LECTURE

1

CY11001
Spring 2018

Introduction

- Course introduction
- Introduction: Basic Concepts, Definitions

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Ground Rules for the Class:

- Switch off mobile phones
- Attendance in the lectures and tutorials will be closely monitored
- Vast syllabus and fast paced, must take classes seriously
- You can always approach me after the class in my office or by Email

Course Moodle Page

Find Lectures, Tutorials, and Other Information @
http://10.57.2.100/moodle/login/index.php

moodle.helpdeskiitkgp@gmail.com

CLASS SCHEDULE:

Sections 15 & 16

Phys Chem: Jan 3 to Feb 1 = 13 hours

Inorg Chem: Feb 2 to Mar 14 = 13 hours

Org Chem: Mar 15 to Apr 13 = 13 hours

Lectures: at NR221

Wed 1100–1155
Thu 1200–1255
Fri 0800-0855

Wed	Thu	Fri
Jan 3	Jan 4	Jan 5
Jan 10	Jan 11	Jan 12
Jan 17	Jan 18	Jan 19
Jan 24	Jan 25	Jan 26
Jan 31	Feb 1	

Tutorial

Wednesday 3 – 4 PM

Section	From	To	Room	TA
Section 15A	17AE10007	17EX20015	NC241	Ms. Sultana Parveen
Section 15B	17EX20031	17QD30014	NC242	Dr. Dipankar Mondal
Section 16A	17AE10008	17EX20032	NC243	Mr. Vipin Mishra
Section 16B	17GG20028	17PH20038	NC244	Ms. Anurupa Maiti

Distribution of Marks:

Mid Sem (Only Physical Chemistry): 30

End Sem (Inorganic & Organic Chemistry): 50

TA: 20
Physical Chemistry (6), Inorganic Chemistry (7), Organic Chemistry (7)

Physical Chemistry: TA marks to be based on Online Quiz on Jan 31, 2018 (~6 PM)

Weekly (practice) Online Quizzes (Every Tuesday 7 PM to 9 PM)

Books:

Atkin's Physical Chemistry by *Atkins & de Paula*
Physical Chemistry by *Levine*

Course outline

Physical Chemistry

- Essential concepts and definitions in Thermodynamics
- Revision: heat, work & energy; Real gas
- First Law of Thermodynamics
- The Second Law of Thermodynamics, Entropy
- Gibbs Free Energy
- Chemical Potential
- Phase and Reaction Equilibria
- Electrochemistry
- Chemical Kinetics

Table A1.1 The SI base units

Physical quantity	Symbol for quantity	Base unit
Length	*l*	metre, m
Mass	*M*	kilogram, kg
Time	*t*	second, s
Electric current	*I*	ampere, A
Thermodynamic temperature	*T*	kelvin, K
Amount of substance	*n*	mole, mol

Table A1.2 A selection of derived units

Physical quantity	Derived unit*	Name of derived unit
Force	$1\ \text{kg m s}^{-2}$	newton, N
Pressure	$1\ \text{kg m}^{-1}\text{s}^{-2}$	pascal, Pa
	$1\ \text{N m}^{-2}$	
Energy	$1\ \text{kg m}^{2}\text{s}^{-2}$	joule, J
	1 N m	
	$1\ \text{Pa m}^{3}$	

Table A1.4 Some common units

Physical quantity	Name of unit	Symbol for unit	Value*
Volume	litre	L, l	$1\ dm^3$
Mass	tonne	t	$10^3\ kg$
Pressure	bar	bar	$10^5\ Pa$
	atmosphere	atm	101.325 kPa

Thermodynamics

- The study of the transformations of energy (work, heat, energy and their effect on the state of the system). Concerned with equilibrium positions of systems.

- Provides a framework of relating the ***macroscopic*** properties of a system to one another.

- Our discussions will be restricted to equilibrium thermodynamics which deals with systems in equilibrium.

SOME BASIC CONCEPTS:

- ☐ **Thermodynamic System – Open, Closed, Isolated**
- ☐ **Surroundings**
- ☐ **Boundary / Wall**
  - Rigid and Nonrigid (movable)
  - Permeable and Impermeable
    (no matter is allowed to pass through it)
  - Adiabatic and Nonadiabatic
    (diathermic boundary –
    permits the passage of energy as heat)

A system surrounded by a rigid, impermeable, adiabatic wall – **Isolated system**

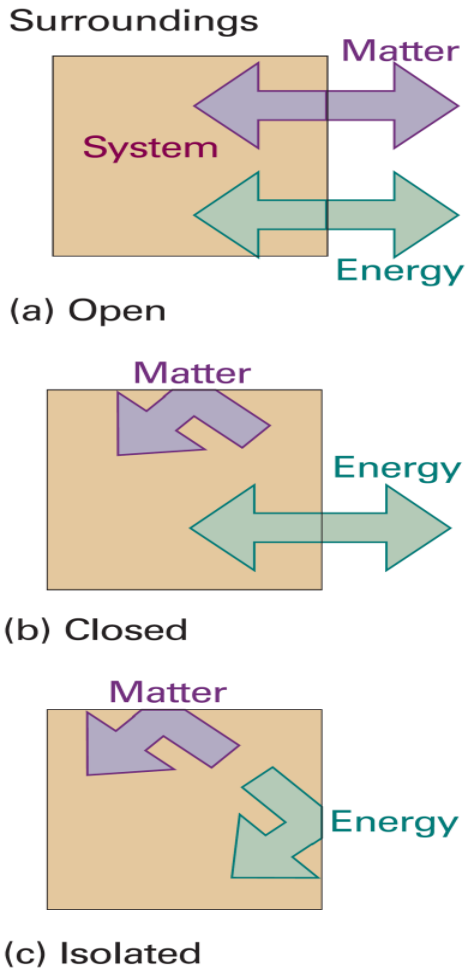

Fig. 2.1 (a) An open system can exchange matter and energy with its surroundings. (b) A closed system can exchange energy with its surroundings, but it cannot exchange matter. (c) An isolated system can exchange neither energy nor matter with its surroundings.

Thermodynamic Equilibrium

For Isolated system:

Macroscopic properties do not change with time

For Non-isolated system:

a) Macroscopic properties do not change with time
b) Removal of the system from contact with its surroundings causes no change in the properties of the system

- Mechanical Equilibrium
- Thermal Equilibrium
- Material Equilibrium

Mechanical equilibrium

the condition of equality of pressure on either side of a movable wall.

No unbalanced forces act on or within the system – system does not undergo acceleration or no turbulence inside the system

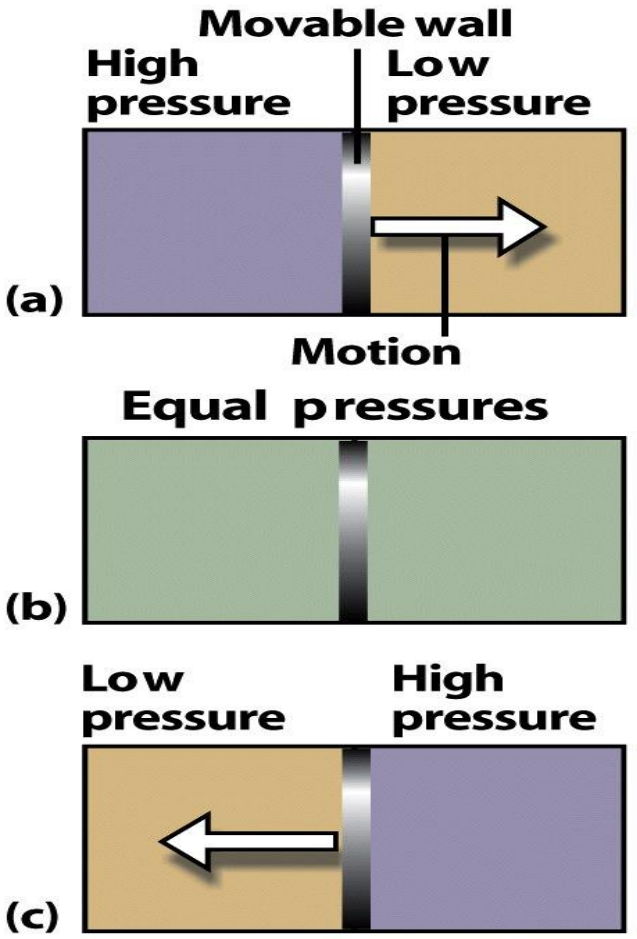

Figure 1-1
Atkins Physical Chemistry, Eighth Edition

Thermal equilibrium

between system and the surroundings, is a condition in which no change in the properties of the system or surroundings when they are separated by a thermally conducting wall.

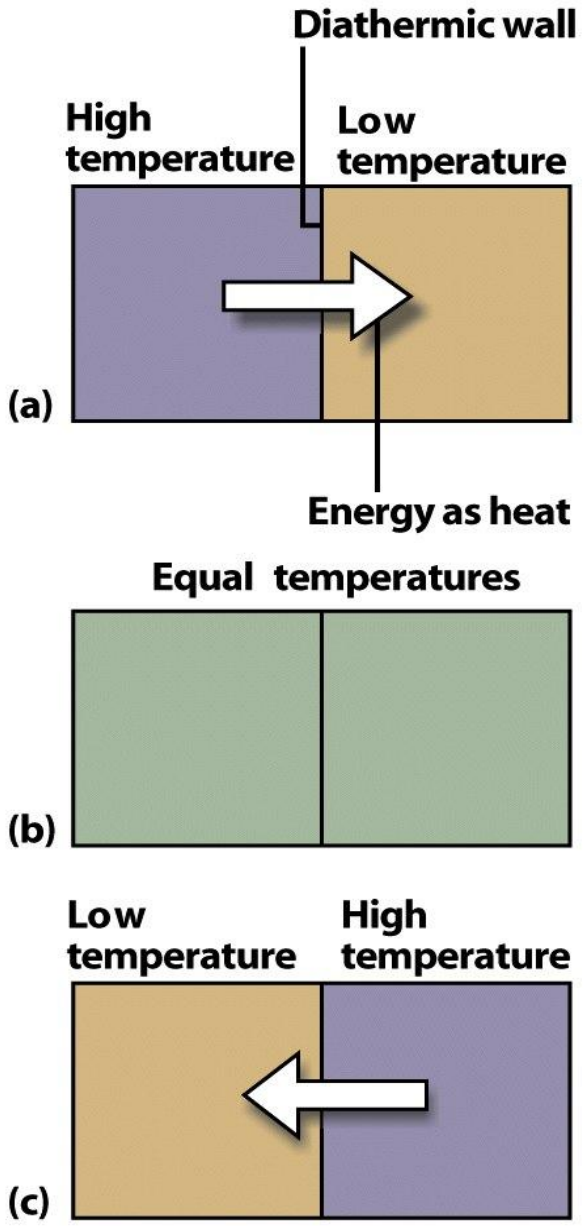

Figure 1-2
Atkins Physical Chemistry, Eighth Edition

Material equilibrium

Concentrations of the chemical species in the various parts of the system are constant with time

a) No net chemical reactions are occurring in the system

b) There is no net transfer of matter from one part (phase) of the system to another or between the system and its surroundings

For thermodynamic equilibrium, all three kinds of equilibrium must be present