

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

17% 1. Only $O_2(g)$ and $H_2(g)$
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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Lecture 12 CH101 A1 (MWF 9:05 am)

Wednesday, October 4, 2017

For today …
- Review: Limiting reagent and percent yield

Begin ch6
- Hydrogen bonding in ice and water
- Heat versus temperature
- Heat capacity

Next lecture: Vapor pressure and boiling; Intermolecular forces: Hydrogen bonding; dipole-dipole interaction (polarity); temporary dipole attraction (dispersion); relative boiling points

Limiting reagent

Balanced chemical equation is the "recipe"

$2\ A + B \rightarrow 2\ C$

8 mol A and 5 mol B react to form 6 mol C.

What is the limiting reagent?

What is the percent yield?

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Limiting reagent

Balanced chemical equation is the "recipe"

$2\ A + B \rightarrow 2\ C$

Amount we can make depends on how much "ingredients"

	A	B	C
Start	8	5	0

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Limiting reagent

Balanced chemical equation is the "recipe"

2 A + B → 2 C

Amount we can make depends on how much "ingredients"

	A	B	C
Start	8	5	0
Reaction	−6	−3	+6

Limiting reagent

Balanced chemical equation is the "recipe"

2 A + B → 2 C

Amount we can make depends on how much "ingredients"

	A	B	C
Start	8	5	0
Reaction	−6	−3	+6
Actual Finish	2	2	6

Limiting reagent

Balanced chemical equation is the "recipe"

2 A + B → 2 C

Amount we can make depends on how much "ingredients"

	A	B	C
Start	8	5	0
Reaction	−6	−3	+6
Actual Finish	2	2	6
Maximum Finish	0	1	8

Limiting reagent

Balanced chemical equation is the "recipe"

2 A + B → 2 C

Amount we can make depends on how much "ingredients"

	A	B	C
Start	8	5	0
Reaction	−6	−3	+6
Actual Finish	2	2	6
Maximum Finish	0	1	8

Yield = 100% × (actual/maximum) = 100% × (6/8) = 75%

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[Quiz] Substances A and B combine to form substance C in the balanced chemical equation

$A + 3\,B \rightarrow 2\,C$

8 mol A and 5 mol B react to form 2 mol C. The % yield is ...

20% 1. 100%
20% 2. 75%
20% 3. 60%
20% 4. 40%
20% 5. None of these

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Response Counter 10

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H-bonding in ice and water

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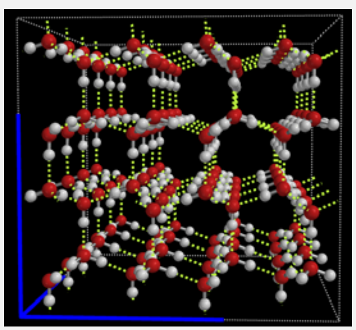
Ice and water



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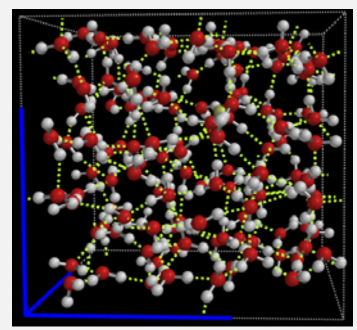
Ice and water



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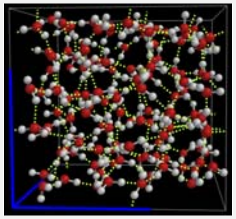
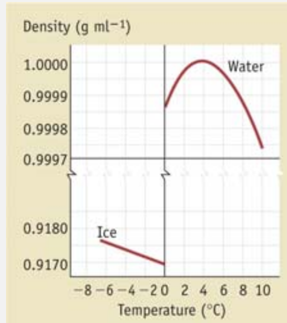
Effect of T on water density

Why does the density rise from 0 °C to 4 °C?

Why does the density fall from 4 °C to higher temperatures?





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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 …

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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.

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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 = mass × specific heat capacity

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Specific heat capacity

$\Delta H = \text{constant} \times (T_{\text{final}} - T_{\text{initial}}) = \text{constant} \times \Delta T$

constant = mass × specific heat capacity

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

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

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