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| **TEXAS CTE LESSON PLAN**[www.txcte.org](http://www.txcte.org) |
| **Lesson Identification and TEKS Addressed** |
| **Career Cluster** | Law, Public Safety, Corrections, & Security |
| **Course Name** | Forensic Science |
| **Lesson/Unit Title** | Using the Scientific Method |
| **TEKS Student Expectations** | **130.339. (c) Knowledge and Skills**(3) The student uses scientific methods and equipment during laboratory and field investigations. (B) The student is expected to know that scientific hypotheses are tentative and testable statements that must be capable of being supported or not supported by observational evidence. Hypotheses of durable explanatory power that have been tested over a wide variety of conditions are incorporated into theories(C) The student is expected to know scientific theories are based on natural and physical phenomena and are capable of being tested by multiple independent researchers. Unlike hypotheses, scientific theories are well-established and highly reliable explanations, but they may be subject to change as new areas of science and new technologies are developed(E) The student is expected to plan and implement descriptive, comparative, and experimental investigations, including asking questions, formulating testable hypotheses, and selecting equipment and technology(F) The student is expected to collect and organize qualitative and quantitative data and make measurements with accuracy and precision using tools such as calculators, spreadsheet software, data-collecting probes, computers, standard laboratory glassware, microscopes, various prepared slides, stereoscopes, metric rulers, electronic balances, gel electrophoresis apparatuses, micro-pipettors, hand lenses, Celsius thermometers, hot plates, lab notebooks or journals, timing devices, cameras, Petri dishes, lab incubators, dissection equipment, meter sticks, and models, diagrams, or samples of biological specimens or structures |
| **Basic Direct Teach Lesson**(Includes Special Education Modifications/Accommodations and one English Language Proficiency Standards (ELPS) Strategy) |
| **Instructional Objectives** | The student will be able to:1. Demonstrate conversions of measurements from English to International System (SI) units.
2. Distinguish between physical and chemical properties.
3. Determine the elements within a compound or mixture.
4. Identify the four types of chemical reactions.
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| **Rationale** | The ability to use scientific methods is a critical skill in problem solving and forensic science. An investigator will use scientific methods to analyze evidence, determine what happened at a crime scene, and to narrow down a suspect pool. |
| **Duration of Lesson** | 3.5 hours |
| **Word Wall/Key Vocabulary***(ELPS c1a,c,f; c2b; c3a,b,d; c4c; c5b) PDAS II(5)* |  |
| **Materials/Specialized Equipment Needed** | * Chemical Reactions Tree Map
* Chemical Reactions Tree Map Key
* Cooperative Teams Rubric
* Discussion Rubric
* Conversion Quiz
* Conversion Quiz Key
* Metric Conversion Worksheet
* Metric Conversion Worksheet Key
* White Powder Lab
* 10 Unknown Solids – Data Sheet
* Reactions Worksheet
* Reactions Worksheet Key
* Unknown Lab Teacher Notes
* Unknowns Lab
* Calculators
* Computer
* Projector

*White Powder Lab** Boric acid, H3BO3
* Sodium Chloride, NaCl
* Calcium carbonate, CaCO3
* Calcium sulfate, CaSO4
* Sodium hydroxide, NaOH
* Cornstarch
* Sodium carbonate, Na2CO3
* Sucrose, C12H22O11
* Sodium bicarbonate, NaHCO3
* Magnesium sulfate, MgSO4
* Iodine tincture, 6 drops
* Sodium hydroxide solution, 0.2M, 18 drops
* Isopropyl alcohol solution, 12mL
* White vinegar, 4mL
* Phenolphthalein solution,1%
* Deionized water
* 10 Test tubes, 13x100mm
* Stirring rod
* Ring stand & ring
* Test tube rack
* Graduated cylinder, 10mL
* 250mL beaker
* Marking pen
* Bunsen burner

*Unknowns Lab** Vinegar
* Baking Soda
* Alum
* Overhead Transparencies
* Plastic beral pipettes
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| **Anticipatory Set**(May include pre-assessment for prior knowledge) | Do an Internet search for the following video: Fortune Teller Fish Amy Toy. Have the students watch the video. Then have them work in pairs and discuss how they would use scientific methods to figure out how the fortune fish works. You can find these fortune teller fish at many local party or toy shops. (An alternative to the video would be to give each pair of students a fortune teller fish and ask them to use scientific methods to figure it out.) Give a disclaimer for the students to not destroy the fish, so you can reuse them year after year. Use the Discussion Rubric for assessment. |
| **Direct Instruction \*** | 1. The Metric System
	1. The worldwide standard for measurements
	2. All measurements have two parts
		1. A number
		2. Units
	3. Based on multiples of ten
	4. Basic Units
		1. Length = meter
		2. Volume = liter
		3. Mass = gram
		4. Time = second
		5. Temperature = Kelvin
	5. Other Units
		1. Area = m2
		2. cm3 = mL (volume)
	6. Metric Prefixes
		1. Smaller
			1. Deci = 1/10
			2. Centi =1/100
				1. Milli = 1/1000
				2. Micro = 1/1,000,000
				3. Nano =1/1,000,000,000
		2. Larger
			1. Deka = 10
			2. Hecto = 100
			3. Kilo = 1000
	7. Examples
		1. Centimeter = 1/100 of a meter
		2. Milligram = 1/1000 of a gram
		3. Kiloliter = 1000 liters
	8. Remember
		1. King Henry Died by drinking chocolate milk
		2. Kilo, hecto, deka base deci, centi, milli
2. Dimensional Analysis (the Factor-Label Method)
	1. Steps
		1. Write down the given measurement
		2. Create one or more expressions of 1 using the following
			1. Put the given unit in the denominator (bottom) of the conversion
			2. Put the unit you want to convert to in the numerator (top)
			3. Remember (as in the example below), there are 100cm in 1m; therefore 100cm/1m = 1
		3. Cancel the redundant units (those in both the denominator and the numerator) and solve for the desired unit
	2. Example
		1. Convert 3.60 meters to inches
			1. 100cm = 1

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|  |  |  | 1m |  |  |  |  |  |
|  | b) 1in = 1 |  |  |  |  |  |
|  |  | 2.54cm |  |  |  |  |  |  |
| 2. | 3.60m x 100cm x |  | 1in | = ? |  |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  | 1m |  | 2.54cm |  |  |
| 3. | 3.60 | ~~m~~ | x 100 | ~~cm~~ |  | x |  | 1in | = ? |  |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  | 1 | ~~m~~ |  |  | 2.54 | ~~cm~~ | (360  2.54 = 141.7) |  |
| 4. | 3.60 x 100 x 1in = 141.7in |  |
|  | 2.54 |  |  |  |  |  |  |  |  |  |  |

1. Physical Properties
	1. Observed with the senses and can be determined without destroying the object
	2. Examples are color, shape, mass, length, odor, density, melting point, and boiling point
2. Chemical Properties
	1. Indicate how a substance reacts with something else
	2. The substance is changed while the chemical property is observed
	3. Examples are iron rusting, food digesting, marshmallows burning
3. Types of Reactions (Rxns)
	1. Synthesis Rxns
		1. Two or more substances combine to form a more complex substance
		2. A + B  AB
		3. For example, 4Al + 3O2  2Al2O3\* \*1 product formed
	2. Decomposition Rxns
		1. One substance breaks down to form two or more simpler substances
		2. AB  A + B
		3. For example, 2CaCO3\*  2CaO + 2CO2 \*1 reactant
	3. Single Replacement Rxns
		1. One substance is replaced in its compound by another substance
		2. A + BC  AC + B
		3. Zn + CuSO4  ZnSO4 + Cu
		4. Cl2 + 2KBr  2KCl + Br2
	4. Double Replacement Rxns
		1. Ions of two compounds exchange places to form two new compounds
		2. AB + CD  AD + CB
		3. For example, BaCl2 + Na2SO4  2NaCl + BaSO4
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| **Guided Practice \*** | White Powder Lab. Have students analyze 10 unknown powders to determine their identity using the White Powder Lab. They will use scientific method and observations of physical and chemical properties to make these determinations. Have the students complete the data chart and flowchart on the 10 Unknown Solids – Data Sheet. Answers will vary based on how you choose to set up the lab. Make a key after you assign numbers to the chemicals. The Cooperative Teams Rubric may also be used for assessment. |
| **Independent Practice/Laboratory Experience/Differentiated Activities \*** | Metric Conversions Worksheet. Have students use the steps of dimensional analysis that they learned, to convert between English and Metric measurements. Use the Metric Conversion Worksheet Key for assessment.Reactions Worksheet. Have students use their knowledge of the types of chemical reactions, to determine the types of reactions on the Reactions Worksheet. Use the Reactions Worksheet Key for assessment. |
| **Lesson Closure** |  |
| **Summative/End of Lesson Assessment \***  | * Conversion Quiz and Key
* Metric Conversion Worksheet Key
* Reactions Worksheet Key
* Chemical Reactions Tree Map Key
* Cooperative Teams Rubric
* Discussion Rubric
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| **References/Resources/****Teacher Preparation** | * Saferstein, Richard. *Forensic Science: An Introduction*. New Jersey: Pearson Prentice Hall, 2008.
* Do an Internet search for the following video: Fortune Teller Fish Amy Toy
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| **Additional Required Components** |
| **English Language Proficiency Standards (ELPS) Strategies** |  |
| **College and Career Readiness Connection[[1]](#footnote-1)** |  |
| **Recommended Strategies** |
| **Reading Strategies** |  |
| **Quotes** |  |
| **Multimedia/Visual Strategy****Presentation Slides + One Additional Technology Connection** |  |
| **Graphic Organizers/Handout** |  |
| **Writing Strategies****Journal Entries + 1 Additional Writing Strategy** |  |
| **Communication****90 Second Speech Topics** |  |
| **Other Essential Lesson Components** |
| **Enrichment Activity**(e.g., homework assignment) | For enrichment, students will perform the Unknowns Lab. Teacher notes are included with materials and setup directions. When setting up, make a key of your unknowns to assess students. |
| **Family/Community Connection** |  |
| **CTSO connection(s)** | SkillsUSA |
| **Service Learning Projects** |  |
| **Lesson Notes** |  |

1. Visit the Texas College and Career Readiness Standards at <http://www.thecb.state.tx.us/collegereadiness/CRS.pdf>, Texas Higher Education Coordinating Board (THECB), 2009. [↑](#footnote-ref-1)