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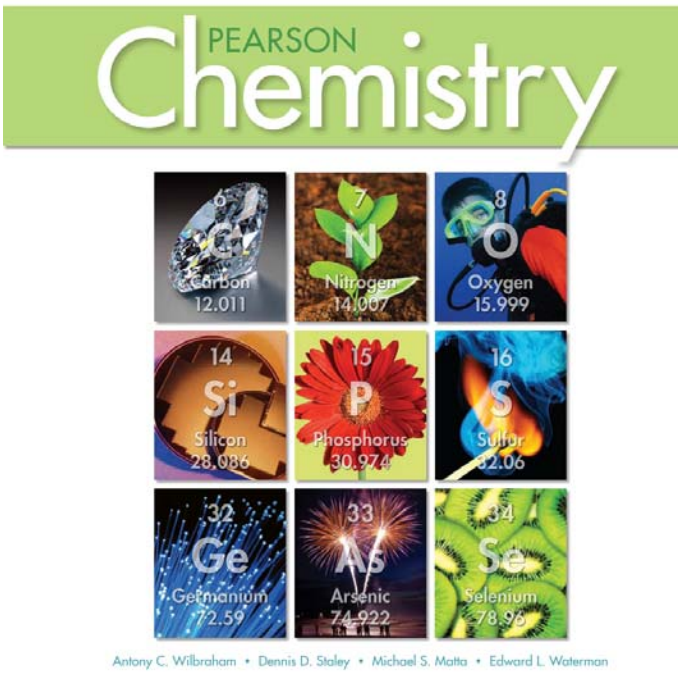


To the

# Missouri Science Course Level Expectations for Chemistry I

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## INTRODUCTION

This document demonstrates how ***Pearson Chemistry* ©2012** meets the Missouri Course Level Expectations for Chemistry I. Correlation page references are to the Student and Teacher Editions and are cited at the page level.

***Pearson Chemistry*** combines proven and tested content with cutting-edge digital support and hands-on learning opportunities. This program provides you with everything you need to engage and motivate your students, as well as the tools to support the varied types of learners in your classroom.

Built on Grant Wiggins' *Understanding by Design* framework, this learning model connects curriculum, instruction, and assessment to the "Big Ideas" of chemistry that develops deep understanding.

***Pearson Chemistry*** provides all of the problem-solving and math support that students need to be successful in the course, with ample opportunity for practice both in the Student Edition and in the program's digital resources.

***Pearson Chemistry*** helps you meet the unique learning styles of each student in your classroom with a variety of resources. A variety of assessment opportunities helps you monitor student progress ensure student success on high-stakes tests.

**Pearsonchem.com** integrates key concepts from the text and brings them alive online with complete Student and Teacher eTexts, animations, virtual labs, tutorials, practice problems, and a comprehensive teacher center. Digital references are referenced at point-of-use in the textbook. PearsonChem.com also offers valuable tools you can use to monitor student's progress through your course.

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| **Science Course Level Expectations:** | |
| *A Framework for Instruction and Assessment* | |
| **SCOPE AND SEQUENCE** | |
| This is one model of a curriculum scope and sequence. Grade level expectations for grades K-8 are clustered into suggested units and arranged to support development of conceptual understanding. School district personnel are encouraged to adapt this model as necessary in order to better meet the needs of their students. The Expectations described in Strand 7: Inquiry and Strand 8: Science/Technology/Human Activity should be made a priority and integrated throughout every teaching unit in each of the other strands. Grade-span assessments will be administered in science at grades 5, 8, and 11 in the spring of the 2007-2008 school year. Beginning no later than spring 2009, students completing Biology I (or its equivalent) will be administered the Biology I end-of-course assessment. The development and administration of future end-of-course assessments is dependent upon decisions of the State Board of Education and state funding. | |
| **Strand 1: Properties and Principles of Matter and Energy** | |
| **1. Changes in properties and states of matter provide evidence of the atomic theory of matter** | |
| **Concept** | |
| **Chemistry I** | |
| **A. Objects, and the materials they are made of, have properties that can be used to describe and classify them** | |
| a. Compare the densities of regular and irregular objects using their respective measures of volume and mass | **SE/TE:** 80-82, 89, 322 |
| b. Identify pure substances by their physical and chemical properties (i.e., color, luster/reflectivity, hardness, conductivity, density, pH, melting point, boiling point, specific heat, solubility, phase at room temperature, chemical reactivity) | **SE/TE:** 35, 44, 54, 56, 561 |
| c. Classify a substance as being made up of one kind of atom (element) or a compound when given the molecular formula or structural formula (or electron dot diagram) for the substance | **SE/TE:** 45-47, 54, 55 |
| d. Compare and contrast the common properties of metals, nonmetals, metalloids (semi-conductors), and noble gases | **SE/TE:** 164-166, 185, 191, 484, R2, R6, R10, R14, R20, R24, R28, R36 |

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| **B. Properties of mixtures depend upon the concentrations, properties, and interactions of particles** | |
| a. Classify solutions as either dilute or concentrated; as either saturated, unsaturated, or supersaturated | **SE/TE:** 520, 522, 525 |
| b. Compare and contrast the properties of acidic, basic, and neutral solutions | **SE/TE:** 653-654, 656, 682 |
| c. Predict the effects of solvent and solute polarity on solubility ("like dissolves like"); and predict the effects of temperature, surface area, particle size, and agitation on rates of solubility | **SE/TE:** 521-524 |
| **C. Properties of matter can be explained in terms of moving particles too small to be seen without tremendous magnification** | |
| Not assessed at this level | |
| **D. Physical changes in states of matter due to thermal changes in materials can be explained by the Kinetic Theory of Matter** | |
| a. Using the Kinetic Theory model, explain the changes that occur in the distance between atoms/molecules and temperature of a substance as energy is absorbed or released during a phase change | **SE/TE:** 421-422, 424, 442, 443-445, 450-454, 478, 480-483, 485 |
| b. Predict the effect of a temperature change on the properties (e.g., pressure, density) of a material (solids, liquids, gases) | **SE/TE:** 252-253, 257, 425, 430, 431, 442, 443 |
| c. Predict the effect of pressure changes on the properties (e.g., temperature, density) of a material (solids, liquids, gases) | **SE/TE:** 429, 523, 614 |
| **E. The atomic model describes the electrically neutral atom** | |
| a. Describe the atom as having a dense, positive nucleus surrounded by a cloud of negative electrons | **SE/TE:** 107-109, 121, 122-124, 302 |
| b. Calculate the number of protons, neutrons, and electrons of an isotope, given its mass number and atomic number | **SE/TE:** 114-115, 119, 122, 125, 156, 176, 190, 194-199, 218, 342, 380, 416, R52 |
| c. Describe the information provided by the atomic number and the mass number (i.e., electrical charge, chemical stability) | **SE/TE:** 112-113, 115, 125 |

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| **F. The periodic table organizes the elements according to their atomic structure and chemical reactivity** | |
| a. Explain the structure of the periodic table in terms of the elements with common properties (groups/families) and repeating properties (periods) | **SE/TE:** 164-166, 167-173, 185, 187, 218, 342, R2-R3, R6-R7, R10-R11, R14-R15, R20-R21, R24-R25, R28-R29, R32, R36-R37 |
| b. Classify elements as metals, nonmetals, metalloids (semi-conductors), and noble gases according to their location on the Periodic Table | **SE/TE:** 164-166, 170, 185, 191, 194, 484, R2, R6, R10, R14, R20, R24, R28, R36 |
| c. Predict the chemical reactivity of elements, and the type of bonds that may result between them, using the Periodic Table | **SE/TE:** 123, 361, 717<br>**TE:** 115, 178, 197, 237, 877 |
| **G. Properties of objects and states of matter can change chemically and/or physically** | |
| a. Distinguish between physical and chemical changes in matter | **SE/TE:** 37, 42-43, 48-49, 58, 571 |
| **H. Chemical bonding is the combining of different pure substances (elements, compounds) to form new substances with different properties** | |
| a. Describe how the valence electron configuration determines how atoms interact and may bond | **SE/TE:** 194-195, 763 |
| b. **Chem II Content**<br>Predict the reaction rates of different substances based on their properties (i.e., concentrations of reactants, pressure, temperature, state of matter, surface area, type of reactant material) | **SE/TE:** 598-601, 638-639, 643, 794, R66 |
| c. Compare and contrast the types of chemical bonds (i.e., ionic, covalent) | **SE/TE:** 201-203, 213, 214-215, 226, 256, 260, 302, 904 |
| d. Predict the products of an acid/base (neutralization), oxidation (rusting), and combustion (burning) reaction | **SE/TE:** 363-365, 367, 379, 723 |
| **I. Mass is conserved during any physical or chemical change** | |
| a. Compare the mass of the reactants to the mass of the products in a chemical reaction or physical change as support for the Law of Conservation of Mass | **SE/TE:** 349-354, 359, 361, 363, 365, 367, 370-371, 373-379, 381, 388-389, 399, 404, 416, 446, 484, 514, 642, 758, 904, R57-R58 |
| b. Recognize whether the number of atoms of the reactants and products in a chemical equation are balanced | **SE/TE:** 349-354, 359, 361, 363, 365, 367, 370-371, 373, 374, 375, 376, 377-379, 381, 388-389, 399, 404, 416, 446, 484, 514, 642, 758, 904, R57-R58 |

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| **2. Energy has a source, can be stored, and can be transferred but is conserved within a system** | |
| **Concept** | |
| **Chemistry I** | |
| **A. Forms of energy have a source, a means of transfer (work and heat), and a receiver** | |
| a. Differentiate between thermal energy (the total internal energy of a substance which is dependent upon mass), heat (thermal energy that transfers from one object or system to another due to a difference in temperature), and temperature (the measure of average kinetic energy of molecules or atoms in a substance) | **SE/TE:** 78, 556 |
| b. Describe the relationship among wavelength, energy, and frequency as illustrated by the electromagnetic spectrum | **SE/TE:** 138-141, 148, 149, 151-155, 157, 260, 416, 446, R53 |
| c. **Chem II Content** Describe sources and common uses of different forms of energy: chemical (the energy stored in the electrical fields between atoms in a compound), nuclear, thermal, mechanical, electromagnetic | **SE/TE:** 10, 142-143, 420, 424, 426, 556-557, 576, 596, 627, 732-735, 839-840 |
| d. Describe the effect of different frequencies of electromagnetic waves on the Earth and living organisms (e.g., radio, infrared, visible, ultraviolet, gamma, cosmic rays) | **SE/TE:** 139, 152-153 |
| **B. Mechanical energy comes from the motion (kinetic energy) and/or relative position (potential energy) of an object** | |
| a. **Chem II Content** Relate kinetic energy to an object's mass and its velocity | *Opportunities to address this standard can be found on the following pages:*<br>**SE/TE:** 420, 423-424, 426 |
| **C. Electromagnetic energy from the Sun (solar radiation) is a major source of energy on Earth** | |
| **a. Chem II Content** Describe how electromagnetic energy is transferred through space as electromagnetic waves of varying wavelength and frequency | **SE/TE:** 139-140, 152-153 |

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| **D. Chemical reactions involve changes in the bonding of atoms with the release or absorption of energy** | |
| a. Describe evidence of energy transfer and transformations that occur during exothermic and endothermic chemical reactions | **SE/TE:** 562-568, 569-575, 578-582 |
| **E. Nuclear energy is a major source of energy throughout the universe** | |
| a. Describe how changes in the nucleus of an atom during a nuclear reaction (i.e., nuclear decay, fusion, fission) result in emission of radiation | **SE/TE:** 874, 888-891 |
| **F. Energy can be transferred within a system as the total amount of energy remains constant (i.e., Law of Conservation of Energy)** | |
| a. Classify the different ways to store energy (i.e., chemical, nuclear, thermal, mechanical, electromagnetic) and describe the transfer of energy as it changes from kinetic to potential, while the total amount of energy remains constant, within a system (e.g., using gasoline to move a car, photocell generating electricity, biochemical reaction, energy generated by nuclear reactor) | **SE/TE:** 10, 420, 423-424, 556, 576-577, 596, 732-735, 889-890 |

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| **Strand 5: Processes and Interactions of the Earth's Systems** | |
| **(Geosphere, Atmosphere, and Hydrosphere)** | |
| **1. Earth's Systems (geosphere, atmosphere, and hydrosphere) have common components and unique structures** | |
| **Concept** | |
| **Chemistry I** | |
| **B. The hydrosphere is composed of water (a material with unique properties) and other materials** | |
| a. Recognize the importance of water as a solvent in the environment as it relates to acid rain and water pollution | **SE/TE:** 494, 621, R23 |
| **C. The atmosphere (air) is composed of a mixture of gases, including water vapor, and minute particles** | |
| a. Relate the composition of gases and temperature of the layers of the atmosphere (i.e., troposphere, stratosphere, ionosphere) to cloud formation and transmission of radiation (e.g., ultraviolet, infrared) | **SE/TE:** 3, 6, 83, 224, 226, 230, 234, 237, 420-421, 455 |
| b. Describe the causes and consequences of observed and predicted changes in the ozone layer | **SE/TE:** 226, 237, 735, R27 |
| **2. Earth's Systems (geosphere, atmosphere, and hydrosphere) interact with one another as they undergo change by common processes** | |
| **Concept** | |
| **Chemistry I** | |
| **F. Climate is a description of average weather conditions in a given area due to the transfer of energy and matter through Earth's systems.** | |
| a. Provide evidence (e.g., variations in sea level, glaciation, and permafrost layers, fossils, desertification) that supports theories of climate change due to natural phenomena and/or human interactions | **SE/TE:** R18 |

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| **Strand 7: Scientific Inquiry** | |
| **1. Science understanding is developed through the use of science process skills, scientific knowledge, scientific investigation, reasoning, and critical thinking** | |
| **Concept** | |
| **Chemistry I** | |
| **A. Scientific inquiry includes the ability of students to formulate a testable question and explanation, and to select appropriate investigative methods in order to obtain evidence relevant to the explanation** | |
| a. Formulate testable questions and hypotheses | *Opportunities to address this standard can be found on the following pages:*<br><br>**SE/TE:** 51, 92, 120, 149, 200, 254, 324, 374, 399, 435, 475, 508, 545, 583, 635, 717, 752, 849<br><br>**TE only:** 254, 475 |
| b. Analyzing an experiment, identify the components (i.e., independent variable, dependent variables, control of constants, multiple trials) and explain their importance to the design of a valid experiment | **SE/TE:** 17, 207, 238, 254, 435, 491, 662, 750 |
| c. Design and conduct a valid experiment | **SE/TE:** 17, 51, 92, 149, 184, 200, 254, 374, 399, 435, 475, 508, 545, 551, 583, 635, 670, 717, 752, 787, 849, 887 |
| d. Recognize it is not always possible, for practical or ethical reasons, to control some conditions (e.g., when sampling or testing humans, when observing animal behaviors in nature) | *Opportunities to address this standard can be found on the following pages:*<br><br>**SE/TE:** 16, 17, 51, 92, 149, 184, 200, 254, 374, 399, 435, 475, 508, 545, 551, 583, 635, 670, 717, 752, 787, 849, 887 |
| e. Acknowledge some scientific explanations (e.g., explanations of astronomical or meteorological phenomena) cannot be tested using a controlled laboratory experiment, but instead by using a model, due to the limits of the laboratory environment, resources, and/or technologies | *Opportunities to address this standard can be found on the following pages:*<br><br>**SE/TE:** 16, 17, 887, 896 |
| f. Acknowledge there is no fixed procedure called “the scientific method”, but that some investigations involve systematic observations, carefully collected and relevant evidence, logical reasoning, and some imagination in developing hypotheses and other explanations | **SE/TE:** 15-17 |

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| g. Evaluate the design of an experiment and make suggestions for reasonable improvements | **SE/TE:** 17, 51, 92, 149, 184, 200, 254, 374, 399, 435, 475, 508, 545, 551, 583, 635, 670, 717, 752, 787, 849, 887 |
| **B. Scientific inquiry relies upon gathering evidence from qualitative and quantitative observations** | |
| a. Make qualitative and quantitative observations using the appropriate senses, tools and equipment to gather data (e.g., microscopes, thermometers, analog and digital meters, computers, spring scales, balances, metric rulers, graduated cylinders) | **SE/TE:** 17, 39, 51, 72, 92, 142, 149, 200, 207, 208, 238, 254, 279, 295, 324, 328, 354, 355, 374, 399, 404, 435, 437, 467, 475, 491, 508, 519, 545, 571, 583, 600, 635, 662, 670, 671, 681, 699, 717, 744, 750, 752, 787, 818, 828, 849, 887, 896 |
| b. Measure length to the nearest millimeter, mass to the nearest gram, volume to the nearest milliliter, force (weight) to the nearest Newton, temperature to the nearest degree Celsius, time to the nearest second | **SE/TE:** 78-79, 82, 88, 91, 218, R46 |
| c. Determine the appropriate tools and techniques to collect, analyze, and interpret data | **SE/TE:** 17, 39, 51, 92, 120, 200, 207, 238, 254, 279, 324, 328, 354, 374, 399, 404, 435, 467, 475, 491, 508, 519, 545, 583, 600, 635, 662, 670, 717, 750, 752, 849, 887 |
| d. Judge whether measurements and computation of quantities are reasonable | **SE/TE:** 23-24, 144, 465-466, 471, 530, 543-545, 561 |
| e. Calculate the range, average/mean, percent, and ratios for sets of data | **SE/TE:** 92, 97, 98, 119, 120, 122, 155, 442-444, 552, 590, 594-595 |
| f. Recognize observation is biased by the experiences and knowledge of the observer (e.g., strong beliefs about what should happen in particular circumstances can prevent the detection of other results) | *Opportunities to address this standard can be found on the following pages:*<br><br>**SE/TE:** 51, 120, 200, 238, 254, 328, 374, 399, 435, 467, 635, 699, 717, 752, 849, 887 |
| **C. Scientific inquiry includes evaluation of explanations (laws/principles, theories/models) in light of evidence (data) and scientific principles (understandings)** | |
| a. Use quantitative and qualitative data as support for reasonable explanations (conclusions) | **SE/TE:** 175, 178, 429, 438, 456, 468, 587, 589, 601, 641, 665, 686-687, 765, 773, 882 |
| b. Analyze experimental data to determine patterns, relationships, perspectives, and credibility of explanations (e.g., predict/extrapolate data, explain the relationship between the independent and dependent variable) | **SE/TE:** 8, 59, 175, 178, 257, 341, 423, 429, 456, 458, 521, 765, 793 |

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| c. Identify the possible effects of errors in observations, measurements, and calculations, on the validity and reliability of data and resultant explanations (conclusions) | **SE/TE:** 92, 120, 571<br><br>**TE only:** 17, 563 |
| d. Analyze whether evidence (data) and scientific principles support proposed explanations (laws/principles, theories/models) | *Opportunities to address this standard can be found on the following pages:*<br><br>**SE/TE:** 102-103, 107-109, 129-130, 143, 147-148, 240-246, 420 |
| **D. The nature of science relies upon communication of results and justification of explanations** | |
| a. Communicate the procedures and results of investigations and explanations through: | |
| oral presentations | **TE:** 18, 27, 39, 80, 91, 108, 120, 142, 149, 200, 281, 410, 635, 713 |
| drawings and maps | **SE/TE:** 25, 182<br><br>**TE:** 240, 251, 323, 336, 357 |
| data tables (allowing for the recording and analysis of data relevant to the experiment such as independent and dependent variables, multiple trials, beginning and ending times or temperatures, derived quantities) | **SE/TE:** 29, 190, 258, 482, 887 |
| graphs (bar, single, and multiple line) | **SE/TE:** 175, 178, 429, 438, 456, 468, 587, 589, 601, 641, 665, 686-687, 765, 773, 882 |
| equations and writings | **SE/TE:** 72, 92, 120, 149, 324, 328, 399, 467, 545, 571, 583, 635, 670, 849 |
| b. Communicate and defend a scientific argument | *Opportunities to address this standard can be found on the following pages:*<br><br>**SE/TE:** 51, 92, 120, 149, 200, 254, 295, 324, 374, 399, 435, 475, 508, 545, 583, 635, 670, 717, 752, 828, 849, 887 |
| c. Explain the importance of the public presentation of scientific work and supporting evidence to the scientific community (e.g., work and evidence must be critiqued, reviewed, and validated by peers; needed for subsequent investigations by peers; results can influence the decisions regarding future scientific work) | *Opportunities to address this standard can be found on the following pages:*<br><br>**SE/TE:** 51, 92, 120, 149, 200, 254, 295, 324, 374, 399, 435, 475, 508, 545, 583, 635, 670, 717, 752, 828, 849, 887 |

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| **Strand 8: Impact of Science, Technology and Human Activity** | |
| **1. The nature of technology can advance, and is advanced by, science as it seeks to apply scientific knowledge in ways that meet human needs** | |
| **Concept** | |
| **Chemistry** | |
| **A. Designed objects are used to do things better or more easily and to do some things that could not otherwise be done at all** | |
| Not assessed at this level | |
| **B. Advances in technology often result in improved data collection and an increase in scientific information** | |
| **2. Historical and cultural perspectives of scientific explanations help to improve understanding of the nature of science and how science knowledge and technology evolve over time** | |
| **Concept** | |
| **Chemistry I** | |
| **A. People of different gender and ethnicity have contributed to scientific discoveries and the invention of technological innovations** | |
| a. Recognize contributions to science are not limited to the work of one particular group, but are made by a diverse group of scientists representing various ethnic and gender groups | **SE/TE:** 18-19, 102-103, 105-109, 128-130 |
| **B. Scientific theories are developed based on the body of knowledge that exists at any particular time and must be rigorously questioned and tested for validity** | |
| a. Identify and describe how explanations (laws/principles, theories/models) of scientific phenomena have changed over time as a result of new evidence (e.g., basic structure of matter, structure of an atom) | **SE/TE:** 15, 17, 102-104, 105-109, 123-124, 128-130, 133, 152 |

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| **3. Science and technology affect, and are affected by, society** | |
| **Concept** | |
| **Chemistry I** | |
| **A. People, alone or in groups, are always making discoveries about nature and inventing new ways to solve problems and get work done** | |
| Not assessed at this level | |
| **B. Social, political, economic, ethical and environmental factors strongly influence, and are influenced by, the direction of progress of science and technology** | |
| a. Analyze the roles of science and society as they interact to determine the direction of scientific and technological progress (e.g., prioritization of and funding for new scientific research and technological development is determined on the basis of individual, political and social values and needs; understanding basic concepts and principles of science and technology influences debate about the economics, policies, politics, and ethics of various scientific and technological challenges) | *Found throughout the text. See, for example:* **SE/TE:** 7-11, 12-13, 14-15, 19, 27, 28-30, 52-53, 83, 101, 102-104, 105-109, 110-111, 121, 122-124, 126-127, 133, 138, 146, 155, 163, 183, 189, 193, 211-212, 217, 218, 239, 270, 305, 334-335, 355, 368, 397, 440-441, 455, 476-477, 502-503, 532-533, 576-577, 602-603, 681, 700, 716, 736, 774, 782-786, 803, 821, 853, 859-861, 867, 888-890, 892-893, 894-897, R2-R41 |
| b. Identify and describe major scientific and technological challenges to society and their ramifications for public policy (e.g., global warming, limitations to fossil fuels, genetic engineering of plants, space and/or medical research) | **SE/TE:** 1, 7-11, 27, 28, 30, 110-111, 502-503, 602-603, 784, 867, 892-893 |
| **C. Scientific ethics require that scientists must not knowingly subject people or the community to health or property risks without their knowledge and consent** | |
| **D. Scientific information is presented through a number of credible sources, but is at times influenced in such a way to become non-credible** | |
| a. Evaluate a given source for its scientific credibility (e.g., articles in a new periodical quoting an "eye witness", a scientist speaking within or outside his/her area of expertise) | **SE/TE:** 19<br>**TE:** 18 |
| b. Explain why accurate record-keeping, openness, and replication are essential for maintaining an investigator's credibility with other scientists and society | **SE/TE:** 18-19 |