

# Lecture 18 — The Canonical Ensemble

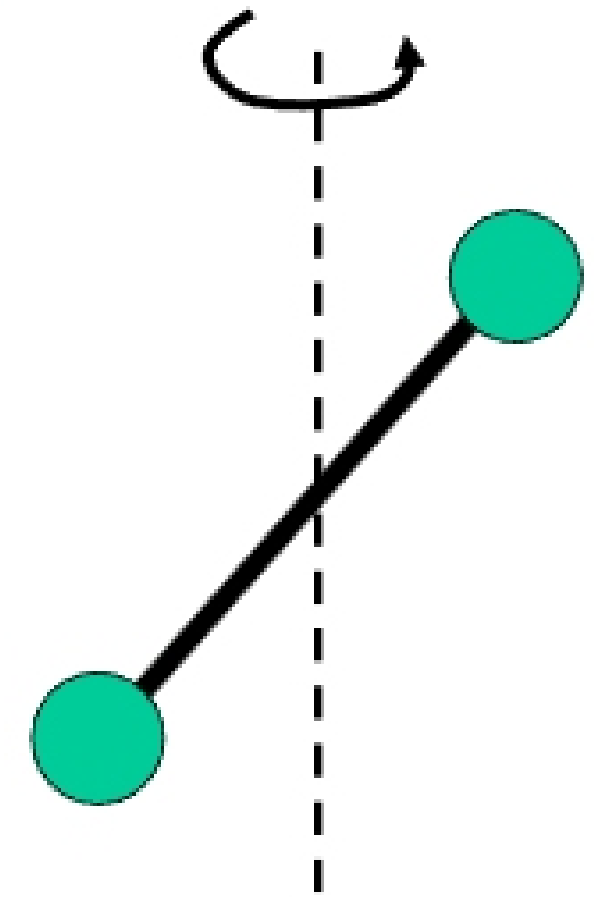
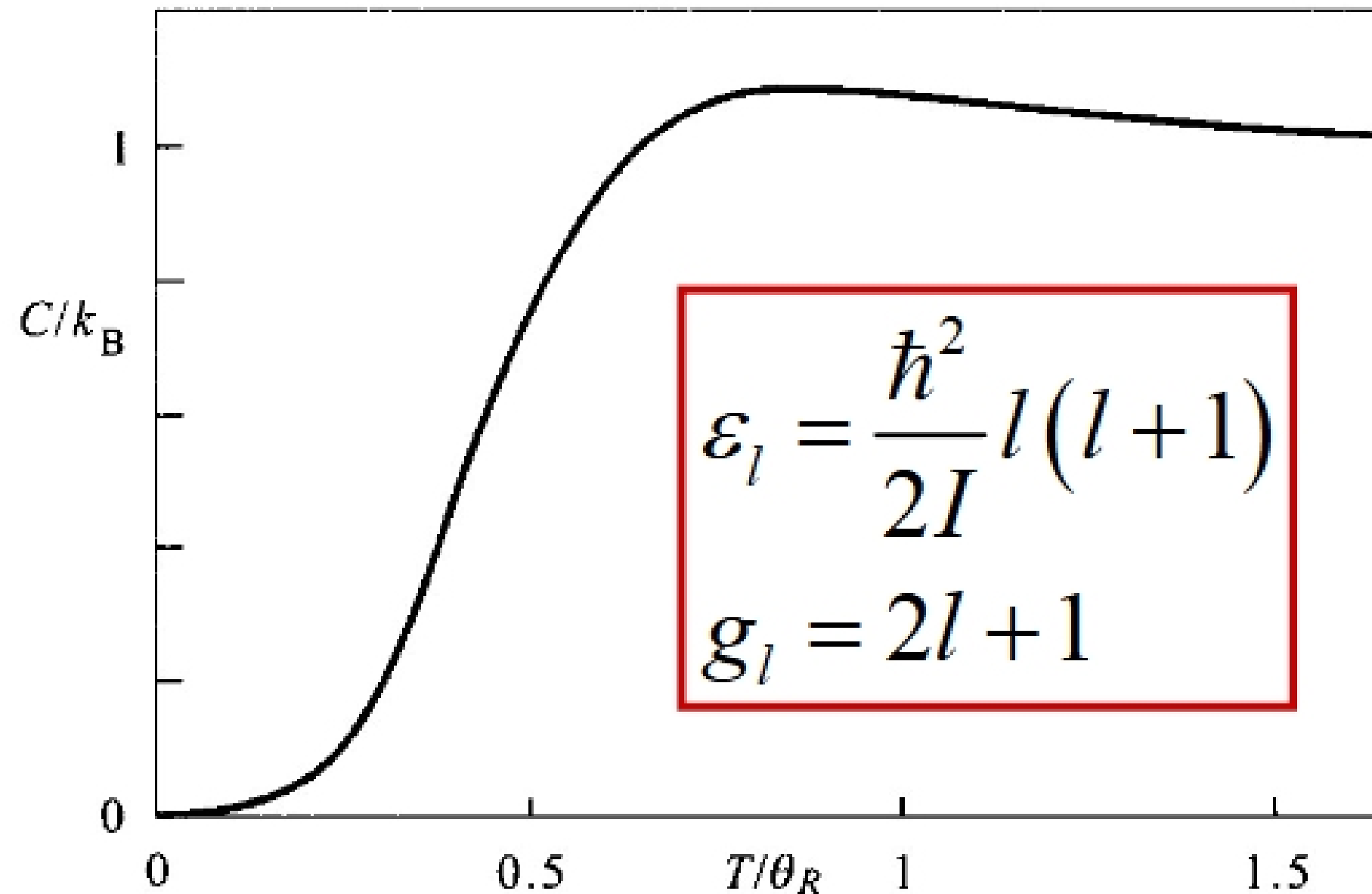
## Chapter 6, Wednesday February 20<sup>th</sup>

- Rotational energy levels in diatomic molecules
- Vibrational energy levels in diatomic molecules
- More on the equipartition theorem

**Reading:** All of chapter 5 (pages 91 - 123)  
Homework 5 due next Friday (22nd)  
Homework assignments available on web page  
Assigned problems, Ch. 5: 8, 14, 16, 18, 22

# Rotational energy levels for diatomic molecules

$l = 0, 1, 2, \dots$  is angular momentum quantum number

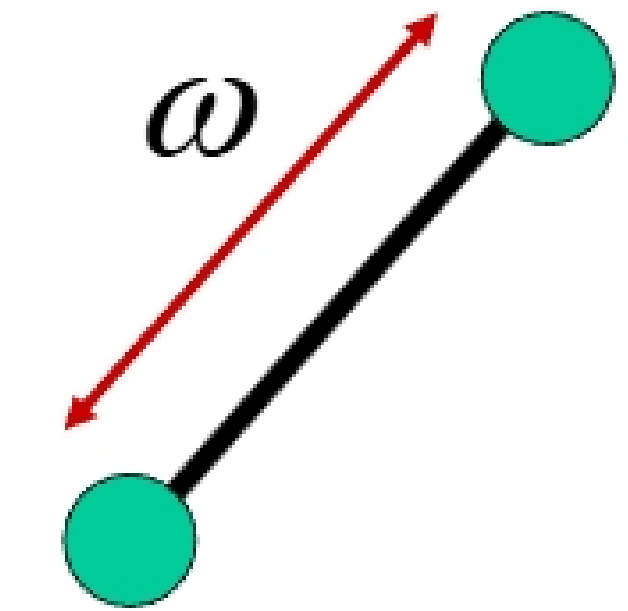
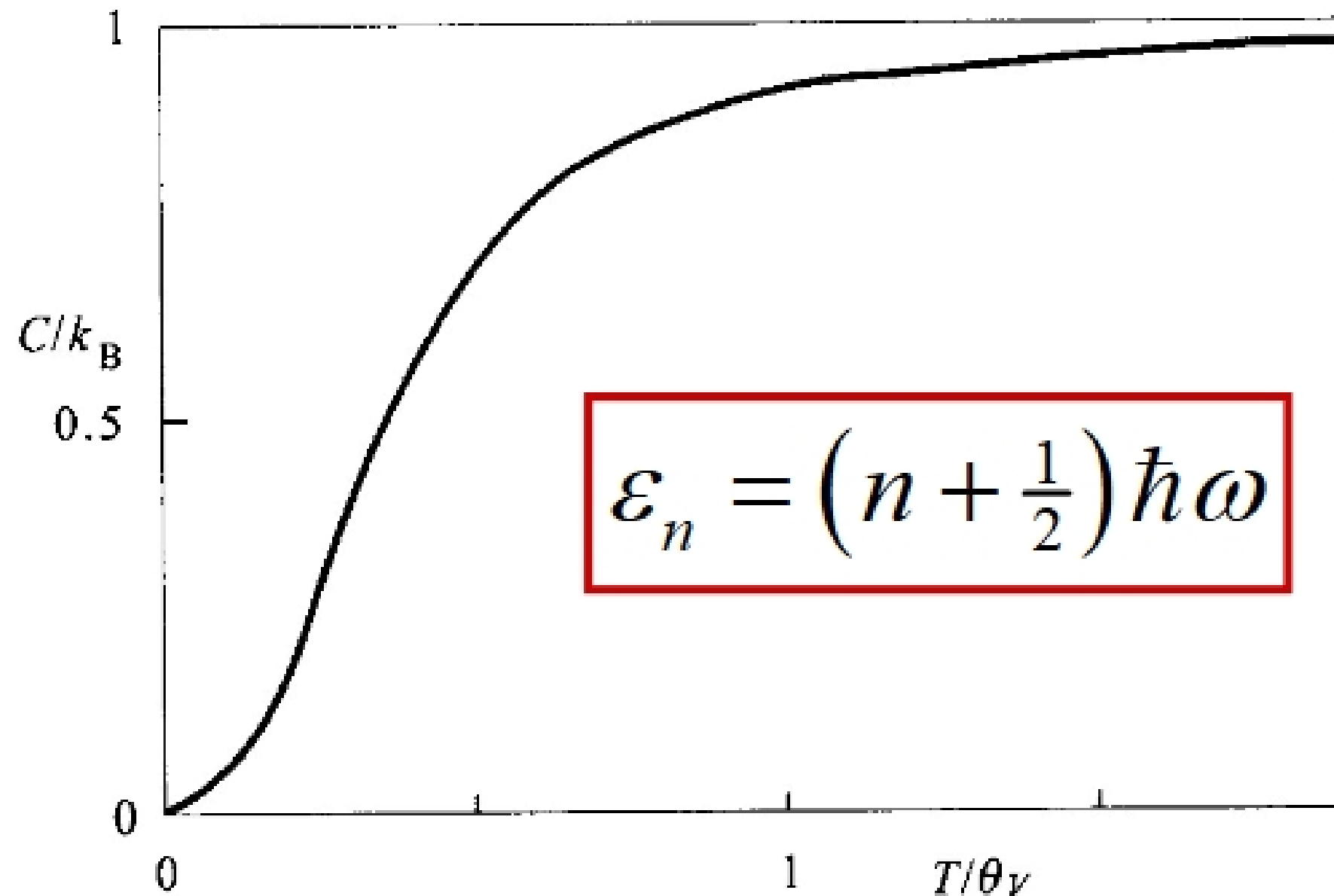


$I =$  moment of inertia

	$\text{CO}_2$	$\text{I}_2$	$\text{HI}$	$\text{HCl}$	$\text{H}_2$
$\theta_R(\text{K})$	0.56	0.053	9.4	15.3	88

# Vibrational energy levels for diatomic molecules

$n = 0, 1, 2...$  (harmonic quantum number)



$\omega =$  natural frequency of vibration

	$I_2$	$F_2$	HCl	$H_2$
$\theta_v$ (K)	309	1280	4300	6330