Three characteristics of Rigor

1.

2.

3.

Rigor definition from CCSSI Math:

Rigor is about precision in argument:

first avoiding making false statements,

then saying more precisely what one assumes,

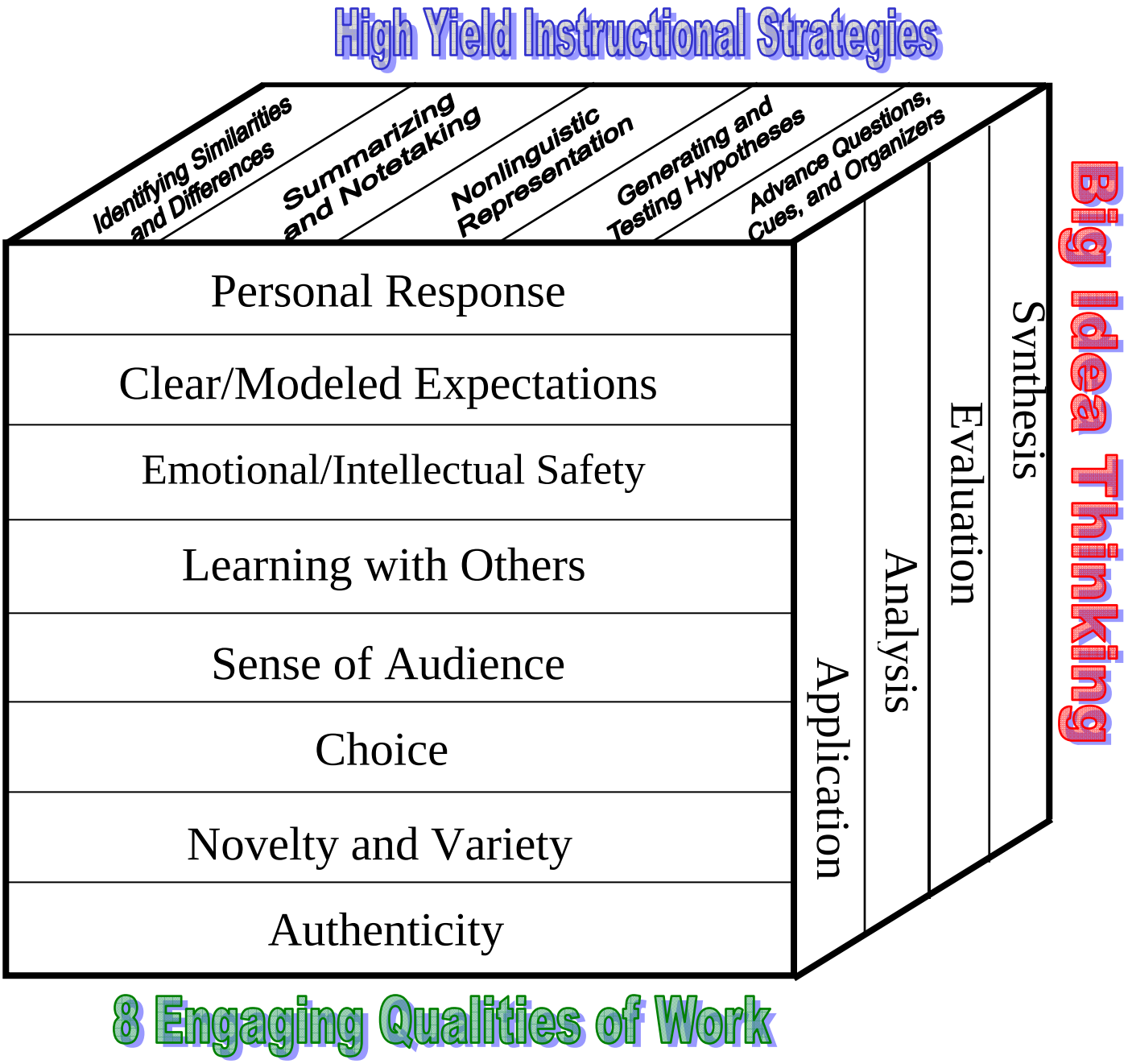
and providing the sequence of deductions one makes on this basis.

Assessments should also include tasks that examine a student's ability to

analyze a provided explanation,

identify flaws,

and correct them.



Based upon the work of

Marzano, R., Pickering, D. & Pollock, J. (2001). *Classroom Instruction That Works: Research-Based Strategies for Increasing Student Achievement.* Alexandria, VA: Association for Supervision and Curriculum Development.

Bloom, B., Englehart, M. Furst, E., Hill, W., & Krathwohl, D. (1956). *Taxonomy of educational objectives: The classification of educational goals. Handbook I: Cognitive domain*. New York, Toronto: Longmans, Green.

Schlechty, P. (2002) *Working on the Work.* San Francisco, CA: Jossey-Bass.

The Learning Cube can be found in the book *Writing as a Measure and Model of Thinking* (Flying Monkeys Press, 2008). Available at www.colleaguesoncall.com

Powerful Task Rubric for Designing Student Work

The "Rigor Divide"

	Power Component	1	2	3	4
Cognitive Demand	Bloom – Revised Taxonomy	Recall	Understand	Apply/Analyze	Evaluate/Create
	Examples	Name the steps	Follow the steps	Infer with text support	Argue, defend, or justify
	Antonetti/Garver – Patterns	Repeat patterns	Restate or reproduce patterns	Find patterns Find use for patterns	Compare patterns Add/combine/ignore patterns
	Webb – DOK (Assessment)	Recall	Skill/Concept	Strategic thinking	Extended thinking
	Stein/Smith – Mathematics	Memorization	Procedures without connections	Procedures with connections	Doing Mathematics
Academic Strategies*	Similarities and Differences	List facts about A and B	Parallel facts about A and B	Compare or contrast by trait	
	Summarizing/Notetaking	Copy	Restate	Personalize or make unique decisions about content	
	Nonlinguistic Representation	Copy other given forms	Place into other forms	Create a new representation	
	Generating/Testing Hypotheses	Copy	Restate "known" pattern	Identify and extend patterns	
Engaging Qualities**	Personal Response (Clear/Modeled Expectations)	Not necessary	Fill in the blank with "my" answer	Explain and support my ideas (open)	Explain and defend or justify my ideas
	Intellectual/Emotional Safety	Not required	Not required	Expression of concepts or recognized patterns	Expression of supported opinions or new ideas
	Learning with Others	Take turns talking	Listen and repeat	Interdependence in roles or mini tasks	Interdependence of ideas
	Sense of Audience	A partner	The class	An audience I want to appreciate me or my ideas	An audience I want to influence
	Novelty and Variety	Recall is fun or different	Product without concepts	Product with concepts	Perspective
	Authenticity	Teacher connects to world	Repeat real examples	Recognize real examples	Create real examples
	Questions	Closed with single right or wrong answers	Closed but with a "choice" of answers	Open with a range of answers, support, strategies, connections	

* The strategies listed are those directly influencing rigor or cognitive demand.

** The engaging quality of "Choice" is not listed; it is effectively provided through choice *between* rigorous tasks.

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College and Career Readiness Anchor Standards for Reading

Key Ideas and Details
1. Read closely to determine what the text says explicitly and to make logical inferences from it; cite specific textual evidence when writing or speaking to support conclusions drawn from the text.
2. Determine central ideas or themes of a text and analyze their development; summarize the key supporting details and ideas.
3. Analyze how and why individuals, events, and ideas develop and interact over the course of a text.
Craft and Structure
4. Interpret words and phrases as they are used in a text, including determining technical, connotative, and figurative meanings, and analyze how specific word choices shape meaning or tone.
5. Analyze the structure of texts, including how specific sentences, paragraphs, and larger portions of the text (e.g., a section, chapter, scene, or stanza) relate to each other and the whole.
6. Assess how point of view or purpose shapes the content and style of a text.
Integration of Knowledge and Ideas
7. Integrate and evaluate content presented in diverse media and formats, including visually and quantitatively, as well as in words.
8. Delineate and evaluate the argument and specific claims in a text, including the validity of the reasoning as well as the relevance and sufficiency of the evidence.
9. Analyze how two or more texts address similar themes or topics in order to build knowledge or to compare the approaches the authors take.
Range of Reading and Text Complexity
10. Read and comprehend complex literary and informational texts independently and proficiently.

College and Career Readiness Anchors for Writing

Text Type and Purposes
1. Write arguments to support claims in an analysis of substantive topics or texts using valid reasoning and relevant and sufficient evidence.
2. Write informative/explanatory texts to examine and convey complex ideas and information clearly and accurately through the effective selection, organization, and analysis of content.
3. Write narratives to develop real or imagined experiences or events using effective technique, well-chosen details and well-structured event sequences.
Production and Distribution of Writing
4. Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience.
5. Develop and strengthen writing as needed by planning, revising, editing, rewriting, or trying a new approach.
6. Use technology, including the Internet, to produce and publish writing and to interact and collaborate with others.
Research to Build and Present Knowledge
7. Conduct short as well as more sustained research projects based on focused questions, demonstrating understanding of the subject under investigation.
8. Gather relevant information from multiple print and digital sources, assess the credibility and accuracy of each source, and integrate the information while avoiding plagiarism.
9. Draw evidence from literary or informational texts to support analysis, reflection, and research.
Range of Writing
10. Write Routinely over extended time frames (time for research, reflection, and revision) and shorter time frames (a single sitting or a day or two) for a range of tasks, purposes, and audiences.

W.K.1. Use a combination of drawing, dictating, and writing to compose opinion pieces in which they tell a reader the topic or the name of the book they are writing about and state an opinion or preference about the topic or book (e.g., *My favorite book is...*).

W.1.1. Write opinion pieces in which they introduce the topic or name the book they are writing about, state an opinion, supply a reason for the opinion, and provide some sense of closure.

W.2.1. Write opinion pieces in which they introduce the topic or book they are writing about, state an opinion, supply reasons that support the opinion, use linking words (e.g., *because*, *and*, *also*) to connect opinion and reasons, and provide a concluding statement or section.

W.3.1. Write opinion pieces on topics or texts, supporting a point of view with reasons.

- Introduce the topic or text they are writing about, state an opinion, and create an organizational structure that lists reasons.
- Provide reasons that support the opinion.
- Use linking words and phrases (e.g., *because*, *therefore*, *since*, *for example*) to connect opinion and reasons.
- Provide a concluding statement or section.

W.4.1. Write opinion pieces on topics or texts, supporting a point of view with reasons and information.

Academic Knowledge & Skills - High School

Grade:	**High School**	**(GPS, HSGT) (SCCH_B2005-11)**
Subject:	**Science**	
Course:	**Chemistry**	
Topic:	**B - Academic Knowledge**	
AKS:	**use the organization of the periodic table of elements to predict the properties of elements (GPS, HSGT) (SCCH_B2005-11)**	

Indicators of Achievement:

11a - use the periodic table to predict periodic trends including atomic radii, ionic radii, ionization energy, electronegativity, reactivity, and oxidation number of various elements (GPS)
, 11b - compare and contrast trends in the chemical and physical properties of elements based on their position on the periodic table (GPS)
, 11b1 - identify metals, nonmetals, and metalloids
, 11b2 - determine phases at room temperature

The Periodic Table of the Elements (with Ionization Energies)

1																	18
Hydrogen 1 H 1.01 1312	2											13	14	15	16	17	Helium 2 He 4.00 2372
Lithium 3 Li 6.94 520	Beryllium 4 Be 9.01 900											Boron 5 B 10.81 801	Carbon 6 C 12.01 1087	Nitrogen 7 N 14.01 1402	Oxygen 8 O 16.00 1314	Fluorine 9 F 19.00 1681	Neon 10 Ne 20.18 2081
Sodium 11 Na 22.99 496	Magnesium 12 Mg 24.31 738		3	4	5	6	7	8	9	10	11	12	Aluminum 13 Al 26.98 578	Silicon 14 Si 28.09 787	Phosphorus 15 P 30.97 1012	Sulfur 16 S 32.07 1000	Chlorine 17 Cl 35.45 1251	Argon 18 Ar 39.95 1521
Potassium 19 K 39.10 419	Calcium 20 Ca 40.08 590		Scandium 21 Sc 44.96 633	Titanium 22 Ti 47.88 659	Vanadium 23 V 50.94 651	Chromium 24 Cr 52.00 653	Manganese 25 Mn 54.94 717	Iron 26 Fe 55.85 763	Cobalt 27 Co 58.93 760	Nickel 28 Ni 58.69 737	Copper 29 Cu 63.55 746	Zinc 30 Zn 65.39 906	Gallium 31 Ga 69.72 579	Germanium 32 Ge 72.61 762	Arsenic 33 As 74.92 947	Selenium 34 Se 78.96 941	Bromine 35 Br 79.90 1140	Krypton 36 Kr 83.80 1351
Rubidium 37 Rb 85.47 403	Strontium 38 Sr 87.62 550		Yttrium 39 Y 88.91 600	Zirconium 40 Zr 91.22 640	Niobium 41 Nb 92.91 652	Molybdenum 42 Mo 95.94 684	Technetium 43 Tc (98) 702	Ruthenium 44 Ru 101.07 710	Rhodium 45 Rh 102.91 720	Palladium 46 Pd 106.42 804	Silver 47 Ag 107.87 731	Cadmium 48 Cd 112.41 868	Indium 49 In 114.82 558	Tin 50 Sn 118.71 709	Antimony 51 Sb 121.76 834	Tellurium 52 Te 127.60 869	Iodine 53 I 126.90 1008	Xenon 54 Xe 131.29 1170
Caesium 55 Cs 132.91 376	Barium 56 Ba 137.33 503	57-70 *	Lutetium 71 Lu 174.97 524	Hafnium 72 Hf 178.49 659	Tantalum 73 Ta 180.95 761	Tungsten 74 W 183.84 770	Rhenium 75 Re 186.21 760	Osmium 76 Os 190.23 840	Iridium 77 Ir 192.22 880	Platinum 78 Pt 195.08 870	Gold 79 Au 196.97 890.1	Mercury 80 Hg 200.59 1007	Thallium 81 Tl 204.38 589	Lead 82 Pb 207.20 716	Bismuth 83 Bi 208.98 703	Polonium 84 Po (209) 812	Astatine 85 At (210) 890	Radon 86 Rn (222) 1037
Francium 87 Fr (223) 380	Radium 88 Ra (226) 509	89-102 **	Lawrencium 103 Lr (262) 470	Rutherfordium 104 Rf (267) 580	Dubnium 105 Db (268) ---	Seaborgium 106 Sg (271) ---	Bohrium 107 Bh (272) ---	Hassium 108 Hs (270) ---	Meitnerium 109 Mt (276) ---	Darmstadtium 110 Ds (281) ---	Roentgenium 111 Rg (280) ---	Copernicium 112 Cn (285) ---	Ununtrium 113 Uut (284) ---	Ununquadium 114 Uuq (289) ---	Ununpentium 115 Uup (288) ---	Ununhexium 116 Uuh (293) ---	Ununhexium 117 Uus ---	Ununoctium 118 Uuo (294) ---

- Alkali metals
- Alkaline earth metals
- Transition metals
- Lanthanides
- Actinides
- Other metals
- Metalloids (semi-metal)
- Nonmetals
- Halogens
- Noble gases

Element name → Mercury
Atomic # → 80
Symbol → Hg
Avg. Mass → 200.59
First ionization energy (kJ/mol) → 1007

*lanthanides	Lanthanum 57 La 138.91 538	Cerium 58 Ce 140.12 534	Praseodymium 59 Pr 140.91 527	Neodymium 60 Nd 144.24 533	Promethium 61 Pm (145) 540	Samarium 62 Sm 150.36 545	Europium 63 Eu 151.97 547	Gadolinium 64 Gd 157.25 593	Terbium 65 Tb 158.93 566	Dysprosium 66 Dy 162.50 573	Holmium 67 Ho 164.93 581	Erbium 68 Er 167.26 589	Thulium 69 Tm 168.93 597	Ytterbium 70 Yb 173.04 603
**actinides	Actinium 89 Ac (227) 499	Thorium 90 Th 232.04 587	Protactinium 91 Pa 231.04 568	Uranium 92 U 238.03 598	Neptunium 93 Np (237) 605	Plutonium 94 Pu (244) 585	Americium 95 Am (243) 578	Curium 96 Cm (247) 581	Berkelium 97 Bk (247) 601	Californium 98 Cf (251) 608	Einsteinium 99 Es (252) 609	Fermium 100 Fm (257) 627	Mendelevium 101 Md (258) 635	Nobelium 102 No (259) 642

John Medina's *Brain Rules* and connections to John Antonetti's Qualities of Engaging Work:

RULE #1 *Exercise boosts brain power.*

RULE #2 *The human brain evolved, too.*

RULE #3 *Every brain is wired differently.*

RULE #4 *We don't pay attention to boring things.*

RULE #5 *Repeat to remember.*

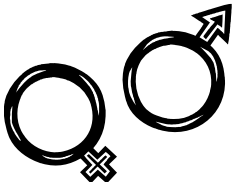
RULE #6 *Remember to repeat.*

RULE #7 *Sleep well, think well.*

RULE #8 *Stressed brains don't learn the same way.*

RULE #9 *Stimulate more of the senses.*

RULE #10 *Vision trumps all other senses.*



RULE #11 *Male and female brains are different.*

RULE #12 *We are powerful and natural explorers.*

Medina, John. Brain Rules : 12 Principles for Surviving and Thriving at Work, Home, and School. New York: Pear P, 2008. John Antonetti can be reached at www.colleaguesoncall