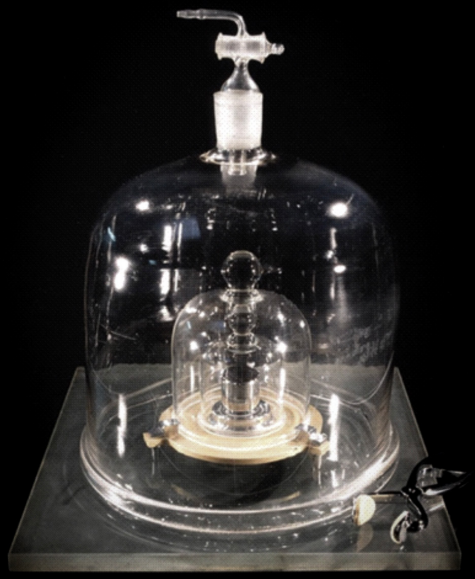
SI



He whakarāpopoto o te Pūnaha Waeine ā-Ao, te SI

Ko te Mātauranga Inenga te pūnaha pūtaiao o ngā taumaha me ngā inenga, kei roto nei ngā momo inenga katoa, he mea hanga mai i tētahi taumata o te warawara kei te mōhiotia, ahakoa tēhea ia te momo mahi a te tangata.

I whakatūria te Mana ā-Ao mō ngā Taumaha me ngā Inenga (The Bureau International des Poids et Mesures – BIPM), e te Wāhanga 1 o te Rūnanga o te Mita (Convention du Mètre) i te 20 Haratua 1875, ā, kua whakahautia tēnei Mana ki te whakarato i te pūtake o te pūnaha inenga kotahi, he mea mārama tonu, hei whakamahinga mā te ao katoa. Ko te pūnaha ngahuru, i takea mai i te wā o te Pāhoro Wīwī, i whakatūria i runga i te mita me te manokaramu. I runga i ngā whakaritenga o te Rūnanga o 1875, i hanga hōutia ngā tauira taketake ā-ao o te mita me te manokaramu (kirokaramu), ā, i whakamanatia ōkawatia ērā i te hui tuatahi a te Rūnanga Whānui mō ngā Taumaha me ngā Inenga (Conférence Générale des Poids et Mesures – CGPM) i te tau 1889. I whanake haere tēnei pūnaha i roto i te huringa o te wā, nā e whitu rawa āna waeine pūtaketake i tēnei wā. I te tau 1960 i whakatauria ai i te hui 11 o te CGPM kia karangatia tēnei pūnaha ko te Pūnaha Waeine ā-Ao (Système International d'Unités, arā te SI), (ki te reo Ingarihi: International System of Units). Ehara te SI i te pūnaha pateko engari he mea panoni haere tonu kia rite i a ia ngā hiahia pakeke tonu i ngā taumata katoa o te inenga tika pū, i ngā wāhanga katoa hoki o te pūtaiao, o te hangarau, o te whāinga a te tangata. He whakarāpopototanga o te **Puka Whakamārama SI** tēnei tuhinga, he tānga nā te BIPM e kōrero ana mō te tūnga o te SI i tēnei wā.

Ko ēnei **waeine pūtaketake** e whitu o te SI, e whakarārangitia nei ki te Tūtohi 1, te pūtake tohutoro ka whakamahia ki te tāutu i ngā waeine katoa o te Pūnaha ā-Ao. Ka nuku whakamua ana te pūtaiao, ā, ka whātikatia ake anō ngā tikanga inenga, me tirotiro rawa ngā tikanga whakamārama o ēnei inenga, me whaka-hāngai hoki. Ki te nui rawa te tika pū o ngā inenga, kia tino nui rawa anō te tiaki kei te tika pū ngā waeine.

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Tūtohi 1 Ngā waeine pūtaketake e whitu o te SI

Rahinga		Waeine, tohu: te tikanga o te waeine
roa	**length**	**mita, m:** Ko te mita ko te roanga o te ara e haere ai te tūrama i te korehau i roto i te wā o te 1/299 792 458 o te hākona (tohu s [second]). *Nō reira, ko te horo o te tūrama i te korehau,* c_0*, ko* 299 792 458 m/s *rite pū.*
papatipu	**mass**	**manokaramu, kg:** Ko te manokaramu (kirokaramu) ko te waeine papatipu, he ōrite ki te taumaha o te tauira taketake ā-ao o te manokaramu. *Nō reira, ko te papatipu o te tauira taketake ā-ao o te manokaramu, m(K), ko te* 1 kg *rite pū i ngā wā katoa.*
wā	**time**	**hākona, s:** Ko te hākona ko te roanga o ngā wā 9 192 631 770 o te hihinga e rite ana ki te whakawhitinga i waenga ngā taumata tino mōkito e rua o te āhua ā-whenua o te ngota konukororā 133 (caesium 133). *Nō reira, ko te wāhinga tino mōkito i te āhua ā-whenua o te ngota konukororā* 133 *(caesium* 133 *atom),* ν (hfs Cs)*, ko* 9 192 631 770 Hz *rite pū.*
iahiko	**electric current**	**wae-iahiko, A:** Ko te wae-iahiko ko taua iahiko aumou ka whakaputa i te iahiko te rite o 2×10^{-7} newton mō ia mita roanga o ngā pūkawe iahiko whakarara e rua, nā rā ki te whakapūmautia tōna rere rā roto o ēnei pūkawe iahiko e rua, he mea tata kore noa iho tō rāua motuhanga porowhita, he mea whakatakoto hoki 1 mita tētahi i tētahi i te korehau. *Nō reira, ko te tau pūmau autō,* μ_0*, e mōhiotia nei hoki ko te kaha uruhanga o te ātea noa, ko te* $4\pi \times 10^{-7}$ H/m *rite pū.*
pāmahana wera ahupūngao	**thermodynamic temperature**	**kelvin, K:** Ko te kelvin ko te waeine o te pāmahana wera ahupūngao, ko te hautanga 1/273.16 o te pāmahana wera ahupūngao o te pūwāhi reatoru o te wai. *Nō reira, ko te pāmahana wera ahupūngao o te pūwāhi reatoru o te wai,* T_{tpw}*, ko te* 273.16 K *rite pū.*
rahinga matū	**amount of substance**	**tīwhanga, (mol):** 1. Ko te tīwhanga te rahinga matū o tētahi pūnaha kei roto rā ngā wāhi taketake te rite o ngā ngota kei roto i te 0.012 manokaramu o te waro 12. 2. Ina whakamahia te tīwhanga, me āta whakahua ngā wāhi taketake mēnā he ngota, he rāpoi ngota, he katote, he irahiko, he momo matūriki kē rānei, he rōpū whakaingoa rānei o ēnei matūriki. *Nō reira, ko te papatipu tīwhanga o te waro*12*,* $M(^{12}C)$*, ko te* 12 g/mol *rite pū*
kukū whakaputa tūrama	**luminous intensity**	**kānara, (cd):** Ko te kānara ko te kukū whakaputa tūrama, ki tētahi ahunga whakarite, nā tētahi puna e whakaputa ana i te hihinga kanotahi o te auautanga 540 x 10^{12} hertz he kukū rukeruke tōna ki taua ahunga o te 1/683 wata ki ia tātoro pūrua (watt per steradian). *Nō reira, ko te kukū whakaputa tūrama, K, mō te ira rukeruke kanotahi o te auautanga* 540 *x* 1012 Hz *ko* 683 lm/W *rite pū.*

Ko ngā **rahinga pūtaketake** e whitu e taurite ana ki ngā **waeine pūtaketake** e whitu ko te roa, ko te papatipu, ko te wā, ko te iahiko, ko te pāmahana wera ahupūngao, ko te rahinga matū, ko te kukū whakaputa tūrama. E whakarārangitia ana ngā **rahinga taketake** me ngā **waeine taketake**, me ā rātou tohu, ki te Tūtohi 2.

Tūtohi 2 Ngā rahinga pūtaketake me ngā waeine pūtaketake o te SI

Rahinga pūtaketake		**Tohu**	**Waeine pūtaketake**	**Tohu**
roa	length	*l, h, r, x*	mita	m
papatipu	mass	*m*	manokaramu	kg
wā	time, duration	*t*	hākona	s
iahiko	electric current	*I, i*	wae-iahiko	A
pāmahana wera ahupūngao	thermodynamic temperature	T	kelvin	K
rahinga matū	amount of substance	*n*	tīwhanga	mol
kukū whakaputa tūrama	luminous intensity	I_V	kānara	cd

Ka whakaahuatia ērā atu rahinga katoa hei **rahinga pūhua**, nā ka inea ki te **waeine pūhua**, e tautuhia hei otinga o ngā pū o ngā **waeine pūtaketake**. E whakarārangi nei ki te Tūtohi 3 ngā tauira o ngā **rahinga pūhua** me ngā **waeine pūhua**.

Tūtohi 3 He tauira o ngā rahinga pūhua me ngā waeine pūhua

Rahinga pūhua		**Tohu**	**Waeine pūhua**	**Tohu**
horahanga	area	A	mita pūrua	m^2
rōrahi	volume	V	mita pūtoru	m^3
horo	speed, velocity	v	mita ki te hākona	m/s
whakahohoro	acceleration	a	mita ki te hākona pūrua	m/s^2
tau ngaru	wavenumber	$\sigma, \tilde{\nu}$	mita taupoki	m^{-1}
kiato papatipu	mass density	ρ	manokaramu ki te mita pūtoru	kg/m^3
kiato ā-papa	surface density	ρ_A	manokaramu ki te mita pūrua	kg/m^2
rōrahi tauwhāiti	specific volume	v	mita pūtoru ki te manokaramu	m^3/kg
kiato iahiko	current density	j	wae-iahiko ki te mita pūrua	A/m^2
torokaha papa autō	magnetic field strength	H	wae-iahiko ki te mita	A/m
kukū	concentration	c	tīwhanga ki te mita pūtoru	mol/m^3
kukū papatipu	mass concentration	ρ, γ	manokaramu ki te mita pūtoru	kg/m^3
whakaputa tūrama	luminance	L_V	kānara ki te mita pūrua	cd/m^2
taupū atatāhapa	refractive index	n	kotahi	1
kaha uruhanga pānoa	relative permeability	μ_r	kotahi	1

Kia mōhio hoki, he tauira te taupū atatāhapa me te kaha uruhanga pānoa o ngā rahinga rahikore, mōna hoki ko te kotahi, 1, te waeine SI, ahakoa ehara tēnei waeine i te mea tuhi iho.

Ka hoatu anō he **ingoa motuhake** ki ētahi o ngā **waeine pūhua**, he momo whakapoto mō te whakahuanga o ngā huihuinga o ēnei **waeine pūtaketake** ka whakamahia auau noa. Nāwai, hei tauira, ko te joule, tohu J, ko tōna tikanga ko te rite o te m^2 kg s^{-2}. E 22 rawa ēnei ingoa motuhake mō ngā waeine kua whakaaetia hei whakamahitanga i roto i te SI i tēnei wā, ā, kua whakarārangitia ki te Tūtohi 4.

Tūtohi 4 Ngā waeine pūhua o te pūnaha SI me ō rātou ingoa motuhake

Rahinga pūhua		**Ingoa o te waeine pūhua**	**Tohu o te waeine**	**Tōna whaka-huanga ki ērā atu waeine**
horahanga	plane angle	tātoro (radian)	rad	$m/m = 1$
koki āhua ahu-toru	solid angle	tātoro pūrua (steradian)	sr	$m^2/m^2 = 1$
auautanga	frequency	hertz	Hz	s^{-1}
tōpana	force	newton	N	$m\ kg\ s^{-2}$
pēhanga	pressure, stress	pascal	Pa	$N/m^2 = m^{-1}\ kg\ s^{-2}$
pūngao, tōpanatanga, whakaputanga wera	energy, work, amount of heat	joule	J	$N\ m = m^2\ kg\ s^{-2}$
hiko, whakaputanga iahiko rukeruke	power, radiant flux	watt	W	$J/s = m^2\ kg\ s^{-3}$
ngaohiko, rahinga ngaohiko	electric charge, amount of electricity	coulomb	C	$s\ A$
rerekētanga ngaohiko moe	electric potential difference	wae ngaohiko	V	$W/A = m^2\ kg\ s^{-3}\ A^{-1}$
whakaputanga iahiko	capacitance	farad	F	$C/V = m^{-2}\ kg^{-1}\ s^4\ A^2$
parenga iahiko	electric resistance	ohm	Ω	$V/A = m^2\ kg\ s^{-3}\ A^{-2}$
kaha kawe hiko	electric conductance	siemens	S	$A/V = m^{-2}\ kg^{-1}\ s^3\ A^2$
whakaputanga autō	magnetic flux	weber	Wb	$V\ s = m^2\ kg\ s^{-2}\ A^{-1}$
kiato whakaputanga autō	magnetic flux density	telsa	T	$Wb/m^2 = kg\ s^{-2}\ A^{-1}$
whakaputanga iahiko o roto	inductance	henry	H	$Wb/A = m^2\ kg\ s^{-2}\ A^{-2}$
pāmahana Celsius	Celsius temperature	waeine Celsius	°C	K
whakaputanga tūrama	luminous flux	lumen	lm	$cd\ sr = cd$
rukinga tūrama	illuminance	lux	lx	$lm/m^2 = m^{-2}\ cd$
te koringa ka tāpae ki te ngota ira karihi	activity referred to a radionuclide	becquerel	Bq	s^{-1}
pota mimiti, pūngao tauwhāiti (he mea tuku), kerema	absorbed dose, specific energy (imparted), kerma	gray	Gy	$J/kg = m^2\ s^{-2}$
pota ōrite, pota karapoti ōrite	dose equivalent, ambient dose equivalent	sievert	Sv	$J/kg = m^2\ s^{-2}$
koringa whakakōkī	catalytic activity	katal	kat	$s^{-1}\ mol$

Ahakoa ōrite tahi te hertz me te becquerel ki te hākona taupoki, ka whakamahia te hertz ki ngā tītohunga porowhita, ko te becquerel ia ki ngā tukanga tūponotanga o te piraunga ira tukituki.

Ko te waeine o te pāmahana Celsius ko te waeine Celsius, °C, ko tōna rarahi ko te rite o tō te kelvin, K, te waeine o te pāmahana wera ahupūngao. Ka whakawhanaungatia te rahinga pāmahana Celsius t ki te pāmahana wera ahupūngao T mā te whārite $t/^{\circ}\mathrm{C} = T/\mathrm{K} - 273.15$.

Ko te sievert ka whakamahia hoki mō ngā rahinga o te pota ōrite ahunga, o te pota ōrite whaiaro hoki.

Ko ngā ingoa motuhake mō ngā waeine e whā whakaoti o te Tūtohi 4 i āta tangohia hei tiaki i ngā inenga e pā ana ki te hauora tangata.

Mō tēnā rahinga, mō tēnā rahinga, kotahi tonu te waeine o te SI (ahakoa whakahuatia ai ki ngā tikanga rerekē maha mā te whakamahi i ngā ingoa motuhake). Heoi anō ka taea te waeine kotahi o te SI te whakamahi hei whakahua i ngā uara o ngā rahinga rerekē maha (hei tauira, ka taea te waeine J/K o te SI te whakamahi hei whakahua i te uara o te whakaputanga wera me te piraunga ira tukituki). Nā reira, he mea nui kia kaua te waeine e whakamahia i tōna kotahi hei tāutu i tētahi rahinga. Ka tika hoki tēnei mō ngā tuhinga pūtaiao, mō ngā taputapu ine anō hoki (arā, kia tohu te pānuitanga o tētahi taputapu ine i te rahinga e hāngai ana, me te waeine).

Ko ngā rahinga rahi kore, e whakahuatia anō hei rahinga o te rahi kotahi, ka tautuhia tikanga noa hei ōwehenga o ngā rahinga e rua o te momo rite (hei tauira, ko te taupū atatāhapa ko te ōwehenga o ngā horo e rua; ko te kaha uruhanga pānoa ia, ko te ōwehenga o te kaha uruhanga o tētahi kawenga iahiko matarua ki tō te ātea noa). Nā reira ko te waeine o tētahi rahinga rahi kore ko te ōwehenga o ngā waeine SI e rua rite pū, nō reira ka ōrite ki te kotahi i ngā wā katoa. Heoi anō, ina whakahuatia ngā uara o ngā rahinga rahi kore, kāore e tuhia te waeine kotahi, te 1.

Ngā taurea whaiira me ngā taurea-iho o ngā waeine SI

Kua whakaaetia he huinga arohere hei whakamahi tahi me ngā waeine SI, e āhei ai te whakahua i ngā uara o ngā rahinga e tino nui ake ana, e tino iti ake ana rānei i te waeine SI arohere kore. Ina tāpiritia te arohere ki mua o te waeine matua (arā, te aromauī), koirā ngā waeine nui ake. Ina tāpiritia te arohere ki muri o te waeine matua (arā, te aromatau), koirā ngā waeine iti iho. E whakarārangitia ana ēnei arohere SI ki te Tūtohi 5. Ka taea ēnei te whakamahi tahi me te katoa o ngā waeine **pūtaketake**, me te katoa hoki o ngā **waeine pūhua** whai ingoa motuhake.

Taurea	Ingoa	Tohu	Taurea	Taurea	Taurea
10^{1}	deca	da	10^{-1}	deci	d
10^{2}	hecto	H	10^{-2}	centi	c
10^{3}	kilo	K	10^{-3}	milli	m
10^{6}	mega	M	10^{-6}	micro	µ
10^{9}	giga	G	10^{-9}	nano	n
10^{12}	tera	T	10^{-12}	pico	p
10^{15}	peta	P	10^{-15}	femto	f
10^{18}	exa	E	10^{-18}	atto	a
10^{21}	zetta	Z	10^{-21}	zepto	z
10^{24}	yotta	Y	10^{-24}	yocto	y

Ina whakamahia ngā arohere, ka whakakotahitia te ingoa arohere me te ingoa waeine kia kupu kotahi, ā, rite tonu ki tēnei ka tuhia āputa kore ai te tohu arohere me te tohu waeine kia kotahi te tohu, he mea ka taea tonu te whakarea ake mā tētahi pū, ahakoa. Hei tauira, ka taea e tātou te tuhi: manomita (kiromita rānei), km; mitamano, mm; hākonafemto, fs; 50 V/cm = 50 V $(10^{-2}\,\mathrm{m})^{-1}$ = 5000 V/m.

Ina whakamahia arohere kore ai ngā **waeine pūtaketake** me ngā **waeine pūhua**, ka whakaahuatia te huinga waeine ka puta hei mea pipiri. He huanga hangarau tā te whakamahinga i te huinga waeine pipiri (tirohia te Puka Whakamārama SI). Heoi anō, he mea pai tonu te whakamahi i ngā arohere, nō te mea mā konei ka āraia te tikanga whakamahi i ngā taurea o te 10^{n} hei whakahua i ngā uara o ngā rahinga tino nui rawa, tino iti rawa rānei. Hei tauira, whakahuatia ngāwaritia noa ake ai te roa o tētahi hononga matū ki te mitanano, mn, mahue ia ki te mita, m, pērā anō hoki te tawhiti mai i Rānana ki Parihi, whakahuatia ngāwaritia noa ake ai ki te manomita, mm (km), mahue ia ki te mita, m.

Ko te manokaramu, kirokaramu rānei (kg) tētahi mea awere, nō te mea ahakoa he **waeine pūtaketake** kei roto kē i tōna ingoa tētahi arohere, he mea heke mai nō nehe rā anō. Ko ngā taurea me ngā taurea-iho o te manokaramu ka tuhia mā te whakakotahi i ngā arohere ki te karamu: nāwai tuhi ai tātou i te karamumano (milligram, mg), ehara i te manokaramumano (microkilogram), µkg.

Ngā waeine i waho tonu o te pūnaha SI

Ko te SI anake te pūnaha waeine kei te whakaaetia ā-aotia, nāwai kei a ia te tino huanga ki te whakaū i te kōrerorero tahi ā-ao. Ko ētahi atu momo waeine, arā, ngā mea ehara i te SI, ka tautuhia tikanga noa ai ki te āhua o ngā waeine SI. Mā te whakamahinga i te pūnaha SI ka ngāwari ake te whakaakoranga pūtaiao. Mō ēnei take kei te whakahauhia kia whakamahia ngā waeine SI ki ngā pekanga katoa o te pūtaiao, o te hangarau.

Hāunga tērā, kei te whakamahia whānuitia tonu ētahi waeine ehara i te waeine SI. Ko ētahi, pēnei i te meneti, te haora me te rā hei waeine o te wā, ka whakamahia ake tonu atu nō te mea kua hōhonu rawa te titi ki tō tātou ahurea. Ko ētahi anō, kei te whakamahia mō ngā take hītori, hei whakatutuki i ngā wawata o ētahi rōpū whakaaro motuhake, nō te mea rānei kāore he mea pai kē a te SI. Ka noho tonu hei mana motuhake mā te tohunga pūtaiao te whiriwhiri i ngā waeine e tino rite ana mō tōna kaupapa. Heoi anō, ina whakamahia ngā waeine ehara i te SI, kia whakahuatia anō tāna huri-nga ki te tikanga SI. Kua whakarārangitia ki te Tūtohi 6 i raro nei ētahi waeine ehara i te SI me ā rātou tau huringa ki te tikanga SI. Mō tētahi rārangi whānui ake, tirohia te Puka Whakamārama SI, te paetukutuku a te BIPM rānei.

Tūtohi 6 Ētahi waeine ehara i te SI

Rahinga		Waeine	Tohu	Huringa ki te SI
wā	time	meneti	min	1 min = 60 s
		haora	h	1 h = 3600 s
		rā	d	1 d = 86 400 s
rōrahi	volume	rita	L or l	1 L = 1 dm^3
papatipu	mass	tana	t	1 t = 1000 kg
ahupūngao	energy	irahiko waengaohiko (electronvolt)	eV	1 eV≃1.602 x 10^{-19} J
pēhanga	pressure	pae	bar	1 bar = 100 kPa
		mitamano konuoi	mmHg	1 mmHg≃133.3 Pa
roa	length	ångström	Å	1 Å = 10^{-10} m
		maero moana (nautical mile)	M	1 M = 1852 m
tōpana	force	taina (dyne)	dyn	1 dyn = 10^{-5} N
ahupūngao	energy	ereke (erg)	erg	1 erg = 10^{-7} J

Tīmata ai ngā tohu waeine ki te pūmatua ina whakaingoatia i muri i tētahi tangata (hei tauira, ampere, A; kelvin, K; hertz, Hz; coulomb, C). Ki te kore ka tīmata ki te pūriki (hei tauira, mita, m; hākona, s; tīwhanga, mol). Ko te tohu rita anake te mea awere: ka taea he pūriki, he pūmatua L rānei, ka tukua hoki te pūmatua L kei pōraruraru te tangata i waenganui i te pūriki l me te tau kotahi, 1. Ko te tohu mō te maero moana ka homai ki konei ko te M; heoi anō, kāore he whakaaetanga whānui ki tētahi tohu mō te maero moana.

Te reo pūtaiao:
te whakamahi i te SI hei whakahua i ngā uara rahinga

Ka tuhia te uara o tētahi rahinga hei whakaotinga o tētahi tau me tētahi waeine, nā, ko te tau e whakarea ki taua waeine te uara ā-tau o te rahinga o taua waeine. Ka mahue he wāhi ātea kotahi i waenganui i te tau me te waeine i ngā wā katoa. Mō ngā rahinga rahi kore, mōna nei ko te kotahi te waeine, ka waiho atu te waeine. Hei runga tonu i te waeine kua kōwhiria te uara ā-tau, nā reira ahakoa rite te uara rahinga tērā e rerekē pea ngā uara ā-tau ki te whakahuatia ki ngā waeine rerekē, pēnei i ēnei tauira i raro nei.

Ko te horo āwhiwhi o tētahi pahikara ko
v = 5.0 m/s = 18 km/h.
Ko te roangaru o tētahi rārangi konutai kōwhaiwhai ko
$\lambda = 5.896 \times 10^{-7}$ m = 589.6 nm.

Ka tāngia tītahatia ngā tohu rahinga, otirā, ko te tikanga he pū kotahi anō ēnei o te arapū Ratini, arapū Kariki rānei. Ka taea ngā pūmatua, pūriki rānei te whakamahi, ā, ka taea hoki ētahi atu kōrero mō te rahinga te tāpiri hei kupu hauraro, hei kupu whakataiapa rānei.

Arā noa ētahi tohu e whakahaua ana mō ētahi rahinga nunui, he mea homai nā ngā mana pēnei i te ISO (te Whakahaere Whakamana Waeine ā-Ao) me ngā ūniana rōpū ā-ao maha noa, pērā i te IUPAP me te IUPAC. Ko ētahi tauira ko:

T	mō te pāmahana
C_p	mō te kahapupuri wera i tētahi pēhanga aumou
x_i	mō te hautanga tīwhanga (nuinga hautanga) o te momo i
μ_r	mō te kaha uruhanga pānoa
$m(K)$	mō te papatipu o te tauira taketake ā-ao o te manokaramu, K

Ka tuhia rōmanatia (tika tonu) ngā tohu waeine, ahakoa te momotuhi kei te whakamahia ki ērā atu tuhinga tawhio noa. He tikanga pāngarau hoki ēnei, ehara i te whakapotonga noa iho; kore kau hoki e tuhia me te irakati i muri (hāunga ia i te mutunga o te rerenga kōrero), kore kau anō te pū s mō ngā mea takitini. He mea āta whakahau anō kia tika tonu te whakamahi i ngā tohu waeine, ā, e whakaahuatia ana ki ētahi tauira i te **Puka Whakamārama SI**. Tērā e nui ake pea i te pū kotahi te tohu waeine. Ka tuhia ki te pūriki, engari he pūmatua te pū tuatahi ina kua tapaina te waeine mō tētahi tangata. Heoi anō, ki te tuhia ā-katoatia te ingoa waeine, kia tuhia ki te pūriki (hāunga rā kei te tīmatanga ia o te rerenga kōrero), kia wehewehea te waeine i te tangata.
Ina tuhia te uara o tētahi rahinga hei whakaotinga o tētahi uara ā-tau me tētahi waeine, ka taea tonu kia whakamahia te tau me te waeine i runga i ngā tikanga taurangi. Hei tauira, ka taea tonu te whārite T = 293 K kia tuhia kia T/K = 293. Whakaahuatia ai tēnei tukanga ko te whakamahinga o te rahinga tuanaki, te taurangi o ngā rahinga rānei. He pai tonu hei ūpoko mō ngā tūtohi, hei tapa i ngā tuaka kauwhata rānei, e noho ai hei tau noa ngā tuhinga ki te tūtohi, ngā tohu ki ngā tuaka rānei. Kei te tauira i raro nei he tūtohi o te pēhanga tākohu anō he pānga pāmahana, ā, ko te taupū kōaro o te pēhanga tākohu anō he pānga o te pāmahana taupoki, me te mea hoki kua pēnei anō te tapanga o ngā pou.

T/K	$10^3\ \mathrm{K}/T$	p/MPa	$\ln(p/\mathrm{MPa})$
216.55	4.6179	0.5180	−0.6578
273.15	3.6610	3.4853	1.2486
304.19	3.2874	7.3815	1.9990

Ka taea tonu ngā āhua taurangi ōrite te rahi te whakamahi hei whakakapi mō te $10^3\ \mathrm{K}/T$, pēnei i te kK/T, te $10^3\ (T/\mathrm{K})^{-1}$ rānei.

Ka haere tonu ngā whakaritenga tikanga noa o te taurangi ina hangaia he otinga whakarea, otinga wehe rānei o ngā waeine. Ina hangaia he otinga o ngā waeine, kia waiho he wāhi ātea i waenganui i ngā waeine (tērā anō rānei e taea te whakamahi he pū haurua tiketike ki waenga hei tohu whakareanga). Kia mahara ki te nui o te wāhi ātea, hei tauira, e tohu ana te m s i te otinga o te mita me te hākona, engari he hākonamano kē te ms. Waihoki, ina hangaia ngā otinga waeine whīwhiwhi, whakamahia he taiapa, he pū tōraro rānei kia kore ai e whakapōauautia te tangata. Hei tauira, ka homai te tau pūmau titiwha hau R mā te:

$$pV_m/T = R = 8.314\ \mathrm{Pa\ m^3\ mol^{-1}\ K^{-1}}$$
$$= 8.314\ \mathrm{Pa\ m^3/(mol\ K)}$$

Ina whakatakoto i ngā tau ka taea te tohu whaiira te tuhi hei ira, hei piko rānei, tēnā e tika ana mō aua āhuatanga. Mō ngā tuhinga i te reo Ingarihi ko te ira te tikanga, heoi mō ētahi reo maha o Ūropi me ētahi atu whenua ko te piko te tikanga.

Ki te nui ngā mati o tētahi tau, ko te tikanga kia whakarōpūtia ngā mati kia takitorutia ki tēna taha, ki tēnā taha o te ira, kia ngāwari ai te kōrero. Ehara i te mea kia pēnei rawa, engari auau noa te pēneitanga, otirā he tikanga āwhina tonu tēnei. Ki te pēnei rawa, kia wehea ngā whakarōpū mati takitoru mā tētahi wāhi ātea (he mea whakawhāiti), kia kaua anō te kopi, te piko rānei e whakamahi. Ka taea te warawaratanga o te uara ā-tau o tētahi rahinga te whakaatu pai noa mā te hoatu i te warawaratanga o ngā mati tāpua iti rawa ki ngā taiapa i muri i te tau.

Hei tauira: Ko te uara pūngao pūmotu kua homai ki te rārangi 2002 CODATA o ngā tau pūmau taketake ko

$$e = 1.602\ 176\ 53\ (14) \times 10^{-19}\ \mathrm{C},$$

ko te 14 te warawara whānui i ngā mati whakaoti kua homai mō te uara ā-tau.

Mō ētahi atu pārongo, haere ki te paetukutuku BIPM, tirohia rānei te **Puka Whakamārama SI tānga 8**, e wātea ana i **www.bipm.org/en/si**.

Nā te Komiti Tohutohu mō ngā Waeine (Comité Consultatif des Unités - CCU) o te Komiti ā-Ao mō ngā Taumaha me ngā Inenga (Comité International des Poids et Mesures – CIPM) tēnei whakarāpopototanga i whakariterite, ā, nā te BIPM i tā.

Poutūterangi 2006
Ernst Göbel, Perehitini o te CIPM
Ian Mills, Perehitini o te CCU
Andrew Wallard, Mana hautū o te BIPM

He mea tuhi ēnei kōrero i runga i te whakaaetanga mai a te BIPM, kei a ia anō te manatā-ā-ao e pūmau tonu ana. Kāore te BIPM e whakaae kia herea ia mō te hāngaitanga, te tika, te otinga, te kounga rānei o ngā kōrero e takoto ana i tēnei whakamāoritanga, i tētahi atu rānei. Ko te tuhinga whai mana anake ko tērā i tuhia ki te reo Wīwī i te tuhinga taketake nā te BIPM anō i waihanga.