[TP] [Exercise 6.2] It takes 20.0 s to heat 1.00 kg of water from 25 °C to 75 °C. To heat the same mass of ethanol from 25 °C to 50. °C it would take

20% 1. about 5 s
20% 2. about 10 s
20% 3. about 20 s
20% 4. about 40 s
20% 5. about 80 a

Substance	c (J K^{-1} g^{-1})
Water, $H_2O(\ell)$	4.18
Ethanol, $C_2H_5OH(\ell)$	2.44
Diethyl ether, $C_2H_5OC_2H_5(\ell)$	2.37
Hexane, $C_6H_{14}(\ell)$	2.27
Acetone, $CH_3COCH_3(\ell)$	2.17
Carbon disulfide, $CS_2(\ell)$	1.00
Bromine, $Br_2(\ell)$	0.47

Lecture 13 CH101 A1 (MWF 9:05 am)

Wednesday, October 3, 2018

For today ...

Begin ch6: Chemical of water, chemistry in water
- Heat versus temperature
- Heat capacity
- Vapor pressure and boiling

Next lecture: intermolecular forces; hydrogen bonding; polarity; dipole-dipole vs. temporary dipole (dispersion)

Representative questions: 6.1, 6.2, 6.3, 6.4, 6.9, 6.12, 6.17, 6.19, 6.22, 6.23

Heat versus temperature

We use qualitative terms to describe these phenomena...

"It's hot in here!"
"That fire is giving off a lot of heat!"
"I had a temperature, so I felt awful."
"The water's temperature is too hot."

Is our skin ...

a heat sensor or ...
a temperature sensor (thermometer)?
Let's see ...

Heat versus temperature

Conclusion: Skin is sensitive to ...

energy transfer rather than temperature

Heating is energy transfer to an object
Cooling is energy transfer from an object

Temperature is a measure energy stored as internal motion.

Specific heat capacity

Moving hand from cold water (0 °C) to warm water (20 °C), sensation was "hot"

Moving hand from hot water (40 °C) to warm water (20 °C), sensation was "cold"

How to express results in terms of temperature?

Answer: "heat" ΔH = constant × ($T_{\text{final}} - T_{\text{initial}}$) = constant × ΔT

constant = heat capacity = mass × specific heat capacity

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Specific heat capacity

ΔH = constant × ($T_{\text{final}} - T_{\text{initial}}$) = constant × ΔT

constant = mass × specific heat capacity

$\Delta H = m\, c\, \Delta T$

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[TP] [Exercise 6.2] It takes 20.0 s to heat 1.00 kg of water from 25 °C to 75 °C. To heat the same mass of ethanol from 25 °C to 50. °C it would take …

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Exercise 6.2: Heating

It takes 20.0 s to heat 1.00 kg of water from 25 °C to 75 °C. To heat the same mass of ethanol from 25 °C to 50. °C it would take …

Energy = Watts × Time = $m\, c\, \Delta T$

Since the c of ethanol is about half that of water and ΔT of ethanol is about half that of water, about a quarter of the energy is needed, and so about one quarter of the time.

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[TP] From e6.4 (p 163): A bubble in a pot of boiling water contains...

17% 1. Only $O_2(g)$ and $N_2(g)$
17% 2. Only $H_2O(g)$
17% 3. Only air
17% 4. $H_2O(g)$ and air
17% 5. All of the above equally
17% 6. None of the above

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Liquid-vapor equilibrium

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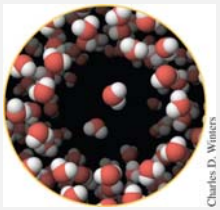
Boiling: Fig 6.7, p 164

Boiling means "bubbles"

Bubbles are pure vapor of the liquid



Substance	Equilibrium Vapour Pressure (kPa)
Water, $H_2O(\ell)$	3.17
Ethanol, $C_2H_5OH(\ell)$	7.87
Hexane, $C_6H_{14}(\ell)$	20.2
Bromine, $Br_2(\ell)$	28.7
Acetone, $CH_3COCH_3(\ell)$	30.8
Carbon disulfide, $CS_2(\ell)$	48.2
Diethyl ether, $C_2H_5OC_2H_5(\ell)$	71.7

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