UNIVERSITY OF CENTRAL ARKANSAS
ACADEMIC ASSESSMENT PLAN

Requirements

1. *Submit with New Program Proposal*
    a. *Programs are encouraged to consult with the Office of University Assessment.*
    b. *Contact information assessment@uca.edu*
2. *Send copy of Assessment Plan to the Office of University Assessment, Wingo 215.*
3. *Update the Program Assessment Plan based upon EAPR or Accreditation Cycles.*

Basic Information

Program Name: Chemistry

College: Natural Sciences and Mathematics

Department: Chemistry & Biochemistry

Program Level (check all that apply)

	Associate's
X	Bachelor's
	Undergraduate Certificate
	Master's
	Doctoral
	Graduate Certificate

Date Plan Submitted: 08-24-20

College Dean & email: S. Addison saddison@uca.edu
College Curriculum Committee Chairperson & Email: S. Austin saustin@uca.edu
Department Chairperson & email: P. Desrochers patrickd@uca.edu
Department Curriculum Committee Chairperson & email: R. Mauldin rmauldin@uca.edu

1. Introduction (identify college, unit, and degree programs)

- Purpose
  The Department of Chemistry & Biochemistry in the College of Natural Sciences and Mathematics is a primarily undergraduate department, approved by the American Chemical Society (ACS), that provides several baccalaureate degree plans in chemistry & biochemistry. These degree plans include two that are ACS certified, B.S. ACS Standard track and BS ACS Biochemistry focus, plus a B.S. including minor(s) chosen by the student. The department also serves the B.S. in Environmental Science (biology, chemistry, and policy tracks) degree programs as well as teaching core science for significant majors on campus including biology, nursing, and health science.

- Unit Mission Statement
  The mission of the Department of Chemistry at the University of Central Arkansas is to prepare its undergraduate students for professional life after graduation by providing them the highest quality, comprehensive education, including research, scholarship, and personal mentoring. Additionally, the department contributes to the field of chemistry and serves the community at large.

2. Student Outcomes

Graduates of UCA Chemistry programs will:

a. Have firm foundations in the fundamentals and application of current chemical and scientific theories in each of the following sub-disciplines:
   (i) Organic Chemistry
   (ii) Inorganic Chemistry
   (iii) Physical Chemistry
   (iv) Analytical Chemistry
   (v) Biochemistry

b. Be skilled in problem solving, critical thinking, quantitative and analytical reasoning,

c. Be capable of using modern laboratory instrumentation and understand the theory and limitations associated with each technique,

d. Be able to use chemical theory to identify problems, design experiments to solve these problems, and interpret the results of these experiments,

e. Know and follow proper procedures and regulations for safe handling and use of chemicals,

f. Keep thorough laboratory records and be effective in both oral and written communication,

g. Effectively use the chemical literature,

h. Work effectively as part of a team.

i. Application of green chemistry principles and systematic thinking in lab/research.

3. Assessment Cycle

- Assessment Cycle will be determined with assistance from the Office of Assessment

	2015-2016	2016-2017	2017-2018	2018-2019	2019-2020	2020-2021	2021-2022	2022-2023	2023-2024	2024-2025
a	C	A	I	C	A	I	C	A	I	C
b/d	A	I	C	A	I	C	A	I	C	A
c	C	A	I	C	A	I	C	A	I	C
e	I	C	A	I	C	A	I	C	A	I
f	A	I	C	A	I	C	A	I	C	A
g	A	I	C	A	I	C	A	I	C	A
h	I	C	A	I	C	A	I	C	A	I
i					C	A	I	C	A	I

C = Collect data, A = Analyze data, I = Implement Changes

4. Curriculum Maps

- Office of Assessment will provide examples and consultative services to meet this requirement.

See Curriculum Map tables on the following pages

Student Learning Outcomes Mapped to Chemistry Curriculum and Courses

Course SLO	1450 CCI	1451 CCII	2401 OCI	3411 OCII	3211 Spec	3520 Quant	4450 PC I	4460 PC II	4320 BC I	4112 Smnr	3360 IntIn	Misc. Rsrch[1]	4335 BC II	4121 BClab	4380 AdvIn	3150 AdvInlab	4451 AdvAn
a. i			I	I,A,R	A,R							I,A,R [2]					
a. ii											I,A				I,A,R	A,R	
a. iii							I,A,R	I,A,R									
a. iv						I,A,R											A,R
a. v									I,A				A,R	A,R			
b/d			I,A,R	I,A,R	I,A,R	I,A,R	I,A,R	I,A,R	I,A,R			A,R	A,R	A,R	A,R	A,R	A,R
c			I	A,R	A,R	I,A	I,A	I,A,R	A			I,A,R		A,R		A,R	A,R
e			I	A,R		A,R	R	A,R				I,A,R		A,R		A,R	A,R
f			I,A	I,A		I,A	A,R	A,R	A,R	I,A,R		A,R	A,R	A,R	A,R	A,R	A,R
g						A,R	A,R	A,R	A,R	A,R	A,R	A,R	A,R	A,R	A,R	A,R	A,R
h			I	I,A,R		A,R	A,R	A,R	A,R			A,R	A,R	A,R		A,R	A,R
i			I	I,A,R					A		A	A	A	A		A	A

a. Have firm foundations in the fundamentals and applications of current chemical and scientific theories in each of the following sub-discipline: i. Organic Chemistry. ii. Inorganic Chemistry. iii. Physical Chemistry. iv. Analytical Chemistry. v. Biochemistry

b/d. Be skilled in problem solving, critical thinking, quantitative and analytical reasoning by using scientific, especially chemical theories.

c. Be capable of using modern instrumentation and understand the theory and limitations.

e. Know and follow proper procedures and regulations for safe handling and use of chemicals.

f. Be effective in both oral and written communication.

g. Effectively use the chemical database and literature.

h. Work effectively as part of a team.

i. Apply green chemistry principles and systematic thinking in lab and research activities.

[1] The department provides a wide spectrum of research opportunities based on faculty members' expertise (inorganic, organic, analytical, physical, biochemistry and chemical education) for students to apply skills introduced and reinforced from regular courses. Because of this variability in expertise focus, each research project is unique to the extent that it introduces/applies/reinforces SLO(a), but evaluations from both faculty and students serve to assess students' research performance.

[2] Unique features of various SLO's are alternately (I)ntroduced, (A)pplied in a unique way, and continuously (R)einforced across different research programs and different faculty research interests.

Modern Chemical Instrumentation Mapped to Chemistry Curriculum and Courses

SLO	Course	1450/1451 CCI/CCII	2401 OCI	3411 OCII	3211 Spec	3520 Quant	4450 PC I	4460 PC II	4320 BC I	4112 Smnr	3360 IntIn	Misc. Rsrch	4335 BC II	4121 BClab	4380 AdvIn	3150 AdvInlab	4451 AdvAn
NMR	Theory		I	I	A							R			R		
	Operate				I							R				R	
	Interpret		I	I	A							R					
FTIR	Theory		I		A							R					R
	Operate											R				R	
	Interpret		I		A							R				R	R
UV-vis	Theory											R			I		
	Operate							A				R				A	A
	Interpret							A				R			I	A	A
Mass Spec.	Theory			I	A												R
	Operate																R
	Interpret			I	A												A
Chrom.	Theory		I			R											R
	Operate		I			R		A									R
	Interpret		I			R		A									R
			I – introduce A – apply R – reinforce														

5. Assessment Methods and Measures (Formative and Summative recommended)

- Record the assessment measure(s) that evaluate each student learning outcome (note: each learning outcome should have an associated assessment measure).
- Direct Methods/Measures Preferred/Used at the Course and Program Levels (examples: writing examples, oral examinations, internships, clinicals, quizzes, test, team/group projects and presentations)
- Indirect Methods/Measures Preferred/Used at the Course and Program Levels (examples: surveys, quantitative data, course grades, alumni surveys, student evaluation of instruction

1. Fundamentals and application of chemical theories (subcommittee a): Standardized Major Field Test (MFT).

2. Critical inquiry (subcommittee b/d): Mandatory ACS research reports from ACS certified chemistry majors and rubric evaluation for critical inquiry based on these reports.

3. Instrumentation (subcommittee c): Rubric evaluation of hands on operating experience of instrument and test questions embedded into exams in CHEM3211 (Organic Spectroscopy), CHEM3520 (Quantitative Analysis) and CHEM4380 (Inorganic Chemistry).

4. Safety (subcommittee e): ACS safety quiz given in CHEM3520 (Quantitative Analysis).

5. Oral and written communication (subcommittee f): Rubric evaluation based on research presentations in CHEM4112 (Seminar) and ACS research reports from ACS certified chemistry majors.

6. Chemical literature (subcommittee g): Assignments given in CHEM4450 (Physical Chemistry I) and rubric evaluation in CHEM4112 (Seminar).

7. Team work (subcommittee h): Peer evaluation through rubric in CHEM3520 (Quantitative Analysis).

8. Green chemistry (subcommittee i): Rubric evaluation on lab and research activities.

6. Data Collection and Review

- When will data be collected for each outcome?
- How will data be collected for each outcome?
- What will be the benchmark/target for each outcome?
- What individuals/groups will be responsible for data collection?

Fundamentals and application of chemical theories (subcommittee a): Standardized Major Field Test (MFT) will be completed by graduating seniors during their final semester at UCA. Median scores on each sub-discipline (analytical chemistry, inorganic chemistry, organic chemistry, physical chemistry and biochemistry), critical thinking and overall will be collected and analyzed.
Benchmarks: Median of overall percentile should be above 60% and median of subdivisions percentile should be above 50%. No decrease in the overall percentile for two consecutive years
Subcommittee members: Nolan Carter, Tori Dunlap (chair), Kristin Dooley, Nathan Meredith, Marsha Massey

Critical inquiry (subcommittee b/d): At the end of spring semester, mandatory ACS research reports from ACS certified chemistry majors will be deposited on department Google drive. Rubric evaluation for critical inquiry based on these reports will be submitted by research advisor through online forms.
Benchmarks: Average score of 12 (maximum 16).
Subcommittee members: Nolan Carter, Bill Taylor, Faith Yarberry, Rob Mauldin (Chair).

Instrumentation (subcommittee c): First, questions will be given during the exit survey of graduating seniors and rubric evaluation will be evaluated through online forms. Second, test questions will be embedded into exams in CHEM3211 (Organic Spectroscopy), CHEM3520 (Quantitative Analysis) and CHEM4380 (Advanced Inorganic Chemistry) throughout each academic year.
Benchmarks:

Instrument	Scores of 2 or better on core instruments
NMR	75%
IR	75%
Mass Spec	75%
UV-Vis	75%
Chromatography	75%

Subcommittee members: Tori Dunlap, Greg Naumiec, Bill Taylor (Chair)

Safety (subcommittee e): Department safety quiz will be given in CHEM3520 (Quantitative Analysis) and at the time of students taking MFT.
Benchmark: 75% or above.
Subcommittee members: Jamie Freeman (co-chair), Greg Naumiec, Adrian Brown (student), Pat Desrochers (co-chair)

Oral and written communication (subcommittee f): Online rubric evaluation based on research presentations in CHEM4112(Seminars) and ACS research reports from ACS certified chemistry majors will be performed at the end of spring semester.
Benchmarks: Oral communication with an average score of 15 or above (maximum 20) and written communication with an average score of 15 or above (maximum 20).
Subcommittee members: Mellisa Kelly (chair), Kristin Dooley

Chemical literature (subcommittee g): Database assignments will be given in CHEM4450 (Physical Chemistry I) and online rubric evaluation based on students' performance in CHEM4112 (Seminar) will be given at the end of each spring semester.
Benchmarks: Database assignment with an average of 70% or above (average score of 5.6 out of total 8) and literature performance of an average of 6 or above (maximum 8).
Subcommittee members: Kristine Dooley, Makenzie Long, Lori Isom (Chair)

Team work (subcommittee h): Peer evaluation through online rubric form will be performed in CHEM3520 (Quantitative Analysis).
Benchmark: TBD
Subcommittee members: Greg Naumiec, Faith Yarberry and Marsha Messey (chair)

Green chemistry (subcommittee i): Rubric evaluation on lab and research activities will be performed.
Benchmark: TBD
Subcommittee members: Kristine Dooley, Rick Tarkka (Chair) and one more

7. Participation in Assessment Process

- Who will participate in carrying out the assessment plan?
- What will be their specific role/s?

In an effort to equitably share the assessment work, the following basic guidelines are followed:

- If a faculty member serves as a subcommittee chair, the faculty member will serve in two or less subcommittees.
- If a faculty member doesn't serve as a subcommittee chair, the faculty member will serve in two or three subcommittees as a regular committee member.

Special consideration are given for some subcommittees:

- Subcommittee a requires one faculty member from each chemistry subdivision (inorganic chemistry, organic chemistry, analytical chemistry, physical chemistry and biochemistry) due to the fact that MFT is a comprehensive test involving all five subdivisions.
- Subcommittee c requires faculty members who teach CHEM3211 (Organic Spectroscopy), CHEM3520 (Quantitative Analysis) and CHEM4380 (Advanced Inorganic Chemistry), so students' results can be analyzed more effectively.
- Subcommittee e requires the participation of department chair and department lab coordinator because safety is an important matter involving the whole department. A student member of department ACS chapter is also involved to collect input from students.
- Subcommittee I requires the participation of department lab coordinator because one part of green chemistry involves chemical safety and waste handling.

Faculty members	**a**	**b/d**	**c**	**e**	**f**	**g**	**h**	**i**
Kerry Barnet	Newly hired faculty will be assigned in the future							
Nolan Carter	X	X						
Patrick Desrochers				X				
Kristin Dooley					X	X		X
Tori Dunlap	X		X					
Jamie Freeman				X				
Lori Isom						X		
Melissa Kelly					X			
Makenzie Long	X					X		
Marsha Massey	X						X	
Robert Mauldin		X						
Greg Naumiec			X	X			X	
Richard Tarkka								X
Bill Taylor		X	X					
Lei Yang	Department assessment program director							
Faith Yarberry	X						X	
Student safety officer elected by student ACS chapter				X				
X-subcommittee chair X-regular subcommittee member								

8. Data Analysis

- How will the data and findings be shared with faculty?
- Who was involved in analyzing the results?
- How are results aligned to outcomes and benchmarks?

The benchmarks are made and revised based on previous assessment work. After each evaluation year, the results are collected and analyzed by each subcommittee during the next academic year.

One of major tasks of these discussions is to compare the students' outcomes with benchmarks to identify whether the benchmarks are not being meet, are met or are exceeded. The data, analyses and findings are deposited on a shared department Google drive where they are accessible to all faculty members. In addition, the department assessment program director interviews subcommittee chairs at the end of year to collect feedback, suggestions and comments. Then a department presentation is given by the assessment program director at the beginning of each fall semester to share and discuss the data/findings with the whole department.

9. Plan for Using Assessment Results to Improve Program

- How will you use the results to improve your program?

Based on the evaluation results, each subcommittee identifies reasons that students' outcomes/performances fall below established benchmarks, and proposes actions/changes accordingly in order to improve student performance and outcomes. During the next academic year, these actions/changes are implemented into rubric/survey/assignment/test to collect new data/results.

It also happens that emerging areas of interest (i.e. *green chemistry*) are deemed by the department with input from the ACS Center for Professional Training as worthy of inclusion in courses. These represent new student learning outcomes considered valuable in graduates from the department. Appropriate assessment benchmarks and rubrics are then developed accordingly.

10. What are the plans to evaluate students' post-graduate success?

Graduates will be periodically polled via an anonymous email survey soliciting perspectives on how specific SLO's may or may not be relevant to their current situation post-graduation. These will inform future deliberations and recommendations for assessment and possible alteration in SLO's. It is important for the department SLO's to strike a balance between chemical educational best-practices and the post-graduate experiences and career needs of our graduates. The department's program is approved by the American Chemical Society's Committee on Professional Training. This organization uses input from the broader national and international chemistry community to develop guidelines for educational best practices.

Each graduating student in the department conducts an exit interview with the department chair several months before graduation. This interview forms the basis for student perspectives on their experience with the department's program and details student plans following graduation. The department chair periodically summarizes trends in student perspectives and presents these for discussion at regular department meetings. When repeated suggestions indicate a clear pattern of student interest for a program improvement, the department works to implement these changes.

11. What are the plans to evaluate teaching effectiveness?

Each September the department has a collective discussion of assessment results that were (C)ollected and (A)nalyzed by respective departmental assessment subcommittees during the previous AY. This evaluation considers the extent to which students are meeting the SLO's and presents each subcommittees' recommendations for any changes that need to be (I)mplemented in the next assessment cycle. These recommendations are based on committee deliberations during the previous AY. Subcommittee faculty assignments are made in part to have broad chemical subdiscipline representation, ensuring pedagogical best-practice input from each of the traditional chemical subdisciplines (analytical, biochem, inorganic, organic, physical) across all of the assessment areas. Results of this departmental discussion include 1) broad consensus on the meaning of specific assessment results and 2) endorsement of or suggested alterations in instructional practices recommended by the responsible subcommittee. Faculty charged with implementing these recommended practices leave that meeting prepared to address them in the coming AY; they are free to discuss and seek clarification from the subcommittee and colleagues if they have any uncertainty.

Each spring individual faculty have annual performance evaluation meetings with the department chair, with annual digital measures reports, student evaluations, and occasional external observations of their teaching serving as the outline for topics in this discussion. A component of this discussion includes the extent to which the faculty member is meeting instructional obligations expected for their discipline, what current best practices they are including or could add to improve effectiveness, and how they might consider sharing particularly insightful approaches with their peers and a national audience. Each faculty member is asked the question, "What do you need from the chair (to be more effective)?" These answers are recorded by the chair and compiled into a list of considerations that inform departmental priorities in the year ahead. These priorities could include acquisition of tools to aid instruction, support from the chair and other department colleagues to help improve instructional effectiveness in a particular area, or sometimes reduction and reorganization of faculty responsibilities to allow time for development of improved instructional methods.

Faculty are encouraged to pursue external peer-evaluations of their teaching, including CTE instructional observations, from national audiences at conferences, and through peer-reviewed chemical education publications. The latter two examples are especially helpful recognition for exceptional educational practices that can benefit chemical education broadly.

12. Appendices-Required….Curriculum Maps by Program, Assessment Tools (examples: Rubrics, Surveys, Tests, etc.), any other important materials/documentation

Appendix 1. MFT results from 2018-2019 academic year

Appendix 2. Critical inquiry (subcommittee b/d)

Appendix 3. Instrumentation use survey (subcommittee c)

Appendix 4. Safety assessment quiz (subcommittee e)

Appendix 5. Oral and written communication rubrics (subcommittee f)

Appendix 1. MFT results from 2018-2019 academic year

	Percentile	Overall	Physical chemistry	Organic chemistry	Inorganic chemistry	Analytical chemistry
Student 1	58	150	56	47	51	39
Student 2	1	126	41	29	24	20
Student 3	34	141	47	37	54	33
Student 4	28	140	41	42	38	44
Student 5	60	151	44	47	54	62
Student 6	28	140	50	26	48	47
Student 7	83	164	79	47	65	59
Student 8	47	146	56	34	48	50
Student 9	55	149	59	39	51	39
Student 10	25	139	44	31	41	41
Student 11	66	154	62	56	51	41
Student 12	28	140	39	45	32	39
Student 13	20	137	39	42	32	39
Student 15	25	139	41	29	45	51
Student 16	60	151	41	50	61	41
Student 17	39	154	68	37	58	53
Student 18	17	136	44	31	45	23
Student 19	74	158	59	42	74	53
Student 20	55	149	53	59	45	50
Student 21	88	169	68	47	81	74
Student 22	20	137	36	42	35	39
Student 23	45	145	53	34	48	56
Student 24	64	153	68	29	58	65
Student 25	47	146	41	47	54	41
Student 26	79	161	71	50	58	59
Student 27	7	132	44	29	32	25
Student 28	28	140	36	50	29	36
Student 29	15	135	33	47	38	28
Student 30	23	138	53	37	26	33
Median	39	145	47	42	48	41
Average	42	145	50.5	40.7	47.4	41.4

Appendix 2. Critical inquiry (subcommittee b/d):

UCA CORE–Critical Inquiry Rubric

This rubric is used to assess students' progress towards Goal B of the Critical Inquiry area of the UCA Core.

Goal B: Apply scientific process to solve problems/answer questions.

This rubric assesses the following four specific skill or knowledge areas to Goal B:

1. Define Problem/Question: A statement or summary that identifies a problem or raises a question that is relavent to the topic or assignment, appropriate to the discipline, and open to empirical inquiry (i.e., objective observation).

2. Propose hypotheses: Formulating testable propositions that follow from one particular solution/answer to the problem/question.

3. Idenfity Methodology: Selecting the appropriate set of procedures to test the hypotheses.

4. Evalute results: An objective assessment of the hypotheses based on the empirical evidence gathered from the methodology.

How to use this rubric:

1. Apply the rubric to at least one assignment. If different skill or knowledge areas are assessed by different assignments. Then apply the respective rows of the rubric to those assignments that assess each specific skill or knowledge area. All skill or knowledge areas listed in this rubric must be assessed by the end of the course.

2. For each specific skills or knowledge area, assign a score from 0 to 4 based on the student learning outcome that best matches the performance of the student on the assignment.

3. Although the rubric may inform the grading scheme used for the assignment, it should not replace it. Scores of 4, 3, 2, and 1 do not necessarily corresponds to A, B, C, and D. The rubric is used to track students' progress thoughout the UCA Core, not just their performance in a single course. Thus, a score of 4 represents the expected mastery of that skill or knowledge are by time a student graduates. That mastery may come earlier or later in a student's progression though the UCA Core, but generally speaking, scores of 1 and 2 are expected in lower division courses, whereas scores of 3 and 4 are expected in upper-division and capstone courses.

Student name *

Research advisor name *

Time of evaluation *

MM / DD / YYYY

☐ This student did not turn in an acceptable response to the assignment (e.g. Failed

to turn in a research report, plagiarizam, et al).

Criterion 1. Define Problem/Question

4 points
Communicates comprehensive, contextual understanding of the problem/question.

3 points
Compare problem/question statements to determine which best summarizes the problem.

2 points
Composes a basic, accurate problem/question statement.

1 point
Recognize an applicable problem/question statement.

0 point
Assign a zero for performance that does not meet a score of one (1). *

Criterion 2. Propose Hypotheses

4 points
Communicate a hypothesis reflecting a comprehensive understanding of the problem/question.

3 points
Develops a hypothesis that links variables.

2 points
Composes a testable hypothesis from a scenario.

1 point
Recognizes a testable hypothesis.

0 point
Assign a zero for performance that does not meet a score of one (1). *

Criterion 3. Identify Methodology

4 points
Proposes complex, multi-level strategic approaches for solving the problem or addressing the question.

3 points
Devises a complete appropriate strategic plan including controls to address the problem/question.

2 points

Distinguishes between valid options to select the best strategic plan to address the problem/question.

1 point
Recognizes appropriate strategic steps that address the problem/question.

0 point
Assign a zero for performance that does not meet a score of one (1). *

Criterion 4. Evaluate Results

4 points
Articulates a comprehensive evaluation of results including next steps.

3 points
Produces an accurate interpretation of data including a consideration of sources of error.

2 points
Select the best interpretation of results.

1 point
Recognizes an accurate interpretation of results.

0 point
Assign a zero for performance that does not meet a score of one (1). *

Total points from the four criteria:

Submit

Powered by MachForm

Appendix 3. Instrumentation use survey and sample course questions (subcommittee c):

Instrument use survey

Gauging the level of your exposure and experience with major chemical instrumentation in the department.

Name *

First Last

Chemistry degree earned from UCA *

Term BS completed *

Year BS completed *

20

Core Instruments

For each instrument specify on a scale of 0 to 4 your knowledge and experience with that equipment.
We expect that most students will not have used all of the instruments on this list.

NMR *

- ○ 0 I have not used the instrument or watched someone else use it.
- ○ 1 I have only watched someone use this.
- ○ 2 I have used this only with direct supervision and continuous step by step instructions on what to do next.
- ○ 3 I can use the instrument, though I sometimes need someone to help me.
- ○ 4 I can use the instrument with little or no supervision. I usually do not need any help

FT-IR *

- ○ 0 I have not used the instrument or watched someone else use it.
- ○ 1 I have only watched someone use this.
- ○ 2 I have used this only with direct supervision and continuous step by step instructions on what to do next.
- ○ 3 I can use the instrument, though I sometimes need someone to help me.
- ○ 4 I can use the instrument with little or no supervision. I usually do not need any help

UV-vis *

- ○ 0 I have not used the instrument or watched someone else use it.
- ○ 1 I have only watched someone use this.

- ○ 2 I have used this only with direct supervision and continuous step by step instructions on what to do next.
- ○ 3 I can use the instrument, though I sometimes need someone to help me.
- ○ 4 I can use the instrument with little or no supervision. I usually do not need any help

Mass spectrometer*
(Identify specific MS in next field) *

- ○ 0 I have not used the instrument or watched someone else use it.
- ○ 1 I have only watched someone use this.
- ○ 2 I have used this only with direct supervision and continuous step by step instructions on what to do next.
- ○ 3 I can use the instrument, though I sometimes need someone to help me.
- ○ 4 I can use the instrument with little or no supervision. I usually do not need any help

***specific MS instrument that most applies to your answer above** *

- ☐ MALDI TOF MS
- ☐ LCMS
- ☐ GCMS

Other Instruments

For each instrument specify on a scale of 0 to 4 your knowledge and experience with that equipment.

Atomic absorption (AA) spectrometer *

- ○ 0 I have not used the instrument or watched someone else use it.
- ○ 1 I have only watched someone use this.
- ○ 2 I have used this only with direct supervision and continuous step by step instructions on what to do next.
- ○ 3 I can use the instrument, though I sometimes need someone to help me.
- ○ 4 I can use the instrument with little or no supervision. I usually do not need any help

Luminescence (fluorimeter) spectrometer *

- ○ 0 I have not used the instrument or watched someone else use it.
- ○ 1 I have only watched someone use this.
- ○ 2 I have used this only with direct supervision and continuous step by step instructions on what to do next.
- ○ 3 I can use the instrument, though I sometimes need someone to help me.
- ○ 4 I can use the instrument with little or no supervision. I usually do not need any help

EPR *

- ○ 0 I have not used the instrument or watched someone else use it.

- ◯ 1 I have only watched someone use this.
- ◯ 2 I have used this only with direct supervision and continuous step by step instructions on what to do next.
- ◯ 3 I can use the instrument, though I sometimes need someone to help me.
- ◯ 4 I can use the instrument with little or no supervision. I usually do not need any help

Cyclic voltammetry *

- ◯ 0 I have not used the instrument or watched someone else use it.
- ◯ 1 I have only watched someone use this.
- ◯ 2 I have used this only with direct supervision and continuous step by step instructions on what to do next.
- ◯ 3 I can use the instrument, though I sometimes need someone to help me.
- ◯ 4 I can use the instrument with little or no supervision. I usually do not need any help

Other instrument*
(identify other below)

- ◯ 0 I have not used the instrument or watched someone else use it.
- ◯ 1 I have only watched someone use this.
- ◯ 2 I have used this only with direct supervision and continuous step by step instructions on what to do next.
- ◯ 3 I can use the instrument, though I sometimes need someone to help me.
- ◯ 4 I can use the instrument with little or no supervision. I usually do not need any help

***Other instrument**

Submit

Sample course questions on instrument use.

Chromatography

1. The height equivalent of a theoretical plate (H) is related to the number of theoretical plates (N) and the length of the column (L) via the following equation:

$$H = \frac{L}{N}$$

If N is large, this means that:
A. Peaks will be broad.
B. The flow rate will be low.
C. The retention time will be very short.
D. The separation will be efficient.
E. The peaks will overlap.

2. An open tubular column is 11 m long and has an inner diameter of 0.53 mm. Unretained solute passes through in 2.5 min, whereas a particular solute has a retention time of 9.4 min. Calculate the linear velocity.
A. 2.4 X 10^4 cm^3/min
B. 0.97 cm^3/min
C. 0.044 cm/min
D. 4.4 X 10^2 cm/min
E. 2.1 X 10^{-2} cm/min

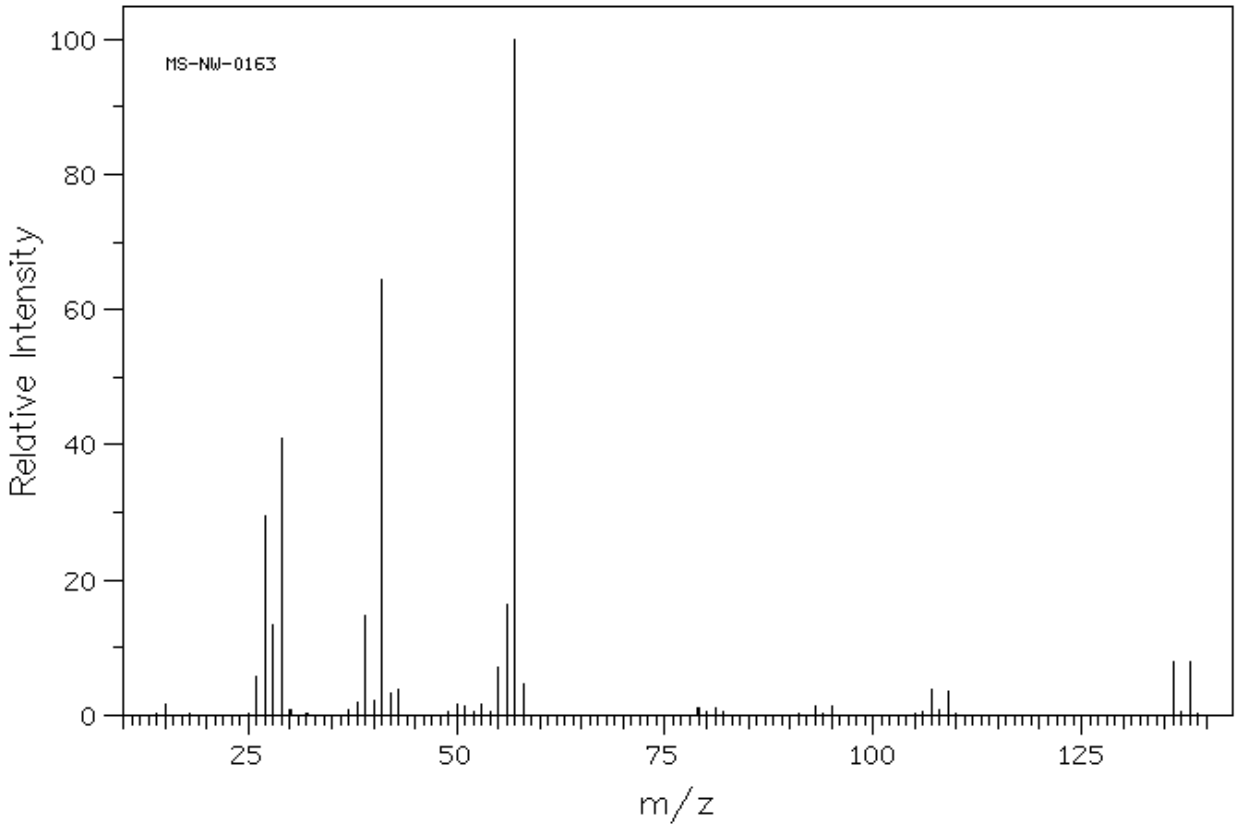
3. Which type of chromatography is considered to be the most selective, employing specific (often lock and key) interactions between one kind of solute and a second molecule that is covalently attached to the stationary phase?
A. Adsorption Chromatography
B. Partition Chromatography
C. Ion-Exchange Chromatography
D. Molecular Exclusion Chromatography
E. Affinity Chromatography

4. The van Deemter equation describes how plate height is related to flow rate and accounts for contributions to peak broadening. At low flow rates, the plate height increases due to which of the following factors?
A. Longitudinal diffusion
B. Nonequilibrium mass transfer
C. Multiple paths
D. Resolution
E. Number of theoretical plates

5. In molecular exclusion chromatography,
A. Polar molecules elute first
B. Large molecules elute first
C. Molecules elute in order of their boiling point (from low to high)
D. Molecules elute based on strength of intermolecular forces between the mobile phase and the stationary phase.
E. Nonpolar molecules elute first

Mass spectroscopy

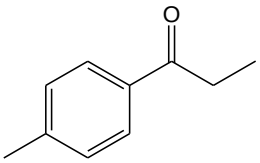
1. What statement best describes the compound with the mass spectrum shown below?

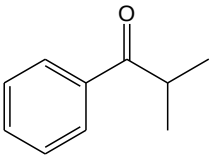


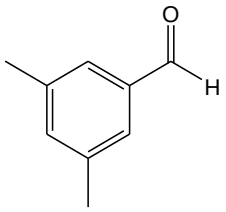
a) The compound contains a nitrogen atom
b) The compound contains a chlorine atom
c) The compound contains a bromine atom
d) The compound contains an oxygen atom
e) The compound contains a sulfur atom

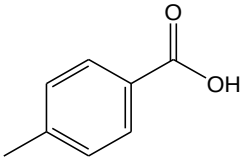
2. Which of the following statements is true?
a) ESI-MS is a hard ionization method.
b) The molecular ion peak is the peak with the highest intensity in a mass spectrum.
c) All the daughter peaks in a mass spectrum are produced from molecular ion directly.
d) In mass spectroscopy, neutral species can NOT be observed.
e) The base peak is the peak with the highest mass to charge ratio.

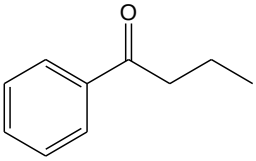
3. Which of the following compounds would be most likely show a loss of *m*/*z* = 28 (M-28) in its mass spectrum?

a) 

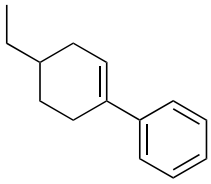
b) 

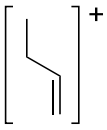
c) 

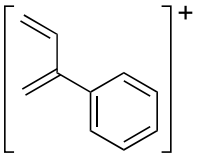
d) 

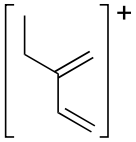
e) 

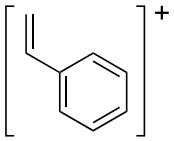
4. If retro Diels-Alder cleavage occurs on the following compound, choose the correct structure of the fragment which can be observed in the mass spectrum.

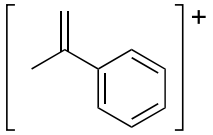


(a) 

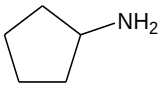
(b) 

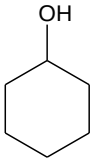
(c) 

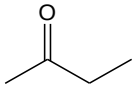
(d) 

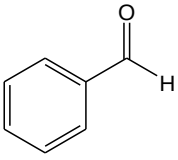
(e) 

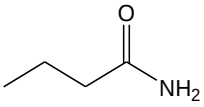
5. Which of the following compounds would undergo fragmentation to give rise to a M-18 peak?

a) 

b) 

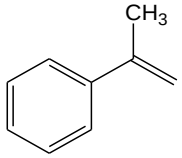
c) 

d) 

e) 

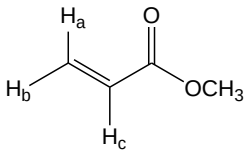
NMR

1. Choose the statement that best applies to the number ^{1}H and ^{13}C NMR signals (the number of chemically equivalent protons and carbons) observed for α-methylstyrene.



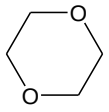
a) the compound displays eight ^{1}H NMR signals and nine ^{13}C NMR signals
b) the compound displays five ^{1}H NMR signals and six ^{13}C NMR signals
c) the compound displays six ^{1}H NMR signals and seven ^{13}C NMR signals
d) the compound displays seven ^{1}H NMR signals and seven ^{13}C NMR signals
e) none of the above are correct

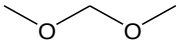
2. Rank the proton coupling constants for methyl acrylate (shown below).

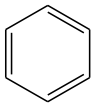


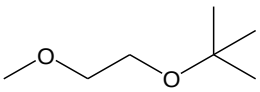
a) $J_{ab} < J_{ac} < J_{bc}$
b) $J_{ac} < J_{bc} < J_{ab}$
c) $J_{ab} < J_{bc} < J_{ac}$
d) $J_{bc} < J_{ab} < J_{ac}$
e) $J_{bc} < J_{ac} < J_{ab}$

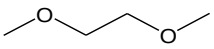
3. Identify the compound that has an ^{1}H NMR spectrum that does NOT consist entirely of singlets.

a) 

b) 

c) 

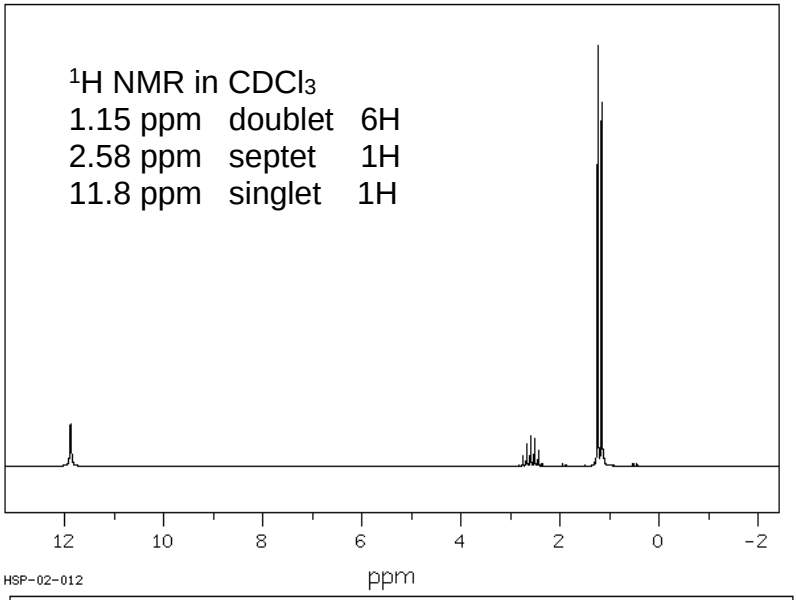
d) 

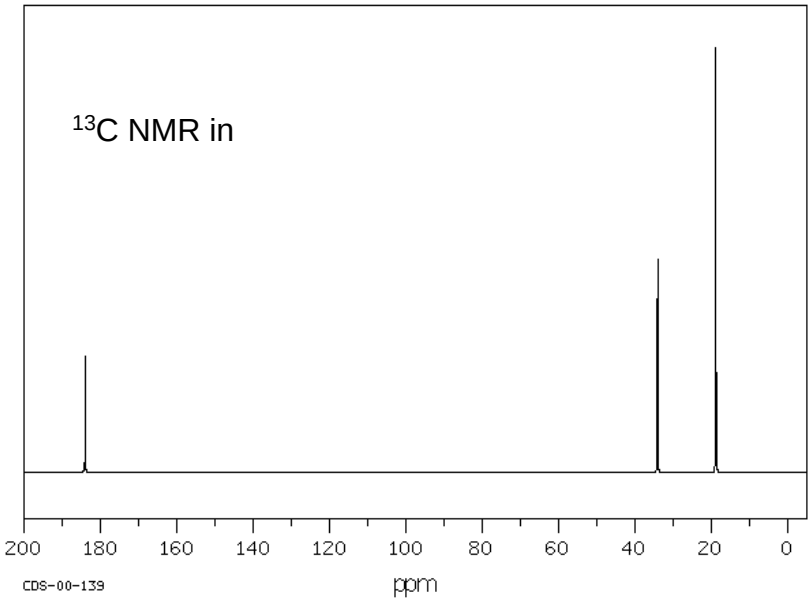
e) 

4. Chloroform has a chemical shift of 724 Hz from TMS on a 100 MHz spectrometer. What will the chemical shift in ppm be on a 60 MHz spectrometer?

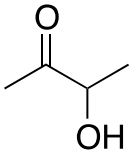
a) 12.10 ppm
b) 4.34 ppm
c) 7.24 ppm
d) 2.90 ppm
e) 11.58 ppm

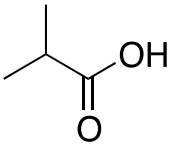
5. The compound with the formula $C_4H_8O_2$ has the ^1H and ^{13}C NMR spectra shown. The IR spectrum shows a strong and sharp peak at 1712 cm^{-1}.

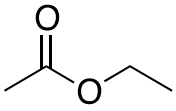


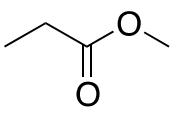


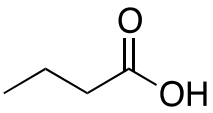
Which one of the following structures is correct?

a) 

b) 

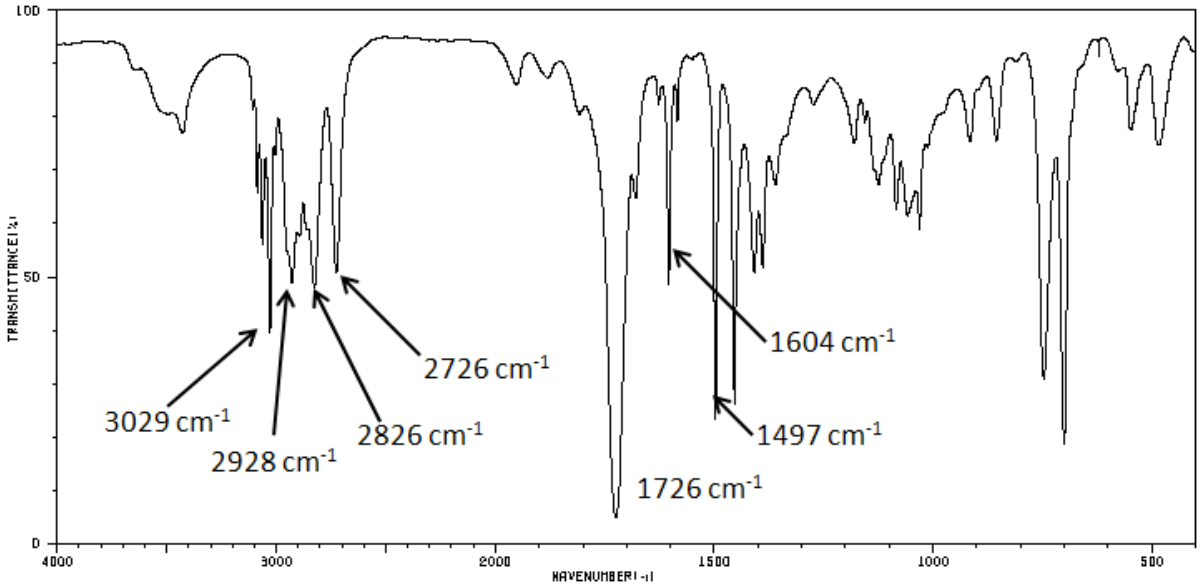
c) 

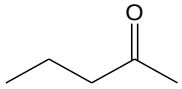
d) 

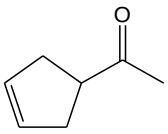
e) 

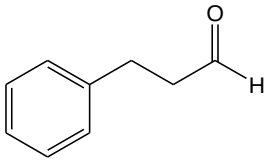
FT-Infrared

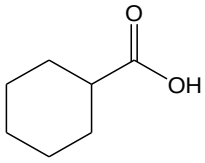
1. Which of the following compounds has the IR spectrum shown below?

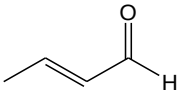


a) 

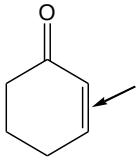
b) 

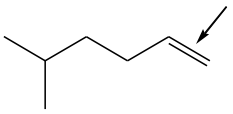
c) 

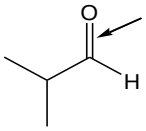
d) 

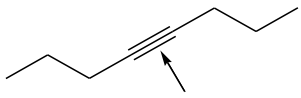
e) 

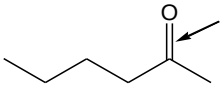
2. Of the bonds marked below, which would have the weakest IR absorption?

a) 

b) 

c) 

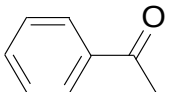
d) 

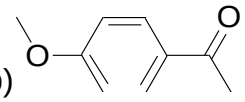
e) 

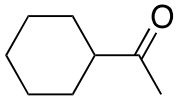
3. Rank the stretching frequencies for the following bonds: O-H, S-H, and Se-H.

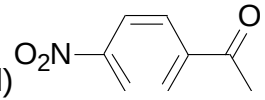
a) O-H < Se-H < S-H
b) Se-H < S-H < O-H
c) S-H < O-H < Se-H
d) Se-H < O-H < S-H
e) O-H < S-H < Se-H

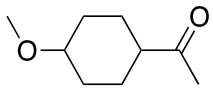
4. Which one of the following compounds will have the lowest C=O stretching frequency?

a) 

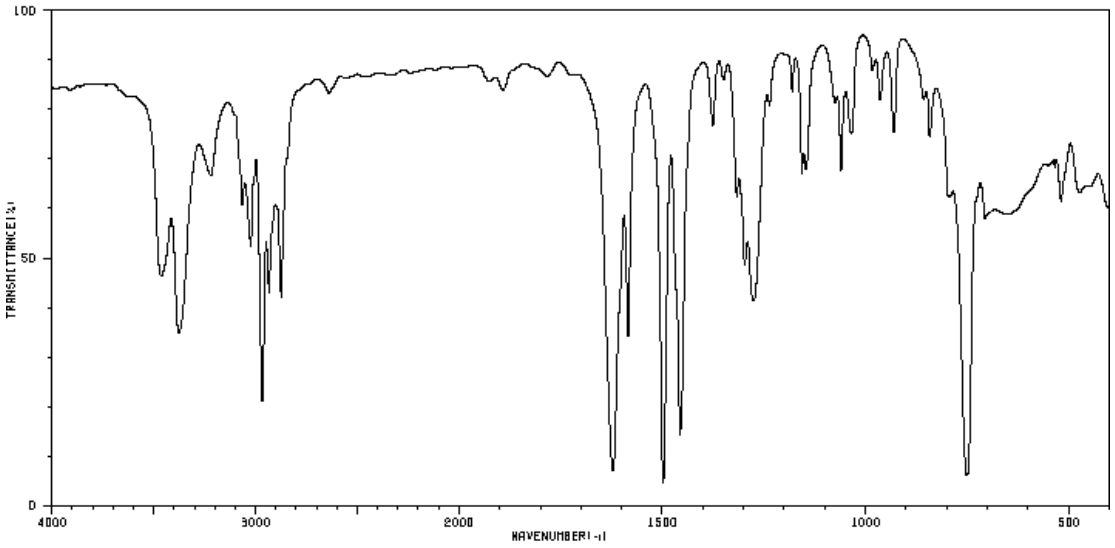
b) 

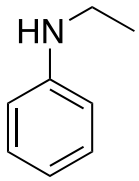
c) 

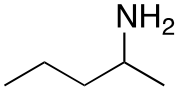
d) 

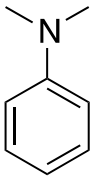
f) 

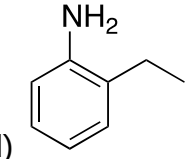
5. Which one of the following amines would give the IR spectrum shown below?

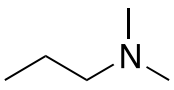


a) 

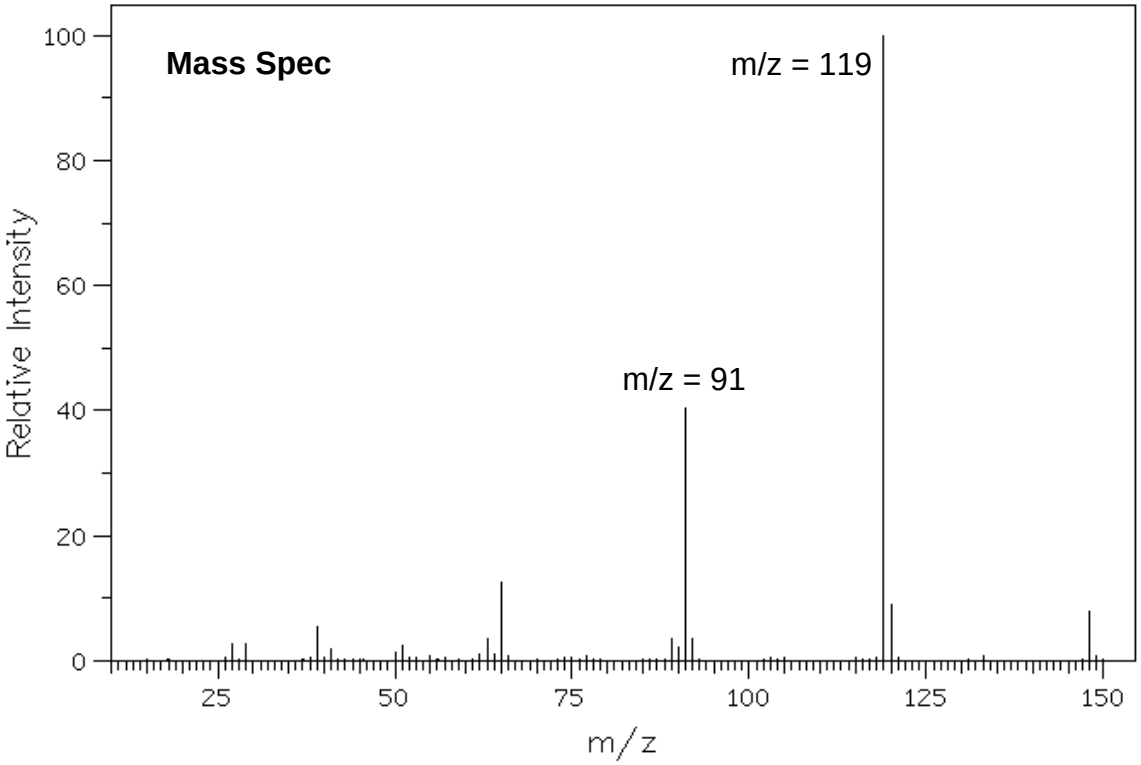
b) 

c) 

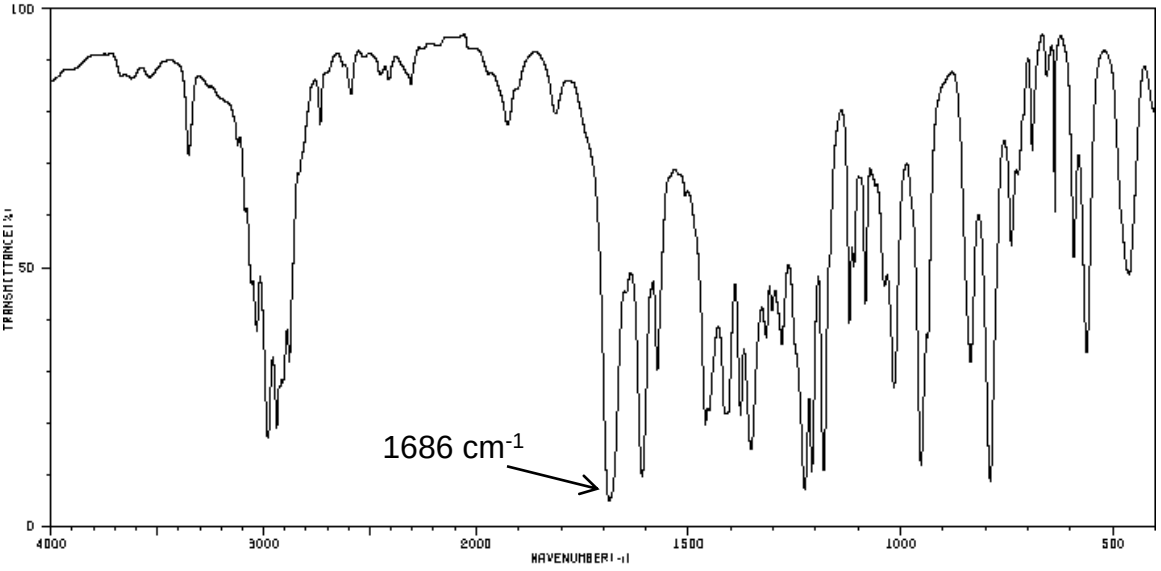
d) 

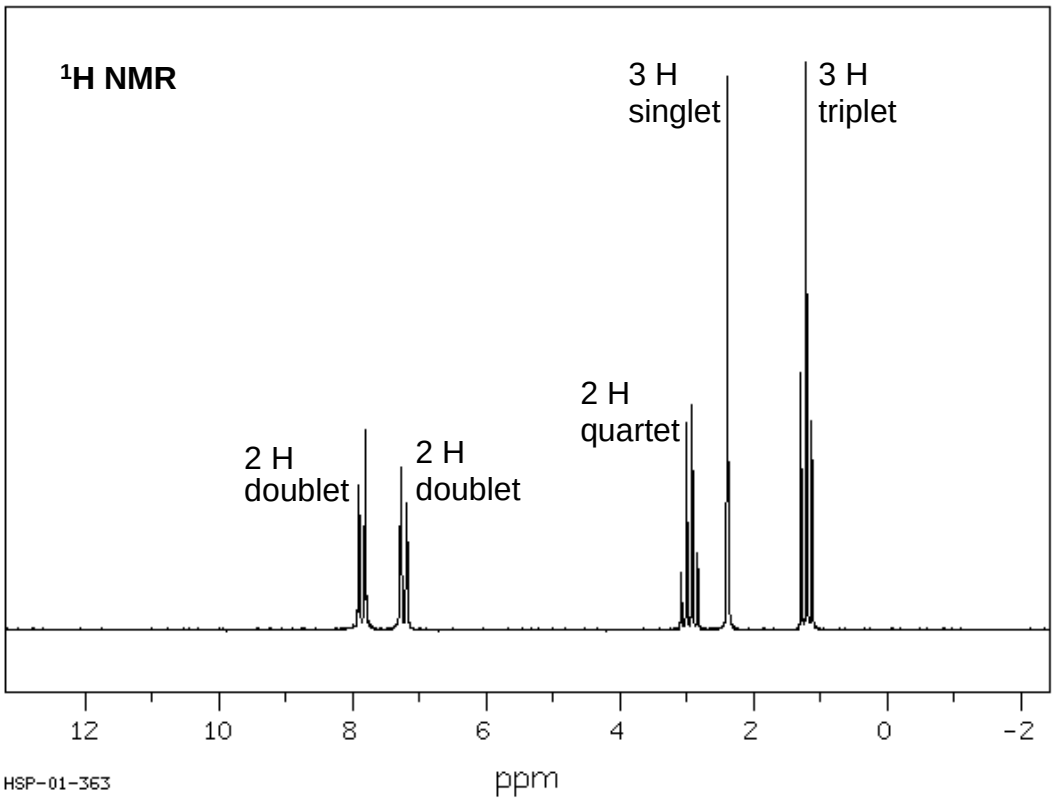
f) 

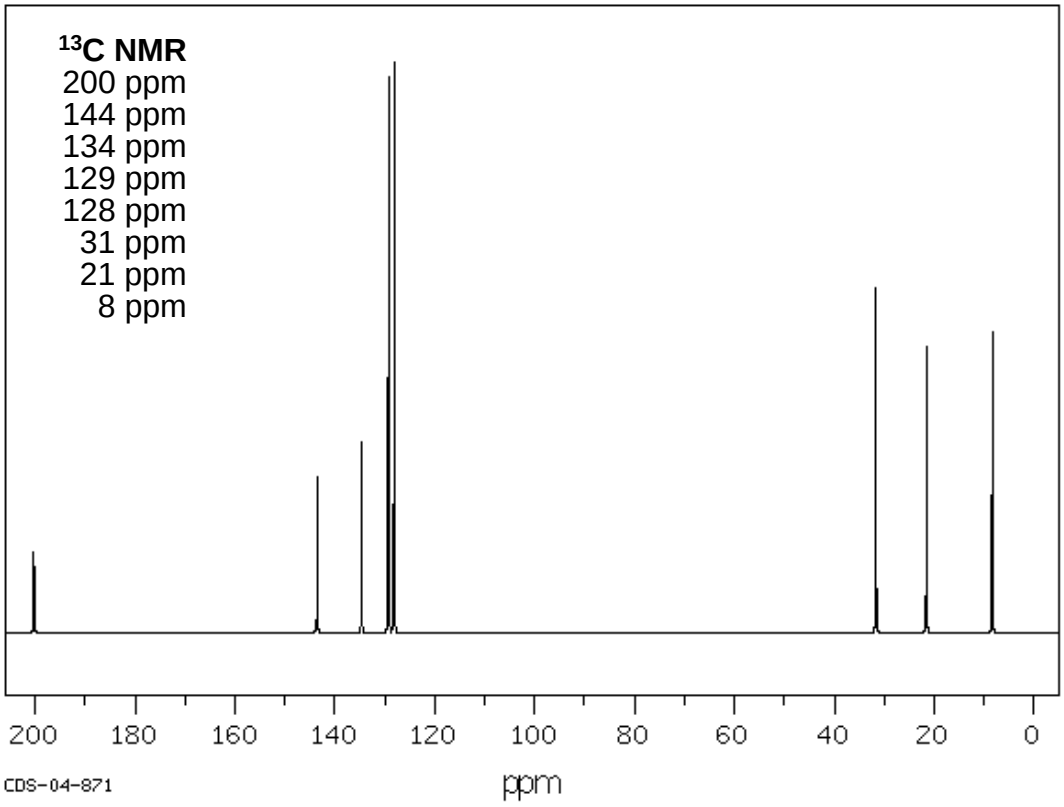
An unknown compound $C_{10}H_{12}O$ (FW = 148.2) was fully characterized by MS, FT-IR, ^{1}H NMR and ^{13}C NMR. (**30 pts**)
(a) Propose the correct structure of this compound and assign the ^{1}H NMR peaks.
(b) Propose the fragmentation mechanism for the two labeled mass spec peaks (m/z = 119 and 91).



FT-IR



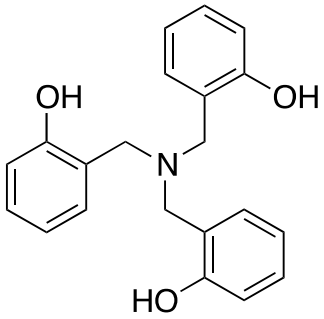

^{1}H NMR
3 H
singlet
3 H
triplet
2 H
quartet
2 H
doublet
2 H
doublet
12
10
8
6
4
2
0
-2
HSP-01-363
ppm

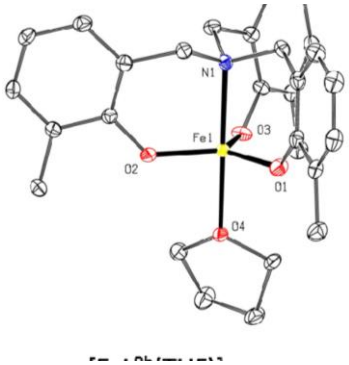

^{13}C NMR
200 ppm
144 ppm
134 ppm
129 ppm
128 ppm
31 ppm
21 ppm
8 ppm
200
180
160
140
120
100
80
60
40
20
0
CDS-04-871
ppm

UV-Vis

1. Which one of the following statements about UV-vis is correct?
(a) UV-vis gives information about functional groups on ligands.
(b) Transition metal complexes should have at least one d-d transition band.
(c) d-d transition bands usually have higher molar absorption coefficient than charge transfer band.
(d) UV-vis can NOT be used to obtain concentration information.
(e) For a certain compound, molar absorption coefficient won't change with concentration.

2. The following compound has been reported. It has a UV-vis absorption band at 410 nm. What is the color of this iron complex?





Inorganic Chemistry, **2012**, *51*, 10639

(a) green
(b) blue
(c) yellow
(d) purple
(e) orange

3. Second and third row transition metals form strong metal ligand bonds and this is reflected in the appearance of their compounds. Which of the following describes the most common color range appearance expected for second and third row transition metal complexes:
a) yellow to orange
b) blue to green
c) yellow to blue
d) purple to blue
e) purple to red

4. Chlorophyll is a bright green metal complex, in which the central metal ion is magnesium in a porphyrin-like ligand. Which of the following must be the origin of the bright green color:

a) charge transfer transitions centered on the ligand
b) d to d transitions on magnesium
c) ligand to metal charge transfer transitions
d) the surrounding solvent in which the sample is dissolved
e) metal to ligand charge transfer transitions

5. In Chem 1451 an experiment is conducted in which the aspirin (colorless acetylsalicylic acid) content of a sample is analyzed by binding chemically modified aspirin to iron(III) ions. A deep purple solution results and this is quantified using Spec-20 instrumentation. These are cheaper (~1/10 the cost) and therefore more abundant in our department that has two electronic spectrophotometers.

Which of these situations would be true for analyses of the purple iron-aspirin complex on either instrument (Spec-20 or electronic spectrometer)

a) The sample would show a maximum absorption in the purple region of the visible spectrum.
b) Absorbance of the sample would be directly proportional to the concentration of the iron-aspirin complex in the sample.
c) Before the addition of the iron(III) to the modified aspirin, the aspirin content would be undetectable by either instrument.
d) A calibration curve of absorbance and concentration would only be necessary is the electronic spectrometer was used.

The sample would absorb the photons in the blue region of the light source.

Appendix 4. Safety assessment quiz (subcommittee e)

Safety Assessment

Students will be required to take a standardized safety quiz at the start of Quantitative Analysis. The expectation is that they will score at minimum of **75** percent on the quiz.
Students will be required to take the same standardized safety quiz during their senior year. The expectation is that they will score a minimum of **85** percent on the quiz.

Name: _____

_____1. To reduce the probability of accidents:
A. Practice the habit of accident prevention.
B. Use the smallest quantity of material necessary.
C. Use personal protective equipment.
D. When possible, substitute a less hazardous chemical for a more hazardous one.
E. All of the above.

_____2. Examples of personal protective equipment do NOT include:
A. Respirators.
B. Lab coats.
C. Safety glasses.
D. Fire extinguishers.
E. All of the above.

_____3. Safety in the instructional laboratory is:
A. The responsibility of the student only.
B. The responsibility of the professor only.
C. A shared responsibility.
D. The responsibility of the safety officer.

_____4. Who is required to wear eye protection in the laboratory?
A. Students but not professors.
B. Everyone, but only when performing a chemical operation.
C. All visitors, unless they are present for less than one minute.
D. Everyone.

_____5. General guidelines for preventing accidents include:
A. Follow all safety instructions carefully.
B. Become familiar with the hazards of the chemicals to be used.
C. Know where the safety equipment is.
D. Become familiar with the hazards of equipment to be used.
E. All of the above.

_____6. Jewelry is a potential safety issue because:
A. Chemicals can be trapped under it, in contact with sensitive skin.
B. It might catch on lab equipment.
C. Plastic jewelry can dissolve in solvents and adhere to your skin.
D. All the above.

_____7. When using gloves as personal protective equipment, which of the following procedures should **NOT** be followed?
A. Wear gloves of a material known to be resistant to permeation by the substances in use.
B. Keep gloves on at all times in the lab, even when handling objects in the lab such as doorknobs, telephones, pens, and computer keyboards.
C. Inspect gloves for small holes or tears before use.
D. Decontaminate or wash gloves before removing them.
E. Replace gloves periodically, depending on the frequency of use.

____8. What is the singular most potentially dangerous aspect of distillation?
A. The reduced pressure required for the procedure.
B. The exothermic nature of the reaction.
C. The use of flammable materials in the presence of heat.

____9. Material to be disposed of in the laboratory:
A. Must always be diluted copiously with water first.
B. Must always be neutralized first.
C. Must always be handled in accordance with safety guidelines specific to that class of compounds, as found in the Safety Data Sheets.
D. According to the guideline that all liquids go down the drain and all solids go in the trash can.

____10. Toxic chemicals:
A. Can be assimilated directly through the skin unless proper protection is taken.
B. Can be inhaled even if the substance has a very high boiling point.
C. Can be ingested by transference from hand to mouth after leaving the laboratory.
D. Can be injected into the body.
E. All the above.

____11. Where can information regarding specific chemical safety be found?
A. BEP
B. OSHA
C. SDS
D. PPE

____12. The CAS registry number is
A. A rating of reactivity.
B. A unique identifying number for each chemical.
C. A rating of flammability.
D. A rating of health hazards.

____13. Liquids such as hydrogen peroxide and nitric acid are particularly hazardous because:
A. They are flammable.
B. They both exhibit chronic toxicity.
C. They are both oxidants that can form explosive mixtures with organic solvents.
D. All of the above.

____14. The label CORROSIVE on a chemical container indicates:
A. That the material can degrade rapidly upon exposure to air.
B. That the material is an oxidant.
C. That contact destroys living tissue as well as equipment.
D. Volatility of the chemical.

____15. The word FLAMMABLE means:
A. Explosive.
B. Easily ignited and capable of burning rapidly.
C. Capable of auto-ignition at room temperature.
D. The material can degrade upon exposure to air.

____16. Teratogens:
A. Are substances that only pregnant women should be particularly concerned about.
B. Are naturally occurring pyrophoric poisons.
C. Are substances that cause birth defects.
D. Are extremely corrosive.

____17. Organic solvents are potential hazards because:
A. Most organic solvents absorb directly through the skin.
B. Most organic solvents are volatile and flammable.
C. Most organic solvents are oxidizers.
D. All of the above.

____18. Major factors in toxicity include:
A. Dose.
B. Personal factors such as age or gender.
C. The route of exposure.
D. All of the above.

____19. When diluting an acid with water:
A. Add water to the acid to control the heat released upon dilution.
B. Always add acid to water, not water to acid, in order to minimize splashing of the acid.
C. Take precautions due to the heat absorbed by the dilution.
D. Add water to the acid in order to minimize exposure to the acid.

____20. For safety purposes, which of the following chemicals are incompatible:
A. Acid/base pairs.
B. KOH and isopropanol.
C. Polar and non-polar solvents.
D. Mineral oil and alkali metals.
E. Diastereomers.

____21. Cryogenic liquids are materials with boiling points of less than -73°C (-100°F). Liquid nitrogen, helium, and argon, and slush mixtures of dry ice with isopropanol are the materials most commonly used in cold traps to condense volatile vapors from a system. In addition, oxygen, hydrogen, and helium are often used in the liquid state. The primary hazards of cryogenic liquids include:
A. Fire or explosion.
B. Frostbite.
C. Asphyxiation.
D. Pressure buildup.
E. All of the above.

____22. There is a definite correlation between orderliness and level of safety in the laboratory. In addition, a disorderly laboratory can hinder or endanger emergency response personnel. Which of the following housekeeping rules does **NOT** need to be followed?
A. Clean work areas, including floors, regularly.
B. Properly label and store all chemicals.
C. Secure all compressed gas cylinders to walls and benches.
D. Store chemical containers on the floor.
E. Never obstruct access to exits and emergency equipment.

____23. "Secondary Containment" refers to:
A. Off-site waste collection.
B. An organization's chemical hygiene plan.
C. An additional pan or equipment for transporting the chemical that will catch and contain a spill if the original vessel containing a hazardous material accidentally breaks.
D. Legal procedure for cases involving safety accidents.

____24. All containers or laboratory glassware having chemicals in them should be properly labeled. When should you place a label on a container?
A. After adding a chemical to the container.
B. Prior to adding a chemical to the container.
C. After the container has been emptied.
D. During use of the chemical container.

____25. The failure of a belt-driven roof-mounted fume hood motor is indicated by:
A. The sounding of a hood alarm.
B. Reverse flow of air out of the hood.
C. Loss of airflow into the hood.
D. Unusual silence.
E. Any of the above.

____26. On hoods where sashes open vertically, work with the fume hood sash in the _____ position.
A. Highest possible.
B. Lowest possible.
C. Most comfortable viewing.
D. Mid-point.

____27. Flammable liquids burn only when their vapor is mixed with air in appropriate concentration. When handling flammable liquids you should:
A. Minimize the creation of flammable vapors.
B. Use adequately ventilated work areas.
C. Keep containers closed except during transfer of contents.
D. Ground metal lines and vessels to avoid static-generated sparks.
E. All of the above.

____28. Centrifuges are particularly unsafe if:
A. Not balanced.
B. Starting to walk off the table.
C. A clinking sound is heard.
D. Opened prior to coasting to a full stop.
E. All of the above.

____29. When heating a reaction:
A. Flames should be avoided.
B. Always be careful not to exceed the smoking temperature of the oil if an oil bath is used.
C. The equipment should be assembled in such a way that heat can be removed rapidly and easily at any time.
D. All of the above.

____30. When working at reduced pressure:
A. Surround the apparatus with shielding.
B. Always be aware of the danger of implosion.
C. Place a cold trap between the apparatus and the vacuum pump.
D. Be alert to bumping (sudden boiling).
E. All of the above.

____31. When an emergency occurs:
A. Tell others in the vicinity about the nature of the emergency.
B. Do not move any injured individuals unless they are in immediate danger.
C. Meet the ambulance or fire crew at the place indicated.
D. When calling 911, stay on the line and follow the dispatcher's instructions. Be prepared to tell them your location, phone number, where you will meet emergency crews, general medical status of any hurt or trapped individuals, whether an explosion has occurred, and whether there is a chemical or electrical fire.
E. All of the above.

____32. A "Class-A" fire extinguisher can be used to treat fires involving _____ as fuel sources.
A. Flammable or combustible liquids.
B. Electrical equipment.
C. Combustible metals.
D. Ordinary combustibles (woods, plastics, etc.).

____33. When operating a fire extinguisher, remember the mnemonic PASS. PASS represents the steps used to properly operate the extinguisher and it stands for which of the following?
A. Pin, Aim, See, Swing.
B. Pull, Aim, Squeeze, Sweep.
C. Plan, Access, Squeeze, Swing.
D. Pull, Access, Seize, Sweep.

____34. For small liquid spills that only affect a small area of skin:
A. Flush the affected area with plenty of water.
B. Use the safety shower.
C. Remove the liquid from your skin with a paper towel.
D. If not acidic or basic, make a paste with baking soda and water.

____35. Larger spills of hazardous liquid on the skin:
A. Can usually be wiped off without serious problem.
B. Can be treated by flushing the affected area of skin with water from the sink.
C. Require immediate use of the safety shower.
D. Follow the same procedures that are used for smaller spills on the skin.

____36. True or False: Kitty litter is often effective for cleaning up spilled liquids.
A. True.
B. False.

_____37. Which one of the following is NOT an example of required safety equipment in every chemistry laboratory?
A. First aid kit.
B. Fire extinguisher.
C. Oxygen sensor.
D. Fire blanket.
E. Eye wash fountain.

_____38. Which one of the following is NOT a safety guideline for gas cylinders:
A. When transporting, make sure that the lid is attached to the tank and that the cylinder is strapped to a hand truck designed to carry gas cylinders.
B. When in use or storage, a gas cylinder should be secured by an approved cylinder stand or a wall bracket with straps.
C. Inert gases must be kept separate from other gas cylinders.
D. Store gas cylinders so that they are not blocking exits, exit routes, or use of other safety equipment in the lab such as a safety shower.
E. Store gas cylinders in well-ventilated areas.

_____39. Regarding waste containers, which one of the following is NOT correct?
A. A label with the word “Waste” is all that is needed.
B. The label must list the names of the solutes and solvents.
C. The waste container must be compatible with the waste being stored.
D. The label should include the date that the waste was generated.
E. All of the above.

_____40. You have ordered a chemical and it was shipped to you. At this point, you should:
A. Label the container with the date received.
B. Once opened, label the container with the date opened.
C. Make sure that the chemical container has not been damaged and that there are no leaks.
D. All of the above.
E. None of the above.

____41. Which of the following statements about laboratory fume hoods is false?
A. Fume hoods are not designed to contain explosions and implosions.
B. Fume hoods protect you from harmful vapors.
C. Fume hoods protect you from lachrymators.
D. Fume hoods can be used for the long term storage of chemicals.
E. None of the above.

Appendix 5. Oral and written communication rubrics (subcommittee f)

Chem 4112 Peer Critique

Please submit thoughtful responses regarding your peer's presentation.

Speaker's name *

Your Name (to record participation) *

Central message (score 4-highest to 1-lowest) *

Organization (score 4 to 1) *

Supporting material/evidence (Score 4 to 1) *

Context and audience (Score 4 to 1) *

Verbal/nonverbal delivery (Score 4 to 1) *

Submit

UCA CORE – Written Communication Rubric

This rubric is used to assess students' progress towards Goal B of the Effective Communication area of the UCA Core.

Effective Communication: the ability to develop and present ideas logically and effectively in order to enhance communication and collaboration with diverse individuals and groups.

Goal B: Students will use appropriate conventions and strategies in written communication for various audiences and purposes.

This rubric assesses the following five specific skill or knowledge areas related to Goal B:

1. Central Message: The topic, thesis, or main point of the communication that is consistent with the purpose of the assignment.

2. Organization: The grouping of material in the communication, including a specific introduction, conclusion, sequenced material within the body, and transitions.

3. Supporting Material/Evidence: Explanations, examples, illustrations, statistics, analogies, quotations from relevant authorities, or other kinds of information or analysis that support the central message.

4. Context and Audience: The people and situations surrounding the communication, including the cognitive, social, and cultural factors that influence the audience and communicator.

5. Control of Syntax and Mechanics: The use of language to communicate meaning, including word choice, sentence and paragraph structure, grammar, punctuation, and spelling.

How to use this rubric:

1. Apply the rubric to at least one assignment. If different skill or knowledge areas are assessed by different assignments, then apply the respective rows of the rubric to those assignments that assess each specific skill or knowledge area. All skill or knowledge areas listed in this rubric must be assessed by the end of the course.

2. For each specific skill or knowledge area, assign a score from 0 to 4 based on the student learning outcome that best matches the performance of the student on the assignment. NOTE: The student's work should be scored in each area according to genre and disciplinary conventions (i.e., the formal and informal rules inherent in the expectations for communicating in particular forms and/or academic fields).

3. Although the rubric may inform the grading scheme used for the assignment, it should not replace it. Scores of 4, 3, 2, and 1 do not necessarily correspond to A, B, C, and D. The rubric is used to track students' progress throughout the UCA Core, not just their performance in a single course. Thus, a score of 4 represents the expected mastery of that skill or knowledge area by the time a student graduates. That mastery may come earlier or later in a student's progression through the UCA Core, but generally speaking, scores of 1 and 2 are expected in lower-division courses, whereas scores of 3 and 4 are expected in upper-division and capstone courses.

Student name *

Research advisor name *

Time of evaluation *

MM / DD / YYYY

☐ This student did not turn in an acceptable response to the assignment (e.g. Failed to turn in a research report, plagiarizam, et al).

Criterion 1. Central Message

4 points
Central message is compelling, reinforced, and strongly supported.

3 points
Central message is clear and consistent with the supporting material.

2 points
Central message is basically understandable but is not reinforced.

1 point
Central message can be deduced, but is not explicitly stated.

0 point
Assign a zero for performance that does not meet a score of one (1). *

Criterion 2. Organization

4 points
Organizational pattern is clear and consistent, polished, and makes the content cohesive.

3 points
Organizational pattern is clear and consistent.

2 points
Organizational pattern is partially developed.

1 point
Organizational pattern is poorly developed and unclear.

0 point
Assign a zero for performance that does not meet a score of one (1). *

Criterion 3. Supporting Material/Evidence

4 points
Employs timely and relevant material to provide effective support in a way that reflects a thorough understanding of the topic/thesis.

3 points
Selects sufficient and relevant supporting materials, but lack in analysis, comparisons, or credible authorities.

2 points
Uses some supporting materials with limited or incomplete explanations, examples, and/or descriptions.

1 point
Uses insufficient or inappropriate supporting materials.

0 point
Assign a zero for performance that does not meet a score of one (1). *

Criterion 4. Context and Audience

4 points
Demonstrates a thorough understanding of the context, uses compelling language appropriate to the audience.

3 points
Demonstrates adequate consideration of the context and uses thoughtful language given the audience.

2 points
Demonstrates some awareness of the context and uses mundane language given the audience.

1 point
Demonstrates minimal attention to the context and uses unclear language given the audience.

0 point
Assign a zero for performance that does not meet a score of one (1). *

Criterion 5. Control of Syntax and Mechanics

4 points
Demonstrates clear and fluid control of syntax and mechanics that skillfully communicates meaning to readers and is virtually error-free.

3 points
Uses syntax and mechanics that generally conveys meaning to readers with clarity. The language has few errors.

2 points
Exhibits substantive errors in syntax and mechanics which, at times, impedes the clarity of the work.

1 point
Shows a serious pattern of error in syntax and mechanics that interferes with meaning.

0 point
Assign a zero for performance that does not meet a score of one (1). *

Total points from the five criteria:

Overall, has this student demonstrated appropriate knowledge and skills for this level in this discipline? *

- [ ] Yes
- [ ] No

Submit

Appendix 6. Chemical literature (subcommittee g)

UCA CORE – Chemical Literature Rubric

Student name *

Time of evaluation *

MM / DD / YYYY

☐ This student did not turn in an acceptable response to the assignment (e.g. Failed to turn in a research report, plagiarizam, et al).

Criterion 1. Non-literature Database Usage

4 points
Locates at least 90% of required information.

3 points
Locates at least 75% of required information.

2 points
Locates at least 50% of required information.

1 point
Locates database but extracts less than 50% of required information.

0 point
Assign a zero for performance that does not meet a score of one (1). *

Criterion 2. Literature Utilization

4 points
Finds multiple relevant articles independently.

3 points
Finds relevant article independently.

2 points
Finds assigned reference in literature database.

1 point
Uses assigned scientific literature database.

0 point

Assign a zero for performance that does not meet a score of one (1). *

Total points from the four criteria:

Overall, has this student demonstrated appropriate knowledge and skills for this level in this discipline? *

- [ ] Yes
- [ ] No

Submit

13. Submit Assessment Plan electronically to assessment@uca.edu