IB: Heat Exchange & Calorimetry Day 3 4/18/17

Thermal Inertia: Ability of an object to resist changes in temperature

- Thermal Inertia depends on mass and the specific heat capacity
- Thermal Inertia = mass × specific Heat

Conservation of Energy

Heat gained by one substance should equal the heat lost by the other substance

Ques: Calc. the final temp of 100g of wat @ 80°C is mixed with 200g of a substance @ 20°C with 1/4 the specific heat capacity

Heat lost by Wat = Heat gained by other

$mc|\Delta T| = mc|\Delta T|$

$100\,g\,(1\,cal/g°C)(80 - T_f) = 200\,(1/4)(T_f - 20)$

Write $(80 - T_f)$ because we want a positive Ans $T_f < 80$

Write $(T_f - 20)$ because we want a positive answer $T_f > 20$

$100(80 - T_f) = 50(T_f - 20)$

$T_f = 60$

Specific Heat J/kg °C

| | | Heat of Fusion | Heat of Vaporization |
|---|---|---|---|
| Water (ICE) | 2100 | | |
| (Liquid) | 4186 | $L_f$ | $L_v$ |
| (Vapor) | 2010 | $3.33\times10^5$ J/kg | $22.6\times10^5$ J/kg |

- Both Examples go over

Example 1 How much energy does a refrig have to remove from 1.5 kg of water @ 20°C to make ice @ -12°C

(20°C) Water → $H_f$ → ICE (-12°C)

$Q = mc|\Delta T| + mL_f + mc|\Delta T|$

$Q = 1.5(4186)(20°C - 0°C) + 1.5\,kg(3.33\times10^5\,J/kg) + 1.5\,kg(2100)(0 - -12°$

$125,580 + 499,500 + 25,201$

$Q = 650,281$ J or 650 KJ

- Not on video

Example 2 A .5kg ice cube @ -10°C is put in 3kg of wat @ 20°C
At what temp will the final mixture be?

-10 to 0 $H_f$ → 0 to $T_f$ Water =

.5kg ICE Cube → Water (3kg)

$mc|\Delta T| + mL_f + mc|\Delta T| = mc|\Delta T|$

$.5(2100)(0 - -10°C) + .5(3.33\times10^5)(.5)(4186)(T_f - 0) = 3(4186)(20 - T_f$

$10,500 + 166,500 + 2093T_f = 251,160 - 1255T_f$

$\frac{14,651\,T_f}{14,651} = \frac{74,160}{14,651}$

$T_f = 5.06$ or $T_f = 5.1°C$