Marshall University

College of Science

Department of Physics

PS 121

Physical Science for Teachers: Chemistry

Fall 2018

Instructor: Dr. André Wehner, Science 255, wehnera@marshall.edu, 304.696.2372

 Office Hours: MW 9:00-11:00, 4:00-6:00, or by appointment.

Class: TTh 6:30-8:20, Science 179.

Text: Physical Science for Teachers: Chemistry (Pearson Custom Text). Mastering Chemistry online course management system (Course ID: **PS121FALL18** )

**Catalog Description**

PS121 is part of a 3 course sequence of Physical Science for K-9 Education majors. Includes 2-hr, 1 credit lab.

**Course Description**

PS121 is a survey of introductory chemistry, particularly focused on content related to the Next Generation Science Standards (NGSS). It is designed to provide the chemistry background (atomic structure, properties of matter, phase changes, chemical reactions, heating & cooling) required for K-9 Education majors, as well as provide practice in the applied engineering principles included in these new standards. This course will model the type of inquiry-based, interactive learning environment expected of teachers by the NGSS. Lectures will be brief and interspersed with lab activities and investigations designed to foster higher-order learning and enhance critical thinking skills.

Homework will be assigned from the textbook publisher's online system, MasteringChemistry ([www.masteringchemistry.com](http://www.masteringchemistry.com) )An access code is bundled with the textbook. This section’s course ID is PS121FALL18.

At least half the class will be devoted to hands-on, laboratory-style investigations; design or testing problems; and lecture tutorials. Many of these will be ''open-ended'' problems. The exact design and procedure of the investigation will be up to you. This is in keeping with both the letter and spirit of the NGSS, so you will have a chance in this course to practice what you will teach. All of your experimental work on the investigations will be kept in your science journal, as well as your conclusions on the results.

Three exams, each covering about the same amount of material, will be conducted throughout the semester. Material from the investigations willbe included on the exams. The final exam willbe cumulative.

Grading

Your grade will be determined as follows:

3 exams @ 15% each = 45%

Final 20%

Online Homework 20%

Investigations and journal 15%

*No extra credit assignments will be given and the lowest score will not be dropped.*

The grading scale will be as follows:

A: ≥ 90% B: ≥ 80% C: ≥ 70% D: ≥ 60%

Expectations

I expect you to be on time, prepared for class and to actively participate in the class discussion every day – being prepared means at the very least doing your homework, reading the sections, and looking over notes from previous classes.

Attendance will be recorded as per MU’s policy for 100- and 200-level classes, but will not be counted explicitly in the grade. **Four unexcused absences will result in a lowering of the grade. If you miss more than ten classes (excused and unexcused), you will receive a failing grade.**

If you have to miss a test for a valid reason (proof required!), you will be allowed to make it up. If you know in advance you will have to miss a test, you should make arrangements to take it early.

By enrolling in this course, you agree to the University Policies listed below. The full text of each policy is at <http://www.marshall.edu/academic-affairs/policies> .

Academic Dishonesty/ Excused Absence Policy / Computing Services Acceptable Use/ Dead Week/ Inclement Weather/ Students with Disabilities/ Academic Forgiveness/ Academic Probation and Suspension/ Academic Rights and Responsibilities/ Affirmative Action/ Sexual Harassment

The expectation at MU is that the principles of truth and honesty will be rigorously followed in all academic endeavors. This assumes that all work will be done by the person who purports to do the work without unauthorized aids. In addition, when making use of language and some idea not his or her own, whether quoting them directly or paraphrasing them into his or her own words, the student must attribute the source of the material in some standard form, such as naming the source in the text or offering a footnote. University policies are described in detail at: <http://www.marshall.edu/academic-affairs/?page_id=802>.

Marshall University is committed to equal opportunity in education for all students, including those with physical, learning and psychological disabilities.  University policy states that it is the responsibility of students with disabilities to contact the Office of Disabled Student Services (DSS) in Prichard Hall 117, phone 304 696-2271 to provide documentation of their disability.  Following this, the DSS Coordinator will send a letter to each of the student’s instructors outlining the academic accommodation he/she will need to ensure equality in classroom experiences, outside assignment, testing and grading.  The instructor and student will meet to discuss how the accommodation(s) requested will be provided.  For more information, please visit <http://www.marshall.edu/disabled> or contact Disabled Student Services Office at Prichard Hall 11, phone 304-696-2271.

Schedule (tentative)

|  |  |  |
| --- | --- | --- |
| Week | Day | Material covered (chapter) |
|  |  |  |
| 1 | 8/21 | 1, 2: Units, Sig Figs, Density |
|  | 8/23 | Math Background |
| 2 | 8/28 | 3: Physical & Chemical Properties |
|  | 8/30 | Heat & Energy & Temperature |
| 3 | 9/4 | Heat Capacity |
|  | 9/6 | 4: Atoms and Elements, Periodic Table |
| 4 | 9/11 | **Test 1** |
|  | 9/13 | 5: Molecules & Compounds |
| 5 | 9/18 | 6: Chemical Composition |
|  | 9/20 | 7: Types of Reactions |
| 6 | 9/25 | Elements & Compounds |
|  | 9/27 | Balancing Equations |
| 7 | 10/2 | 8: Quantities in Reactions |
|  | 10/4 | 9: Bohr model of atom, radiation |
| 8 | 10/9 | Orbitals, electron configuration |
|  | 10/11 | **Test 2** |
| 9 | 10/16 | 10: Chemical bonding, Lewis structures |
|  | 10/18 | Molecular shape, electronegativity |
| 10 | 10/23 | 11: Gas laws |
|  | 10/25 | 12: Liquids and solids |
| 11 | 10/30 | Intermolecular forces |
|  | 11/1 | 13: Solutions |
| 12 | 11/6 | 14: Acids & Bases |
|  | 11/8 | Titrations or 15: Chemical Equilibrium |
| 13 | 11/13 | 16: Oxidation and Reduction |
|  | 11/15 | **Test 3** |
| 14 | 11/27 | 17: Radioactivity and Nuclear Chemistry |
|  | 11/29 | 18: Organic Chemistry |
| 15 | 12/4 |  |
|  | 12/6 | 19: Biochemistry |
|  | 12/11 | Final |

*Disclaimer*: The above schedule, policies, procedures, and assignments in this course are subject to change in the event of extenuating circumstances, by mutual agreement, and/or to ensure better student learning.

**Learning Outcomes:**

⚫ Plan and conduct an investigation to describe and classify different kinds of materials by their observable properties.

⚫ Develop a model to describe that matter is made of particles too small to be seen. Develop models to describe the atomic composition of simple molecules and extended structures.

⚫ Construct an argument with evidence that some changes caused by heating or cooling can be reversed and some cannot.

⚫ Measure and graph quantities to provide evidence that regardless of the type of change that occurs when heating, cooling, or mixing substances, the total weight of matter is conserved.

⚫ Develop and use a model to describe how the total number of atoms does not change in a chemical reaction and thus mass is conserved.

⚫ Conduct an investigation to determine whether the mixing of two or more substances results in new substances.

⚫ Analyze and interpret data on the properties of substances before and after the substances interact to determine if a chemical reaction has occurred.

⚫ Gather and make sense of information to describe that synthetic materials come from natural resources and impact society.

⚫ Analyze data obtained from testing different materials to determine which materials have the properties that are best suited for an intended purpose.

⚫ Undertake a design project to construct, test, and modify a device that either releases or absorbs thermal energy by chemical processes.

⚫ Apply scientific principles to design, construct, and test a device that either minimizes or maximizes thermal energy transfer.

⚫ Plan an investigation to determine the relationships among the energy transferred, the type of matter, the mass, and the change in the average kinetic energy of the particles as measured by the temperature of the sample.

⚫ Develop a simple sketch, drawing, or physical model to illustrate how the shape of an object helps it function as needed to solve a given problem.

⚫ Define a simple design problem reflecting a need or a want that includes specified criteria for success and constraints on materials, time, or cost.

⚫ Define the criteria and constraints of a design problem with sufficient precision to ensure a successful solution, taking into account relevant scientific principles and potential impacts on people and the natural environment that may limit possible solutions.

⚫ Evaluate competing design solutions using a systematic process to determine how well they meet the criteria and constraints of the problem.

⚫ Analyze data from tests to determine similarities and differences among several design solutions to identify the best characteristics of each that can be combined into a new solution to better meet the criteria for success.

⚫ Develop a model to generate data for iterative testing and modification of a proposed object, tool, or process such that an optimal design can be achieved.