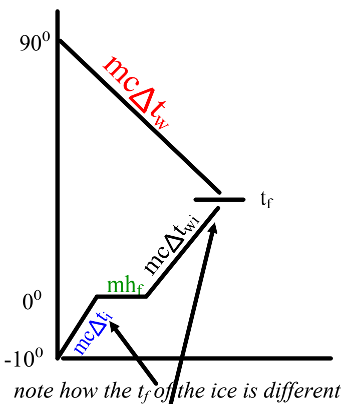
100.0 g of ice at -10.0° C is placed in 1.00 kg of water at 90.0° C. What is the final temperature of the mixture?

Mar 20-7:32 AM

100.0 g of ice at -10.0° C is placed in 1.00 kg of water at 90.0° C. What is the final temperature of the mixture?



note how the t_f of the ice is different then the t_f of water that came from ice

We have two substances in thermal contact.
The Law of Heat Exchange governs thermal contact.

$Q_{lost} + Q_{gained} = 0$

What losses and what gains TE

Δt_w ... change in "t" of *water*

Δt_i ... change if "t" of *ice*

Δt_{wi} ... change in "t" of water that came from ice

Mar 20-7:24 AM

100.0 g of ice at -10.0° C is placed in 1.00 kg of water at 90.0° C. What is the final temperature of the mixture?

$$Q_L + Q_g = 0$$

$$mc\Delta t_w + mc\Delta t_i + mh_f + mc\Delta t_{wi} = 0$$

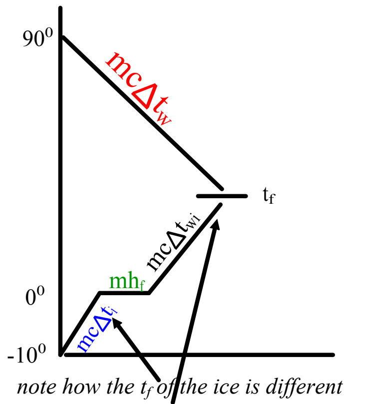
$$mc\Delta t_w + mc\Delta t_{wi} = -mc\Delta t_i - mh_f$$

$$mct_{fw} - mct_{iw} + mct_{fwi} - mct_{iwi} = -mc\Delta t_i - mh_f$$

$$mct_{fw} + mct_{fwi} = -mc\Delta t_i - mh_f + mct_{iw} + mct_{iwi}$$

$$t_f(mc_w + mc_{wi}) = -mc\Delta t_i - mh_f + mct_{iw} + mct_{iwi}$$

$$t_f = \frac{-mc\Delta t_i - mh_f + mct_{iw} + mct_{iwi}}{(mc_w + mc_{wi})}$$



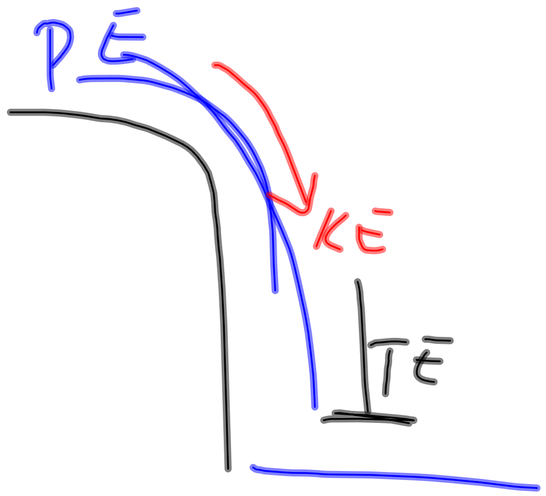
note how the t_f of the ice is different then the t_f of water that came from ice

$$t_f = \frac{-.10\text{ kg}(2060\text{ J/kgC})10^\circ\text{C} - .10\text{ kg}(3.34\text{X}10^5\text{ J/kg}) + 1\text{ kg}(4180\text{ J/kgC})90.0^\circ\text{C}) + .10\text{ kg}(4180\text{ J/kgC})0^\circ\text{C}}{((1\text{ kg}(4180\text{ J/kgC}) + .10\text{ kg}(4180\text{ J/kgC}))}$$

$$t_f = 74.1^\circ\text{ C}$$

Mar 26-7:26 AM

How much of a change in temperature does water experience if it falls from 55.0 m and 50.0% of the potential energy converts to thermal energy?



Mar 27-5:45 AM

How much of a change in temperature does water experience if it falls from 55.0 m and 50.0% of the potential energy converts to thermal energy?

$PE = Q$

$mgh = mc\Delta t$ *m's cancel*

$\Delta t = gh/c$

$\Delta t = (9.81\ m/s^2 \times 55.0\ m)/4180\ J/kg\ C$

$\Delta t = .129^{o}\ C$ $50.0\% = 0.0645^{o}\ C$

Mar 27-5:47 AM

A 37.5 g lead bullet traveling at 445 m/s strikes a tree and 35.0% of the KE is converted to TE. What is the change in temperature of the bullet?

Mar 27-6:00 AM

A 37.5 g lead bullet traveling at 445 m/s strikes a tree and 35.0% of the KE is converted to TE. What is the change in temperature of the bullet?

KE = Q

$\frac{1}{2}mv^2 = mc\Delta t$ *m's cancel*

$\Delta t = v^2/2c$

$\Delta t = (445\ m/s)^2/(2 \times 130.\ J/kg\ C)$

$\Delta t = 761\ ^0C$ 35.0% = 267^o C

Mar 27-5:54 AM

What is the "c" of your skin if you're running at 9.30 km/hr and you trip and fall and your "knee skin" increases in temperature 22.0^o C? The mass of your "knee skin" is 44.5 g and your mass is 65.0 kg.

Mar 27-6:00 AM

What is the "c" of your skin if you're running at 9.30 km/hr and you trip and fall and your "knee skin" increases in temperature 22.0^o C? The mass of your "knee skin" is 44.5 g and your mass is 65.0 kg.

KE = Q

$\frac{1}{2}mv^2_y = mc\Delta t_s$ *m's cancel*

$c = m_y v^2/(2m\Delta t_s)$ body is moving(KE)

knee skin Δt

$c = 65.0\ kg(2.58\ m/s)^2/[2(.0445\ kg)22.0^0C]$

c = 221 J/kg C

Mar 27-6:36 AM

What is the power rating of a heater that changes 45.0 liters of water at 17.0^o C in a 15.0 kg glass fish tank to 22.0^o C in 3.5 hours?

Mar 27-6:42 AM

What is the power rating of a heater that changes 45.0 liters of water at 17.0^o C in a 15.0 kg glass fish tamk to 22.0^o C in 3.5 hours?

1 liter of H_2O = 1 kg of mass

$P = W/t$, *or* $P = E/t$, *or* $P = Q/t$

What gains TE?...both the water and the glass

$P = (mc\Delta t_y + mc\Delta t_s)/t$

$P = ((45.0 \text{ kg} \times 4180 \text{ J/kg C} \times 5.0^o \text{ C}) + (15.0 \text{ kg} \times 664 \text{ J/kg C} \times 5.0^o\text{C}))/12600 \text{ s}$

$P = 79^o$ W

Mar 27-6:44 AM