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PUBLISHER:			
SUBJECT:		**SPECIFIC GRADE:**	
COURSE:		**TITLE**	
COPYRIGHT:			
SE ISBN:		**TE ISBN:**	

NON-NEGOTIBLE EVALUATION CRITERIA

2016-2022
Group IV – Science
Chemistry

Equity, Accessibility and Format				
Yes	No	N/A	CRITERIA	NOTES
			1. INTER-ETHNIC The **instructional** materials meets the requirements of inter-ethnic: concepts, content and illustrations, as set by WV Board of Education Policy (Adopted December 1970).	
			2. EQUAL OPPORTUNITY The instructional material meets the requirements of equal opportunity: concepts, content, illustration, heritage, roles contributions, experiences and achievements of males and females in American and other cultures, as set by WV Board of Education Policy (Adopted May 1975).	
			3. FORMAT This resource is available as an option for adoption in an interactive electronic format.	
			4. BIAS The instructional material is free of political bias.	

			5. **INQUIRY** This resource must include rigorous and developmentally appropriate active inquiry, investigations, and hands-on activities.	
			6. **SAFETY** This resource must include explicit guidance for demonstrating the safe and proper techniques for handling, manipulating and caring for developmentally appropriate science materials and treating living organisms humanely.	

GENERAL EVALUATION CRITERIA

2016-2022
Group IV – Science
Chemistry

The general evaluation criteria apply to each grade level and are to be evaluated for each grade level unless otherwise specified. These criteria consist of information critical to the development of all grade levels. In reading the general evaluation criteria and subsequent specific grade level criteria, **e.g. means "examples of" and i.e. means that "each of" those items must be addressed**. Eighty percent of the general and eighty percent of the specific criteria must be met with I (in-depth) or A (adequate) in order to be recommended.

(Vendor/Publisher) SPECIFIC LOCATION OF CONTENT WITHIN PRODUCTS	(IMR Committee) Responses							
	I=In-depth, **A**=Adequate, **M**=Minimal, **N**=Nonexistent	**I**		**A**		**M**		**N**
	In addition to alignment of Content Standards and Objectives (CSOs), materials must also clearly connect to Learning for the 21st Century which includes opportunities for students to develop:							
Next Generation Skills:								
Thinking and Problem-Solving Skills Science Content:								
	1. provides opportunities for student collaboration.							
	2. requires students to investigate and discover multiple solutions through inquiry.							
	3. includes options for using technology tools to gather information, make informed decisions and justify solutions.							
	4. engages students in critical thinking and the synthesis of information to analyze real-world problems.							
	5. offers activities to connect multiple scientific phenomena to real-world events.							
Information and Communication Skills *For student mastery of content standards and objectives, the instructional materials will include multiple strategies that provide students with opportunities to:*								

	6. interact with secure external multimedia resources for local and global collaboration.							
	7. develop conceptual understanding and research skills.							
	8. articulate thoughts and ideas through oral, written, and multimedia communications.							
Personal and Workplace Productivity Skills *For students mastery of content standards and objectives, the instructional materials will provide students with opportunities to:*								
	9. use interpersonal skills to work cooperatively to accomplish a task.							
	10. develop and initiate a plan of action to complete a task or project.							
	11. practice time- and project-management skills							
	12. reflect upon and evaluate the results of a task or project.							
	13. assume various roles and responsibilities when working independently or as a group.							
	14. explore science-related careers.							
	15. conduct research, validate sources, and report findings ethically.							
	16. provide learning experiences for students to demonstrate mastery through multiple efforts.							
Developmentally Appropriate Instructional Resources and Strategies *For student mastery of content standards and objectives, the instructional materials:*								
	17. include multiple research-based strategies for differentiation, intervention and enrichment to support all learners.							
	18. support college and career readiness.							
	19. provide multiple opportunities for incorporating various learning modalities.							

	20. cultivate investigative abilities leading to logical conclusions.							
	21. incorporate authentic vocabulary acquisition.							
	22. integrate laboratory safety practices within learning experiences.							
Assessment *The materials provide:*								
	23. ongoing diagnostic formative and summative assessments.							
	24. a variety of assessment formats, including performance tasks as well as multimedia simulations, portfolio evaluations, and data-dependent and open-ended questions.							
	25. rubrics wherein all learners demonstrate progress toward mastery.							
Organization, Presentation and Format *The materials:*								
	26. are organized in logical sequence to optimize instructional effectiveness and efficiency.							
	27. connect common themes across multiple science disciplines.							
	28. integrate cross-curricular connections.							
	29. provide educators necessary science content knowledge, pedagogy, and management techniques to guide learning experiences.							
Life Skills *For student mastery of content standards and objectives, the instructional materials will provide students with opportunities to:*								
	30. persevere to complete a task.							
	31. be exposed to varying viewpoints.							
	32. engage in physical activity to promote the understanding of science content.							

	33. investigate the natural world and universe.							
	34. practice situational language (e.g., presentations, debates, speeches, collaborative discussions, social media) in real-world activities.							
	35. understand the impact of global issues and events on their lives, communities, and greater society.							
	36. use laboratory equipment properly.							

SPECIFIC EVALUATION CRITERIA

2016-2022
Group IV – Science
Chemistry

Chemistry is an advanced elective course designed for students pursuing Science Technology Engineering Mathematics (STEM) education and careers. Students will develop a deeper understanding of the core concepts of: Structure and Properties of Matter and Chemical Reactions as they prepare for college chemistry requiring a strong mathematical foundation. The chemistry course prepares high school students to explain more in-depth phenomena central not only to the physical sciences, but to life and earth and space sciences as well. The chemistry objectives blend the core ideas with scientific and engineering practices and crosscutting concepts to support students in developing useable knowledge to explain ideas across the science disciplines. There is a focus on several scientific practices which include developing and using models, planning and conducting investigations, analyzing and interpreting data, using mathematical and computational thinking, and constructing explanations. Students will use these practices to demonstrate understanding of the core ideas as well as demonstrate understanding of several engineering practices, including design and evaluation. Students will engage in active inquiries, investigations, and hands-on activities as they develop and demonstrate conceptual understandings and research and laboratory skills described in the objectives. Safety instruction is integrated in all activities, and students will implement safe procedures and practices when manipulating equipment, materials, organisms, and models.

All West Virginia teachers are responsible for classroom instruction that integrates content literacy and *21st Century Learning Skills and Technology Tools.*

General Science Content
The General Science Standard is a content standard that provides an integrated approach to science instruction that is arranged in a coherent manner, follows the logic of learning progressions and spans kindergarten through middle school. The three disciplines of science--Physical Science, Life Science, and Earth and Space Science--are limited to the major topics in the core ideas from each discipline. From the Life Science discipline the core ideas are the following: From Molecules to Organisms: Structures and Processes; Ecosystems: Interactions, Energy, and Dynamics; Heredity: Inheritance and Variation of Traits Across Generations; and Biological Evolution: Unity and Diversity. From the Physical Science discipline, the topics are the following: Matter and Its Interactions; Motion and Stability, Forces and Interactions; Energy; and Waves and Their Applications in Technologies for Information Transfer. Earth's Place in the Universe; Earth's Systems; and Earth and Human Activity are the topics from the Earth and Space Science discipline. Limiting instruction to the main topics of core ideas allows opportunities for deep exploration of important concepts and provides time for students to develop meaningful understandings, engage in science and engineering practices, and reflect on crosscutting concepts and the nature of science. The foundation not only provides an organizational structure for the acquisition of new knowledge, it prepares students to engage in deeper levels of scientific and engineering practices as they continue to high school, college, and beyond.

Earth and Space Science Content
The Earth and Space Standard is a content standard which spans kindergarten through high school and provides opportunities for students to investigate processes that operate on Earth and also address its place in the solar system and the galaxy. The standard encompasses three core ideas: Earth's Place in the Universe; Earth's Systems; and Earth and Human Activity. Beginning in kindergarten, students make observations, ask questions, and make predictions as they describe patterns in their local Weather and Climate. In later grades, the content progresses to include these topics: Space Systems: Patterns and Functions; Earth Systems: Processes that Shape the Earth; Earth's Systems: Space Systems: Stars and the Solar System; History of Earth; and Human Impacts. Elementary students observe and investigate matter and processes in their own yards and neighborhoods with their own eyes; the content continues in the grades that follow to include investigations of invisibly small phenomena to the unimaginably large and distant. As students investigate the atmosphere, hydrosphere, geosphere, and biosphere, they gain understanding of the differing sources of energy, matter cycles, multiple systems' interconnections, and feedbacks which cause Earth to change over time.

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Life Science Content

The Life Science Standard is a content standard which spans kindergarten through high school and focuses on patterns, processes, and relationships of living organisms. The standard includes four core ideas: From Molecules to Organisms: Structures and Processes; Ecosystems: Interactions, Energy, and Dynamics; Heredity: Inheritance and Variation of Traits across Generations; and Biological Evolution: Unity and Diversity. These four core ideas, which represent basic life science fields of investigation—structures and processes in organisms, ecology, heredity, and evolution—have a long history and solid foundation based on the research evidence established by many scientists working across multiple fields. Beginning in kindergarten, curious learners explore Animals, Plants, and Their Environment as they learn of the Interdependent Relationships in Ecosystems. In the grades which follow, the inquiry continues as the standards encompass these topics: Structure, Function, and Information Processing; Inheritance and Variation of Traits: Life Cycles and Traits; Matter and Energy in Organisms and Ecosystems; and Growth, Development, and Reproduction of Organisms. Investigations include single molecules, organisms, ecosystems, and the entire biosphere that is all life on Earth. Students examine processes that occur on time scales from the blink of an eye to those that happen over billions of years. As they make observations, construct hypotheses, perform experiments, evaluate evidence, build models, and use technology to explore how life works, they prepare to answer questions about themselves and the world around them.

Physical Science Content

The Physical Science Standard is a content standard which spans kindergarten through high school as two subjects, physics and chemistry, are presented in a coherent approach which addresses four core ideas: Matter and Its Interactions; Motion and Stability, Forces and Interactions; Energy; and Waves and Their Applications in Technologies for Information Transfer. Beginning in kindergarten, students explore pushes and pulls as an introduction to the Forces and Interactions Topic. The inquiry continues through each programmatic level and includes the following topics: Light and Sound, Structure and Properties of Matter, Forces and Interactions, Energy, Waves and Information, Matter and Energy in Organisms and Ecosystems, Waves and Electromagnetic Radiation, and Chemical Reactions. An understanding of these topics allows students to answer two fundamental questions- “What is everything made of?’ and “Why do things happen?” Students apply these core ideas to explain and predict a wide variety of phenomena, such as the evaporation of water, the transmission of sound, the digital storage and transmission of information, the tarnishing of metals, and photosynthesis, to name just a few. Because such explanations and predictions rely on a basic understanding of matter and energy, students’ abilities to conceive the interactions of matter and energy are central to their science education.

Chemistry Content

The Chemistry Standard is a content standard which focuses on the core concepts: Structure and Properties of Matter and Chemical Reactions. Opportunities are provided for studying in-depth phenomena central not only to the physical sciences, but to life science and earth and space science, as well. The standard includes the chemistry concepts found in the Physical Science Standard, but *not* those emphasizing Forces & Interactions, Energy, and Waves and Electromagnetic Radiation. Instead the standard goes into greater depth in the study of matter, its composition, and its changes by including concepts such as the periodic table and modern theories of bonding, the effects of temperature, concentration, and vapor pressure on solubility, types of chemical reactions, stoichiometry, molarity, and gas laws. The standard blends the core ideas with scientific and engineering practices and crosscutting concepts to support students in developing useable knowledge to explain ideas across the science disciplines. There is an emphasis on several scientific practices which include developing and using models, planning and conducting investigations, analyzing and interpreting data, using mathematical and computational thinking and constructing explanations.

Physics Content

The Physics Standard is a content standard which focuses on the core concepts: Forces and Interactions, Energy, and Waves and Electromagnetic Radiation. Opportunities are provided for studying in-depth phenomena central not only to the physical sciences, but to life science and earth and space science, as well. The standard includes the physics concepts found in the Physical Science Standard, but *not* those emphasizing Structure and Properties of Matter and Chemical Reactions. Instead the standard goes into greater depth in the studies of elastic and inelastic collisions, buoyancy and fluid dynamics, projectile motion, vectors, circuits and currents, and optics. The standard blends the core ideas with scientific and engineering practices and crosscutting concepts to support students in

developing useable knowledge to explain ideas across the science disciplines. There is an emphasis on several scientific practices which include developing and using models, planning and conducting investigations, analyzing and interpreting data, using mathematical and computational thinking and constructing explanations.

Environmental Content
The Environmental Standard is a content standard which focuses on chemical, physical, biological, and geological processes and the interdependent relationships in the natural world. Concepts from the major science disciplines—Life Science, Physical Science, and Earth and Space Science—are integrated into six environmental topics which include: Biogeochemical cycles, Energy Conservation, Ecosystems, Oceans and Climate, Water Management, Land Use. There is an emphasis on several scientific practices that include developing and using models; planning and conducting investigations; analyzing and interpreting data; constructing explanations; engaging in arguments from evidence; obtaining, evaluating, and communicating information; and synthesizing concepts across various science disciplines. The standard provides opportunities for students to develop an understanding of systems of a complex world and the interdependence of organisms as well as an appreciation of the ecosystem in which they live. As students develop an awareness of the environment and its associated problems, they acquire knowledge and skills of how to work individually and collectively toward solutions of current problems and the prevention of new ones.

Forensic Science Content
The Forensic Science Standard is a content standard which applies the knowledge and technology of science to criminal and civil law. Concepts from the three major disciplines--Life Science, Physical Science, and Earth and Space Science--are reinforced and made relevant and pertinent to students as they acquire techniques and skills and learn the limitations of the modern crime laboratories. There is an emphasis on several scientific practices which include planning and carrying out investigations; analyzing and interpreting data; obtaining, evaluating and communicating information; and using mathematics and computations. Students must address the attention to detail and protocol that are necessary for providing impartial scientific evidence that may be used in courts of law to support the prosecution or defense in criminal and civil investigations. These skills and attitudes transfer readily to other areas of science.

Human Anatomy and Physiology Content
Human Anatomy and Physiology is a content standard which addresses the structures and functions of the human body. While concepts from the Life Science discipline are the major focus of study, concepts from the Physical Sciences are incorporated to explain processes and mechanisms of the human body. The interdisciplinary nature of the sciences is revealed through the interdependency of body systems. There is an emphasis on several scientific practices which include asking questions, developing and using models, constructing explanations, and obtaining and communicating information. Engineering Design Standards are integrated throughout instruction as students define problems and design solutions related to the course objectives. The standard encompasses gross and microscopic an atom, basic biochemistry and physiological concepts which are foundational to medical fields of study and useful as students make health related decisions.

Engineering, Technology, and Applications of Science
Engineering, Technology, and Applications of Science Standards (ETS) are included in science instruction, kindergarten through high school, and provide opportunities for students to utilize science and appreciate the distinctions and relationships between engineering, technology, and applications of science. The ETS are in programmatic levels- Kindergarten through Second Grade, Third through Fifth Grade, Middle School, and High School. As Engineering, Technology, and the Application of Science objectives are integrated with content from the three major strands of science- life science, physical science, and earth and space science- students develop understandings of how scientific knowledge is acquired, scientific explanations are developed, and science is applied in the world around us. The interactive cycle of design offers potential in applying science knowledge and engaging in engineering practices. Students gain experiences and understandings about the following: 1.) using technology to modify the natural world to fulfill human needs or desires; 2.) using an engineering approach to design objects, use processes, or construct systems to meet human needs and wants; and 3.) applying scientific knowledge for a specific purpose, whether to do more science, design a product, process, or medical treatment, develop a new technology, or to predict the impacts of human actions.

Literacy

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Literacy Standards span middle and high school and address skills which are critical to building knowledge in science. The standards work in tandem with the specific content standard demands outlined in the West Virginia Next Generation Science Standards and Objectives. Reading in science requires an appreciation of the norms and conventions of the sciences which includes a working knowledge of domain-specific words, phrases, and symbols; an understanding of the nature of evidence used to support claims; an attention to precision and detail; and the capacity to make and assess intricate arguments, synthesize complex information often presented qualitatively and quantitatively in tables and graphs, and follow detailed procedures and accounts of events and concepts. Students also need to be able to gain knowledge from elaborate diagrams and data that convey information and illustrate scientific concepts. Likewise, writing and presenting information orally are key means for students to assert and defend claims in science, demonstrate what they know about a concept, and convey what they have experienced, imagined, thought, and learned. The skills and understandings students are expected to demonstrate in both reading and writing have a wide applicability outside the classroom and workplace and serve students as they address public and private responsibilities and interests.

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For student mastery of content standards and objectives, the instructional materials will provide students with the opportunity to

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Chemistry Content								
Structure and Properties of Matter								
	1. use the periodic table as a model to predict the relative properties of elements based on the patterns of electrons in the outermost energy level of atoms.							
	2. research and evaluate contributions to the evolution of the atomic theory.							
	3. describe atoms using the Quantum Model.							
	4. produce electron configurations and orbital diagrams for any element on the periodic table and predict the chemical properties of the element from the electronic configuration.							
	5. plan and conduct an investigation to gather evidence to compare the structure of substances at the bulk scale to infer the strength of electrical forces between particles.							
	6. investigate the solubility of various materials in water and determine experimentally the effects of temperature, concentration and vapor pressure on solution properties.							
	7. develop models to illustrate the changes in the composition of the nucleus of the atom and the energy released during the processes of fission, fusion and radioactive decay.							
	8. communicate scientific and technical information about why the molecular-level structure is important in the functioning of designed materials.*							
Chemical Reactions								

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	9. construct and revise an explanation for the outcome of a simple chemical reaction based on the outermost electron states of atoms, trends in the periodic table, and knowledge of the patterns of chemical properties.							
	10. predict the products, write and classify balanced chemical reactions including single replacement, double replacement, composition, decomposition, combustion and neutralization reactions.							
	11. design a properly working electrolytic cell based on redox principles.							
	12. compare and contrast the Arrhenius and Bronsted-Lowry definitions of acids and bases.							
	13. compare methods of measuring pH: • indicators • indicator papers • pH meters.							
	14. predict the product of an acid-base reaction.							
	15. develop a model to illustrate that the release or absorption of energy from a chemical reaction system depends upon the changes in total bond energy.							
	16. apply scientific principles and evidence to provide an explanation about the effects of changing the temperature or concentration of the reacting particles on the rate at which a reaction occurs.							
	17. refine the design of a chemical system by specifying a change in conditions that would produce increased amounts of products at equilibrium. *							
	18. use mathematical representations to support the claim that atoms, and therefore mass, are conserved during a chemical reaction.							
	19. generate mole conversions that demonstrate correct application of scientific notation and significant:							

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	• mass to number of particles • number of particles to volume • volume to mass.							
	20. perform calculations using the combined gas laws.							
	21. perform the following “mole” calculations showing answers rounded to the correct number of significant figures: • molarity • percentage composition • empirical formulas • molecular formulas • formulas of hydrates • mole-mole and mass-mass stoichiometry • determination of limiting reactant • theoretical yield.							
Engineering, Technology, and Applications of Science								
Engineering Design								
	22. analyze a major global challenge to specify qualitative and quantitative criteria and constraints for solutions that account for societal needs and wants.							
	23. design a solution to a complex real-world problem by breaking it down into smaller, more manageable problems that can be solved through engineering.							
	24. evaluate a solution to a complex real-world problem based on prioritized criteria and trade-offs that account for a range of constraints, including cost, safety, reliability, and aesthetics, as well as possible social, cultural, and environmental impacts.							

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	25. use a computer simulation to model the impact of proposed solutions to a complex real-world problem with numerous criteria and constraints on interactions within and between systems relevant to the problem.							
Science Literacy								
Reading- Key Ideas and Details								
	26. cite specific textual evidence to support analysis of science and technical texts, attending to important distinctions the author makes and to any gaps or inconsistencies in the account.							
	27. determine the central ideas or conclusions of a text; summarize complex concepts, processes, or information presented in a text by paraphrasing them in simpler but still accurate terms.							
	28. follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks; analyze the specific results based on explanations in the text.							
Reading- Craft and Structure								
	29. determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades 11–12 texts and topics.							
	30. analyze how the text structures information or ideas into categories or hierarchies, demonstrating understanding of the information or ideas.							
	31. analyze the author's purpose in providing an explanation, describing a procedure, or discussing an experiment in a text, identifying important issues that remain unresolved.							
Reading- Integration of Knowledge and Ideas								
	32. integrate and evaluate multiple sources of information presented in diverse formats and media (e.g., quantitative data, video, multimedia) in order to address a question or solve a problem.							

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	33. evaluate the hypotheses, data, analysis, and conclusions in a science or technical text, verifying the data when possible and corroborating or challenging conclusions with other sources of information.							
	34. synthesize information from a range of sources (e.g., texts, experiments, simulations) into a coherent understanding of a process, phenomenon, or concept, resolving conflicting information when possible.							
Reading- Range of Reading and Level of Text Complexity								
	35. by the end of grade 12, read and comprehend science/technical texts in the grades 11–CCR text complexity band independently and proficiently.							
Writing- Text Types and Purposes								
	36. write arguments focused on *discipline-specific content*. • introduce precise, knowledgeable claim(s), establish the significance of the claim(s), distinguish the claim(s) from alternate or opposing claims, and create an organization that logically sequences the claim(s), counterclaims, reasons and evidence. • develop claim(s) and counterclaims fairly and thoroughly, supplying the most relevant data and evidence for each while pointing out the strengths and limitations of both claim(s) and counterclaims in a discipline-appropriate form that anticipates the audience's knowledge level, concerns, values and possible biases. • use words, phrases and clauses, as well as varied syntax to link the major sections of the text, create cohesion, and clarify the relationships between claim(s) and reasons, between reasons and evidence, and between claim(s) and counterclaims. • establish and maintain a formal style and objective tone while attending to the norms and conventions of the discipline in which they are writing. • provide a concluding statement or section that follows from or supports the argument presented.							
	37. write informative/explanatory texts, including the narration of historical events, scientific procedures/ experiments, or technical processes.							

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	• introduce a topic and organize complex ideas, concepts and information so that each new element builds on that which precedes it to create a unified whole; include formatting (e.g., headings), graphics (e.g., figures and tables), and multimedia when useful to aid comprehension. • develop the topic thoroughly by selecting the most significant and relevant facts, extended definitions, concrete details, quotations, or other information and examples appropriate to the audience's knowledge of the topic. • use varied transitions and sentence structures to link the major sections of the text, create cohesion and clarify the relationships among complex ideas and concepts. • use precise language, domain-specific vocabulary and techniques such as metaphor, simile and analogy to manage the complexity of the topic; convey a knowledgeable stance in a style that responds to the discipline and context as well as to the expertise of likely readers. • provide a concluding statement or section that follows from and supports the information or explanation provided (e.g., articulating implications or the significance of the topic).							
Writing- Production and Distribution of Writing								
	38. produce clear and coherent writing in which the development, organization and style are appropriate to task, purpose and audience.							
	39. develop and strengthen writing as needed by planning, revising, editing, rewriting or trying a new approach, focusing on addressing what is most significant for a specific purpose and audience.							
	40. use technology, including the Internet, to produce, publish and update individual or shared writing products in response to ongoing feedback, including new arguments or information.							
Writing- Research to Build and Present Knowledge								
	41. conduct short as well as more sustained research projects to answer a question (including a self-generated question) or solve a problem; narrow or broaden the inquiry when appropriate; synthesize multiple sources on							

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	the subject, demonstrating understanding of the subject under investigation.							
	42. gather relevant information from multiple authoritative print and digital sources, using advanced searches effectively; assess the strengths and limitations of each source in terms of the specific task, purpose and audience; integrate information into the text selectively to maintain the flow of ideas, avoiding plagiarism and overreliance on any one source and following a standard format for citation.							
	43. draw evidence from informational texts to support analysis, reflection and research.							
Writing- Range of Writing								
	44. write routinely over extended time frames (time for reflection and revision) and shorter time frames (a single sitting or a day or two) for a range of discipline-specific tasks, purposes and audiences.							

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