Foundations of Vacuum Science

VACT 1900 (2 credits)   Online Only   8 weeks

INSTRUCTOR CONTACT INFORMATION:

Instructor: Dr. Ruth Robinson (Dr. R)
Email: ruth.robinson@normandale.edu

DISCLAIMER

This syllabus is subject to change & correction. Changes will be announced on D2L.

COURSE PREREQUISITES: Eligible for MATH 601 recommended

COURSE MATERIALS:

- *Non-programmable* scientific calculator (includes Log, 10^x, Exp (or EE), Ln, and e^x keys). Highly recommended: TI-30XA , available in the Normandale bookstore.
- Course Workbook "Printed project", only at NCC Bookstore.
- Access to a computer with internet & **a backup plan** for both, in case of problems.
- Recommended: 3 ring binder for course workbook

D2L

This course will use D2L for course delivery.   For technical and other help, go here:
http://www.normandale.edu/departments/finance-and-operations/information-technology/student-computing/getting-started

EMAIL

You must check your campus email on a daily basis. You are responsible for information given via campus email.   Also, your email communication with me should be done only via your Normandale email address.

GRADING: Points

	Points
Activities: online labs, quizzes etc. 16 @ 10-25 points ea	323
Module Quizzes, 8 @ 25 points ea	200
Mid-term Exam	50
Final Exam	100
Total Course Points	673

Your course grade will be determined as follows from the Total Course points you earn:
      A 90% +   B 80-89%   C 70-79%   D 55-69%   F below 55%

EXAMS

There will be a mid-term exam and a comprehensive final exam. Both are taken online. The exams will be taken within a strict time period and once you begin an exam, you must complete it within that time. In other words, you cannot stop it to complete at a later time.

ABSENCE/LATE POLICY

Since this is a fully online course, you will have a great deal of flexibility to do the assigned work as it fits into your own schedule. You are expected to schedule your work in this course around your other life obligations (a job, care for dependents, etc.) such that you can complete all of the assignments on time. It is highly recommended that you don't leave work to do for the last minute before the deadline, in case things come up (they always do!). Given that, if you find yourself under an <u>unusual</u> hardship, beyond your control, please contact the instructor.

HOW MUCH TIME SHOULD YOU BE SPENDING ON VACT 1900?

The amount of time students need to master this course will vary a great deal depending upon many factors. However an average student can expect to spend about 10 hours per week completing all of the tasks for this course. Keep in mind that you may need to spend more or less time than this, depending upon your background in science, and other factors.

GETTING HELP!

- **Ask fellow students in the D2L Student Lounge Discussion.** A special discussion forum will be set up where you can talk to other students in the course.
- **Dr. Robinson**.
    - Come visit during office hours, or schedule an appointment.
    - Send an email with questions.
    - Request a private chat on D2L between me and you.

OTHER TYPES OF HELP: on campus and off

- **The Computer Center, 3rd floor of College Services Building** *Services Offered:* The Computer Center is equipped with Dell OptiPlex computers, PC's, and Macs as well as friendly helpers. Students have access to various types of software and other resources like printers and scanners. All computers have internet access, direct links to campus email, DVD-RW drives, USB ports, and headphone jacks. There is also a laptop work area and wireless connectivity.
- **The Writing Center, Room L1780** *Services Offered:* Tutors offer writing workshops and walk-in help on key stages of the writing process—understanding the assignment, prewriting and planning, researching, drafting, and revising.
- **Help with various IT services:** http://www.normandale.edu/departments/finance-and-operations/information-technology/getting-help
- **Disability Services and Accommodation:**
  Normandale Community College is committed to providing equal access for students with disabilities through the services provided by the Office for Students with Disabilities (OSD). If you have an educational need because of a disability, please make an appointment for an

intake/interview to discuss these needs so that appropriate accommodations can be implemented for your Normandale courses. Appointments can be made by calling the OSD staff at 952-358-8625, emailing osd@normandale.edu, or stopping by the L2751 office. *This syllabus is available in alternate formats upon request.*

- **Personal counseling services:** The Counseling Center on campus provides free, confidential individual appointments to talk with a counselor about life issues, crisis and to get referrals to other forms of help. These services are offered free of charge to currently enrolled students and can be accessed by making an appointment. To make an appointment, call 952-358-8261 or stop by the Counseling Office reception desk.

COURSE DESCRIPTION

Basic principles of chemistry, math and physics are applied to the understanding of concepts needed to continue in courses of vacuum technology. Topics include atomic structure, states of matter, compounds, behavior of gases, scientific measurement and calculations, intermolecular forces, and Ohm's Law.

COURSE OBJECTIVES

- Distinguish pure substances from mixtures; further distinguish elements, compounds, homogeneous and heterogeneous mixtures.
- Describe the different states of matter, their characteristics and changes between them.
- Distinguish chemical and physical properties; chemical reactions defined.
- Apply the nuclear model of the atom; write atomic symbols;
- Describe general properties of the periodic table, including specific groups and diatomic molecules, atomic number, atomic mass, states
- Identify isotopes from the numbers of protons and neutrons
- Identify ions from the numbers of protons and electrons
- Identify the # of atoms in molecular structures & chemical formulas.
- Distinguish molecular vs ionic compounds from their formulas
- Write names of compounds from their formulas
- Convert numbers between scientific and standard notation.
- Define common units (length, mass, temperature, time & volume)
- Use prefixes to convert between units.
- Apply dimensional analysis to solve mathematical problems
- Set up and execute multistep conversion problems.
- Define mole and Avogadro's number
- Convert between counts and moles of a substance
- Calculate molar mass of a compound or molecule
- Convert between mass and moles of a substance
- Explain gas movement in terms of elastic collisions
- Compare speeds of molecules vs mass and temperature
- Discuss qualitative aspects of kinetic energy
- Define temperature and pressure in terms of Kinetic molecular theory
- Perform density calculations
- Employ significant figures in calculations and measurements
- Relate the temperature units of Fahrenheit, Celsius and Kelvin

- Relate the pressure units of psi, torr, mmHg, atm, Pa and bar.
- Define vacuum regimes of rough, medium, high, UHV in terms of pressure units and gas behavior
- Define mean free path and perform calculations
- Solve simple algebraic equations
- Explain and apply the ideal gas law; use appropriate value of R
- State and apply Boyle's, Charles', Amonton's, and Avogadro's Laws.
- Recognize the properties of mixtures of gases
- Apply Dalton's law to gas mixtures
- Calculate relative diffusion and effusion (leak) rates of gases
- Predict mixture composition changes based on effusion and diffusion
- Discuss how heat is transferred in gaseous systems in the regimes of convection, conduction and radiation
- Describe behavior of gas molecules colliding with a surface
- Perform calculations using logarithms.
- Recognize graphs of logarithms as related to linear graphs
- Create graphs using Excel.
- Identify the polarity of water and hydrocarbons
- Explain how intermolecular forces affect boiling points, surface adhesion
- Define vapor pressure
- Explain trends in vapor pressure in closed and open systems
- Define equilibrium of a liquid and gas in a closed system.
- Interpret MSDS sheets
- Define acids and bases and how they neutralize each other
- State qualitative and quantitative aspects of the pH scale.
- Know the names of common acids and bases.
- Define terms, symbols and units for electric current, potential, and resistance.
- Apply the equations, $V=IR$ and $1/R = 1/R1 + 1/R2$.
- Define capacitors and inductors.

ACADEMIC HONESTY:

- Students are expected to adhere to the Code of Conduct: http://www.normandale.edu/current-students/code-of-conduct
- Academic dishonesty includes, but is not limited to: copying someone else's work, turning in group effort when individual effort is required, re-using work, using unauthorized materials or help while taking an exam or quiz, and plagiarism.
- Anyone caught cheating, or supporting cheating, will receive an automatic zero (or F) for that assignment or exam. Students may receive a failing grade for the class at the discretion of the instructor.
- The incident will also be reported to the Dean of Students for documentation and possible further disciplinary action enforced by the College.