



Course Syllabus

SCIT 1270 – Petroleum Chemistry

Catalog Description: Petroleum Chemistry

Lecture hours = 1, Lab hours = 4

Prerequisites: Introduction to Energy (ENER 1350)

Semester Credit Hours: 2

Lecture Hours per Week: 1

Lab Hours per Week: 4

Contact Hours per Semester: 80

State Approval Code: 40.0504

Class Section Meeting Time:

Students are expected to spend sufficient time each week reading, watching screencasts, reviewing, and participating in assigned activities outside of class time for successful completion of this course. (Study time not included) Additionally, students are expected to spend 3 hours per week in lab and working on lab related assignments.

Instructional Goals and Purposes: The overall purpose of this course is to provide students with an understanding of Petroleum Chemistry and the skills needed for successful employment. The course is primarily focused on the oil and gas sector of the petroleum industry. The skills include knowledge of chemical composition and properties of petroleum (oil and gas), petroleum products and alternative fuels. Hands on skills, behaviors and attitudes are demonstrated in the laboratory, as testing techniques are taught, developed and mastered. The team oriented learning environment in the laboratory provides further professional development for the student. The course will also review the chemical basis for the most important production processes.

Learning Outcomes:

1. Understand factors that affect the choice of production chemicals including greener chemicals
2. Understand **the control of...** production chemicals for the oil & gas industry.... water and gas; scale; acid stimulation; sand; corrosion in production; gas hydrate; wax (paraffin wax); demulsifiers; foam; flocculants; biocides; hydrogen sulfide scavengers; oxygen scavengers; and drag-reducing agents.
3. Understand **hydrogen carbon...** terminology, definitions, classifications, properties and chemical composition and associated metals, and including natural gas properties
4. Understand the chemistry of the cementing process as it relates to casings and other applications
5. Understand the equipment and procedures for evaluating drilling fluid performance
6. Understand clay mineralogy and the colloid chemistry of drilling fluids
7. Understand hole stability, well logging and wire logging

8. Understand chemical analysis associated with natural gas processing: oil and gas separation, conversion and finishing which includes physical properties and analytical analysis... Understand the chemistry associated with natural gas processing and separation techniques. Also, discuss the ideal gas laws and their effect on processing and separation
9. Understand the chemistry of natural gas refining and crude oil refining: distillation and separation; hydrogenation and dehydrogenation; thermal, hydro and catalytic cracking; isomerization and Vis-breaking and other processing processes.

Specific Course Objectives (includes SCANS):

After studying all materials and resources presented in the course, the student will be able to:

1. Understand factors that affect the choice of production chemicals including greener chemicals. (1A-i, 1A-ii, 1A-iv, 1B-iii, 1B-iv, 1C-i, 1C-iv, 2A-I, 2A-iii, 2B-I, 2C-i, 2C-ii, 2C-iii, 2D-ii, 2D-iii, 2E-ii)
 - a. Chemical injection
 - b. Where to inject
 - c. Other methods of chemical deployment
 - d. Designing greener chemicals
2. Understand the control of production chemicals for the oil & gas industry.... water and gas; scale; acid stimulation; sand; corrosion in production; gas hydrate; wax (paraffin wax); demulsifiers; foam; flocculants; biocides; hydrogen sulfide scavengers; oxygen scavengers; and drag-reducing agents. (1A-i, 1A-ii, 1A-iv, 1B-iii, 1B-iv, 1C-i, 1C-iv, 2A-I, 2A-iii, 2B-I, 2C-i, 2C-ii, 2C-iii, 2D-ii, 2D-iii, 2E-ii)
 - a. Definitions and Terminology
 - b. Chemicals used
 - c. Chemical methods and control strategies
3. Understand hydrogen carbon... terminology, definitions, classifications, properties and chemical composition and associated metals, and including natural gas properties (1A-i, 1A-ii, 1A-iv, 1B-iii, 1B-iv, 1C-i, 1C-iv, 2A-I, 2A-iii, 2B-I, 2C-i, 2C-ii, 2C-iii, 2D-ii, 2D-iii, 2E-ii)
 - a. Introduction and discussion
4. Understand the chemistry of the cementing process as it relates to casings and other applications (1A-i, 1A-ii, 1A-iv, 1B-iii, 1B-iv, 1C-i, 1C-iv, 2A-I, 2A-iii, 2B-I, 2C-i, 2C-ii, 2C-iii, 2D-ii, 2D-iii, 2E-ii)
 - a. Procedures
 - b. Composition and forms of cements
 - c. API cements
 - d. Additives
5. Understand the equipment and procedures for evaluating drilling fluid performance (1A-i, 1A-ii, 1A-iv, 1B-iii, 1B-iv, 1C-i, 1C-iv, 2A-I, 2A-iii, 2B-I, 2C-i, 2C-ii, 2C-iii, 2D-ii, 2D-iii, 2E-ii)
 - a. Density, Viscosity, Gel Strength, Filtration
 - b. Particle size determination
 - c. Determination of Gas, Oil and Solids content
 - d. Electrical properties
 - e. Foams and foaming agents rheological properties
 - f. Chemical analysis
6. Understand clay mineralogy and the colloid chemistry of drilling fluids (1A-i, 1A-ii, 1A-iv, 1B-iii, 1B-iv, 1C-i, 1C-iv, 2A-I, 2A-iii, 2B-I, 2C-i, 2C-ii, 2C-iii, 2D-ii, 2D-iii, 2E-ii)
 - a. Clay swelling mechanisms
 - b. Flocculation
 - c. DE flocculation
7. Understand hole stability, well logging and wire logging (1A-i, 1A-ii, 1A-iv, 1B-iii, 1B-iv, 1C-i, 1C-iv, 2A-I, 2A-iii, 2B-I, 2C-i, 2C-ii, 2C-iii, 2D-ii, 2D-iii, 2E-ii)
 - a. The mechanics of borehole stability
 - b. Hole instability caused by interaction between the drilling fluid and shale formations
8. Understand chemical analysis associated with natural gas processing: oil and gas separation, conversion and finishing which includes physical properties and analytical analysis... Understand the chemistry associated with natural gas processing and separation techniques. Also, discuss the ideal gas laws and their effect on processing and separation (1A-i, 1A-ii, 1A-iv, 1B-iii, 1B-iv, 1C-i, 1C-iv, 2A-I, 2A-iii, 2B-I, 2C-i, 2C-ii, 2C-iii, 2D-ii, 2D-iii, 2E-ii)

- a. Separation techniques and the study of hydrates
 - b. Conversion and finishing which includes physical properties and analytical analysis
 - c. The Chemistry associated with separation
 - d. The ideal gas laws and their effect on processing and separation
9. Understand the chemistry of crude oil refining: distillation and separation; hydrogenation and dehydrogenation; thermal, hydro and catalytic cracking; isomerization and vis breaking (1A-i, 1A-ii, 1A-iv, 1B-iii, 1B-iv, 1C-i, 1C-iv, 2A-I, 2A-iii, 2B-I, 2C-i, 2C-ii, 2C-iii, 2D-ii, 2D-iii, 2E-ii)
- a. distillation and separation
 - b. Hydrogenation and dehydrogenation
 - c. Thermal, hydro and catalytic cracking
 - d. Isomerization
 - e. Vis-breaking

Course Content:

Students in all sections of this course will be required to do the following:

1. Students will study assigned materials and complete quizzes and exams to assess understanding and comprehension.
2. Students will complete all lab assignments as scheduled and all students are required to wear Personal Protective Equipment (PPE) in the lab.

Methods of Instruction/Course Format/Delivery:

Students in traditional, hybrid and Internet classes will have access to courses via Canvas. Students in the traditional class will meet regularly for lecture. Students in the Internet class will be required to take quizzes and exams at an approved testing facility or, they may also be administered by the instructor. Students in hybrid classes will have both in class and online assignments. Resources for this course, provided through Canvas, include the following Sections in Canvas....

- Modules: Chapter study materials, self-assessment exercises, quizzes and exams
- Announcements and Recent Activities List: Instructor Announcements
- Inbox: Email (to communicate with instructor and classmates inside Canvas)
- Grades: Student grades in Canvas
- Other sections, as assigned by the Instructor: Students in both the traditional and Internet classes should use the People feature within Canvas (includes Canvas Email) to communicate with the instructor. Using Canvas Email located in the "In Box" menu, gives the student access to the instructor and other classmates without having to remember or type email addresses; the student just selects a name from the list. The instructor will attempt to respond to all Canvas email within 24 hours. For example, if a student makes an appointment with the instructor through Canvas email to take an exam, the instructor will reply to the student's Canvas email – if the instructor does not reply within the time needed, call the instructor's at his or her office. Please, always include in the subject line of the Canvas email, the student's name, course number and course section number.

Major Assignments / Assessments:

The following items will be assigned during the semester and used to calculate the student's final grade:

ATTENDANCE AND PARTICIPATION

Students are expected to attend face to face classes and labs, and be on time. Students are also required to participate with other students during class exercises.

QUIZZES / SPECIAL ASSESSMENTS

After working through the chapter or chapters and completing the assignments, the student will take online or paper quizzes over the chapters studied. Quizzes will generally contain True/False, Multiple Choice, Matching and/or Fill In-The-Blank questions.

ASSIGNMENTS – LAB EXERCISES

Students are provided with step-by-step instructions for completing each assignment. Assignments may include laboratory exercises, case studies, team-group assignments and other instructor assigned work. The student may be required to compile and turn in a notebook containing the completed performance sheets along with the student's tabulated data or as otherwise directed by the instructor. Throughout the semester there will be hands on lab exercises. Virtual Labs may be used when feasible. Students will be assessed on his or her ability to complete the task with minimal assistance.

In addition, students may be assigned to complete a Service Learning Project during the regular semester. Details of the project will be provided by the instructor in Canvas.

EXAMS

Multiple exams may be given during the semester assessing the students various skills and may include lab exercises.

Course Grade:

The grading scale for this course is as follows:

- Assignments/Quizzes: 20%
- Labs: 25%
- Exams: 40%
- Final Exam: 15%

Grading Notes:

Missed Exams: Missed exams due to legitimate reasons should be taken prior to the reporting of mid-term or final grades as applicable. It is the responsibility of the student to reschedule the makeup with the instructor. The Instructor reserves the right to change the test format of any makeup. Instructors are not required to makeup work for an unexcused class absence. The Instructor also reserves the right to give full or partial credit for any makeup work that is allowed and that resulted from an unexcused absence.

Missed Quizzes: Missed quizzes due to legitimate reasons should be rescheduled within one week of the scheduled quiz or a date assigned by the Instructor. It is the responsibility of the student to reschedule makeup quizzes. The Instructor reserves the right to change the test format of the makeup quiz. Instructor is not required to makeup work for unexcused class absences. Instructor reserves the right to give full or partial credit for any make up work that is allowed and that resulted from an unexcused absence.

Attendance: Attendance is based on the student missing no more than 10% out of the semester without a valid excuse. After the 10% the instructor may withdraw the student at their discretion. Any

student thirty or more minutes late will be counted absent. Students that leave before class is dismissed will be counted absent. The Instructor reserves the right to dock points for any missed class without a legitimate excuse.

Missed Lab Exercises: Students will have one day out of the semester assigned by the instructor to make up any lab exercises missed due to the student being absent for legitimate reasons. Instructors are not required to make up work for unexcused class absences. Instructors reserve the right to give full or partial credit for makeup work that is given because of unexcused absences.

Safety: All students are required in lab exercises to bring and wear the proper PPE as instructed by your instructor. Failure to do so will result in one warning; if a student continues to violate safety rules the student will be sent home and counted absent.

Class Conduct: All cell phones should be turned off in all classes. If you must receive a call notify your instructor and step out of the classroom. No cell phones are allowed during testing. No disruptive behaviour is allowed in class; if a student is being disruptive as determined by the instructor one warning will be given. If behavior persists student will be sent home and counted absent.

Additional Classroom Policies

Attendance (face to face classes) – is expected for all class meeting times. Attendance in lecture and lab is required for course completion. Class attendance is monitored and recorded. However, this level of instruction includes expected personal responsibility that will not always be addressed. YOU are responsible for missed information. Attendance WILL affect your grade because you probably missed something you needed to learn how to do. Attendance is considered when rounding any grade. For Panola College approved and excused absences, it is your responsibility to contact me about what you missed. Please see syllabus and make up work policies before you ask. See the handbook for rules concerning allowed absences.

NO CELL PHONES (face to face classes) – Cell phones are not allowed to be used as calculators in class or lab.

Withdrawal Policy: A student may need to withdraw from the course before the semester's end. It is the student's responsibility to complete and submit the appropriate forms (as provided by the student success office) on or before the withdrawal date. The withdrawal date is posted on the college academic calendar. A student who ceases to attend class without formal withdrawal will receive a grade of "F" for the course. The instructor reserves the right to withdraw a student from the course in accordance with college policy. Students should consider that they may only drop 6 total courses during their college tenure.

Incomplete Grade: An Incomplete grade is a temporary grade given to a student who is unable to complete the course as the result of an authorized absence (i.e. serious illness or emergency). Incomplete grades will only be approved by the instructor for students who have maintained good standing in the course. All incompletes must be further approved by the Vice President of Instruction. Students should note that an incomplete grade ("I") has the effect of an "F" on their GPA. The "I" will be removed once the student completes the course. Students have a maximum of six weeks to complete the course from the semester's end or they will receive a grade of "F" for the course.

Classroom Etiquette (face to face classes): Students should arrive on time and remain in class until the full class period has expired. Appropriate dress attire should be worn (i.e. no pajamas or overly revealing attire), headwear should be removed, and students should be respectful (in language and

behavior) toward one another and the instructor. Students are highly encouraged to engage the class by participating in class discussions and asking appropriate questions. The standards of student conduct must be maintained with the instructor outside of class and in all electronic communication with the instructor or other students. Cell phones, computers, and all other electronic devices must be silenced before the beginning of class unless indicated by the instructor. Students shall be allowed to record lectures but their recording device must be placed at the front of the class on or near the instructor. Recording a lecture does not excuse a student from attending class. At all times students are expected to uphold the standards of student conduct as defined in the Student Handbook. A failure to comply with these conditions will result in removal from the classroom and an absent mark on the attendance record.

Internet Etiquette: All online users should take great care in their internet behavior. Students are expected to remain respectful in all electronic communication as any publicly or privately shared media will be viewed by others. This communication includes all written material, submitted assignments, pictures, audio recordings, and video recordings. The instructor reserves the right to remove online submissions that contain inappropriate or obscene material. Students who violate proper internet etiquette in an assignment shall fail the assignment on the first offense and shall fail the class upon the second offense.

No user shall post personal or confidential information concerning another party without their express permission. No student shall copy, alter or share files of course material submitted by another student. All of the standards of the academic honesty policy shall apply to all online course material. Students shall be held accountable for posting libelous or obscene material on any electronic forum hosted or expressly regulated by the college under user agreement. The instructor and the college reserve the right to remove said material and hold disciplinary actions in accord with college policy. At all times students are expected to uphold the standards of student conduct as defined in the Student Handbook. The instructor and the college shall have the right to remove a student from the course (resulting in a failing grade) and take appropriate disciplinary actions (as defined by the student handbook) for violating any of the aforementioned policies.

Cheating: "Cheating" is defined as unauthorized help on an examination or assigned course material. A student must not receive from any other student or give to any other student any information, answers, or help during an exam. A student must not "steal" the answers from an unsuspecting student during an exam.

A student must not use any sources for answers during an exam (including, but not limited to: notes, books, or electronic devices) without prior authorization from the professor.

A student must not obtain exam questions illegally, tamper with the exam questions, nor change the results of an exam after it has been graded.

All cheating infractions will result in a grade of "0" for the assignment. A student will fail the class upon their second cheating offense. This policy shall be adhered to unless mitigating circumstances should prove a lesser penalty should apply.

Students shall have the right to contest a cheating claim. The appeals process is specifically defined in the student handbook.

Plagiarism: "Plagiarism" is defined as the taking of a person's ideas, words, or information and claiming those properties as one's own. The use of all ideas, words, or information from any source must be properly referenced and due credit must be given to it's author.

All class assignments must be submitted through Canvas. Canvas will run the submitted assignments through turnitin.com. Any assignment which scores higher than 40% on copied material will automatically receive a grade of "0". Properly quoting and citing borrowed information is NOT plagiarism. However, since the integrity of the assignment is based upon the originality of the student's work, no student may turn in a paper which exceeds a 30% score in properly quoted and cited material. The instructor reserves the right to employ other means outside of turnitin.com to check the "originality" of a students work. Students shall have the right to contest a plagiarism or cheating claim. The appeals process is specifically defined in the student handbook.

All plagiarizing infractions will result in a grade of "0" for the assignment. A student will fail the class upon their second plagiarizing offense. This policy shall be adhered to unless mitigating circumstances should prove a lesser penalty should apply.

Privacy Policy: The instructor will uphold the privacy of a student's grades, disability, and all other personal information in accord with school policy, state and federal law. A student perpetually maintains the right to review their course grades. A student's right to review their grades shall not be interpreted as the right for the release of an instructor's grading keys.

The instructor and the college do not assume responsibility for the disbursement of any grade information a student freely gives of himself in private correspondence or in a public forum. The instructor reserves the right to remove grade information which a student freely reveals of him or herself in an online public forum hosted or regulated by the college to preserve the integrity of the course.

The instructor reserves the right to pursue disciplinary and legal action against any student who illicitly obtains and reveals private instructional information, including, but not limited to answer keys or class grades.

Disability Policy: Students with a learning disability must verify their disability with the Career/Technical Advisor in the Student Success Office. The student is responsible for presenting proper verification to the instructor at the beginning of the course. Upon verification, the instructor shall make the appropriate accommodations for the student. The instructor shall not implement special accommodations for students whose disability has not been verified by the college. The instructor is not responsible for a student's poor class performance before verification is presented. Students with a condition that may require emergency assistance (i.e. seizures, pacemaker malfunctions, hyperventilation, etc) should meet with the instructor in private to discuss emergency procedures. A disability does not exempt a student from proper classroom etiquette or the student code of conduct. This class will fully comply with the college handbook, state, and federal laws.

Instructor Philosophy:

Chemistry is a core discipline essential to a college education regardless of major or career choice. Recognizing a broad range of interests, preparations, and future needs among chemistry students, this course is designed to allow each student to individually select topics for various assignments in order to further develop possible career choices. Every attempt on my part is made to ensure your area of interest is discussed. Please let me know if there is a topic that particularly interests you.

Organization, time management, and determination are several of the keys to success in this course. We will discuss goal setting, time management, degree plans, and study skills within the first week of class. I highly recommend a notebook or a three ring binder to keep up with all assignments, quizzes, homework and exams. For example, if there is a problem with the homework system and you can show the instructor your work, we are able to give you some amount of credit.

The instructor really wants you to be successful in this course. Please do not hesitate to come by the office for help. If the office hours conflict with your schedule, every effort will be made to arrange an alternative time. We cannot fix what we are not aware of so communication is a must. Please know that Canvas Email is the best way to get a quicker response since we don't access the office phone from home after school hours.

Chemistry is an active learning course. Changes to this syllabus, how class is conducted, and how grades are calculated may occur by the instructor if deemed best by the instructor for student learning and success.

Canvas: This course is available on Canvas and will contain all information necessary for the course. Canvas is also the method in which you will contact me, make any necessary appointments, receive

announcements, take quizzes, do your homework, and watch screen casts. Please make sure you know how to use it. Make sure you have the latest free download of adobe flash player. There are canvas orientations through the distance learning office you may attend for assistance.

Grading Scale A=90-100, B=80-89, C=70-79, D=60-69, F=69 and below

Texts, Materials, and Supplies:

- *STUDENT TEXTBOOK (Students are required to purchase this textbook) **Production Chemicals for the Oil & Gas Industry, 2nd Edition, CRC Press, Malcolm A. Kelland***
- *REFERENCE BOOK LOCATED IN THE PANOLA LIBRARY AT THE REFERENCE DESK: **The Chemistry and Technology of Petroleum, by James G. Speight, Fourth Edition, 4th Edition., 2010***

Other:

- For current texts and materials, use the following link to access bookstore listings: <http://www.panolacollegestore.com>
- For testing services, use the following link: <http://www.panola.edu/elearning/testing.html>
- If any student in this class has special classroom or testing needs because of a physical learning or emotional condition, please contact the ADA Student Coordinator in Support Services located in the Administration Building or go to <http://www.panola.edu/student-success/disability-support-services/> for more information.
- Withdrawing from a course is the student's responsibility. Students who do not attend class and who do not withdraw will receive the grade earned for the course.
- Student Handbook, *The Pathfinder*: <http://www.panola.edu/student-success/documents/pathfinder.pdf>

SCANS CRITERIA

1) **Foundation skills are defined in three areas: basic skills, thinking skills, and personal qualities.**

a) **Basic Skills:** A worker must read, write, perform arithmetic and mathematical operations, listen, and speak effectively. These skills include:

- i) Reading: locate, understand, and interpret written information in prose and in documents such as manuals, graphs, and schedules.
- ii) Writing: communicate thoughts, ideas, information, and messages in writing, and create documents such as letters, directions, manuals, reports, graphs, and flow charts.
- iii) Arithmetic and Mathematical Operations: perform basic computations and approach practical problems by choosing appropriately from a variety of mathematical techniques.
- iv) Listening: receive, attend to, interpret, and respond to verbal messages and other cues.
- v) Speaking: Organize ideas and communicate orally.

b) **Thinking Skills:** A worker must think creatively, make decisions, solve problems, visualize, know how to learn, and reason effectively. These skills include:

- i) Creative Thinking: generate new ideas.
- ii) Decision Making: specify goals and constraints, generate alternatives, consider risks, and evaluate and choose the best alternative.
- iii) Problem Solving: recognize problems and devise and implement plan of action.
- iv) Visualize ("Seeing Things in the Mind's Eye"): organize and process symbols, pictures, graphs, objects, and other information.
- v) Knowing How to Learn: use efficient learning techniques to acquire and apply new knowledge and skills.
- vi) Reasoning: discover a rule or principle underlying the relationship between two or more objects and apply it when solving a problem.

c) **Personal Qualities:** A worker must display responsibility, self-esteem, sociability, self-management, integrity, and honesty.

- i) Responsibility: exert a high level of effort and persevere toward goal attainment.
- ii) Self-Esteem: believe in one's own self-worth and maintain a positive view of oneself.
- iii) Sociability: demonstrate understanding, friendliness, adaptability, empathy, and politeness in group settings.
- iv) Self-Management: assess oneself accurately, set personal goals, monitor progress, and exhibit self-control.
- v) Integrity and Honesty: choose ethical courses of action.

2) **Workplace competencies are defined in five areas: resources, interpersonal skills, information, systems, and technology.**

a) **Resources:** A worker must identify, organize, plan, and allocate resources effectively.

- i) Time: select goal-relevant activities, rank them, allocate time, and prepare and follow schedules.
- ii) Money: Use or prepare budgets, make forecasts, keep records, and make adjustments to meet objectives.
- iii) Material and Facilities: Acquire, store, allocate, and use materials or space efficiently.

Examples: construct a decision time line chart; use computer software to plan a project; prepare a budget; conduct a cost/benefits analysis; design an RFP process; write a job description; develop a staffing plan.

- b) **Interpersonal Skills:** A worker must work with others effectively.
- i) Participate as a Member of a Team: contribute to group effort.
 - ii) Teach Others New Skills.
 - iii) Serve Clients/Customers: work to satisfy customer's expectations.
 - iv) Exercise Leadership: communicate ideas to justify position, persuade and convince others, responsibly challenge existing procedures and policies.
 - v) Negotiate: work toward agreements involving exchange of resources, resolve divergent interests.
 - vi) Work with Diversity: work well with men and women from diverse backgrounds.

Examples: collaborate with a group member to solve a problem; work through a group conflict situation, train a colleague; deal with a dissatisfied customer in person; select and use appropriate leadership styles; use effective delegation techniques; conduct an individual or team negotiation; demonstrate an understanding of how people from different cultural backgrounds might behave in various situations.

- c) **Information:** A worker must be able to acquire and use information.
- i) Acquire and Evaluate Information.
 - ii) Organize and Maintain Information.
 - iii) Interpret and Communicate Information.
 - iv) Use Computers to Process Information.

Examples: research and collect data from various sources; develop a form to collect data; develop an inventory record-keeping system; produce a report using graphics; make an oral presentation using various media; use on-line computer data bases to research a report; use a computer spreadsheet to develop a budget.

- d) **Systems:** A worker must understand complex interrelationships.
- i) Understand Systems: know how social, organizational, and technological systems work and operate effectively with them.
 - ii) Monitor and Correct Performance: distinguish trends, predict impacts on system operations, diagnose deviations in systems' performance and correct malfunctions.
 - iii) Improve or Design Systems: suggest modifications to existing systems and develop new or alternative systems to improve performance.

Examples: draw and interpret an organizational chart; develop a monitoring process; choose a situation needing improvement, break it down, examine it, propose an improvement, and implement it.

- e) **Technology:** A worker must be able to work with a variety of technologies.
- i) Select Technology: choose procedures, tools or equipment including computers and related technologies.
 - ii) Apply Technologies to Task: understand overall intent and proper procedures for setup and operation of equipment.
 - iii) Maintain and Troubleshoot Equipment: Prevent, identify, or solve problems with equipment, including computers and other technologies.

Examples: read equipment descriptions and technical specifications to select equipment to meet needs; set up and assemble appropriate equipment from instructions; read and follow directions for troubleshooting and repairing equipment.