공정시스템특강1

Green Engineering

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Syllabus

Green Engineering I (458.701)

Textbook

David T. Allen and David R. Shonnard

Green Engineering:

Environmentally Conscious Design of Chemical Processes

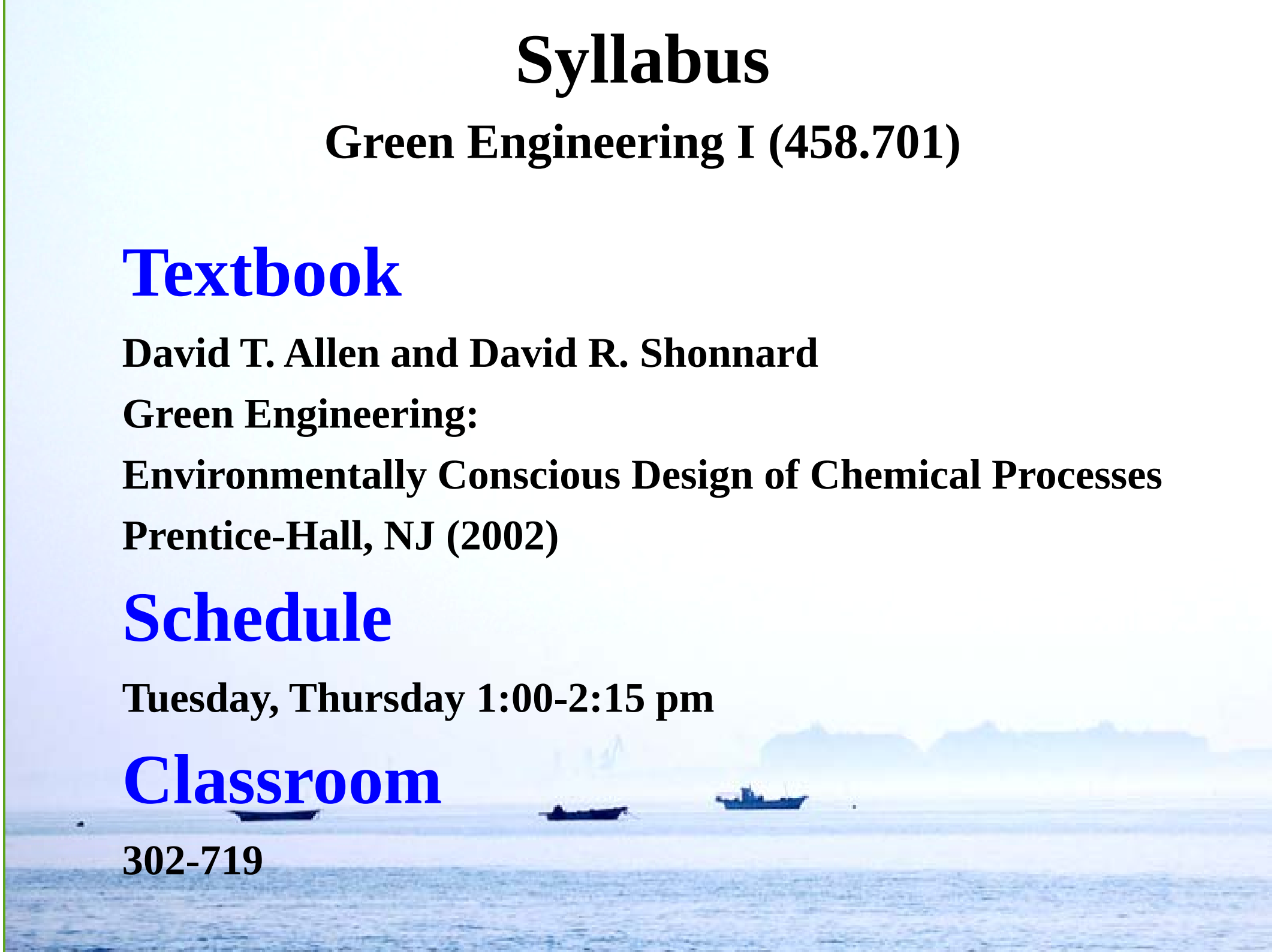
Prentice-Hall, NJ (2002)

Schedule

Tuesday, Thursday 1:00-2:15 pm

Classroom

302-719



Syllabus

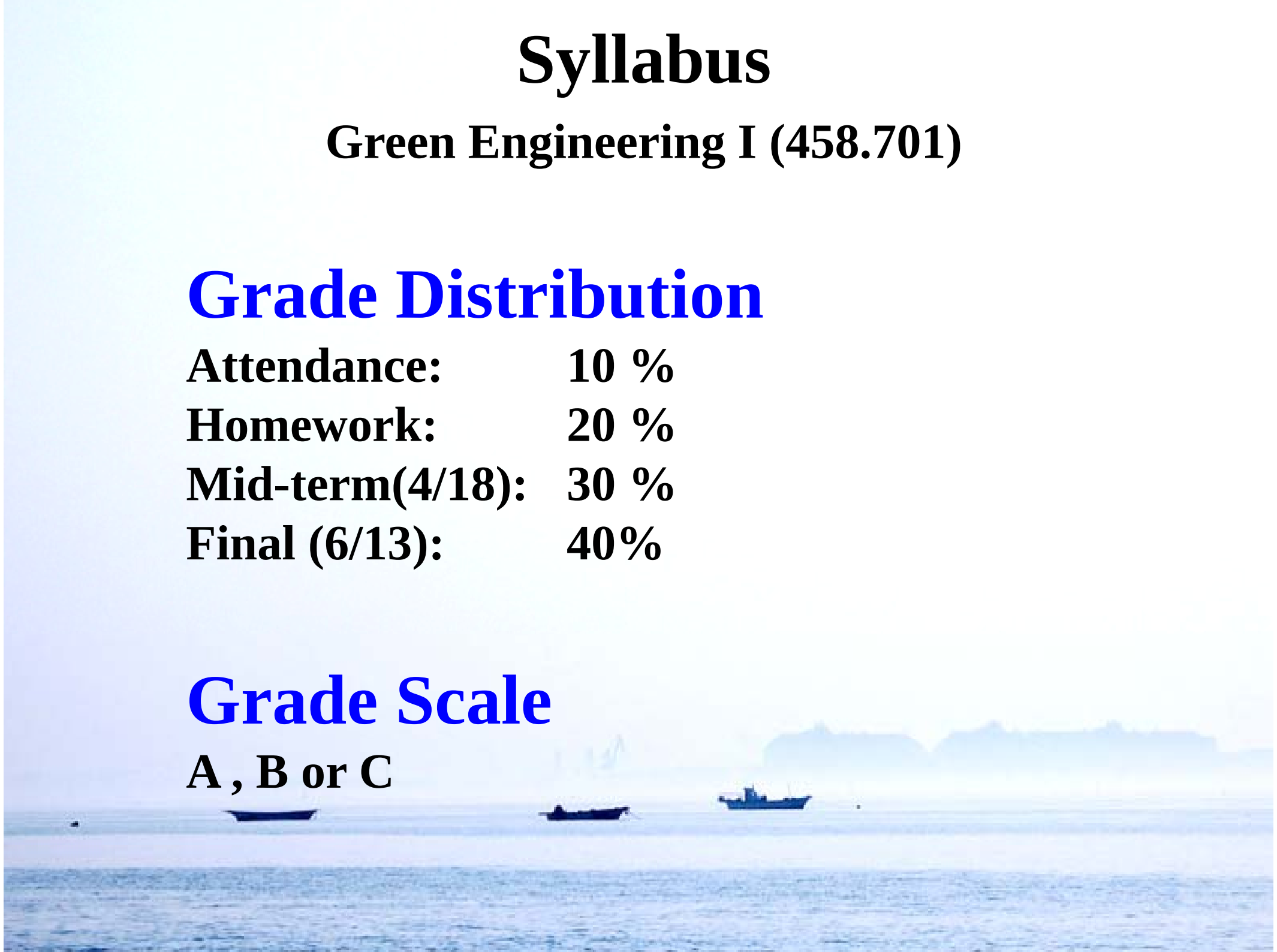
Green Engineering I (458.701)

Grade Distribution

Attendance:	**10 %**
Homework:	**20 %**
Mid-term(4/18):	**30 %**
Final (6/13):	**40%**

Grade Scale

A , B or C



Midterm Examination

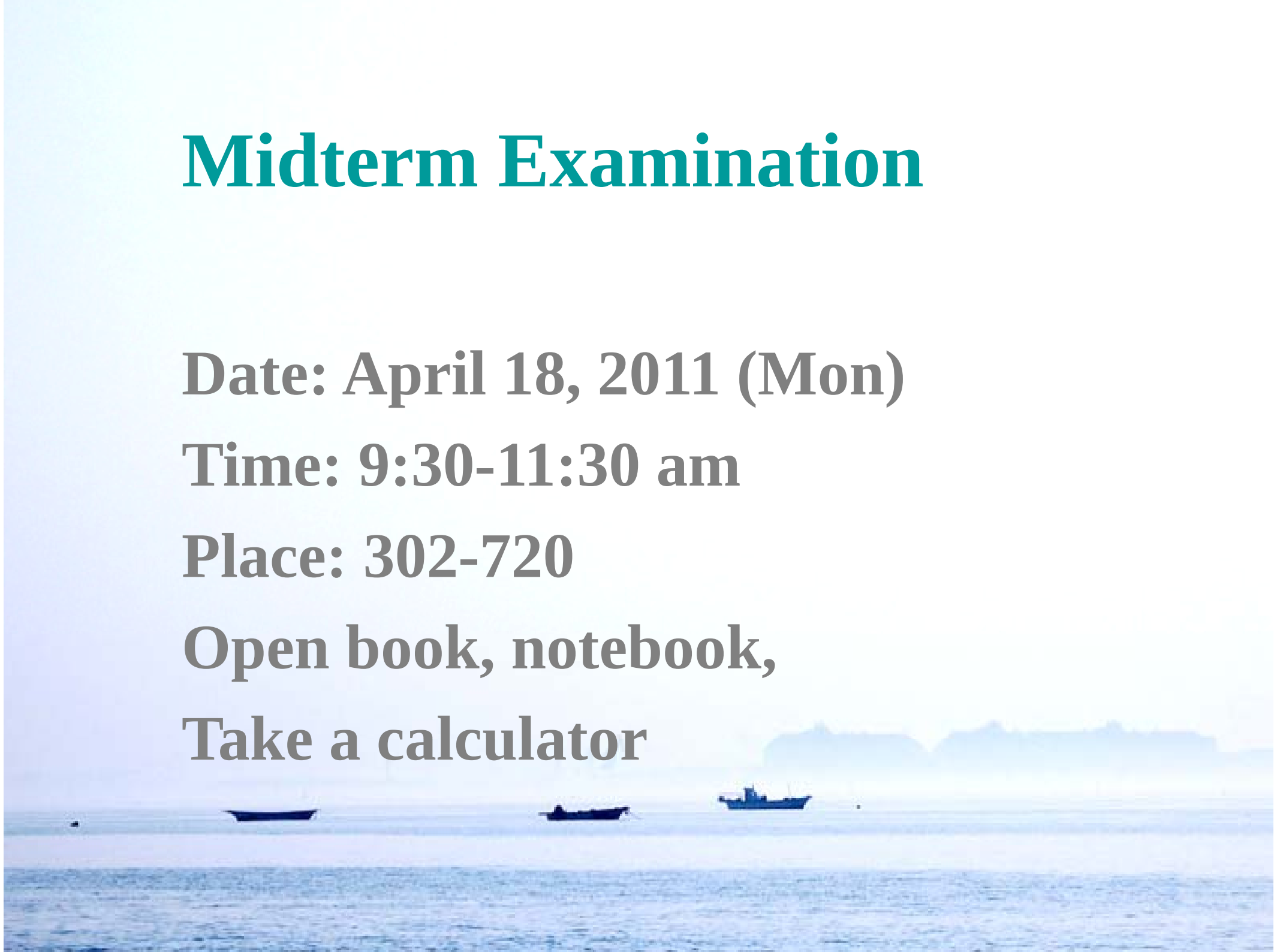
Date: April 18, 2011 (Mon)

Time: 9:30-11:30 am

Place: 302-720

Open book, notebook,

Take a calculator



Final Examination

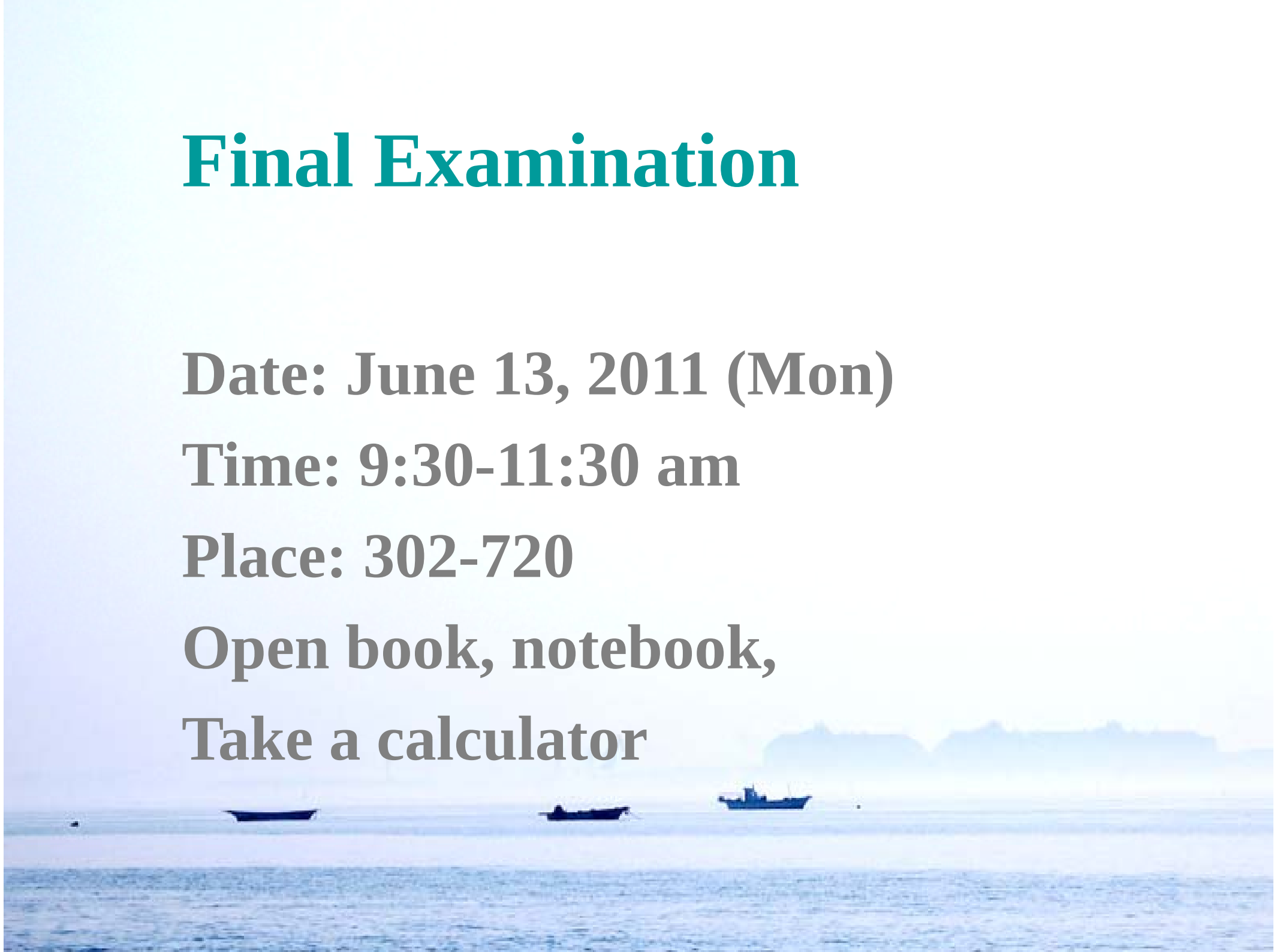
Date: June 13, 2011 (Mon)

Time: 9:30-11:30 am

Place: 302-720

Open book, notebook,

Take a calculator



Lecture Schedule

1st week:	Introduction to Environmental Issues
2nd week:	Risk concepts
3rd week:	Environmental Regulation
4-5th weeks:	Evaluation Engineering Fate:
	Approaches based on Chemical Structure
6th week:	Evaluating Exposures
7th week:	Green Chemistry
8 -9th weeks:	Evaluating Environmental Performance
	During Process Synthesis
10-11th weeks:	Unit Operation & Pollution Prevention
12-13th weeks:	Flow Sheet Analysis for Pollution Prevention
14th week:	Environmental Cost Accounting
15th week:	Life-Cycle Concept, Industrial Ecology

Course Objectives

On completion of this course, class participants should have a general understanding of:

Environmentally Conscious Design of Chemical Processes

Course Objective

The goal of this course is to present
the engineering tools
that are used to improve the environmental performance of chemical products and processes.

This includes
assessment tools,
such as life cycle assessment and risk assessment, as well as design tools
such as heat and mass exchange network synthesis.

Knowledge, Abilities, and Skills
Students should gain from this course:

1. **An understanding of important environmental issues, and how chemical processes and products impact the environment**
2. **A conceptual understanding of risk assessment**
3. **A familiarity with major pieces of environmental legislation**
4. **An appreciation of the ethical duties and responsibilities of engineers in environmental problem solving**
5. **Ability to assess the environmental fate of chemicals**
6. **An ability to estimate exposures to chemicals**
7. **Ability to identify and evaluate the environmental impacts of materials and reaction pathways**

Knowledge, Abilities, and Skills
Students should gain from this course:

8. Ability to assess the environmental performance of process flow sheets, unit operations, and process flow sheets
9. Ability to evaluate potential economic benefits of superior environmental performance
10. Quantitative and qualitative understanding of product life cycles and the role of chemical processes in industrial material and energy flows

Contents

Part I. Engineer's Guide to Environmental Issues and Regulations

Contents

Part II. Evaluating and Improving Environmental Performance of Chemical Processes

Contents

Attendance book

Submit a file of photograph of face
with your name and student number
to ywlee@snu.ac.kr
by March 6, 2011

12 Principles of Green Engineering

(Anastas, P. T.; Warner, J. C. *Green Chemistry: Theory and Practice*, Oxford University Press: New York, 1998, p.30. By permission of Oxford University Press)

1. Prevention

It is better to prevent waste than to treat or clean up waste after it has been created.

2. Atom Economy

Synthetic methods should be designed to maximize the incorporation of all materials used in the process into the final product.

3. Less Hazardous Chemical Syntheses

Wherever practicable, synthetic methods should be designed to use and generate substances that possess little or no toxicity to human health and the environment.

4. Designing Safer Chemicals

Chemical products should be designed to effect their desired function while minimizing their toxicity.

5. Safer Solvents and Auxiliaries

The use of auxiliary substances (e.g., solvents, separation agents, etc.) should be made unnecessary wherever possible and innocuous when used.

6. Design for Energy Efficiency

Energy requirements of chemical processes should be recognized for their environmental and economic impacts and should be minimized. If possible, synthetic methods should be conducted at ambient temperature and pressure.

12 Principles of Green Engineering

(Anastas, P. T.; Warner, J. C. *Green Chemistry: Theory and Practice*, Oxford University Press: New York, 1998, p.30. By permission of Oxford University Press)

7. Use of Renewable Feedstocks

A raw material or feedstock should be renewable rather than depleting whenever technically and economically practicable.

8. Reduce Derivatives

Unnecessary derivatization (use of blocking groups, protection/ deprotection, temporary modification of physical/chemical processes) should be minimized or avoided if possible, because such steps require additional reagents and can generate waste.

9. Catalysis

Catalytic reagents (as selective as possible) are superior to stoichiometric reagents.

10. Design for Degradation

Chemical products should be designed so that at the end of their function they break down into innocuous degradation products and do not persist in the environment.

11. Real-time analysis for Pollution Prevention

Analytical methodologies need to be further developed to allow for real-time, in-process monitoring and control prior to the formation of hazardous substances.

12. Inherently Safer Chemistry for Accident Prevention

Substances and the form of a substance used in a chemical process should be chosen to minimize the potential for chemical accidents, including releases, explosions, and fires.

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