

**UNIVERSITY OF CALGARY  
FACULTY OF SCIENCE  
DEPARTMENT OF CHEMISTRY  
COURSE OUTLINE  
WINTER 2020**

**1. Course: CHEMISTRY 471, Physical Chemistry: Kinetics and Spectroscopy**

LEC	DAYS	TIME	ROOM	INSTRUCTOR	OFFICE	EMAIL	OFFICE HOURS
L01	MWF	12:00-12:50	SB 146	Max Anikovskiy	EEEL 237A	m.anikovskiy	By appointment
T01	Tu	9:30-10:30	ST 059	Cyrus Mackie	SB 05	cjmackie	By appointment
T02	Fr	9:00-10:00	SS 006	Max Anikovskiy	EEEL 237A	m.anikovskiy	By appointment

Desire 2 Learn (D2L) CHEM 471 L01 – (Winter 2020)

Departmental Office: Room SA 229, Tel: 403-220-5341, e-mail: chem.info@ucalgary.ca

**2. Course Description:** Vibrational, electronic and magnetic resonance spectra. Reaction kinetics and transport properties in the gas phase and in solution. Catalysis. Laboratory: Experimental measurements, interpretations, and calculations relating to the topics discussed in lectures.

**3. Recommended/ Required Textbook(s):**

1) *"Quantum chemistry and spectroscopy"*, 4th Edition, by Thomas Engel, Pearson

2) *"Thermodynamics, statistical thermodynamics, and kinetics"*, 4th Edition, by Thomas Engel and Philip Reid, Pearson

**4. Topics Covered and Suggested Readings:**

**Course Content**

**Kinetics Section**

Collision theory  
Arrhenius behaviour  
Kinetics of complex reactions  
Diffusion & Diffusion-limited reactions  
Potential energy surfaces and activated complex theory  
Examples taken from Chapter 19 (textbook 2)

**Molecular spectroscopy Section**

Introduction to spectroscopy  
Rotational and Vibrational Spectra  
Electronic Spectroscopy  
Spontaneous emission & lasers  
Nuclear magnetic resonance spectroscopy

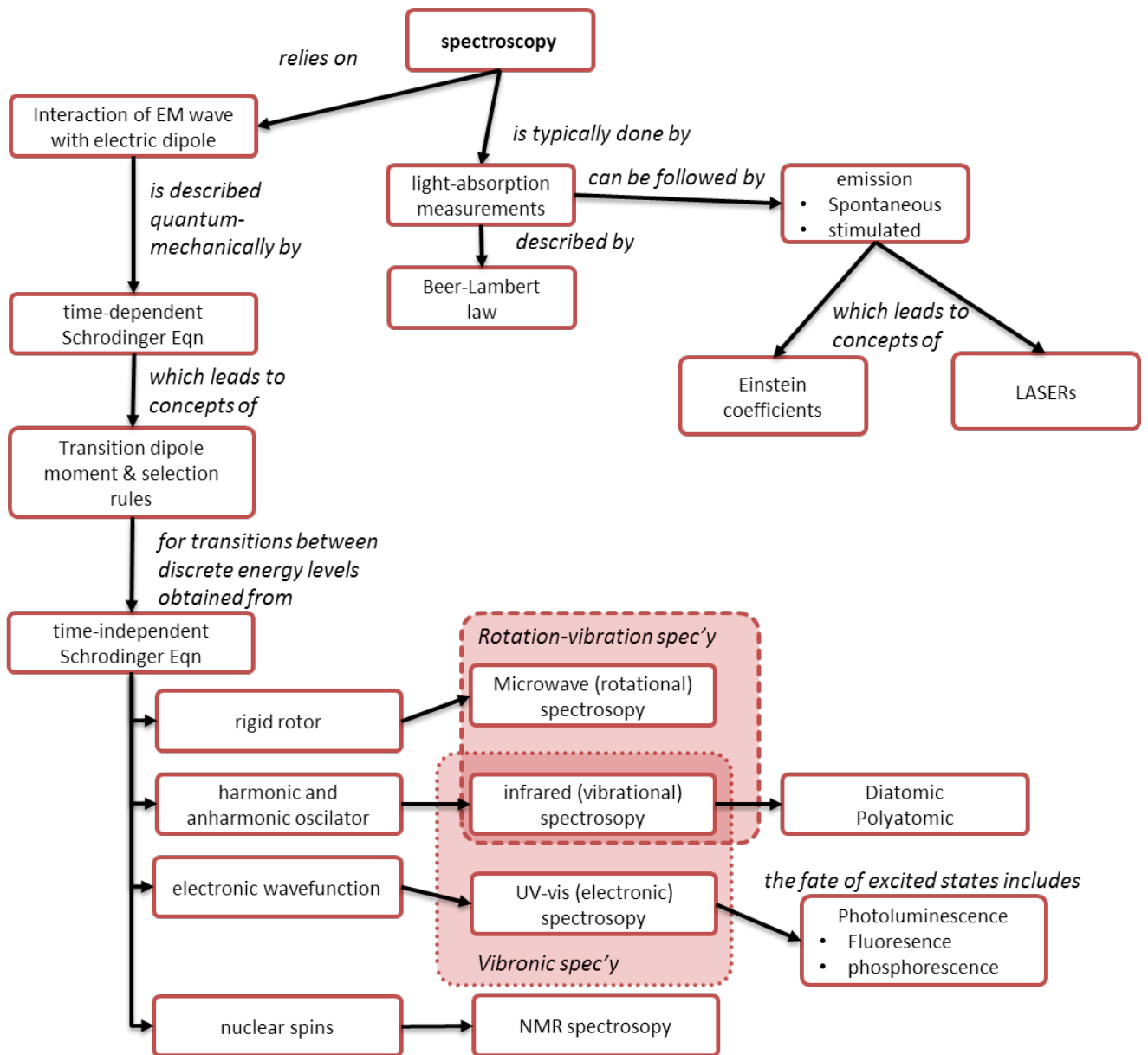
**Chapter in Textbooks**

*(not all sections will be covered)*

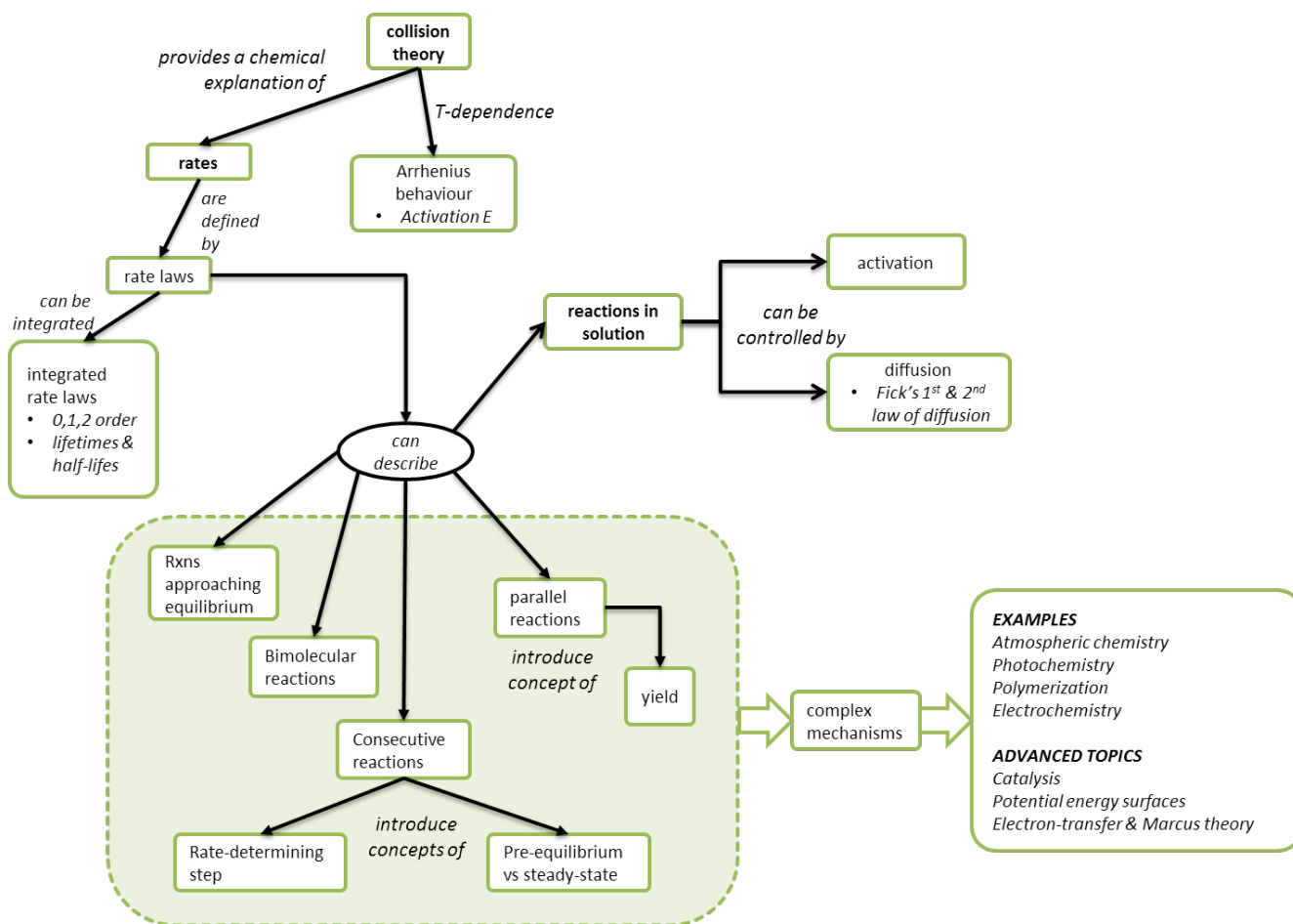
**Textbook 2: Chapter 16, Sections 6-7  
Chapter 18, Section 9  
Chapter 18, Sections 7, 8, 10  
Chapter 17, Sections 2, 3  
Chapter 18, Sections 13, 14, 15**

**Textbook 1: Chapter 8,  
Sections 1, 3-6  
Chapter 14, Sections 1,3-8  
Chapter 8, Section 2 and Chapter 11,  
Section 7  
Chapter 17, Sections 1-9**

**CHEM 471 Concept map: Spectroscopy**



**CHEM 471 Concept map: Kinetics**



**4. Laboratory Experiments:** (12 weeks, 3 hours/ week)

The Kinetics Isotope Effect

Determination of the Bond Dissociation Energies of Bromine and Iodine from their Absorption Spectra

The Effects of Solvent Environment on Fluorescence Spectra

Determination of the Reaction Order using the Method of Initial Rates

Electron Transfer Reactions and their Effect on Fluorescence

Independent Kinetics or Spectroscopy Project

Department Approval \_\_\_\_\_ Electronically Approved \_\_\_\_\_ Date \_\_\_\_\_ January 6, 2020 \_\_\_\_\_