

National FFA Nursery/Landscape Career Development Event

A Special Project of the National FFA Foundation

Important Note

Please thoroughly read the Introduction Section at the beginning of this handbook for complete rules and procedures that are relevant to all National FFA Career Development Events.

I. Event Purpose

The purpose of the National FFA Nursery/Landscape Career Development Event is to promote career interest, encourage proficiency development and recognize excellence in participants of the event which includes all aspects of the industry to produce, market, utilize and maintain landscape plants (woody and herbaceous plants and turf grasses), as well as related production and landscaping products, equipment and services including design.

II. Objectives

- A. Nursery/Landscape Principles: To apply nursery and landscape principles and practices as they impact **residential, commercial, public and recreational applications**.
- B. Plant Materials: To demonstrate the ability to identify, select and utilize nursery and landscape plants (interior/exterior), landscape materials and turf grasses commonly used in the United States.
- C. Plant Disorders: To demonstrate the ability to identify unhealthy plant conditions due to pests, nutritional/physiological disorders and mechanical/chemical injury.
- D. Cultural Practices: To demonstrate knowledge of the principles and skills involved in propagation, growth requirements, growing techniques, harvesting, sustainability, marketing and maintenance of interior and exterior landscape plants and turf grasses.
- E. Design and Construction: To demonstrate knowledge of the principles and techniques of landscape design and construction.
- F. Supplies and Equipment: To demonstrate the ability to identify, select, use and maintain appropriate supplies and equipment for nursery and landscape operations, including equipment and procedures in mechanization and automation.
- G. Safety: To demonstrate knowledge of safety practices in nursery and landscape operations.
- H. Interpersonal Relations: To demonstrate skills in oral and written business communications.
- I. Marketing: To demonstrate an understanding of marketing principles as well as proper sales and service skills.
- J. Records and Reports: To demonstrate the ability to prepare accurate and legible records and reports and to interpret business documents.

III. Agriculture, Food and Natural Resources (AFNR) Career Cluster Content Standards

With the recommendation of the National FFA Board of Directors, all national FFA programs have incorporated these standards to guide the direction and content of program materials and activities. Refer to Appendix A in this chapter of the handbook for a complete list of the measurable activities that participants will carry out in this event. For details about the incorporation of AFNR standards, refer to the Introduction chapter of the CDE handbook.

IV. Event Rules

- A. Each team will be comprised of three or four team members. The top three individual scores and the team activity and skills challenge scores will be used to determine the final team score.
- B. It is highly recommended that participants wear FFA Official Dress for this event.
- C. Coaches may accompany participants to the event site, but must then leave the area at the start of the event. At the conclusion of all event components, the superintendent will announce when participants and coaches may enter the competition area to review the materials and organization.
- D. Under no circumstances will any participant be allowed to touch or handle plant materials or other specimens during the event except as expressly permitted in certain practicums.
- E. Any participant in possession of an electronic device in the event area is subject to disqualification.

VI. Event Format

- A. Each participant must have the following individual tools:
 1. A clean clipboard
 2. At least two No. 2 pencils
 3. A ball-point or felt-tip pen
 4. A calculator (Calculators used in this event should be battery operated, non-programmable and silent with large keys and large displays. Calculators may have only these functions: addition, subtraction, multiplication, division, equals, percent, square root, +/- key and one memory register. No other calculators are allowed to be used during the event.)
 5. An architect's scale
 6. An engineer's scale
 7. Additional items allowed but not required include the following: a pocket-size dictionary or electronic speller and a personal hand pruner or knife.
 8. Teams may also be requested to supply a laptop computer.
- B. Team Interactive Events (process orientation)
 1. **Phase 1: Team Activity - 50 individual points each + 100 team points**

This practicum involves the team members working together towards accomplishing an assignment. It is designed to evaluate individual and group contributions in coordination and cooperation of knowledge, evaluation and decision-making. The team activity has two parts, described below.

 - a. Team Preparation – The team members work as a group in evaluating a landscape or nursery business-type situation (production, service, personnel, business operations/relations) or educational programming, as in the following general themes: promotions, start up business plan, consulting, customer service, service-learning or community involvement. The team will have 30 minutes for preparation. Notepaper and other supplies, including computer resources that may be appropriate for the situation will be available. References will not be needed beyond what is provided for this preparation section. A judge will be observing and scoring teamwork during this time but not interacting with the team. If needed, the team may ask the judge basic questions about the assignment or materials provided.
 - b. Team Presentation — Each of the team members will participate in the verbal presentation to a judge based on decisions made during the preparation. The team will have 15 minutes for the presentation and interaction with the judge. The presentation format is informal and conversational as at a conference table, not a speech prepared with visual aids. Division of the time and organization of the presentations

is at the team's discretion. The judge may ask questions of the team members during this time. Information will be provided on the judge's role as business client, supervisor or other appropriate party to facilitate the dialogue.

- c. Scoring criteria for the team preparation and presentation portions are given on the "Team Activity" scorecard. Individual components from both phases have a value of 50 points added to the individual score, while the team components of both phases have a value of 100 points added to the composite team score.

2. Phase 2: Team Skills Challenge - 100 team points

This phase is designed to evaluate the team's ability to apply nursery/landscape knowledge and skills by completing a variety of hands-on and problem solving activities. Teams will be given a list of tasks which may be accomplished individually, in pairs or more as determined by the team members according to the skills, experience and preferences of each team member. After completing their tasks, team members may then assist other team members as time allows. Both objective questions and qualitative evaluations may be included in the task scoring. Some examples of activities include the following:

- Equipment specifications, maintenance and repair.
- Lawn care procedures and equipment operation.
- Hardscape procedures, e.g. pavers or retaining wall installation, irrigation pipe assembly.
- Chemical handling procedures, e.g. fertilizer or pesticide equipment calibration and application.
- Preparing business records, reports or invoices.
- Plant material quality in nursery grading and pruning maintenance.
- Written material problem solving.

The number and type of activities will vary from year to year. General topic areas (not actual tasks) will be communicated in the team orientation packet.

Scoring of the separate tasks will be based on correct answers for objective questions or on criteria appropriate for the task recorded by a judge. Example criteria for a possible qualitative task in riding mower operation (one team member) might include: equipment checked, engine started, proper handling and speed in covering marked course, equipment properly shut down. All task scores will be converted to percentage scores recorded on the "Team Skills Challenge" scorecard with team points earned as the average percentage of all tasks assigned.

C. Individual Events

1. Phase 3: General Knowledge Examination - 150 points

Objective questions will be prepared on topics reflecting subject areas in the objectives. This phase will evaluate the participant's knowledge and understanding of basic horticultural principles in producing, marketing, using and maintaining landscape plants and turf. Participants will record their answers on a scan form.

2. Phase 4: Identification of Plants, Pests, Disorders, Equipment and Supplies - 150 points

Participants will identify items selected from the provided list covering the following categories:

- Plant Materials
- Pests and Disorders
- Equipment and Supplies

Plants to identify will be presented as intact, live specimens. Equipment may be either an intact item or photograph. Pest and disorder items may be presented as an intact specimen, photograph or preserved specimen (herbarium sheet, insect mount, etc.). When a

problem must be presented with an affected plant, a “Disorder” label will be with the item to designate identification of the problem rather than the plant.

Each specimen will be designated by a station number. When the participant identifies the item, its name is then located on the identification list. The participant then records the number by that name on a scan form at the respective station number.

Each participant will be provided a copy of the list at the event site. No specimens or items may be touched or handled in any way.

3. Phase 5: Landscape Estimating - 100 points

This practicum is designed to evaluate participant knowledge of and ability in

1) evaluating a landscape design, 2) reading a landscape drawing, 3) measuring and calculating materials needed to execute a landscape plan, 4) evaluating factors that affect profitability of a landscape business.

A landscape drawing and scratch paper will be provided to the participants. There will be objective questions about the landscape plan. Participants will record their answers using a scan form.

4. Phase 6: Verbal Customer Assistance - 50 points

This interpersonal relations practicum is designed to evaluate participant knowledge of and ability in 1) verbal communication, 2) sales and customer assistance skills, 3) plant materials, plant culture and problems, 4) garden center supplies and equipment.

The participant will assume the role of a customer service representative (garden center or other related business or an educational agency) responding to an assistance need of the customer or client (the judge). General themes might include, but are not limited to, the following: clinic diagnosis or recommendations; care advice; sales of plants, equipment, treatments; deal with complaints.

Each participant will be located at a separated station with one minute allotted to review the materials and information provided prior to arrival of the judge. These materials may be handled and referred to as appropriate for the conversation with the judge. Plants, disorders, supplies not listed on the material and plant resource lists will be communicated prior to the event. Scoring criteria are listed on the respective scorecard.

5. Phase 7: Written Customer Assistance - 50 points

This interpersonal relations practicum has the same objectives as in Phase 6: Verbal Customer Assistance applied to written communication.

The participant will assume the role of a customer service representative. A copy of correspondence about a plant, landscape or business question will be provided, along with the appropriate response information. Each participant will compose an appropriate response in written or electronic format. Scratch paper will be provided for a rough draft in pencil if desired. If it is hand written, only the final draft in ink will be scored.

Thirty minutes will be allowed for this practicum. A pocket-size dictionary or electronic speller is allowed for checking spelling. Scoring criteria are presented on the “Written Customer Assistance” scorecard, which will be recorded by a judge.

6. Phase 8: Nursery Propagation or Potting - 50 points

This practicum is designed to evaluate participant knowledge of and ability in performing fundamental nursery production practices. All participants will perform one of the following exercises. The selected exercise will not be announced prior to the start of the event. Judges will ask clarifying questions of the students.

a. *Propagating Nursery Stock* — Each participant will be furnished a stock plant, rooting flat and media, rooting powder, a hand pruner, a label and marking pen.

(Personal propagating knives or pruners are allowed, if desired.) Participants are to prepare the designated softwood or hardwood cuttings and place them in the media with a single label.

- b. Potting Nursery Stock* — Each participant will be furnished a supply of plants, nursery containers or pots of appropriate size and media. Hand pruners, a label and a marking pen will also be provided. (Personal pruners are allowed, if desired.) The participants will pot the plants, one per container, using standard nursery practices. Plant division or grading of liners may be involved. One finished container will be labeled.

An official will observe and score each participant during the application of the practicum. Following completion of the assigned practicum the official will ask questions regarding the propagation or potting activity. Scoring criteria are listed on the respective scorecards.

VII. Scoring

Participant scores are the sum of the nine individual phases of the event, and team scores are the sum of the three highest member scores plus the group portion of the team activity and team challenge. Possible points are as follows:

Phase	Member	Team
1A. Team Activity – Individual	50	150
1B. Team Activity – Group		100
2. Team Skills Challenge		100
3. Examination	150	450
4. Identification	150	450
5. Landscape Estimating	100	300
6. Verbal Customer Assistance	50	150
7. Written Customer Assistance	50	150
8. Nursery Propagation/Potting	50	150
Individual Total	600	
Team Total		2000

VIII. Tiebreakers

If needed in the case of tied individual or team total scores, final placings will be determined by comparing, in order, scores for the following:

1. Phase 2 – Written Exam
2. Phase 3 – Identification Section
3. Phase 4 – Landscape Estimating

IX. Awards

Awards will be presented to individuals and/or teams based upon their rankings at an awards ceremony. Awards are sponsored by a cooperating industry sponsor(s) as a special project, and/or by the general fund of the National FFA Foundation.

In addition to the general awards of the career development events, the top three participants in the following two areas will be specially recognized:

- **Nursery/Landscape Knowledge and Principles** — based on the composite score from Written Exam and Identification section.
- **Nursery/Landscape Applications** — based on the composite score from the five practicums from the following sections: Team Activity – Individual; Landscape Estimating; Verbal Customer Assistance; Written Customer Assistance; Production Practices.

X. Recommended References

The following list of references is a guide to team training. Some content areas have more than one title listed. This reflects the wide array of quality references available that will provide a proper foundation for this event. No single reference is recommended as superior over others in that area. However, multiple references for the plant materials may be desirable as no single source is comprehensive for the entire country or plant list. Other references than those listed may be equally valuable resources, along with the many video and computer-based training aids that are available.

National FFA Core Catalog

- Nursery/Landscape CDE materials: <http://shop.ffa.org/cde-materials-c1289.aspx>
- CDE Q&A's: <http://shop.ffa.org/cde-qas-c1413.aspx>

Books

Introduction to Horticulture. 4th Edition, 2009. Charles B. Schroeder, Eddie Dean Seagle, Lorie M. Felton, John M. Ruter, William Terry Kell, and Gerard Krewer. Prentice-Hall, Inc., Englewood Cliffs, NJ. ISBN 0130364134

Introductory Horticulture. 8th Edition, 2011. H. Edward Reiley and Carroll L. Shry, Jr. Clifton Park, NY : Delmar Cengage Learning. ISBN 9781435480391

Ornamental Horticultur. 4rd Edition, 2010. Jack Ingels. Delmar Publishers Inc., Albany, NY. ISBN-13: 9781435498167

Introduction to Plant and Soil Science and Technology. 2003. Ronald J. Biondo and Jasper S. Lee. Prentice-Hall, Inc., Englewood Cliffs, NJ. ISBN 0813432162

Principles of Plant Science: Environmental Factors and Technology in Growing Plants. 2005. Dennis R. Decoteau. Pearson/Prentice Hall, Upper Saddle River, NJ. ISBN 0130163015

Practical Horticulture. 7th Edition. 2011. Laura W. Rice and Robert P. Rice. Prentice-Hall, Inc., Englewood Cliffs, NJ. ISBN 0135038669

Plant Propagation: Principles and Practices. 8th Edition, 2011. Hudson T. Hartmann, Fred T. Davies, Jr., Dale E. Kester, and Robert L. Genieve. Prentice Hall, Boston. ISBN 0135014492

Nursery Production - A Teachers Manual. Revised edition, 1989. Department of Agricultural Education, Pennsylvania State University, University Park, PA. http://www.eric.ed.gov/ERICWebPortal/search/detailmini.jsp?_nfpb=true&_ERICExtSearch_SearchValue_0=ED057243&ERICExtSearch_SearchType_0=no&accno=ED057243

Nursery Management: Administration and Culture. 4th Edition, 2000. Harold Davidson, Roy Mecklenburg, and Curtis Peterson. Prentice-Hall, Upper Saddle River, NJ. ISBN 0138579962

American Standard for Nursery Stock. 2004. American Association of Nurserymen, Inc., 1250 I St., NE, Suite 500, Washington, DC. (available as pdf file free to nonmembers at <http://www.anla.org/docs/About%20ANLA/Industry%20Resources/ANLAStandard2004.pdf>)

Landscape Plants, Their Identification, Culture, and Use. 2nd Edition, 2003. Ferrell M. Bridwell. Delmar Thomson Learning, Albany, NY. ISBN 0766836347

Manual of Woody Landscape Plants. 6th Edition, 2009. Michael A. Dirr. Stipes Publishing Co., Champaign, IL. ISBN 978-1-58874-868-3

A Field Guide to Woody Landscape Plants of the Southeast. 2002. Rex Bishop. Tea Olive Productions. Marietta, GA. ISBN 097253430X

Know It and Grow It III: A Guide to the Identification and Use of Landscape Plants. 1999. Carl E. Whitcomb. Lacebark, Inc. Stillwater, OK. ISBN 0961310910

Manual of Herbaceous Ornamental Plants. 4th Edition, 1994. Steven M. Still. Stipes Publishing Co., Champaign, IL. ISBN 0-87563-433-8.

Herbaceous Perennial Plants: A Treatise on Their Identification, Culture, and Garden Attributes. 3rd Edition, 2008. Allan M. Armitage, Stipes Publishing Co., Champaign, IL. ISBN 978-1-58874-868-3.

Professional Interior Plantscaping. 2002, Barbara L. Collins. Stipes Publishing Co., Champaign, IL. ISBN 1-58874-141-9.

Introduction to Landscaping: Design, Construction, and Maintenance. 3rd Edition. 2009. Ronald J. Biondo and Charles B. Schroeder. Prentice-Hall, Inc., Englewood Cliffs, NJ. ISBN 0133626385

Landscaping Principles and Practices. 7th Edition, 2010. Jack Ingels. Delmar Publishers Inc., Albany, NY. ISBN 13: 9781428376410

Landscape Design: A Practical Approach. 5th Edition, 2002. Leroy G. Hannebaum. Prentice-Hall, Inc., Upper Saddle River, NJ. ISBN 0130105813

An Illustrated Guide to Landscape Design, Construction, and Management. 1998. Gregory M. Pierceall. Prentice-Hall, Inc., Englewood Cliffs, NJ. ISBN 0813430194

Landscaping Construction. 2nd Edition, 3rd Edition, 2011. David Sauter. Delmar Publishers Inc., Albany, NY. ISBN 143549718X

Planting Design: A Manual of Theory and Practice. 3rd Edition, 2004. William R. Nelson, Stipes Publishing Co., Champaign, IL. ISBN 1-58874-358-6

Landscape Construction Procedures, Techniques, and Design. 4th Edition, 1999. Floyd Giles. Stipes Publishing Co., Champaign, IL. ISBN 0875638848

Landscape Operations: Management, Methods, and Materials. 5th Edition, 2001. Leroy Hannebaum. Prentice-Hall, Inc., Upper Saddle River, NJ. ISBN 0138569150

Professional Landscape Management. 3rd Edition, 2010. David L. Hensley. Stipes Publishing Co., Champaign, IL. ISBN 1588749509

Arboriculture: Integrated Management of Landscape Trees, Shrubs and Vines. 4th Edition, 2004. Richard W. Harris, James R. Clark, and Nelda P. Matheny. Prentice-Hall, Inc., Englewood Cliffs, NJ. ISBN 0130888826

Turfgrass Science and Management. 4rd Edition, 2008. Robert D. Emmons. Delmar Publishers Inc., Albany, NY. ISBN 10: 1418013307

Turfgrass Management. 9th Edition, 2011. A.J. Turgeon. Prentice-Hall, Inc. Boston. ISBN 0137074352

The Turf Problem Solver: Case Studies and Solutions for Environmental, Cultural, and Pest Problems. 2006. A.J. Turgeon and J.M. Vargas, Jr. J. Wiley, Hoboken, NJ. ISBN 9780471736196.

Turfgrass Management Handbook. 5th Edition, 2002. Charles B. Schroeder and Howard B. Sprague. Prentice-Hall, Inc. Englewood Cliffs, NJ. ISBN 0813430836

Ortho Problem Solver. 6th Edition, 2003. Michael McKinley (ed.). Meredith Books. Des Moines, IA. ISBN 0897214943

Home Gardener's Problem Solver. 2001. Michael McKinley. Meredith Books. Des Moines, IA. ISBN 0897215044

Insects That Feed on Trees and Shrubs. 2nd Edition, 1991. Warren T. Johnson and Howard H. Lyon. Comstock Publishing Associates, Ithaca, NY. ISBN 0801426022

Diseases of Trees and Shrubs. 2nd Edition, 2005. Wayne A. Sinclair and Howard H. Lyon. Comstock Publishing Associates, Ithaca, NY. ISBN 9780801473718

Math for Horticulture. 1994. Ohio Agricultural Education Curriculum Materials Service, The Ohio State University, Columbus, OH. Item #E025L .

Care and Operation of Small Gasoline Engines. 1988. American Association for Vocational Instructional Materials, Athens, GA. ISBN 0896062619

Reference Manual for Office Personnel. 6th Edition, 1999. Clifford R. House. South-Western Publishing Co., Cincinnati, OH. ISBN 0538114517

Business Communications. 6th Edition, 2004. A.C. Krizon, Patricia Merrier, Carol Jones Larson. South-Western Publishing Co., Cincinnati, OH. ISBN 0324272251

Trade Periodicals

American Nurseryman. American Nurserymen Publishing Co., Chicago, IL.

Grounds Maintenance. Primedia, Overland Park, KS.,
www.grounds-mag.com/

Turf Magazine, plus several other on-line titles. Moose River Media LLC.
www.turfmagazine.com/

Interiorscape.com: A Forum for Interior Plantscape Professionals.
www.interiorscape.com/

Catalogs

Many horticultural supply company catalogs can be utilized for reference support on tools, equipment and supplies that may not be illustrated in other sources. The following company has given permission for listing their catalog:

A.M. Leonard, Inc., 665 Spiker Road, Piqua, OH 45356 (513/773-2697 or <http://www.amleo.com/index1.html>)

Websites and Problem Samples

Visit the National FFA website at <http://www.ffa.org/> for information on career development events, access to prior-year event materials and links to additional study aids. Additional links and resources will be included as they are developed or identified, along with the following links of the CDE sponsors:

<http://www.stihlusa.com/information/>

<http://www.kubota.com>

<http://www.arysta-na.com>

Special Note for State Events

No national listings of plant materials and disorders can match perfectly the industry situation in every state due to the wide range of environments across the U.S. Thus, the national event committee recommends that state event coordinators, wherever feasible, modify both sections of the list to serve better their industry and student educational needs.

Nursery/Landscape Plant Identification

Participant No.	<i>Botanical Name</i> /Common Name	State/Number	<i>Botanical Name</i> /Common Name
101	<i>Abelia x grandiflora</i> / Glossy Abelia	136	<i>Ficus elastica</i> 'Decora' / Decora Rubber Plant
102	<i>Abies concolor</i> / White Fir	137	<i>Forsythia x intermedia</i> cv. / Border Forsythia
103	<i>Acer palmatum</i> cv. / Japanese Maple	138	<i>Fraxinus americana</i> cv. / White Ash
104	<i>Acer platanoides</i> cv. / Norway Maple	139	<i>Gaillardia aristata</i> cv. / Common Blanketflower
105	<i>Acer rubrum</i> cv. / Red Maple	140	<i>Gardenia jasminoides</i> 'Fortuniana' / Common Gardenia
106	<i>Acer saccharum</i> cv. / Sugar Maple	141	<i>Ginkgo biloba</i> / Ginkgo, Maidenhair Tree
107	<i>Ajuga reptans</i> cv. / Carpet Bugle	142	<i>Gleditsia triacanthos inermis</i> cv. / Thornless Honeylocust
108	<i>Antirrhinum majus</i> cv / Snapdragon	143	<i>Hedera helix</i> cv. / English Ivy
109	<i>Aquilegia x hybrida</i> cv. / Columbine	144	<i>Hemerocallis spp.</i> and cv. / Day lily
110	<i>Amelanchier arborea</i> / Downy Serviceberry	145	<i>Hosta x hybrida</i> cv. / Plaintain Lily
111	<i>Astilbe hybrid</i> cv. / Astilbe	146	<i>Hydrangea quercifolia</i> / Oakleaf Hydrangea
112	<i>Begonia semperflorens-cultorum</i> / Wax Begonia	147	<i>Ilex cornuta</i> cv. / Chinese Holly
113	<i>Berberis x mentorensis</i> / Mentor Barberry	148	<i>Ilex crenata</i> cv. / Japanese Holly
114	<i>Betula nigra</i> / River Birch	149	<i>Ilex x meserveae</i> cv. / Meserve Holly
115	<i>Brassaia actinophylla</i> / Schefflera, Octopus Tree	150	<i>Impatiens hybrid</i> cv. / Impatiens
116	<i>Buxus microphylla</i> cv. / Littleleaf Boxwood	151	<i>Iris x germanica florentina</i> cv. / Beard- ed Iris
117	<i>Camellia japonica</i> cv. / Common Camellia	152	<i>Juniperus chinensis</i> cv. / Chinese Juniper
118	<i>Cedrus atlantica</i> 'Glauca' / Blue Atlas Cedar	153	<i>Juniperus horizontalis</i> cv. / Creeping Juniper
119	<i>Cercis canadensis</i> / Redbud	154	<i>Lagerstroemia indica</i> cv / Crape Myrtle
120	<i>Chaenomeles speciosa</i> cv. / Japanese (Flowering) Quince	155	<i>Leucanthemum x superbum</i> cv. / Shasta Daisy
121	<i>Cornus florida</i> cv. / Flowering Dogwood	156	<i>Liquidambar styraciflua</i> / Sweet Gum
122	<i>Cotoneaster dammeri</i> / Bearberry Cotoneaster	157	<i>Liriodendron tulipifera</i> / Tuliptree
123	<i>Cotoneaster divaricatus</i> / Spreading Cotoneaster	158	<i>Liriope spp.</i> cv. / Lily-Turf
124	<i>Crataegus phaenopyrum</i> / Washington Hawthorn	159	<i>Lobularia maritima</i> / Sweet Alyssum
125	<i>Cynodon dactylon</i> cv / Bermudagrass	160	<i>Lonicera japonica 'Halliana'</i> / Hall's Japanese Honeysuckle
126	<i>Dieffenbachia maculata</i> cv. / Spotted Dumb Cane	161	<i>Magnolia grandiflora</i> cv. / Southern Magnolia
127	<i>Dracaena deremensis</i> 'Warneckii' / Striped Dracaena	162	<i>Magnolia x soulangiana</i> cv. / Chinese (Saucer) Magnolia
128	<i>Dracaena fragens</i> 'Massangeana' / Corn Plant	163	<i>Mahonia aquifolia</i> cv. / Oregon Grape
129	<i>Echinace purpurea</i> / Purple Coneflower	164	<i>Malus spp.</i> and cv. / Flowering Crabapple
130	<i>Epipremnum spp.</i> / Pothos	165	<i>Myrica pensylvanica</i> / Bayberry
131	<i>Euonymus alatus</i> / Winged Euonymus		
132	<i>Euonymus fortunei</i> cv. / Wintercreeper		
133	<i>Fagus sylvatica</i> cv. / European Beech		
134	<i>Festuca spp.</i> and cv / Fescue		
135	<i>Ficus benjamina</i> / Benjamin Fig		

- 166 *Nandina domestica* / Heavenly Bamboo
 167 *Narcissus pseudonarcissus* cv. / Daffodil
 168 *Nyssa sylvatica* / Sour (Black) Gum
 169 *Pachysandra terminalis* / Japanese Spurge
 170 *Paeonia hybrid* cv. / Peony
 171 *Parthenocissus tricuspidata* / Boston Ivy
 172 *Pelargonium x hortorum* cv. / Zonal Geranium
 173 *Pennisetum ruppelia* / Fountain Grass
 174 *Petunia x hybrida* cv. / Petunia
 175 *Philodendron scandens oxycardium* / Heartleaf Philodendron
 176 *Picea abies* / Norway Spruce
 177 *Picea pungens* cv. / Colorado (Blue) Spruce
 178 *Pieris japonica* / Lily-of-the-Valley Bush
 179 *Pinus mugo* / Mugo Pine
 180 *Pinus strobus* / Eastern White Pine
 181 *Pinus sylvestris* / Scotch Pine
 182 *Pinus thunbergiana* / Japanese Black Pine
 183 *Platanus x acerifolia* / London Planetree
 184 *Poa pratensis* cv. Kentucky Bluegrass
 185 *Podocarpus macrophyllus* / Southern Yew
 186 *Potentilla fruticosa* cv. / Shrubby Cinquefoil
 187 *Prunus laurocerasus* cv. / Cherry Laurel
 188 *Prunus serrulata* 'Kwanzan' / Kwanzan Japanese Flowering Cherry
 189 *Pyracantha coccinea* cv. / Firethorn
 190 *Quercus alba* / White Oak
 191 *Quercus palustris* / Pin Oak
 192 *Quercus rubra* / Red Oak
 193 *Rhododendron x catawbiense* / Catawba Hybrid Rhododendron
 194 *Rhododendron Hybrid* / Exbury Hybrid Azalea
 195 *Rosa spp.* Class Hybrid Tea cv. / Hybrid Tea Rose
 196 *Salvia nemorosa* cv. / Meadow Sage
 197 *Sedum spurium* cv. / Sedum
 198 *Solenostemon scutellarioides* / Coleus
 199 *Sorbus aucuparia* / European Mountain Ash
 200 *Spiraea x bumalda* / Bumalda Spirea
 201 *Syringa vulgaris* cv. / Common Lilac
 202 *Tagetes spp.* cv. / Marigold
 203 *Taxodium distichum* / Bald Cypress
 204 *Taxus spp.* and cv. / Yew
 205 *Thuja occidentalis* cv. / American Arborvitae
 206 *Tilia cordata* / Littleleaf Linden
 207 *Tsuga canadensis* / Canadian Hemlock
 208 *Tulipa spp.* cv. / Tulip
 209 *Verbena x hybrida* cv. / Garden Verbena
 210 *Viburnum x burkwoodii* / Burkwood Viburnum
 211 *Viburnum trilobum* / American Cranberrybush Viburnum
 212 *Vinca minor* cv. / Periwinkle
 213 *Viola x wittrockiana* cv. / Pansy
 214 *Wisteria sinensis* cv. / Chinese Wisteria
 215 *Yucca filamentosa* / Adam's Needle
 216 *Zinnia elegans* / Zinnia

Nursery/Landscape Pests and Disorders Identification

No.	Item Name	No.	Item Name
<i>Insects</i>		<i>Weeds</i>	
217	Aphid	237	Annual Bluegrass
218	Bagworm	238	Broadleaf Plantain
219	Borer	239	Buckhorn Plantain
220	Leafhopper	240	Chickweed
221	Leaf Miner	241	Crabgrass
222	Scale	242	Dandelion
223	Spider Mite	243	Henbit
224	Snail/Slug	244	Nutsedge
225	Whitefly	245	Oxalis
226	White Grub	246	Purslane
		247	White Clover
<i>Diseases</i>		<i>Physiological Problems</i>	
227	Anthracnose	248	Frost/Freeze Injury
228	Apple Scab	249	Iron Deficiency
229	Black Spot	250	Leaf Scorch (drought/winter burn)
230	Botrytis	251	Nitrogen Deficiency
231	Canker	252	Pot-bound roots
232	Cedar-Apple Rust	253	String Trimmer Injury
233	Crown Gall	254	2,4-D Injury
234	Fireblight		
235	Powdery Mildew		
236	Root Rot		

Nursery/Landscape Equipment and Supplies Identification

No.	Item Name	No.	Item Name	No.	Item Name
255	anvil-and-blade pruner	289	ground/pelleted limestone	324	reel mower
256	architect's scale	290	hearing protection	325	resin-coated fertilizer
257	ball cart (B&B truck)	291	hedge shears	326	respirator
258	bark mulch	292	hoe	327	rotary mower
259	bark medium	293	hook-and-blade pruners	328	rototiller
260	bow saw	294	hose-end repair fitting	329	round point shovel
261	brick paver	295	hose-end sprayer	330	safety goggles
262	broadcast (cyclone) spreader	296	hose-end washer	331	sand
263	bubbler head, irrigation	297	hose repair coupling	332	scoop shovel
264	bulb planter	298	impulse sprinkler	333	shade fabric
265	burlap	299	landscape fabric	334	sharpening stone
266	chaps	300	leaf rake	335	siphon proportioner
267	compressed air sprayer	301	loppers	336	soaker hose
268	core aerifier	302	mattock	337	soil sampling tube
269	chain saw	303	measuring wheel	338	solenoid valve
270	cut-off machine	304	mist nozzle (mist bed)	339	spade
271	drip emitter, irrigation	305	mower blade balancer	340	spark plug gap gauge
272	dry-lock wall block	306	nursery container	341	sphagnum moss
273	duster	307	oscillating sprinkler	342	spray suit
274	dust mask	308	peat moss	343	square point (flat) shovel
275	edger (power or hand)	309	pick axe	344	string trimmer
276	edging	310	planting/earth/soil auger	345	tape measure
277	engineer's scale	311	planting bar	346	time clock
278	erosion netting	312	pole pruner	347	topsoil
279	fertilizer tablet	313	polyethylene film	348	tree caliper
280	galvanized pipe	314	polyethylene pipe	349	tree wrap
281	garden (spading) fork	315	pop-up irrigation head	350	trowel
282	garden (bow) rake	316	post-hole digger	351	T-square
283	gas mask	317	power blower	352	vermiculite
284	grafting band	318	power hedge trimmer	353	vertical mower
285	grafting tool	320	pot-in-pot units	354	water breaker
286	granular fertilizer	321	propagation mat	355	wire tree basket
287	gravity (drop) spreader	322	pruning saw		
288	grass shears	323	PVC (polyvinylchloride) pipe		

**Nursery/Landscape
Potting Nursery Stock Practicum Scorecard**

Name: _____ **Chapter:** _____
State: _____ **Team No.:** _____
Member No.: _____

	Possible Points	Member Score
Potting Process (34 points)		
Preparation of Plants		
<ul style="list-style-type: none"> • Plants selected for quality and uniformity • Inspects/prunes/grooms damaged parts • Prunes excess root length • Handles plants properly 	10	
Placement of Plants in Containers		
<ul style="list-style-type: none"> • Plant centered and vertical • Roots carefully and properly spread • Plant at proper depth • Plant roots covered 	10	
Media Filling and Settling		
<ul style="list-style-type: none"> • Sufficient media added • Media settled by bumping • Plant remains stable 	10	
Labeling of Completed Units		
<ul style="list-style-type: none"> • Plant (variety) name and date • Legible 	2	
Safety Practices Applied		
<ul style="list-style-type: none"> • Proper cutting technique • Tool closed when finished • Minimal clutter/good organization in work area 	2	
Potting Productivity (10 points)		
Number of Units Completed	5	
Quality of Units Completed		
<ul style="list-style-type: none"> • Overall quality and uniformity of lot 	5	
Response to Questions		
	6	
Total Points	50 points	

Judge's Name: _____ **Signature/Date:** _____

**Nursery/Landscape
Propagating Nursery Stock Practicum Scorecard**

Name: _____

Chapter: _____

State: _____

Team No.: _____

Member No.: _____

	Possible Points	Member Score
Propagation Process (34 points)		
Removal of Cuttings		
<ul style="list-style-type: none"> • Selects best quality, uniform stock • Cuts at appropriate lengths • Makes clean cuts 	5	
Preparation of Cuttings		
<ul style="list-style-type: none"> • Leaves stripped/trimmed/groomed as needed • Proximity of cuts to nodes • Angled or wounded basal cut • Cutting/buds not damaged 	10	
Application of Proper Hormone		
<ul style="list-style-type: none"> • Sufficient applied and excess removed • Hormone kept clean 	7	
Placement of Cuttings in Media		
<ul style="list-style-type: none"> • Proper medium depth, as applicable • Media furrow cut and closed • Proper sticking depth • Efficient row and cutting spacing 	8	
Labeling of Completed Units		
<ul style="list-style-type: none"> • Plant (variety) name, date, treatment • Legible 	2	
Safety Practices Applied		
<ul style="list-style-type: none"> • Proper cutting technique • Tool closed when finished • Minimal clutter in work area 	2	
Propagation Productivity (10 points)		
Number of Units Completed	5	
Quality of Units Completed		
<ul style="list-style-type: none"> • Uniform size and placement • Cuttings stable in media 	5	
Response to questions		
	6	
Total Points	50 points	

Judge's Name: _____ Signature/Date: _____

Nursery/Landscape Team Activity Scorecard

Name: _____

Chapter: _____

State: _____

Team No.: _____

Member No.: _____

<i>Team Preparation</i>	Individual Possible Score	1	2	3	4	Team	Actual Team Score
Team leadership roles established/evident						10	
Project assignment and goal defined						10	
Member responsibilities outlined and defined						10	
Members effective in individual tasks	10 pts each						
Members supportive of each other	10 pts each						
Members interact in positive/constructive way	10 pts each						
<i>Sub-Total (A)</i>	30 possible						
Agreement reached on individual evaluation						10	
Presentation plan developed (who does what/when)						10	
<i>Sub-Total (B)</i>						50	
<i>Team Presentation</i>	Individual Possible Score	1	2	3	4	Team	Actual Score
Positive voice, grammar, eye contact	5 pts each						
Effective organization of information	5 pts each						
Effective communication of information	5 pts each						
Demonstrates knowledge of subject	5 pts each						
<i>Sub-Total (C)</i>	20 possible						
Effective team interaction during presentations						15	
Appropriate participation from each team member						15	
Effective total team presentation						10	
Team Assignments fulfilled						10	
<i>Sub-Total (D)</i>						50	
<i>Total Team Member Points (A + C)</i>	(50 possible)						
<i>Total Team Points (B + D)</i>						100	

Judge's Name, section A & B _____ Signature/Date: _____

Judge's Name, section C & D _____ Signature/Date: _____

**Nursery/Landscape
Verbal Customer Assistance Practicum Scorecard**

Name: _____

Chapter: _____

State: _____

Team No.: _____

Member No.: _____

	Possible Points	Member Score
Conversation (35 points)		
Approach		
<ul style="list-style-type: none"> • Effective greeting and offer to help • Positive, enthusiastic; not hesitant 	4	
Personality		
<ul style="list-style-type: none"> • Pleasant, friendly manner • Not pushy in selling 	7	
Voice		
<ul style="list-style-type: none"> • Easy to hear and understand • Proper grammar used; good speaking form 	7	
Information Requested from Customer		
<ul style="list-style-type: none"> • Determines assistance needs • Effectively ask details/preferences 	7	
Salesmanship		
<ul style="list-style-type: none"> • Effective; tries to expand sale • Develops customer confidence in product/service 	7	
Closing		
<ul style="list-style-type: none"> • Repeats order, handles payment (as applicable) • Asks if instructions understood • Thank you close 	3	
Product/Problem/Procedure Presentation * (15 points)		
Correct Product/Procedure/Selections	6	
Correct Product/Problem Information Provided	6	
Clarity of Information Provided to Customer	3	
Total Points	50 points	

* Includes, as applicable, evaluation of order form for completeness, spelling and arithmetic accuracy, clarity.

Judge's Name: _____ Signature/Date: _____

**Nursery/Landscape
Written Customer Assistance Practicum Scorecard**

Name: _____

Chapter: _____

State: _____

Team No.: _____

Member No.: _____

	Possible Points	Member Score
Customer Relations <ul style="list-style-type: none"> • Does the letter create/maintain goodwill (is it free of negative words that create an unpleasant tinge)? • Is the tone appropriate for the letter purpose? • Does the letter emphasize reader (you) rather than writer (I)? • Is the tone and reading level appropriate for reader? 	10	
Business Letter Form <ul style="list-style-type: none"> • Is the letter written in acceptable business format including the date, inside address, salutation, body, complimentary close, signature and additional data (pc, enclosure, etc.)? 	10	
Organization <ul style="list-style-type: none"> • Is the content organized in logical, coherent order? • Is the letter properly divided into paragraphs with topic sentences? • Is the letter divided into sentences which clearly convey key points? • Does the letter use short conversational words? 	10	
Technical Information <ul style="list-style-type: none"> • Is the technical information provided in letter correct? • Is the information provided in simple, clear, concise manner? • Does the letter relate directly to the inquiry? 	10	
Grammar/Punctuation <ul style="list-style-type: none"> • Is the letter free of grammatical errors and misspelled words? 	10	
Total Score:	50	
Deductions (i.e., Rules Infractions, Missing Content)		()
Grand Total:		

Judge's Name: _____ Signature/Date: _____

**Nursery/Landscape
Team Skills Challenge Scorecard**

Name: _____ **Chapter:** _____
State: _____ **Team No.:** _____

Complete lines for number and type of events included. Record percentages as whole numbers only.

A Score = _____ points of _____ possible = _____%

B Score = _____ points of _____ possible = _____%

A Score = _____ points of _____ possible = _____%

B Score = _____ points of _____ possible = _____%

C Score = _____ points of _____ possible = _____%

D Score = _____ points of _____ possible = _____%

E Score = _____ points of _____ possible = _____%

F Score = _____ points of _____ possible = _____%

G Score = _____ points of _____ possible = _____%

Team Score (average) = _____%

Judge's Name: _____ Signature/Date: _____

Appendix A: AFNR Career Content Cluster Standards

	Performance Measurement Levels	Event Activity Addressing Measurement	Related Academic Standards
NRS.01.02. Performance Indicator: Classify natural resources.			Science: F3
	NRS.01.02.01.b. Identify trees and other woody plants.	ID, general exam	
PS.01.01. Performance Indicator: Classify agricultural plants according to taxonomy systems.			Science: C3
	PS.01.01.01.c. Classify agricultural plants according to the hierarchical classification system, life cycles, plant use and as monocotyledons or dicotyledons.	ID, general exam	
	PS.01.01.02.c. Identify agriculturally important plants by scientific names.	ID, general exam	
PS.01.02. Performance Indicator: Apply knowledge of plant anatomy and the functions of plant structures to activities associated with plant systems.			Science: B6, C3 and C5
	PS.01.02.02.c. Relate the active and passive transport of minerals into and through the root system to plant nutrition.	general exam	
	PS.01.02.03.c. Apply concepts associated with translocation to the management of plants.	general exam	
	PS.01.02.04.c. Explain the relationships between leaf structure and functions and plant management practices.	general exam	
	PS.01.02.05.c. Apply the knowledge of flower structures to plant breeding, production and use.	general exam	
	PS.01.02.06.c. Apply the knowledge of seed and fruit structures to plant culture and use.	general exam	
PS.01.03. Performance Indicator: Apply knowledge of plant physiology and energy conversion to plant systems.			Science: B6 and C5
	PS.01.03.01.b. Explain requirements necessary for photosynthesis to occur and identify the products and byproducts of photosynthesis.	general exam	
	PS.01.03.02.b. Explain factors that affect cellular respiration and identify the products and byproducts of cellular respiration.	general exam	
	PS.01.03.03.c. Relate the principles of primary and secondary growth to plant systems.	pruning/ propagation, exam, assessment	
PS.02.01. Performance Indicator: Determine the influence of environmental factors on plant growth.			Science: C6
	PS.02.01.01.c. Evaluate plant responses to varied light color, intensity and duration.	assessment and solution	
	PS.02.01.02.c. Design, implement and evaluate a plan to maintain optimal conditions for plant growth.	propagation, team activity	

PS.02.02. Performance Indicator: Prepare growing media for use in plant systems.		Science: B2
	PS.02.02.01.c. Formulate and prepare growing media for specific plants or crops.	assessment and solution
	PS.02.02.02.b. Discuss how soil drainage and water-holding capacity can be improved.	exam, assessment and solution
PS.02.03. Performance Indicator: Develop and implement a fertilization plan for specific plants or crops.		Math: 4B Science: A2
	PS.02.03.01.b. Describe nutrient deficiency symptoms and recognize environmental causes of nutrient deficiencies.	ID, general exam, assessment and solution
	PS.02.03.02.b. Contrast pH and cation exchange capacity between mineral soil and soilless growing media.	exam, assessment and solution
	PS.02.03.04.b. Calculate the amount of fertilizer to be applied and calibrate equipment to apply the prescribed amount of fertilizer.	assessment and solution
PS.03.01. Performance Indicator: Demonstrate plant propagation techniques.		Science: C2
	PS.03.01.01.b. Diagram the process of plant fertilization.	general exam
	PS.03.01.03.a. Describe optimal conditions for asexual propagation and demonstrate techniques used to propagate plants by cuttings, division, separation and layering.	propagation, production practices
	PS.03.01.04.a. Define micropropagation, discuss advantages associated with the practice and outline the four main stages of the process.	general exam
PS.03.02. Performance Indicator: Develop and implement a plant management plan for crop production.		Science: C5 and C6 Language Arts: 7
	PS.03.02.01.b. Inspect propagation material for evidence of pests or disease.	propagation
	PS.03.02.02.a. Explain the reasons for preparing growing media before planting.	general exam, potting
	PS.03.02.03.b. Apply pre-plant treatments required of seeds and plants and evaluate the results.	general exam, production practices
PS.03.03. Performance Indicator: Develop and implement a plan for integrated pest management.		Science: C4 and C6 Language Arts: 7
	PS.03.03.01.b. Identify major local weeds, insect pests and infectious and noninfectious plant diseases.	ID, general exam, assessment and solution
	PS.03.03.02.a. Describe damage caused by plant pests and diseases.	general exam
	PS.03.03.03.b. Describe types of pesticide controls and formulations.	general exam, assessment and solution
	PS.03.03.04.b. Explain procedures for the safe handling, use and storage of pesticides.	general exam, assessment and solution

PS.03.05. Performance Indicator: Harvest, handle and store crops.		Science: F5
PS.03.05.01.a. Identify harvesting methods and harvesting equipment.	general exam	
PS.03.05.03.a. Identify storage methods for plants and plant products.	general exam	
PS.03.05.04.a. Explain the reasons for preparing plants and plant products for distribution.	general exam	
PST.01.03. Performance Indicator: Identify and use hand and power tools and equipment for service, construction and fabrication.		Science: E2
PST.01.03.01.b. Select, maintain and use hand and power tools in service, construction and fabrication.	ID, general exam, assessment and solution	
PST.02.01. Performance Indicator: Perform service routines to maintain power units and equipment.		Science: E2
PST.02.01.01.a. Identify and schedule power unit and equipment lubrication.	exam	
PST.02.01.02.b. Adjust equipment, including belts and drives, chains and sprockets, and maintain fluid conveyance components, such as hoses, lines and nozzles.	ID, general exam, assessment and solution	
PST.04.01. Performance Indicator: Create sketches and plans of agricultural structures.		Math: 4A Science: A3 and E1
PST.04.01.01.a. Identify symbols and drawing techniques used to develop plans and sketches.	estimating	
PST.04.04. Performance Indicator: Follow architectural and mechanical plans to construct and/or repair equipment, buildings and facilities.		Math: 1C, 4A and 4B Science: E2
PST.04.04.05.b. Construct and/or repair with concrete, brick, stone or masonry units.	estimating, assessment and solution	
PST.04.04.06.a. Measure and calculate fencing materials.	estimating, assessment and solution	
CS.01.01. Performance Indicator: Action: Exhibit the skills and competencies needed to achieve a desired result.		Social Studies: 4d and 4h
CS.01.01.01.c. Work independently and in group settings to accomplish a task.	team activity, assessment and solution	
CS.01.01.03.c. Implement an effective project plan.	team activity, assessment and solution	
CS.01.01.04.b. Use appropriate and reliable resources to complete an action or project.	assessment and solution	
CS.01.01.06.b. Assign project parts equitably amongst team members to achieve a given task.	team activity, assessment and solution	

CS.01.02. Performance Indicator: Relationships: Build a constituency through listening, coaching, understanding and appreciating others.		Language Arts: 12 Social Studies: 4h
CS.01.02.01.c. Demonstrate human relation skills including compassion, empathy, unselfishness, trustworthiness, reliability and being friendly to co-workers.	team activity	
CS.01.02.02.c. Engage others in conversations to respond to an obstacle when completing a task.	team activity	
CS.01.02.04.c. Evaluate the effectiveness of team members.	team activity	
CS.02.03. Performance Indicator: Professional Growth: Develop awareness and apply skills necessary for achieving career success.		Language Arts: 12 Social Studies: 4a
CS.02.03.01.a. Explore various career interests/options.	general exam	
CS.02.03.03.c. Demonstrate employability skills for a specific career.	all event activities	
CS.02.04. Performance Indicator: Mental Growth: Demonstrate the effective application of reasoning, thinking and coping skills.		Math: 6C Science: A4 Language Arts: 4 and 8
CS.02.04.01.c. Demonstrate critical and creative thinking skills while completing a task.	team activity, assessment and solution, verbal	
CS.02.04.02.c. Implement effective problem solving strategies.	team activity	
CS.02.04.03.c. Demonstrate the skills needed to negotiate with others.	team activity, verbal	
CS.03.01. Performance Indicator: Communication: Demonstrate oral, written and verbal skills.		Language Arts: 4, 5 and 12
CS.03.01.01.c. Demonstrate technical and business writing skills to communicate effectively with co-workers and supervisors.	verbal and written	
CS.03.01.03.c. Make effective business presentations.	team activity, verbal	
CS.03.02. Performance Indicator: Decision Making –Analyze situations and execute an appropriate course of action.		Science: A1 and A5 Social Studies: 1c and 4h
CS.03.02.02.c. Use problem-solving skills.	all event activities	
CS.06.03 Performance Indicator: Provide health, safety and environmental operating guidelines.		Science: F4 and F5 Language Arts: 4 and 5
CS.06.03.01.a. Demonstrate the importance of safety, health, and environmental practices in the workplace.	general exam, production practices	

Appendix B: Academic Standards Addressed

National academic standards for mathematics, science, English language arts and social studies related to this event are reported below. The statements are based on information in reports of the respective associations/organizations in the academic areas. Some adjustment of numbering was done to facilitate the process of alignment with the standards that have been developed in the pathways of the Agriculture, Food and Natural Resources (AFNR) Career Cluster.

The approach was to determine the presence of alignment between the content standards, expectations or thematic strands of the four academic areas and the performance indicators of the AFNR Standards. Supporting statements have been included to clarify content of the respective content standards, expectations or thematic strands. The statements were initially developed independently by the respective organizations and, therefore, are not parallel in wording and presentation. Occasionally minor editing was done to adjust the background or stem of a statement but not the statement itself.

Math

1. Standard and Expectations: Number and Operations
 - 1C. Compute fluently and make reasonable estimates.
4. Standard and Expectations: Measurement
 - 4A. Understand measurable attributes of objects and the units, systems and processes of measurement.
 - 4B. Apply appropriate techniques, tools and formulas to determine measurements.
6. Standard and Expectations: Problem Solving
 - 6C. Apply and adapt a variety of appropriate strategies to solve problems.

Science

- A. Content Standard: Science as an Inquiry
 - A1. Identify questions and concepts that guide scientific investigation.
 - A2. Design and conduct scientific investigations.
 - A3. Use technology and mathematics to improve investigations and communications.
 - A5. Recognize and analyze alternative explanations and models.
- B. Content Standard: Physical Science
 - B2. Structure and properties of matter
 - B6. Interactions of energy and matter
- C. Content Standard: Life Science
 - C2. Molecular basis of heredity
 - C3. Biological evolution
 - C4. Interdependence of organisms
 - C5. Matter, energy and organization in living systems
 - C6. Behavior of organisms
- E. Content Standard: Science and Technology
 - E1. Abilities of technological design
 - E2. Understanding about science and technology
- F. Content Standard: Science in Personal and Social Perspectives
 - F3. Natural resources
 - F4. Environmental quality
 - F5. Natural and human-induced hazards

English Language Arts

4. Students adjust their use of spoken, written and visual language (e.g., conventions, style, vocabulary) to communicate effectively with a variety of audiences and for different purposes.
5. Students employ a wide range of strategies as they write and use different writing process elements appropriately to communicate with different audiences for a variety of purposes.
7. Students conduct research on issues and interests by generating ideas and questions, and by posing problems. They gather, evaluate and synthesize data from a variety of sources (e.g., print and non-print texts, artifacts, people) to communicate their discoveries in ways that suit their purpose and audience.
12. Students use spoken, written and visual language to accomplish their own purposes (e.g., for learning, enjoyment, persuasion and the exchange of information).

Social Studies

1. Thematic Strand: Culture
 - 1c. apply an understanding of culture and an integrated whole that explains the functions and interactions of language, literature, the arts, traditions, beliefs and values and behavior patterns;
4. Thematic Strand: Individual Development and Identity
 - 4a. articulate personal connections to time, place and social/cultural systems;
 - 4d. apply concepts, methods and theories about the study of human growth and development, such as physical endowment, learning, motivation, behavior, perception and personality;
 - 4h. work independently and cooperatively within groups and institutions to accomplish goals;