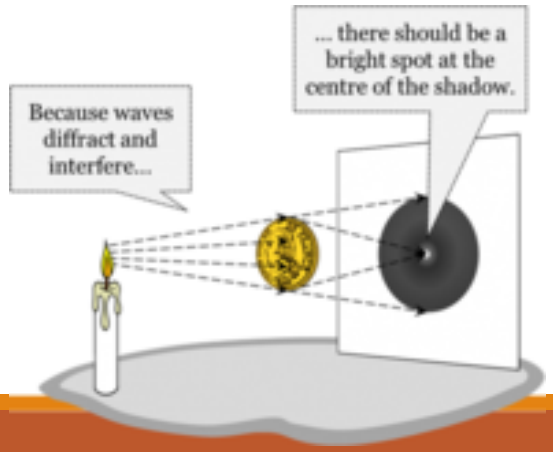


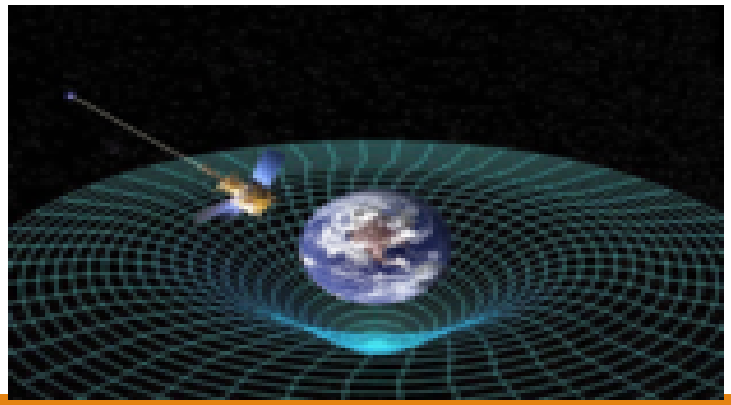
cÂ`k Aa¨vq t-Av‡cwÿK ZË¡

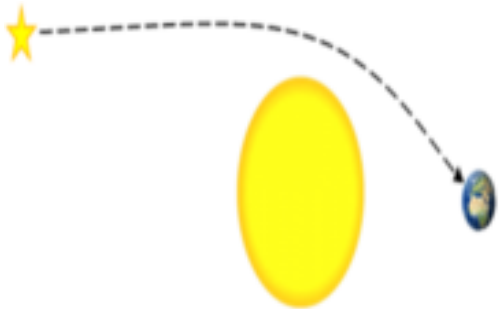
1905 mv‡j hLb AvjevU©AvBb÷vBb Gi eqm wek eQi ZLb wZwb Av‡cwÿKZvi we‡kl ZË¡cÖK K‡ib Avgv‡`i wPšÍ †PZbv ev wekvÍ‡mi A‡bK wKQz cwieZ©mvab K‡i‡Q GB Av‡cwÿKZvi ¯’vb, Kvj I fi †Kv‡bvB cig ev wbi‡cÿ iwk bq|

weÁvb Z_v c`v_©Áv‡bi ¯’vb I Kvj AZ¨šÍ¸iæZ¡c¥© avivYv| ‡Kv‡bv NUbv eY©v Ki‡Z Avgv‡`i ¯’vb I Kv‡ji cÖvRb nq| NUbwU †Kv_vq NU‡Q Ges KLb N‡U‡Q GUv bv Rvb‡j Avgiv NUbwU m¤ú‡K© wbQ avivYv cve bv| †Kv‡bv e¯‘i Ae¯’vb †Kv_vq Ges e¯‘U KZUv RvqMv `Lj K‡i Zv eySZ ¯’v‡bi avivYv cÖvb Kvj †_‡K P‡j Avm‡Q| †Kvb NUbv Av‡M NU‡Q Ges †Kvb NUbv c‡i NU‡Q Ges KZÿY a‡i NU‡Q Zv eySZ mg‡qi avivYv cÖvRb|

M¨vwjwjI Gi avivYv t- M¨vwjwjI Zvi mvgvwe`¨v ev Roe¯‹i †ÿ‡Î ¯’vb I Kvj e¨envi K‡i‡Qb Zvi MwZ I Zj‡Yi m‡Î| Gi d‡j c`v_©Kvi ¯’vb I Kvj AZ¨šÍ¸iæZ¡c~Y© wk wn‡m‡e MvwYwZK mgxKiY cÖKvk K‡i‡Q| wbDU‡bi avivYv t- ¯’vb I Kvj avivYv Av‡iv ¯úó I cwigvYMZ if‡c MÖnY K‡i‡Q wbDU‡bi ejwe`¨vi gva¨‡g|

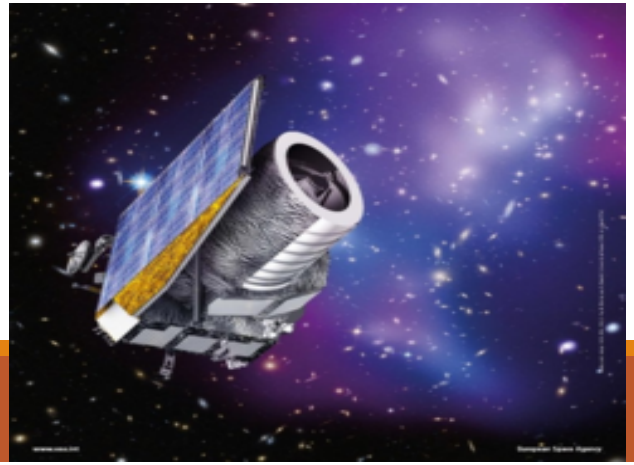






BDwK‡Wi Gi avivYv t- ¯’v‡bi R¨vwgwZK avivYv cÖg Dc¯’vcbv K‡ib BDwKW| Avgv‡`i Pvicv‡k hv Av‡Q meB ¯’vb|

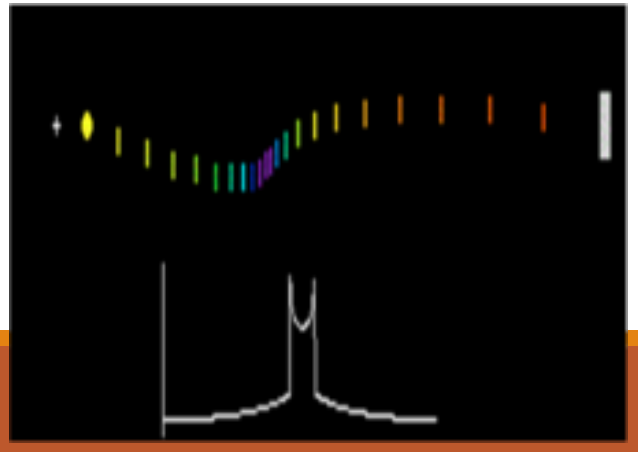
wbDUbxq ev wPivqZ c`v_©Áv‡b ¯’vb n‡”Q wÎgwÎK GK we¯ÍZ.| ¯’v‡b †Kv‡bv ïiæ ev †kl †bB| hv Amxg Gi we¯ÍZ.| ¯’vb‡K AwZÿz`ªAs‡k fvM Kiv hvq A_v©¯’vb wbiewQbœ es ¯’vb mgmË| ¯’vb †hgb e¯‘I NUbv wbi‡cÿ †ZgbB mgq wbi‡cÿ, d‡j Kv‡ji cÖ‡n ¯’vb‡K e`jv‡Z cv‡i bv|



wbDU‡bi avi Yv Abyôv‡i mgq ev Kvj wbR¯^avivq cÖwnZ n‡e| †Kv‡bv e¯‘ev NUbvi Øviv GB Kwj K cÖwn cÖweZ nq bv| mg‡qi †Kv‡bv ïi“ ev ‡kl †bB| mgq‡K AwZ ÿ z ª As‡k fvM Kiv hvq| mgq ¯’vb wbi‡cÿ|

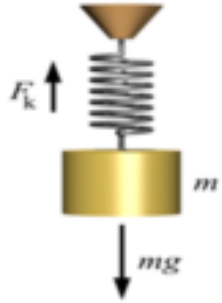
wbDUbxq ¯’vb Kv‡j i avi Yvq Avgv‡`i GB gnvwe‡k^wÎgvwÎK ¯’vb I GKgvwÎK mgq wb‡q MwVZ nq| †hLv‡b mg¯ÍNUbv NU‡Q I mg¯Íe¯‘avi Yv Kiv Av‡Q|

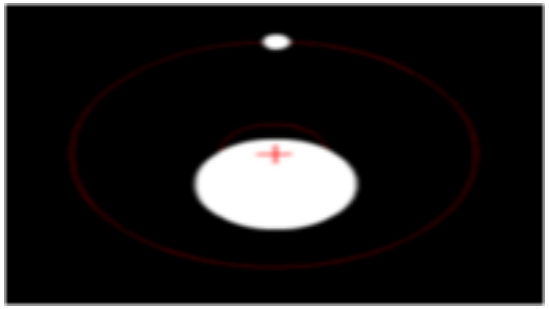
Avavbv K c`v_©Áv‡bi wbDUbxq ¯’vb Kv‡j i cwieZ©G‡m‡Q| Gi g‡j i‡q‡Q AvBb÷vB‡bi Av‡cwÿK ZË¡Ges cø¼i †Kvqv›Uvg ZË¡|



e¯‘i fi t-

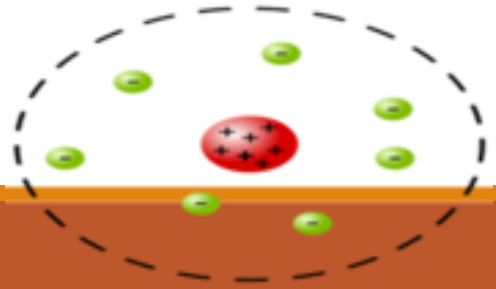
†Kv‡bv e¯‡Z †gvU †h cwigvY c`v_©Av‡Q Zv‡K Zvi (e¯‘i) fi e‡j| ¯’vb‡f‡` Gi gv‡bi †Kv‡bv cwieZb©nq bv| Z‡e e¯‘hw` Lye B D”P †e‡Mi (Av‡jvi †e‡Mi KvQvKvwQ) P‡j †m‡ÿ‡Î f‡ii cwiewZ©nq|

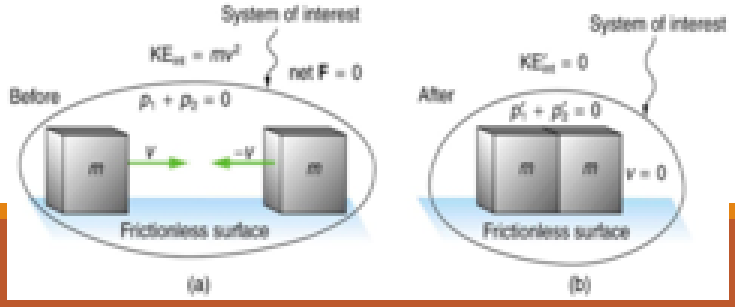




w¯’wZ f‡ii msÁv t-

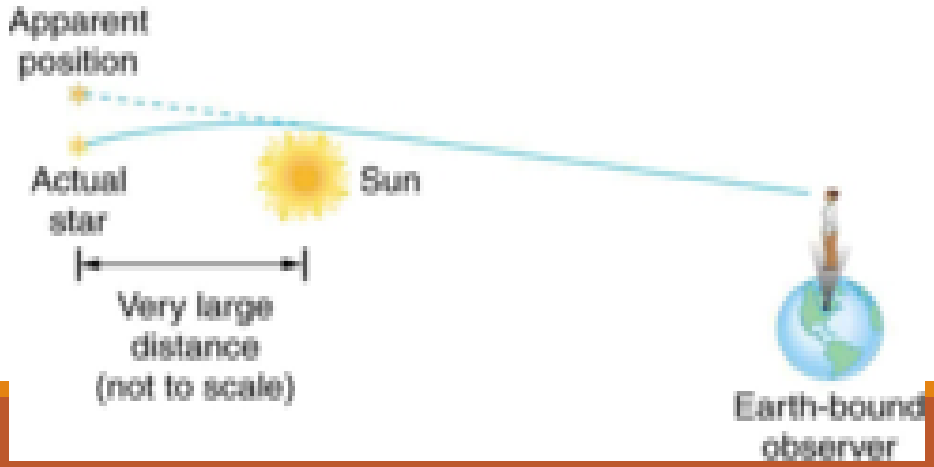
chy©ÿK wekvÖ mv‡c‡ÿ e¯‘i fi cwigvY Kiv n‡j Zv‡K w¯’wZ fi e‡j| w¯’wZ fi e¯‘i GKwU mnRvZ ag©



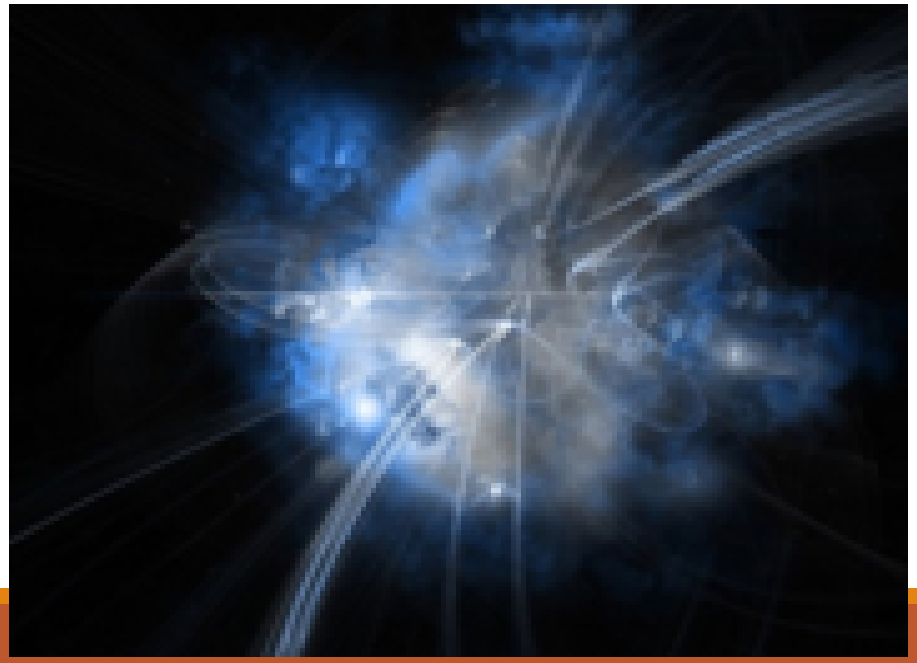


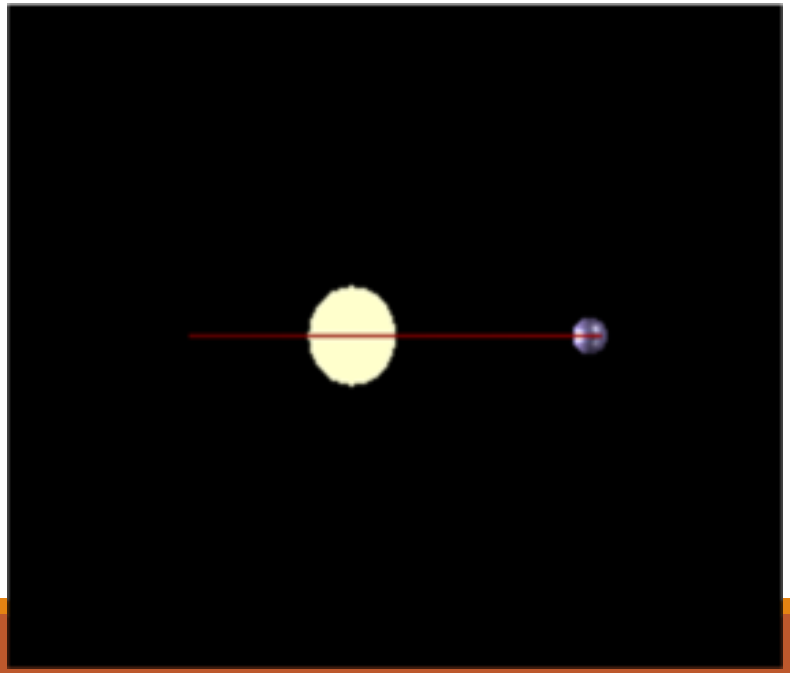
Av‡cwÿKZv Gi ZË¡t-

wbDUb ¯’vb, Kvj I fi‡K wbi‡cÿ ai‡j I AvjevU© AvBb÷vBb Zvi Av‡cwÿK Z‡Ë¡ G ¸‡jv‡K Av‡cwÿK a‡ib| wbi‡cÿ k‡ãi A_©‡Kv‡bv wKQz mv‡c‡ÿ hv cwieZ©b kxj bq| hw` †Kv‡bv e¯‘cwicwk©‡Kv‡bv wKQz mv‡c‡ÿ ¯’vb cwieZ©b bv K‡i Zvi bvg w¯’wZ, Avi hw` cwieZ©b K‡i Zvi bvg MwZ, Kv‡RB Av‡cwÿK w¯’wZ Ges Av‡cwÿK MwZ Qvov Ab¨ wKQz‡ejv A_©vb| wKš‘wbDUb cig †e‡Mi aviYvq wekvmx wQ‡jb|



AvBb÷vBb ¯úó fvlvB e¨³ K‡ib †h ¯’vb, Kvj Ges fi G‡`i †KvbwU wbi‡cÿ bq| GB wZbwU wel‡qi cÖZ¨KwU Ab¨ †Kv‡bv wKQz mv‡c‡ÿ we‡ewPZ nevi bvgB Av‡cwÿK| Av‡cwÿKZvi we‡kl ZZ¡Abyw‡i cig MwZ wbi_K©, me MwZB Av‡cwÿK|





Av‡cwÿKZvi we‡klZË¡Ges †gŠwjK ¯’vKvh©

mPbv t-

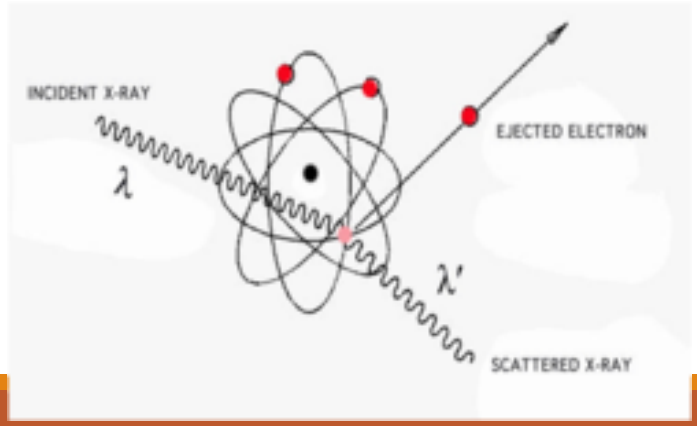
weÁvbx gvB‡Kjmb Ges weÁvbx gwj©B_v‡ii Aw¯Í¡cÖ‡Yi Rb¨ GKwU cixÿv m¤úv`vb K‡ib| Zv‡`i cixÿv n‡Z wbb¥wjwLZ wm×v‡šÍDcbxZ nIqv wMqv‡Q|

(1) B_vi ej‡Z G we‡k¦KQz‡bB|

(2) M¨wjwjI i‡cvšÍi mwVK bq|

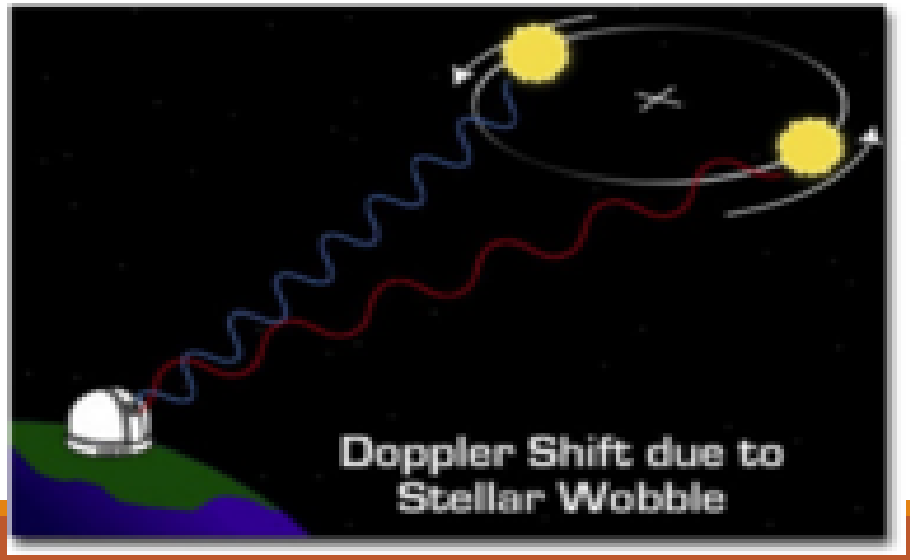
(3) Av‡jv‡Ki †eM GKwU aæe iwk| GwU Drm A_ev ch©ÿY ev gva¨‡gi MwZi Dci wbf©K‡i bv|

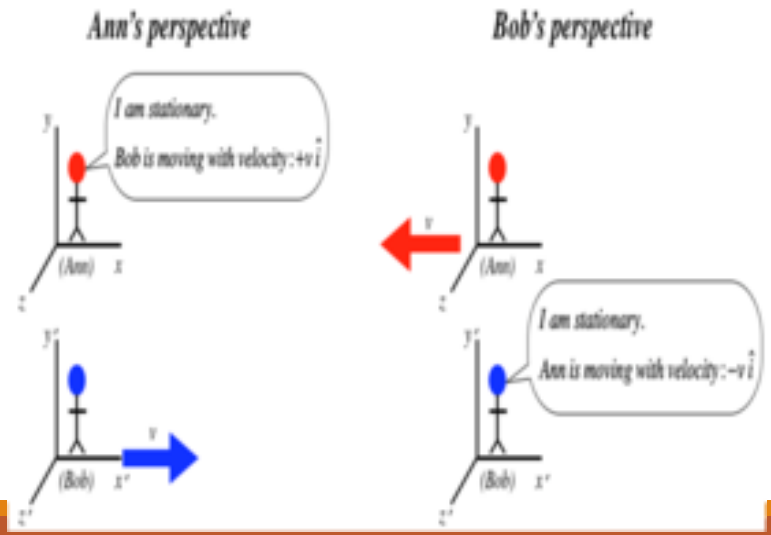
1905 mv‡j hLb Avjev U©AvBb÷vBb Av‡cwÿKZvi we‡kl ZË¡cÖZb©K‡ib hv wbb¥wjwLZ `wÿY †gŠwjK ¯ÍKvh©ci cÖwôZ| GB `wÿY ¯ÍKvh©K Av‡cwÿKZvi we‡kl Z‡Ë¡ †gŠwjK ¯ÍKvh©e‡j| wb‡b¥ ¯ÍKvh©wÿY weeZ„Z I e¨vL¨v Kiv n‡jv -



cÖg ¯xKvh©

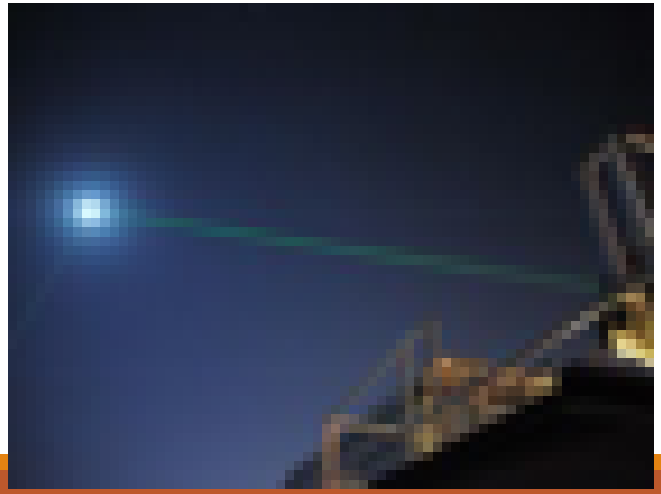
Ro KvVv‡gv‡Z ev M¨vwjwjq KvVv‡gv‡Z c`v_©Áv‡bi mÎmgn- Awfbœv‡K| Ab¨ K_vq ejv hvq, ci¯ú‡ii mv‡_ mg‡e‡M avegvb mKj cÖ½ KvVv‡gv‡Z c`v_©Áv‡bi mÎ¸‡jv GKBi¸‡c mgxKiY Øviv cÖKvk Kiv †h‡Z cv‡i|

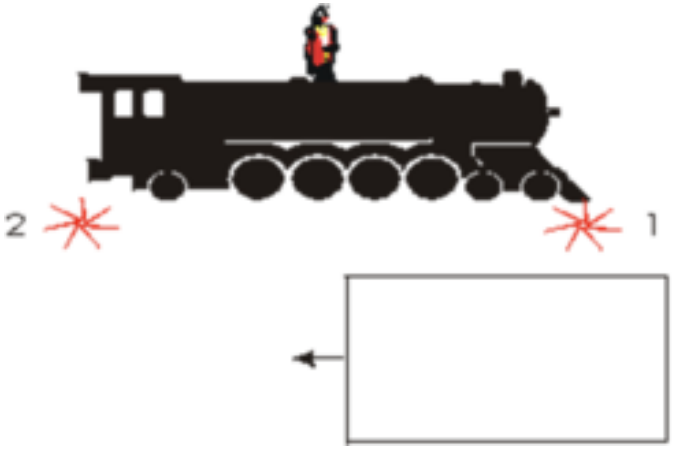




e¨vL¨v t-

wbDU‡bi MwZm‡Îi 1g m‡Î †h cÖ½ KvVv‡gv‡Z cÖ¯
nq,Zv‡K RoZvi KvVv‡gv e‡j| hw` †Kv‡bv e¯‘RoZvq
(w¯’i ev MwZ) _v‡K, Z‡e Gi Dci ewn¨K ej cÖ¯ bv
n‡j Gi Ae¯’vi †Kv‡bv cwieZb©n‡e bv| GB ¯xKvh©
Abyw‡i `ÿZb chœ¨K GKB ˆiwLK †e‡M Pj‡Z _vK‡j
†h‡Kv‡bv †fŠZ m‡Îi i‚c ev Ae¯’v GKB _vK‡e|



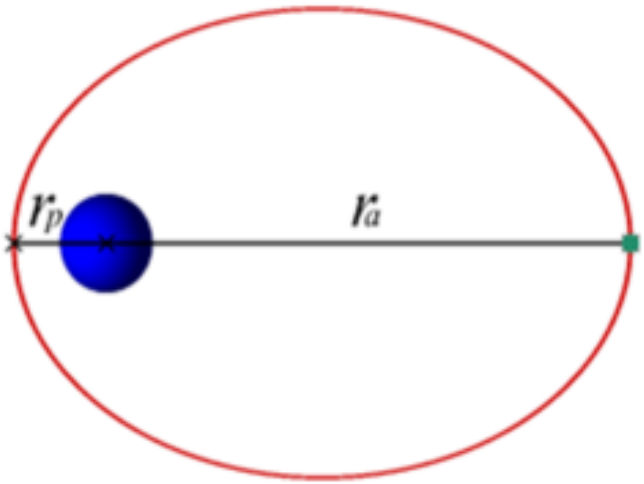


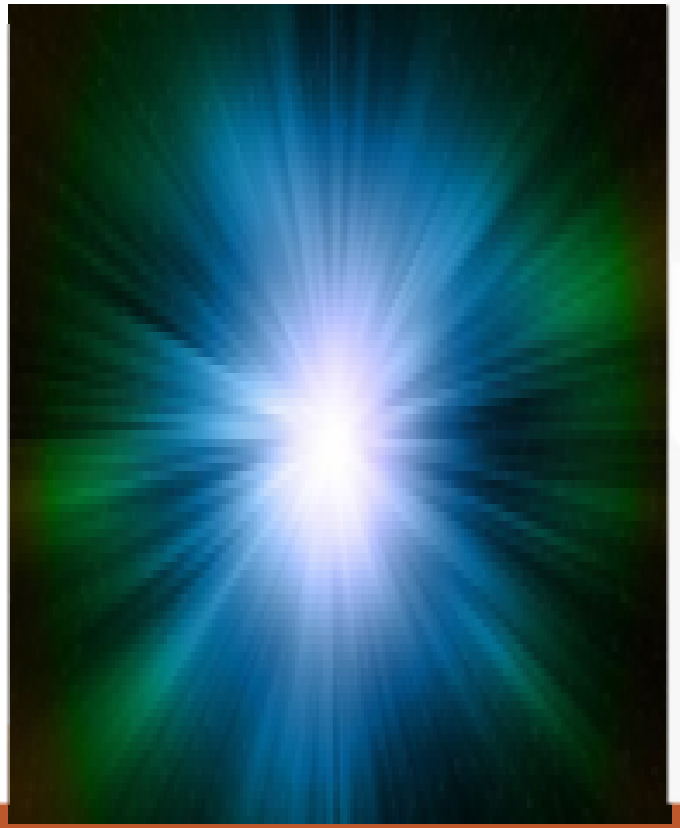
D`vniY t-

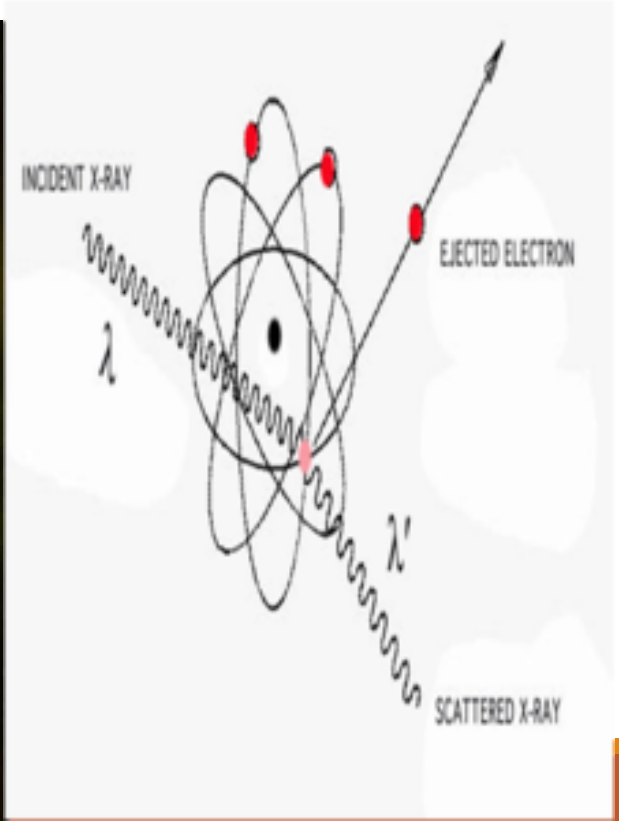
mgMwZm¤úbœKv‡bv †Uªbhv Îx Kvgivi wfZ‡ii †Kv‡bv cixÿvi mvnv‡h¨ cÖKí Ki‡Z cvi‡eb bv †Uªb w¯’i i‡q‡Q bv Pj‡Q| c`v_©Kv‡bi mKj cixÿvi dj †Uªb w¯’i _vK‡jI hv n‡e, mg‡e‡M Pj‡jI ZvB cvIqv hv‡e|

wØZxq ¯xKvh©

kb¨¯v‡b mKj ch©ey‡Ki wbKU Av‡jv‡Ki †eM me© mgvb _v‡K| G †eM Av‡jvK cÖ‡ni w`K, Drm Ges ch©ey‡Ki Av‡cwÿK †e‡Mi Dci wbf©K‡i bv|



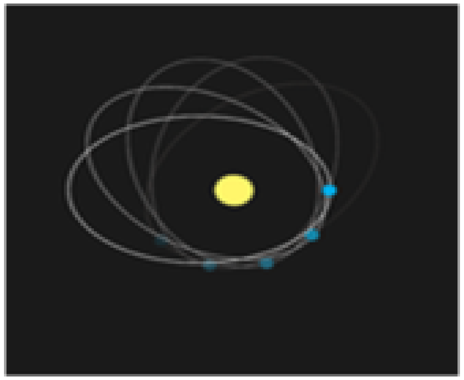




e¨vL¨v t-

GB ¯‹Kv‡hvM cwi‡cÖ‡Z B_v‡ii Aw¯Í¡ ¯‹Kvi Kiv †Kv‡bv g‡ZB m¤ú nqbv| ZvQvov B_vi gva¨‡gi lRb ev mv›`ªZv wKQzbYq Kiv hvq bv| AvBb÷vB‡bi g‡Z Av‡jvK cwievnx B_v‡ii cÖZK Abvek¨K| gvB‡Kjmb- gwj cixÿv Ges cieZx© ÿgZv eû cixÿv wbixÿvi mvnv‡h¨ cÖ`vYZ n‡q‡Q †h kvw¯—v‡b ev evqygvaŸ¨g Av‡jv‡Ki †eM,Av‡jvK cÖwZni w`K, Drm Ges chvweÿ‡Ki Av‡cwÿK †e‡Mi Dci wbf©ikxj bq| GwU GKwU aªæe iwk|

Av‡cwÿK Z‡Ëi cÖwi‡f` t-



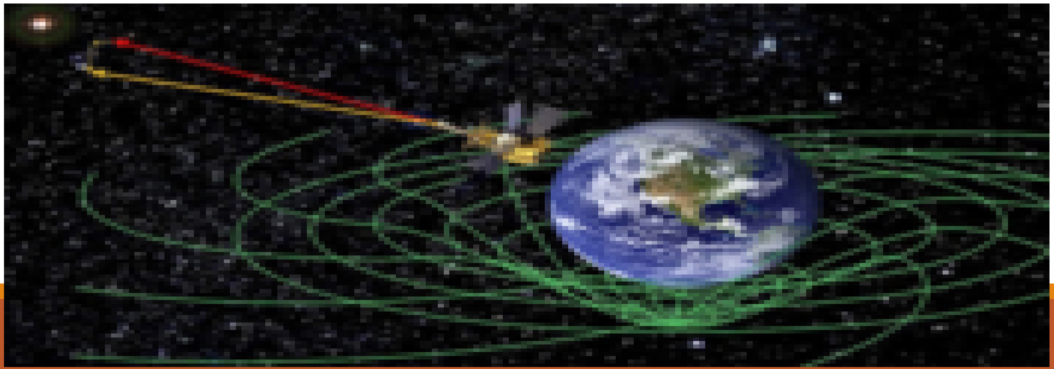
Av‡cwÿK ZË¡gÐZ `yB fv‡M wef³, h_v -

(1) Av‡cwÿKZvi mvaviY ev mvwe©K ZË¡ Ges

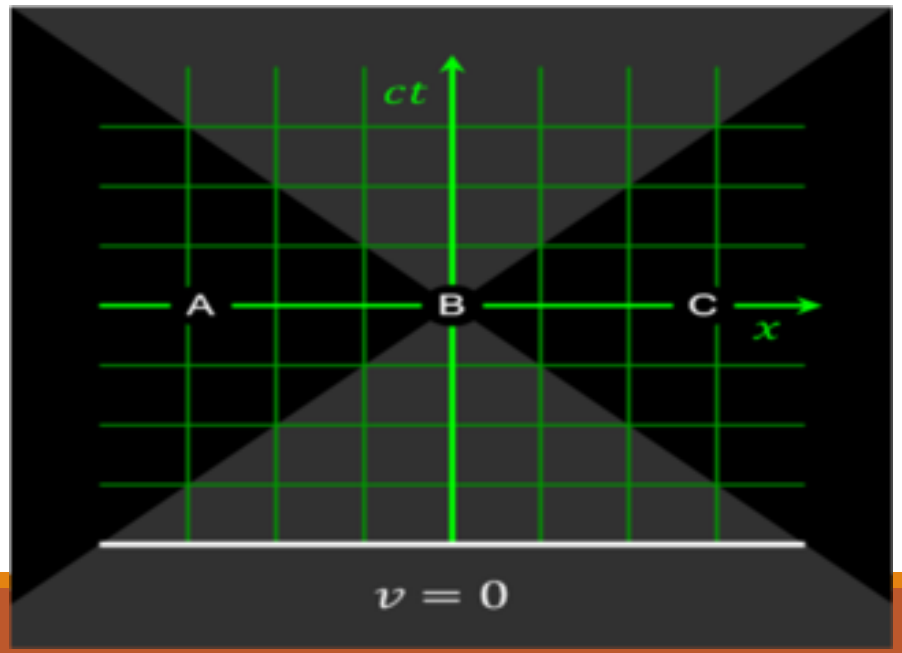
(2) Av‡cwÿKZvi we‡kl ZË¡

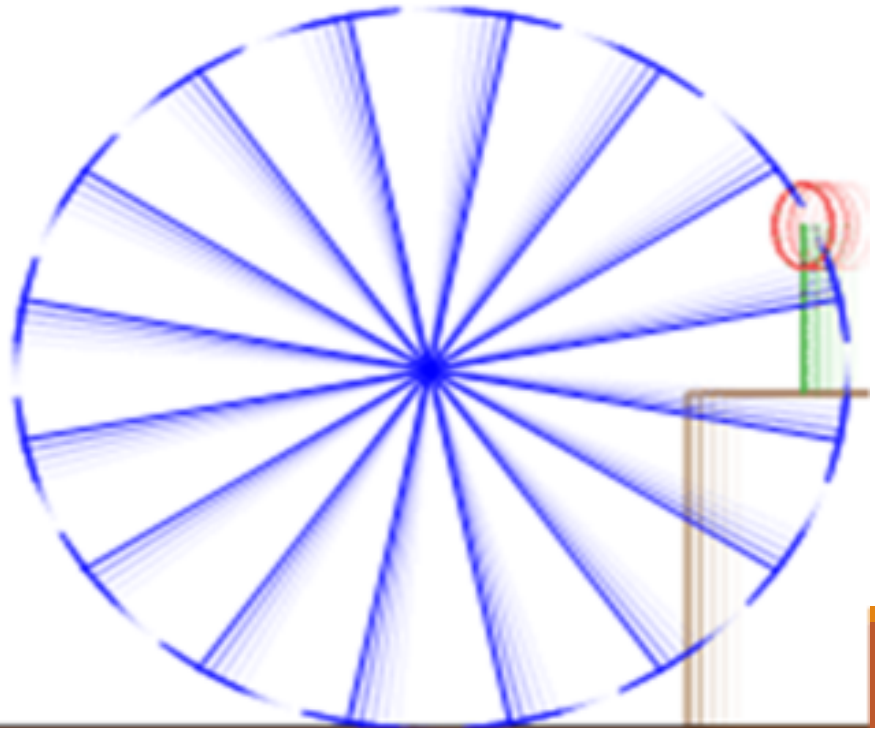
Av‡cwÿKZvi mvaviY ev mvwe©K ZË¡ ci¯ú‡ii Zzjbvq EaŸ©ev wbb¥ MwZkxj (Z¡iZ) e¯‘mgn ev wm‡÷g wb‡q Av‡jvPbv K‡i‡Q| ‡hgb mh©,`ª, bÿÎ, ag‡KZz, Déw`cÛ cÖf…Z.i MwZ, gva¨vKlŸ© Ges mgMÖ we‡k¦i MVb m¤ú‡K© Zv ‰eÁwbK I `vk©wbK gZev`mgn Av‡cwÿKZvi mvaviY Z‡Ëi Aš—f©|

GwU cÖKvwkZ nq 1916 mv‡j|



cÿvšÍi Av‡cwÿKZvi we‡kl ZË¡ïaycÖ¯ú‡ii Zzjbvq mgMwZ‡Z mÂiYkxj (AZ¥iZ) ev AmÂiYkxj (AcwieZ©x qfv‡e kã¨MwZwewkó) e¯‘ev wm‡÷g wb‡q Av‡jvPbv Kiv n‡q‡Q| e¯Z we‡kl ZË¡mwewkó ev mvaviY Z‡Ë¡ GKwU we‡kl i¶c| GB Aa¨v‡q Av‡cwÿKZvi we‡kl ZË¡Av‡jvPbv Kie|

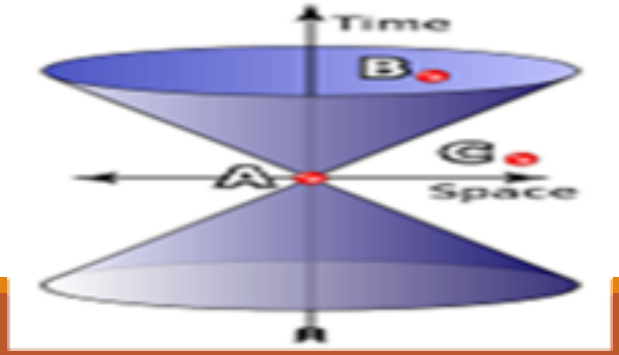


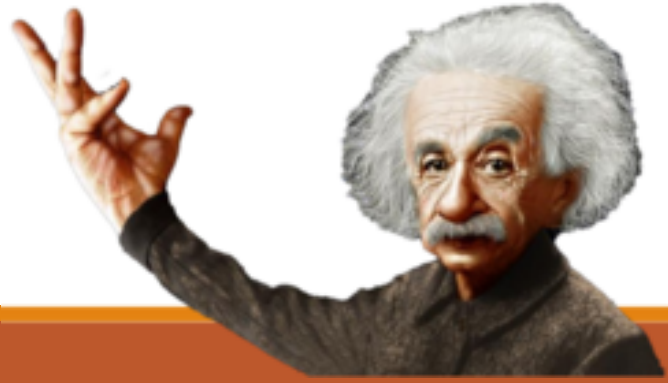


‰`‡N¨©I mg‡qi Av‡cwÿKZv t-

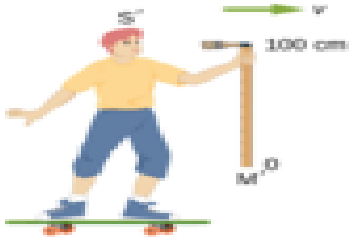
Kvj cwigv‡ci gZ Av‡cwÿK MwZ Øviv ^`N¨©cwigvcI cÖwZ nq| wPivqZ c`v_©`¨vi g‡Z e¯‘i mv‡c‡ÿ ch©ÿ‡Ki †eM hvB †nvK bv †Kb mKj ch©ÿ‡Ki wbKU e¯‘i ^`N¨©gvb ev Awfbœ eKš‘Av‡cwÿK ZË¡Abyôv‡i MwZi mv‡_ e¯‘i ^`N¨©cwieZb©N‡U|

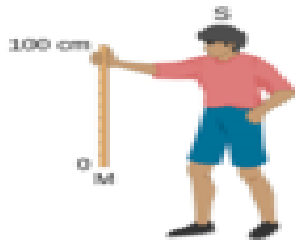
‡h Nwo †Kvb ch©ÿ‡Ki mv‡c‡ÿ MwZkxj †mB NwowU hw` MwZkxj bv n‡q wbðj _vKZ Zvn‡j †h mgq w`Z †P‡q MwZkxj Ae¯’q Kg mgq †`‡e|



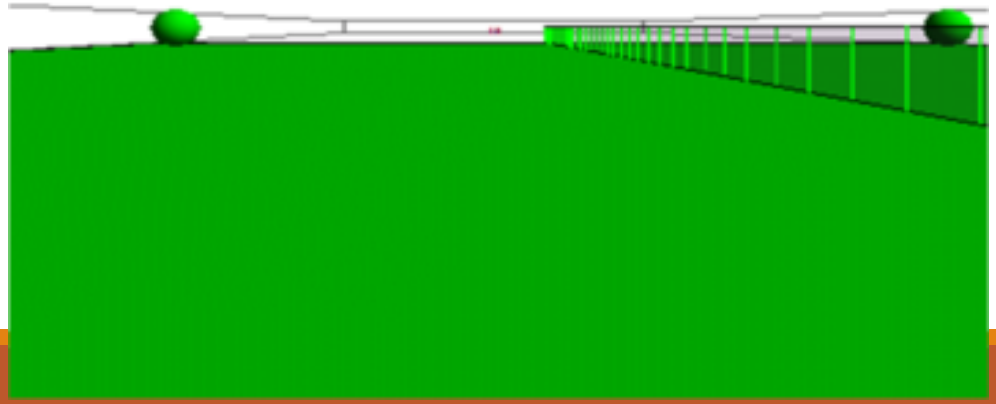


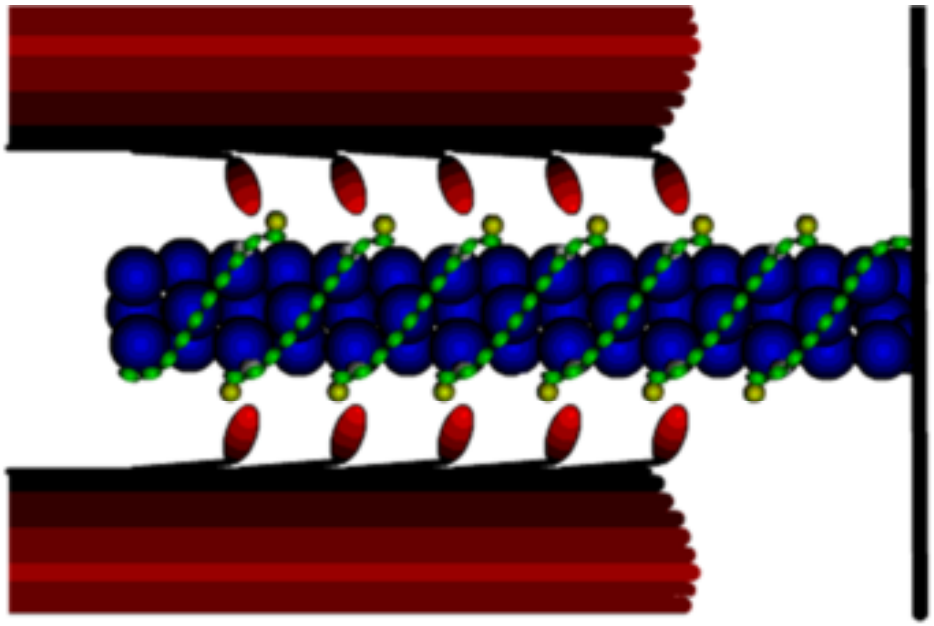
^`N¨@s‡KvPb Gi msÁv t-





†Kvb ch©ÿ‡Ki mv‡c‡ÿ MwZkxj †Kvb e¯‘i ^`N¨@H ch©ÿ‡Ki mv‡c‡ÿ wbðj Ae¯’vq H GKB e¯‘i ^`N¨© †P‡q †QvU nq, GB cÖe‡K ^`N¨@s‡KvPb ejv nq|

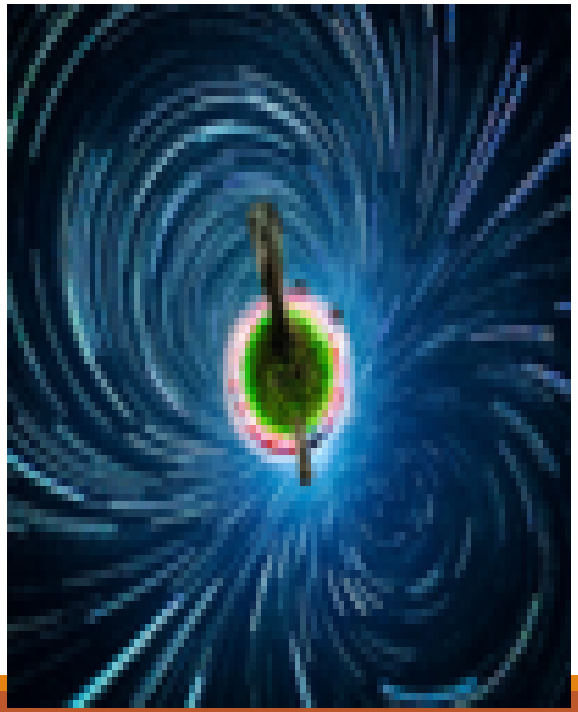


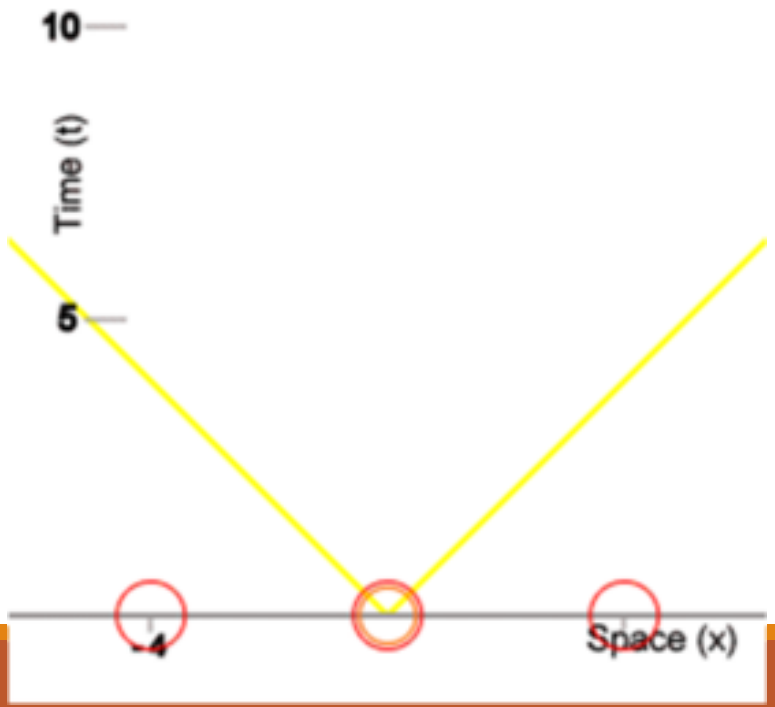


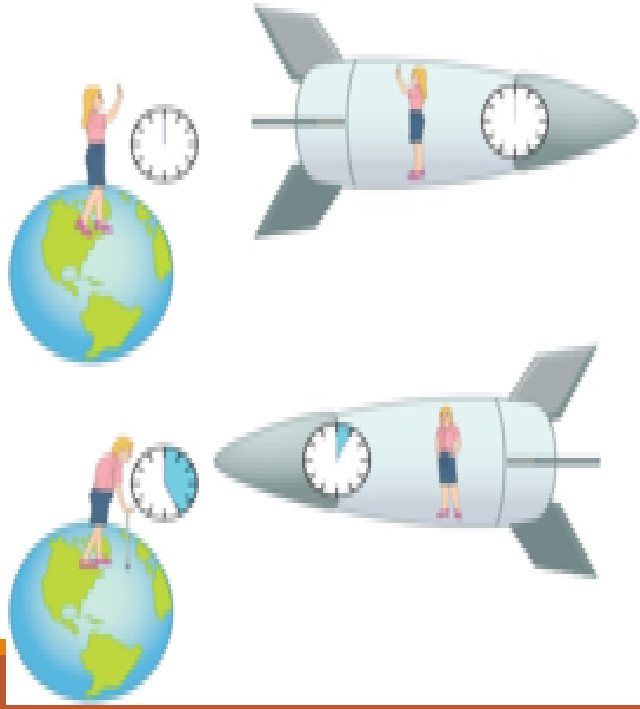
The action potential inhibits the calcium pumps, and calcium escapes from the sarcoplasmic reticulum.

Kvj `xNvQb Gi msÁv t-

†Kvb ch©ÿ‡Ki mv‡c‡ÿ MwZkxj Ae¯’vq msNwUZ `ywU NUbvi ga¨eZx©Kvj e¨eavb H ch©ÿ‡Ki mv‡c‡ÿ wbðj Ae¯’vq msNwUZ H GKB NUbvØ‡qi ga¨eZx©Kvj e¨eav‡bi †P‡q †ewk n‡e, GB cÖe‡K Kvj `xNvQb e‡j|







cgvY Ki †h, $E=mc^2$ (‡hLv‡b cÖKvK¸‡jv cÖwZ A_©vnb K‡i)|
weÁvbx AvBb÷vBb Gi fi kw³ mgxKiYwU cgvY Ki|
Av‡cwÿKZvi we‡kl Z‡Ë¡i cwi‡cÖw‡Z fi kw³i mvaviY †ei Ki|

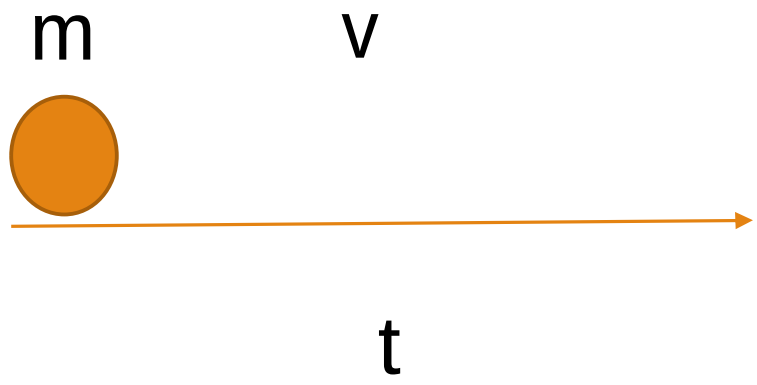
wbDU‡bi wØZxq MwZ m¤ú‡K© n‡Z Avgiv Rwb fi- †e‡Mi cwieZ©‡bi nvi‡K ej e‡j|

AZGe, $F = \frac{d}{dt}(mv)$--------(1)

Av‡cwÿK Z‡Ë¡n‡Z Avgiv Rwb fi Ges †eM Df‡qB cwieZ©‡bi kxj|

$\therefore F = \frac{d}{dt}(mv)$

$= m.\frac{dv}{dt} + v.\frac{dm}{dt}$ ------(2)



g‡bKwi ej F e¯‘i dx miY NUvq|

AZGe KZK.KvR = F . dx |

GB KvR e¯wUi MwZkw³ ewµ×i mgvb|

dE_k = F . dx

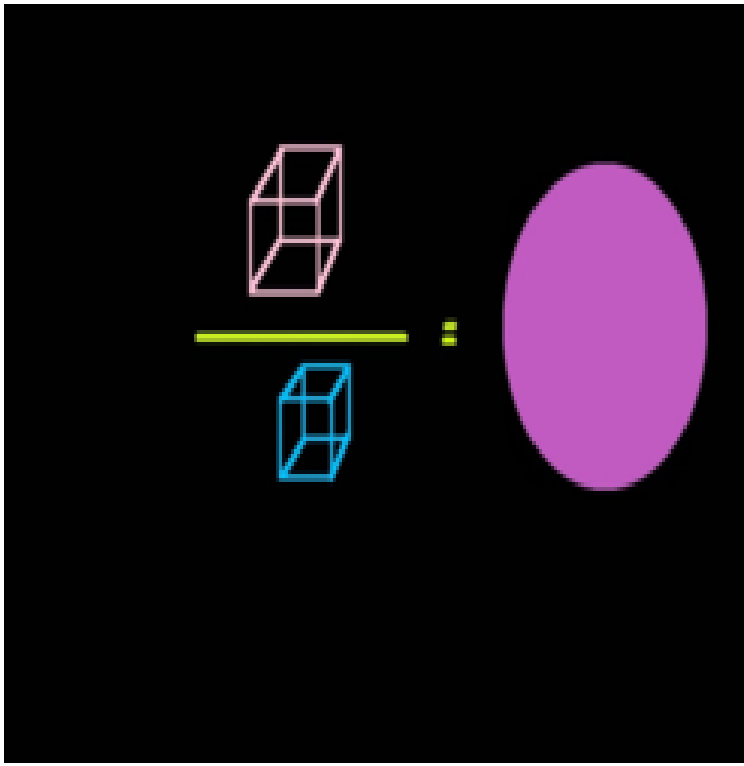
= [m. $\frac{dv}{dt}$ +v. $\frac{dm}{dt}$]. dx

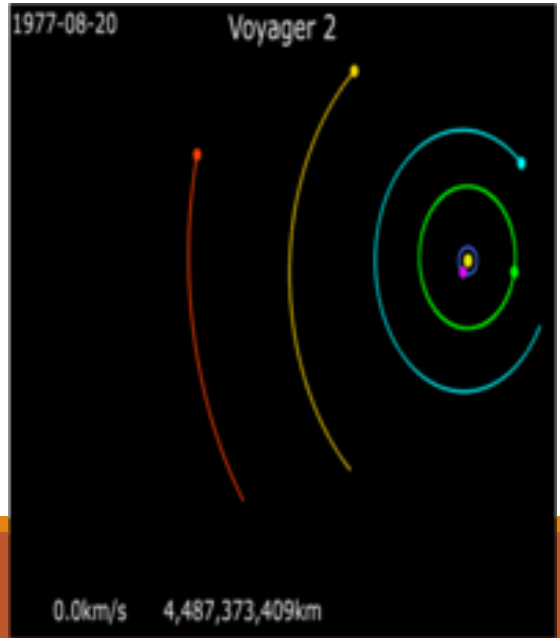
= m $\frac{dv}{dt}$. dx +v $\frac{dm}{dt}$. dx

= m $\frac{dx}{dt}$. dv +v .$\frac{dx}{dt}$. dm

= m.v. dv+v.v.dm [$\frac{dx}{dt}$ = v]

∴ dE_k = mvdv+v^2dm----(3)





GLb fi I †e‡Mi m¤cK©‡Z cvB,

$$m=\frac{m_0}{\sqrt{1-\frac{v^2}{c^2}}} \quad \text{----------(4)}$$

Dfq cÿ‡K eM©‡Ki cvB.

$$m^2 = \frac{m_0^2}{1-\frac{v^2}{c^2}}$$

ev, $m^2[\frac{c^2-v^2}{c^2}] = m_0^2$

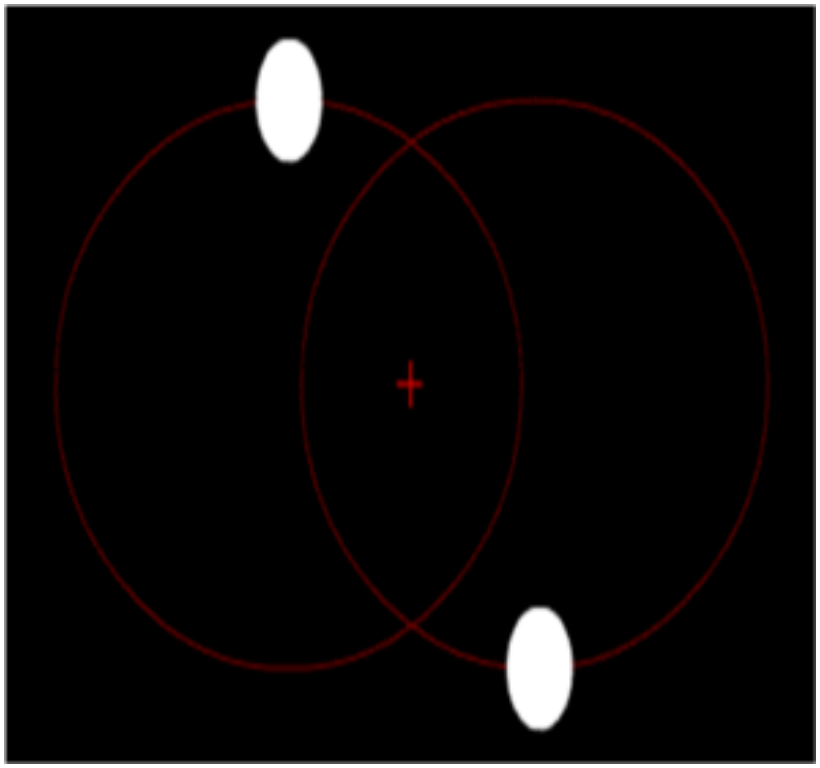
ev, $m^2(c^2 - v^2) = m_0^2\ c^2$

ev, $m^2c^2 - m^2v^2 = \quad m_0^2\, c^2$

ev, $m^2c^2 = m^2v^2 + m_0^2\, c^2$

ev, $m^2c^2 = m^2v^2$ [w¯’i Ae¯’vq e¯’i fi m_0= 0 I Av‡jvi †eM c=0 Df‡q a©eK]

$m^2c^2 = m^2v^2$---------- (5)



(5) bs Gi Dfq cÿ‡K AšÍiKjb K‡i cvB,

$d(m^2c^2) = d(m^2v^2)$

ev, $c^2d(m^2) + m^2d(c^2) = v^2d(m^2) + m^2d(v^2)$

ev, $c^2 2mdm + m^2 .2cdc = v^2 2m.dm + m^2 2v.dv$

ev, $c^2 2mdm = v^2 2mdm + m^2 2vdv$ [Av‡jvi †eM aªæe ZvB]

$\therefore\ c^2 dm = v^2 dm + mvdv$ ---------------- (6)

GLb (3) bs I (6) bs mgxKiY n‡Z Avgiv cvB,

$\therefore\ dE_k = c^2 dm$ -----------(7)

D³ mgxKiY n‡Z cÖvwYZ nq †h, MwZkw³i cwieZ©b f‡ii

cwieZ©‡bi mgvbycvwZK| A_©vr $dE_k \propto dm$

e¯‘hw` w¯’i _v‡K, Z‡e $v = 0$ Ges $K.E=0$
GgZve¯’vq $m= m_0$ | wKš‘e¯’i †eM hLb v nq, ZLb f‡ii gvb nq m| AZGe mgxKiY (7) bs †K mgvKjb K‡i cvB, $\int_0^{E_k} dE_k = \int_{m_0}^{m} c^2 dm$

ev, $\int_0^{E_k} dE_k = c^2 \int_{m_0}^{m} dm$

ev, $[E_k - 0]= c^2[m - m_0]$

$\therefore E_k= mc^2 - m_0c^2$ ----------(8)

GwUB n‡jv Av‡cwÿKZvi MwZkw³ i mgxKiY|

e¯‘hw` w¯’wZkxj Ae¯’vq _v‡K, Z‡e Zvi g‡a¨ †h kw³ mwÂZ _v‡K, Zv‡K w¯’i fikw³ e‡j Ges Gi cwigvY = m_0c^2 e¯‘i †gvU kw³

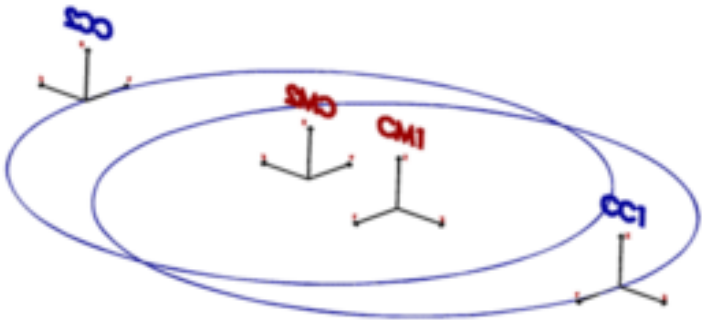
E = MwZkw³ + w¯’i fikw³

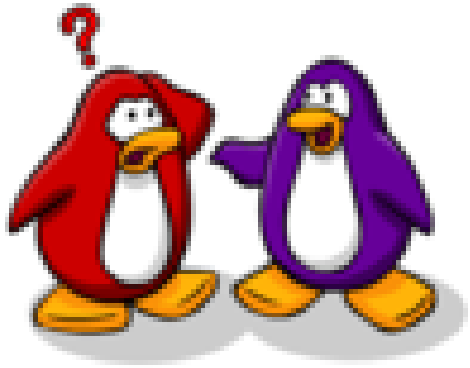
ev, E = $E_k + m_0c^2$

ev, E = $mc^2 - m_0c^2 + m_0c^2$ [$\because E_k = mc^2 - m_0c^2$]

$\therefore E = mc^2$

GwUB n‡jv weÁvbx AvBb÷vBb Gi fikw³ mgxKiY|





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