

GEN ED#9 – EMPLOY CONCEPTS AND METHODS OF THE NATURAL AND PHYSICAL SCIENCES TO MAKE INFORMED JUDGMENTS**QCC Example Outcomes:**

- a. Describe fundamental concepts in a field of science
- b. Explain and demonstrate the process of scientific inquiry
- c. Discuss the role of science and its impact on the individual, society and the environment

Common Core Outcomes:**Required Core:****I.C – Life and Physical Sciences**

1. Identify and apply the fundamental concepts and methods of a life or physical science.
2. Apply the scientific method to explore natural phenomena, including hypothesis development, observation, experimentation, measurement, data analysis, and data presentation.
3. Use the tools of a scientific discipline to carry out collaborative laboratory investigations.
4. Gather, analyze, and interpret data and present it in an effective written laboratory or fieldwork report.
5. Identify and apply research ethics and unbiased assessment in gathering and reporting scientific data.

Flexible Core:**II.E – Scientific World***(1-3) are in QCC 4 and 5 above)*

1. Identify and apply the fundamental concepts and methods of a discipline or interdisciplinary field exploring the scientific world, including, but not limited to: computer science, history of science, life and physical sciences, linguistics, logic, mathematics, psychology, statistics, and technology-related studies.
2. Demonstrate how tools of science, mathematics, technology, or formal analysis can be used to analyze problems and develop solutions.
3. Articulate and evaluate the empirical evidence supporting a scientific or formal theory.
4. Articulate and evaluate the impact of technologies and scientific discoveries on the contemporary world, such as issues of personal privacy, security, or ethical responsibilities.
5. Understand the scientific principles underlying matters of policy or public concern in which science plays a role.

GEN ED OUTCOMES ADDRESSED IN ASSESSMENT:**QCC 9**

- a. Describe fundamental concepts in a field of science
- b. Explain and demonstrate the process of scientific inquiry

I.C – Life and Physical Sciences

1. Identify and apply the fundamental concepts and methods of a life or physical science.
2. Apply the scientific method to explore natural phenomena, including hypothesis development, observation, experimentation, measurement, data analysis, and data presentation.

Flexible Core:**II.E – Scientific World**

4. Identify and apply the fundamental concepts and methods of a discipline or interdisciplinary field exploring the scientific world, including, but not limited to: computer science, history of science, life and physical sciences, linguistics, logic, mathematics, psychology, statistics, and technology-related studies.

EVIDENCE/ MEASURABLE DATA

- **GROUP SIZE:**
No. of students 72
No. of sections 5

The KPRS Assessment Exam for Organic Chemistry 1:

The exam was collectively written by the organic faculty members at QCC. Students will take this exam at the end of the semester. One of the selected exam questions surveys a general chemistry concept that is highly pertinent to organic chemistry. Three of the exam questions have been selected to represent fundamental concepts in organic chemistry. The selected problems require students to integrate knowledge learned in the classroom and apply logical reasoning towards problems common in organic chemistry. They also represent some of the topics that are critical to student success in subsequent organic and biochemistry courses. In particular, the exam will test the student's knowledge of acids and bases and electron movement as it pertains to mechanistic behavior and resonance structures. The exam questions are a mixture of multiple choice and short answer questions including

	drawing two dimensional representations of three dimensional organic structures.
FINDINGS	<p>Two learning outcomes addressed Gen. Ed.#9</p> <ol style="list-style-type: none"> 1. Students will integrate and expand on the knowledge learned in general chemistry as it applies to organic chemistry (Gen Ed Objectives (GEO) #2,5,9; Curricular Objectives (CO) #6,10,12) 2. Students will understand and apply terms describing the movement of electrons as they pertain to resonance and the drawing of acceptable Lewis structures (GEO #2,5,9; CO #6,10,12) <p>Question #3 on the exam tested learning outcome #1: 43% of students scored 3, 5% scored 2, 24% scored 1, and 28% scored 0. The number of students who scored 3 were slightly lower than the expected outcome. More students scored 1's and 0's than was expected. This problem tested the students' knowledge of acids and bases and the distinction between the different subtypes, their ability to represent the molecule with the appropriate bonding and lone pairs, and to make the connection from concepts originally learned in general chemistry and used in a different context in organic chemistry.</p> <p>Question #5 on the exam tested learning outcomes #1 and 2: 8% of students scored 3, 23% scored 2, 38% scored 1, and 31% scored 0. It was expected that 70% of the students would get the problem completely or mostly correct (score of 3 or 2). However, the actual percentage was 31%. This problem tested the students' ability to expand on the concept of resonance, as taught in general chemistry, and apply it to a structure used in organic chemistry. Students had to use their knowledge of electron movement to correctly draw all three Lewis structures</p>
ACTION PLAN*	<p>The results of the assessment will be disseminated to the three instructors who teach CH-251 so all instructors can evaluate the students' learning. Future discussions with the instructors will discuss the outcome of each question and discuss strategies to improve student learning on key concepts. A new assessment test will be given in future semesters. This test is written by the American Chemical Society (ACS) and is a national, standardized assessment test. Similar questions/topics as above will be chosen on the ACS test and the results on each test will be compared. This assessment was useful in guiding our approach on future tests with four aspects in mind: 1) questions should avoid ambiguity in the answer or in the way the question is written, 2) fewer parts should be asked per question thereby simplifying the rubric, and 3) the students should have an incentive to study for the test to be able to assess true end-of-year student learning and retention of key concepts. Another potential strategy for a revised KPRS assessment exam is to increase the diversity of questions by asking each organic chemistry instructor to provide two to three questions for each of the four main topics-general chemistry concepts, resonance concepts, mechanism concepts, and chemical reactions. From this pool of questions, the instructors could randomly select one question for each of the four main topics and include them in the general test format.</p>

*Include this information in the Department's Year-End Report.

GEN ED#9 – EMPLOY CONCEPTS AND METHODS OF THE NATURAL AND PHYSICAL SCIENCES TO MAKE INFORMED JUDGMENTS**QCC Example Outcomes:**

- a. Describe fundamental concepts in a field of science
- b. Explain and demonstrate the process of scientific inquiry
- c. Discuss the role of science and its impact on the individual, society and the environment

Common Core Outcomes:**Required Core:****I.C – Life and Physical Sciences**

1. Identify and apply the fundamental concepts and methods of a life or physical science.
2. Apply the scientific method to explore natural phenomena, including hypothesis development, observation, experimentation, measurement, data analysis, and data presentation.
3. Use the tools of a scientific discipline to carry out collaborative laboratory investigations.
4. Gather, analyze, and interpret data and present it in an effective written laboratory or fieldwork report.
5. Identify and apply research ethics and unbiased assessment in gathering and reporting scientific data.

Flexible Core:**II.E – Scientific World**

(1-3 are in QCC 4 and 5 above)

4. Identify and apply the fundamental concepts and methods of a discipline or interdisciplinary field exploring the scientific world, including, but not limited to: computer science, history of science, life and physical sciences, linguistics, logic, mathematics, psychology, statistics, and technology-related studies.
5. Demonstrate how tools of science, mathematics, technology, or formal analysis can be used to analyze problems and develop solutions.
6. Articulate and evaluate the empirical evidence supporting a scientific or formal theory.
7. Articulate and evaluate the impact of technologies and scientific discoveries on the contemporary world, such as issues of personal privacy, security, or ethical responsibilities.
8. Understand the scientific principles underlying matters of policy or public concern in which science plays a role.

GEN ED OUTCOMES ADDRESSED IN ASSESSMENT:**QCC 9**

- a. Describe fundamental concepts in a field of science
- b. Explain and demonstrate the process of scientific inquiry
- c. Discuss the role of science and its impact on the individual, society and the environment

Required Core:**I.C – Life and Physical Sciences**

1. Identify and apply the fundamental concepts and methods of a life or physical science.
2. Apply the scientific method to explore natural phenomena, including hypothesis development, observation, experimentation, measurement, data analysis, and data presentation.

Flexible Core:**II.E – Scientific World**

6. Identify and apply the fundamental concepts and methods of a discipline or interdisciplinary field exploring the scientific world, including, but not limited to: computer science, history of science, life and physical sciences, linguistics, logic, mathematics, psychology, statistics, and technology-related studies.
7. Demonstrate how tools of science, mathematics, technology, or formal analysis can be used to analyze problems and develop solutions.
8. Articulate and evaluate the empirical evidence supporting a scientific or formal theory.

EVIDENCE/ MEASURABLE DATA• **GROUP SIZE:**No. of students 136No. of sections

This assessment addressed the following student learning outcomes:

1. An understanding of the major concepts of Microbial life processes.
 2. An ability to understand, use and interpret the general concepts and language of microbiology to comprehend the current technical advances in the field.
 3. The ability to perform and apply basic microbiology laboratory techniques such as basic aseptic technique, methods of sterilization and disinfection, use of the microscope and basic staining techniques. The ability to use the techniques acquired as above in their chosen health-allied careers.
- A short assessment quiz was administered to students in select lab and lecture sections to assess student learning gains in the lecture sections. Students took the quiz after their final Lab Practical or the last lecture exam. A rubric was used to analyze the results of the assessment activity.

FINDINGS

Following are the results and observations of the analysis of assessment quiz-

	<ul style="list-style-type: none"> • Total 136 students took the quiz. The average score on the quiz was 67% success. • Students performed well for most of the competencies in course content areas such as Cell theory, general classification of microorganisms and microbial control etc. <p>More than 70% answered one question correctly whereas 60% answered both questions correctly.</p> <ul style="list-style-type: none"> • Overall student performance was found to be poor in competencies that cover course content areas such as Microbial Genetics and Microbial metabolism. While about 50% students answered one question correctly, less than 40% students answered both questions correctly. • Student performance was also found to be barely satisfactory in competencies of comprehension and ability to apply the knowledge gained to daily life challenges. 50% of the students failed to apply the concepts learned in class to everyday situations.
ACTION PLAN*	<p>When these results were shared and discussed with some of the course instructors, it was a common agreement that the results of five lecture exams administered by are in consensus with the outcome of the above quiz, so the above results were not surprising. However we recognize certain issues which may have adversely affected the outcome of the assessment activity.</p> <ol style="list-style-type: none"> 1. The timing of the assessment activity could have been better. Since at the end of the semester after taking a one hour Final practical exam, most students may not be in their best mind set to take another quiz though it was short. 2. The questions used/worded on the quiz may not be familiar to many students. It would be good to get the consensus of faculty in the beginning of the semester before starting the assessment i.e. to collect a pool of most commonly agreed upon, most commonly used/worded questions by many instructors who teach the course. 3. For assessment of lecture classes, it would be good idea to have a pool of 1-2 questions each per course syllabus unit (there are total 6 units in the course syllabus) which every instructor can incorporate in their lecture exams. So it is not needed to carry out a separate assessment activity.
<ul style="list-style-type: none"> • TIMELINE for ACTION PLAN implementation* 	At the end of the semester, these results can be analyzed.

*Include this information in the Department's Year-End Report.

GEN ED#9 – EMPLOY CONCEPTS AND METHODS OF THE NATURAL AND PHYSICAL SCIENCES TO MAKE INFORMED JUDGMENTS	
QCC Example Outcomes:	Common Core Outcomes:
<ul style="list-style-type: none"> a. Describe fundamental concepts in a field of science b. Explain and demonstrate the process of scientific inquiry c. Discuss the role of science and its impact on the individual, society and the environment 	<p>Required Core:</p> <p>I.C – Life and Physical Sciences</p> <ol style="list-style-type: none"> 1. Identify and apply the fundamental concepts and methods of a life or physical science. 2. Apply the scientific method to explore natural phenomena, including hypothesis development, observation, experimentation, measurement, data analysis, and data presentation. 3. Use the tools of a scientific discipline to carry out collaborative laboratory investigations. 4. Gather, analyze, and interpret data and present it in an effective written laboratory or fieldwork report. 5. Identify and apply research ethics and unbiased assessment in gathering and reporting scientific data. <p>Flexible Core:</p> <p>II.E – Scientific World (1-3 are in QCC 4 and 5 above)</p> <ol style="list-style-type: none"> 4. Identify and apply the fundamental concepts and methods of a discipline or interdisciplinary field exploring the scientific world, including, but not limited to: computer science, history of science, life and physical sciences, linguistics, logic, mathematics, psychology, statistics, and technology-related studies. 5. Demonstrate how tools of science, mathematics, technology, or formal analysis can be used to analyze problems and develop solutions. 6. Articulate and evaluate the empirical evidence supporting a scientific or formal theory. 7. Articulate and evaluate the impact of technologies and scientific discoveries on the contemporary world, such as issues of personal privacy, security, or ethical responsibilities. 8. Understand the scientific principles underlying matters of policy or public concern in which science plays a role.
GEN ED OUTCOMES ADDRESSED IN ASSESSMENT:	
EVIDENCE/ MEASURABLE DATA <ul style="list-style-type: none"> • GROUP SIZE: No. of students _____ No. of sections _____ 	
FINDINGS	The overall results were acceptable for all of the general education objectives (67% or more achieving good or excellent) except for “identify concepts and methods of the mathematical, physical and biological sciences and make judgments about contemporary issues in science and technology.” Only 57% achieved good or excellent on this objective. More analysis is required as the lower success rate may be due to the fact that this objective is not directly connected to any specific learning outcome.
ACTION PLAN*	

*Include this information in the Department’s Year-End Report.