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Mission

The career portfolio is a compilation of four years of student work requiring teamwork between the student and the vocational and academic instructors. The student is responsible for the contents, and all instructors are responsible for guiding, encouraging, reviewing, and supporting the development of the portfolio. The four-year cumulative portfolio is refined during the senior year and presented for scoring as part of the school graduation requirements. To facilitate the creation of student portfolios, student work that demonstrates advanced or superior technical skills will be recognized by instructors and recommended for inclusion in the portfolio. Students are often unsure as to what qualifies for inclusion. Outstanding projects or skill sets should be photographed or documented and reported in the form of a 350 to 500-word narrative. Community service projects in which students demonstrate high-level technical skills make good entries. The projects chosen for inclusion in the portfolio should demonstrate the student’s attainment of several high-level vocational competencies and life skills. Evidence provided to accompany these projects should be detailed, clearly labeled, include technical terminology, and be accompanied by one or more digital images or drawings that enhance the narrative. Participation in special programs such as Tech Prep should be documented and included in the collection. Remember that the object of the portfolio is to showcase the individual as a motivated and skilled graduate of his or her technical area who is ready to continue on in the world of higher education or to enter the workforce.

Letters of recommendation from placement sites, vocational instructors, and members of the community should be collected for the portfolio. A wards and press releases citing high quality work the student completes as part of a group or as an individual should also be included. Ultimately, the portfolio is an advertisement for the student performing at his or her best. The portfolio, or parts of it, will serve students in the future as they seek access to higher education, quality job placements, and attainment of their Certificate of Occupational Proficiency.
In addition, the career portfolio is an integral part of the Certificate of Occupational Proficiency assessment process. Students competing for the C.O.P. will be required to submit a portfolio that adheres to the guidelines in this handbook. The portfolio will constitute 1/3 of the qualifying requirements for the COP. The remainder of the COP assessment will be the written test and the hands on demonstration of technical skills. The portfolio addresses additional areas of competency not addressed by the written test or the hands on demonstration of technical skills including literacy. It is intended to be a professional document with a serious tone and purpose demonstrating the student's readiness for higher education and the workplace.

**Section Divisions**
The GNBVT career portfolio will be divided into three sections: I. Employability, II. Credentials, and III. Work Samples. Although there are certain required entries for each section, provisions have been made for individual creativity. This flexibility allows individual technical areas to seamlessly incorporate the portfolio process into their own programs. This guide further attempts to clarify required entries and acceptable variations. In addition, the guide provides lists of entries that may be included in each section to enhance the student's presentation.

Assessment of the portfolio will take place in the spring of the senior year and scoring will be standardized by means of a rubric. Students will be afforded an opportunity for a second scoring if their first attempt does not meet the standard of "Meets Requirements"; a minimal score of 2. Students will not be eligible to graduate without this piece. A copy of the rubric is included in this guide.

Finally, the assessment process of a wide variety of technical areas requires that the portfolio address skills common to all. Hence, the focus of the first two sections is employability skills. Nevertheless, the core of the portfolio is the Work Sample Section in which students are expected to demonstrate high-level technical competencies (a minimum of 7 work sample – 1 from grade 9, 2 from grade 10, 2 from grade 11 and 2 from grade 12). The scoring of this section is closely linked to the lists of vocational competencies produced by the technical committees and approved by the Department of Elementary and Secondary Education.
The Work Sample section of the portfolio tests the student’s ability to communicate his or her skills to a team of experts. The portfolio forces the student to begin the lifelong process of self-evaluation that will assist the student to recognize the skills they have, as well as those they have yet to master, and lead them to become lifelong learners.
EMPLOYABILITY

Employability skills are those qualities that graduates from every program worldwide must achieve to experience success in the workplace as well as the halls of higher education. They include communication skills, motivation, the ability to be a team player and many other technical and non-technical skills. Without attaining an acceptable number of these skills, students are likely to encounter stumbling blocks along their career paths. Therefore, the Employability section of the portfolio is the first section. This section must include an introductory piece and a list of technical competencies attained by the student and validated by a representative of the student's school.

Introductory Piece-
This written narrative (Goals essay) is the first document a reader will see when examining the portfolio. The tone should be serious and professional as the audience will be primarily the scoring committee, admission officers, and potential employers. It may be written as an introductory letter in which students summarize their academic and career plans. It is similar in scope to a cover letter for a resume or a college essay. This introductory piece must include a level of detail sufficient to provide the reader with a clear picture of the presenter's career plan. It will include a sufficient level of detail to indicate that the student plan has been carefully developed and guided by academic, technical, and guidance personnel. Electronic submissions may submit this piece as a voice over for their presentation. However, it must be the opening piece.

Competency List-
The competency list must include all competencies designated by the appropriate technical committee and approved by the Department of Elementary and Secondary Education. Technical areas that do not yet have the required DESE approved lists may substitute the competency list designed in-house. This list must be current, signed, and dated by appropriate instructors. An individual certified in the area of technical study must validate the list. The included list will indicate the student's skill level in each area.
Massachusetts Cooperative Education Learning Plan -
Every senior participating in the Cooperative Education Program must include in his or her portfolio Work Based Competency lists validated by the Cooperative Education supervisor and an individual certified in the student's area of technical study (Career and Technical Program). This list may be designed by the individual school, but must be based on the recommendations of the C.O.P. Employability Skills Committee and approved by the Department of Elementary and Secondary Education. A copy of the document used by GNBVT is located in the appendix.

Students may include any similar documentation used by their school to provide evidence of their acquisition of workplace skills, for example, the Massachusetts Work Based Learning Plan, career-planning profiles, or employee skill plans. All submitted documents must be validated in order to appear in the portfolio. Also, students must include the Career Transition Plan that they work on with their respective guidance counselor.

Attendance Record - (optional)
Students may wish to include a copy of their attendance record as evidence of their reliability. Students should include this only if they have really good attendance practices. This may be obtained in the Guidance Department.
CREDENTIALS

The credentials section will showcase further evidence of student's readiness for entry into the workplace environment. Student candidates for the Certificate of Occupational Proficiency will prepare this section as if they were at the beginning of a job search. Required elements include a professional resume and references. Additional entries may include a variety of awards, recognitions, and licenses. This section is also the location for documents related to participation in special programs such as Tech Prep or Skills USA. Transcripts may also be considered for students with exemplary documentation. In general, this section of the portfolio is the location for any validated record that further proves a student's readiness for the workplace.

Resume- There is no standard format required for the C.O.P. portfolio, however, the resume should adequately summarize a student's marketable skills. The resume is, in fact, a one-page encapsulation of all other documents. It includes a clear and specific objective, personal information, education to date, marketable skills or qualifications, and references. Any resume format adopted should be professional in tone and appearance. Samples are included in the Appendix.

References- Candidates must submit (3) references with their portfolio. References will be held to workplace standards, i.e. references from family members or individuals who cannot truly validate a student's qualifications for the workplace or higher learning are not acceptable.

Licenses- Students who obtain professional certifications or licenses should include them in this section of the portfolio. These documents make the student more marketable and validate the student's attainment of benchmark skills. Licenses and certificates should be appropriately grouped.
Transcript-The inclusion of the transcript is optional, however, students who wish to demonstrate a strong academic history as well as a challenging course of study should be encouraged to include the transcript. A copy of a student transcript may be obtained in the Guidance Department.

Awards- The inclusion of awards is optional. However, students may wish to include them as further evidence of their personal commitment to high standards in all areas of their life. The awards should follow the licenses and be appropriately grouped. Suggested groups are academic awards, community service awards, special organizations (Boy Scouts, 4H, various religious organizations), and athletics. Students should carefully review these awards and avoid repetition (28 basketball participation awards) and quality. It is important that awards selected for inclusion provide evidence of accomplishment rather than participation.
WORK SAMPLES

Students are required to submit a minimum of seven substantial work samples that provide evidence of their acquisition of high level technical skills identified by the technical competencies of their respective technical areas. Work samples may be presented in a variety of formats, but must include clear explanations of 350-500 words and visual evidence. Some technical areas may require drawings, calculations, and materials lists accompanied by narrative. Others may be narrative based with images added to enhance understanding. Electronic submissions may substitute voice-overs for written narrative or narrated video clips of technical demonstrations. Each entry in this section must be visibly labeled in order that a nontechnical reader or viewer of the portfolio is able to understand the submission.

Career portfolios are intended to demonstrate technical growth over time; therefore, students who accumulate work samples over the course of their four-year program should be directed to include all of their work samples. These work samples should be logically organized (freshman samples, sophomore samples, junior samples, senior samples) to avoid confusion during the scoring process. Only students who demonstrate growth over time in the Work Sample section of the portfolio will be eligible for a score of "Advanced" (4). However, the Occupational Competency score in the rubric is based on the four substantial samples gathered from the junior and senior years.

In general, all work samples should be clearly organized, provide adequate detail, include visuals, and provide evidence of the attainment of complex technical skills.

Samples are available in the appendix of this guide.

Senior technical instructors are responsible for guiding the students as they select work samples for their portfolios. Students should be directed towards showcasing the highest level of technical skill they have attained. All work samples must be read for technical content before the portfolio is submitted to the scoring committee.
The portfolio rubric targets six categories for assessment, employability, occupational competencies, credentials, work samples, design quality and organization, and written communication. Each category will be measured against anchor portfolios. Students must meet a minimum standard of "meets requirements" (2) for the portfolio to be considered.

Electronic Portfolios must meet the same requirements and will be scored with the same rubric.

Scoring will begin in the spring of the senior year. The Portfolio Scoring Committee is comprised of the Scheduling / Reporting Coordinator (Portfolio Chair person) and two Career and Technical Readers. Students may present their own electronic portfolio if need be. Portfolios failing below the minimum standard will be returned to the student for revision. The student will be provided with the necessary support and direction to improve the portfolio before the second round of scoring.

After each technical area has completed the first scoring cycle, students who failed to meet the minimum standard during the first cycle will be eligible to resubmit their portfolio. Students who do not meet the minimum standard by the deadline set by the school administration will not be allowed to attend graduation. However, students may submit their revised portfolios during the summer school session following graduation in order to be awarded a diploma. Questions arising from special situations should be directed to the Vocational Principal.
## SCORING RUBRIC

<table>
<thead>
<tr>
<th>Category</th>
<th>Exemplary 4</th>
<th>Proficient 3</th>
<th>Meets Requirements 2</th>
<th>Attempted 1</th>
<th>No Evidence 0</th>
<th>Points Earned</th>
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</thead>
<tbody>
<tr>
<td><strong>Employability</strong></td>
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<tr>
<td>1. Goals essay included</td>
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<td>2. Massachusetts Cooperative Learning Plan</td>
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<td>(required for students who have been on co-op)</td>
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<td>1. Goals essay included</td>
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<td>2. Massachusetts Cooperative Learning Plan</td>
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<td>1. Competency List</td>
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<td>3. Licenses</td>
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<td>4. Transcript (optional)</td>
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<td>5. Awards</td>
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<td><strong>Work Samples</strong></td>
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<tr>
<td>Includes 5 work samples which demonstrate high level of competency as determined by the technical competency list.</td>
<td>Includes 5 work samples which demonstrate high level or intermediate competencies as determined by the technical competency list.</td>
<td>Includes 5 work samples which demonstrate basic competencies as determined by the technical competency list.</td>
<td>Submitted work samples fail to demonstrate minimum competencies as defined by the technical competency list.</td>
<td>Insufficient evidence submitted</td>
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<tr>
<td>Demonstrates growth over time with the inclusion of work samples from four year program</td>
<td>Demonstrates growth over time with the inclusion of work samples from four year program</td>
<td>Demonstrates growth over time with the inclusion of work samples from four year program</td>
<td>Demonstrates growth over time with the inclusion of work samples from four year program</td>
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<td><strong>Design Quality and Organization</strong></td>
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<td>All narratives typed</td>
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<td>Includes usable method of navigation</td>
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<td>Neat layout and design</td>
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<td>Includes visual evidence</td>
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<td>Creative layout and graphic design</td>
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<td><strong>Written Communication</strong></td>
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<td>Evidence of rich technical vocabulary</td>
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<tr>
<td>Information clearly communicated in all sections of portfolio</td>
<td>Information clearly communicated in all sections of portfolio</td>
<td>Information clearly communicated in all sections of portfolio</td>
<td>Errors interfere with understanding</td>
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<td><strong>Total Points</strong></td>
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## Portfolio Checklist (portfolios should NOT be set up in this order!)

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<th>Freshmen Requirements</th>
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<tr>
<td>Freshmen Academic Entries (optional)</td>
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<tr>
<td>- English, Math, Social Studies and Science</td>
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<tr>
<td>Freshmen Vocational Entry (ex: compare / contrast)</td>
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<tr>
<td>Sophomore Goals Essay</td>
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<td>Sophomore Academic Entries (optional)</td>
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<tr>
<td>- Science – Lab Project</td>
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<tr>
<td>Vocational Entry</td>
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<tr>
<td>- Narrative or other samples of work</td>
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<tr>
<td>Vocational Entry</td>
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<tr>
<td>- Narrative or other samples of work</td>
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<thead>
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<th>Junior Portfolio</th>
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<tbody>
<tr>
<td>Junior Goals Essay</td>
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<td>Junior Resume</td>
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<tr>
<td>Junior Academic Entries (optional)</td>
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<tr>
<td>- English, Math, Social Studies and Science</td>
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<tr>
<td>Vocational Entry</td>
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<tr>
<td>- Narratives or other samples of work</td>
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<tr>
<td>Vocational Entry</td>
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<tr>
<td>- Narratives or other samples of work</td>
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<thead>
<tr>
<th>Senior Portfolio</th>
<th>Score</th>
<th>Date</th>
<th>Initials</th>
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</thead>
<tbody>
<tr>
<td>Updated Goals Essay</td>
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<tr>
<td>Updated Resume</td>
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<tr>
<td>Three Letters of Recommendation</td>
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<tr>
<td>Community Service Log – **minimum of 20 hours</td>
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<tr>
<td>Competency List</td>
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<tr>
<td>Career Plan (Guidance counselor score and initial)</td>
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<td>Senior Academic Entries (optional)</td>
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<tr>
<td>- English, Social Studies and Science</td>
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<td>Vocational Entry</td>
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<td>Vocational Entry</td>
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<td>- Narratives or other samples of work</td>
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<tr>
<td>Awards and Recognitions (if applicable)</td>
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<tr>
<td>Attendance Record / Transcript (optional)</td>
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All written pieces must be typed. The portfolio should be arranged according to a clear organizational plan. The following is the plan that has been recommended by the COP Portfolio Committee.

**Section I. Employability and Occupational Competencies**

1. Include a copy of the goals essay written and revised senior year.
2. Students are must include a copy of their technical competency profile validated by their technical instructors.
3. Students participating in the cooperative learning program (Co-op) **must** include copies of their Massachusetts Cooperative Education Learning Plans. These are kept on file in the office of Allen Vaughn, Co-op Supervisor (J104). See sample in Appendix.

**Section II. Credentials**

1. Include a copy of the resume. Make sure the objective on the resume matches what is stated in the goals essay.
2. Include references from three sources. References must be academic, technical, or work related.
3. Include awards and recognitions. Select these carefully. Eliminate repetitious items.
Section III. Work Samples

1. Include seven work samples that demonstrate **high-level** technical skills. Each sample must be accompanied by a written narrative (350-500 words) and visual evidence. Visual evidence may include digital images, drawings, or schematics. Writing guides to assist in the creation of the narrative are available in Appendix B. The COP Portfolio Committee has identified the work sample section of the portfolio as the most important section of the portfolio.
Promotion Requirements - All Grades

Effective September 2003, the portfolio requirements have been modified as follows:

Grade 9:
- 1 work sample  (beginning with the class of 2013)

Grade 10:
- 2 work samples, 350-500 words, based on work completed during the sophomore Year.  This is a promotion requirement.

Grade 11:
- Revised goals essay
- Resume
- 2 work samples, 350-500 words, based on work completed during the junior year. This is a promotion requirement.

Grade 12:
Required:
- Revised goals essay
- Updated Senior resume
- 3 letters of reference
- Career Plan
- 2 senior work samples (6 in total), 350-500 words, based on work completed during the senior year
- Transcript
- Competency list
- Community Service Hours (beginning with the class of 2012)

Optional:
- Awards, honors, recognitions
- Attendance record
This resume format is the one used by SkillsUSA in the health service portfolio competition. There are many other options available.

Update your resume as needed to include additional education, work experience or a change in references. Be sure to maintain a current resume in your career portfolio.

Chris P. Matthews
2165 Simpson Ave., Apt. 10
Bontemps, Louisiana 53648
Ph: (201) 444-777 Email: cmatthews@gnbvt.edu

Objective:
Seeking an entry-position where I can use my skills in a customer service position.

Skills:

• Enjoy working with others
• Filing, typing, telephone work IBM word processing
• Skilled in all office procedures
• Excellent communication skills
• Nail grooming skills
• Work well with other people
• Work with little supervision

Employment:
06/92-Present
Cut Above Beauty Salon, Cranberry, Maine Nail Technician
-Responsibilities include all aspects of nail grooming, scheduling appointments and customer relations.

Education:
09/90-06/92 Professional Cosmetology Institute, Bontemps, Louisiana State of Louisiana Licensed Nail Technician
09/87 06/90 Robinson High School, Shellysburg, Louisiana Major: Cosmetology

Awards and Honors:
President of German Club; First Place in a state speech contest; Listed in Who's Who in American High School Students; Rotary Student of the Month; Selected to attend a Summer Leadership Camp; Lettered in varsity basketball three years.

References: List with contacts
Optional Writing Guide: Goals Essay

Objective: Student will write a well-organized, clearly stated plan for his/her future, which includes educational and career planning.

Tone: Professional Audience: Potential employers, instructors, and admission officers

Paragraph #1
Begin your first sentence with the name of your vocational technical area. Discuss what led you to this field and then specifically identify what you plan to do with this training.

Sample
Medical assisting is my chosen field of study. I am currently in my sophomore year of training at GNBR Voc Tech. This program, or a program like it, has been my goal since I was eight years old and became aware of the many different types of jobs that people held. My role model was...........

Paragraph #2
Evaluate the quality of your skills in your technical area. Be specific as to what your strengths are. Discuss what specific areas you are targeting for improvement. Do not overlook oral and written communication as it is of great importance in every field.

Paragraph #3
Discuss your community experience in your field. Name specific programs or placement sites. Consider live jobs in the community on which you have worked.

Paragraph #4
Discuss what job you hope to obtain as a result of this training. Indicate what your plans are for future education after high school. This is the time to discuss any plans you may have for the armed services.

Paragraph #5
Close with a vision of your professional future.
### Massachusetts Cooperative Education Learning Plan Greater New Bedford Regional Vocational Technical High School

**Student:** ID#:  
**Job Title:**

**Company**  
**Supervisor:** Worksite Performance Evaluations

<table>
<thead>
<tr>
<th>Needs Development</th>
<th>Competent</th>
<th>Proficient</th>
<th>Advanced</th>
<th>N/A</th>
</tr>
</thead>
<tbody>
<tr>
<td>Practicing Safety: Understands and practices protocols.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Communicating: Appropriately understands and expresses ideas in an organized and concise manner.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Analyzing: Organizes and evaluates work-related data for accuracy and relevance</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Problem Solving: Identifies problems and develops solutions.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Using Equipment/Technology: Uses appropriate tools or office equipment for assigned tasks in a safe and professional manner.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Completing Tasks: Completes assigned projects in a timely manner with quality results</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Working to Standards: Meets worksite standards regarding attendance, promptness, appearance, dress code, behavior, and safety</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cooperating: Interacts appropriately and respectfully with others, maintains self-control in difficult circumstances and accepts corrective instruction.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Understanding Career Choices: Has knowledge and awareness of career option.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Assuming Responsibility for Career Choices: Balances demands of work, school, personal life, and takes responsibility for personal choices.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Student Signature Date**  
**Supervisor Signature Date**
APPENDIX B

This section includes a generic writing guide, student–written and teacher-written work samples, and a scoring rubric for individual work samples.
Optional Writing Guide for Work Samples
Shop specific guides and model work samples created by technical teachers are located in Appendix C

Paragraph#1 Identify the problem or job
Here are some samples. 🏷️ The 1991 Ford Escort would not start. (Automotive) 🏷️ The patient stopped breathing during a stress test. (Health Services or Medical Assisting) 🏷️ The traffic lights were not properly synchronized. (Electronics or Electrical) 🏷️ The client requested an unusual haircut. (Cosmetology) 🏷️ The customer needed a custom designed part for a machine that was no longer in production. (Machine Technology)

How did you gather information? (This is the research phase.) Disassembled? Diagnostic testing? Manufacturer's guide? Measuring?

How did you plan the job? (This is the organizational phase.) Drawings? Calculations?

What was your proposed solution? (This is the stage when your plan or hypothesis is about to be tested.)

Paragraph#2, 3, 4 The process of implementing your solution
Describe the journey to your end product. Use technical terms. This is the documentation phase.

What was required to successfully complete the job? Materials? Crew? Consults? Cost? What problems did you encounter? How did you solve them? How long did it take to complete? Did you perform any diagnostic tests or troubleshooting along the way?

Paragraph #5, 6 Resolution
Evaluate the end product. Assess your job performance. Include assessments received from supervisors or instructors. Reflect on what was learned from the project and discuss how strategies could have been improved. (This is the assessment phase.)

Discuss the quality of your work. Were you satisfied with the results? Evaluate your performance? (attitude, time management) Did you make any new discoveries or learn new strategies?
<table>
<thead>
<tr>
<th>Points Awarded</th>
<th>25 points</th>
<th>20 points</th>
<th>16 points</th>
<th>12 points</th>
</tr>
</thead>
<tbody>
<tr>
<td>Organization</td>
<td>Information is organized with well-constructed paragraphs, title, and subheadings where needed.</td>
<td>Information is organized with well-constructed paragraphs.</td>
<td>Information is organized, but insufficient.</td>
<td>The information is disorganized.</td>
</tr>
<tr>
<td>Visual Evidence</td>
<td>Diagrams and illustrations are neat, accurate, labeled, and add to the reader's understanding of the topic.</td>
<td>Diagrams and illustrations are accurate and add to the reader's understanding of the topic.</td>
<td>Diagrams and illustrations are accurate, but poorly presented and only sometimes add to the reader's understanding of the topic.</td>
<td>Diagrams and illustrations are not accurate OR do not add to the reader's understanding of the topic.</td>
</tr>
<tr>
<td>Quality of Technical Information</td>
<td>Information clearly explains the task. It includes several accurate details and/or examples. Uses technical terminology.</td>
<td>Information explains task. Document provides 1-2 supporting details and/or examples. Uses technical terminology.</td>
<td>Information provides basic explanation of the task. Lacks details and/or examples. No use of technical terminology.</td>
<td>Information does not accurately explain the task.</td>
</tr>
<tr>
<td>Mechanics</td>
<td>No grammatical, spelling, or punctuation errors.</td>
<td>Few grammatical, spelling, or punctuation errors</td>
<td>Few grammatical, spelling, or punctuation errors.</td>
<td>Errors interfere with understanding.</td>
</tr>
</tbody>
</table>
Building a Power Supply
By: Paul Vento

During shop there are many tasks that students must do. After I had completed my work for the year I decided to think of ways to make things easier for the student, and the instructor. In thinking about this I came up with the idea of making a power supply. These power supplies did not have the output required for the labs we were to do. I asked if I could use the existing case, seeing that it already had the proto-board attached, and he said yes. Now I had a starting point.

The first step in making this power supply was to determine what output voltage the supply would need to produce. To determine this was a very drawn out process. This process involved going through all the labs and recording what voltage or voltages were needed to perform the individual labs, and recording the current they were operating at. After doing this I came to the conclusion that I needed a 0 - 24 volt D.C. output. This was due to the fact that the majority of the labs required 0 - 24 volts. With this piece of information I could now move on to the next step of the supply production.

The next step was to draw up a schematic for the circuit I was designing. In this case it was a power supply circuit. In drawing this circuit I had to keep in mind that the circuit had to fit within the dimensions of the existing case. This is not usually a factor due to the fact that usually you would design and assemble the circuit, and then build the case to fit the circuit. To design any circuit you have to understand how each component in the circuit works. In turn you will know how the circuit it self works. From what I had previously learned I came up with a circuit that contained a voltage transformer, fuse, power switch, bridge rectifier, potentiometer, light, two output knobs, three resistors, two capacitors and a voltage regulator. With the schematic drawn I could now determine what values to assign the components. These values are determined to meet the required perimeters, in this case the output that was mentioned earlier. Since we need a maximum of 24 volts the voltage transformer’s maximum output is 24 volts at 1 amp. With this I could determine the rest of the components values.

Once that I knew the ratings of the components and it worked mathematically on paper, I could begin gathering the components I needed. After gathering the components I could build a prototype of your circuit on a proto-board. This allowed me to test the circuit and make sure there were not any problems before permanently placing the circuit together. In testing it, I took measurements from the live circuit and compared them to the mathematical readings. If there were problems they could be easier to change now rather than after assembling the circuit permanently. From this point I could now move on to my next step.

Once the circuit worked on a proto-board I could assemble the circuit on a vector board, which is full of holes for vector pins. To form the circuit on a vector board I had to place the vector pins in a specific pattern. The components were connected to the pins.
using solder. On the reverse side of the board I connected the pins together in a certain pattern to connect the components that needed to be connected. After assembling the circuit board I performed, another test to determine if anything was connected wrong or damaged during the assembly process. After I had done this and there were not any problems I moved on to the next step.

The next step involved mounting the circuit in the case being used. Mounting the circuit required drilling holes in the case, fastening the circuit to stand offs, and fastening the stand offs to the case. The stand offs were used to keep the metallic pieces of the circuit from touching the case. The reason for this is so that no one would get an electric shock from touching the case. This step was the easiest part of the whole project. My final step was when the circuit had been mounted in its case and all the assembly was done. The last step was to test the completed power supply for one last time. This test proved that my power supply worked and was ready for use. Also, it determined if something had gone wrong while putting the circuit in the case. Most of all it proved that all my hard work was worthwhile!

In the end I was successful in my task of making a power supply. Also my goal in making life easier for my instructor was a success. All the time and effort I had put into this project gave me hands on experience that cannot be achieved from working out of a book. I take great pride in my project!
During junior year, I was given an assignment by our instructor, Mr. McFall, to break down (disassemble) and then reassemble the motherboard (the main circuit board inside of a computer to which every device is somehow connected) of one of the older Retrofit™ PCs in the shop. This assignment gave us an in-depth look at the inside of a personal computer and how all of the connections are made, and in the connections were not made exactly as they were, the computer would not function properly from then on in.

However, before we started probing around inside these computers, we had to draw up a schematic of the motherboard with all of the connections intact. This way, we would
have a guide as to how to reassemble the motherboard to properly. The reason being that many of the cables and connectors have to be connected so that the first pin of the connector, also called Pin 1, was properly connected, or a device, such as a hard disk drive, CD-ROM drive, or floppy disk drive would not be recognized.

My schematic for the Retrofit™ motherboard, as drawn in Microsoft Paint.

After Mr. McFall approved the schematic, which he had rigorously followed standards for detail, I proceeded to take all of the cards, including the Network Interface Card (NIC), the video card, and the sound card, as well as disconnecting but not removing the hard disk drive, the CD-ROM drive, and the floppy disk drive. Even the Central Processing Unit (CPU) chip, the Random Access Memory (RAM) chips, cache memory chip, and all of the connection port cables were removed from the motherboard, to bring it to a total breakdown.

The motherboard after the breakdown’s completion.

Upon the breakdown’s completion, the more tedious task of placing all of the components back in correctly was presented to us. To the novice computer user, a
computer can be difficult, and the inside can be downright frightening, appearing as a jungle of microchips, wires and cables, components, and circuit boards. To us, the students of Computer Technology, it wasn’t as imposing but still present a challenge and had to be completely reassembled with just the schematic to serve as our guide. Needless to say, everyone was faced with even slight problems.

<table>
<thead>
<tr>
<th>Some motherboard components</th>
</tr>
</thead>
<tbody>
<tr>
<td>Random Access Memory (RAM) chips</td>
</tr>
<tr>
<td>Video Card</td>
</tr>
</tbody>
</table>

Once I had everything completely reconnected, I restored power to the computer, and like many, it failed to boot properly. Dumbfounded at first, I carefully troubleshoot the computer until I found that problems were I had improperly connected the hard disk drive cable and floppy disk drive, and to top things off, the floppy drive on this particular system wasn’t operating properly and required replacement. Afterward, the machine booted properly.

The first two years of Computer Technology were devoid of the technological aspect of the computer, focusing mainly on office skills as opposed to something as technical such as this project. This project helped me develop many skills, including the understanding of the importance of accurate documentation, how the average personal computer is laid out inside, how the computer functions on a basic hardware level, and troubleshooting in the event of equipment failure. This exercise was an important cornerstone for the rest of my educational career, as it introduced the basics of computer hardware repair and maintenance, which are something that are in very high demand and I have just been given the basics with this operation.
APPENDIX C

The writing guides and work samples in this section were created during the Career Portfolio Workshop. Students are encouraged to use the writing guide designed by the instructors for their technical area.
Paragraph #1

Identify the procedure

• Explain the procedure in technical terms
• Why is this procedure necessary?
• What pre–op instructions were given to the patient?

Paragraph #2, 3, 4

Describe the process of carrying out your procedure

• What materials and instruments are required to successfully complete the procedure?
• What challenges did you encounter & how did you solve them?
• How long did it take you to complete the procedure?

Paragraph #5, 6

Assess your performance

• Evaluate your skills during the procedure
• What post-treatment instruction was given to the patient?
Amalgam Restoration

Mrs. Jones arrived at the office for a 9:00 AM dental appointment with Dr. Jeckle. I observed her apprehension. I greeted her by name with a warm smile of reassurance and told her we would take good care of her. I talked to her about the weather and her family. I attempted to instill confidence in her and make her feel somewhat more at ease and welcome in our environment. It’s normal to be nervous at the dentist. She complained of a sharp sensation upon eating sweets. After exposing and examining a freshly processed radiograph, the doctor had determined that a silver filling, known as an amalgam was in order for tooth # 3, the upper right first molar. The amalgam would be an MOD, meaning it would take in the mesial, occlusal and distal surfaces.

The armamentarium needed would include:

- Mirror
- Explorer
- Cotton plier
- High & low speed hand pieces and burs
- Anesthetic syringe
- Cotton tip applicator
- Cotton rolls
- 2x2 gauze
- Floss
- Topical
- Tofflemire band & wedges
- Amalgam carrier
- Small spoon excavator
- Small & large condensers
- Discoid-cleoid
- Burnisher
- Hollenback
- Cavity liner
- Cavity varnish
- Amalgam filling material
- Amalgamator
- Squeeze cloth or amalgam well
- Articulating paper & holder

- PPE I donned my glasses then mask, washed my hands and donned my gloves. I positioned myself at the patient’s left side across from the doctor so I could have full view of the field.
I placed the topical on the patient’s gingival. I then handed the doctor the anesthetic syringe so he could anesthesitize the area. I rinsed the patient’s mouth.

While the doctor picked up the high-speed hand piece, I suctioned with my left hand while retracting the tongue with my right. I rinsed and dried the area as required. Upon the doctor’s nod, I mixed the cavity liner and held it at the patient’s chin. The doctor took the application instrument me and proceeded to apply it. I took the applicator from him and handed him a small cotton ball moistened with cavity varnish. I then dried the area and handed him the assembled tofflemire band to place. The next thing he needed was the two wooden wedges at the end of the cotton pliers. I dried the area for the final time and started the amalgamator. I placed the amalgam carrier in the cavity preparation and released the amalgam. The next instrument to follow was the condenser. I passed the amalgam carrier alternately with the condenser until the preparation was full and condensed down. When the doctor nodded next he was ready for the explorer; I suctioned again and received the tofflemire and wedges with my right hand. Next the doctor took the hollenback followed by the discloid-cleoid. I continued to suction as required. The last thing he wanted was a cotton roll and then some dental floss.

I rinsed the patient’s mouth and sat her upright. I removed her patient bib and told her what a good patient she was; I cautioned her to get up slowly. She left with a smile.
Writing Guide for Welding and Sheet Metal Technology
Created by Richard L’Abbe

Section I.

• Define the job. Is it fabrication, installation, or troubleshooting?
• How did you plan the job? (Which did you use? Did you measure the job and develop a sketch, or read a blue print? How did you calculate the amount of stock required? Which type of layout are you going to use?)

Section II.

• Provide a materials and tool list.

Section III.

• Describe the process. Write the steps in chronological order and use technical terms from text manuals. Include any problems you encountered. For each problem, state how you solved it. This is the section where you should insert pictures to support your explanation.

Section IV.

• Evaluate your end product. Identify whether this is a basic, intermediate or advanced project.
Fabrication of a Rectangular to Round Fitting  
Created by Richard L’Abbe

The processes for developing the pattern for a rectangular to round fitting is called triangulation. When triangulating a fitting for layout you simply divide the drawing representing the surface of the article into triangles. From the drawing, the true lengths of the various sides must be found, and the triangles constructed.

To find the true length of any foreshortened line, in the plan view, make the foreshortened line the base of a right triangle. The altitude is the vertical height of the foreshortened line taken from the elevation view. The hypotenuse is the true length line. In essence you are forming a series of triangles.

Once all of the true lengths of the sides of the triangles are found they can be reproduced in regular order to form the pattern. Hence, the term triangulation is most fittingly applied to this method of development of surfaces.

A triangular to round fitting is particularly used in the sheet metal trade for the construction of bases for chimney tops, ventilator heads, fan connections to round duct work, register boots, and transition fittings for rectangular to round, or square to round duct work.

The tools needed to layout and fabricate a rectangular to round fitting are:
1. Circumference rule
2. Inside Reading zigzag rule
3. Scratch awl
4. Prick punch
5. Dividers
6. Tramelpoints
7. Aviation tin snips right hand
8. Aviation tin snips left hand
9. Straight snips
10. Hammer
11. Squaring shear
12. 8 Foot brake

The first step in laying out the rectangular to round fitting is to draw the plan view. Start by laying out the rectangle. Next, divide the length and width of the rectangle in two. Connect the center of the two long lines and the center of the two short lines of the rectangle. This gives you the center point of the rectangle. The center point of the rectangle

is also the center of the circle. Next, construct the desired circle in the center of the rectangle. Next, trisect one quarter of the circle and draw the base line for the triangles to the corresponding corner. The last part of the plan view is to label the trisect points numbers one to four. Call the corner you are using for the base point a, b, c, or d.

Now it is time to construct the true length line graph. Draw a triangle with a height that corresponds to the height of the fitting. This is side (a) of a triangle. The base of the triangle, side (b) must be long enough to accept the longest line of the four numbered points. The next to the last step is to transfer the points a – 1, a – 2, a – 3, a – 4 to the base of the triangle. The last step is to draw the lines from the four transferred point to the top of the triangle to form the four true length lines.

To develop the pattern for the rectangular to round, start with a base line. This is a line equal in length to the long side of the triangle. Indicate points (a) and (b) which are the starting points for the triangulation processes. Next, secure the true length line of point one with the trammel points. Then using points (a) and (b) construct the first triangle by intersecting the points above the base line. This is point one. Next, set your dividers to points one and two on the circle. Use this point to construct the arc from the point created over the base line. This is the start of point 2. Next, secure the true length line of point two and transfer it to the layout, again using point (a) and (b) and again crossing the arc constructed from point one of the first triangle. This is now point two. Do the same steps for points three and four using the previous points.

The last operation is the cutting out and fabrication of the fitting. It is cut out with the straight snips. To cut the notches for the corners and seams, use the left and right hand aviation tin snips. Once it is cut out and notched, both pieces are formed in the brake. Next they are fastened together. They can be fastened together with a lock seam, riveted together, or for heavy stock welded together.

This fitting is considered to be a high-level competency project.
During my senior year, my instructor, Mr. Krogh had me do a **horizontal butt joint** that had to pass a **bend test**. This is a test that is often given as a requirement before being hired by an employer. This project gave me a chance to really test my welding skills.

The first thing I did was to go to the **stock rack** and get a length of 3inch wide by ¼ inch thick **flat bar**. I then took the flat bar to the **power shear** and set the **back gauge** to 6 inches and cut two pieces of **flat bar**. The next step was to **bevel** the edges of the two pieces. This was done using a **flame-cutting machine** I set the **angle** on the **flame cutter** to 30 degrees and **beveled** both plates. I took the plates to the **stationary grinder** and **ground** the beveled plates so they were free of **slag** and there were no **serrations** on the **bevels**. I brought the plates to the **arc-welding booth** where they would be welded, but first I had to set the arc-welding machine to the proper welding setting. Once the machine was set I used a 1/8 inch welding rod to put between the two plates to give me the proper **root opening** to ensure that I would be able to get complete **penetration** with the **root pass**. When the plates were properly spaced I **tack welded** the two ends of the plates to hold them together so the **root opening** wouldn’t close up when I began welding the **butt joint**. With the machine set at 75amps I welded the **root pass**, which is the first weld, made on a **butt joint**. Once the **root pass** was completed I used a **chipping hammer** to clean the **slag** from the weld, and a **wire brush** to further clean the weld. I then raised the welding setting to 95 amps to be able to weld the **fill passes**, which are the welds that fill up the **butt joint**. I then proceeded to weld the **fill passes** making sure to **overlap** each weld and that there was no **under cut** on the **side walls** of the **butt joint**. Each fill pass was cleaned and brushed before the next weld was made. The final welding step was to weld the **cover passes**, which are the welds that cover the butt joint.
Once the butt joint was welded it was time to cut the test coupons that would be bent. First I measured one inch in from each end of the butt joint and drew a line on the test plate. Then I cut the ends of the test plate using the oxy-acetylene cutting torch. The end pieces were then discarded. I proceeded to measure one and one half inches from each end of the test plate and marked the test plate using a piece of soapstone, I cut the test coupons again using the cutting torch. Once the pieces had cooled off, I put the test coupons in a bench vise and used a portable hand grinder to clean the test pieces so they were free of slag, and the welds were ground flush with the test coupons, on both the face side and the root side. It was now time to bend the test coupons to see if they would bend to 180 degrees. Putting the coupons in a bending jig and using the hydraulic press to bend them did this. One of my test coupons broke in half and one bent to the required 180 degrees.

This project helped enhance my knowledge of welding a beveled butt joint, how to prepare a butt joint for welding, and how to properly make a bend test to check the strength of the welds. Being able to pass a test like this should help enhance my employability as a competent welder.
Section I

Identify the skill to be learned or practiced. (Define) (Is it a reading skill, lesson plan, flannel board, presentation skills, thematic unit, bulletin boards, manipulative or classroom enhancement?) Discuss the value of this skill in the classroom. Discuss research that was required for this skill. (Did you examine models, visit websites, or refer to your text?)

Section II

Discuss the planning phase. Explain carefully how you chose your subject matter. (Did you consider audience, tone, theme, attention span of audience, and ability level or special interest?)

Section III

Describe the process using technical language. Describe any problems encountered. How were they solved? Did you develop any special techniques that you could share with peers?

Section IV

Discuss the implementation of this skill in the classroom. Assess your finished product. Discuss revisions or alterations that could be made to improve success.
At the beginning of our sophomore year, our class was informed that we would each be creating a **flannel board** for a project. The flannel board is accepted as an effective **visual aid** for classroom teaching. A flannel board is a **sensory** learning tool. With it, a teacher can present ideas that can be better explained with meaningful illustrations that result in quicker, more thorough pupil comprehension and greater retention. **Tactile** experiences create and stimulate better learning and encourage young readers. It can be used at all grade levels to teach units in all areas of the curriculum, including language arts, arithmetic, science, social studies and music. It lends itself to pupil participation, serves as a change of pace from routine classroom techniques, and is fun for pupils and teacher. I did not know what a flannel board was, but we were given written instructions and literature to follow explaining the importance of a flannel board. I searched many web sites for information and viewed various models, but found them to be too expensive. Thus, creating my own would be more economical. Our first instruction was to choose a children’s book that we enjoyed. I had difficulty doing this because I had memories of many books that I enjoyed reading as a child. I wanted a book that would hold their interest and stimulate them visually. Finally, I chose *The Polar Express*.

As I began this project I asked myself some questions such as, what will children learn from this, and how can I make this a fun lesson for them? We had to choose at least five pictures from the book. I looked for pictures with dramatic and eye-catching appeal. I studied the words and concentrated on where I could express myself by using an exciting voice when needed and a soft tone when necessary. I stood in front of a mirror to get a feeling of a proper stance when reading.

My first step was to shrink the pictures on a **copy machine**, and then trace them onto **12x18-oak tag paper**, using the **opaque machine, or overhead projector**. Next, I had to **double coat** the pictures using either colored markers or colored pencils. I chose colored markers. The instructions stated that I create the pictures to appear like the pictures in the book. Next, I outlined the colored pictures with a black **sharpie** pen. Using the **lamination machine**, I laminated the colored pictures. Using **3M Spray Adhesive**, I glued **felt material** to the back of the laminated oak tag sheets. After they dried over night,
I cut out the pieces and numbered them in **sequential order** on the backside of each felt piece. My final step was to practice the story using the completed flannel board. We were informed that we should be so familiar with the story that we begin to include our own words and know the story by heart without looking at the book. We practiced reading our story in class, using a **tape recorder** to hear our own voices. We were instructed to prepare the lesson we planned to teach with the flannel board by: a) Placing the flannel board in position before the class begins. b) Arranging the cutouts in sequence, ready for use. c) Working from one side of the board and talking to the class as much as possible, not to the board. d) Placing cutouts on the board carefully but quickly. e) Involving the children as much as possible, giving them the opportunity to manipulate the cutouts.

It took a long time to complete this project and I never imagined it would involve so much work. Many times I was frustrated because of the many steps involved and all the detailed work. I recognized that I must develop better organizational skills, which is crucial in the teaching profession. Next time I would use colored pencils, as I feel, that the pictures are too bold with the colored markers. I had fun presenting this story to the children and I know they enjoyed it very much. However, next time I will make certain I know my story well before I read to them again. They ask many questions and I was not prepared to respond to all their questions. I plan to use a flannel board frequently. Children never tire of the colorful, interesting shapes, and I have learned it is one of the most effective devices available to the teacher.
1\textsuperscript{st} paragraph \textbf{Describe the assignment.} What needs to be done? What research or layout work was done before starting? Could you choose between several types? Which one did you choose and why?

2\textsuperscript{nd} & 3\textsuperscript{rd} paragraph \textbf{Provide details of how it was drawn on AutoCAD.}  
Include:

- o type of drawing  
- o type of views drawn
- o related lessons used to complete drawing
- o if assy. dwg. what the package consisted of
- o identify problems encountered

4\textsuperscript{th} paragraph \textbf{Assess your performance and discuss what you learned from doing this assignment.}

Include as many paragraphs as you need. Take pride in your writing.
I was required to design and draw a series of increasingly complex drawings of **pattern developments**. A **pattern development** is a thin walled part that needs to be redrawn to a flat **layout**. This could be a cardboard box or a file drawer. This part must be drawn, and then redrawn to **full scale** as a flat **layout** in order for the **die maker** to produce an accurate **cutting die**.

The final **pattern** drawing was to be a **two-view assembly** drawing of a heater housing. This needed to be **designed** to properly fit over a 55-gallon drum with sufficient **clearance** built into the **tolerances** so that it would fit easily on the drum’s various **diameter variations**. The drums were designed to keep the fruit warm while preventing contamination.

The total number of **detailed layouts** needed was seven, and they needed to be properly **dimensioned** and labeled with proper **tolerances**. The **design package** included:

1. Stovepipe that was a **straight cylinder development**.
2. The cover and the retainer that were both a form of **truncated cone**.
3. The vent that was a **straight cylinder development** with a **helical arc development** in one end to fit the hole died out in the cover.
4. The final three parts were developed as a **3-piece 90deg. elbow** with the top elbow designed with a **helical arc** at one end to properly fit into the hole in the stovepipe.

Since the cost of **scrap** is an important factor in the cost of a part, it was required that I design the parts with a minimum of **stock waste**. To do this the three parts of the elbow were designed in an **offset** pattern by rotating each part 90 degrees in respect to the part before it.

Upon completion of all drawing requirements, I was told to generate a second set of **full size layouts**. These were made on stiff paper, and I was required to cut them out and assembly the part to prove the layouts were **dimensionally** correct and that a shop would be able to assemble the parts in production. This final check was to keep the **die maker** from making the **die patterns** incorrectly.

This series of jobs was informative. I saw how important it is to be **dimensionally** correct in my layouts in order to avoid problems in production.
Identify the project.
Sample:
Tailoring a jacket begins with the selection or design of a pattern. I selected Butterick pattern #2356. This pattern features a 3/4--length jacket with three bound buttonholes, slash pockets, lapels, and a tailored lined skirt with a side slash. The advanced skills featured in this project are the bound buttonholes and the jacket lining. The project called for 4 yards of 45 inch wide material. The cost of the raw materials including the pattern was $43.00.

How did you gather information? (Take measurements? Compare prices for materials? Look at samples?) Did you complete any drawings? Did you make your own pattern? Did you alter the pattern? What calculations were required?

The process of creating your product
Describe the journey to your end product. Include layout, prep work, and include amount of time spent on each step. The times will be important when calculating the total cost of this project. Use technical terms.

What problems did you encounter? How did you solve them?

Evaluate the end product.
Assess your job performance. (time management, attitude) Reflect on what you have learned from the project and discuss how your strategies might have been improved.

Discuss the quality of your work. Were you satisfied with the results? Evaluate your performance? (attitude, time management) Did you make any new discoveries or learn new strategies?

Billing
Complete an itemized bill for a live customer. Include materials, labor, and a detailed description of the product being delivered.
During cycle 1, the senior’s in the Clothing And Textile Department’s first project was to make a **Log Cabin Quilt**. Log cabin quilts consist of seven colors, one center, three dark colors and three light colors. The block is symbolic of life itself. The center square, traditionally red, represents the heart or hearth of the home. The strips around the center square are said to represent the logs of the cabin. The light side of the block represents the sun in front of the cabin. Compare the ‘light side’ to babies, weddings, family, and friends. The dark side of the block represents the shadow behind the cabin, such as death, divorce, or disaster. The ‘dark’ moments in life help us realize how wonderful the ‘light’ moments really are. The seniors’ quilts were many different colors, many different sizes, and the quality of the work represents advanced skills.

One of my first procedures was to decide what size I wanted. Did I want my quilt to be coverlet size, and only cover the mattress, or to be bedspread size, and cover to the floor? I wanted mine extra long with extra wide borders. I wanted my quilt to cover the whole bed with about one inch away from the floor. I usually work with basic colors, brown, black navy blue or gray, but with this quilt, basic wasn’t going to work, not with the color scheme I have in my bedroom. All colors have to blend and enhance one another and I felt this was going to be a job for me before even starting my quilt. Tools weren’t a problem, I could use the tools from shop or purchase my own. I needed a **rotary cutter** for cutting my fabric instead of scissors. A rotary cutter is much more accurate but, can be dangerous if not used correctly. The other tools was a **matt cutting board** with a plastic 5 inch wide by 24 inch long ruler, straight pins, safety pins, paper and pencils and a log cabin book. We went on a field trip with the instructors who helped pick out the materials, explained how much fabric was needed and helped blend the colors. They had some excellent blends; colors that I thought wouldn’t go made a difference with the presentation when it was completed.

I went to **Joann’s Fabric Store** and started my task of picking out my 7 colors. This was not easy, but it became easy when I laid them all together on a table. I would find 3 darks and begin to pick the 3 lights. Just when I thought I was finished picking all the colors, I would realize (with out me knowing) someone had taken one of my colors while I was busy looking for another color. Needless to say, I wanted to give up and throw the
quilt project, but I didn’t. I’ve never been one for quitting. Maybe it would take me a little longer, but I would get it done. I decided on different shades of blues, some prints and some solids. After almost 6 hours of deciding on colors, the size of my quilt and the amount I needed for every color, I was ready to begin the construction of my Log Cabin Quilt.

I washed all fabrics, dried them and pressed them all before anything else. This procedure was to set the colors and allow for shrinkage. I had a sample work sheet of what my blocks would look like, what my center was and where each color would be placed on my quilt.

It took me many weeks to complete the quilt but it was worth it. I now have a Log Cabin Quilt on my bed, everything matches in my room, and the task was a fun project as well as a learning project. Since then I have made 8 log cabin quilts, and many other styles of quilts. I don’t fear mistakes because it is a learning process, but the next time I make a quilt of this size I will watch my fabric a lot closer when looking for my colors in the store. If I were getting graded for this project, I would say I earned a 100 for a grade.
I was assigned the task of building a refrigerator from scratch, scary in only nine days. This project required specific skills.

Some basic: Tube bending, cutting. Some intermediate: Swaging, flaring. Some advanced: Brazing, charging and recovering refrigerant. Some of these skills I learned as a sophomore, others I learned during the process of building my fridge.

My fridge was built in sections. The first section I had to build was my evaporator. To do this I had to cut 12 pieces of 5/16” copper tubing 14” long using a tubing cutter (small hand tool). Then I had to swage one end of each tube using a swaging block, swaging tool, and hammer (safety glasses a must). After swaging I had to make a 180° bend in the same end as the swage on every piece using a 5/16” 180° tubing bender (hand tool). Next I had to braze all the copper pieces together end to end. This forms the evaporator. In order to complete proper brazing joints the following tools were employed:

• Acetylene torch
• Silver solder
• Flux
• Cleaning brush
• Reamer

• Shop cloth After finishing the evaporator I had to manufacture the condenser. This time I had to cut 12 pieces of ¼” copper tubing 12” long. Again I had to swage one end of each piece. I also had to put a 180 Deg bend on the same end as the swage, but this time I only had a 90 Deg. Tubing bender. It was difficult because I had to make two bends on the same end in order to get the full 180 Deg. And they had to be in near perfect alignment to look like one continuous bend. It took longer to make these double bends, but they came out real good.

Now I brazed them end to end just like the evaporator. Now it is time to mount the evaporator and condenser to the project board.
The condenser is mounted below the evaporator. After the condenser is mounted on the board we braze on the filter drier.

Next, I mounted the compressor and condenser fan to the base of the board so I could braze the discharge line from the compressor to the top of the condenser. Then I cut my tubing for the suction line (this is the vapor return from the evaporator to the compressor).
I wrapped a 5’ piece of Cap tube around this suction line which creates a Heat exchanger. One end of the Suction line is brazed to the compressor the other end to the bottom of the evaporator. One end of the cap tube is brazed to the small end of the filter drier; the other end is brazed to the top of the evaporator.

Now I will drill a small 1/8” hole in the suction line in close proximity to the compressor. This will give me access to the sealed system on the low side. Now that this is done all my brazing is complete.

Now I will install my electrical wiring. The condenser fan and the compressor must be wired in parallel with each other and in Series with a switch. This is so the same switch can control them both. An electrical cord is connected to the switch so it can be plugged into a standard 120v receptacle.

Next, I installed my Manifold Gauges to the high and low side access valves that I installed earlier. I hooked up my sealed system to a vacuum pump through the yellow center charging hose on my manifold. After pulling a 30” vacuum on the low side gauge for 5 minutes the gauges are closed and then I wait for another 5 minutes to see if it holds the vacuum. It did so I continued the vacuum for another 25 minutes to make sure I had removed all dirt and moisture.

I charged the system with a couple of ounces of 409A refrigerant. When my gauges showed a balanced pressure I turned on my system. Now I continue to charge my system through the low side of the manifold until I have a full frost pattern on my evaporator.

I demonstrated my system was cooling by switching my system on and off on demand. My evaporator will frost up, my condenser would get hot and my condenser fan would displace the heat from my condenser at the same time cooling my compressor.
My refrigerator project was a success. What I learned from this project is that I need to take big projects like this one segment at a time and not worry so much about finishing on time or rushing.

Although I was not very good at swaging, I was excellent at brazing. This helped me to catch up with the rest of my class. Also, I did not know a thing about manifold gauges when I started, but now feel very comfortable using them. In fact, I was so proficient with them that my teacher had me helping other students who were having trouble.