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Report on the  
Development of the  
Performance Level  
Descriptors

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**Science**

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Education  
July 2010

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## **Report on the Development of the Performance Level Descriptors**

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## REVISION OF THE PERFORMANCE LEVEL DESCRIPTORS FOR SCIENCE

### Spring 2010 – Summer 2010

In the spring of 2010, work on the revisions of the Performance Level Descriptors (PLDs) for Science began. Authorized by the State Board of Education, the goals of the revision were to reduce the number of performance levels and to strengthen alignment among the standards, the assessments, and the curriculum. These revisions also improved the Delaware assessment system.

The revision process began with the original Science PLDs completed in July 2006. These PLDs were contained in five performance levels: Well Below the Standard, Below the Standard, Meets the Standard, Exceeds the Standard, and Distinguished. The number of performance levels for the revised PLDs was to be reduced to four: Advanced, Meets Standard, Below Standard, and Well Below Standard.

The Delaware Department of Education (DDOE) assessment and curriculum staff reviewed the 2006 Science PLDs and redistributed the PLDs from five to four levels and reviewed the alignment of the descriptions at each performance level with the Prioritized Delaware State Science Content Standards. The product of the redistribution and alignment process was the Science Content Summaries for each of the four science content reporting categories: Nature and Application of Science (Inquiry), Physical, Earth, and Life Science. The Science Content Summaries were then turned over to the science consultant. Working with the 2006 Science PLDs, the revised Science Content Summaries, and Prioritized Science Standards, the science consultant drafted modified Performance Level Descriptors for each of the four performance levels: Advanced, Meets Standard, Below Standard, and Well Below Standard. The modified PLDs are located in Appendix A. Characteristics that distinguished performance across each level included difficulty of science principles, the integration of science principles, and reasoning required for successful performance. For instance, it was assumed that performance descriptors at the Advanced level required the integration of several science principles and sophisticated reasoning.

During this time period, the science consultant and the DDOE staff associate, Ellen Mingione, communicated regularly on the phone and by e-mail. The science consultant met in Delaware from July 12 to 14 with DDOE Accountability Resources staff and science teachers.

The modified PLDs were reviewed during the PLD Review Meeting on July 12 and 13, 2010, which was attended by the science consultant and DDOE assessment and curriculum staff. The agenda for the meeting is located at Appendix B, and the list of participants at the PLD Review Meeting is in Appendix C. A physical science staff person also reviewed the modified PLDs but did not attend the meetings. The modified PLDs were reviewed by the participants on the basis of curricular and standards alignment. Changes to the modified PLDs based on this review resulted in the draft that was reviewed by Delaware science teachers on July 14, 2010.

The teacher review began with information regarding the revision process and how the revised PLDs would be used, first in the standards setting process (setting cut scores) and ultimately to communicate to teachers and parents what children's scores of the science assessment means in



terms of science their children know and what their children can do with that knowledge. At this time, the most current performance levels and the format of the PLDs were described to the teachers as well as review criteria they were to apply. Ellen and the science consultant elaborated on the information in the PowerPoint and answered teachers' questions. Ellen's presentation is located in Appendix D.

Teachers met in three groups to review the grades 4–5, grades 6–8, and grades 9–10 Performance Level Descriptors. To accomplish this review, teachers were provided with copies of the Science Standards with priorities indicated. Armed with their own knowledge of the science curriculum in their district and the science knowledge and abilities their students found challenging, the teachers reviewed the PLDs at their grade level.

Once the teachers had completed their reviews and made recommendations for changes in the PLDs, each group reported back to the entire group on their findings and recommendations. Much of the discussion during this time focused on the assignment of performance statements within each grade band and across grade bands. This discussion resulted in recommendations to move some performance statements from the "Meets Standard" level of lower grade bands to "Below Standard" level of the next higher grade band. For instance, moving a single performance statement from grade 4–5 Meets Standard to grades 5–6 Below Standard.

After a final review of their recommendations, each teacher submitted his/her recommendations and completed an Evaluation Survey. A copy of the Evaluation Survey and the results of the survey are in Appendix E.

Teacher recommendations included changing levels for performance statements, adding performance statements, and deletion or revision of statements contained in the PLDs. Most recommendations were incorporated in the PLDs that appear in this report. All of the teachers' recommendations regarding changes to the performance level of performance statements were incorporated into the PLDs draft. Certain of the recommendations regarding additional performance statements were not included primarily because they were too specific or detailed. Most of the performance statements that were deleted represented compacted standards. Revisions of the performance statements were made to clarify the statements and for science accuracy.

The Preliminary PLDs draft incorporating teachers' recommendations was further reviewed by science staff from the DDOE and a representative of American Institutes for Research (AIR). The PLDs that appear in Appendix E reflect the input through the review process.

The science PLDs for each grade 5, 8, and 10 are introduced with a content summary. The content summaries describe performances at the Advanced or Meets Standard level for each of the Standards. Performance at each lower level (Below or Well Below Standard) is described in the PLDs. Performances at the lower levels identify aspects of the knowledge and abilities that are required to perform at the Advanced or Meets Standard levels.



## **APPENDIX A – MODIFICATION OF 2006 PERFORMANCE LEVEL DESCRIPTORS**

The existing (2006 approved) Performance Level Descriptors were modified and distributed during the Review Meeting on July 12–13, 2010, as a starting point for the teachers to begin their process. The items in this Appendix are modified PLDs and should not be used. The final PLDs are located in Appendix F.

### Modified Grade 5 Performance Level Descriptors

	<b>4 Advanced</b>	<b>3 Meets Standard</b>	<b>2 Below Standard</b>	<b>1 Well Below Standard</b>
	The student demonstrates outstanding performance beyond the expectations.	The student demonstrates competency over challenging subject matter and meets the expectations.	The student demonstrates limited competency over basic knowledge and skills, and partially meets the expectations.	The student demonstrates minimal competency over basic knowledge and skills, and does not meet the expectations.
	Students at this level are generally able to:	Students at this level are generally able to:	Students at this level are generally able to:	Students at this level are generally able to:
<b>Nature and Application of Science and Technology</b>	Distinguish questions that can be investigated using a fair test from those which cannot be investigated using a fair test. Identify conclusions that are consistent with data from a fair test.	Distinguish a well designed fair test from a flawed fair test. Match numerical data with verbal descriptions of patterns in the data.	Match a graph with a verbal description of the information contained in the graph.	Match tools with the physical properties they measure.
<b>Physical Science</b>	Identify a process that will successfully separate the components of a mixture (for instance a mixture of water, salt, iron filings and sand). Give examples of stored forms of energy.	Distinguish objects that have kinetic energy from those that do not have kinetic energy that is objects that are in motion from those that are at rest. Recognize that unbalanced forces on objects change their motion. Give examples of forces (pushes, pulls, gravity, magnetism) Trace the path of electricity through series and parallel circuits. Identify examples of the reflection, refraction, and absorption of visible light.	Identify the physical property used to classify familiar materials. Identify changes in states of matter that result when materials are cooled. Identify changes in states of matter that result when materials are heated. Identify magnetism as a force that acts at a distance Distinguish solutions from mixtures Distinguish complete from incomplete electrical circuits	Recognize that the combined mass of the parts of an object are equal to the mass of the whole object. Give examples of different forms of energy. Identify energy transformations in nature and in the home. Identify the physical properties of common objects.

	<b>4 Advanced</b>	<b>3 Meets Standard</b>	<b>2 Below Standard</b>	<b>1 Well Below Standard</b>
<b>Earth Science</b>	<p>Identify how the motion of the Earth in the Earth/sun system explains day and night.</p> <p>Identify processes that produce slow changes in Earth's surface.</p> <p>Identify the role water plays in the processes of weathering and erosion.</p> <p>Distinguish weather, climate and seasons.</p>	<p>Order Earth materials (clay, fine sand, coarse sand, gravel, stones) on the basis particle size.</p> <p>Distinguish processes that result in building Earth structures from those that wear down Earth structures.</p>	<p>Identify examples of how human activities, ground cover, and the slope of land can affect the flow of water.</p> <p>Identify processes that produce sudden changes in Earth's surface.</p>	<p>Identify Earth as one of the planets in the Solar System.</p> <p>Match the shapes of the moon's phases with the name of the phase.</p> <p>Distinguish weathering from erosion.</p>
<b>Life Science</b>	<p>Identify structures that distinguish one kind of animals from another (for instance, fish from mammals or birds from reptiles) and how the distinguishing structures help the animal survive.</p> <p>Identify changes in the behavior of organisms that result from changes in the organism's environment (for instance, hibernation, color changes of rabbits).</p> <p>Distinguish physical characters that can be passed on to offspring from those that cannot be passed on (for instance, color of eyes, vs. loss of a tail).</p> <p>Recognize that variation in appearance and behavior of organisms of the same kind often is advantageous to survival and reproduction.</p> <p>Predict the changes in kinds and numbers of organisms when the population of one or</p>	<p>Identify structures of familiar plants and the function each serves in the life of the plant.</p> <p>Know that organisms of the same kind have variation in their appearance (eye color, height, tail length) and behavior (ability to hunt, ability to fend off predators).</p> <p>Analyze energy and matter flow in food chains.</p> <p>Identify the role of decomposers in food chains.</p> <p>Order the stages in the life cycle of the butterfly.</p>	<p>Match organs of the digestive system with their functions.</p> <p>Identify examples of limited resources.</p> <p>Give examples of biotic and abiotic components of ecosystems.</p>	<p>Identify the organs that comprise the digestive system.</p> <p>Give examples of ways that human activity (for instance, logging, burning fossil fuels) changes ecosystems.</p>

	<b>4 Advanced</b>	<b>3 Meets Standard</b>	<b>2 Below Standard</b>	<b>1 Well Below Standard</b>
	<p>more organisms in a food web decreases in number or is extinguished.</p> <p>Predict the effects on the number and size of populations of organisms in an ecosystem as biotic and abiotic components change.</p>			

MODIFIED

### Modified Grade 8 Performance Level Descriptors

	<b>4 Advanced</b>	<b>3 Meets Standard</b>	<b>2 Below Standard</b>	<b>1 Well Below Standard</b>
	The student demonstrates outstanding performance beyond the expectations.	The student demonstrates competency over challenging subject matter and meets the expectations	The student demonstrates limited competency over basic knowledge and skills, and partially meets the expectations.	The student demonstrates minimal competency over basic knowledge and skills, and does not meet the expectations.
	Students at this level are generally able to:	Students at this level are generally able to:	Students at this level are generally able to:	Students at this level are generally able to:
<b>Nature and Application of Science and Technology</b>	Distinguish questions that can be investigated scientifically from those which cannot be investigated scientifically (For instance, a question that can be investigated scientifically is how changing temperature change evaporation rates while an example of a question that cannot be investigated scientifically is... Distinguish hypotheses that can be tested scientifically from those which cannot be tested scientifically. Identify conclusions that are consistent with a given data set.	Distinguish a well designed investigation from a flawed investigation. Match numerical data with verbal descriptions of patterns in the data. Match a location on a graph with a verbal description of that location.	Identify flaws in simple investigations.	Match tools with the physical properties they measure (For instance, thermometer to measure temperature, balance to compare masses...)
<b>Physical Science</b>	Identify changes that occur in the motion of molecules and the distance between molecules as energy is added or removed from a material. Identify changes in an object's motion when unbalanced forces act on the object. Match energy level of radiant energy with its wave length.	Distinguish energy flow through systems that are due to convection, radiation, and conduction. Compare the energy levels of infrared, ultraviolet, and visible light. Distinguish extrinsic and intrinsic properties. Know that the mass of a mixture is equal to the mass of the components from which it made	Know that visible light of different colors has different energy. Sequence phases of the moon.	Identify forms of energy in simple natural systems and in homes. Identify the physical properties of common objects. Identify physical changes that occur when energy is added or removed from materials. Identify common forms of energy. Identify physical properties of common objects.



	<b>4 Advanced</b>	<b>3 Meets Standard</b>	<b>2 Below Standard</b>	<b>1 Well Below Standard</b>
		Identify energy transformation and transfer in simple systems.		
<b>Earth Science</b>	<p>Relate the position and orientation of Earth on its axis to seasonal change.</p> <p>Identify parts (including asteroids, comets, moons) of the solar system and match the physical characteristics and motion with each part.</p> <p>Identify state and energy changes in the water cycle.</p> <p>Orders by time of deposition, layers of sedimentary rock using the fossils contained in the layers.</p> <p>Applies information from a weather map to predict the weather conditions that most likely will be observed.</p>	<p>Relate the position and motion of the Earth/sun system to day and night.</p> <p>Relate the position and motion of the moon/Earth system to the phases of the moon.</p> <p>Order Earth materials (clay, fine and coarse sand, gravel of different sizes) on the basis of the rate at which water flows through them.</p> <p>Relates the rate at which water flows to the elevation through with the water has fallen.</p>	Sequence the phases of the moon.	Identify the sun as the energy source that drives most of the changes in Earth's systems (water hydrologic, atmospheric, and geological). Match shapes of the phases of the moon with their names.
<b>Life Science</b>	<p>Identify ways in which cells, organs, and organ systems interact to maintain homeostasis.</p> <p>Identify relationships among DNA, genes, chromosomes, and traits.</p> <p>Analyze genotype and phenotype of dihybrid crosses using punnet square approach.</p>	<p>Identify structural relationships among cells, organs, and organ systems.</p> <p>Describe familiar functions of each structure that comprise the human body.</p> <p>Uses punnet square to represent genotype and identify phenotype for a single trait cross.</p> <p>Identify advantages of sexual reproduction over asexual reproduction.</p> <p>Identify structures that are relevant to the transmission of genetic information (DNA, genes, chromosomes).</p> <p>Identify ways in which changes in biotic and abiotic factors</p>	Identify ways in which human activity impacts ecosystems. Identify structures (cell, organ, organ systems) that comprise the human body.	Identify functions of major systems of the human body (respiratory, circulatory, and digestive). Differentiate sexual from asexual reproduction. Distinguish habitats from ecosystems. Distinguish biotic from abiotic factors in ecosystems. Know that matter is recycled in ecosystems. Identify the sun as the energy source for all ecosystems.

	<b>4 Advanced</b>	<b>3 Meets Standard</b>	<b>2 Below Standard</b>	<b>1 Well Below Standard</b>
		<p>change the kinds of organisms and the number of organisms of a particular kind in an ecosystem.</p> <p>Identify the direction of energy flow in a food web.</p> <p>Use energy webs to predict how changes in one population of animals will change populations of other animals.</p>		

MODIFIED

## Modified Grade 10 Performance Level Descriptors

	<b>4 Advanced</b>	<b>3 Meets Standard</b>	<b>2 Below Standard</b>	<b>1 Well Below Standard</b>
	The student demonstrates outstanding performance beyond the expectations.	The student demonstrates competency over challenging subject matter and meets the expectations.	The student demonstrates limited competency over basic knowledge and skills, and partially meets the expectations.	The student demonstrates minimal competency over basic knowledge and skills, and does not meet the expectations.
	Students at this level are generally able to:	Students at this level are generally able to:	Students at this level are generally able to:	Students at this level are generally able to:
<b>Nature and Application of Science and Technology</b>	Distinguish well constructed scientific explanations from poorly constructed scientific explanations Distinguish conclusions that are consistent with observations from conclusions that are not consistent with observations.	Distinguish hypotheses that can be tested experimentally from hypotheses that cannot be tested experimentally.	Distinguish well organized experimental data from poorly organized experimental data.	Match graphical data with numerical data in tabular form.
<b>Physical Scienc</b>	Apply knowledge of the organization of the periodic table to predict the chemical properties of elements. Distinguish diagrams illustrating chemical bonding that results from the transfer of valence electrons from bonding that results when valence electrons are shared. Relate changes in temperature, pressure, and concentration to the rate of chemical reactions. Knows that balanced chemical equations are representations of the conservation of mass.	Identify statements and equations that show the relationship between energy and matter. Identify descriptions of the organization of the periodic table. Identify trends in chemical and physical properties across the periodic table. Identify trends in chemical and physical properties in columns of the periodic table. Identify factors that influence the rate of chemical reactions. Know that chemical and physical changes obey the law of conservation of mass and of energy.	Identify the atomic structure of elements using information (atomic mass and number) from the periodic table. Balance simple chemical equations. Knows that atoms are neutral and have equal numbers of electrons and protons.	Predict that change will occur when matter and energy interact. Locate electrons, protons and neutrons on a diagram of an atom.

	<b>4 Advanced</b>	<b>3 Meets Standard</b>	<b>2 Below Standard</b>	<b>1 Well Below Standard</b>
<b>Earth Science</b>	<p>Match descriptions of the evolution of the solar system and the composition of the Earth to the tenets of Solar Nebula Theory</p> <p>Identify the relationship between the zones of volcanic activity and earthquakes to tectonic plates</p> <p>Identify sources of energy that fuel interaction in Earth's systems.</p>	<p>Identify changes that occur as rock materials move through the rock cycle</p> <p>Identify changes that occur when Earth systems interact.</p>	<p>Identify materials and structures found in the geosphere.</p>	<p>Identify Earth systems (hydrosphere, atmosphere, biosphere and geosphere).</p>
<b>Life Science</b>	<p>Interpret molecular representations of metabolic processes of plants and animals.</p> <p>Represent metabolic processes of plants and animals at the molecular level (respiration, action of enzymes).</p> <p>Apply knowledge of metabolic processes to predict how changes in an organism's environment will effect changes in the process (for instance, how light intensity and carbon dioxide concentration in the atmosphere affects rate of photosynthesis).</p> <p>Order the progression of energy transformations in animal digestion and metabolism.</p> <p>Order the progression of energy transformations in photosynthesis and plant respiration.</p> <p>Relate the molecular structure of enzymes to the molecular structure of the substrates on</p>	<p>Identify the ways in which photosynthesis and respiration influence the flow of energy in living systems and in ecosystems.</p> <p>Compare the products, reactants, and energy changes that occur in photosynthesis and cellular respiration.</p> <p>Identify energy transformation that occurs in organisms and how these transformations contribute to the survival of the organism.</p> <p>Identify the relationship between diversity in plant and animal populations and the survival of the population when changes occur in the environment.</p> <p>Identify how evolution, survival of the fittest and species diversity are related.</p> <p>Identify examples of plants' synthesis of substances other than sugars and starches that are important to human life.</p>	<p>Identify ways in which organisms of the same species exhibit diverse physical characteristics and behaviors</p> <p>Identify examples complex chemical substances that animals synthesize from the foods they eat</p>	<p>Identify biotechnology applications in areas such as food production, medicine, agriculture and manufacturing (genetically altered corn, animal cloning, development of synthetic blood cells, and production of drugs).</p>

	<b>4 Advanced</b>	<b>3 Meets Standard</b>	<b>2 Below Standard</b>	<b>1 Well Below Standard</b>
	<p>which the enzymes act.</p> <p>Relate the survival and reproduction of organisms that have adapted to changes in a population's environment to changes in the genetic information of a population.</p> <p>Relate structures contained in plant and animal cells to the processes of photosynthesis and respiration that occur at the cellular level.</p>	<p>Identify how the structure of cell relates to the energy transformations and chemical changes that take place in cells.</p>		

MODIFIED



## **APPENDIX B – PERFORMANCE LEVEL DESCRIPTORS REVIEW MEETING**

### **Agenda**

#### **Plan Meeting for Developing Performance Level Descriptions Collette Building, July 12-13, 2010**

#### **I. Plan of Modifying Science PLDs**

1. PLD Committee
  - Number of teachers/educators per committee
  - District Science Specialist
2. Process of modifying PLDs
  - Initial draft based on current PLDs
  - Modify descriptors to reflect 4 levels from previous 5 levels
  - Change descriptor statements to reflect structure of DCAS assessment (i.e., multiply choice and grid items versus constructed response)
  - Adjust grade level content for high school assessment. (Grade 10 verses Grade 11)
  - Develop training materials
  - Editing
  - Review and finalize PLDs
  - Timeline
3. Format of PLDs
  - Sample(s) of PLDs
  - Format of Delaware PLDs
  - General vs. details
  - Special issues of each test
4. Consistency
  - Consistency across grades
  - Consistency across performance Levels within grade
  - Consistency of performance level across grades
  - Consistency across tests
5. Development meeting
  - June and July phone conference calls
  - Additional meeting(s)?
6. Information/Data
  - Information (science standards, initial performance level descriptors)
  - Additional information/data needed
7. Implications of the vertical alignment



## APPENDIX C – PLD REVIEW MEETING PARTICIPANTS

<b>Name</b>	<b>District</b>	<b>Grade Level</b>
Jacque Kisiel	Cape Henlopen	5
Julie Picciotti	Red Clay	5
Janice Trainer	Christina	5
Corryn Barnes	Lake Forest	8
Kelly Darnell	Brandywine	8
Chris Lenhart	Cape Henlopen	8
Joyce Nauman	Milford	8
Sheila Smith	Red Clay	8
Katherine Holloway	Indian River	10
Jennifer Joseph	Polytech	10
Christy Parsons	Delmar	10
Rita Vasta	New Castle Votech	Science Specialist 9-12
Ellen Mingione	Delaware Department of Education	Education Associate
Audrey B. Champagne	Professor at Emerita University in Albany, SUNY	Science Consultant



## APPENDIX D – POWERPOINT PRESENTATION OF SCIENCE PERFORMANCE LEVEL DESCRIPTORS

### Slide 1

**SCIENCE**  
**DCAS**  
**Performance Level**  
**Descriptors**  
**(PLDs)**  
**July, 2010**

Delaware  
Department of Education

### Slide 2

- **What are the performance level descriptors [PLDs]?**
  - PLDs identify and define what a student knows and can do at the completion of a specific grade cluster.
- **Why are the PLDs important?**
  - The descriptors guide teachers and stakeholders in the standards setting process by articulating the expectations for each performance level.
  - PLDs help parents, educators, and students understand the performance level scores a student receives on DCAS.

Delaware  
Department of Education

### Slide 3

Performance Levels	
DSTP PLDs	DCAS PLDs
	<b>NEW</b>
5- Distinguished	4- Advanced
4- Exceeds	3- Meets
3- Meets	2- Below
2- Below	1- Well below
1- Well below	

Delaware  
Department of Education



**Slide 4**

### Defining the categories

- 4 **Advanced:** demonstrates outstanding performance beyond the expectations
- 3 **Meets:** demonstrates competency over challenging subject matter and meets the expectations
- 2 **Below:** demonstrates limited competency over basic knowledge and skills and partially meets the expectations
- 1 **Well-below:** demonstrates minimal competency over basic knowledge and skills and does not meet the expectations



**Slide 5**

### The performance level descriptors

When using **grade appropriate text**, a student who performs at this level will –

**Level 4:** consistently, effectively, and/or skillfully...

**Level 3:** frequently, accurately, and/or satisfactorily...

**Level 2:** inconsistently, inadequately, and/or partially...

**Level 1:** rarely, incorrectly, and/or minimally...



**Slide 6**

### Why are PLDs necessary?

- The Federal Accountability System required to have content specific performance level descriptors for Peer Review
- According to the Peer Review Guidance for standards and assessments published by the Department of Education **“the State’s academic achievement standards must include descriptions of the content-based competencies associated with each level.”**





**Slide 7**

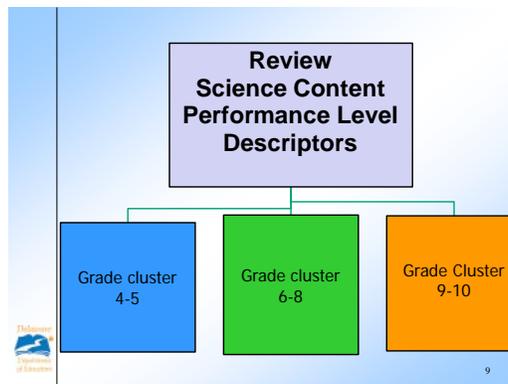
**How PLDs  
are used in the  
Science DCAS**

- Descriptors are directly linked to the science content standards
- Test items are chosen/developed based on content standards
- The report to parents and students will include performance levels and descriptors



5

**Slide 8**



**Slide 9**

**Your task....**

- Review the performance level descriptors to insure that they accurately reflect the expectation for students at end of the grade cluster
- Review the grade cluster and check for a logical sequence of expectations based on the Delaware prioritized Science Standards.





**Slide 10**

**Think About...**

- How well do the PLDs reflect the Delaware Content Standards?
- How well do the PLDs reflect the performance levels for DCAS?
- Are the PLDs consistent across grade levels?
- Are the PLDs consistent across performance levels?



**Slide 11**

- Are the PLDs user-friendly for teachers?
- Are the PLDs user-friendly for parents?
- Will the PLDs help teachers understand the DCAS performance levels?
- Will the PLDs help parents understand the DCAS performance levels?
- Will the PLDs help students understand the DCAS performance levels?





## APPENDIX E – EVALUATION SURVEY

### Review of Science Performance Level Descriptions Delaware Archives July 14, 2010

This survey is used to evaluate the workshop for the Performance Level Descriptors review in Science. Please take a few minutes to answer the following questions and provide us with your comments. Thanks for your cooperation.

#### ***PLD Review Session***

1. *Which grade of PLDs did you review?*

- Grade 5    3 participants
- Grade 8    5 participants
- Grade 10   3 participants

2. *How well did the training prepare you for reviewing the PLD?*

- 9 Responses “very well”
- 2 Responses “adequately”

1	2	3	4
Not Well	Somewhat	Adequately	Very Well

3. *How well do you think the meeting organized?*

- 11 Responses “very well”

1	2	3
Not Well	Somewhat	Very Well

#### ***Quality of PLDs***

4. *How well does the PLD reflect the Delaware Content Standards?*

- 7 Responses “very well”
- 4 Responses “adequately”

1	2	3	4
Not Well	Somewhat	Adequately	Very Well

5. *How well does the PLD reflect the performance levels for DCAS?*

- 8 responses “very well”
- 3 responses “adequately”

1	2	3	4
Not Well	Somewhat	Adequately	Very Well



6. *Do you think the PLDs are consistent across grade levels?*

11 responses “very well”

1	2	3
Not Well	Somewhat	Very Well

7. *Do you think the PLDs are consistent across performance levels within grade?*

11 responses “very well”

1	2	3
Not Well	Somewhat	Very Well

8. *Do you think the PLDs are user-friendly for teachers?*

11 responses “very well”

1	2	3
Not Well	Somewhat	Very Well

9. *Do you think the PLDs are user-friendly for parents?*

9 responses “very well”

2 responses “somewhat”

1	2	3
Not Well	Somewhat	Very Well

10. *Do these PLDs help teachers understand the DCAS performance levels?*

11 responses “very useful”

1	2	3	4
Not Useful	Somewhat	Useful	Very Useful

11. *Do these PLDs help students understand the DCAS performance levels?*

8 responses “very useful”

3 responses “useful”

1	2	3	4
Not Useful	Somewhat	Useful	Very Useful

12. *Do these PLDs help parents understand the DCAS performance levels?*

9 responses “very useful”

2 responses “Useful”

1	2	3	4
Not Useful	Somewhat	Useful	Very Useful



## **Additional Comments**

Please provide us with additional comments, recommendations, and suggestions that will help improve the PLD development process. Make sure you specify the content, grade level, and your contact information if you are willing to.

“Great professional development”

“I really enjoyed coming today – very positive!!”

“Glad to be part of this process”

“It was great interacting and discussing.... PLDs among different grade levels”

“How will Essential and important relate to this process?”

“Thanks you for this opportunity”

Suggestion “Have a more detailed version for teachers and a more general one for parents”

Suggestion “More time to explore the progression of the strand through the grade levels”

“Facilitators listened and incorporated our changes- thanks!”



## APPENDIX F – SCIENCE PERFORMANCE LEVEL DESCRIPTORS

### Introduction to Performance Level Descriptors

The Delaware Science Performance Levels Descriptors (PLDs) provide descriptions of what students should know and be able to do in science at the end of Grades 5, 8, and 10 as measured by the Delaware Comprehensive Assessment System (DCAS). The PLDs are based on the eight Delaware Science Content Standards. Each performance level provides a description that differentiates groups of students at four levels: Advanced, Meets Standard, Below the Standard, and Well Below the Standard. Students at Performance Level 3, Meets Standards, perform at grade level. Students above Performance Level 3 exceed science standards, and those below need intervention.

#### Performance Level Definitions

##### Level 4 – Advanced

Students performing at this level consistently, effectively, and skillfully demonstrate knowledge of grade-level content. Students are able to apply their content knowledge in a variety of new contexts.

##### Level 3 – Meets Standard

Students performing at this level frequently, accurately, and satisfactorily demonstrate knowledge of grade-level science content knowledge.

##### Level 2 – Below Standard

Students performing at this level inconsistently, inadequately, or partially demonstrate knowledge of grade-level science content.

##### Level 1 – Well Below Standard

Students performing at this level rarely, incorrectly or minimally demonstrate knowledge of science grade-level content.

It is the expectation within the content standards that, as students progress through grade-level content from grade 5 through grade 10, the subject matter complexity increases and requires students to use higher-level thinking skills.

Performance Level Descriptors (PLDs) for each grade, 5, 8, and 10 are introduced with a Content Summary. Content Summaries describe performances at the Advanced or Meets Standard level. Performance at each lower level (Below or Well Below Standard) is described in the PLDs. Performances at the lower levels identify elements of the knowledge and abilities that are required to perform at the Advanced or Meets Standard level.



## Grade 5 – Content Summary

### ***Nature and Application of Science and Technology***

*Performances:*

- Distinguish well designed fair tests from flawed fair tests.
- Distinguish questions that can be investigated using a fair test from those which cannot be investigated using a fair test.
- Identify conclusions that are consistent with data from a fair test.

### ***Physical Science***

*Performances:*

- Recognize that unbalanced forces on objects changes their motion.
- Distinguish diagrams showing particles that compose a liquid from a diagram showing particles that compose a solid.

### ***Earth Science***

*Performances:*

- Distinguish processes that result in building Earth structures from those that wear down Earth structures.
- Identify the reason two objects of different diameters (for instance, the moon and the sun) may appear to be the same diameter.

### ***Life Science***

*Performances:*

- Identify structures of familiar plants and animals and the function each serves in the life of the plant or animal.
- Recognize that variation in appearance and behavior of organisms of the same kind often is advantageous to survival and reproduction.



## Science – Grade 5

Performance Level 4 – Advanced	
<p><i>Students are able to consistently, effectively, and skillfully demonstrate knowledge of grade-level science content. Students are able to apply their content knowledge in a variety of new contexts.</i></p>	<p><b>Nature and Application of Science and Technology:</b></p> <ul style="list-style-type: none"> <li>▪ Distinguish questions that can be investigated using a fair test from those which cannot be investigated using a fair test</li> <li>▪ Identify conclusions that are consistent with data from a fair test</li> </ul> <p><b>Physical Science:</b></p> <ul style="list-style-type: none"> <li>▪ Distinguish diagrams that show particles comprising a liquid from diagrams that show particles comprising a solid</li> <li>▪ Recognize that unbalanced forces on objects will change their motion</li> <li>▪ Compare the energy of two objects of the same mass and shape moving at different speeds</li> </ul> <p><b>Earth Science:</b></p> <ul style="list-style-type: none"> <li>▪ Identify processes that produce “slow” changes in Earth’s surface</li> <li>▪ Distinguish processes that result in building Earth’s topography from those that wear down Earth materials</li> </ul> <p><b>Life Science:</b></p> <ul style="list-style-type: none"> <li>▪ Recognize that variation in appearance and behavior of organisms of the same group often is advantageous to survival and reproduction</li> <li>▪ Predict the changes in groups and numbers of organisms when one population in a food chain decreases in number or is extinguished</li> <li>▪ Predict the effects on the number and size of populations of organisms in an ecosystem as biotic and abiotic components change</li> </ul>



## Science – Grade 5

Performance Level 3 – Meets Standard	
<p><i>Students frequently, accurately, and satisfactorily demonstrate knowledge of grade-level science content.</i></p>	<p><b>Nature and Application of Science and Technology:</b></p> <ul style="list-style-type: none"> <li>▪ Match numerical data with verbal descriptions of patterns in the data</li> </ul> <p><b>Physical Science:</b></p> <ul style="list-style-type: none"> <li>▪ Identify processes that will successfully separate the components of a mixture (e.g. a mixture of water, iron filings and sand)</li> <li>▪ Give examples of forces (e.g. pushes, pulls, gravity, magnetism)</li> <li>▪ Identify the energy of an object due to its motion</li> <li>▪ Compare the speeds of moving objects</li> <li>▪ Give examples of stored forms of energy</li> <li>▪ Trace the path of electricity through series and parallel circuits</li> <li>▪ Distinguish a complete electrical circuit from an incomplete electrical circuit</li> </ul> <p><b>Earth Science:</b></p> <ul style="list-style-type: none"> <li>▪ Identify how the motion of Earth in the Earth/Sun system explains day and night</li> <li>▪ Order Earth materials (clay, fine sand, coarse sand, gravel) on the basis of particle size</li> </ul> <p><b>Life Science:</b></p> <ul style="list-style-type: none"> <li>▪ Identify structures within familiar plants and the function each serves in the life of the plant</li> <li>▪ Order the stages in the life cycle of a familiar plant or animal</li> <li>▪ Identify structures that can be used to distinguish one group of animals from another (e.g. fish from mammals, or birds from amphibians) and how the distinguishing structures help the animal survive</li> <li>▪ Identify changes in the physical characteristics and behavior of an organism that result from changes in the organism's environment (e.g., hibernation, color changes of rabbits)</li> <li>▪ Know that organisms of the same species have variation in their appearance (eye color, height, tail length) and behavior (ability to hunt, ability to fend off predators)</li> <li>▪ Analyze energy and matter flow in food chains</li> </ul>



## Science – Grade 5

Performance Level 2 – Below Standard	
<p><i>Students inconsistently, inadequately, or partially demonstrate knowledge of grade-level science content.</i></p>	<p><b>Nature and Application of Science and Technology:</b></p> <ul style="list-style-type: none"> <li>▪ Match a graph with a description of the information contained in the graph</li> </ul> <p><b>Physical Science:</b></p> <ul style="list-style-type: none"> <li>▪ Identify materials that are heat insulators</li> <li>▪ Identify physical properties that are used to classify familiar materials</li> <li>▪ Distinguish the physical characteristics of solutions from the physical characteristics of heterogeneous mixtures.</li> <li>▪ Identify changes in states of matter that result when materials are heated or cooled</li> <li>▪ Recognize that the combined mass of the parts of an object is equal to the mass of the whole object</li> <li>▪ Identify magnetism as a force that acts at a distance</li> </ul> <p><b>Earth Science:</b></p> <ul style="list-style-type: none"> <li>▪ Order Earth materials (clay, fine sand, coarse sand, gravel) by their rate of deposition</li> <li>▪ Identify processes that produce “sudden” changes in Earth’s surface</li> <li>▪ Identify examples of how human activities (e.g., altering percentage of ground cover, slope of the land) can affect the flow of water</li> </ul> <p><b>Life Science:</b></p> <ul style="list-style-type: none"> <li>▪ Identify physical characteristics (e.g., hair, number of toes, flowers, arrangement of leaves on stems) that offspring typically inherit from their parents</li> <li>▪ Recognize that offspring will show variation in those physical characteristics that are inherited from the same parents (e.g., a brother and sister can have different shapes to their noses)</li> <li>▪ Identify physical characteristics of organisms that allow them to survive in their environments</li> <li>▪ Categorize organisms in an ecosystem as either producers, consumers, or decomposers</li> <li>▪ Identify examples of limited resources</li> </ul>



## Science – Grade 5

Performance Level 1 – Well Below Standard	
<p><i>Students rarely, incorrectly, or minimally demonstrate knowledge of grade-level science content.</i></p>	<p><b>Nature and Application of Science and Technology:</b></p> <ul style="list-style-type: none"><li>▪ Match tools with the physical properties they measure (e.g., thermometer to measure temperature, balance to compare masses)</li></ul> <p><b>Physical Science:</b></p> <ul style="list-style-type: none"><li>▪ Identify the physical properties of common objects</li><li>▪ Give examples of different forms of energy</li><li>▪ Identify ways in which speed is measured</li><li>▪ Identify energy transformations observed in nature and in the home</li></ul> <p><b>Earth Science:</b></p> <ul style="list-style-type: none"><li>▪ Identify Earth as one of the planets in the Solar System</li><li>▪ Identify examples of weathering and erosion</li></ul> <p><b>Life Science:</b></p> <ul style="list-style-type: none"><li>▪ Identify the basic needs of plants and animals</li><li>▪ Give examples of ways that human activity (e.g. logging, burning fossil fuels) can change ecosystems</li><li>▪ Give examples of biotic and abiotic components of ecosystems</li></ul>



## Grade 8 – Content Summary

### ***Nature and Application of Science and Technology***

*Performances:*

- Distinguish questions that can be investigated scientifically from those which cannot be investigated scientifically.
- Distinguish hypotheses that can be tested scientifically from those which cannot be tested scientifically. Identify conclusions that are consistent with a given data set.

### ***Physical Science***

*Performances:*

- Distinguish changes that occur in the motion of molecules and the distance between molecules as energy is added or removed from a material.
- Relate the mass of solute that will dissolve in a solvent as the temperature of the solvent increases or decreases.

### ***Earth Science***

*Performances:*

- Relate the position and orientation of Earth on its axis to seasonal change.
- Order by time of deposition, layers of sedimentary rock using the fossils contained in the layers.

### ***Life Science***

*Performances:*

- Identify ways in which cells, organs, and organ systems interact to maintain homeostasis.
- Recognize that an advantage of sexual reproduction is that it results in diversity within a population and increases the probability of the survival and reproduction of the population.



## Science – Grade 8

Performance Level 4 – Advanced	
<p><i>Students are able to consistently, effectively, and skillfully demonstrate knowledge of grade-level science content. Students are able to apply their content knowledge in a variety of new contexts.</i></p>	<p><b>Nature and Application of Science and Technology:</b></p> <ul style="list-style-type: none"> <li>▪ Distinguish questions that can be investigated scientifically from those which cannot (e.g., how does changing temperature change evaporation rate)</li> </ul> <p><b>Physical Science:</b></p> <ul style="list-style-type: none"> <li>▪ Distinguish forces that act at a distance (gravitational and magnetic) from contact forces</li> <li>▪ Distinguish changes that occur in the motion of particles and the distance between molecules as energy is added or removed from a material</li> <li>▪ Relate the mass of solute that will dissolve in a solvent as the temperature of the solvent increases or decreases</li> <li>▪ Distinguish heat energy from temperature</li> <li>▪ Match energy level of radiant energy with its wavelength and frequency</li> <li>▪ Recognize that balanced forces do not change the motion of an object</li> <li>▪ Identify energy transformation and transfer in complex systems</li> </ul> <p><b>Earth Science:</b></p> <ul style="list-style-type: none"> <li>▪ Relate the position and orientation of Earth on its axis to seasonal change</li> <li>▪ Identify parts of the solar system (including asteroids, comets, moons) and match the physical characteristics and motion with each part</li> <li>▪ Identify state and energy changes in the water cycle</li> </ul> <p><b>Life Science:</b></p> <ul style="list-style-type: none"> <li>▪ Identify ways in which cells, organs, and organ systems interact</li> <li>▪ Identify relationships among DNA, genes, chromosomes, and traits</li> <li>▪ Recognize that an advantage of sexual reproduction is that it results in diversity within a population and increases the probability of survival of the population</li> </ul>



## Science – Grade 8

Performance Level 3 – Meets Standard	
<p><i>Students frequently, accurately, and satisfactorily demonstrate knowledge of grade-level science content.</i></p>	<p><b>Nature and Application of Science and Technology:</b></p> <ul style="list-style-type: none"> <li>▪ Distinguish a well designed investigation from a flawed investigation</li> <li>▪ Match numerical data with descriptions of patterns in the data</li> <li>▪ Match a location on a graph with a description of that location</li> <li>▪ Identify conclusions that are consistent with a given data set</li> <li>▪ Identify variables that must be controlled in an investigation</li> </ul> <p><b>Physical Science:</b></p> <ul style="list-style-type: none"> <li>▪ Distinguish extrinsic and intrinsic properties</li> <li>▪ Predict the mass of a mixture based on the mass of the materials from which it is made</li> <li>▪ Distinguish homogeneous mixtures from heterogeneous mixtures</li> <li>▪ Use intrinsic properties to identify a material</li> <li>▪ Compare the energy levels of waves and recognize how waves transfer energy</li> <li>▪ Identify energy flow through systems that are due to convection, radiation, and conduction</li> <li>▪ Identify changes in an object's motion when unbalanced forces act on the object</li> <li>▪ Identify energy transformation and transfer in simple systems</li> </ul> <p><b>Earth Science:</b></p> <ul style="list-style-type: none"> <li>▪ Relate the position and motion of the Earth/Sun system to day and night</li> <li>▪ Relate the position and motion of the Moon/Earth system to the phases of the Moon</li> <li>▪ Order Earth materials (clay, fine and coarse sand, gravel of different sizes) on the basis of the rate at which water flows through them</li> <li>▪ Order by time of deposition, layers of sedimentary rock</li> <li>▪ Apply information from a weather map to predict the weather conditions that most likely will be observed</li> </ul> <p><b>Life Science:</b></p> <ul style="list-style-type: none"> <li>▪ Identify structural relationships among cells, organs, and organ systems</li> <li>▪ Describe familiar functions of the respiratory, circulatory and digestive system</li> <li>▪ Identify characteristics of living organisms</li> <li>▪ Use a Punnet Square to represent genotype and identify phenotype for a single trait cross</li> <li>▪ Identify advantages of sexual reproduction over asexual reproduction</li> <li>▪ Identify structures that are relevant to the transmission of genetic information (DNA, genes, chromosomes)</li> <li>▪ Identify the direction of energy flow in a food web</li> <li>▪ Use energy webs to predict how changes in one population of animals will change populations of other animals</li> <li>▪ Predict the effects on the number and size of populations of organisms in an ecosystem as biotic and abiotic components change</li> </ul>



## Science – Grade 8

Performance Level 2 – Below Standard	
<p><i>Students inconsistently, inadequately, or partially demonstrate knowledge of grade-level science content.</i></p>	<p><b>Nature and Application of Science and Technology:</b></p> <ul style="list-style-type: none"> <li>▪ Identify flaws in simple investigations</li> <li>▪ Use information from the description of an investigation to identify the tools needed to conduct the investigation</li> </ul> <p><b>Physical Science:</b></p> <ul style="list-style-type: none"> <li>▪ Order visible light of different colors according to their energies</li> <li>▪ Identify forms of energy in simple natural systems and in homes</li> <li>▪ Recognize that waves can transfer energy</li> <li>▪ Identify sound and light as common examples of waves</li> </ul> <p><b>Earth Science:</b></p> <ul style="list-style-type: none"> <li>▪ Sequence the phases of the Moon</li> <li>▪ Relate the rate at which water flows to the elevation through which the water has fallen</li> </ul> <p><b>Life Science:</b></p> <ul style="list-style-type: none"> <li>▪ Identify structures (cell, organ, organ systems) that comprise the human body</li> <li>▪ Distinguish biotic from abiotic factors in ecosystems</li> <li>▪ Identify recycling of matter as a characteristic of ecosystems</li> <li>▪ Identify ways in which human activity impacts ecosystems</li> </ul>



**Science – Grade 8**

Performance Level 1 – Well Below Standard	
<p><i>Students rarely, incorrectly, or minimally demonstrate knowledge of grade-level science content.</i></p>	<p><b>Nature and Application of Science and Technology:</b></p> <ul style="list-style-type: none"> <li>▪ Match tools with the physical properties they measure</li> </ul> <p><b>Physical Science:</b></p> <ul style="list-style-type: none"> <li>▪ Identify the physical properties of common objects</li> <li>▪ Identify common forms of energy (e.g., light, sound, electrical, kinetic, potential)</li> <li>▪ Identify physical changes that occur when energy is added or removed from materials</li> </ul> <p><b>Earth Science:</b></p> <ul style="list-style-type: none"> <li>▪ Identify the Sun as the energy source that drives most of the changes in Earth's systems (water, hydrologic, atmospheric, geological)</li> </ul> <p><b>Life Science:</b></p> <ul style="list-style-type: none"> <li>▪ Identify functions of major systems of the human body (respiratory, circulatory, digestive)</li> <li>▪ Differentiate sexual from asexual reproduction</li> <li>▪ Distinguish habitats from ecosystems</li> <li>▪ Identify the Sun as the energy source for all ecosystems</li> </ul>



## Grade 10 – Content Summary

### ***Nature and Application of Science and Technology***

*Performances:*

- Distinguish hypotheses that can be tested experimentally from hypotheses that cannot be tested experientially.
- Distinguish well constructed scientific explanations from poorly constructed scientific explanations.
- Distinguish conclusions that are consistent with observations from conclusions that are not consistent with observations.

### ***Physical Science***

*Performances:*

- Apply knowledge of the organization of the periodic table to predict the chemical properties of elements.
- Distinguish diagrams illustrating chemical bonding that results from the transfer of valence electrons from bonding that results when valence electrons are shared.
- Identify statements and equations that show the relationship between energy and matter.

### ***Earth Science***

*Performances:*

- Match descriptions of the evolution of the solar system and the composition of the Earth to the tenets of Solar Nebula Theory
- Identify sources of energy that fuel interaction in Earth's systems.

### ***Life Science***

*Performances:*

- Apply knowledge of metabolic processes to predict how changes in an organism's environment will effect changes in the process (for instance, how light intensity and carbon dioxide concentration in the atmosphere affects rate of photosynthesis).
- Relate changes in the genetic information of a population to the survival and reproduction of organisms that have adapted to changes in the population's environment.



## Science – Grade 10

Performance Level 4 – Advanced	
<p><i>Students are able to consistently, effectively, and skillfully demonstrate knowledge of grade-level science content. Students are able to apply their content knowledge in a variety of new contexts.</i></p>	<p><b>Nature and Application of Science and Technology:</b></p> <ul style="list-style-type: none"> <li>▪ Distinguish well constructed scientific explanations from poorly constructed scientific explanations</li> <li>▪ Distinguish conclusions that are consistent with observations from conclusions that are not consistent with observations</li> </ul> <p><b>Physical Science:</b></p> <ul style="list-style-type: none"> <li>▪ Apply knowledge of the organization of the periodic table to predict the chemical properties of elements</li> <li>▪ In diagrams illustrating chemical bonding, distinguish bonding that results from the transfer of valence electrons from bonding that results when valence electrons are shared</li> <li>▪ Recognize that chemical and physical changes obey the law of conservation of mass and of energy</li> <li>▪ Relate changes in temperature, pressure, and concentration to the rate of chemical reactions</li> <li>▪ Distinguish at the molecular level the transfer of energy by waves from the transfer of heat</li> </ul> <p><b>Earth Science:</b></p> <ul style="list-style-type: none"> <li>▪ Match descriptions of the evolution of the Solar System and the composition of the Earth to the tenets of Solar Nebula Theory</li> <li>▪ Identify the relationship between the zones of likely volcanic activity and high earthquake potential to tectonic plates</li> <li>▪ Identify sources of energy that fuel interaction in Earth's systems</li> </ul> <p><b>Life Science:</b></p> <ul style="list-style-type: none"> <li>▪ Relate the molecular structure of enzymes to the molecular structure of the substrates on which the enzymes act</li> <li>▪ Identify how the structure of cells relate to energy transformations, energy transport, chemical changes, and the transport of chemicals that take place in cells (e.g., passive and active transport through cell membranes)</li> <li>▪ Predict the effect of mutations on the function of organisms</li> <li>▪ Interpret molecular representations of metabolic processes of plants and animals</li> <li>▪ Represent metabolic processes of plants and animals at the molecular level (respiration, action of enzymes)</li> <li>▪ Apply knowledge of metabolic processes to predict how changes in an organism's environment will affect changes in the process (e.g. how light intensity and carbon dioxide concentration in the atmosphere affects rate of photosynthesis)</li> <li>▪ Order the progression of energy transformations in animal digestion and metabolism</li> <li>▪ Relate events during meiosis to variation of organisms in a species</li> <li>▪ Relate the survival and reproduction of organisms that have adapted to changes in a population's environment to changes in the genetic information of a population</li> </ul>



## Science – Grade 10

Performance Level 3 – Meets Standard	
<p><i>Students frequently, accurately, and satisfactorily demonstrate knowledge of grade-level science content.</i></p>	<p><b>Nature and Application of Science and Technology:</b></p> <ul style="list-style-type: none"> <li>▪ Distinguish hypotheses that can be tested scientifically from guesses that cannot be tested scientifically</li> </ul> <p><b>Physical Science:</b></p> <ul style="list-style-type: none"> <li>▪ Identify trends in chemical and physical properties across the periodic table</li> <li>▪ Know that a balanced chemical equation is a representation of the law of conservation of mass</li> <li>▪ Identify factors that influence the rate of chemical reactions</li> </ul> <p><b>Earth Science:</b></p> <ul style="list-style-type: none"> <li>▪ Identify gravity as the force that keeps objects in the Solar System in their orbit</li> <li>▪ Identify changes that occur as Earth materials move through the rock cycle</li> <li>▪ Identify changes that occur when Earth systems interact (e.g., the hydrosphere/atmosphere interactions of the water cycle)</li> </ul> <p><b>Life Science:</b></p> <ul style="list-style-type: none"> <li>▪ Identify a complete equation for photosynthesis and identify the missing elements in an incomplete equation for photosynthesis</li> <li>▪ Compare the products, reactants, and energy changes that occur in photosynthesis and cellular respiration</li> <li>▪ Identify energy transformations that occur in organisms and how these transformations contribute to the survival of the organism</li> <li>▪ Identify examples of plants' synthesis of substances other than sugars and starches that are important to human life (e.g. synthesis of vitamin C in orange and grapefruit plants)</li> <li>▪ Sequence the stages of mitosis</li> <li>▪ Identify the structures and processes involved in reproduction, development, transmission of genetic information (e.g. chromosomes, DNA, cell cycle, meiosis, fertilization)</li> <li>▪ Identify the relationship between diversity in plant and animal populations and the survival of the population when changes occur in the environment</li> <li>▪ Identify how evolution and diversity within species are related</li> <li>▪ Identify the ways in which photosynthesis and respiration influence the flow of energy in living systems and in ecosystems</li> </ul>



## Science – Grade 10

Performance Level 2 – Below Standard	
<p><i>Students inconsistently, inadequately, or partially demonstrate knowledge of grade-level science content.</i></p>	<p><b>Nature and Application of Science and Technology:</b></p> <ul style="list-style-type: none"> <li>▪ Distinguish well organized experimental data from poorly organized experimental data</li> </ul> <p><b>Physical Science:</b></p> <ul style="list-style-type: none"> <li>▪ Identify the atomic structure of elements using information (atomic mass and number) from the periodic table</li> <li>▪ Balance simple chemical equations</li> <li>▪ Recognize that an atom is neutral when the number of protons in an atom's nucleus equals the number of electrons surrounding the nucleus</li> <li>▪ Identify the sequence of energy transfer by waves in a familiar system (e.g. the transfer of energy from a vibrating violin string to an ear drum)</li> <li>▪ Identify the sequence of energy transfers and transformations in a familiar system (e.g., from burning coal to electrical energy)</li> </ul> <p><b>Earth Science:</b></p> <ul style="list-style-type: none"> <li>▪ Identify materials and structures found in the geosphere</li> </ul> <p><b>Life Science:</b></p> <ul style="list-style-type: none"> <li>▪ Identify examples of the complex chemical substances that animals synthesize from the foods they eat</li> <li>▪ Identify the advantages of sexual reproduction over asexual reproduction</li> <li>▪ Use Punnet squares to represent genotype and use genetic information to identify the phenotype for a single trait cross</li> <li>▪ Identify ways in which members of the same species exhibit diverse physical characteristics and behaviors</li> </ul>



## Science – Grade 10

Performance Level 1 – Well Below Standard	
<p><i>Students rarely, incorrectly, or minimally demonstrate knowledge of grade-level science content.</i></p>	<p><b>Nature and Application of Science and Technology:</b></p> <ul style="list-style-type: none"> <li>▪ Match graphical data with numerical data in tabular form</li> </ul> <p><b>Physical Science:</b></p> <ul style="list-style-type: none"> <li>▪ Locate electrons, protons and neutrons on a diagram of an atom</li> <li>▪ Balance simple chemical equations</li> <li>▪ Identify common forms of energy</li> <li>▪ Predict that change will occur when matter and energy interact</li> </ul> <p><b>Earth Science:</b></p> <ul style="list-style-type: none"> <li>▪ Identify Earth systems (hydrosphere, atmosphere, biosphere and geosphere)</li> </ul> <p><b>Life Science:</b></p> <ul style="list-style-type: none"> <li>▪ Identify structures that are relevant to the transmission of genetic information (DNA, genes, chromosomes)</li> <li>▪ Identify biotechnology applications in areas such as food production, medicine, agriculture and manufacturing (genetically altered corn, animal cloning, development of synthetic blood cells, and production of drugs)</li> </ul>