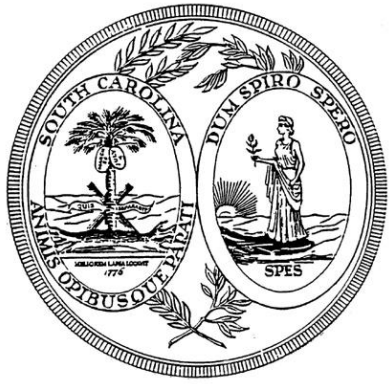
South Carolina Academic Standards and Performance Indicators for Science 2014



Instructional Units Resource

7th Grade

South Carolina Academic Standards and Performance Indicators for Science 2014
Seventh Grade Science Instructional Unit Resource

As support for implementing the *South Carolina Academic Standards and Performance Indicators for Science 2014*, the standards for Seventh Grade have been grouped into possible units. In the Overview of Units below, the titles for those possible units are listed in columns. Refer to the Overview document to note these unit titles and how Standards, Conceptual Understandings, Performance Indicators, Science and Engineering Practices, and Crosscutting Concepts align. Following the Overview of Units, an Instructional Unit document is provided that delivers guidance and possible resources in teaching our new *South Carolina Academic Standards and Performance Indicators for Science 2014*. The purpose of this document is to provide guidance as to how all the standards in this grade may be grouped into units and how those units might look. Since this document is merely guidance, districts should implement the standards in a manner that addresses the district curriculum and the needs of students. This document is a living document and instructional leaders from around the state will continuously update and expand these resource documents. These documents will be released throughout the 2016-2017 school year with the intentionality of staying ahead of instruction. Teachers should also note that links to the Standards document, A Framework for K-12 Science Education: Practices, Crosscutting Concepts, and Core Ideas, the SEP Support Document, and the Support Document 2.0 are embedded throughout the Instructional Unit format for reference.

Acknowledgments

Jean Baptiste Massieu, famous deaf educator, made a statement that is now considered a French proverb. “Gratitude is the memory of the heart. Indeed, appreciation comes when you feel grateful from the depths of your heart. The head keeps an account of all the benefits you received and gave. But the heart records the feelings of appreciation, humility, and generosity that one feels when someone showers you with kindness.” It is with sincere appreciation that we humbly acknowledge the dedication, hard work and generosity of time provided by teachers and instructional leaders across the state that have made and are continuing to make the Instructional Unit Resources possible.

Grade 7 Overview of Units

Unit 1		Unit 2		Unit 3	Unit 4	
PHYSICAL SCIENCE: CLASSIFICATION AND CONSERVATION OF MATTER		LIFE SCIENCE: ORGANIZATION IN LIVING SYSTEMS		LIFE SCIENCE: HEREDITY – INHERITANCE AND VARIATION OF TRAITS	ECOLOGY: INTERACTIONS OF LIVING SYSTEMS AND THE ENVIRONMENT	
Standard		**Standard**		**Standard**	**Standard**	
7.P.2		7.L.3		7.L.4	7.EC.5	
Conceptual Understanding		**Conceptual Understanding**		**Conceptual Understanding**	**Conceptual Understanding**	
7.P.2A	7.P.2B	7.L.3A	7.L.3B	7.L.4A	7.EC.5A	7.EC.5B
Performance Indicators		**Performance Indicators**		**Performance Indicators**	**Performance Indicators**	
7.P.2A.1 7.P.2A.2 7.P.2A.3 7.P.2A.4	7.P.2B.1 7.P.2B.2 7.P.2B.3 7.P.2B.4 7.P.2B.5	7.L.3A.1 7.L.3A.2 7.L.3A.3 7.L.3A.4	7.L.3B.1 7.L.3B.2	7.L.4A.1 7.L.4A.2 7.L.4A.3 7.L.4A.4 7.L.4A.5 7.L.4A.6	7.EC.5A.1 7.EC.5A.2 7.EC.5A.3	7.EC.5B.1 7.EC.5B.2 7.EC.5B.3 7.EC.5B.4
***Science and Engineering Practices**		***Science and Engineering Practices**		***Science and Engineering Practices**	***Science and Engineering Practices**	
7.S.1A.2 7.S.1A.3 7.S.1A.4 7.S.1A.5 7.S.1A.6 7.S.1A.8		7.S.1A.2 7.S.1A.4 7.S.1A.7 7.S.1A.8		7.S.1A.2 7.S.1A.5 7.S.1A.6 7.S.1A.7 7.S.1A.8	7.S.1A.1 7.S.1A.2 7.S.1A.4 7.S.1A.7	
***CrossCutting Concepts**		***CrossCutting Concepts**		***CrossCutting Concepts**	***CrossCutting Concepts**	
1, 2, 3, 4, 5, 6, 7		2, 4, 6		1, 2, 4, 6, 7	1, 2, 3, 4, 5, 6, 7	

**Teachers have the discretion to enhance the selected SEP's and CCC's.*

Unit Title
Heredity: Inheritance and Variation of Traits
Standard http://ed.sc.gov/scdoe/assets/file/agency/ccr/Standards-Learning/documents/South_Carolina_Academic_Standards_and_Performance_Indicators_for_Science_2014.pdf
7.L.4 The student will demonstrate an understanding of how genetic information is transferred from parent to offspring and how environmental factors and the use of technologies influence the transfer of genetic information.

Conceptual Understanding
7.L.4A. Inheritance is the key process causing similarities between parental organisms and their offspring. Organisms that reproduce sexually transfer genetic information (DNA) to their offspring. This transfer of genetic information through inheritance leads to greater similarity among individuals within a population than between populations. Technology allows humans to influence the transfer of genetic information.
New Academic Vocabulary **Some students may need extra support with the following academic vocabulary in order to understand what they are being asked to understand and do. Teaching these terms in an instructional context is recommended rather than teaching the words in isolation. A great time to deliver explicit instruction for the terms would be during the modeling process. Ultimately, the student should be able to use the academic vocabulary in conversation with peers and teachers. These terms are pulled from the essential knowledge portion of the Support Doc 2.0 (http://ed.sc.gov/instruction/standards-learning/science/support-documents-and-resources/) and further inquiry into the terms can be found there.**

Acquired trait	Allele	Biomedical research	Chromosome	Codominance
Dominant	Gene	Genetic engineering	Genetic trait	Genotype
Heterozygous	Homozygous	Incomplete dominance	Inherited trait	Monohybrid cross
Mutation	Offspring	Phenotype	Punnett squares	Recessive
Selective breeding				

Performance Indicators

Text highlighted below in *orange* and *italicized/underlined* shows connections to SEP's

7.L.4A.1 *Obtain and communicate information* about the relationship between genes and chromosomes to construct explanations of their relationship to inherited characteristics.

7.L.4A.2 *Construct explanations* for how genetic information is transferred from parent to offspring in organisms that reproduce sexually.

7.L.4A.3 *Develop and use models* (Punnett squares) to describe and predict patterns of the inheritance of single genetic traits from parent to offspring (including dominant and recessive traits, incomplete dominance, and codominance).

7.L.4A.4 *Use mathematical and computational thinking* to predict the probability of phenotypes and genotypes based on patterns of inheritance.

7.L.4A.5 *Construct scientific arguments* using evidence to support claims for how changes in genes (mutations) may have beneficial, harmful, or neutral effects on organisms.

7.L.4A.6 *Construct scientific arguments* using evidence to support claims concerning the advantages and disadvantages of the use of technology (such as selective breeding, genetic engineering, or biomedical research) in influencing the transfer of genetic information.

***Science and Engineering Practices**

Support for the guidance, overviews of learning progressions, and explicit details of each SEP can found in the Science and Engineering Support Doc (http://ed.sc.gov/scdoe/assets/File/instruction/standards/Science/Support%20Documents/Complete_2014SEPsGuide_SupportDoc2_0.pdf). It is important that teachers realize that the nine science and engineering practices are not intended to be used in isolation. Even if a performance indicator for a given standard only lists one of the practices as a performance expectation, scientists and engineers do not use these practices in isolation, but rather as part of an overall sequence of practice. When educators design the learning for their students, it is important that they see how a given performance expectation fits into the broader context of the other science and engineering practices. This will allow teachers to provide comprehensive, authentic learning experiences through which students will develop and demonstrate a deep understanding of scientific concepts.

7.S.1A.2 Develop, use, and refine models to (1) understand or represent phenomena, processes, and relationships, (2) test devices or solutions, or (3) communicate ideas to others.

7.S.1A.5 Use mathematical and computational thinking to (1) use and manipulate appropriate metric units, (2) collect and analyze data, (3) express relationships between variables for models and investigations, or (4) use grade-level appropriate statistics to analyze data.

7.S.1A.6 Construct explanations of phenomena using (1) primary or secondary scientific evidence and models, (2) conclusions from scientific investigations, (3) predictions based on observations and measurements, or (4) data communicated in graphs, tables, or diagrams.

7.S.1A.7 Construct and analyze scientific arguments to support claims, explanations, or designs using evidence from observations, data, or informational texts.

7.S.1A.8 Obtain and evaluate scientific information to (1) answer questions, (2) explain or describe phenomena, (3) develop models, (4) evaluate hypotheses, explanations, claims, or designs or (5) identify and/or fill gaps in knowledge. Communicate using the conventions and expectations of scientific writing or oral presentations by (1) evaluating grade-appropriate primary or secondary scientific literature, or (2) reporting the results of

student experimental investigations.

***Cross Cutting Concepts** http://www.nap.edu/read/13165/chapter/8

The link above provides support from the Framework for K-12 Science Education: Practices, Crosscutting Concepts, and Core Ideas (2012). The text in blue and *italicized/underlined* below provides a brief explanation for how the specific content ties to the CCC's.

1. Patterns: The National Research Council states "Observed patterns of forms and events guide organization and classification, and they prompt questions about relationships and the factors that influence them" (p. 84). *Genetic information is passed along from parent to offspring according to a predictable patterns of inheritance as can be determined through the use of Punnett squares.*

2. Cause and effect: The National Research Council states "events have causes, sometimes simple, sometimes multifaceted. A major activity of science is investigating and explaining causal relationships and the mechanisms by which they are mediated. Such mechanisms can then be tested across given contexts and used to predict and explain events in new contexts" (p. 84). *Parental genetic information results in traits and characteristics exhibited and identified in offspring.*

4. Systems and system models: The National Research Council states that this includes "defining the system under study—specifying its boundaries and making explicit a model of that system—provides tools for understanding and testing ideas that are applicable throughout science and engineering" (p. 84). *Populations of organisms act as systems whose inputs are comprised of new genetic material and outputs are the genetic offspring.*

6. Structure and function: The National Research Council states that "the way in which an object or living thing is shaped and its substructure determine many of its properties and functions (p. 84). *Genes are the substructures that determine the way a living thing is shaped and its properties.*

7. Stability and change: The National Research Council states "for natural and built systems alike, conditions of stability and determinants of rates of change or evolution of the system are critical elements of study" (p. 84). *Genetic mutations, biomedical engineering, selective breeding and genetic engineering affect the stability and changes within genetics systems.*

**Teachers have the discretion to enhance the required SEP's and CCC's.*

Prior Knowledge

- 4.L.5A.4 (Inheritance and Environmental Factors, Traits)

Subsequent Knowledge

- H.B. 2 (Cell Systems)
- H.B. 4 (Characteristics of Traits and Genes)

Possible Instructional Strategies/Lessons

Strategies and lessons that will enable students to master the standard and/or indicator.

- 7.L.4A.1 Who Am I? (See appendices) Create a graphic organizer (Microsoft Word SmartArt- relationships) showing how chromosomes, genes, and DNA relate to inherited traits.

- 7.L.4A.2 Match the offspring Baby Lab Students will flip coins to create a simulated baby to demonstrate how traits are passed from parent to offspring (Mendelian Genetics). This resource can be found at: http://www.biologyjunction.com/baby_lab.pdf

- 7.L.4A.3 Playing Card Activity (See appendices) Students will use playing cards to introduce students to the patterns of inheritance (dominant, recessive, heterozygous, homozygous)

- 7.L.4A.3-7.L.4A.4 Punnett Square activity (See appendices) Student will complete Punnett squares and draw conclusions to determine the transference of genetic information from parents to offspring. Students will calculate the probability of the genotype and phenotype of offspring.

- 7.LaA.3-7.L.4A.4 Bean Bag Genetics Students will draw beans from bags to demonstrate how traits are passed from parent to offspring. The activity is connected to Punnett Squares as well. http://extension.uga.edu/k12/science-behind-our-food/lesson-plans/monohybridcrossespunnettsquare.pdf

- 7.L.4A.1-7.L.4A.4 SpongeBob Resources Use the SpongeBob genetics powerpoint, practice, and quiz to describe and predict patterns of the inheritance of single genetic traits from parent to offspring (including dominant and recessive traits, incomplete dominance, and codominance). SpongeBob PPT- sciencespot.net/Media/SpongeBobGenetics ;
  Sponge Bob Genetics http://www.bioeyes.org/teachers/activities/inter/spongebob-genetics.pdf
  ReBOB Babies genes and alleles activity - https://communities.naae.org/docs/DOC-1424

- 7.L.4A.3-7.L.4A.4 Punnett Square Steps Students will develop and use Punnett Squares to describe and predict patterns of the inheritance and to predict the probability of phenotypes and genotypes based on these patterns of inheritance. This activity provides students with steps to use to complete and analyze Punnett squares. (See Appendices)

- 7.L.4A.5-7.L.4A.6 Developing Scientific Arguments Use these resources to develop student understanding.

  Jelly Genes This activity models what occurs during various types of genetic mutations. This resource can be found at: oklahoma4h.okstate.edu/biotech/**jelly_genes**.doc

  Monstrous Mutations: Students simulate the advantages and disadvantages of genetic mutations. This resource can be found at: http://mypages.iit.edu/~smile/cb1298.htm

  Research and analyze the use of HeLa cells in the advancement of biomedical research and treatment.

Resources

- The Gene Scene A simple video that introduces students to genes, chromosomes and DNA. https://www.youtube.com/watch?v=xc2wbIDfO7EAmoeba Sisters

- Punnett Squares and a Dihybrid Cross A video that introduces the Dihybrid Cross. https://www.youtube.com/c/amoebasisters/videos

- Genetic Engineering A series of activities exploring genetic engineering. http://www.discoveryeducation.com/teachers/free-lesson-plans/genetic-engineering.cfm

- Teach Genetics: This resource provides various activities and information about genetics. _http://teach.genetics.utah.edu/content/heredity/

- Restocking Mt. Vernon's Barnyard with Rare Breeds: A story of a woman's attempt to bring back rare animals to Mt. Vernon. http://www.mountvernon.org/george-washington/farming/animals/restocking-mount-vernons-barnyard-with-rare-breeds

Sample Formative Assessment Tasks/Questions

Additional sample formative assessment tasks/questions for grade bands are located at the end of each of the SEP Support Doc (http://ed.sc.gov/scdoe/assets/File/instruction/standards/Science/Support%20Documents/Complete_2014SEPsGuide_SupportDoc2_0.pdf)

- Analyze a Punnett Square to determine the probability of a single recessive genetic trait based upon phenotype of both parents.
- Students create a "Super Baby" based on the performance task found in Georgia's 7th grade Science Performance Standards Culminating Assessment https://www.georgiastandards.org/
- SpongeBob Genetics Quiz This resource can be found at: sciencespot.net/Media/gen_spbob**genetics**qz.pdf

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7th Grade – Heredity: Inheritance and Variation of Traits

Who Am I?

Materials:

- X & Y die-cuts all the same color
- 5 small strips of paper per strips of paper (2X1 inch)

Procedures:

1. Explain that female chromosomes are XX and male chromosomes are XY. Have each student get their pair of chromosomes based on their gender.
2. Instruct all XX's to go to one side of the room, and the XY's to go to the other side.
3. Have each team talk about their physical characteristics - differences and similarities.
4. Gather the whole group back together and talk about their findings.
5. Explain to them how they acquired their chromosomes. Explain they also acquire genes which give them their special characteristics
6. On each of the five strips, have students write a physical characteristic (gene) that makes them unique.
7. Close by having students share with a partner their five genes.

Standard 7.L.4: The student will demonstrate an understanding of how genetic information is transferred from parent to offspring and how environmental factors and the use of technologies influence the transfer of genetic information.

Conceptual Understanding

7.L.4A. Inheritance is the key process causing similarities between parental organisms and their offspring. Organisms that reproduce sexually transfer genetic information (DNA) to their offspring. This transfer of genetic information through inheritance leads to greater similarity among individuals within a population than between populations. Technology allows humans to influence the transfer of genetic information.

Performance Indicators:

7.L.4A.1 *Obtain and communicate information* about the relationship between genes and chromosomes to construct explanations of their relationship to inherited characteristics.

Science and Engineering Practices:

7.S.1A.8 Obtain and evaluate scientific information to (1) answer questions, (2) explain or describe phenomena, (3) develop models, (4) evaluate hypotheses, explanations, claims, or designs or (5) identify and/or fill gaps in knowledge. Communicate using the conventions and expectations of scientific writing or oral presentations by (1) evaluating grade-appropriate primary or secondary scientific literature, or (2) reporting the results of student experimental investigations.

Cross Cutting Concepts

1. Patterns. The National Research Council states "Observed patterns of forms and events guide organization and classification, and they prompt questions about relationships and the factors that influence them" (p. 84). *Genetic information is passed along from parent to offspring according to a predictable patterns of inheritance as can be determined through the use of Punnett squares.*

6. Structure and function. The National Research Council states that "the way in which an object or living thing is shaped and its substructure determine many of its properties and functions (p. 84). *Genes are the substructures that determine the way a living thing is shaped and its properties.*

References

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7th Grade – Heredity: Inheritance and Variation of Traits

Playing Card - Genetics

Materials:

- Deck of regular playing cards

Procedure:

1. Provide each child with two cards. Explain that each card represents a characteristic or trait from each parent.

   Discussion Questions Part 1

   - How many of you have two cards that are the same color? red/black
   - How many of you have a card of each color?

   Discuss the ideas of homozygous and heterozygous.

2. Have students place their cards in a stack. Explain to students that black covers red cards. (If they have two black cards it doesn't matter which is on top; two red - no black to cover.

   Discussion Questions Part 2

   - How many of you have a black card showing?
   - How many of you have a red card showing?
   - Why do we have more people with black cards showing?

   Discuss the ideas of dominant and recessive traits.

   Claim: Write a statement about traits that they learned from this short activity.

   Evidence: What evidence do you have to support your claim?

Standard 7.L.4: The student will demonstrate an understanding of how genetic information is transferred from parent to offspring and how environmental factors and the use of technologies influence the transfer of genetic information.

Conceptual Understanding

7.L.4A. Inheritance is the key process causing similarities between parental organisms and their offspring. Organisms that reproduce sexually transfer genetic information (DNA) to their offspring. This transfer of genetic information through inheritance leads to greater similarity among individuals within a population than between populations. Technology allows humans to influence the transfer of genetic information.

Performance Indicators:

7.L.4A.3 *Develop and use models* (Punnett squares) to describe and predict patterns of the inheritance of single genetic traits from parent to offspring (including dominant and recessive traits, incomplete dominance, and codominance).

Science and Engineering Practices:

7.S.1A.2 Develop, use, and refine models to (1) understand or represent phenomena, processes, and relationships, (2) test devices or solutions, or (3) communicate ideas to others.

Cross Cutting Concepts

1. Patterns. The National Research Council states "Observed patterns of forms and events guide organization and classification, and they prompt questions about relationships and the factors that influence them" (p. 84). *Genetic information is passed along from parent to offspring according to a predictable patterns of inheritance as can be determined through the use of Punnett squares.*

2. Cause and effect: The National Research Council states "events have causes, sometimes simple, sometimes multifaceted. A major activity of science is investigating and explaining causal relationships and the mechanisms by which they are mediated. Such mechanisms can then be tested across given contexts and used to predict and explain events in new contexts" (p. 84). *Parental genetic information results in traits and characteristics exhibited and identified in offspring.*

References

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7th Grade – Heredity: Inheritance and Variation of Traits

Punnett Squares Steps

Materials:

- Resources that provide students information about scenarios that could be used to generate Punnett squares
- A copy of the steps for completing Punnett squares and a chart with the steps posted in the classroom
- Pencil
- Paper

Rationale: Use the gradual release model to provide steps that can increase student achievement. The gradual release model consists of a teacher model/think-aloud, guided practice, closure to ensure mastery before the independent practice, followed by independent practice (Hollingsworth, 12). The use of white boards or some other tool that can be used for every student to show their work will maximize student engagement and understanding.

Procedures: Using the steps listed below, create an anchor chart for the classroom and make copies for each student. Have them put the steps in a journal or other place so that they will have them when needed.

- Teacher Model: Model the steps, stopping along the way to ask students questions about what the teacher is doing only. Do not ask them what comes next. Stick with questions that require them to reflect on what the teacher is doing. For example, the teacher should be referring to the steps throughout the process and talking through his/her thought process.
- Guided Practice: Students begin to work with the teacher to complete Punnett squares. The teacher may ask students to complete the first step on their white boards and show them. The teacher may also ask students to share what step comes next. This should be repeated until most of the students are comfortably completing each step with teacher support.
- Closure: At this point, the teacher provides students with scenario. As each student finishes, the teacher checks student work. If 80% or more of the students successfully complete the Punnett square, the students are ready for independent practice.
- Independent Practice: Students complete steps to complete Punnett squares and respond to questions independently. Teacher should work with students in small groups who were not ready for independent practice.

7th Grade – Heredity: Inheritance and Variation of Traits

Punnett Squares Steps

Steps for Completing a Punnett Square:

1. Identify the genotype of each parent.
2. Draw a Punnett square.
3. Write the genotype of one parent across the top.
4. Write the genotype of the other parent down the side.
5. One allele is given from each parent and copied in the boxes beginning with the columns.
6. Complete distributing alleles by moving across the rows.
7. Upon completion, there should be 2 letters in all 4 boxes representing all of the possible genotypes for the offspring.

Standard
Standard 7.L.4: The student will demonstrate an understanding of how genetic information is transferred from parent to offspring and how environmental factors and the use of technologies influence the transfer of genetic information.

Conceptual Understanding
7.L.4A. Conceptual Understanding: Inheritance is the key process causing similarities between parental organisms and their offspring. Organisms that reproduce sexually transfer genetic information (DNA) to their offspring. This transfer of genetic information through inheritance leads to greater similarity among individuals within a population than between populations. Technology allows humans to influence the transfer of genetic information.

Performance Indicators
7.L.4A.3 *Develop and use models* (Punnett squares) to describe and predict patterns of the inheritance of single genetic traits from parent to offspring (including dominant and recessive traits, incomplete dominance, and codominance).
7.L.4A.4 *Use mathematical and computational thinking* to predict the probability of phenotypes and genotypes based on patterns of inheritance.

Science and Engineering Practice
7.S.1A.2 Develop, use, and refine models to (1) understand or represent phenomena, processes, and relationships, (2) test devices or solutions, or (3) communicate ideas to others.
7.S.1A.5 Use mathematical and computational thinking to (1) use and manipulate appropriate metric units, (2) collect and analyze data, (3) express relationships between variables for models and investigations, or (4) use grade-level appropriate statistics to analyze data.

7th Grade – Heredity: Inheritance and Variation of Traits

Punnett Squares Steps

Cross Cutting Concepts:

1. Patterns. The National Research Council states "Observed patterns of forms and events guide organization and classification, and they prompt questions about relationships and the factors that influence them" (p. 84) *Genetic information is passed along from parent to offspring according to a predictable patterns of inheritance as can be determined through the use of Punnett squares.*

2. Cause and effect: The National Research Council states "events have causes, sometimes simple, sometimes multifaceted. A major activity of science is investigating and explaining causal relationships and the mechanisms by which they are mediated. Such mechanisms can then be tested across given contexts and used to predict and explain events in new contexts" (p. 84) *Parental genetic information results in traits and characteristics exhibited and identified in offspring.*

4. Systems and system models. The National Research Council states that this includes "defining the system under study—specifying its boundaries and making explicit a model of that system—provides tools for understanding and testing ideas that are applicable throughout science and engineering" (p. 84) *Populations of organisms act as systems whose inputs are comprised of new genetic material and outputs are the genetic offspring.*

7. Stability and change. The National Research Council states "for natural and built systems alike, conditions of stability and determinants of rates of change or evolution of the system are critical elements of study" (p. 84). *Genetic mutations, biomedical engineering, selective breeding and genetic engineering affect the stability and changes within genetics systems.*

References

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