

Zvcgvîv

fygKv

th tfŠZ iŵki mŵvth" tKvb e`zKZUKzDò er KZUK VvÛv cwi gvc Kiv nq Zv†K H e`ž Zvcgvîv
etj | Avgiv A†bK mgq nvZ w†q tKvb e`ž DòZv ešvi tPón Kw | ŵKŠz`úk@ŵZi mŵvth"
Zvcgvîv m`ú†K©mŵK avi Yv cvl qv hvq bv | mŵK Zvcgvîv Rvbvi Rb" h†šj c†qvRb | th h†šj
mŵvth" Zvcgvîv ŵbY@ Kiv hvq Zv†K _v†g@ŵvi ejv nq |

G BDŵb†U ŵKfv†e Zvcgvîv cwi gvc Kiv hvq Ges Zvcgvîv cwi gv†ci ŵŵfbet`j m`ú†K©Av†j vPbv Kiv
n†e |

cW - 1

Zvcgvîv, Zvcgvîvi cwi gvc, ZvcigvîZK ag[©] | ZvcigvîZK c`v_[©]
_vtgîgUvîi w`i ve`y | Zvcgvîvi t`j |

Dîk

G cW tkîl Avcib -

- | Zvcgvîvi msÁv ej tZ cvi teb,
- | ZvcigvîZK ag[©] | ZvcigvîZK c`v_[©] eY[©] Kî tZ cvi teb,
- | _vtgîgUvîi w`i ve`y | _vtgîgUvîi gj- mgxKiY wj LtZ cvi teb |

12.1.1 t Zvcgvîv

wfbæZvcgvîvi KtqKîU e`zcvkvcnk ti tL `útk[©] mrvvth` Avgiv ej tZ cwi, tKvbiU teuk DĒB,
tKvbiU Kg DĒB, tKvbiU Kg kxZj, tKvbiU teuk kxZj |
DĒB e`z Zvcgvîv teuk, kxZj e`z Zvcgvîv Kg |

AZGe, Avgiv ej tZ cwi -

Zvcgvîv e`z Ggb GK Zvcîq Ae`v hv e`z DĒBZv ev kxZj Zvi gvîv (degree of hotness or
Coldness) e[©] |

Aveni, GKîU kxZj e`z GKîU DĒB e`z ms`útk[©] Avbv nîj kxZj e`z µgk DĒB nîZ _vtK Ges
DĒB e`z µgk kxZj nîZ _vtK | GK mgq `y e`z GKB Zvcgvîvq DcbxZ nq | G Ae`vtK Zvcîq
mvg`ve`v ej v nq |

GB cîµvq D`P Zvcgvîvi e`z _vtK Zvc v bæZvcgvîvi e`z cĕvvnZ nq |

AZGe, Zvc cĕvtni w`K wetePbv Kîi Zvcgvîvi v bæc msÁv t`I qv hvqt
òZvcv³ tKvb AvfgtL cĕvvnZ nte Zv vbt`R Kîi th vnk ZvtKB Zvcgvîv etj ó |

Aveni, Zvcîq mvg`ve`v wetePbv Kîi Zvcgvîvi v bæc msÁv t`I qv hvqt
òtKvb e`z Ab` e`z mvt_ Zvcîq mvg`ve`v AvtQ wK bvB Zv vba[©] Z Kîi e`z th ag[©] ZvtKB Zvcgvîv
etj ó |

12.1.2 t ZvcigvîZK ag[©] ZvcigvîZK c`v_[©]

Zvc cîqvîM A`[©] Zvcgvîv e[©] xî dtj e`z A[©]tk t[©]šZ atg[©] cwi eZ[©] nq | Zvcgvîv cwi eZ[©] bi mvt_
e`z Gme t[©]šZ cwi eZ[©] KvtR j vM[©] t[©]q Zvcgvîv cwi gvc Kiv nq |

Zvcgvîv cwi gvc c`vt_[©] th me t[©]šZ ag[©] KvtR j vM[©] t[©]q nq, H ag[©] t[©]j vtK ZvcigvîZK ag[©]
(Thermometric Property) ej v nq | th me c`vt_[©] ZvcigvîZK ag[©] e`envi Kîi _vtgîgUvîi `Zwi Kiv
nq, Zvt`i tK ZvcigvîZK c`v_[©] (Thermometric Substance) ej v nq |

ubtPi mvi YrtZ KtqKwU vtgUvti e`euZ ZvcgwZK c`v`e Dnvt`i ZvcgwZK ag`m`fU`e`wi Z weeiY t`l qv ntjv|

vtgUvti	ZvcgwZK c`v`e	ZvcgwZK ag`	cvi gvc mgv ⁰ C
cvi` vtgUvti	cvi`	Kkk btj cvi` -#` `N`	-38 t`tK 350
w`i Pvc M`vm vtgUvti	w`i Pvtc M`vm	M`vtmi AvqZb	-183 t`tK 600
w`i AvqZb M`vm vtgUvti	w`i AvqZtb M`vm	M`vtmi Pvc	-200 t`tK 1500
tiva vtgUvti	প্লাটিনাম Zvi	Zior tiva	-200 t`tK 1200
ZvcZior vtgUvti	avZe c`vt`P hMj	Zvcxq Ziwo`Pij K ej	-200 t`tK 3000
vg`i	Aaewi evnx c`v`e	Zior tiva	-70 t`tK 300
cvBti vgtv	avZe Zvi	D ^{3/4} j`	D`P ZvcgvIv

12.1.2 t vtgUvti i w`i ve`y ZvcgvIv t`j

rfmek Pvtc th ZvcgvIvq wei`x eid Mj tZ`ii` Kti ZvtK ub`aw`i ve`yev eid ve`yev ingvsk (Lower fixed point or Ice point or Freezing point) etj | rfmek Pvtc th ZvcgvIvq wei`x cvnb dltZ`ii` Kti, ZvtK EaY`i ve`yev ÷xg ve`yev Öbbiv` (Upper fixed point or Steam point or Boiling point) etj | EaY`i ve`yev ub`aw`i ve`yev ga`eZP e`eavbtk c`vgK e`eavb ev tgsij K e`eavb ejv nq| G e`eavbtk KZK, wj mgvb fvM fvM Kti GKwU t`j Mvb Kiv nq| c`Z fvMtk w`w` (Degree) ejv nq|

aiv hvK, eid ve`yev ÷xg ve`yev Z GKwU ZvcgwZK c`vt`P atgP gvb h`v`vtg X_{ice} | X_{steam} ; hv` Ab` tkvb ZvcgvIv tZ H atgP gvb x₀ nq Ges tgsij K e`eavtbi fvM msL`v n nq, Zvntj

$$\frac{\theta}{n} = \frac{X_{\theta} - X_{ice}}{X_{steam} - X_{ice}}$$

$$ev, \theta = \frac{X_{\theta} - X_{ice}}{X_{steam} - X_{ice}} \times n \text{ ----- (1)}$$

B w`i ve`y cvit`c`vtZ GwU vtgUvti gj- mgxKiY|

1bs mgxKiYtk newfbae vtgUvti i t`vt newfbae vtj Lv hvq| ubtP newfbae vtgUvti i t`vt mgxKiY, wj tj Lv ntjv|

(K) cvi` vtgUvti i t`vt DaY`i ub`aw`i ve`yev Z cvi` -#` `N`h`v`vtg l₁₀₀ | l₀ ntj Ges θ^0 C ZvcgvIvq cvi` -#` `N` θ ntj

$$\theta = \frac{l_{\theta} - l_0}{l_{100} - l_0} \times 100 \text{ ----- 1(K)}$$

(M) w`i AvqZb M`im _vtgngUvtii t`q`f`f` ZvcigwZK ag`M`vtmi Pvc (P);

∴ tm`f`q`f`f`T, T = (273.16 $\frac{P}{P_{tr}}$) K ----- 2(M)

(N) tiva _vtgngUvtii t`q`f`f`f`

∴ tm`f`q`f`f`T, T = (273.16 $\frac{R}{R_{tr}}$) K ----- 2(N)

(O) Zvc-Zuor _vtgngUvtii t`q`f`f`f` ZvcigwZK ag`Zvcxq Zuo`Pij K ej (E)

∴ tm`f`q`f`f`T, T = (273.16 $\frac{E}{E_{tr}}$) K ----- 2(O)

mvi mst`q`c

Zvcxq-mvg`ve`v t wfbæZvcgv`Ivi `m` e`zZvcxq ms`ú`k`Avmvi ci hLb mgZvcgv`Ivq DcbxZ nq, ZLb H Ae`t`K Zvcxq mvg`ve`v ej v nq|

Zvcgv`Iv t tKiv e`zAb` e`z` mvt`_ Zvcxq mvg`ve`vq AvtQ wK bvB Zv uba`wi Z Kti e`z` th ag`Zvt`KB Zvcgv`Iv e`tj |

ZvcigwZK ag`l ZvcigwZK c`v`_c` vt`_P th me t`f`S`Z ag`ej x Kvt`R j wM`tq` _vtgngUvi `Zwi Kiv nq, tmme ag`f`K ZvcigwZK ag`ej v nq Ges th me c`vt`_P ZvcigwZK ag`e`envi Kti _vtgngUvi `Zwi Kiv nq Zvt` i`K ZvcigwZK c`v`_ej v nq|

w`i ve`y` Zvcgv`Ivi t`j `Zixi Rb` ubw` 0 w`i ve`y`c`l`qv`Rb| 1954 wLbvt`ã Aby`Z AvšR`wZK I Rb I cwi gvc ms`vi Awat`ekt`bi w`x`v`š`-Aby`vti Zvcgv`Iv cwi gvt`c c`mbi `T`a ve`y`K w`i ve`y`y`nt`m`te ai v nq|

c`mbi `T`a ve`y`y` c`mbi `T`a ve`y`y`Ggb GK Zvcgv`Iv hvt`Z wei`x` eid, wei`x` c`mb I ms`ú`³ Rj xq er`ú` GKw Zvcxq mvg`ve`vq Ae`vb Kti | c`mbi `T`a ve`y`y`273.16 K ev .01°C Ges Rj xq er`ú`Pvc 4.58 mm Cvi` |

c`l`wgK e`eavb t 1954 Lx`÷`vt`ãi c`te`m` w`i ve`y`AvšR`wZKfvte MpxZ nq| `v`f`v`e`K P`vt`c th Zvcgv`Ivq wei`x` eid Mj`z`i`i` Kti Zvt`K ub`æ`w`i ve`y`y`ev eid ve`y`y`etj | `v`f`v`e`K P`vt`c th Zvcgv`Ivq wei`x` c`mb dlt`z`i`i` Kti, Zvt`K Ea`v`l`v`i ve`y`y`ev ÷`xg ve`y`y`etj | ub`æ`w`i ve`y`y`l` Ea`v`l`v`i ve`y`y`ga`e`Z`l`e`eavb`K ej v nq c`l`wgK e`eavb ev tgš`ij K e`eavb |

çVvËi gj`vqb

K. `be`P̂K çkät mW/K DËti i çk k W/K Wÿ (v) ŵ b|

1| çmbi `Ta we`y ZrcgvÎv KZ ?

- (K) .01 K (L) -273.16 K
- (M) 273.16 K (N) 273.15 K

2| ÷xg we`y ZrcgvÎv KZ?

- (K) 100 K (L) 373 K
- (M) 273 K (N) 373°C

3| %â a we`yZ Rj xq ev`úPrc KZ wgvj wglvi ?

- (K) 4.58 mm çvi ` (L) 2.73 mm çvi `
- (M) 5.65 mm çvi ` (N) 5.48 mm çvi `

msvW|B çkæ

1| çmbi `Ta we`yKv̂K etj? çmbi `Ta we`y çwi tçM|Z `vtgWgiZi gj- mgxKiY wj Lç|

2| `vtgWglvii w`i we`yYDv Ki`b| `B w`i we`y çwi tçM|Z `vtgWgiZi gj- mgxKiY wj Lç|

cW - 2

**Zvcgvîvi veifbœt`j , Zvcgvîvi veifbœt`đj i gta` m`úK,° cvi`
_vtg`gUvi |**

D`i`k`

G cW tk`l Ávcib -

- | Zvcgvîvi veifbœt`j eY`v Ki`Z cvi`eb,
- | cvi`_vtg`gUvi c`Z c`vj x eY`v Ki`Z cvi`eb,
- | Zvcgvîvi veifbœt`đj i gta` m`úK`bi`cb Ki`Z cvi`eb|

12.2.1 t Zvcgvîvi veifbœt`j

(1) tmj umqum t`j (Celcius Scale) t G t`đj ub`œv`i ve`đK 0° Ges EaY`v`i ve`đK 100° aiv nq Ges tg`šij K e`eavb`K 100 fivM fivM Kiv nq| c`Z`K fivM`K 1° tmj umqum (mst`đtc °C) ejv nq| mđtW`đbi tR`vZve° Á`vUvi mivb tmj umqum G t`j D`m`eb K`ib|

(2) dv`i`bnvBU t`j (Fahrenheit Scale) t G t`đj ub`œv`i ve`đ`y82° Ges EaY`v`i ve`đ`y12° ađi tg`šij K e`eavb`K 180 fivM fivM Kiv nq| c`Z`K fivM`K 1° dv`i`bnvBU (mst`đtc °F) ejv nq| Rvg`đ veÁvbx vR.vv. dv`i`bnvBU G t`j D`m`eb K`ib|

tmj umqum I dv`i`bnvBU t`đj i Z`đbv t

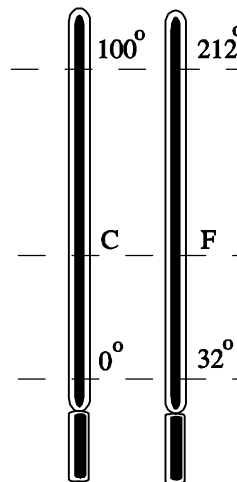
tmj umqum t`đj 100° = dv`i`bnvBU t`đj 180°

tmj umqum t`đj 1° = dv`i`bnvBU t`đj $\left(\frac{180}{100}\right)^\circ$

ev, $1^\circ\text{C} = \frac{9}{5} \text{ F}$ ----- (1)

A`_` Zvcgvîvi cvieZ`đbi t`đt`

$1^\circ\text{C} = \frac{9}{5} \text{ F}$



vPÎÑ 12.1

(3) tKj vfb t`j (Kelvin Scale) t j W`qKj vfb 1850 vL`v`đ Ggb GKvU Zvcgvîvi t`j D`m`eb K`ib hv tKv`bv e`ž t`šZ , Yvej xi Dci vbf`P`kij bq| Zui bvgvbyv`đi G t`đj i bvgKiY nq tKj vfb t`j |

GB t`j`đK cig t`j (absolute Scale) ev ZicMZXq t`j (Thermodynamic Scale) ejv nq| t`j vUv kb` Zvcgvîv`đK cig kb` Zvcgvîv ejv nq|

AvR ch`S-Ggb tKv`bv h`š; Avve`z.nq bvb hv`đZ G t`j m`đU ev`e avi Yv cvl qv hvq| GvU GKvU Z`đxq t`j |

Zte t`Lv hvq th, Ly ubaePvtc w`i AvqZb M`im vtgmgUvti i ZvcgvIv ZvcMZxq t`fj i ZvcgvIvi
 mvt_ Awfbzv cKvk Kti | Ly ubaePvtc ev`e M`im Av`kM`vtmi gtZv AvPiY Kti Ges Av`k`f`j
 tKvb ubw` M`vtmi atgP Dci wbfPkxj bq|

Av`kM`vtmi t`j ev tKj wfb t`fj i ZvcgvIv wbtPi mgxKiYi mvrvtth` wYq Kiv nq|

$$T = \left(\frac{P}{P_{tr}} \times 273.16 \right) K$$

GLvtb, P = T ZvcgvIvq ubw` M`im AvqZtbi Av`kM`vtmi Pvc|

$$P_{tr} = \text{cmbi } \hat{T}a \text{ wv`yZ GKB AvqZtbi M`vtmi Pvc|}$$

cmbi $\hat{T}a \text{ wv`yZ ZvcgvIvi } \frac{1}{273.16} \text{ Asktk 1K aiv nq| G t`fj eitdi Mj br} \frac{1}{4} \text{ 273.16K Ges}$
 cmbi $\hat{U}b \text{ br} \frac{1}{4} \text{ 373.16K | Zte mvariYZ tKj wfb t`fj eitdi Mj br} \frac{1}{4} \text{ 273K Ges cmbi } \hat{U}y \text{ bsk}$
 373K aiv nq|

tKj wfb t`fj ZvcgvIv = tmj wqvqm ZvcgvIv + 273.16

$$A_{\text{F}} K = ^{\circ}C + 273.16$$

mvariYZ K = ^{\circ}C + 273 aiv nq|

ZvcgvIvi S.I. GKK Kelvin

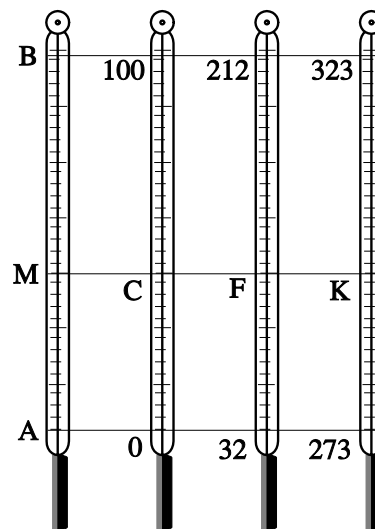
12.2.2 t ZvcgvIvi wvfbat`fj i gta` m`uK

ZvcgvIvi wvfbat`fj i KtqKwU c`qRbxq Z` wbtPi mvi YtZ eYv Kiv ntjv|

t`j	mtZ	ubaePvtc wv`y	DaYvtc wv`y	tgwji K e`eavtbi fvm msL`v
tmj wqvqm	C	0°	100°	100
dvtibnvBU	F	32°	212°	180
tKj wfb	K	273	373	100

tmj wqvqm, dvtibnvBU I tKj wfb t`fj i
 cvi`uwi K m`uK wYvti Rb` GKwU vtgmgUvti
 AB tblqv nq hvi eid wv`yI ÷ xgv`y
 h_vmtg A I B `vtMi mvt_ wgtj hvq (wP
 12.2)|

aiv hvK, tKvb ZvcgvIvq AB vtgmgUvti i
 cvi`kxl` hLb M Ae`vtb Avtm, ZLb
 tmj wqvqm, dvtibnvBU I tKj wfb t`fj
 ZvcgvIv h_vmtg C, F I K| AZGe Argiv
 wj LtZ cwi,



wP 12.2

$$\frac{MA}{BA} = \frac{C-0}{100-0} = \frac{F-32}{212-32} = \frac{K-273}{373-273}$$

$$\text{ev, } \frac{C}{100} = \frac{F-32}{180} = \frac{K-273}{100}$$

$$\text{ev, } \frac{C}{5} = \frac{F-32}{9} = \frac{K-273}{5} \text{ -----(2)}$$

∴ tmj mqv m I dvfi bnuBU t`fj i gta" m`úK`nt`Q

$$\frac{C}{5} = \frac{F-32}{9} \text{ ----- (3)}$$

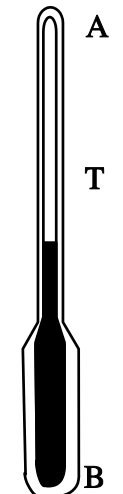
$$\text{ev, } F = \frac{9}{5} C + 32 \text{ ----- (4)}$$

cnbi `Ta ve`tz tKj wfb t`fj i Zvcgv`vi 273.16 K tmj mqv m t`fj .01°C, dvfi bnuBU t`fj 32.018° F .

12.2.3 t cvi` _vtg`gUvi

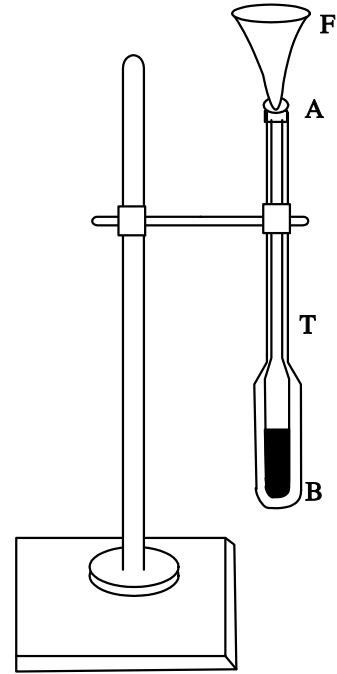
cvi` GKiu D^{3/4}j avZe Zij c`v` Zvc c`qv`M Zvcgv`vi cwieZ`bi mvt` mvt` cvi`i AvqZb mygfvte evto| cvi`i GB ag`K Kv`R j mltq _vtg`gUvi `Zix Kiv nq Ges GB _vtg`gUvi tK cvi` _vtg`gUvi ejv nq|

eYDv t cvi` _vtg`gUvi myg uQ`a weikó GKiu m`je `KukK bj _vtK| G btj i GK c`š-eÜ _vtK I Ab" c`š-GKiu evj e _vtK| evj e wQy`ei x cvi` _vtK| KvPbtj i Mvtq Zvcgv`vi t`j `vMm`Z _vtK| evj eW tKv`bv e`z ms`útk`Avmtj cvi`i AvqZb cwieZ` nq Ges cvi` k`I` Ae`vb t`_tK H e`z Zvcgv`vi Rvbr hvq|



IP`N12.3

c0Z c0vjxt GKUW m7ael myg uQ`a weikó i Ktbr KvPi
 bj tbqv nq| btji GK c0š-GKUW evj e B _vK Ges
 Ab` c0š-A tLjv| bj uK GKUW ó`vÜi mrvth` Lvorfvte
 `rcb Kti tLjvgtL GKUW dvbji F emvbr nq| dvbji
 uKQywei x I i`cvi` Xjv nq| mi` btji gta` cri`
 c0ek KitZ cvi bv| evj uKZ Aí Zvc c0qM Kitj
 evj e I btji wFZti evqy AvqZb evto Ges uKQyevqy
 cri`i ga` w`tq e`ye`y AvKviti tei ntq hvq| Geri
 evj uK VvÜv Kitj evj e I btji Aewkó evqy AvqZb
 Ktg hvq| dtj evBti evqy Pvc uKQycvi` btji wFZi
 c0ek Kti |

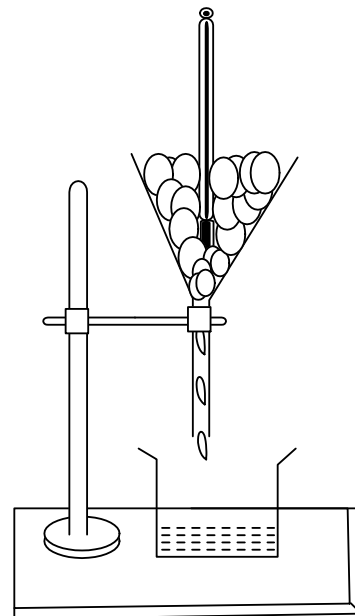


uP1N 12.4

Gfite chqumtg Mig I VvÜv Kti bj I evj e m`uYFvte cri` fWZKiv nq| Zvici dvbji tK mmi t`q
 evj uK h`ó Mig Kiv nq hvZ Gi tfZti cvi` d0Z _vK Ges DvZ cvi` ev`ú btji wFZti i
 evqK tei Kti t`q|

Zxe` I mi` AmwekLvi mrvth` bj Gi tLjv gy Mij t`q eÜ Kti t`lqv nq| evj e VvÜv ntq K7
 Zvcgvvq wdti Avmtj cvi` m`uYevj e I btji uKQyAsk cYKti ivtL Ges btji emK Ask evqy
 kb` Ae`vq _vK|

vb`aw`i ve` ybYq t vb`aw`i ve` ybYq i Rb`
 GKUW eo dvbji i`cvi` I wei`x eitdi AtbK`uj
 UKiv tbqv nq| cvi` _vtgUviti GKUW ó`vÜi
 mrvth` Lvorfvte `rcb Kiv nq hvZ _vtgUviti i
 evj e eitdi UKivi gta` Xkvbr _vK (uP1
 12.5)| cvi` m`uPZ ntq vbtP tbtg Avtm| btji
 cvi` eitdi Zvcgvvq tcS0tj Zv Avi m`uPZ
 ntq bv| cvi` kx1P Ae`vrb GKUW `vM KvÜv nq|
 GvB cvi` _vtgUviti i vb`aw`i ve` y`y



uP1N 12.5

D`niY

1| GKwJ Ktñji ZvcgvÎv 30°C : dvñi bñvBU t`ñj Gi gvb KZ?

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

$$\text{GLvñb, } C = 30^\circ \text{C}$$

$$F = ?$$

$$\frac{30}{5} = \frac{F-32}{9}$$

$$\text{ev, } 6 = \frac{F-32}{9}$$

$$\text{ev, } F-32 = 54$$

$$\text{ev, } F = 54+32 = 86^\circ \text{F}$$

Dt 86°F

2| tKvb e`ñ ZvcgvÎv 15°C evñ tçtj dvñi bñvBU t`ñj D³ evñi gvb KZ?

$$1^\circ \text{C cwi eZ}^\circ = \frac{9}{5} \text{ F cwi eZ}^\circ$$

$$\therefore 15^\circ \text{C cwi eZ}^\circ = \frac{9}{5} \times 15 = 27^\circ \text{F cwi eZ}^\circ$$

A_ñ 27°F evñ çvte|

Dt 27°F

3| dvñi bñvBU t`ñj GK e`w³i kixñi ZvcgvÎv cvl qv tMj 104°F | tKj wfb t`ñj D³ e`w³i ZvcgvÎv KZ?

$$\text{Avgiv Rmb, } \frac{F-32}{9} = \frac{K-273}{5}$$

$$\text{GLvñb, } F = 104^\circ \text{F}$$

$$\therefore \frac{104-32}{9} = \frac{K-273}{5}$$

$$\text{ev, } \frac{72}{9} = \frac{K-273}{5}$$

$$\text{ev, } 8 = \frac{K-273}{5}$$

$$\text{ev, } 40 = K - 273$$

$$\text{ev, } K = 40+273 = 313 \text{ K}$$

Dt 313 K

4/ GK1U $\hat{T}^{\circ}UcY^{\circ}$ vtgmgUvi $\hat{T}^{\circ}fmeK$ P1tc ei1d 1°C Ges evt[®]ú 98°C c1V t`q/ D³ vtgmgUvi 45°C c1V w`tj cKZ.Zvcgv1v KZ?

Avgiv Rmb, th tKvb vtgmgUvtii t`q1t1,

$$\frac{vtgmgUvtii\ c1V -\ eid\ me\`y}{\div\ xg\ me\`y -\ eid\ me\`y} \text{ AbgvZ\ mgvb/}$$

$$A_{\hat{T}}, \frac{X_{\theta} - X_{ice}}{X_{steam} - X_{ice}} \text{ AbgvZ\ mgvb/}$$

GLvtb $\hat{T}^{\circ}UcY^{\circ}$ vtgmgUvtii

$$X_{ice} = 1^{\circ}$$

$$X_{steam} = 98^{\circ}$$

$$X_{\theta} = 40^{\circ}$$

cKZ.Zvcgv1v = KZ Zv 1bY[®] Ki1Z nte/

aiv hvK, hLb $\hat{T}^{\circ}UcY^{\circ}$ vtgmgUvi c1V t`q 40°C ZLb tmj 1mqvm t`1j cKZ.Zvcgv1v C/ tmj 1mqvm t`1j i m1t_ Z1bv K1i c1B,

$$\frac{C-0}{100-0} = \frac{45-1}{98-1}$$

$$ev, \frac{C}{100} = \frac{44}{97}$$

$$\therefore C = \frac{100 \times 44}{97} = 45.36^{\circ}C$$

Dt 45.36°C

mvi m1t`q1c

ZvcMZxq t`j t j W[®]tKj 1fb Ggb GK t`j D[™]teb K1i b hv c`vt_[®] cK1uZ. ev atg[®] Dci 1bf[®] K1i b1; i ag1¹ Zvcgv1vi Dci 1bf[®] K1i | G t`j tK tKj 1f1bi cig t`j ev ZvcMZxq t`j ej v nq/

Zvcgv1vi 1e1fbat`j :

(K) tmj 1mqvm t`j

(L) d1t1 b1vBU t`j

(M) tKj 1fb t`j

Zvcgv1vi 1e1fbat`1j i g1a` m[®]úK[®]

$$\frac{C}{5} = \frac{F-32}{9} = \frac{K-273}{5}$$

K. ^be^P K çkæ

K. ^be^P K çkæ m^M K DËti i çk k wK wPý (v) w b|

(1) ZvcgvÎvi Gm AvB GKK tKvbU?

(L) tKj wfb

(L) dvti bnvBU

(M) tmwU#Mw

(N) Dçti i tKvbUB bq|

(2) tmj wmqv#mi m#_ ZvcgvÎvi Gm. AvB GKtKi m#úKçKvb mgxKiY t_#K cvl qv hvq?

(K) $T = \theta + 273.15$

(L) $T = \theta - 273.15$

(M) $\theta = T + 273.15$

(N) $\theta = T - 273.16$

(3) ZvcgvÎv çw eZ#bi tçt# tmj wmqv#m l dvti bnvBtUi gta" m#úKçKvbU?

(K) $1^{\circ}\text{F} = \frac{5^{\circ}}{9} \text{C}$

(L) $1^{\circ}\text{C} = \frac{9^{\circ}}{5} \text{F}$

(M) $1^{\circ}\text{C} = \frac{5^{\circ}}{9} \text{F}$

(N) $1^{\circ}\text{F} = \frac{9^{\circ}}{5} \text{C}$

L. msççB çkæ

1| tmj wmqv#m t^-j wU msççç eYçv Ki"b |

2| dvti bnvBU t^-j wU msççç eYçv Ki"b |

cW - 3

w`i AvqZb M`im _vtgngUvi, Zvc-Zvor _vtgngUvi, প্লাটিনাম tiva _vtgngUvi, _wgei, cvBtiwngUvi |

Dt`ik`

G cW tk`i AvcibN`

- | w`i AvqZb M`im _vtgngUvi i eY`v w`tz cvi`teb,
- | Zvc-Zvor _vtgngUvi i c`Z c`Yj x l Kvh`Yj x wj LtZ cvi`teb,
- | প্লাটিনাম tiva _vtgngUvi, _wgei l cvBtiwngUvi wK Zv eY`v Ki`Z cvi`teb|

welq e`z

12.3.1 t w`i AvqZb M`im _vtgngUvi

eY`v t G _vtgngUvi GK wj Uvi AvqZb weik`o evj & B, GKwU m`jel myg wQ`weik`o KivPbj C Gi mnv`th` cri` g`v`bmgUvi M Gi mvt` msh`y Kiv nq| g`v`bmgUviwU iev`ii bj T Oviv cri` cv`I R Gi mvt` msh`y Kiv nq| _vtgngUvi i evj &W nBt`Wt`Rb, bvt`Utt`Rb ev wuj qvg M`im Oviv cY`Kiv nq| G evj &W KivP, wPbvgwU, tKvqvR, প্লাটিনাম ev প্লাটিনাম-Bwi wQvg m`i avZzi`tq` Zix Kiv nq| g`v`bmgUvi i evg evut`Z GKwU`vM KivUv _vt`K|

Kvh`Yj x t cri` cv`It`K DVvbgv Kti cvi` -`#` D`PZv memgq g`v`bmgUvi i evut`Z KivUv`vM chS`ivLv nq| Gfiv`te M`v`mi AvqZb w`i ivLv nq| th e`e`vi Zvcgv`Iv wby` Kti`Z nte evj &W H e`e`vq`vcb Kiv nq| Zvcgv`Iv cwieZ`bi dtj AvqZb te`to ev Ktg tM`tj cri` cv`It`K DVvbgv Kti AvqZb wby` O`v`M w`i ivLv nq| t`j s Gi mnv`th` g`v`bmgUvi i` B` evui cri` -`#` D`PZvi cv`R` wby` Kti evj &e M`v`mi Pvc wby` Kiv nq| hw` evqg`U`tj i Pvc P₀ Ges g`v`bmgUvi i` B` evui cri` -`#` D`PZvi cv`R` h nq, Zvntj wby` Zvcgv`Ivq M`v`mi Pvc,

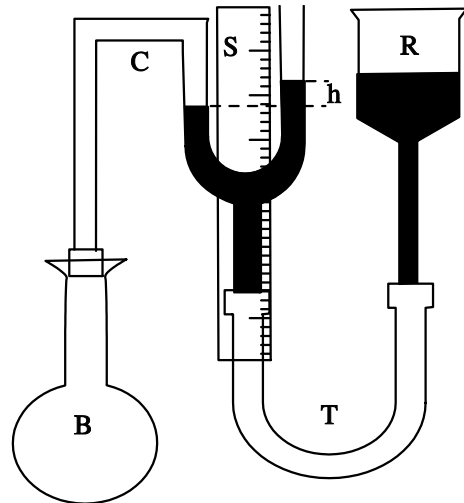
$$P = P_0 + h\rho g$$

$$GLv`tb, \rho = cvi`i NbZi$$

$$g = gva`vKI`RwbZ Zi Y|$$

Gevi _vtgngUvi i evj &tK cvibi `Ia w`y`Kt`l (Triple point Cell) `vcb Kti M`v`mi Pvc (P_{tr}) wby` Kiv nq| wbt`Pi mgxKi`Y P l P_{tr} Gi gvb emt`q (tKj wfb t`dj) Zvcgv`Iv wby` Kiv nq|

$$T = \left(273.16 \times \frac{P}{P_{tr}} \right) K$$



wT`N12.8

‘ θ ’-i we`ye`envi Kti ubtPi mgxKitYi mnvth` tmj umqvm t`-tj ZvcgvTv ubYq Kiv hvq|

$$\theta = \left(\frac{P_{\theta} - P_0}{P_{100} - P_0} \times 100 \right)^0 C$$

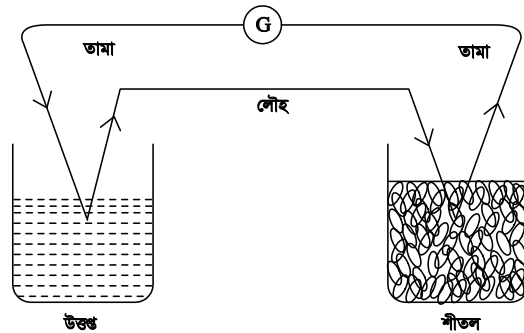
GLvtb, P_{θ} , P_0 | P_{100} h_vmtg ubtYq ZvcgvTv, eid we`y| ÷xg we`tjz M'vtmi Pic|

cwi gvc mkgv t GB _vtg0gUvti i mnvth` -200⁰ C t`_tK 1500⁰ C chS-ZvcgvTv cwi gvc Kiv hvq|

12.3.2 t mteK uqv (Seebeck effect)

‘ θ ’ wfbævZz Zvti i ‘ θ ’ c0š-tRvor j vMtq hw` eZ0x` Zix Kiv hvq Ges Zvi ‘ θ ’i msthvM` j ‘ θ ’tZ ZvcgvTv e`earb m0 Kiv hvq Zvtj H eZ0x`Z Zvor c0vvnZ nte| 1821 mL0vtã mteK me00g NUBvU cZ`q Ktib| ZvB G NUBvtK mteK uqv etj |

‘ θ ’ wfbævZi 0vivi m0 G e`e`-tK ejv nq Zvc hMj | 12.9 bs wPtT Zvgv I tjvvi Zvti` Zix GKvU Zvc hMj c0kZ ntv| 12.9 bs wPtT i eZ0x`Z GKvU M'vj fvtbvngUvi mshy Kiv ntqtQ| M'vj fvtbvngUvti i Kivv metq c w`tj eSv hvte th, eZ0x`Z Zvor c0vvnZ nt`Q|



wPt t 12.9

12.3.3 t Zvc-Zvor _vtg0gUvi

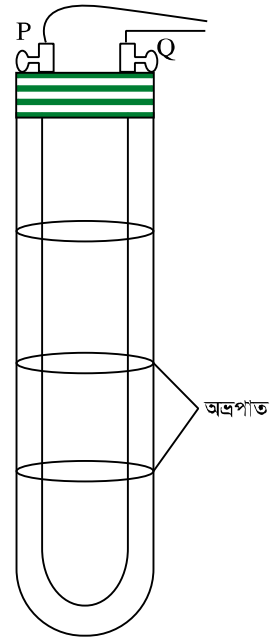
gj- ZE; t ‘ θ ’ wfbævZz Zvti i ‘ θ ’ c0š-tRvor j vMtq hw` eZ0x` Zix Kiv hvq Ges Zvi ‘ θ ’i msthvM` j ‘ θ ’tZ ZvcgvTv e`earb m0 Kiv hvq, Zvtj H eZ0x`Z Zvor c0vvnZ nte| eZ0x`Z th Zvo`Pvj K etj i D^{me} nq ZvtK Zvcxq Zvo`Pvj K ej ejv nq|

_vtg0gUvi c0Z c0vj x

th tKvb ‘ θ ’ avZz ‘ θ ’ Zvti i c0š0q GKtT SijvB Kti Gt` i GK c0š-tRvor j vMtq nq| GB c0švU nte Zvc hMj i DEB msthvM| Zvi ‘ θ ’tK tcvtm0 tbi bj ev KvtPi btj` vcb Kiv nq|

btj i wfbæv`vtb mgvš-vtj` mcZ KZ_wj AãcvtZi Af`š-`w0t`i ga` w`tq c0ek Kvitq Zvi ‘ θ ’tK btj i gta` Lvovfvt e ivLv nq|

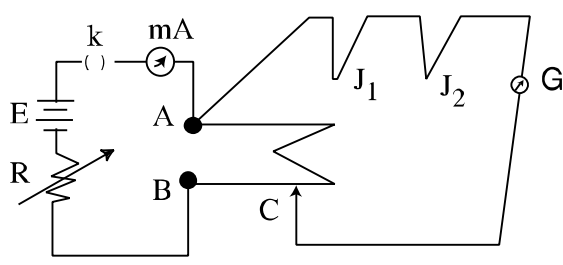
Khevj x t G vtgUvii mnvth mfvte Zvcgvv
 grcvi Rb GKU mje`x tctUbmIvUvi e`envi Kiv nq/
 12.11 bs pTvblyq cvtUbmIvUvi Zvtii A I B cts
 mvt_ GKU cwieZkij tiva R, GKU e`vUvix E, GKU
 Pme (K) I GKU vgvj -A`vUvii tkYx mgevtq hZ Kiv
 nq/ tctUbmIvUvi Zvtii GKcs-A we`y mvt_ Zvc
 hvtj i` msthM J₁, J₂ I GKU mje`x M`vj fvbtvUvi
 G Gi ga`w`tq Rukmn Ab` cts msthM t`qv nq/



pTn12.10

Zvc hvtj i msthM`vdi GKUtK (J₁) Mj s-eitd vbgvZ Kti 0° C Zvcgvvq memgq w`i ivLv
 nq/ Ab` msthMtK (J₂) Zijc`GKU Avaiti vbgvZ Kti Gi Zvcgvvq μgk evovbv nq/ hv
 tctUbmIvUvi Zvtii tiva r Ges H Zvtii ga`w`tq Zvorc`vni nq, Zvtj tctUbmIvUvi Zvtii
 `y cs-A I B Gi gta`wevfe cv`R` = ir / tctUbmIvUvi Zvtii`N°10m ntj cZ vUvii wefe
 $cv`R` = \frac{ir}{10}$ |

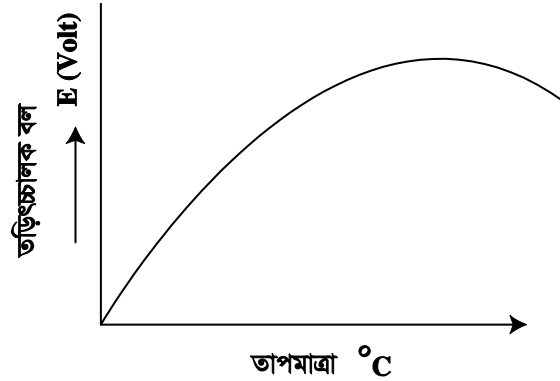
Gevi DEB msthMtK tkvb Zvcgvvq Ges
 kvZj msthMtK 0° C Zvcgvvq ivLvj hv
 t`Lv hvq th, tctUbmIvUvi Zvtii c we`y
 mvt_ Ruk`uk`Kivtj M`vj fvbtvUvi tkvb
 we`q/c n`Q bv, Zvtj esv hvte th, Zvc-
 hvtj th Zvcxq Zvo`Pvj K etj i D`me ntqtQ
 Zv tctUbmIvUvi Zvtii AC`N`P wefe
 cv`K`i mgvb/ hv` AC = l nq, Zvtj
 Zvcxq Zvo`Pvj K etj i gvb, $E = \frac{irl}{10}$



pTn12.11

Gfvte DEB msthMtMi wevfbvZvcgvvq KtqKU Zvo`Pvj K etj i gvb tei Kiv nq/ AZtci Zvo`Pvj K
 ej ebgv Zvcgvvq tj LpT A`b Kiv nq/
 Gevi th e`e`vi Zvcgvvq vbyq Kitz nte DEB msthMtK tm e`e`vq`vcb Kti Zvo`Pvj K ej vbyq
 Kiv nq Ges tj LpT t`K সংশ্লিষ্ট (Corresponding) Zvcgvvq vbyq Kiv nq/

cmigvc mxgv t Zvgr I Kb÷vUvBb Zvc hMj e'envi Kti-170⁰C t_#K 600⁰C chS-
 প্লাটিনাম-ইথের্মালকোয় মসKi e'envi Kti mtePP
 1700⁰C chS- Bmi Wvqvg-ইথের্মালকোয় m/i avZz
 Zvc hMj e'envi Kti mtePP 2100⁰C chS-
 Ges Uvst÷b-gwj etWbrg msktii Zvc hMj
 e'envi Kti mtePP 3000⁰C chS-Zvcgriv
 cmigvc Kiv hqj



পট্টন 12.12

12.3.4 t প্লাটিনাম tiva _vtgngUvi

Zvcgriv epxi mtf_ avZe c`vt_P `e`yZK tiva teto hqj/ প্লাটিনাংgi G ag#K Kv#R j Wltq প্লাটিনাম
 tiva _vtgngUvi `Zix Kiv nqj/ 1871 Wlv#ã weAvbx Wmtgb প্লাটিনাম tiva _vtgngUvi `Zix Ktib/
 hir 0⁰C Zvcgrivq প্লাটিনাম Zv#i tiva R₀ Ges 0⁰C Zvcgrivq tiva R₀ nq, Zv#j

$$R_{\theta} = R_0(1 + \alpha\theta + \beta\theta^2) \text{ ----- (1)}$$

GLv#b, α I β `W a'e msl`v/ G#`i gvb Zv#i Dcv`v#bi Dci WbfP Kti/ weix প্লাটিনাংgi t#t#T,

$$\alpha = 3.94 \times 10^{-3}$$

$$\beta = -5.8 \times 10^{-7}$$

`B W`i we`ye'envi Kti tmj Wmqvm t`#j Zvcgriv WY#qi mgxKiY t

$$\theta = \frac{R_{\theta} - R_0}{R_{100} - R_0} \times 100^{\circ}\text{C}$$

GLv#b, R₀ , R₀ I R₁₀₀ h_v#tg Wb#Y# Zvcgriv θ , eid we`yl ÷xg we`#Z `e`yZK tiva/

cmigvc mxgv t GB _vtgngUv#i i mrv#h` -200⁰C t_#K 1200⁰C chS-Zvcgriv cmigvc Kiv hqj/

12.3.5 t _wq#i (Thermistor)

wq#i AaeWievnx c`v#v#v `Zix GKW e'e`v hvi mrv#h` Zvcgriv cmigvc Kiv hqj/ tiva
 _vtgngUv#i g#Zv _wq#i ZvcgrivZK ag#tiva/ Zte tiva _vtgngUv#i mtf_ Gi cv_#` n#jv tiva
 vtgngUv#i Zvcgriv epxi mtf tiva epx cvqj/ WkSz _wq#i tiva Zvcgriv epxi mtf_ nwm cvqj/
 tiva _vtgngUv#i Z#brq _wq#i A#bK tenk m#e`x/

cmigvc mxgv t _wq#i i mrv#h` -70⁰C t_#K 300⁰C chS-Zvcgriv cmigvc Kiv hqj/

12.3.6 cvBtiwglvi (Pyrometer)

Pyros ktai A Fire A Av, b/ 1000°C Zvcgvivi Avak Zvcgviv cwi gvtci Rb cvBtiwglvi e`euZ nq/ cvBtiwglvi tK DEB e`z Mtq ukKivtZ nq bvl/ ZvB DEB e`z Zvcgviv AtbK tewk ntj I htšj tKibi Kg qwZ nq bvl

cvBtiwglvi cKvi | h_v- cYemKiY cvBtiwglvi Ges Avtj vK cvBtiwglvi |

cYemKiY cvBtiwglviti minvth tKvb e`zKZR. meKvY Zvtci cwi gvY cwi gvc Kti w`tdb Gi mF c0qM Kti Zvcgviv wbyq Kiv nq/

Avtj vK cvBtiwglviti bmvZ ntjv; tKvb e`zK Lq DEB Kiti GiU Avtjv meKiY Kti Ges Zvcgviv epxi mvz mvz Gi J3/4j evto/ Gi J3/4j i Dci wvE Kti A AvtjvKvqfite (Optically) cZ`q Kti Zvcgviv wbyq Kiv nq/ ZvB GtK Avtj vK cvBtiwglvi ejv nq/

D`niY

1/ GKw w`i AvqZb M`vm vtgglvi cwi Ta me`jZ Pvc $2 \times 10^4 \text{ N m}^{-2}$ Ges GKw D0 Zi tj Pvc $4 \times 10^4 \text{ N m}^{-2}$ c0k0 Kti | H Zij wji Zvcgviv KZ?

GKw w`i AvqZb M`vm vtgglviti Zvcgviv

$$T = \left(273.16 \times \frac{P}{P_{tr}} \right) \text{ K}$$

$$GLvtb, P = 4 \times 10^4 \text{ N m}^{-2}$$

$$P_{tr} = 2 \times 10^4 \text{ N m}^{-2}$$

$$\begin{aligned} \therefore T &= 273.16 \times \frac{4}{2} \\ &= 546.32 \text{ K} \end{aligned}$$

Dt 546.32 K

2/ GKw w`i AvqZb M`vm vtgglviti eid I evt`u vcb Kiti h_vmtg 75cm I 102cm cvi` Pvc c0k0 Kti | hw` tKvb Zi tj vcb Kiv ntj vtgglvi w 24cm cvi` Pvc c0k0 Kti, Zvntj H Zi tj i Zvcgviv KZ?

Avgiv Rwb, w`i AvqZb M`vm vtgglviti t`q`t` tmj wqv t`dj Zvcgviv -

$$\theta = \frac{P_{\theta} - P_0}{P_{100} - P_0} \times 100$$

GLvtb, $P_{\theta} = \theta^{\circ} \text{c}$ Zvcgviv M`vm vtgglviti c0B Pvc = 24 cm cvi`

$$P_0 = 75 \text{ cm} \text{cvi`}$$

$$P_{100} = 102 \text{ cm} \text{cvi`}$$

$$\begin{aligned} \therefore \text{wb}tY\text{q} \text{ Zvcgv} \hat{I}v, \theta &= \frac{24-75}{102-75} \times 100 \\ &= -188.88^{\circ} \text{C} \end{aligned}$$

Dt -188.88°C

3/ GKwU tiva vtgngUvtii tiva 0°C I 100°C ZvcgvIvq h_vμtg 8 Ohm. I 20 Ohm. vtgngUviiUtk GKwU DEB e`z`rcb Kiv ntj tiva cvlqv hvq 25 Ohm. tiva vtgngUvti DEB e`i ZvcgvIv KZ nte?

Avgiv Rwb, tmj umqvm t`dj tiva vtgngUvti ZvcgvIv θ ntj,

$$\theta = \frac{R_{\theta} - R_0}{R_{100} - R_0} \times 100^{\circ} \text{C}$$

GLvtb,

$$R_0 = 8 \text{ ohm}$$

$$R_{\theta} = 25 \text{ ohm}$$

$$R_{100} = 20 \text{ ohm}$$

$$\begin{aligned} \therefore \theta &= \frac{25-8}{20-8} \times 100^{\circ} \text{C} \\ &= \frac{17}{12} \times 100 \\ &= 141.66^{\circ} \text{C} \end{aligned}$$

Dt 141.66°C

4/ GKwU প্লাটিনাম tiva vtgngUvtii minivth` cmbi `Îa ne`z` tiva 6.7 Ohm Ges Kqj ZvcgvIvq tiva 7 Ohm cvlqv hvq| tiva vtgngUvti Kqj ZvcgvIv KZ?

Avgiv Rwb, tKj wfb t`dj tiva vtgngUvti ZvcgvIv T ntj,

$$T = 273.16 \frac{R}{R_{tr}}$$

GLvtb, $R = Kqj \text{ ZvcgvIvq tiva} = 7 \text{ ohm}$

$$R_{tr} = \text{cmbi } \hat{Î}a \text{ ne`z` tiva} = 6.7 \text{ ohm}$$

$$\begin{aligned} \therefore T &= 273.16 \times \frac{7}{6.7} \\ &= 285.39 \text{ K} \\ &= 12.23^{\circ} \text{C} \end{aligned}$$

Dt 12.23°C ev, 285.39 K

MwVvZK cêce

- 1/ tmj umqvm t⁻çj 2°C ZvcgvÎv ewx ntj dvfi bnvBU t⁻çj KZ wVMô ewx crte?
- 2/ 50° F ZvcgvÎv KZ wVMô tmj umqvm Gi mgvb ?
- 3/ tKvb ZvcgvÎv tmj umqvm I dvfi bnvBU t⁻çj GKB msL'v Øviv cêKik Kiv hvq ?
- 4/ GKwU Î'wUcY[©] _vtgngUvfi eid we>`y 5°C I ÷xg we>`y 15°C ; tKvb e⁻ç cêKZ.ZvcgvÎv 50°C ntj H _vtgngUvfi i cvV KZ nte?
- 5/ GKwU w⁻i AvqZb M'vm _vtgngUvfi K GKwU Zij, eid I evt[®]ú 'rcb Kij h_vµtg 90cm, 75cm I 102cm cvi` Pvc cêkê Kti | Zij wU ZvcgvÎv KZ?
- 6/ GKwU w⁻i AvqZb M'vm _vtgngUvfi cmbi Î'a we>`ç Pvc $2.5 \times 10^4 \text{ N m}^{-2}$ Ges GKwU Ziçj Pvc cêkê Kti $3.5 \times 10^4 \text{ N m}^{-2}$ | H Zij wU ZvcgvÎv KZ?
- 7/ GKwU tiva _vtgngUvfi tiva 0°C I 100°C ZvcgvÎvq h_vµtg 8 ohm I 20 ohm; _vtgngUvfi wUçK GKwU ççliçZ 'rcb Kij tiva 25 ohm nq| ççliç ZvcgvÎv KZ?
- 8/ GKwU প্লাটিনাম tiva _vtgngUvfi mivvth' cmbi Î'a we>`ç tiva 6.7 ohm Ges Kçj ZvcgvÎvq tiva 8 ohm cvl qv hvq| tiva _vtgngUvfi Kçj ZvcgvÎv KZ nte?