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Course 565/665 Lecture Number ______ Date 4/18/03

Lecturer Dr. Silvia Cavagnero Note Taker Eric Fulmer

Last Time

Math Review: Vector Analysis

$$\vec{\nabla} = \left(\frac{\partial}{\partial x}\right)\hat{i} + \left(\frac{\partial}{\partial y}\right)\hat{j} + \left(\frac{\partial}{\partial z}\right)\hat{k}$$

gradient operator (also known as "grad" or "del")

But Wait: Some Problem Set Business.

Typo in Problem 15.5

$\Delta S_{dissolving} = -14 \text{ cal/mol K}$ (Negative, not positive)

$$\boxed{\Delta S_{diss.} = \underbrace{\Delta S_{mixing}}_{\text{Always Positive}} + \Delta S_{interaction}}$$

hydrophobic, etc.

In a show of democracy, the schedule of the course was changed. The new schedule is the following.

- Friday April 25 Review Lecture
- Monday April 28 Energy Landscape Lecture.
- Tuesday April 29 No Class – Exam II

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Exam II. Chapters 10-19 (Skipping the chapters that we skipped. The format of the exam will be the same as the first.

Textbook Evaluation (Improvement Comments and Typos) due on the final day of class (May 9). 1-3 ex. cr.

The $\vec{\nabla}$ can be applied to both scalars (numbers with no directionality) or vectors (quantities with a specific direction or orentiation).

$$\vec{\nabla} T = \left(\frac{\partial T}{\partial x}\right)\hat{i} + \left(\frac{\partial T}{\partial y}\right)\hat{j} + \left(\frac{\partial T}{\partial z}\right)\hat{k}$$

$$\vec{\nabla}\cdot\vec{M} = \left[\left(\frac{\partial}{\partial x}\right)\hat{i} + \left(\frac{\partial}{\partial y}\right)\hat{j} + \left(\frac{\partial}{\partial z}\right)\hat{k}\right]\cdot\left[M_x\hat{i} + M_y\hat{j} + M_z\hat{k}\right]$$

$$= \left(\frac{\partial M_x}{\partial x}\right) + \left(\frac{\partial M_y}{\partial y}\right) + \left(\frac{\partial M_z}{\partial z}\right)$$

$\hat{i}\cdot\hat{i} = 1$ like unit vectors: dot product = 1

$i\cdot j = 0$ unlike, orthogonal unit vectors; dot product = 0

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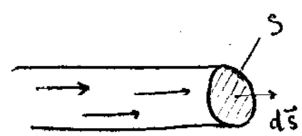
Laplacian Operator (∇^2)

$$\nabla^2 = \vec{\nabla} \cdot \vec{\nabla} = \left| \vec{\nabla}^2 \right| = \frac{\partial^2}{\partial x^2} + \frac{\partial^2}{\partial y^2} + \frac{\partial^2}{\partial z^2}$$ (scalar, not vectorial)

Flux (the flowing of material through a space or in/out of an area). "J"



$$J = \int_{\text{surface}} \vec{v} \cdot d\vec{s}$$

Note, for a closed surface, $J > 0$ if it points outwards from the surface, and $J < 0$ if it points inwards

Gauss Theorem

$$\int_{\text{close surface}} \vec{v} \cdot d\vec{s} = \int \nabla \cdot \vec{v} \, d\vec{v}$$

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Physical Kinetics (Chapter 18)

Kinetics ⟶ κινεσις (Motion) Away from Equilibrium.

At equilibrium:

$A \rightleftharpoons B$

- No Concentration Gradients of A, B vs. Time or Space.

Kinetics
- Concentration gradient vs. space and/or time.

Concentration Gradients as a function of Space

J ≡ amount of material passing per unit time (per unit surface/area).

Material ≡ # of molecules, mass, volume, of all molecules...

Flux ∝ Velocity of the Flow (proportional to)