

NATIONAL RESOURCE CENTER FOR MATERIALS TECHNOLOGY EDUCATION

Core Competency Gap Analysis Preliminary Report Summary Update 02/09

SUMMARY -- Data Sets A - H		Data Set:				Level:	
		A	PNNL	E	MAST	Intro	grades 8 to 16
		B	ECI	F	MTAG	Intermed	grades 11 to 16
	Gaps Identified (Preliminary):	C	CITE	G	Macrogal	Advanced	undergrad
	Important gap areas for module focus	D	MWM	H	MatEd lab		
	Major gap areas for module focus			R	Peer Rev		
Ref. No.	COMPETENCY	INTRODUCTORY		INTERMEDIATE		ADVANCED	
0	Basic competencies related to work as a technician						
	A Demonstrate Good Communication Skills			F			
	B Prepare Tests and Analyze data	R		R		R	
	C Utilize Good Workplace Performance Methods			F			
	D Demonstrate General Technical Competence			F			
1	Measurement and basic technical skills						
	A Carry Out Measurements of Dimensions and of Physical Phenomena	R		FR			
	B Interpret Technical Drawings			F			
	C Apply Laboratory Skills	R		FR		R	
	D Apply Electrical Phenomena to Physical Measurements			D		D	
2	Mathematics, calculations, and data analysis						
	A Apply Basic Mathematics Fundamentals			F			
	B Demonstrate Proper Use of Units and Conversions			F			
	C Apply Geometry and Trigonometric Fundamentals						
	D Show Appropriate Use of Algebra and Functions						
	E Demonstrate Appropriate Use of Statistics			FR			
3	Computer skills						
	A Practice General Computer Skills and Uses			F			
	B Demonstrate Use of Computer Applications			F			
	C Apply Technical Software to Practice			R		R	
4	Teamwork, professionalism, globalism, and multiculturalism skills						
	A Demonstrate Effective Work with Teams	R		F		R	
	B Determine and Develop Effective Project Interactions			F			
	C Show Personal Professionalism			F			
	D Demonstrate Cultural Awareness in the Workplace						

E	Recognize where a Global Perspective Should be Used in the Workplace						
Ref. No.	COMPETENCY	INTRODUCTORY	INTERMEDIATE	ADVANCED			
5	Chemical Science skills						
A	Apply Safe and Environmentally Appropriate Methods to Chemical Handling	R	DFR				
B	Demonstrate Knowledge of Chemistry fundamentals	ER	ER				
C	Describe Atom Structure and Nuclear Applications	E	E				
6	Physical Science skills						
A	Apply Basic Concepts of Mechanics		R	R			
B	Apply Concepts of Fluids, Heat and Thermal Conduction	ER	ER				
C	Describe and Apply Concepts of Electricity and Magnetism	E	R	R			
D	Apply Concepts of Light and Sound		E	E			
7	Fundamentals of materials science and technology						
A	Identify the General Nature of Metals	ABEHR	ER	R			
B	Describe the General Nature of Plastics	CEGH	ABDE				
C	Describe the General Nature of Composites	EH	ABDR	R			
D	Identify the General Nature of Semiconductors and Optical Materials	E					
E	Describe the General Nature of Ceramics and Glasses	ABEHR	ABDR	R			
F	Identify Properties of Other Materials	CE					
G	Define Stress and Strength	CH	R	R			
H	Define Strain and Deformation	CR	R				
I	Explain Methods for Analysis of Material Structure	H					
J	Demonstrate How Materials Properties are Used in Engineering Design	C	DR	R			
K	Compare Thermal, Physical, and Other Properties of Materials		CDE				
L	Explain How Plastics and Polymers Differ from Other Materials	EGH	CE				
M	Describe the General Nature of Emerging Materials Technologies		D				
8	Materials testing						
A	Demonstrate the Planning and Execution of Materials Experiments	R	R	R			
B	Apply Mechanical Testing Processes to Solid Materials	CE	E				
C	Perform Visual and Nondestructive Testing Methods for Solids		CER	ER			
D	Demonstrate Knowledge of Standards Applied to Materials						
E	Perform Appropriate Tests of Metallic Materials	C	ER	CR			
F	Perform Appropriate Tests of Plastics and Composites	CG	CDER	CR			
G	Perform Appropriate Tests of Wood and Concrete	CE	C	C			
H	Perform Appropriate Tests of Liquids						

9	Materials and processing - Metals						
A	Define and Describe Constituents, Properties and Processing of Steel	H		ER		E	
B	Define and Describe Types and Properties of Cast iron			R		R	
C	Identify Types, Properties and Processing in Aluminum and its Alloys			R		R	
D	Identify Types and Advantages of Copper and its Alloys			ABE			
Ref. No.	COMPETENCY		INTRODUCTORY	INTERMEDIATE	ADVANCED		
E	Identify Uses for Zinc and its Alloys			AB			
F	Identify Properties and Uses for Magnesium and its Alloys						
G	Identify Advantages of Nickel Alloys and their Uses						
H	Identify Uses and Processing of Titanium and its Alloys			R		R	
10	Materials and processing - Plastics						
A	Identify Properties and Applications of Thermoplastic Materials	AG		BDE		C	
B	Identify Properties and Applications of Thermoset Plastics	AG		BDE			
11	Materials and processing - Composites						
A	Describe Structure and Advantages of Composite Materials	AEHR		BDR		R	
B	Explain Basic Processing Processes for Composites	A		BDER		R	
12	Materials and processing - Wood	C					
A	Describe the Properties and Testing Processes for Wood						
13	Materials and processing - Concrete	EH		D			
A	Describe Constituents and Testing Procedures for Concrete						
14	Materials and processing - Glasses	ER		ABR			
A	Describe Structure, Properties and Behavior of Glass						
15	Materials and processing - Ceramics	E		ABD		C	
	Describe Structure, Properties and Behavior of Ceramics						
16	Relationships between processing variables, quality, material properties, defects						
A	Explain Effects of Processing and Manufacturing Variations on Material Properties	CEHR		DER		CR	
B	Describe the Effects of Defects on Material Properties	HR		R		R	
17	Fabrication, machining, fastening, welding, forming, forging, finishing, etc.						
A	Explain General Means for Processing Materials	ABEFR		R		R	
B	Describe Techniques Used for Metals Processing	ABR		ER		R	
C	Explain Methods for Processing of Plastics and Composites	AB		ER		R	
18	Tooling, dies, jigs, fixtures						
A	Describe General Tooling Practices						

	B	Explain Use of Dies and Jigs used for Metal Processing							
	C	Explain Use of Tooling for Plastics and Composites Processing							
19		Manufacturing operations and quality management							
	A	Demonstrate Processes to Promote Quality Management Practices			F		R		
	B	Apply statistical, cost, lifecycle and related management principles to							

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Explanation of the data for core competencies in materials education shown on the other three worksheets in this workbook

The other three worksheets summarize the results of ratings of a list of core competencies in the materials field that should be acquired by both materials technicians and general technicians.

Materials Technicians (MT) are those whose primary job tasks relate to the testing or processing of materials in a laboratory or production situation

General Technicians (GT) are those whose primary job tasks concern product development, design, product performance testing, manufacturing, production and similar functions but who do not have direct responsibility for the properties and behavior of materials

The two worksheets labeled '**Full List-GT Sort**' and '**Full List-MT Sort**' each contain a total of 397 individual competencies that were proposed by the project team and members of four focus groups of industrial professionals from a variety of industries and materials fields.

Each of the 397 competencies were rated by the focus group participants using the scale shown at the top of the sheets. The weighted-average scores for each competency were then separated into three colored ranges according to the '**Color Code**' shown at the upper right of the sheet.

Green color indicates the **most important competencies** with scores from 1.000 to 2.200

Blue color indicates **desirable competencies** with scores between 2.201 and 3.200

Red color indicates **less desirable competencies** with scores greater than 3.200

The competencies in each category were then sorted by **GT Score** or **MT Score** as indicated by the name of the worksheet.

In the full list, the competencies were subdivided into 75 categories to facilitate the use of the list for acquiring educational materials for a database that is designed for use by educators in associate degree programs in engineering technology and lower division engineering programs.

The worksheet labeled '**75 List-Major Competencies**' contains only the 75 categories described above with the following information:

1. The number of individual competencies that make up each category; '**No. of items**'
2. The **mean** of the scores for all of the items in the category for both **GT** and **MT**
3. The **range** of the scores (**MIN and MAX**) for all items in the category for both **GT** and **MT**

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Full list of 397 core competencies expected of technicians in the materials area, sorted by the score for <i>General Technicians</i>		Rating Scale								Color Code					
		1 = Vital				2 = Important				Green	≤2.200				
		3 = Desirable, not critical				4 = Not important				Blue	2.201 to 3.200				
										Red	>3.200				
Refer.	COMPETENCY	General technician				Materials technician				GT	MT	Number of		Site	
No.	<i>Each competency begins with "Ability to "</i>	1	2	3	4	1	2	3	4	Score	Score	ratings	where		
0.000	Basic competencies related to work as a technician											N-GT	N-MT	added	
	Communication														
0.004	Follow directions from supervisors and request additional information as needed	29	4	0	0	28	4	0	0	1.121	1.125	33	32		
0.001	Orally communicate effectively in English with technical staff using good interpersonal skills	22	9	2	0	24	6	3	0	1.394	1.364	33	33		
0.002	Read instructions and technical manuals in English	22	9	2	0	24	8	1	0	1.394	1.303	33	33		
0.018	Demonstrate good listening skills	14	10	0	0	16	8	0	0	1.417	1.333	24	24	LA	
0.003	Write clear letters, memorandums, and technical reports in English	4	16	13	0	11	14	8	0	2.273	1.909	33	33		
0.005	Use email effectively for communicating within industry	5	14	12	1	8	18	7	0	2.281	1.970	32	33		
0.027	Effectively communicate a non-documented process to fellow employees or supervisors	3	10	8	1	6	7	8	2	2.318	2.261	22	23	LA	
0.028	Effectively fax documents to customers, in-plant personnel, and vendors	3	6	7	1	3	6	6	1	2.353	2.313	17	16	DET	
0.030	Read non-English information such as material specifications	1	4	6	6	3	2	6	7	3.000	2.944	17	18	DET	
	Testing and data analysis														
0.007	Accurately record experiment details and results; Demonstrate good lab notebook skills	18	8	4	2	25	7	0	0	1.688	1.219	32	32		
0.008	Set up tests and take accurate data	17	8	2	5	28	5	0	0	1.844	1.152	32	33		
0.009	Analyze test data, compare and contrast information, and draw rational conclusions	6	8	15	4	15	9	9	0	2.515	1.818	33	33		
	Workplace performance														
0.017	Practice good workplace safety methods	21	2	1	0	20	3	1	0	1.167	1.208	24	24	LA	
0.019	Adhere to company policies such as safety, diversity, confidentiality, etc.	12	5	0	0	11	5	1	0	1.294	1.412	17	17	DET	
0.010	Demonstrate good attendance, timeliness, and punctuality	20	13	0	0	20	13	0	0	1.394	1.394	33	33		
0.020	Demonstrate time management skills	5	7	0	0	6	5	0	0	1.583	1.455	12	11	CLE	
0.021	Practice good housekeeping skills	12	9	3	0	13	8	3	0	1.625	1.583	24	24	LA	
0.006	Work effectively in teams within the industrial workforce	14	15	4	0	15	15	3	0	1.697	1.636	33	33		
0.015	Demonstrate flexibility and a willingness to learn on the job	16	10	7	0	15	14	4	0	1.727	1.667	33	33		
0.011	Remain diligent throughout the workday and perform without supervision	8	23	2	0	12	19	1	0	1.818	1.656	33	32		
0.013	Recognize what needs to be done and take steps to accomplish it; Self-starter	8	19	6	0	11	17	5	0	1.939	1.818	33	33		
0.012	Apply a variety of problem solving methods and continuous improvement techniques	8	12	12	0	8	15	10	0	2.125	2.061	32	33		
0.014	Exercise independent judgment and willingness to assume responsibility	5	18	9	0	8	19	6	0	2.125	1.939	32	33		
0.025	Perform job functions demanding manual dexterity, dynamic, and explosive strength	6	5	11	1	6	9	7	1	2.304	2.130	23	23	LA	
0.029	Effectively break out a non-documented process into a series of tasks or activities	2	6	13	1	4	8	10	1	2.591	2.348	22	23	LA	
	General technical competence														
0.022	Recall key job-related information, e.g. processes, references, terminology, acronyms	8	14	2	0	10	12	2	0	1.750	1.667	24	24	LA	
0.023	Exhibit good observation skills during demonstrations of processes or equipment operation	7	13	3	0	7	14	2	0	1.826	1.783	23	23	LA	
0.024	Perform troubleshooting of equipment and instrumentation	8	16	5	0	10	16	4	0	1.897	1.800	29	30	SEA	
0.016	Perform basic setup, diagnosis, and repair of industrial machinery and instrumentation	11	13	8	1	13	14	5	1	1.970	1.818	33	33		
0.026	Use vendor catalogs to acquire materials and components for work tasks	4	10	5	1	4	9	5	1	2.150	2.158	20	19	SEA	

1.000	Measurement and basic technical skills	General technician				Materials technician				GT	MT	Number of		Site
		1	2	3	4	1	2	3	4	Score	Score	ratings	where	
	Measurement of dimensions and physical phenomena											N-GT	N-MT	added
1.001	Measure accurately dimensions using scales, micrometers, vernier calipers, etc.	23	7	3	0	26	6	0	0	1.394	1.188	33	32	
1.033	Demonstrate knowledge of order of magnitude of measurements and scales	7	3	1	0	6	5	0	0	1.455	1.455	11	11	CLE
1.023	Correctly use the terms weight, mass, and density in technical tasks	11	9	3	0	12	7	3	0	1.652	1.591	23	22	SEA
1.003	Measure accurately temperature, pressure, force, torque, and related quantities	13	14	6	0	19	13	1	0	1.788	1.455	33	33	
1.025	Perform calibration of instruments and describe the importance of proper calibration	5	13	2	0	9	11	2	0	1.850	1.682	20	22	SEA
1.022	Describe the difference between precision and accuracy	7	7	7	0	10	6	5	0	2.000	1.762	21	21	SEA
1.002	Measure accurately mass using a chemical balance and other such devices	10	10	9	3	20	9	1	3	2.156	1.606	32	33	
1.026	Apply precision metrology devices and inspection tools	4	10	6	1	4	10	7	1	2.190	2.227	21	22	SEA
1.021	Describe and apply effectively a variety of types of thermocouples	3	6	10	0	4	8	8	1	2.368	2.286	19	21	SEA
1.005	Measure accurately hardness, impact strength, and related properties of materials	2	11	14	4	29	3	0	0	2.645	1.094	31	32	
1.004	Measure accurately tensile, compressive, and shear properties of materials	4	7	15	5	27	6	0	0	2.677	1.182	31	33	
1.006	Perform tests of physical properties such as density, viscosity, pH, etc.	2	5	16	8	20	10	1	1	2.968	1.469	31	32	
1.027	Use effectively steam table data and the vapor pressure of water	0	5	6	10	1	3	3	15	3.238	3.455	21	22	SEA
1.028	Use vapor pressure data for solvents and other liquids	0	4	6	10	1	5	6	10	3.300	3.136	20	22	SEA
	Working with technical drawings													
1.007	Read and interpret technical drawings	20	7	5	0	18	10	5	0	1.531	1.606	32	33	
1.024	Interpret and apply tolerances on component dimensions and GD&T specifications	4	9	3	3	5	5	7	4	2.263	2.476	19	21	SEA
1.032	Read specifications on non-English technical drawings	0	5	5	9	1	3	6	6	3.211	3.063	19	16	DET
	Laboratory skills													
1.008	Demonstrate familiarity with good laboratory practices	16	8	6	2	24	8	1	0	1.813	1.303	32	33	
1.031	Operate successfully basic shop machinery and tools	8	7	5	1	5	12	4	1	1.952	2.045	21	22	LA
1.029	Practice good operating methods in clean rooms	6	6	6	3	6	5	6	4	2.286	2.381	21	21	LA
1.013	Select appropriate devices and instruments for measurement of a variety of phenomena	8	9	8	6	13	11	5	3	2.387	1.938	31	32	
1.011	Operate air and gas flow systems and pressure and flow regulators	5	10	14	2	8	16	6	2	2.419	2.063	31	32	
1.012	Operate a digital camera to obtain high quality visual images of technical objects	3	13	11	4	15	12	5	0	2.516	1.688	31	32	
1.010	Operate vacuum equipment and read vacuum data in a variety of units	3	9	15	4	6	14	9	3	2.645	2.281	31	32	
1.009	Use a microscope for measurement and observation of material structures	1	10	13	8	22	10	1	0	2.875	1.364	32	33	
	Working with sensors and electrical phenomena													
1.016	Use a digital multimeter for measurement of resistance, current, voltage, and continuity	5	17	4	5	11	11	5	5	2.290	2.125	31	32	
1.018	Perform soldering operations for electrical connections	5	12	10	4	4	9	13	6	2.419	2.656	31	32	
1.030	Measure electrical conductivity and other electrical properties of materials	2	9	8	2	7	5	6	4	2.476	2.318	21	22	LA
1.015	Use a variety of sensors for measurement physical phenomena	4	13	8	6	9	13	7	3	2.516	2.125	31	32	
1.017	Analyze and apply basic DC and AC circuits	2	12	10	7	4	7	12	9	2.710	2.813	31	32	
1.014	Apply principles of electricity and electronics to measurement and equipment operation	2	9	14	6	3	13	12	4	2.774	2.531	31	32	
1.019	Manipulate the electrical equation $V = IR$	1	8	14	8	4	8	10	10	2.935	2.813	31	32	
1.020	Perform electrical circuit bread boarding	0	5	7	5	1	4	6	10	3.000	3.190	17	21	SEA

2.000	Mathematics, calculations, and data analysis	General technician				Materials technician				GT	MT	Number of		Site
		1	2	3	4	1	2	3	4	Score	Score	ratings	where	
	Basic mathematics fundamentals											N-GT	N-MT	added
2.001	Demonstrate mastery of basic arithmetic including proportions, percentages, etc.	24	7	2	0	25	7	1	0	1.333	1.273	33	33	
2.002	Use mental arithmetic and calculators as computation tools	20	12	1	0	20	12	1	0	1.424	1.424	33	33	
2.003	Ensure that data and calculations are reasonable	19	8	6	0	23	9	1	0	1.606	1.333	33	33	
2.004	Prepare and interpret graphs using a variety of scales and presentation techniques	8	9	12	4	11	15	5	1	2.364	1.875	33	32	
	Proper use of units and conversions													
2.007	Manipulate and report accurately units for all calculations	21	9	2	1	25	6	1	1	1.485	1.333	33	33	
2.006	Perform conversion of units from one system to another	14	11	6	2	20	9	3	1	1.879	1.545	33	33	
2.008	Demonstrate mastery of significant numbers, accuracy, and precision	14	10	8	1	17	10	5	1	1.879	1.697	33	33	
2.005	Use accurately both U.S. Customary and the International System of Units (SI)	10	10	12	1	13	16	3	1	2.121	1.758	33	33	
	Geometry and trigonometric fundamentals													
2.010	Apply concepts of perimeter, area, and volume of basic shapes	8	18	5	1	17	9	6	1	1.969	1.727	32	33	
2.009	Apply concepts of angles and triangles	8	11	12	1	10	9	10	3	2.188	2.188	32	32	
2.013	Apply concepts of trigonometry, especially sine, cosine, tangent, and related functions	3	9	13	7	7	8	14	4	2.750	2.455	32	33	
	Algebra and functions													
2.011	Apply concepts of algebra to solve equations for desired result	4	10	14	4	10	10	11	2	2.563	2.152	32	33	
2.014	Demonstrate proper use of slope and rate of change	3	14	9	6	9	12	9	3	2.563	2.182	32	33	
2.012	Analyze functions such as linear, exponential, quadratic, polynomial, and logarithmic	4	5	14	9	8	8	13	4	2.875	2.394	32	33	
2.015	Work effectively with inequalities	2	5	13	11	6	8	11	7	3.065	2.594	31	32	
	Statistics													
2.018	Compute the mean, median, and standard deviation of data sets	13	7	6	5	17	11	2	2	2.097	1.656	31	32	
2.016	Apply the fundamentals of statistics and probability	5	14	7	6	12	12	6	3	2.438	2.000	32	33	
2.017	Make inferences based on data analysis, measures of central tendency, and variability	8	6	11	6	10	9	9	4	2.484	2.219	31	32	
2.019	Apply concepts of the normal curve	6	8	8	10	10	11	6	6	2.688	2.242	32	33	
3.000	Computer skills	General technician				Materials technician				GT	MT	Number of		Site
	General computer skills and practices											N-GT	N-MT	added
3.012	Avoid inappropriate usage of computer systems	15	8	1	0	15	8	3	0	1.417	1.538	24	26	LA
3.011	Demonstrate adherence to computer security policies	17	7	7	1	18	10	5	0	1.750	1.606	32	33	
3.001	Demonstrate good keyboard skills	12	14	7	0	15	13	5	0	1.848	1.697	33	33	
3.007	Use email effectively and with good grammar and spelling	10	12	9	1	12	14	7	0	2.031	1.848	32	33	
	Computer applications in the office and laboratory													
3.003	Create and use spreadsheets for data analysis; graphing; and record keeping	10	14	4	4	16	14	3	0	2.063	1.606	32	33	
3.008	Use the Internet effectively for researching and acquiring technical information	7	15	7	3	12	14	7	0	2.188	1.848	32	33	
3.002	Create quality written documents using word processing	7	14	10	2	12	14	7	0	2.212	1.848	33	33	
3.004	Create and use database applications	6	11	11	4	13	12	6	2	2.406	1.909	32	33	
3.005	Integrate documents containing word processing, spreadsheets, and graphics	4	10	13	5	8	14	8	3	2.594	2.182	32	33	
	Technical software applications													
3.010	Use commercially available software for analysis, data acquisition, and similar tasks	5	10	10	7	7	16	7	3	2.594	2.182	32	33	
3.006	Create and modify technical drawings using computer aided design including 3D modeling	4	5	14	9	6	8	13	6	2.875	2.576	32	33	
3.009	Use computational software such as Matlab, MathCAD, or Maple	1	7	13	11	4	7	13	8	3.063	2.781	32	32	

4.000	Teamwork, professionalism, globalism, and multiculturalism skills	General technician				Materials technician				GT	MT	Number of		Site
		1	2	3	4	1	2	3	4	Score	Score	ratings	where	
	Working effectively in teams											N-GT	N-MT	added
4.001	Work productively in an industrial team environment	26	6	1	0	22	9	2	0	1.242	1.394	33	33	
4.019	Demonstrate an understanding of the behavior of successful teams	4	6	2	0	3	5	3	0	1.833	2.000	12	11	CLE
4.010	Manage conflict effectively and with sensitivity to the needs and perceptions of others	10	18	3	1	10	17	5	1	1.844	1.909	32	33	
	Understanding project interactions													
4.013	Plan and track work flow using the principles of project management	3	10	12	7	4	11	13	5	2.719	2.576	32	33	
4.011	Describe the functions of various departments commonly found in industry	4	5	15	8	4	8	14	7	2.844	2.727	32	33	
4.007	Plan effective agendas for meetings	2	8	13	10	3	10	13	7	2.939	2.727	33	33	
4.008	Conduct effective meetings	3	5	12	11	3	7	15	7	3.000	2.813	31	32	
	Personal professionalism													
4.009	Manage time efficiently	17	15	1	0	17	15	1	0	1.515	1.515	33	33	
4.004	Demonstrate adherence to the human resource policies of the employer	18	9	6	0	18	10	5	0	1.636	1.606	33	33	
4.017	Practice proper personal hygiene	10	11	3	0	11	10	3	0	1.708	1.667	24	24	LA
4.018	Effectively adopt and adapt skills and knowledge acquired during training	8	12	3	0	9	12	2	0	1.783	1.696	23	23	LA
4.002	Display the personal and ethical characteristics necessary to be identified as a professional	12	15	6	0	15	14	4	0	1.818	1.667	33	33	
4.015	Describe and practice the basic principles of intellectual property protection	6	7	6	2	7	7	5	3	2.190	2.182	21	22	SEA
4.014	Demonstrate life-long learning and plan and track personal professional growth	4	11	15	2	6	14	11	2	2.469	2.273	32	33	
4.016	Demonstrate good presentation skills for small groups and larger audiences	2	4	13	2	2	8	13	1	2.714	2.542	21	24	SEA
	Cultural awareness in the workplace													
4.006	Demonstrate cultural awareness to facilitate effective communication among people	7	13	12	1	7	14	11	1	2.212	2.182	33	33	
4.012	Apply a basic understanding of human behavior in dealing with workplace issues	7	12	13	1	8	12	12	1	2.242	2.182	33	33	
	Globalism													
4.020	Demonstrate a basic knowledge of global economic trends	2	1	8	1	2	0	9	1	2.667	2.750	12	12	CLE
4.003	Demonstrate a basic understanding of the global economic system	3	6	15	9	4	8	14	7	2.909	2.727	33	33	
4.005	Identify key elements of import and export strategies and global trade issues	3	3	10	17	3	4	10	16	3.242	3.182	33	33	

5.000	Chemical Science skills	General technician				Materials technician				GT	MT	Number of		Site
		1	2	3	4	1	2	3	4	Score	Score	ratings	where	
	Safety and environmental issues											N-GT	N-MT	added
5.005	Safely apply information from Material Safety Data Sheets (MSDS)	18	10	2	0	19	10	2	0	1.467	1.452	30	31	
5.004	Safely handle acids, bases, flammable liquids, cryogenic fluids, & compressed gases	16	12	3	0	23	7	2	0	1.581	1.344	31	32	
5.003	Apply knowledge of chemical and environmental safety including waste disposal & recycling	15	12	4	0	18	12	2	0	1.645	1.500	31	32	
5.009	Define flammability hazards of solvents such as flash point and explosive potential	11	8	11	1	17	8	7	0	2.065	1.688	31	32	
5.001	Demonstrate understanding of the interactions of science and technology with society	3	7	10	12	4	7	12	10	2.969	2.848	32	33	
	Chemistry fundamentals													
5.018	Describe the importance of material compatibility	5	8	9	1	10	9	4	1	2.261	1.833	23	24	LA
5.007	Read basic chemical abbreviations for compounds; e.g. HCL is hydrochloric acid	8	8	13	2	22	7	3	0	2.290	1.406	31	32	
5.006	Demonstrate knowledge of chemical symbols and the periodic table of the elements	7	7	15	2	21	6	5	0	2.387	1.500	31	32	
5.002	Apply the scientific method in a laboratory and in a variety of technical situations	5	11	14	2	12	13	7	0	2.406	1.844	32	32	
5.015	Describe the fundamental nature of liquids, solids, and gases	4	8	14	5	10	14	7	1	2.645	1.969	31	32	
5.008	Demonstrate knowledge of chemical concentrations	3	8	16	4	15	11	5	1	2.677	1.750	31	32	
5.017	Describe and compare the nature of organic and inorganic chemicals	1	6	18	6	9	11	9	3	2.935	2.188	31	32	
5.011	Demonstrate knowledge of corrosion potential, chemical batteries, and galvanic series	2	4	17	8	9	13	8	2	3.000	2.094	31	32	
5.016	Describe the chain structure of polymers	2	4	14	11	10	9	10	3	3.097	2.188	31	32	
5.014	Demonstrate understanding of chemical bonds as applied to solids	1	6	13	11	7	15	6	4	3.097	2.219	31	32	
5.010	Prepare etching solutions	1	1	17	12	12	13	5	2	3.290	1.906	31	32	
	Nuclear applications													
5.012	Describe the basic characteristics of electrons, neutrons, and protons in atomic structure	1	2	16	12	5	8	14	5	3.258	2.594	31	32	
5.013	Describe the characteristics of radioactive decay	0	1	13	18	3	6	11	12	3.531	3.000	32	32	
		General technician				Materials technician				GT	MT	Number of		Site
6.000	Physical Science skills	1	2	3	4	1	2	3	4	Score	Score	ratings		where
	Mechanics											N-GT	N-MT	added
6.008	Apply correctly appropriate units for physical quantities	11	10	8	2	18	11	3	0	2.032	1.531	31	32	
6.005	Apply correctly the concepts of weight and mass	6	13	8	4	13	12	4	3	2.323	1.906	31	32	
6.016	Apply the principles of friction	4	8	7	2	4	7	8	3	2.333	2.455	21	22	LA
6.001	Apply principles of forces, moments, and static equilibrium	3	10	15	3	5	16	6	5	2.581	2.344	31	32	
6.006	Apply Newton's law; $F = ma$	3	9	13	6	5	11	9	7	2.710	2.563	31	32	
6.002	Apply fundamentals of motion including displacement, velocity, acceleration, momentum	2	11	11	7	6	8	10	8	2.742	2.625	31	32	
6.003	Apply fundamentals of rotational motion	2	9	13	6	4	8	11	8	2.767	2.742	30	31	
6.004	Apply fundamentals of potential and kinetic energy and conservation of energy	2	10	11	8	6	8	11	7	2.806	2.594	31	32	
6.007	Apply concepts of inertia and its relationship with acceleration	2	7	10	12	4	8	8	12	3.032	2.875	31	32	
	Fluid and thermal concepts													
6.017	Apply concepts of thermal expansion and differential thermal expansion	2	6	8	0	4	8	4	0	2.375	2.000	16	16	DET
6.010	Apply concepts of heat including temperature, thermal conductivity, specific heat, etc.	4	10	15	2	13	12	6	2	2.484	1.909	31	33	
6.009	Apply concepts of fluid pressure and the behavior of fluids in annealing and heat treating	0	6	17	8	4	19	6	3	3.065	2.250	31	32	
	Electricity and magnetism													
6.015	Describe the electrical properties of conductors, insulators, and semiconductors	1	12	9	8	5	9	10	8	2.800	2.656	30	32	
6.014	Apply concepts of magnetism and its role in electric motors and generators	1	8	14	8	2	9	11	10	2.935	2.906	31	32	
6.013	Apply concepts of electromagnetic waves: X-rays, ultraviolet rays, radio waves, and visible light	0	9	14	8	5	11	12	4	2.968	2.469	31	32	
	Light and sound													
6.011	Apply concepts of light and optics as applied to physical measurement	2	9	12	8	4	10	12	6	2.839	2.625	31	32	
6.012	Apply concepts of sound measurement and control	1	8	15	7	2	9	11	10	2.903	2.906	31	32	

7.000	Fundamentals of materials science and technology	General technician				Materials technician				GT	MT	Number of		Site
		1	2	3	4	1	2	3	4	Score	Score	ratings	where	
	General nature of metals											N-GT	N-MT	added
7.001	Describe the general nature of ferrous metals	3	12	14	2	17	12	2	1	2.484	1.594	31	32	
7.002	Describe the general nature of non-ferrous metals	2	12	15	2	16	13	1	1	2.548	1.581	31	31	
7.003	Describe five types of common non-ferrous metals	1	8	18	4	12	17	2	1	2.806	1.750	31	32	
7.011	Describe the general nature of magnetic materials	0	9	15	7	8	12	9	3	2.935	2.219	31	32	
	General nature of plastics													
7.005	Describe the general nature of thermoplastic plastics	1	10	18	2	10	14	8	0	2.677	1.938	31	32	
7.004	Describe the general nature of thermoset plastics	1	9	19	2	10	13	9	0	2.710	1.969	31	32	
7.013	Describe the general nature of elastomeric materials	0	11	18	2	9	13	8	2	2.710	2.094	31	32	
	General nature of composites													
7.010	Describe the general nature of fiber reinforced composites	0	9	16	6	9	13	6	4	2.903	2.156	31	32	
7.014	Describe the general nature of structural foam materials	0	6	17	8	9	8	9	5	3.065	2.323	31	31	
	General nature of semiconductors and optical materials													
7.012	Describe the general nature of semiconductors and other materials for electronic devices	0	7	16	8	5	12	9	5	3.032	2.452	31	31	
7.016	Describe the general nature of optical materials for lenses and displays	0	9	12	10	6	11	5	8	3.032	2.500	31	30	
7.015	Describe the general nature of optical fibers	0	7	15	9	5	11	7	8	3.065	2.581	31	31	
	General nature of ceramics and glasses													
7.008	Describe the general nature of ceramics	0	10	14	7	8	16	5	3	2.903	2.094	31	32	
7.009	Describe the general nature of glasses	0	10	13	8	7	14	5	6	2.935	2.313	31	32	
	Other materials													
7.006	Describe the general nature of woods	0	7	15	9	6	10	7	9	3.065	2.594	31	32	
7.007	Describe the general nature of concrete	0	6	14	11	6	10	6	10	3.161	2.625	31	32	
	Stress and strength													
7.017	Define stress	7	13	10	0	19	11	1	0	2.100	1.419	30	31	
7.028	Define ultimate tensile strength	4	12	11	4	19	11	2	0	2.484	1.469	31	32	
7.026	Define yield point for metals and describe materials that exhibit this property	4	9	15	3	16	11	5	0	2.548	1.656	31	32	
7.029	Define ultimate compressive strength	3	10	14	3	16	12	3	0	2.567	1.581	30	31	
7.025	Define impact strength	3	10	15	3	17	9	4	1	2.581	1.645	31	31	
7.027	Define yield strength for metals and describe materials that exhibit this property	3	10	13	4	17	11	3	1	2.600	1.625	30	32	
7.036	Define residual stress	4	2	11	4	6	11	3	1	2.714	1.952	21	21	SEA
7.035	Define endurance strength and describe S-N curves, and fatigue cracking	2	4	12	3	5	11	4	1	2.762	2.048	21	21	SEA
7.040	Define lap shear stress and strength	1	5	9	5	5	7	7	2	2.900	2.286	20	21	LA
	Strain and deformation													
7.018	Define strain	7	14	10	0	20	11	1	0	2.097	1.406	31	32	
7.021	Describe and compare the behavior of ductile and brittle materials	4	14	9	3	20	10	2	0	2.367	1.438	30	32	
7.054	Describe methodology of fracture between ductile and brittle metals	2	3	7	0	5	4	2	0	2.417	1.727	12	11	CLE
7.019	Define modulus of elasticity in tension and compression	4	11	11	4	18	11	3	0	2.500	1.531	30	32	
7.022	Define ductility	3	12	11	4	18	10	4	0	2.533	1.563	30	32	
7.031	Compare mechanical properties of different metals, ceramics, polymers and composites	2	12	14	3	15	9	7	1	2.581	1.813	31	32	
7.024	Define percent reduction in area	2	12	13	4	16	10	4	1	2.613	1.677	31	31	
7.023	Define percent elongation	2	11	13	5	18	9	4	0	2.677	1.548	31	31	
7.020	Define modulus of elasticity in shear	3	9	15	5	16	12	3	0	2.688	1.581	32	31	
7.030	Define creep of materials	3	6	18	4	16	11	3	1	2.742	1.645	31	31	

(Continuation of Section 7.000)		General technician				Materials technician				GT	MT	Number of		Site
7.000	Fundamentals of materials science and technology	1	2	3	4	1	2	3	4	Score	Score	ratings		where
	Analysis of material structure											N-GT	N-MT	added
7.042	Describe the types of flaws that can occur in materials and how they affect properties	3	6	5	2	4	10	1	0	2.375	1.800	16	15	DET
7.043	Describe the methods used to vary the strength and toughness of materials	3	3	6	2	3	10	2	0	2.500	1.933	14	15	DET
7.053	Identify materials by their trade names	2	4	4	2	1	6	3	1	2.500	2.364	12	11	CLE
8.040	use image analysis software and tools	0	4	5	3	5	4	1	1	2.917	1.818	12	11	CLE
	Design considerations													
7.045	designing with materials	2	6	4	3	3	9	3	0	2.533	2.000	15	15	DET
7.041	Define strength to weight ratio and describe its significance to performance of materials	2	8	8	3	5	11	3	2	2.571	2.095	21	21	LA
7.044	Explain how and why the designer chooses properties of materials	2	5	6	3	3	4	6	0	2.625	2.231	16	13	DET
7.046	Describe modes of wear and metal loss	2	4	6	4	3	5	7	0	2.750	2.267	16	15	DET
7.047	Describe environmental embrittlement	3	3	5	5	3	7	3	2	2.750	2.267	16	15	DET
7.034	Prepare material samples for analysis of grain structure and failure sites	3	3	9	6	12	2	2	2	2.857	1.667	21	18	SEA
7.033	Describe how grain structures of materials affect their properties	3	3	9	6	9	8	2	2	2.857	1.857	21	21	SEA
	Thermal, physical, and other properties of materials													
7.038	Describe flammability and toxicological issues of materials	3	7	10	1	7	7	7	0	2.429	2.000	21	21	SEA
7.037	Compare thermal properties of different materials	2	8	9	2	5	9	7	0	2.524	2.095	21	21	SEA
7.032	Compare electrical properties of different metals, ceramics, polymers and composites	1	9	16	5	15	5	6	6	2.806	2.094	31	32	
	Plastics and polymers													
7.048	Describe how polymers differ from metals, glasses, and ceramics; how this affects properties	2	5	4	1	7	2	2	0	2.333	1.545	12	11	CLE
7.039	Describe significance of glass transition temperature of plastics & how they are measured	1	5	8	7	5	7	7	2	3.000	2.286	21	21	SEA
	Emerging materials technologies													
7.052	Describe the general nature of biocompatibility	0	4	4	4	1	3	4	3	3.000	2.818	12	11	CLE
7.050	Describe the general nature of microelectromechanical systems	0	4	2	6	1	2	3	5	3.167	3.091	12	11	CLE
7.051	Describe the general nature of nano systems	0	2	6	4	1	3	4	3	3.167	2.818	12	11	CLE
7.049	Describe the general nature of shape memory alloys	0	2	4	6	0	3	4	4	3.333	3.091	12	11	CLE

8.000	Materials testing	General technician				Materials technician				GT	MT	Number of		Site
		1	2	3	4	1	2	3	4	Score	Score	ratings	where	
	Experimental planning and execution											N-GT	N-MT	added
8.043	Demonstrate an understanding of experimental design	3	6	2	1	2	5	4	0	2.083	2.182	12	11	CLE
8.028	Recognize and decipher acronyms used for job tasks	5	11	12	0	3	10	9	0	2.250	2.273	28	22	SEA
8.037	Determine appropriate cleaners to use for different materials	6	5	6	4	8	8	5	1	2.381	1.955	21	22	LA
8.039	Demonstrate a basic knowledge of composition determination techniques	1	4	5	6	3	11	2	0	3.000	1.938	16	16	DET
8.027	Demonstrate a basic understanding of solidification principles and the variables involved	1	6	12	12	11	14	6	1	3.129	1.906	31	32	
	General mechanical testing processes for solid materials													
8.029	Perform life testing, and shock, vibration, and thermal shock testing	2	8	8	4	3	3	8	2	2.636	2.563	22	16	SEA
8.002	Describe the types of material properties found from a tensile test	3	11	11	6	19	13	0	0	2.645	1.406	31	32	
8.004	Describe several methods of measuring hardness of materials	1	10	16	4	17	14	1	0	2.742	1.500	31	32	
8.007	Perform hardness tests for a variety of materials	2	9	13	6	18	13	0	1	2.767	1.500	30	32	
8.038	Demonstrate a basic knowledge of microhardness measurements and hardness profiles	2	2	9	3	6	9	1	0	2.813	1.688	16	16	DET
8.005	Perform tensile tests for a variety of materials	2	7	13	8	19	11	2	0	2.900	1.469	30	32	
8.006	Perform impact tests for a variety of materials	1	7	14	7	17	12	2	0	2.931	1.516	29	31	
8.003	Describe the measurement of impact strength using the Charpy and Izod methods	2	6	15	8	14	17	1	0	2.935	1.594	31	32	
8.032	Perform fatigue tests of materials	0	6	10	10	11	14	3	0	3.154	1.714	26	28	SEA
	Visual and nondestructive testing													
8.034	Perform non-destructive testing using ultrasonic, X-ray, eddy current, and other methods	2	10	10	4	11	12	4	1	2.615	1.821	26	28	SEA
8.042	Demonstrate an understanding of liquid penetrant, radiographic, and magnetic inspection	0	3	8	1	1	5	4	1	2.833	2.455	12	11	CLE
8.041	Demonstrate proficiency in macro-analysis and macro photography	1	1	8	2	4	2	4	1	2.917	2.182	12	11	CLE
8.031	Use effectively electron microscopes, e.g. SEM, FIB, AFB, and FR	0	8	7	10	9	15	2	1	3.080	1.815	25	27	SEA
8.010	Describe the effect of processing on the microstructure of materials	2	4	12	12	15	10	5	2	3.133	1.813	30	32	
8.008	Prepare a material specimen for metallurgical analysis	2	2	12	15	17	10	3	2	3.290	1.688	31	32	
8.030	Use effectively Koller illumination and other light illumination modes	1	1	10	10	3	6	5	8	3.318	2.818	22	22	SEA
8.009	Perform a microscopic evaluation of a metallurgical specimen and report the results	1	2	13	15	17	8	5	2	3.355	1.750	31	32	
	Working with standards													
8.033	Compare American and European standards, e.g. ASTM and ISO	3	6	9	3	5	11	4	1	2.571	2.048	21	21	SEA
8.023	Research the types of materials testing standards promulgated by ASTM International	2	9	10	9	14	10	7	1	2.867	1.844	30	32	
8.024	Research the types of materials testing standards promulgated by SAE International	2	6	11	11	13	7	8	4	3.033	2.094	30	32	
8.025	Research the types of materials testing standards promulgated by API for oils	0	6	7	17	6	7	7	12	3.367	2.781	30	32	
	Testing metallic materials													
8.001	Describe the fundamentals of performing a tensile test of a metallic material	2	10	14	5	19	12	1	0	2.710	1.438	31	32	
	Testing plastics and composites													
8.016	Evaluate the influence of temperature on the mechanical properties of plastics	2	5	12	11	12	9	7	4	3.067	2.094	30	32	
8.035	Perform tests of the effects of solvents and acids on polymers and plastics	1	2	12	6	4	7	7	4	3.095	2.500	21	22	SEA
8.013	Perform tension, compression, and flexure tests of plastics	1	4	14	12	10	11	7	4	3.194	2.156	31	32	
8.017	Evaluate the influence of moisture absorption on the mechanical properties of plastics	2	3	12	13	8	10	8	6	3.200	2.375	30	32	
8.014	Perform impact testing for plastic materials	1	3	14	13	10	12	6	4	3.258	2.125	31	32	
8.026	Perform tests for stress, strain, and impact resistance for composite materials	1	1	18	11	10	13	5	4	3.258	2.094	31	32	
8.015	Perform creep testing for plastic materials	0	3	14	13	9	13	6	4	3.333	2.156	30	32	
	Testing of wood and concrete													
8.011	Perform a compression test of a brittle material such as concrete	1	0	14	14	10	8	7	6	3.414	2.290	29	31	
8.012	Perform bending and shear strength tests for wood	0	0	14	17	6	7	9	10	3.548	2.719	31	32	
	Testing of liquids													
8.018	Perform viscosity measurement for a variety of liquids from low to high viscosities	2	4	13	11	10	11	6	5	3.100	2.188	30	32	
8.022	Perform tests for hydraulic fluids used in fluid power systems	2	3	11	15	5	7	8	11	3.258	2.806	31	31	
8.019	Perform tests of viscosity index for oils	0	5	12	13	5	8	10	9	3.267	2.719	30	32	

8.021	Perform tests for lubricating and engine oils according to SAE standards	1	3	10	16	4	9	7	12	3.367	2.844	30	32	
8.020	Perform viscosity measurements for liquid polymers	2	1	9	18	7	6	9	10	3.433	2.688	30	32	

												Number of		Site
9.000	Materials and processing - Metals	General technician				Materials technician				GT	MT	ratings		where
9.100	Steel	1	2	3	4	1	2	3	4	Score	Score	N-GT	N-MT	added
9.114	Describe hydrogen embrittlement of steels	2	5	8	4	7	9	2	2	2.737	1.950	19	20	SEA
9.106	Describe how the properties of ferrous metals are affected by heat treatment	3	5	15	7	15	11	4	1	2.867	1.710	30	31	
9.107	Define hardenability of steel	3	5	15	7	15	8	6	2	2.867	1.839	30	31	
9.112	Describe work hardening as applied to the condition of steels and the resulting properties	1	8	15	6	11	11	8	1	2.867	1.968	30	31	
9.104	Define stainless steel	1	7	16	6	13	13	5	0	2.900	1.742	30	31	
9.110	Define and describe quenching and tempering of steels	3	4	16	7	15	11	4	1	2.900	1.710	30	31	
9.111	Describe the general nature of case hardening processes used for steels	2	5	17	6	11	13	6	1	2.900	1.903	30	31	
9.101	Describe the primary constituents of steel	0	9	14	7	17	10	3	1	2.933	1.613	30	31	
9.105	Describe the range of carbon content in low, medium, and high carbon steels	1	7	14	8	10	15	5	1	2.967	1.903	30	31	
9.109	Define and describe annealing of steels	2	4	17	7	14	11	5	1	2.967	1.774	30	31	
9.113	Identify the nominal value of the modulus of elasticity for steel alloys	1	7	14	8	11	13	6	1	2.967	1.903	30	31	
9.102	Describe the influence of carbon content on steel properties	0	6	17	7	16	11	3	1	3.033	1.645	30	31	
9.108	Describe the basic structure and function of the phase diagram for a metal alloy	0	7	14	9	14	8	7	2	3.067	1.903	30	31	
9.115	Describe magnetic properties of stainless steels	1	3	9	7	6	8	4	3	3.100	2.190	20	21	LA
9.103	Describe the AISI four-digit designation system for steel alloys	0	5	14	11	11	12	7	1	3.200	1.935	30	31	
										GT	MT			
9.200	Cast iron									Score	Score	N-GT	N-MT	
9.202	How are cast irons different from steels?	3	5	14	9	9	13	7	2	2.935	2.065	31	31	
9.201	Define and describe cast iron and the types available.	2	4	14	10	9	9	11	2	3.067	2.194	30	31	
										GT	MT			
9.300	Aluminum									Score	Score	N-GT	N-MT	
9.307	Describe clad coating of aluminum and the effects of clad penetration	2	6	4	7	4	5	9	3	2.842	2.524	19	21	LA
9.301	Identify several common types of wrought aluminum alloys and their main alloying elements	0	8	13	9	10	15	6	0	3.033	1.871	30	31	
9.304	Describe five common forms of commercially available wrought aluminum	0	8	11	11	8	11	11	1	3.100	2.161	30	31	
9.305	Identify the nominal value of the modulus of elasticity for aluminum alloys	1	6	12	11	10	12	7	2	3.100	2.032	30	31	
9.302	Give the four-digit designation for five common aluminum alloys and describe their uses	0	5	15	10	10	9	11	1	3.167	2.097	30	31	
9.303	Describe three common conditions or tempers in which aluminum is produced	0	4	16	10	7	15	8	1	3.200	2.097	30	31	
9.306	Describe work hardening as applied to the condition of aluminum and the resulting properties	0	4	16	10	7	13	9	2	3.200	2.194	30	31	
										GT	MT			
9.400	Copper and its alloys									Score	Score	N-GT	N-MT	
9.402	Describe three major advantages of copper and copper alloys	2	3	16	9	8	13	8	2	3.067	2.129	30	31	
9.401	Identify three types of copper alloys, their major constituents, uses, and properties	1	4	14	11	7	13	9	2	3.167	2.194	30	31	
										GT	MT			
9.500	Zinc and its alloys									Score	Score	N-GT	N-MT	
9.501	Identify four common uses for zinc and its alloys	2	2	15	11	7	13	7	4	3.167	2.258	30	31	
										GT	MT			
9.600	Magnesium and its alloys									Score	Score	N-GT	N-MT	
9.602	Describe the flammability dangers of magnesium	5	6	7	3	8	7	4	2	2.381	2.000	21	21	LA
9.601	Identify four common uses for magnesium metal	2	2	13	13	7	11	9	4	3.233	2.323	30	31	

		General technician				Materials technician				GT	MT	Number of ratings		Site where added
		1	2	3	4	1	2	3	4	Score	Score	N-GT	N-MT	
9.700	Nickel alloys (Superalloys)													
9.704	Describe Invar and its uses	0	6	5	8	3	4	8	5	3.105	2.750	19	20	SEA
9.703	Describe four common uses for nickel alloys	0	3	19	8	6	16	7	2	3.167	2.161	30	31	
9.702	Describe the advantages of nickel alloys as compared with common steels.	0	3	18	9	8	14	8	1	3.200	2.065	30	31	
9.701	Identify four types of nickel alloys and their primary alloying elements	1	3	15	11	6	16	6	2	3.200	2.133	30	30	
										GT	MT			
9.800	Titanium and its alloys									Score	Score	N-GT	N-MT	
9.801	Identify four common uses for titanium and its alloys	2	4	7	5	5	7	6	1	2.833	2.158	18	19	LA
9.802	Describe the basic types of heat treatment used for titanium alloys	2	3	7	6	5	5	8	1	2.944	2.263	18	19	LA
10.000	Materials and processing - Plastics													
10.100	Thermoplastics													
10.101	Describe the general nature of thermoplastics	5	10	12	4	16	10	6	0	2.484	1.688	31	32	
10.108	Identify four major disadvantages of thermoplastics as compared with metals	1	9	11	8	8	15	6	1	2.897	2.000	29	30	
10.107	Identify four major advantages of thermoplastics as compared with metals	1	9	12	8	9	14	7	1	2.900	2.000	30	31	
10.104	Discuss the effect of rising temperatures on the properties of thermoplastics	1	6	16	7	6	15	9	1	2.967	2.161	30	31	
10.103	Identify and describe five common methods of processing thermoplastics	1	6	14	9	6	13	10	2	3.033	2.258	30	31	
10.109	Describe common filler materials for thermoplastics and their effect on properties	1	3	18	6	8	13	7	2	3.036	2.100	28	30	
10.106	Define creep as it is applied to thermoplastics and describe how it is measured	2	3	15	10	6	13	10	2	3.100	2.258	30	31	
10.111	Describe the effects of polymer additives on plastics	1	3	5	7	1	5	8	2	3.125	2.688	16	16	DET
10.105	Discuss the effect of moisture absorption on the properties of thermoplastics	0	6	14	10	5	15	8	3	3.133	2.290	30	31	
10.102	Identify eight common thermoplastics and describe their common uses	0	6	14	10	6	10	12	2	3.133	2.333	30	30	
10.110	Describe and compare amorphous and crystalline thermoplastics	2	2	6	9	3	6	9	2	3.158	2.500	19	20	SEA
										GT	MT			
10.200	Thermoset plastics									Score	Score	N-GT	N-MT	
10.201	Describe the general nature of thermosets as compared with thermoplastics	2	10	12	6	9	15	7	0	2.733	1.935	30	31	
10.203	Describe the general nature of fiber reinforced plastics (FRP)	1	7	13	7	6	10	12	1	2.929	2.276	28	29	
10.202	Identify two major types of thermosets and describe their common uses	2	4	14	10	7	11	11	2	3.067	2.258	30	31	
10.206	Describe the curing stages of thermoset plastics (ABC stages)	1	5	4	9	2	4	10	5	3.105	2.857	19	21	LA
10.204	Identify five different forms of glass fiber used in FRP	0	5	13	11	5	7	14	3	3.207	2.517	29	29	
10.205	Describe solid surface thermoset plastics, e.g. Corian (TM)	1	0	5	9	1	2	7	7	3.467	3.176	15	17	LA

14.005	Describe slip planes in glasses and its brittle behavior	0	2	5	12	3	3	10	4	3.526	2.750	19	20	SEA
		General technician				Materials technician				GT	MT	Number of		Site
		1	2	3	4	1	2	3	4	Score	Score	N-GT	N-MT	added
15.000	Materials and processing - Ceramics	1	2	3	4	1	2	3	4	Score	Score	N-GT	N-MT	
15.001	Describe ceramic materials	2	5	16	7	7	13	6	3	2.933	2.172	30	29	
15.002	Describe several differences between ceramics and metals as they effect properties	1	4	17	8	8	13	7	3	3.067	2.161	30	31	
15.003	Describe the primary testing procedures for ceramics that differ from metals	1	4	14	11	6	14	8	3	3.167	2.258	30	31	
15.004	Describe how glass ceramics differ from glasses	1	4	4	11	3	8	5	5	3.250	2.571	20	21	SEA
15.006	Describe thermal expansion and thermal shock behavior of ceramics	1	1	5	8	1	1	8	5	3.333	3.133	15	15	SEA
15.007	Describe electrical properties of ceramics	0	2	4	9	0	1	9	5	3.467	3.267	15	15	SEA
15.005	Describe slip planes and brittle behavior of ceramics	0	2	3	10	0	1	7	7	3.533	3.400	15	15	SEA
		General technician				Materials technician				GT	MT			
16.000	Relationships between processing variables, quality, material properties, defects	1	2	3	4	1	2	3	4	Score	Score	N-GT	N-MT	
	Effects of processing and manufacturing variations on material properties													
16.007	Describe how changes in manufacturing processes affect material properties	9	9	1	0	10	10	0	0	1.579	1.500	19	20	LA
8.044	Determine effects of variations due to operator, machine, material, etc.	7	3	2	0	5	3	3	0	1.583	1.818	12	11	CLE
16.002	Describe how cold working affects the mechanical properties of metals	2	12	13	2	15	13	1	1	2.517	1.600	29	30	
16.001	Describe how heat treating affects the mechanical properties of metals	2	11	14	2	15	13	1	1	2.552	1.600	29	30	
	Effects of defects on material properties													
16.003	Describe how defects such as nicks and scratches affect properties of metals and alloys	5	7	14	3	15	11	3	1	2.517	1.667	29	30	
16.006	Describe how defects such as nicks and scratches affect properties of composites	5	7	12	4	10	11	6	2	2.536	2.000	28	29	
16.004	Describe how defects such as nicks and scratches affect properties of plastics	3	11	11	4	11	11	7	1	2.552	1.933	29	30	
16.005	Describe how defects such as nicks and scratches affect properties of ceramics	5	7	12	5	11	10	7	2	2.586	2.000	29	30	
		General technician				Materials technician				GT	MT			
17.000	Fabrication, machining, fastening, welding, forming, forging, finishing, etc.	1	2	3	4	1	2	3	4	Score	Score	N-GT	N-MT	
	General processes													
17.003	Describe several types of mechanical fastening methods	7	12	8	1	8	16	4	1	2.107	1.931	28	29	
17.004	Describe adhesives as applied to fastening materials including surface preparations	6	10	10	2	9	11	6	3	2.286	2.103	28	29	
17.012	Describe the importance of pre-load during fabrication and assembly	4	7	6	2	5	8	6	2	2.316	2.238	19	21	LA
17.013	Describe techniques for using shimming and where and when it is appropriate	4	6	7	2	5	5	8	3	2.368	2.429	19	21	LA
17.009	Describe several methods of finishing materials for appearance and corrosion resistance	3	13	10	2	10	14	4	1	2.393	1.862	28	29	
17.014	Describe the basic requirements of 2-part adhesives	0	4	5	3	0	8	2	1	2.917	2.364	12	11	CLE
17.015	Describe the basic requirements of moisture cure adhesives	0	3	6	3	0	7	2	1	3.000	2.400	12	10	CLE
	Metals processing													
17.005	Describe the basic types of joining processes for metals; welding, brazing, etc.	7	13	6	2	12	13	1	3	2.107	1.828	28	29	
17.001	Describe the primary methods of machining metals	4	16	7	1	9	14	4	1	2.179	1.893	28	28	
17.007	Describe several types of forming, casting and molding processes for metals	4	15	7	2	10	16	1	1	2.250	1.750	28	28	
17.002	Describe how surface finishes of machined metals affect properties	3	13	11	1	12	13	3	1	2.357	1.759	28	29	
17.010	Describe how soldering is used for fabrication of metals	1	12	4	2	4	11	4	1	2.368	2.100	19	20	SEA
17.011	Describe shot peening and roto-peening and how to adjust the processes for metal products	2	5	11	3	4	8	7	3	2.714	2.409	21	22	LA
	Processing of plastics and composites													
17.008	Describe several types of forming, molding, and curing processes for plastics	5	13	8	2	10	13	4	1	2.250	1.857	28	28	
17.006	Describe the basic types of joining processes for plastics and composites	7	10	8	3	10	10	6	3	2.250	2.069	28	29	

18.000	Tooling, dies, jigs, fixtures	General technician				Materials technician				GT	MT	Number of		Site
		1	2	3	4	1	2	3	4	Score	Score	ratings	where	
General tooling practices												N-GT	N-MT	added
18.011	Describe a hard coordinate in tooling	2	9	4	5	5	5	6	5	2.600	2.524	20	21	LA
18.010	Describe a theodolite and a laser tracker and their uses in measurement	1	6	5	7	2	5	6	7	2.947	2.900	19	20	LA
Tooling for metal processing														
18.001	Describe several kinds of cutting tools use for machining metals	11	10	6	1	8	14	6	1	1.893	2.000	28	29	
18.002	Describe grinding tools used for metals	8	12	6	2	7	15	5	2	2.071	2.069	28	29	
18.003	Describe jigs and fixtures as applied to processing metallic parts	8	10	7	3	7	12	7	3	2.179	2.207	28	29	
18.004	Describe dies used in forming and forging of metals	5	9	10	4	5	15	6	3	2.464	2.241	28	29	
18.007	Describe dies used in extruding metals	5	9	9	5	6	15	6	2	2.500	2.138	28	29	
18.005	Describe dies used in casting metals	5	7	10	6	6	15	5	3	2.607	2.172	28	29	
Tooling for plastics and composites processing														
18.012	Describe dies used in extruding plastics	5	9	9	5	6	15	6	2	2.500	2.138	28	29	
18.006	Describe dies used in molding plastics	5	7	9	7	8	13	4	4	2.643	2.138	28	29	
18.009	Describe tools for cutting composites and how they are used	3	6	6	5	2	5	8	6	2.650	2.857	20	21	LA
18.008	Describe the fabrication of molds for composites processing; materials, splash, soft tooling	2	7	6	6	1	5	10	5	2.762	2.905	21	21	SEA
		General technician				Materials technician				GT	MT	Number of		Site
19.000 Manufacturing operations and quality management		1	2	3	4	1	2	3	4	Score	Score	ratings	where	
Quality management												N-GT	N-MT	added
19.013	Recognize and address quality and safety issues	16	4	3	0	15	5	4	0	1.435	1.542	23	24	LA
19.021	Differentiate critical and non-critical defects	4	4	4	0	5	4	1	1	2.000	1.818	12	11	CLE
19.022	Understanding of the concept of internal and external customer; their wants and needs	4	4	2	1	4	5	2	0	2.000	1.818	11	11	CLE
19.020	Describe cost of poor quality parts	4	4	3	1	4	2	3	2	2.083	2.273	12	11	CLE
19.010	Demonstrate knowledge of six sigma tools and practices used in industry	4	9	5	3	3	11	5	3	2.333	2.364	21	22	SEA
19.018	Demonstrate understanding of quality management systems used in industry	0	8	3	1	1	7	2	1	2.417	2.273	12	11	CLE
Manufacturing operations management														
19.001	Apply statistics in process control (SPC)	6	9	5	2	7	9	4	2	2.136	2.045	22	22	SEA
19.014	Consider the cost of manufacturing a product or component	2	12	7	0	5	9	7	1	2.238	2.182	21	22	LA
19.007	Demonstrate knowledge of lean manufacturing tools and practices used in industry	4	7	7	3	3	5	9	3	2.429	2.600	21	20	SEA
19.003	Use effectively manufacturing simulation software	1	8	9	2	0	5	10	6	2.600	3.048	20	21	SEA
19.002	Describe the fundamentals of product life cycle management	1	7	8	3	0	7	6	6	2.684	2.947	19	19	SEA
19.006	Demonstrate knowledge of basic business economics	1	6	12	2	0	8	12	2	2.714	2.727	21	22	SEA
19.005	Demonstrate knowledge of basic product assembly techniques, including determinate assy.	1	9	5	6	0	7	9	6	2.762	2.955	21	22	SEA
19.011	Demonstrate knowledge of workflow control	0	9	7	5	0	7	11	4	2.810	2.864	21	22	SEA
19.004	Describe the fundamentals of supply chain management	1	7	8	5	0	7	8	7	2.810	3.000	21	22	SEA
19.008	Demonstrate knowledge of large scale system integration	1	6	9	5	0	6	10	6	2.857	3.000	21	22	SEA
19.009	Demonstrate knowledge of the fundamentals of risk management	0	5	13	3	0	7	12	3	2.905	2.818	21	22	SEA
19.012	Use enterprise resource planning (ERP) software	1	3	10	7	2	6	8	6	3.095	2.818	21	22	LA

NATIONAL RESOURCE CENTER FOR MATERIALS TECHNOLOGY EDUCATION														
Full list of 397 core competencies expected of technicians in the materials area, sorted by the score for <i>Materials Technicians</i>														
Rating Scale														
Color Code														
1 = Vital														
2 = Important														
3 = Desirable, not critical														
4 = Not important														
Green ≤2.200														
Blue 2.201 to 3.200														
Red >3.200														
Refer.	COMPETENCY	General technician				Materials technician				GT	MT	Number of		Site
No.	<i>Each competency begins with "Ability to "</i>	1	2	3	4	1	2	3	4	Score	Score	ratings	where	
0.000	Basic competencies related to work as a technician											N-GT	N-MT	added
	Communication													
0.004	Follow directions from supervisors and request additional information as needed	29	4	0	0	28	4	0	0	1.121	1.125	33	32	
0.002	Read instructions and technical manuals in English	22	9	2	0	24	8	1	0	1.394	1.303	33	33	
0.018	Demonstrate good listening skills	14	10	0	0	16	8	0	0	1.417	1.333	24	24	LA
0.001	Orally communicate effectively in English with technical staff using good interpersonal skills	22	9	2	0	24	6	3	0	1.394	1.364	33	33	
0.003	Write clear letters, memorandums, and technical reports in English	4	16	13	0	11	14	8	0	2.273	1.909	33	33	
0.005	Use email effectively for communicating within industry	5	14	12	1	8	18	7	0	2.281	1.970	32	33	
0.027	Effectively communicate a non-documented process to fellow employees or supervisors	3	10	8	1	6	7	8	2	2.318	2.261	22	23	LA
0.028	Effectively fax documents to customers, in-plant personnel, and vendors	3	6	7	1	3	6	6	1	2.353	2.313	17	16	DET
0.030	Read non-English information such as material specifications	1	4	6	6	3	2	6	7	3.000	2.944	17	18	DET
	Testing and data analysis													
0.008	Set up tests and take accurate data	17	8	2	5	28	5	0	0	1.844	1.152	32	33	
0.007	Accurately record experiment details and results; Demonstrate good lab notebook skills	18	8	4	2	25	7	0	0	1.688	1.219	32	32	
0.009	Analyze test data, compare and contrast information, and draw rational conclusions	6	8	15	4	15	9	9	0	2.515	1.818	33	33	
	Workplace performance													
0.017	Practice good workplace safety methods	21	2	1	0	20	3	1	0	1.167	1.208	24	24	LA
0.010	Demonstrate good attendance, timeliness, and punctuality	20	13	0	0	20	13	0	0	1.394	1.394	33	33	
0.019	Adhere to company policies such as safety, diversity, confidentiality, etc.	12	5	0	0	11	5	1	0	1.294	1.412	17	17	DET
0.020	Demonstrate time management skills	5	7	0	0	6	5	0	0	1.583	1.455	12	11	CLE
0.021	Practice good housekeeping skills	12	9	3	0	13	8	3	0	1.625	1.583	24	24	LA
0.006	Work effectively in teams within the industrial workforce	14	15	4	0	15	15	3	0	1.697	1.636	33	33	
0.011	Remain diligent throughout the workday and perform without supervision	8	23	2	0	12	19	1	0	1.818	1.656	33	32	
0.015	Demonstrate flexibility and a willingness to learn on the job	16	10	7	0	15	14	4	0	1.727	1.667	33	33	
0.013	Recognize what needs to be done and take steps to accomplish it; Self-starter	8	19	6	0	11	17	5	0	1.939	1.818	33	33	
0.014	Exercise independent judgment and willingness to assume responsibility	5	18	9	0	8	19	6	0	2.125	1.939	32	33	
0.012	Apply a variety of problem solving methods and continuous improvement techniques	8	12	12	0	8	15	10	0	2.125	2.061	32	33	
0.025	Perform job functions demanding manual dexterity, dynamic, and explosive strength	6	5	11	1	6	9	7	1	2.304	2.130	23	23	LA
0.029	Effectively break out a non-documented process into a series of tasks or activities	2	6	13	1	4	8	10	1	2.591	2.348	22	23	LA
	General technical competence													
0.022	Recall key job-related information, e.g. processes, references, terminology, acronyms	8	14	2	0	10	12	2	0	1.750	1.667	24	24	LA
0.023	Exhibit good observation skills during demonstrations of processes or equipment operation	7	13	3	0	7	14	2	0	1.826	1.783	23	23	LA
0.024	Perform troubleshooting of equipment and instrumentation	8	16	5	0	10	16	4	0	1.897	1.800	29	30	SEA
0.016	Perform basic setup, diagnosis, and repair of industrial machinery and instrumentation	11	13	8	1	13	14	5	1	1.970	1.818	33	33	
0.026	Use vendor catalogs to acquire materials and components for work tasks	4	10	5	1	4	9	5	1	2.150	2.158	20	19	SEA

1.000	Measurement and basic technical skills	General technician				Materials technician				GT	MT	Number of		Site
		1	2	3	4	1	2	3	4	Score	Score	ratings	where	
	Measurement of dimensions and physical phenomena											N-GT	N-MT	added
1.005	Measure accurately hardness, impact strength, and related properties of materials	2	11	14	4	29	3	0	0	2.645	1.094	31	32	
1.004	Measure accurately tensile, compressive, and shear properties of materials	4	7	15	5	27	6	0	0	2.677	1.182	31	33	
1.001	Measure accurately dimensions using scales, micrometers, vernier calipers, etc.	23	7	3	0	26	6	0	0	1.394	1.188	33	32	
1.033	Demonstrate knowledge of order of magnitude of measurements and scales	7	3	1	0	6	5	0	0	1.455	1.455	11	11	CLE
1.003	Measure accurately temperature, pressure, force, torque, and related quantities	13	14	6	0	19	13	1	0	1.788	1.455	33	33	
1.006	Perform tests of physical properties such as density, viscosity, pH, etc.	2	5	16	8	20	10	1	1	2.968	1.469	31	32	
1.023	Correctly use the terms weight, mass, and density in technical tasks	11	9	3	0	12	7	3	0	1.652	1.591	23	22	SEA
1.002	Measure accurately mass using a chemical balance and other such devices	10	10	9	3	20	9	1	3	2.156	1.606	32	33	
1.025	Perform calibration of instruments and describe the importance of proper calibration	5	13	2	0	9	11	2	0	1.850	1.682	20	22	SEA
1.022	Describe the difference between precision and accuracy	7	7	7	0	10	6	5	0	2.000	1.762	21	21	SEA
1.026	Apply precision metrology devices and inspection tools	4	10	6	1	4	10	7	1	2.190	2.227	21	22	SEA
1.021	Describe and apply effectively a variety of types of thermocouples	3	6	10	0	4	8	8	1	2.368	2.286	19	21	SEA
1.028	Use vapor pressure data for solvents and other liquids	0	4	6	10	1	5	6	10	3.300	3.136	20	22	SEA
1.027	Use effectively steam table data and the vapor pressure of water	0	5	6	10	1	3	3	15	3.238	3.455	21	22	SEA
	Working with technical drawings													
1.007	Read and interpret technical drawings	20	7	5	0	18	10	5	0	1.531	1.606	32	33	
1.024	Interpret and apply tolerances on component dimensions and GD&T specifications	4	9	3	3	5	5	7	4	2.263	2.476	19	21	SEA
1.032	Read specifications on non-English technical drawings	0	5	5	9	1	3	6	6	3.211	3.063	19	16	DET
	Laboratory skills													
1.008	Demonstrate familiarity with good laboratory practices	16	8	6	2	24	8	1	0	1.813	1.303	32	33	
1.009	Use a microscope for measurement and observation of material structures	1	10	13	8	22	10	1	0	2.875	1.364	32	33	
1.012	Operate a digital camera to obtain high quality visual images of technical objects	3	13	11	4	15	12	5	0	2.516	1.688	31	32	
1.013	Select appropriate devices and instruments for measurement of a variety of phenomena	8	9	8	6	13	11	5	3	2.387	1.938	31	32	
1.031	Operate successfully basic shop machinery and tools	8	7	5	1	5	12	4	1	1.952	2.045	21	22	LA
1.011	Operate air and gas flow systems and pressure and flow regulators	5	10	14	2	8	16	6	2	2.419	2.063	31	32	
1.010	Operate vacuum equipment and read vacuum data in a variety of units	3	9	15	4	6	14	9	3	2.645	2.281	31	32	
1.029	Practice good operating methods in clean rooms	6	6	6	3	6	5	6	4	2.286	2.381	21	21	LA
	Working with sensors and electrical phenomena													
1.016	Use a digital multimeter for measurement of resistance, current, voltage, and continuity	5	17	4	5	11	11	5	5	2.290	2.125	31	32	
1.015	Use a variety of sensors for measurement physical phenomena	4	13	8	6	9	13	7	3	2.516	2.125	31	32	
1.030	Measure electrical conductivity and other electrical properties of materials	2	9	8	2	7	5	6	4	2.476	2.318	21	22	LA
1.014	Apply principles of electricity and electronics to measurement and equipment operation	2	9	14	6	3	13	12	4	2.774	2.531	31	32	
1.018	Perform soldering operations for electrical connections	5	12	10	4	4	9	13	6	2.419	2.656	31	32	
1.017	Analyze and apply basic DC and AC circuits	2	12	10	7	4	7	12	9	2.710	2.813	31	32	
1.019	Manipulate the electrical equation $V = IR$	1	8	14	8	4	8	10	10	2.935	2.813	31	32	
1.020	Perform electrical circuit bread boarding	0	5	7	5	1	4	6	10	3.000	3.190	17	21	SEA

2.000	Mathematics, calculations, and data analysis	General technician				Materials technician				GT	MT	Number of		Site
		1	2	3	4	1	2	3	4	Score	Score	ratings	where	
	Basic mathematics fundamentals											N-GT	N-MT	added
2.001	Demonstrate mastery of basic arithmetic including proportions, percentages, etc.	24	7	2	0	25	7	1	0	1.333	1.273	33	33	
2.003	Ensure that data and calculations are reasonable	19	8	6	0	23	9	1	0	1.606	1.333	33	33	
2.002	Use mental arithmetic and calculators as computation tools	20	12	1	0	20	12	1	0	1.424	1.424	33	33	
2.004	Prepare and interpret graphs using a variety of scales and presentation techniques	8	9	12	4	11	15	5	1	2.364	1.875	33	32	
	Proper use of units and conversions													
2.007	Manipulate and report accurately units for all calculations	21	9	2	1	25	6	1	1	1.485	1.333	33	33	
2.006	Perform conversion of units from one system to another	14	11	6	2	20	9	3	1	1.879	1.545	33	33	
2.008	Demonstrate mastery of significant numbers, accuracy, and precision	14	10	8	1	17	10	5	1	1.879	1.697	33	33	
2.005	Use accurately both U.S. Customary and the International System of Units (SI)	10	10	12	1	13	16	3	1	2.121	1.758	33	33	
	Geometry and trigonometric fundamentals													
2.010	Apply concepts of perimeter, area, and volume of basic shapes	8	18	5	1	17	9	6	1	1.969	1.727	32	33	
2.009	Apply concepts of angles and triangles	8	11	12	1	10	9	10	3	2.188	2.188	32	32	
2.013	Apply concepts of trigonometry, especially sine, cosine, tangent, and related functions	3	9	13	7	7	8	14	4	2.750	2.455	32	33	
	Algebra and functions													
2.011	Apply concepts of algebra to solve equations for desired result	4	10	14	4	10	10	11	2	2.563	2.152	32	33	
2.014	Demonstrate proper use of slope and rate of change	3	14	9	6	9	12	9	3	2.563	2.182	32	33	
2.012	Analyze functions such as linear, exponential, quadratic, polynomial, and logarithmic	4	5	14	9	8	8	13	4	2.875	2.394	32	33	
2.015	Work effectively with inequalities	2	5	13	11	6	8	11	7	3.065	2.594	31	32	
	Statistics													
2.018	Compute the mean, median, and standard deviation of data sets	13	7	6	5	17	11	2	2	2.097	1.656	31	32	
2.016	Apply the fundamentals of statistics and probability	5	14	7	6	12	12	6	3	2.438	2.000	32	33	
2.017	Make inferences based on data analysis, measures of central tendency, and variability	8	6	11	6	10	9	9	4	2.484	2.219	31	32	
2.019	Apply concepts of the normal curve	6	8	8	10	10	11	6	6	2.688	2.242	32	33	
3.000	Computer skills	General technician				Materials technician				GT	MT	Number of		Site
	General computer skills and practices											N-GT	N-MT	added
3.012	Avoid inappropriate usage of computer systems	15	8	1	0	15	8	3	0	1.417	1.538	24	26	LA
3.011	Demonstrate adherence to computer security policies	17	7	7	1	18	10	5	0	1.750	1.606	32	33	
3.001	Demonstrate good keyboard skills	12	14	7	0	15	13	5	0	1.848	1.697	33	33	
3.007	Use email effectively and with good grammar and spelling	10	12	9	1	12	14	7	0	2.031	1.848	32	33	
	Computer applications in the office and laboratory													
3.003	Create and use spreadsheets for data analysis; graphing; and record keeping	10	14	4	4	16	14	3	0	2.063	1.606	32	33	
3.008	Use the Internet effectively for researching and acquiring technical information	7	15	7	3	12	14	7	0	2.188	1.848	32	33	
3.002	Create quality written documents using word processing	7	14	10	2	12	14	7	0	2.212	1.848	33	33	
3.004	Create and use database applications	6	11	11	4	13	12	6	2	2.406	1.909	32	33	
3.005	Integrate documents containing word processing, spreadsheets, and graphics	4	10	13	5	8	14	8	3	2.594	2.182	32	33	
	Technical software applications													
3.010	Use commercially available software for analysis, data acquisition, and similar tasks	5	10	10	7	7	16	7	3	2.594	2.182	32	33	
3.006	Create and modify technical drawings using computer aided design including 3D modeling	4	5	14	9	6	8	13	6	2.875	2.576	32	33	
3.009	Use computational software such as Matlab, MathCAD, or Maple	1	7	13	11	4	7	13	8	3.063	2.781	32	32	

4.000	Teamwork, professionalism, globalism, and multiculturalism skills	General technician				Materials technician				GT	MT	Number of		Site
		1	2	3	4	1	2	3	4	Score	Score	ratings	where	
	Working effectively in teams											N-GT	N-MT	added
4.001	Work productively in an industrial team environment	26	6	1	0	22	9	2	0	1.242	1.394	33	33	
4.019	Demonstrate an understanding of the behavior of successful teams	4	6	2	0	3	5	3	0	1.833	2.000	12	11	CLE
4.010	Manage conflict effectively and with sensitivity to the needs and perceptions of others	10	18	3	1	10	17	5	1	1.844	1.909	32	33	
	Understanding project interactions													
4.013	Plan and track work flow using the principles of project management	3	10	12	7	4	11	13	5	2.719	2.576	32	33	
4.011	Describe the functions of various departments commonly found in industry	4	5	15	8	4	8	14	7	2.844	2.727	32	33	
4.007	Plan effective agendas for meetings	2	8	13	10	3	10	13	7	2.939	2.727	33	33	
4.008	Conduct effective meetings	3	5	12	11	3	7	15	7	3.000	2.813	31	32	
	Personal professionalism													
4.009	Manage time efficiently	17	15	1	0	17	15	1	0	1.515	1.515	33	33	
4.004	Demonstrate adherence to the human resource policies of the employer	18	9	6	0	18	10	5	0	1.636	1.606	33	33	
4.017	Practice proper personal hygiene	10	11	3	0	11	10	3	0	1.708	1.667	24	24	LA
4.018	Effectively adopt and adapt skills and knowledge acquired during training	8	12	3	0	9	12	2	0	1.783	1.696	23	23	LA
4.002	Display the personal and ethical characteristics necessary to be identified as a professional	12	15	6	0	15	14	4	0	1.818	1.667	33	33	
4.015	Describe and practice the basic principles of intellectual property protection	6	7	6	2	7	7	5	3	2.190	2.182	21	22	SEA
4.014	Demonstrate life-long learning and plan and track personal professional growth	4	11	15	2	6	14	11	2	2.469	2.273	32	33	
4.016	Demonstrate good presentation skills for small groups and larger audiences	2	4	13	2	2	8	13	1	2.714	2.542	21	24	SEA
	Cultural awareness in the workplace													
4.006	Demonstrate cultural awareness to facilitate effective communication among people	7	13	12	1	7	14	11	1	2.212	2.182	33	33	
4.012	Apply a basic understanding of human behavior in dealing with workplace issues	7	12	13	1	8	12	12	1	2.242	2.182	33	33	
	Globalism													
4.003	Demonstrate a basic understanding of the global economic system	3	6	15	9	4	8	14	7	2.909	2.727	33	33	
4.020	Demonstrate a basic knowledge of global economic trends	2	1	8	1	2	0	9	1	2.667	2.750	12	12	CLE
4.005	Identify key elements of import and export strategies and global trade issues	3	3	10	17	3	4	10	16	3.242	3.182	33	33	

5.000	Chemical Science skills	General technician				Materials technician				GT	MT	Number of		Site
		1	2	3	4	1	2	3	4	Score	Score	ratings	where	
	Safety and environmental issues											N-GT	N-MT	added
5.004	Safely handle acids, bases, flammable liquids, cryogenic fluids, & compressed gases	16	12	3	0	23	7	2	0	1.581	1.344	31	32	
5.005	Safely apply information from Material Safety Data Sheets (MSDS)	18	10	2	0	19	10	2	0	1.467	1.452	30	31	
5.003	Apply knowledge of chemical and environmental safety including waste disposal & recycling	15	12	4	0	18	12	2	0	1.645	1.500	31	32	
5.009	Define flammability hazards of solvents such as flash point and explosive potential	11	8	11	1	17	8	7	0	2.065	1.688	31	32	
5.001	Demonstrate understanding of the interactions of science and technology with society	3	7	10	12	4	7	12	10	2.969	2.848	32	33	
	Chemistry fundamentals													
5.007	Read basic chemical abbreviations for compounds; e.g. HCL is hydrochloric acid	8	8	13	2	22	7	3	0	2.290	1.406	31	32	
5.006	Demonstrate knowledge of chemical symbols and the periodic table of the elements	7	7	15	2	21	6	5	0	2.387	1.500	31	32	
5.008	Demonstrate knowledge of chemical concentrations	3	8	16	4	15	11	5	1	2.677	1.750	31	32	
5.018	Describe the importance of material compatibility	5	8	9	1	10	9	4	1	2.261	1.833	23	24	LA
5.002	Apply the scientific method in a laboratory and in a variety of technical situations	5	11	14	2	12	13	7	0	2.406	1.844	32	32	
5.010	Prepare etching solutions	1	1	17	12	12	13	5	2	3.290	1.906	31	32	
5.015	Describe the fundamental nature of liquids, solids, and gases	4	8	14	5	10	14	7	1	2.645	1.969	31	32	
5.011	Demonstrate knowledge of corrosion potential, chemical batteries, and galvanic series	2	4	17	8	9	13	8	2	3.000	2.094	31	32	
5.017	Describe and compare the nature of organic and inorganic chemicals	1	6	18	6	9	11	9	3	2.935	2.188	31	32	
5.016	Describe the chain structure of polymers	2	4	14	11	10	9	10	3	3.097	2.188	31	32	
5.014	Demonstrate understanding of chemical bonds as applied to solids	1	6	13	11	7	15	6	4	3.097	2.219	31	32	
	Nuclear applications													
5.012	Describe the basic characteristics of electrons, neutrons, and protons in atomic structure	1	2	16	12	5	8	14	5	3.258	2.594	31	32	
5.013	Describe the characteristics of radioactive decay	0	1	13	18	3	6	11	12	3.531	3.000	32	32	
		General technician				Materials technician				GT	MT	Number of		Site
6.000	Physical Science skills	1	2	3	4	1	2	3	4	Score	Score	ratings	where	
	Mechanics											N-GT	N-MT	added
6.008	Apply correctly appropriate units for physical quantities	11	10	8	2	18	11	3	0	2.032	1.531	31	32	
6.005	Apply correctly the concepts of weight and mass	6	13	8	4	13	12	4	3	2.323	1.906	31	32	
6.001	Apply principles of forces, moments, and static equilibrium	3	10	15	3	5	16	6	5	2.581	2.344	31	32	
6.016	Apply the principles of friction	4	8	7	2	4	7	8	3	2.333	2.455	21	22	LA
6.006	Apply Newton's law; $F = ma$	3	9	13	6	5	11	9	7	2.710	2.563	31	32	
6.004	Apply fundamentals of potential and kinetic energy and conservation of energy	2	10	11	8	6	8	11	7	2.806	2.594	31	32	
6.002	Apply fundamentals of motion including displacement, velocity, acceleration, momentum	2	11	11	7	6	8	10	8	2.742	2.625	31	32	
6.003	Apply fundamentals of rotational motion	2	9	13	6	4	8	11	8	2.767	2.742	30	31	
6.007	Apply concepts of inertia and its relationship with acceleration	2	7	10	12	4	8	8	12	3.032	2.875	31	32	
	Fluid and thermal concepts													
6.010	Apply concepts of heat including temperature, thermal conductivity, specific heat, etc.	4	10	15	2	13	12	6	2	2.484	1.909	31	33	
6.017	Apply concepts of thermal expansion and differential thermal expansion	2	6	8	0	4	8	4	0	2.375	2.000	16	16	DET
6.009	Apply concepts of fluid pressure and the behavior of fluids in annealing and heat treating	0	6	17	8	4	19	6	3	3.065	2.250	31	32	
	Electricity and magnetism													
6.013	Apply concepts of electromagnetic waves: X-rays, ultraviolet rays, radio waves, and visible light	0	9	14	8	5	11	12	4	2.968	2.469	31	32	
6.015	Describe the electrical properties of conductors, insulators, and semiconductors	1	12	9	8	5	9	10	8	2.800	2.656	30	32	
6.014	Apply concepts of magnetism and its role in electric motors and generators	1	8	14	8	2	9	11	10	2.935	2.906	31	32	
	Light and sound													
6.011	Apply concepts of light and optics as applied to physical measurement	2	9	12	8	4	10	12	6	2.839	2.625	31	32	
6.012	Apply concepts of sound measurement and control	1	8	15	7	2	9	11	10	2.903	2.906	31	32	

7.000	Fundamentals of materials science and technology	General technician				Materials technician				GT	MT	Number of		Site
		1	2	3	4	1	2	3	4	Score	Score	ratings	where	
	General nature of metals											N-GT	N-MT	added
7.002	Describe the general nature of non-ferrous metals	2	12	15	2	16	13	1	1	2.548	1.581	31	31	
7.001	Describe the general nature of ferrous metals	3	12	14	2	17	12	2	1	2.484	1.594	31	32	
7.003	Describe five types of common non-ferrous metals	1	8	18	4	12	17	2	1	2.806	1.750	31	32	
7.011	Describe the general nature of magnetic materials	0	9	15	7	8	12	9	3	2.935	2.219	31	32	
	General nature of plastics													
7.005	Describe the general nature of thermoplastic plastics	1	10	18	2	10	14	8	0	2.677	1.938	31	32	
7.004	Describe the general nature of thermoset plastics	1	9	19	2	10	13	9	0	2.710	1.969	31	32	
7.013	Describe the general nature of elastomeric materials	0	11	18	2	9	13	8	2	2.710	2.094	31	32	
	General nature of composites													
7.010	Describe the general nature of fiber reinforced composites	0	9	16	6	9	13	6	4	2.903	2.156	31	32	
7.014	Describe the general nature of structural foam materials	0	6	17	8	9	8	9	5	3.065	2.323	31	31	
	General nature of semiconductors and optical materials													
7.012	Describe the general nature of semiconductors and other materials for electronic devices	0	7	16	8	5	12	9	5	3.032	2.452	31	31	
7.016	Describe the general nature of optical materials for lenses and displays	0	9	12	10	6	11	5	8	3.032	2.500	31	30	
7.015	Describe the general nature of optical fibers	0	7	15	9	5	11	7	8	3.065	2.581	31	31	
	General nature of ceramics and glasses													
7.008	Describe the general nature of ceramics	0	10	14	7	8	16	5	3	2.903	2.094	31	32	
7.009	Describe the general nature of glasses	0	10	13	8	7	14	5	6	2.935	2.313	31	32	
	Other materials													
7.006	Describe the general nature of woods	0	7	15	9	6	10	7	9	3.065	2.594	31	32	
7.007	Describe the general nature of concrete	0	6	14	11	6	10	6	10	3.161	2.625	31	32	
	Stress and strength													
7.017	Define stress	7	13	10	0	19	11	1	0	2.100	1.419	30	31	
7.028	Define ultimate tensile strength	4	12	11	4	19	11	2	0	2.484	1.469	31	32	
7.029	Define ultimate compressive strength	3	10	14	3	16	12	3	0	2.567	1.581	30	31	
7.027	Define yield strength for metals and describe materials that exhibit this property	3	10	13	4	17	11	3	1	2.600	1.625	30	32	
7.025	Define impact strength	3	10	15	3	17	9	4	1	2.581	1.645	31	31	
7.026	Define yield point for metals and describe materials that exhibit this property	4	9	15	3	16	11	5	0	2.548	1.656	31	32	
7.036	Define residual stress	4	2	11	4	6	11	3	1	2.714	1.952	21	21	SEA
7.035	Define endurance strength and describe S-N curves, and fatigue cracking	2	4	12	3	5	11	4	1	2.762	2.048	21	21	SEA
7.040	Define lap shear stress and strength	1	5	9	5	5	7	7	2	2.900	2.286	20	21	LA
	Strain and deformation													
7.018	Define strain	7	14	10	0	20	11	1	0	2.097	1.406	31	32	
7.021	Describe and compare the behavior of ductile and brittle materials	4	14	9	3	20	10	2	0	2.367	1.438	30	32	
7.019	Define modulus of elasticity in tension and compression	4	11	11	4	18	11	3	0	2.500	1.531	30	32	
7.023	Define percent elongation	2	11	13	5	18	9	4	0	2.677	1.548	31	31	
7.022	Define ductility	3	12	11	4	18	10	4	0	2.533	1.563	30	32	
7.020	Define modulus of elasticity in shear	3	9	15	5	16	12	3	0	2.688	1.581	32	31	
7.030	Define creep of materials	3	6	18	4	16	11	3	1	2.742	1.645	31	31	
7.024	Define percent reduction in area	2	12	13	4	16	10	4	1	2.613	1.677	31	31	
7.054	Describe methodology of fracture between ductile and brittle metals	2	3	7	0	5	4	2	0	2.417	1.727	12	11	CLE
7.031	Compare mechanical properties of different metals, ceramics, polymers and composites	2	12	14	3	15	9	7	1	2.581	1.813	31	32	

(Continuation of Section 7.000)		General technician				Materials technician				GT	MT	Number of		Site
7.000	Fundamentals of materials science and technology	1	2	3	4	1	2	3	4	Score	Score	ratings		where
	Analysis of material structure											N-GT	N-MT	added
7.042	Describe the types of flaws that can occur in materials and how they affect properties	3	6	5	2	4	10	1	0	2.375	1.800	16	15	DET
8.040	use image analysis software and tools	0	4	5	3	5	4	1	1	2.917	1.818	12	11	CLE
7.043	Describe the methods used to vary the strength and toughness of materials	3	3	6	2	3	10	2	0	2.500	1.933	14	15	DET
7.053	Identify materials by their trade names	2	4	4	2	1	6	3	1	2.500	2.364	12	11	CLE
	Design considerations													
7.034	Prepare material samples for analysis of grain structure and failure sites	3	3	9	6	12	2	2	2	2.857	1.667	21	18	SEA
7.033	Describe how grain structures of materials affect their properties	3	3	9	6	9	8	2	2	2.857	1.857	21	21	SEA
7.045	designing with materials	2	6	4	3	3	9	3	0	2.533	2.000	15	15	DET
7.041	Define strength to weight ratio and describe its significance to performance of materials	2	8	8	3	5	11	3	2	2.571	2.095	21	21	LA
7.044	Explain how and why the designer chooses properties of materials	2	5	6	3	3	4	6	0	2.625	2.231	16	13	DET
7.046	Describe modes of wear and metal loss	2	4	6	4	3	5	7	0	2.750	2.267	16	15	DET
7.047	Describe environmental embrittlement	3	3	5	5	3	7	3	2	2.750	2.267	16	15	DET
	Thermal, physical, and other properties of materials													
7.038	Describe flammability and toxicological issues of materials	3	7	10	1	7	7	7	0	2.429	2.000	21	21	SEA
7.032	Compare electrical properties of different metals, ceramics, polymers and composites	1	9	16	5	15	5	6	6	2.806	2.094	31	32	
7.037	Compare thermal properties of different materials	2	8	9	2	5	9	7	0	2.524	2.095	21	21	SEA
	Plastics and polymers													
7.048	Describe how polymers differ from metals, glasses, and ceramics; how this affects properties	2	5	4	1	7	2	2	0	2.333	1.545	12	11	CLE
7.039	Describe significance of glass transition temperature of plastics & how they are measured	1	5	8	7	5	7	7	2	3.000	2.286	21	21	SEA
	Emerging materials technologies													
7.052	Describe the general nature of biocompatibility	0	4	4	4	1	3	4	3	3.000	2.818	12	11	CLE
7.051	Describe the general nature of nano systems	0	2	6	4	1	3	4	3	3.167	2.818	12	11	CLE
7.050	Describe the general nature of microelectromechanical systems	0	4	2	6	1	2	3	5	3.167	3.091	12	11	CLE
7.049	Describe the general nature of shape memory alloys	0	2	4	6	0	3	4	4	3.333	3.091	12	11	CLE

8.000	Materials testing	General technician				Materials technician				GT	MT	Number of		Site
		1	2	3	4	1	2	3	4	Score	Score	ratings	where	
	Experimental planning and execution											N-GT	N-MT	added
8.027	Demonstrate a basic understanding of solidification principles and the variables involved	1	6	12	12	11	14	6	1	3.129	1.906	31	32	
8.039	Demonstrate a basic knowledge of composition determination techniques	1	4	5	6	3	11	2	0	3.000	1.938	16	16	DET
8.037	Determine appropriate cleaners to use for different materials	6	5	6	4	8	8	5	1	2.381	1.955	21	22	LA
8.043	Demonstrate an understanding of experimental design	3	6	2	1	2	5	4	0	2.083	2.182	12	11	CLE
8.028	Recognize and decipher acronyms used for job tasks	5	11	12	0	3	10	9	0	2.250	2.273	28	22	SEA
	General mechanical testing processes for solid materials													
8.002	Describe the types of material properties found from a tensile test	3	11	11	6	19	13	0	0	2.645	1.406	31	32	
8.005	Perform tensile tests for a variety of materials	2	7	13	8	19	11	2	0	2.900	1.469	30	32	
8.004	Describe several methods of measuring hardness of materials	1	10	16	4	17	14	1	0	2.742	1.500	31	32	
8.007	Perform hardness tests for a variety of materials	2	9	13	6	18	13	0	1	2.767	1.500	30	32	
8.006	Perform impact tests for a variety of materials	1	7	14	7	17	12	2	0	2.931	1.516	29	31	
8.003	Describe the measurement of impact strength using the Charpy and Izod methods	2	6	15	8	14	17	1	0	2.935	1.594	31	32	
8.038	Demonstrate a basic knowledge of microhardness measurements and hardness profiles	2	2	9	3	6	9	1	0	2.813	1.688	16	16	DET
8.032	Perform fatigue tests of materials	0	6	10	10	11	14	3	0	3.154	1.714	26	28	SEA
8.029	Perform life testing, and shock, vibration, and thermal shock testing	2	8	8	4	3	3	8	2	2.636	2.563	22	16	SEA
	Visual and nondestructive testing													
8.008	Prepare a material specimen for metallurgical analysis	2	2	12	15	17	10	3	2	3.290	1.688	31	32	
8.009	Perform a microscopic evaluation of a metallurgical specimen and report the results	1	2	13	15	17	8	5	2	3.355	1.750	31	32	
8.010	Describe the effect of processing on the microstructure of materials	2	4	12	12	15	10	5	2	3.133	1.813	30	32	
8.031	Use effectively electron microscopes, e.g. SEM, FIB, AFB, and FR	0	8	7	10	9	15	2	1	3.080	1.815	25	27	SEA
8.034	Perform non-destructive testing using ultrasonic, X-ray, eddy current, and other methods	2	10	10	4	11	12	4	1	2.615	1.821	26	28	SEA
8.041	Demonstrate proficiency in macro-analysis and macro photography	1	1	8	2	4	2	4	1	2.917	2.182	12	11	CLE
8.042	Demonstrate an understanding of liquid penetrant, radiographic, and magnetic inspection	0	3	8	1	1	5	4	1	2.833	2.455	12	11	CLE
8.030	Use effectively Koller illumination and other light illumination modes	1	1	10	10	3	6	5	8	3.318	2.818	22	22	SEA
	Working with standards													
8.023	Research the types of materials testing standards promulgated by ASTM International	2	9	10	9	14	10	7	1	2.867	1.844	30	32	
8.033	Compare American and European standards, e.g. ASTM and ISO	3	6	9	3	5	11	4	1	2.571	2.048	21	21	SEA
8.024	Research the types of materials testing standards promulgated by SAE International	2	6	11	11	13	7	8	4	3.033	2.094	30	32	
8.025	Research the types of materials testing standards promulgated by API for oils	0	6	7	17	6	7	7	12	3.367	2.781	30	32	
	Testing metallic materials													
8.001	Describe the fundamentals of performing a tensile test of a metallic material	2	10	14	5	19	12	1	0	2.710	1.438	31	32	
	Testing plastics and composites													
8.016	Evaluate the influence of temperature on the mechanical properties of plastics	2	5	12	11	12	9	7	4	3.067	2.094	30	32	
8.026	Perform tests for stress, strain, and impact resistance for composite materials	1	1	18	11	10	13	5	4	3.258	2.094	31	32	
8.014	Perform impact testing for plastic materials	1	3	14	13	10	12	6	4	3.258	2.125	31	32	
8.013	Perform tension, compression, and flexure tests of plastics	1	4	14	12	10	11	7	4	3.194	2.156	31	32	
8.015	Perform creep testing for plastic materials	0	3	14	13	9	13	6	4	3.333	2.156	30	32	
8.017	Evaluate the influence of moisture absorption on the mechanical properties of plastics	2	3	12	13	8	10	8	6	3.200	2.375	30	32	
8.035	Perform tests of the effects of solvents and acids on polymers and plastics	1	2	12	6	4	7	7	4	3.095	2.500	21	22	SEA
	Testing of wood and concrete													
8.011	Perform a compression test of a brittle material such as concrete	1	0	14	14	10	8	7	6	3.414	2.290	29	31	
8.012	Perform bending and shear strength tests for wood	0	0	14	17	6	7	9	10	3.548	2.719	31	32	
	Testing of liquids													
8.018	Perform viscosity measurement for a variety of liquids from low to high viscosities	2	4	13	11	10	11	6	5	3.100	2.188	30	32	
8.020	Perform viscosity measurements for liquid polymers	2	1	9	18	7	6	9	10	3.433	2.688	30	32	
8.019	Perform tests of viscosity index for oils	0	5	12	13	5	8	10	9	3.267	2.719	30	32	

8.022	Perform tests for hydraulic fluids used in fluid power systems	2	3	11	15	5	7	8	11	3.258	2.806	31	31	
8.021	Perform tests for lubricating and engine oils according to SAE standards	1	3	10	16	4	9	7	12	3.367	2.844	30	32	

												Number of		Site
9.000	Materials and processing - Metals	General technician				Materials technician				GT	MT	ratings		where
9.100	Steel	1	2	3	4	1	2	3	4	Score	Score	N-GT	N-MT	added
9.101	Describe the primary constituents of steel	0	9	14	7	17	10	3	1	2.933	1.613	30	31	
9.102	Describe the influence of carbon content on steel properties	0	6	17	7	16	11	3	1	3.033	1.645	30	31	
9.106	Describe how the properties of ferrous metals are affected by heat treatment	3	5	15	7	15	11	4	1	2.867	1.710	30	31	
9.110	Define and describe quenching and tempering of steels	3	4	16	7	15	11	4	1	2.900	1.710	30	31	
9.104	Define stainless steel	1	7	16	6	13	13	5	0	2.900	1.742	30	31	
9.109	Define and describe annealing of steels	2	4	17	7	14	11	5	1	2.967	1.774	30	31	
9.107	Define hardenability of steel	3	5	15	7	15	8	6	2	2.867	1.839	30	31	
9.111	Describe the general nature of case hardening processes used for steels	2	5	17	6	11	13	6	1	2.900	1.903	30	31	
9.105	Describe the range of carbon content in low, medium, and high carbon steels	1	7	14	8	10	15	5	1	2.967	1.903	30	31	
9.113	Identify the nominal value of the modulus of elasticity for steel alloys	1	7	14	8	11	13	6	1	2.967	1.903	30	31	
9.108	Describe the basic structure and function of the phase diagram for a metal alloy	0	7	14	9	14	8	7	2	3.067	1.903	30	31	
9.103	Describe the AISI four-digit designation system for steel alloys	0	5	14	11	11	12	7	1	3.200	1.935	30	31	
9.114	Describe hydrogen embrittlement of steels	2	5	8	4	7	9	2	2	2.737	1.950	19	20	SEA
9.112	Describe work hardening as applied to the condition of steels and the resulting properties	1	8	15	6	11	11	8	1	2.867	1.968	30	31	
9.115	Describe magnetic properties of stainless steels	1	3	9	7	6	8	4	3	3.100	2.190	20	21	LA
										GT	MT			
9.200	Cast iron									Score	Score	N-GT	N-MT	
9.202	How are cast irons different from steels?	3	5	14	9	9	13	7	2	2.935	2.065	31	31	
9.201	Define and describe cast iron and the types available.	2	4	14	10	9	9	11	2	3.067	2.194	30	31	
										GT	MT			
9.300	Aluminum									Score	Score	N-GT	N-MT	
9.301	Identify several common types of wrought aluminum alloys and their main alloying elements	0	8	13	9	10	15	6	0	3.033	1.871	30	31	
9.305	Identify the nominal value of the modulus of elasticity for aluminum alloys	1	6	12	11	10	12	7	2	3.100	2.032	30	31	
9.302	Give the four-digit designation for five common aluminum alloys and describe their uses	0	5	15	10	10	9	11	1	3.167	2.097	30	31	
9.303	Describe three common conditions or tempers in which aluminum is produced	0	4	16	10	7	15	8	1	3.200	2.097	30	31	
9.304	Describe five common forms of commercially available wrought aluminum	0	8	11	11	8	11	11	1	3.100	2.161	30	31	
9.306	Describe work hardening as applied to the condition of aluminum and the resulting properties	0	4	16	10	7	13	9	2	3.200	2.194	30	31	
9.307	Describe clad coating of aluminum and the effects of clad penetration	2	6	4	7	4	5	9	3	2.842	2.524	19	21	LA
										GT	MT			
9.400	Copper and its alloys									Score	Score	N-GT	N-MT	
9.402	Describe three major advantages of copper and copper alloys	2	3	16	9	8	13	8	2	3.067	2.129	30	31	
9.401	Identify three types of copper alloys, their major constituents, uses, and properties	1	4	14	11	7	13	9	2	3.167	2.194	30	31	
										GT	MT			
9.500	Zinc and its alloys									Score	Score	N-GT	N-MT	
9.501	Identify four common uses for zinc and its alloys	2	2	15	11	7	13	7	4	3.167	2.258	30	31	
										GT	MT			
9.600	Magnesium and its alloys									Score	Score	N-GT	N-MT	
9.602	Describe the flammability dangers of magnesium	5	6	7	3	8	7	4	2	2.381	2.000	21	21	LA
9.601	Identify four common uses for magnesium metal	2	2	13	13	7	11	9	4	3.233	2.323	30	31	

		General technician				Materials technician				GT	MT	Number of ratings		Site where added
		1	2	3	4	1	2	3	4	Score	Score	N-GT	N-MT	
9.700	Nickel alloys (Superalloys)													
9.702	Describe the advantages of nickel alloys as compared with common steels.	0	3	18	9	8	14	8	1	3.200	2.065	30	31	
9.701	Identify four types of nickel alloys and their primary alloying elements	1	3	15	11	6	16	6	2	3.200	2.133	30	30	
9.703	Describe four common uses for nickel alloys	0	3	19	8	6	16	7	2	3.167	2.161	30	31	
9.704	Describe Invar and its uses	0	6	5	8	3	4	8	5	3.105	2.750	19	20	SEA
										GT	MT			
9.800	Titanium and its alloys									Score	Score	N-GT	N-MT	
9.801	Identify four common uses for titanium and its alloys	2	4	7	5	5	7	6	1	2.833	2.158	18	19	LA
9.802	Describe the basic types of heat treatment used for titanium alloys	2	3	7	6	5	5	8	1	2.944	2.263	18	19	LA
10.000	Materials and processing - Plastics													
10.100	Thermoplastics													
10.101	Describe the general nature of thermoplastics	5	10	12	4	16	10	6	0	2.484	1.688	31	32	
10.108	Identify four major disadvantages of thermoplastics as compared with metals	1	9	11	8	8	15	6	1	2.897	2.000	29	30	
10.107	Identify four major advantages of thermoplastics as compared with metals	1	9	12	8	9	14	7	1	2.900	2.000	30	31	
10.109	Describe common filler materials for thermoplastics and their effect on properties	1	3	18	6	8	13	7	2	3.036	2.100	28	30	
10.104	Discuss the effect of rising temperatures on the properties of thermoplastics	1	6	16	7	6	15	9	1	2.967	2.161	30	31	
10.103	Identify and describe five common methods of processing thermoplastics	1	6	14	9	6	13	10	2	3.033	2.258	30	31	
10.106	Define creep as it is applied to thermoplastics and describe how it is measured	2	3	15	10	6	13	10	2	3.100	2.258	30	31	
10.105	Discuss the effect of moisture absorption on the properties of thermoplastics	0	6	14	10	5	15	8	3	3.133	2.290	30	31	
10.102	Identify eight common thermoplastics and describe their common uses	0	6	14	10	6	10	12	2	3.133	2.333	30	30	
10.110	Describe and compare amorphous and crystalline thermoplastics	2	2	6	9	3	6	9	2	3.158	2.500	19	20	SEA
10.111	Describe the effects of polymer additives on plastics	1	3	5	7	1	5	8	2	3.125	2.688	16	16	DET
										GT	MT			
10.200	Thermoset plastics									Score	Score	N-GT	N-MT	
10.201	Describe the general nature of thermosets as compared with thermoplastics	2	10	12	6	9	15	7	0	2.733	1.935	30	31	
10.202	Identify two major types of thermosets and describe their common uses	2	4	14	10	7	11	11	2	3.067	2.258	30	31	
10.203	Describe the general nature of fiber reinforced plastics (FRP)	1	7	13	7	6	10	12	1	2.929	2.276	28	29	
10.204	Identify five different forms of glass fiber used in FRP	0	5	13	11	5	7	14	3	3.207	2.517	29	29	
10.206	Describe the curing stages of thermoset plastics (ABC stages)	1	5	4	9	2	4	10	5	3.105	2.857	19	21	LA
10.205	Describe solid surface thermoset plastics, e.g. Corian (TM)	1	0	5	9	1	2	7	7	3.467	3.176	15	17	LA

14.011	Identify typical melting temperatures of glasses	0	2	5	11	1	2	12	4	3.500	3.000	18	19	LA
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		General technician				Materials technician				GT	MT	Number of ratings		Site where
		1	2	3	4	1	2	3	4	Score	Score	N-GT	N-MT	added
15.000	Materials and processing - Ceramics													
15.002	Describe several differences between ceramics and metals as they effect properties	1	4	17	8	8	13	7	3	3.067	2.161	30	31	
15.001	Describe ceramic materials	2	5	16	7	7	13	6	3	2.933	2.172	30	29	
15.003	Describe the primary testing procedures for ceramics that differ from metals	1	4	14	11	6	14	8	3	3.167	2.258	30	31	
15.004	Describe how glass ceramics differ from glasses	1	4	4	11	3	8	5	5	3.250	2.571	20	21	SEA
15.006	Describe thermal expansion and thermal shock behavior of ceramics	1	1	5	8	1	1	8	5	3.333	3.133	15	15	SEA
15.007	Describe electrical properties of ceramics	0	2	4	9	0	1	9	5	3.467	3.267	15	15	SEA
15.005	Describe slip planes and brittle behavior of ceramics	0	2	3	10	0	1	7	7	3.533	3.400	15	15	SEA
		General technician				Materials technician				GT	MT			
16.000	Relationships between processing variables, quality, material properties, defects	1	2	3	4	1	2	3	4	Score	Score	N-GT	N-MT	
	Effects of processing and manufacturing variations on material properties													
16.007	Describe how changes in manufacturing processes affect material properties	9	9	1	0	10	10	0	0	1.579	1.500	19	20	LA
16.002	Describe how cold working affects the mechanical properties of metals	2	12	13	2	15	13	1	1	2.517	1.600	29	30	
16.001	Describe how heat treating affects the mechanical properties of metals	2	11	14	2	15	13	1	1	2.552	1.600	29	30	
8.044	Determine effects of variations due to operator, machine, material, etc.	7	3	2	0	5	3	3	0	1.583	1.818	12	11	CLE
	Effects of defects on material properties													
16.003	Describe how defects such as nicks and scratches affect properties of metals and alloys	5	7	14	3	15	11	3	1	2.517	1.667	29	30	
16.004	Describe how defects such as nicks and scratches affect properties of plastics	3	11	11	4	11	11	7	1	2.552	1.933	29	30	
16.006	Describe how defects such as nicks and scratches affect properties of composites	5	7	12	4	10	11	6	2	2.536	2.000	28	29	
16.005	Describe how defects such as nicks and scratches affect properties of ceramics	5	7	12	5	11	10	7	2	2.586	2.000	29	30	
		General technician				Materials technician				GT	MT			
17.000	Fabrication, machining, fastening, welding, forming, forging, finishing, etc.	1	2	3	4	1	2	3	4	Score	Score	N-GT	N-MT	
	General processes													
17.009	Describe several methods of finishing materials for appearance and corrosion resistance	3	13	10	2	10	14	4	1	2.393	1.862	28	29	
17.003	Describe several types of mechanical fastening methods	7	12	8	1	8	16	4	1	2.107	1.931	28	29	
17.004	Describe adhesives as applied to fastening materials including surface preparations	6	10	10	2	9	11	6	3	2.286	2.103	28	29	
17.012	Describe the importance of pre-load during fabrication and assembly	4	7	6	2	5	8	6	2	2.316	2.238	19	21	LA
17.014	Describe the basic requirements of 2-part adhesives	0	4	5	3	0	8	2	1	2.917	2.364	12	11	CLE
17.015	Describe the basic requirements of moisture cure adhesives	0	3	6	3	0	7	2	1	3.000	2.400	12	10	CLE
17.013	Describe techniques for using shimming and where and when it is appropriate	4	6	7	2	5	5	8	3	2.368	2.429	19	21	LA
	Metals processing													
17.007	Describe several types of forming, casting and molding processes for metals	4	15	7	2	10	16	1	1	2.250	1.750	28	28	
17.002	Describe how surface finishes of machined metals affect properties	3	13	11	1	12	13	3	1	2.357	1.759	28	29	
17.005	Describe the basic types of joining processes for metals; welding, brazing, etc.	7	13	6	2	12	13	1	3	2.107	1.828	28	29	
17.001	Describe the primary methods of machining metals	4	16	7	1	9	14	4	1	2.179	1.893	28	28	
17.010	Describe how soldering is used for fabrication of metals	1	12	4	2	4	11	4	1	2.368	2.100	19	20	SEA
17.011	Describe shot peening and roto-peening and how to adjust the processes for metal products	2	5	11	3	4	8	7	3	2.714	2.409	21	22	LA
	Processing of plastics and composites													
17.008	Describe several types of forming, molding, and curing processes for plastics	5	13	8	2	10	13	4	1	2.250	1.857	28	28	
17.006	Describe the basic types of joining processes for plastics and composites	7	10	8	3	10	10	6	3	2.250	2.069	28	29	

18.000	Tooling, dies, jigs, fixtures	General technician				Materials technician				GT	MT	Number of		Site
		1	2	3	4	1	2	3	4	Score	Score	ratings	where	
General tooling practices												N-GT	N-MT	added
18.011	Describe a hard coordinate in tooling	2	9	4	5	5	5	6	5	2.600	2.524	20	21	LA
18.010	Describe a theodolite and a laser tracker and their uses in measurement	1	6	5	7	2	5	6	7	2.947	2.900	19	20	LA
Tooling for metal processing														
18.001	Describe several kinds of cutting tools use for machining metals	11	10	6	1	8	14	6	1	1.893	2.000	28	29	
18.002	Describe grinding tools used for metals	8	12	6	2	7	15	5	2	2.071	2.069	28	29	
18.007	Describe dies used in extruding metals	5	9	9	5	6	15	6	2	2.500	2.138	28	29	
18.005	Describe dies used in casting metals	5	7	10	6	6	15	5	3	2.607	2.172	28	29	
18.003	Describe jigs and fixtures as applied to processing metallic parts	8	10	7	3	7	12	7	3	2.179	2.207	28	29	
18.004	Describe dies used in forming and forging of metals	5	9	10	4	5	15	6	3	2.464	2.241	28	29	
Tooling for plastics and composites processing														
18.012	Describe dies used in extruding plastics	5	9	9	5	6	15	6	2	2.500	2.138	28	29	
18.006	Describe dies used in molding plastics	5	7	9	7	8	13	4	4	2.643	2.138	28	29	
18.009	Describe tools for cutting composites and how they are used	3	6	6	5	2	5	8	6	2.650	2.857	20	21	LA
18.008	Describe the fabrication of molds for composites processing; materials, splash, soft tooling	2	7	6	6	1	5	10	5	2.762	2.905	21	21	SEA
		General technician				Materials technician				GT	MT	Number of		Site
19.000 Manufacturing operations and quality management		1	2	3	4	1	2	3	4	Score	Score	ratings	where	
Quality management												N-GT	N-MT	added
19.013	Recognize and address quality and safety issues	16	4	3	0	15	5	4	0	1.435	1.542	23	24	LA
19.021	Differentiate critical and non-critical defects	4	4	4	0	5	4	1	1	2.000	1.818	12	11	CLE
19.022	Understanding of the concept of internal and external customer; their wants and needs	4	4	2	1	4	5	2	0	2.000	1.818	11	11	CLE
19.020	Describe cost of poor quality parts	4	4	3	1	4	2	3	2	2.083	2.273	12	11	CLE
19.018	Demonstrate understanding of quality management systems used in industry	0	8	3	1	1	7	2	1	2.417	2.273	12	11	CLE
19.010	Demonstrate knowledge of six sigma tools and practices used in industry	4	9	5	3	3	11	5	3	2.333	2.364	21	22	SEA
Manufacturing operations management														
19.001	Apply statistics in process control (SPC)	6	9	5	2	7	9	4	2	2.136	2.045	22	22	SEA
19.014	Consider the cost of manufacturing a product or component	2	12	7	0	5	9	7	1	2.238	2.182	21	22	LA
19.007	Demonstrate knowledge of lean manufacturing tools and practices used in industry	4	7	7	3	3	5	9	3	2.429	2.600	21	20	SEA
19.006	Demonstrate knowledge of basic business economics	1	6	12	2	0	8	12	2	2.714	2.727	21	22	SEA
19.009	Demonstrate knowledge of the fundamentals of risk management	0	5	13	3	0	7	12	3	2.905	2.818	21	22	SEA
19.012	Use enterprise resource planning (ERP) software	1	3	10	7	2	6	8	6	3.095	2.818	21	22	LA
19.011	Demonstrate knowledge of workflow control	0	9	7	5	0	7	11	4	2.810	2.864	21	22	SEA
19.002	Describe the fundamentals of product life cycle management	1	7	8	3	0	7	6	6	2.684	2.947	19	19	SEA
19.005	Demonstrate knowledge of basic product assembly techniques, including determinate assy.	1	9	5	6	0	7	9	6	2.762	2.955	21	22	SEA
19.004	Describe the fundamentals of supply chain management	1	7	8	5	0	7	8	7	2.810	3.000	21	22	SEA
19.008	Demonstrate knowledge of large scale system integration	1	6	9	5	0	6	10	6	2.857	3.000	21	22	SEA
19.003	Use effectively manufacturing simulation software	1	8	9	2	0	5	10	6	2.600	3.048	20	21	SEA