

NOCTI	NARRATIVE/ILLUSTRATIONS	ACTIVITIES/APPLICATION
<p>The end of lesson and end of chapter questions and activities are abbreviated as follows: AA = Analyze and Apply, TC = Thinking Critically, SAE for All Opportunities = SAE, ST = STEM and Academic Activities, Communicating about Agriculture CA = Extending Your Knowledge = EX</p> <p>Features abbreviations: Essential Questions = EQ, Hands-On Agriculture = HOA, STEM Connection = STC, Ag Ed Connection Ag Ed;</p>		
<p>Agriculture Biotechnology General Agriculture, Food and Natural Resources Technical Skills</p>		
<p>Apply knowledge of the basics of animal systems</p>	<p>Lesson 9.3 Animal Feeds and Feeding 471 Chapter 10 Large Livestock Production 490-549 Chapter 11 Small Livestock Production 550-615 Chapter 12 Other Animal Production 616-683 Anatomy of     Equine 530     Beef Cattle 495     Dairy Cattle 513     Goats 605-607     Poultry 558     Sheep 592-594     Swine 580 Animal Feeding Considerations 478-479 Avian Digestive System 482, 558 Egg Production (ducks) 569 Hoof Composition 531 How Digestion Works 479-483 Leg Conformation (equine) 531 Modified Monogastric Digestive System 481 Monogastric Digestive System 481 Nutrient Requirements 476-477 Nutrients 472-477 Production Cycle of     Beef Cattle 493 (illustrated)     Dairy Cattle 511 (illustrated)     Poultry 555 (illustrated)     Swine 578 (illustrated)     Sheep 591 (illustrated) (continued)</p>	<p>EQ 471 AA 487 SAE 487 ST #1 488 CA #3 489 SAE #1-#6 508 TC #1, #2 202 TC #2 250 SAE #1 250 AA #2 487 TC #1 487 TC #2 487 TC #2 613 ST #1 614 AA #2 638 AA #1 654 AA #2 669 CA #3 841</p>

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	<p>Goats 604 (illustrated)</p> <p>Bees 658</p> <p>Llamas and Alpacas 661</p> <p>Rabbits 662</p> <p>Deer 664</p> <p>Elk 665</p> <p>Bison 667</p> <p>Reproduction (geese) 571</p> <p>Reproductive Technology 222-224</p> <p>Ruminant Digestive Systems 480</p> <p>STEM Connection: Poultry Reproductive System 556</p> <p>STEM Connection: Water Movement (fish) 643</p> <p>The Basics of Digestion 479</p> <p>Types of Digestive Systems 480-482</p>	
<p>Apply knowledge of the basics of plant and insect systems</p>	<p>Lesson 5.2 Practical Science in Agriculture 204-213</p> <p>Lesson 5.3 Biotechnology in Agriculture 214-231</p> <p>Chapter 13 Plant Production 684-775</p> <p>Chapter 15 Soil and Water Conservation 842-914</p> <p>Lesson 15.2 Soil Formation and Properties 855-873</p> <p>Cellular Respiration 698</p> <p>Clay 863</p> <p>Compaction 867</p> <p>Comparison of monocots and dicots (Figure 13-16) 696</p> <p>Growth Cycle 696</p> <p>Growth cycles (Figure 13-17) 696</p> <p>Leaching 859</p> <p>Limiting Cultivation 866</p> <p>Loamy Soil 865</p> <p>No-Till and Reduced Tillage 866-867</p> <p>Organic Matter 863</p> <p>Photosynthesis 697-698, 801</p> <p>(continued)</p>	<p>AA #1 201</p> <p>TC #1 202</p> <p>SAE #2 229</p> <p>SAE #2 250</p> <p>SAE #2 296</p> <p>AA #3 654</p> <p>AA #1-#3 704</p> <p>TC #1-7 705</p> <p>SAE #2-#3 705</p> <p>AA #1 721</p> <p>AA #3 721</p> <p>AA #2 733</p> <p>AA #1-#3 758-759</p> <p>TC #3 759</p> <p>AA #1 773</p> <p>TC #1-#2, #4 773</p> <p>ST #1, #4 774</p> <p>EX #2 841</p>

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	<p>Plant Classification 695  Plant Parts 689-695  Plant Structure 687-689  Plant Use 696  Precipitation 859  Rotating Crops 866  (continued)  Salinization 868  Sand 862  Silt 862  STEM Connection: Artificial Photosynthesis 698  STEM Connection: Using the Soil Triangle #5 p861  USDA NRCS Soil Test 864  Water, Air, and Pore Spaces 863-864  Windbreaks, Cover Crops, Tillage Systems 866</p>	<p>TC #2 986  ST #1 987  CA #3 987</p>
<p>Apply knowledge of the basics of soil, water, and air systems</p>	<p>Chapter 15 Soil and Water Conservation 842-914  Lesson 15.2 Soil Formation and Properties 855-873  Clay 863  Compaction 867  soil particle sizes (Figure 15-16) 862  Leaching 859  Limiting Cultivation 866  Loamy Soil 865  No-Till and Reduced Tillage 866-867  Organic Matter 863  Precipitation 859  Rotating Crops 866  Salinization 868  Sand 862  Silt 862  Soil Composition and Texture 860-865  (continued)</p>	<p>TC #2 392  ST #1 682  AA #2 733  TC #2 790  TC #2-#3 808  AA #4 823  ST #1 840  EX #2 841  TC #3 854  AA #1-#3 872  TC #1-#3 873  SAE #3 873  SAE #1 887  HOA: Lake Turnover 890  STC: Water Temperature 892  STC: Turbidity 893  AA #1, #3 913</p>

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	<p>Soil Enrichment and Preservation 865-868</p> <p>Soil Erosion 866-867</p> <p>Soil Horizons and Layers 855-857</p> <p>STEM Connection: Using the Soil Triangle #5 p861</p> <p>USDA NRCS Soil Test 864</p> <p>Water Erosion 867</p> <p>Water, Air, and Pore Spaces 863-864</p> <p>Windbreaks, Cover Crops, Tillage Systems 866</p> <p>Chapter 15 Soil and Water Conservation 842-914</p> <p>Lesson 15.3 Hydrological Cycles 874-887</p> <p>Lesson 15.4 Water Quality 888-900</p>	<p>TC #1, #4 913</p> <p>ST #1, #3 914</p> <p>EX #1-#2 915</p> <p>ST #2 914</p> <p>CA #5 915</p>	
<p>Use, maintain, and store tools and equipment appropriately</p>	<p>Lesson 7.3 Agricultural Hand Tools 297-317</p> <p>Lesson 7.4 Agricultural Power Tools and Equipment 318-333</p> <p>Hand and Power Tool Use 153</p> <p>Machinery Safety 168</p>	<p>TC #1 163</p> <p>ST #2 263</p> <p>ST #3 44</p> <p>TC #1, #3, #4 317</p> <p>SAE #2 317</p> <p>AA #1 333</p> <p>TC #1, #3 333</p> <p>SAE #1-#3 333</p>	<p>SAE #2 392</p> <p>SAE #3 317</p> <p>SAE #3 333</p> <p>SAE #3-#4 345</p> <p>CA #3 549</p> <p>ST #2 614</p> <p>ST #3 682</p>
<p>Analyze current issues in the fields of Animal Science, Natural Resources, and Agricultural Biotechnology</p>	<p>Lesson 5.3 Biotechnology in Agriculture 214-231</p> <p>Chapter 10 Large Livestock Production 490-549</p> <p>Chapter 11 Small Livestock Production 550-615</p> <p>Chapter 12 Other Animal Production 616-683</p> <p>Chapter 13 Plant Production 684-775</p> <p>Chapter 14 Environmental Systems Impacting Agriculture 776-841</p> <p>Benefits of GMO Crops 218-220</p> <p>Benefits of Transgenic Animals 224</p> <p>Biofuels 255</p> <p>Genetic Engineering 216</p> <p>Genetic Engineering and Animal Production 221-229</p> <p>Genetically Modified Organisms 216-221</p>	<p>AA #2 42</p> <p>ST #1-#2 44</p> <p>ST #2 774</p> <p>EX #4 915</p> <p>ST #4 488</p> <p>TC #1 508</p> <p>TC #2 547</p> <p>CA #2 683</p> <p>AA #2 808</p> <p>CA #2 841</p> <p>CA #3 915</p> <p>CA #1-#3 957</p> <p>CA #2 987</p>	

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	<p>Lesson 15.4 Water Quality 888-900</p> <p>Lesson 15.5 Conservation Practices in Agriculture 901-915</p> <p>Lesson 9.1 Food Production Systems 438-459</p> <p>Lesson 9.2 Maintaining a Safe Food Supply 460-470</p> <p>Lesson 9.3 Animal Feeds and Feeding 471-489</p> <p>Natural and Artificial Selection (plants and animals) 215</p> <p>Risks of GMO Crops 220-221</p> <p>Risks of Transgenic Animals 224</p>	
<p><b>Agricultural Biotechnology Technical Skills</b></p>		
<p>Describe the fundamentals of agricultural biotechnology</p>	<p>Lesson 5.3 Biotechnology in Agriculture 214-231</p> <p>Natural and Artificial Selection (plants and animals) 215</p> <p>Genetic Engineering 216</p> <p>Genetically Modified Organisms 216-221</p> <p>Genetic Engineering and Animal Production 221-229</p> <p>Natural and Artificial Selection (plants and animals) 215</p> <p>Genetic Engineering 216</p> <p>Genetically Modified Organisms 216-221</p> <p>Genetic Engineering and Animal Production 221-229</p> <p>Benefits of GMO Crops 218-220</p> <p>Risks of GMO Crops 220-221</p> <p>Benefits of Transgenic Animals 224</p> <p>Risks of Transgenic Animals 224</p>	
<p>Investigate the use of agricultural biotechnology in plant and animal sciences</p>	<p>Lesson 5.3 Biotechnology in Agriculture 214-231</p> <p>Benefits of GMO Crops 218-220</p> <p>Risks of GMO Crops 220-221</p> <p>Benefits of Transgenic Animals 224</p> <p>Risks of Transgenic Animals 224</p>	<p>TC #2 43</p> <p>ST #1 44</p> <p>CA #5 44</p> <p>ST #3 230</p> <p>TC #2 722</p>
<p>Investigate the use of agricultural biotechnology in medicine and the food industry</p>	<p>Lesson 5.3 Biotechnology in Agriculture 214-231</p> <p>Benefits of GMO Crops 218-220</p>	<p>TC #2 43</p> <p>ST #1 44</p>

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	Risks of GMO Crops 220-221	CA #5 44 ST #3 230 TC #2 722
Academic Foundations		
Apply reading skills in an Animal Science, Natural Resources, and/or Agricultural Biotechnology environment		<p>Communicating about Agriculture activities are found in the end-of-chapter sections: 44-45, 88-89, 132-133, 188-189, 231, 263, 393, 435, 489, 549, 615, 683, 774, 841, 915, 957, 987</p> <p>Before You Read activities are located on the first page of each lesson: 4, 16, 32, 48, 61, 75, 92, 110, 136, 148, 165, 192, 204, 214, 234, 251, 266, 286, 297, 318, 334, 346, 358, 378, 396, 418, 438, 460, 471, 492, 509, 524, 552, 577, 590, 603, 618, 639, 656, 671, 686, 706, 723, 735, 744, 760, 778, 791, 809, 825, 844, 855, 874, 888, 901, 918, 932, 945, 960, 975</p>
Apply writing skills in an Animal Science, Natural Resources, and/or Agricultural Biotechnology environment		<p>Communicating about Agriculture activities are found in the end-of-chapter sections: 44-45, 88-89, 132-133, 188-189, 231, 263, 393, 435, 489, 549, 615, 683, 774, 841, 915, 957, 987</p> <p>Many other activities in the review section also require writing.</p>
Apply mathematical skills in an Animal Science, Natural Resources, and/or Agricultural Biotechnology environment	Chapter 8 Agricultural Mathematics 394-435 Lesson 8.2 Practical Mathematics in Agriculture 418-435	<p>STEM and Academic Activities in end-of-chapter sections: CH 2 #3 p88; CH 3 #3 p132; CH 5 #4 p230; CH 6 #2 p263; CH 7 #4 p393; CH 8 #4 p434; CH 9 #4 p488; CH 10 #4 p548            CH 11 #4 p614; CH 12 #4 p682; CH 13 #2, #5 p774; CH 14 #5 p840; CH 15 #4 p914; CH 16 #4, 5 p956</p> <p>AA #1 86            SAE #2 345            TC #2 376            TC #2 417            Math problems 432            Practice Problems by Category #1-#10 p432            TC #1-#2 433            SAE #1-#3 433            ST #4 434</p>

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		<p>EX #2 435  AA #1 546  EX #1, #3, #4, #5 549  AA #1 589  AA #1 680</p>
<p>Apply science skills in an Animal Science, Natural Resources, and/or Agricultural Biotechnology environment</p>	<p>Lesson 5.2 Practical Science in Agriculture 204-210  Lesson 5.3 Biotechnology in Agriculture 214-231  The Scientific Method 193-203</p>	<p>STEM and Academic Activities in end-of-chapter materials:  CH 1 #1 p44; CH 3 #1 p132; CH 5 #1 p230; CH 6 #1 p263; CH 8 #1 p434; CH 9 #1 p488; CH 10 #1; CH 11 #1 p614; CH 12 #1 p682; CH 13 #1 p774; CH 14 #1 p840; CH 15 #1 p914; CH 16 #1 p914; CH 16 #1 p956; CH 17 #1 p987</p> <p>TC p202  AA #1 p212  TC #1-2 p213</p>
<p>Systems</p>		
<p>Understand the major governing bodies and groups that impact how Animal Science, Natural Resources, and Agricultural Biotechnology organizations functions (e.g., EPA)</p>	<p>Animal and Plant Health Inspection Service (APHIS) 461  Centers for Disease Control and Prevention (CDC) 461  Environmental Protection Agency (EPA) chemical regulation 206, 849  Food and Nutrition Services (FNS) 461  Legislation That Influenced Modern Agricultural Education 23-24  National Agricultural Library (NAL) 462  National Association of Conservation Districts (NACD) 850  National Institute of Food and Agriculture (NIFA) 462  National Oceanic and Atmospheric Administration (NOAA) 849  Natural Resources Conservation Service (NRCS) 847, 949  Soil and Water Conservation Districts (SWCDs) 850  United States Forest Service (USFS) 845  US Bureau of Economic Analysis (Figure 1-8) 8  US Bureau of Labor Statistics (salaries included in Career Connection Features)</p>	<p>SAE #3 229  ST #5, #6 230  SAE #2 459  AA #2 470  SAE #1, #3 470  ST #6 488  AA #3 507  TC #1 547  ST #5 614  AA #2 654  AA #3 854  SAE #1-#3 854  AA #3 900  AA #4 913  CA #2 915  SAE #2 944  EX #4 988</p>

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	<p>USDA ARS Wheat Quality Lab, SAE for ALL Profile 190</p> <p>USDA, 4-H youth development organization 57</p> <p>USDA, defining genetic engineering 216</p> <p>USDA Economic Research Service</p> <p>Land Use in the United States (Figure 1-4) 6</p> <p>Agricultural Imports and Exports (Figure 1-5) 7</p> <p>Food Dollar Series (Figure 1-9) 9</p> <p>Risk Management 407</p> <p>Household Income Spent on food (Figure 9-3) 441</p> <p>Food Availability (Figure 9-5) 442</p> <p>USDA Food and Drug Administration (FDA), Biotechnology Regulation 225</p> <p>USDA Food Safety and Inspection Service (FSIS) regulations in food production 442</p> <p>USDA Foreign Agricultural Service, Biotechnology Regulation 225</p> <p>US Department of Commerce (Figure 1-8) 8</p> <p>US Department of Homeland Security 461</p>		
<p>Demonstrate knowledge of economic principles as applied to Animal Science, Natural Resources, and/or Agricultural Biotechnology systems (e.g., supply and demand, profit)</p>	<p>Lesson 8.1 Agribusiness and Marketing 396-417</p> <p>Economics in Agriculture 397-401</p>	<p>TC #2 43</p> <p>ST #4 230</p> <p>CA #2 231</p> <p>ST #1 263</p> <p>SAE #2, #3 345</p> <p>TC #2 376</p> <p>AA #2 416</p> <p>TC #1-#2 417</p> <p>SAE #1 417</p> <p>Math #1 432</p> <p>SAE #3 487</p> <p>ST #4 488</p> <p>SAE #6 508</p> <p>AA #2 522</p>	<p>ST #4 548</p> <p>CA #2, 3 549</p> <p>EX #1, #2, #4 549</p> <p>SAE #1 576</p> <p>SAE #1 589</p> <p>AA #2 602</p> <p>SAE #1 602</p> <p>CA #2 614</p> <p>ST #4 682</p> <p>SAE #2 734</p> <p>TC #2 773</p> <p>ST #2 774</p> <p>SAE #1 931</p>

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Ethics and Legal Responsibilities		
<p>Understand the major laws and regulations that impact the Animal Science, Natural Resources, and/or Agricultural Biotechnology industry</p>	<p>USDA, defining genetic engineering 216  USDA Foreign Agricultural Service, Biotechnology Regulation 225  USDA Economic Research Service  Land Use in the United States (Figure 1-4) 6  Agricultural Imports and Exports (Figure 1-5) 7  Food Product Regulations, Quality, and Safety 442  Clean Water Act 849  Clean Water Act 849  Federal Conservation and Environmental Agencies 849  Natural Resources Conservation Service 849-850  Water Management Organizations 909  State and National Parks 920  Wildlife Management Organizations 932-933  Fish and Wildlife Service 933</p>	<p>AA #1, #3 854  TC #3 854  SAE #1-#3 854  AA #3 900  AA #4 913  CA #2 915</p>
<p>Identify and practice ethical behavior in the workplace</p>	<p>Ag Ed Connection: Ethics in Agriculture 119  Business Ethics 412-413  Characteristics of a Good Leader 50, 52  Ethical Data Representation 197</p>	
Communications		
<p>Locate, organize, and reference written information from reliable sources to communicate with coworkers and clients</p>	<p>Written Communication 66-69</p>	<p>HOA: Writing a Speech 65  ST #2, #5 p88  SAE #1 229  SAE #2 459  ST #7 840  SAE #1 887  CA #3 915  CA #1, #2 957  CA #2 987</p>

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<p>Develop and deliver formal and informal presentations using appropriate media to engage and inform audiences</p>	<p>Ag Ed Connection: Conduct of Chapter Meetings and Parliamentary Procedure LDEs 82            Conducting a Meeting 76-77            FFA Connection: Speaking Leadership Events 65            FFA Connection: Presentation Skills 67</p>	<p>CA #2-#6 44            AA #2 p73            TC #1-#6 p87            EX #1-#2 p89            ST #5 88            CA #1 88            CA #5 89            ST #2 188            CA #3, #4 189            SAE #1 229            CA #2-#4 231            AA #3 316            ST #5 393            CA #1 393</p>	<p>CA #3 435            SAE #2 459            CA #2 489            CA #2 549            SAE #2 839            ST #7 840            CA #2 841            SAE #1 887            AA #4 913            SAE #2 913            CA #3, #5 915            CA #1-#3 957            CA #2 987</p>
<p>Apply listening skills and interpret verbal and nonverbal behaviors to enhance communication with coworkers and clients</p>	<p>Communication Basics 62            Listening 66            Nonverbal Communication 62            Verbal Communication 62-66</p>	<p>ST #5 44            CA #2, #4, #6 44            CA #1 88            CA #2, #4 89            CA #3, #4 231            CA #2 549            CA #1 957            CA #1 987</p>	
<p>Interpret and use tables, charts, and graphics to support written and oral communication</p>		<p>AA #1 30            ST #1 88            CA #3 89            ST #2 131            SAE #2 147            SAE #1 487            ST #5 488</p>	<p>TC #2 523            AA #1 602            ST #1, #5 682            ST #5 840            AA #2 900            TC #1 944</p>
<p>Information Technology Applications</p>			

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Use computers and software to increase general work efficiency	Information Systems 37	AA #2 42 ST #2 88 ST #3 230 ST #2 263 AA #2 376 ST #2 434 ST #2 682
Use information technology tools specific to Animal Science, Natural Resources, and/or Agricultural Biotechnology to access and manage information (e.g., GPS)	Information Systems 37	AA #2 42 AA #1 73 ST #2 88 ST #3 230 ST #2 263 AA #2 376 ST #2 434 ST #2 682
Problem Solving, Critical Thinking, and Decision Making		
Information Technology Applications		
Use problem solving and critical thinking skills to locate sources of information about problems and determine appropriate methods for investigating causes	Personal Skills 120-121 Resourcefulness 50-51	Thinking Critically activities are located at the end of each lesson, in illustration captions, and in features
Use problem solving and critical thinking skills to determine root causes of problems and suggest solutions	Personal Skills 120-121 Resourcefulness 50-51	Thinking Critically activities are located at the end of each lesson, in illustration captions, and in features
Leadership and Teamwork		
Exhibit leadership practices to improve production and quality of work and work environment	Chapter 2 Leadership in Agriculture 46-89 Lesson 2.1 Building Leadership Skills through Agriculture 48-60 Lesson 2.2 Communication Skills in the Agricultural Industry 61-74 Lesson 2.3 Conducting Meetings in Agricultural Organizations 75-89	AA #1-#5 59 TC #1 60 SAE #3 60 ST #1 88 CA #4 89 EX #1 89

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	<p>Lesson 3.1 Experiential Learning through Agriculture 92-109</p> <p>Speaking Leadership Events 65</p> <p>Conduct of Chapter Meetings and Parliamentary Procedure LDEs 82</p> <p>FFA Program of Activities 94</p> <p>Employment Skills LDE 122</p> <p>Opportunities to Lead 56-57</p>		
<p>Work effectively in a team environment to improve the quality of work and the work environment</p>	<p>Team Leadership 53-55</p> <p>Servant Leadership 55</p> <p>Followership 55,</p>	<p>EX #1, #3 89</p> <p>TC #2 147</p> <p>EX #1 435</p>	
<p>Safety, Health, and Environmental</p>			
<p>Identify and practice appropriate environmental, health, and safety procedures for Animal Science, Natural Resources, and/or Agricultural Biotechnology occupations</p>	<p>Safety First notes are dispersed throughout the text</p> <p>Chapter 4 Agricultural Safety 134-189</p> <p>Lesson 4.1 Occupational Safety and Health 136-147</p> <p>Lesson 4.2 Shop and Lab Safety 148-164</p> <p>Lesson 4.3 Farm and Work Safety 165-189</p> <p>Best Practices in Workplace Safety 142</p> <p>Electrical Safety 156-157, 171-173</p> <p>Fire Extinguishers 154</p> <p>Ladder and Scaffolding Safety 158</p> <p>Maintaining a Safe Environment 141</p> <p>Personal Protective Equipment 149-153, 166-167</p> <p>Safety Data Sheets 155</p> <p>Safety Procedures 149</p> <p>Shop Safety 153</p> <p>Supervised Agricultural Experience (Safety) 143</p> <p>What Makes Agriculture Jobs So Dangerous? 165-166</p>	<p>AA #1-2 146</p> <p>TC #1, #3 147</p> <p>SAE #1-#3 147</p> <p>AA #1 p163</p> <p>TC #1-3 p163</p> <p>SAE #1-#3 164</p> <p>AA 1-2 187</p> <p>SAE #1 187</p> <p>ST #1-#3 188</p> <p>CA #2 188</p> <p>CA #3-#4 189</p> <p>EX #1 189</p> <p>SAE #3 285</p> <p>SAE #2 317</p> <p>AA #2 333</p> <p>TC #2 333</p> <p>SAE #1 333</p> <p>EX #1 393</p> <p>SAE #3 433</p> <p>SAE #1 470</p> <p>ST #3#5 488</p> <p>SAE #1 773</p> <p>SAE #2 808</p> <p>AA #4 930</p> <p>TC #3 931</p>	
<p>Demonstrate appropriate first aid knowledge and procedures for Animal Science, Natural Resources, and/or Agricultural Biotechnology occupations</p>	<p>First Aid (shop and lab safety) 159</p> <p>First Aid (farm and work safety) 182</p> <p>First-Aid Kits 160, 182</p>	<p>AA #1 163</p> <p>TC #1 163</p> <p>TC #2 164</p> <p>SAE #2 187</p>	

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Employability and Career Development	Chapter 3 Agriculture as a Career 90-133		
Demonstrate employability skills related to a career in Animal Science, Natural Resources, and/or Agricultural Biotechnology	Lesson 3.2 Your Career in Agriculture 110-131 Preparing to Be an Employee 119-121	AA #2-#3 59 TC #1-#2 60 TC #1 74 ST #1 88 EX #3 89 AA #1 108 SAE #3 131 SAE #2 417	SAE #1-#3 433 SAE #2 487 CA #3 549 SAE #3 773 SAE #1 854 SAE #1 913 SAE #3 986
Pursue career development skills to advance in Animal Science, Natural Resources, and/or Agricultural Biotechnology careers		AA #2-#3 59 TC #1 60 TC #2 60 TC #1 74 ST #1 88 EX #3 89 AA #1 108 SAE #3 131	SAE #2 417 SAE #1-#3 433 SAE #2 487 CA #3 549 SAE #3 773 SAE #1 854 SAE #1 913 SAE #3 986
Animal Science			
Maintain animal health sanitation	Deer and Elk Diseases 666 Disease and Pest Control (aquaculture) 647 Health, Welfare, and Handling (companion animals) 624-625 Maintaining Flock Health (poultry) 562 Maintaining Herd Health (beef cattle) 496 Maintaining Herd Health (dairy cattle) 516-517 Maintaining Herd Health (goat) 606-607 Maintaining Swine Health 581-582 Pests, Disease, and Other Threats (bees) 660 Rabbit Diseases 664		
Describe anatomy and physiology	Anatomy of an Equine 530 Anatomy of Beef Cattle 495 Anatomy of Dairy Cattle 513		

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	<p>Anatomy of Goats 605-607            Anatomy of Poultry 558            Anatomy of Sheep 592-594            Anatomy of Swine 580            Hoof Composition (equine) 531            Leg Conformation (equine) 531            STEM Connection: Poultry Reproductive System 556</p>	
Describe handling and shipment of animals and products	<p>Fleece Production (llamas and alpacas) 661            Handling Beef Cattle 497            Handling Dairy Cattle 517            Handling Goats 607            Handling Horses 533            Handling Sheep 594            Handling Swine 582-583            Health, Welfare, and Handling (companion animals) 624-625            Herd Behavior (beef cattle) 496            Horse Behavior 532-533            Maintaining Flock Health (sheep) 593-594</p>	
Explain genetics and breeding	<p>Biotechnology 27            Career Connection: Geneticist 27            Genetic Engineering 216            Genetic Engineering and Animal Production 221-224            Genetically Modified Organisms 216-221            Individual Genetics (nutrient requirements) 477            Natural and Artificial Selection 215            SAE for ALL Profile: Shelle Lenssen 190            STEM Connection: DNA and Genetic Engineering 218            STEM Connection: Domesticating the Silver Fox 19            STEM Connection: Genetics in Agriculture 217</p>	<p>AA #1 p229            TC #1-2 p229            SAE #1-3 p229            EX #3 p231            TC #3 p262</p>
Describe feeds and feeding	Lesson 9.3 Animal Feeds and Feeding 471-489	<p>SAE #6 508            EX #4 549</p>

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<p>Describe specific beef production operations, including breeds and types</p>	<p>Lesson 10.1 The Beef Industry 492-508            Beef Cattle Breeds (illustrated) 498-504            Beef Industry in the United States 492-493            Production Cycle of Beef Cattle 493            Production Cycle of Beef Cattle 494 (illustrated)            The Beef Cattle Industry 493-495</p>	<p>AA #1 507            AA #2 507            AA #3 507            SAE #4 508            ST #3 548            CA #2 549</p>
<p>Describe specific dairy operations, including breeds and types</p>	<p>Lesson 10.2 The Dairy Industry 509-523            Dairy Industry in the United States 509-511            Dairy Cattle Breeds (illustrated) 518-519            Dairy Cattle Events 516            Milking Parlors 513-515            Production Cycle of Dairy Cattle 511-513            Production Cycle of Dairy Cattle 511 (illustrated)</p>	<p>AA #3 522            ST #2 548            CA #3 549</p>
<p>Describe specific poultry operations, including breeds and types</p>	<p>Lesson 11.1 The Poultry Industry 552-563            Chicken Breeds (illustrated) 564-565            Duck Breeds (illustrated) 569-570            Ducks 569            Game Birds 572            Geese 571            Goose Breeds 571-572            Litter (poultry) 563            Production Cycle of Poultry (illustrated) 555            STEM Connection: Poultry Reproductive System 556            Turkey Breeds 566-568            Turkeys 566            Waste Management (poultry house) 238</p>	<p>TC #1 576            TC #2 576            ST #5 614            CA #1 614</p>
<p>Describe specific equine operations, including breeds and types</p>	<p>Lesson 10.3 The Equine Industry 524-543            Draft Breeds 542-543            Equine Breeds 535-543            Equine Industry in the United States 525            Light Horse Breeds 538-540</p>	<p>AA #2 547            TC #1 547            TC #2 547            TC #3 547            SAE #1 547</p>

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	<p>Long-Eared Breeds 536  Pony Breeds 537-538  Production Cycle of Horses 525  The Horse Industry 526-530  Warmbloods 541-542</p>	<p>SAE #2 547  ST #4 548  CA #1 549</p>
<p>Describe specific aquaculture operations, including breeds and types</p>	<p>Lesson 12.2 The Aquaculture Industry 639-  Aquaculture Systems 642-645  Common Types of Aquatic Species 648-650  Global and US Aquaculture Production 640  Types of Aquacultures 640-642</p>	<p>AA #1 654  AA #2 654  AA #3 654  TC #1 654  TC #2 654  TC #3 654  SAE #1 654  SAE #3 654</p>
<p>Describe specific small animal operations, including breeds and types</p>	<p>Chapter 11 Small Livestock Production 550-615  Chapter 12 Other Animal Production 616-683  Lesson 12.1 Companion Animals 618-638  Lesson 12.2 The Aquaculture Industry 639-655  Lesson 12.3 Nontraditional Animal Industries 656-670  By-Products from Animal Industries 671-681  SAE for ALL Profile: Nathan Kindall, Honey Production 616</p>	<p>TC #1 638  AA #2 669  TC #1 670  TC #2 670  SAE #1 670</p>
<p>Describe specific swine operations, including breeds and types</p>	<p>Lesson 11.2 The Swine Industry 577-589  Production Cycle of Swine 578  Production Cycle of Swine (illustrated) 578  Swine Breeds (illustrated) 585-586  Swine Production Systems 578-589  The Swine Industry 580  The Swine Industry in the United States 578</p>	<p>TC #1 589  TC #2 589  ST #2 614</p>
<p>Describe specific sheep/goat operations, including breeds and types</p>	<p>Lesson 11.3 The Sheep Industry 590-602  Production Cycle of Sheep 591  Production Cycle of Sheep (illustrated) 592  Sheep Breeds (illustrated) 596-599</p>	<p>SAE #1 589  SAE #2 589  AA #1 602  AA #2 602</p>

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	The Sheep Industry in the United States 590-591	AA #3 602 TC #2 602 ST #2 614	
Describe specific sheep/goat operations, including breeds and types	Lesson 11.4 The Goat Industry 603-613 Angora Goat Breeds 611 Dairy Goat Breeds 610-611 Meat Goat Breeds 609 Production Cycle of Goats 604 Production Cycle of Goats (illustrated) 604 The Goat Industry 605 The Goat Industry in the United States 603	AA #1 613 AA #2 613 TC #1 613 TC #2 613 SAE #1 613 SAE #2 613 ST #2 614	
Conservation and Sustainable Natural Resources			
Conserve and protect water, land, and soil resources	Lesson 16.3 Stewardship of Natural Resources 945-957 CH 15 Soil and Water Conservation 842-915 Biofuels 255, 286-296 Cover Crops and Mulches 746 Cultural Practices 748 Fertilizer Application 746 How Much Will the Land Sustain? 829-830 Organic Farming 256 Soil Management 745 Sustainable Practices: Conserving Water 795 Vertical Farming 257-258	SAE #1-#2 790 TC #2 808 CA #1 841 AA #2 854 TC #3 854 SAE #3 854 TC #3 887 TC #2 900 AA #4 913 TC #1-#2 913 SAE #2 913 CA #1-#2 915 EX #1, #6 915 SAE #1, #3 955 CA #2 957 EX #3 957	
Recycle and manage waste products	Biomass Energy 272 Chemicals (in groundwater) 876 Coal (plant waste) 274 Environmental Impact (nuclear waste) 280 Food Disposal 440 Groundwater Contamination 877 Litter (poultry) 563 Livestock Waste Management 906-907	TC #3 147 TC #1 202 TC #2 392 TC #2 508 AA #4 887 CA #4 393 AA #2 955 TC #3 955	

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	<p>Manure Pits 175-176  Methanol (livestock waste) 290  Negative-Impact Activities on the Farm 949-952  Refineries 278  Septic Systems 388, 877  Waste Control (vertical farming) 257  Waste Management (equine facility) 242  Waste Management (poultry house) 238  Waste Management (swine barn) 239  Waste Storage Structures 244-245  Wastewater (aquaculture) 242, 647  Wastewater (aquaculture) 647  Wastewater Recycling 272  Wastewater Treatment Systems 388-389  Water Pollution Control 905-906  Work Area 153</p>	<p>SAE #1-#3 955  ST #1, #3 956  CA #1, #4 957  EX #3 957  EX #1 988</p>
<p>Research and develop new, renewable energy sources, including biofuels</p>	<p>Biomass Energy 272  Lesson 7.1 Energy Systems 266-285  Lesson 7.2 Biofuels 286-296</p>	
<p>Plant Science</p>		
<p>Describe plant anatomy and physiology</p>	<p>Chapter 13 Plant Production 684-775  Lesson 13.1 Plant Anatomy and Physiology  Lesson 13.2 Cereal Grain Production  Lesson 13.3 Oil Crop Production  Lesson 13.4 Fiber Crop Production  Lesson 13.5 Fruit and Vegetable Production  Lesson 13.6 Ornamental Horticulture</p>	
<p>Describe taxonomy and plant identification</p>	<p>Plant Classification 695-696  Flower Classification 694-695</p>	<p>SAE #2 705</p>
<p>Explain plant genetics, breeding, and propagation</p>	<p>Plant Reproduction 699-701</p>	<p>SAE #3 164  AA #1 201</p>

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		TC #1 202 TC #2 229 SAE #2 250 SAE #2 296 Hands-On Agriculture: Plant Reproduction 699 TC #7 705 TC #3 759 SAE #3 705
Formulate, mix, and properly handle agricultural chemicals	Fertilizer Needs and Applications 727, 739 Fertilizer Application 746	TC #1 202 Math #1 432 SAE #3 433 Calculating Surface Area 691
Identify plant pests and practice pest control	Pest Control 728-729, 736, 747 Insect Control 748 Weed Control 748-749 Weed, Insect, and Disease Control (fruit production) 753 Maintaining Health of Floriculture Plants 764-766	AA #2 262 TC #2 367 SAE #3 722 AA #3 759 ST #4 774 AA #3 986 TC #2 986 ST #1 987 CA #3 987
Identify and classify plant diseases	Plant Classification 695 Flower Classification 694-695 Integrated Pest Management (IPM) 716-717 Maintaining Health of Floriculture Plants 764-766	
Calculate fertilizer rates and costs		TC #1 202 Math #1 432 SAE #3 433 Calculating Surface Area 691
Determine populations and planting rates	Planting (grain crops) 711-714 Planting Oil Crops 725-726	

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	Planting (fiber crops) 736 Planting (flax) 739 Seeding and Transplanting (vegetable crops) 746-747 Bedding Plants 762-763	
Discuss harvesting and storage of crops	Harvesting (grain crops) 717-718 Harvesting (oil crops) 729-730 Harvesting (cotton) 737 Harvesting (flax) 739-740 Harvesting (vegetables) 750 Harvesting (fruits/nuts) 753	
Identify plant nutrient requirements	Fertilizer Needs and Applications (grain crops) 714 Fertilizer Needs and Applications (oil crops) 727 Fertilizer Needs and Applications (cotton) 736 Fertilizer Needs and Applications (flax) 739 Plants 878 Fertilizer Application (vegetables) 746 STEM Connection: Comparing Nutritional Content	
<b>Soil Management</b>		
Describe preparation of land for efficient cropping	Planting (cereal grains) 712-714 Tillage Operations and Cultivation 714-715 Planting Oil Crops 725-726 Planting (cotton) 735-736 Planting (flax) 738-739 Seeding and Transplanting (fruits/vegetables) 746-747 Soil Enrichment and Preservation 865-868 No-Till and Reduced Tillage 866-867	
Exhibit knowledge of land judging and soil management concepts	Soil Management (vegetables) 745-747 Cultural Practices (vegetables) 748-749 Resource Management (fruits/nuts) 752-753	ST #3 p914
Identify and discuss soil tests and various amendments	STEM Connection: Using the Soil Triangle 861 STEM Connection: NRCS Soil Test 864	ST #1, #3 p914

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Soil Enrichment and Preservation 865-868		
Agricultural Technology		
<p>Explain safe use and maintenance of tools and equipment</p>	<p>Lesson 7.3 Agricultural Hand Tools 297-317            Tool Safety 298            Safety First: Handling Squares 300; Hammer Safety 303; Wrench Safety 307; Pliers Safety 309; Chisel Safety 310; Handsaw Safety 313            Lesson 7.4 Power Tools and Equipment 318-333            Safety First: Drill Press Safety 319; Band Saw Safety 320; Power Tool Safety 321; Circular Saw Safety 322; Jigsaw Safety 323; Drill Safety 323; Router Safety 323; Sander Safety 325; Grinder Safety 325; Table Saw Safety 327-328; Radial Arm Saw Safety 329            Measuring Tools 339-340</p>	<p>AA #1 146            SAE #1 147            SAE #1-#3 164            CA #2 188            CA #3 189            SAE #2 317            SAE #1 333            EX #1 393</p>
<p>Perform calculations and measurements used in agricultural technology</p>	<p>Fluid Quantities 419-420            Conversions 421            Dry Quantities 422            Ratios 423            Fractions 423-424            Percentages 424            Calculating Length and Area 426-427            Calculating Volume 427            Statistics 428</p>	<p>Hands-On Agriculture: Using Squares 340            Math Practice Problems 432</p>
<p>Describe basic welding, electrical, plumbing, and carpentry practices</p>	<p>Lesson 7.7 Principles of Electricity 358-377            Lesson 7.8 Introduction to Plumbing 378-392</p>	<p>ST #2 263            AA #1 391            TC #1 392            SAE #2 392</p>
<p>Explain maintenance of agricultural and livestock containment structures</p>	<p>Lesson 7.5 Agricultural Design and Fabrication 334-345</p>	<p>ST #1 263            AA #2 367</p>
Agri-Business		
<p>Identify sources of credit</p>	<p>Loans 404</p>	
<p>Use appropriate tax management skills</p>		<p>ST #4, #5 434</p>

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		ST #3 131 SAE #1 317 ST #4 434 ST #5 434 ST #4 548	
Describe types of farm businesses and enterprises, including cooperatives	Business Structures 408-410		
Identify assets, liabilities, and net worth	Assets 402-403 Liabilities 404 Net Worth 404 STEM Connection: Calculating Net Worth 505	AA #1 416 SAE #1 Personal Financial Management and Planning 417 SAE #2 Entrepreneurship 417	
Calculate net worth, income and expenses, and cash ow statements	STEM Connection: Calculating Net Worth 505 Exchange of Money (income/expenses) 405-406 Cash Flow Statement (Figure 8-14) 406	AA #2 p416	
Identify fixed and variable costs	Economics in Agribusiness 397-401		
Compute market values of livestock and costs of ownership	Market Analysis 411	SAE #6 508 EX #1-#5 549 AA #1 589 ST #4 614	
Interpret and apply analysis of financial tools and recordkeeping systems	Keeping Accurate Agribusiness Records 401-407	ST #2 p434	
Determine factors of risk management	Risk Management 407-408		
Identify marketing and distribution networks, channels, and processes	Business Management and Marketing 408-412	EX #1 Marketing Plan CDE p435	
Identify agricultural-based sales and marketing skills	Business Management and Marketing 408-412 FFA Connection: Marketing Plan CDE 409		
Identify principles of agri-business economics, including supply/demand	Economics in Agribusiness 397-401 Supply and Demand 399		
Describe career opportunities and advancement pathways	Career Connections throughout text include job descriptions, educational requirements, and median salaries	SAE #1 15 SAE #1 109	SAE #1 670 SAE #1 705

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	<p>Production Agriculturalist 12; Geneticist 7; Market Research Analyst 9; Human Resources Director 127; Agricultural Engineer 144; Agricultural Equipment Sales 183; Agricultural Research, Experiment Station Director 198; Agricultural and Food Scientists 210; Biomedical Engineer 226; General Contractor 247; Wind Turbine Technician 281; Agricultural Engineer 293; Farm Equipment Service Technician 342; Electrical Engineer 363; Licensed Electrician 373; Certified Public Accountant (CPA) 413; Agricultural Fabricator 429; International Shipping Specialist 449</p> <p>Community Garden Program Manager 455; USDA FSIS Veterinarian 467; Animal Nutritionist 483; Equine Chiropractor 534; Livestock Veterinarian 584; Avian Veterinarian 635; Aquaculture Manager 651; Hunting Preserve Manager 667; Rendering Plant Operator 678; Crop Consultant 718; Grain Inspector 731; Cotton Cooperative Manager 741; Food Safety Inspector 755; Floral Designer 770; Ecologist 786; Reservoir Manager 804; Meteorologist 820; Surveying and Mapping Technicians 836; Natural Resources Conservation Service Civil Engineer 851; Soil Scientist 869; Hydrologist 884; Water Quality Specialist 897; Heavy Equipment Operator 910; Conservation Officer 928; Wildlife Biologist 941; Recycler 952; Arborist/Urban Forester 970; Forester 983</p> <p>SAE for ALL Profiles</p> <p>Brylee Ferre, Learning About Agriculture through an SAE 2; Dr. Jim Connors, An SAE in Motions 6; Maggie Elliot, Connecting People to Careers in Agriculture 90; Albert Davis, Playing It Safe in the Shop 134; Shelle Lenssen, Science and an SAE 190; Juan Navarro, UAVs and Production Farming 232; Paul Harris, Lawnmower Repair to Engineering 264; Chase and Kami Holt, The Business of an SAE 394; Spanish Fork FFA Chapter, Local Food from School-Based SAE 436; Karley Rayfield, Beef Cattle Production 490; Matthew Collins, Market Lamb Production 550; Nathan Kindall, A Sweet SAE in Honey Production 616; Ariel Swinson on the Swinson Family Farm 684; Jake Tobin, Battling Invasive Species 776; Therese Becher, Soil and Water Conservation 842; Luke Burris, Wildlife Conservation 916; Kyle Hale, Maple Syrup Production 958</p>	<p>SAE #1-#3 131 ST #1 131 CA #3 132 SAE #3 250 SAE #2 262 SAE #1-#2 285 SAE #1 367 SAE #1 392 ST #1 434 SAE #1 508 SAE #1 547 AA #1 575 SAE #1 638 SAE #1 654</p>	<p>SAE #1 722 SAE #1 734 SAE #3 790 SAE #1 808 SAE #1-#2 824 SAE #1-#2 839 SAE #1-#2 854 SAE #1-#2 873 SAE #1 887 SAE #1, #3 913 SAE #1 931 SAE #1 974 SAE #1 986 CA #1 987</p>

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<p>Performance Assessment</p> <p>NOCTI performance assessments allow individuals to demonstrate their acquired skills by completing actual jobs using the tools, materials, machines, and equipment related to the technical area.</p>	<p>Administration Time: 3 hours and 5 minutes</p> <p>Number of Jobs: 6</p> <p>Areas Covered: vehicle maintenance 20%; calculate net worth 28%; Determine Genotypes and Phenotypes (Punnett Square) 14%; Compute Acreage 14%</p>	
<p>20% Vehicle Maintenance</p> <p>Participants will record vehicle make and model, check oil, record fuel reading, record recommended and actual tire inflation psi, check engine coolant level, complete vehicle maintenance worksheet, and return work area to original condition.</p>		
<p><b>28% Calculate Net Worth</b></p>		
<p>Participants will identify and list current assets, intermediate assets, long-term assets, total assets, current liabilities, absence of intermediate liabilities, long-term liabilities, net worth, total liabilities and capital, and current capital ratio.</p>	<p>Business Structures 408-410</p> <p>Assets 402-403</p> <p>Liabilities 404</p> <p>Net Worth 404</p> <p>STEM Connection: Calculating Net Worth 505</p> <p>STEM Connection: Calculating Net Worth 505</p> <p>Exchange of Money (income/expenses) 405-406</p> <p>Cash Flow Statement (Figure 8-14) 406</p> <p>Economics in Agribusiness 397-401</p> <p>Market Analysis 411</p> <p>Keeping Accurate Agribusiness Records 401-407</p> <p>Risk Management 407-408</p> <p>Business Management and Marketing 408-412</p> <p>Business Management and Marketing 408-412</p> <p>FFA Connection: Marketing Plan CDE 409</p> <p>Economics in Agribusiness 397-401</p> <p>Supply and Demand 399</p>	<p>AA #1 416</p> <p>SAE #1 Personal Financial Management and Planning 417</p> <p>SAE #2 Entrepreneurship 417</p> <p>AA #2 p416</p> <p>ST #2 p434</p> <p>EX #1 Marketing Plan CDE p435</p>
<p>14% Determine Genotypes and Phenotypes (Punnett Square)</p>		

NOCTI	NARRATIVE/ILLUSTRATIONS	ACTIVITIES/APPLICATION
<p>The end of lesson and end of chapter questions and activities are abbreviated as follows: AA = Analyze and Apply, TC = Thinking Critically, SAE for All Opportunities = SAE, ST = STEM and Academic Activities, Communicating about Agriculture CA = Extending Your Knowledge = EX</p> <p>Features abbreviations: Essential Questions = EQ, Hands-On Agriculture = HOA, STEM Connection = STC, Ag Ed Connection Ag Ed;</p>		
<p>Participants will complete a Punnett square, identify four phenotypes, and list 6 genotypes and the number of each.</p>	<p>Genetic Engineering 216            Genetics in Agriculture 217            Genetic Engineering and Animal Production 221-229            Genetically Modified Organisms 216-221</p>	
<p><i>14% Compute Acreage</i></p>		
<p>Participants will compute and record total, corn, potato, wheat, and total acreage.</p>	<p>Calculating Length and Area 426-427</p>	<p>TC #1 p 433</p>
<p><i>Compute Acreage Maximum Time: 30 minutes</i></p> <p>Participant Activity: The participant will use a diagram provided to calculate total acreage and calculate the amount of acreage that is used for corn, wheat, and potatoes.</p>	<p>Calculating Length and Area 426-427</p>	