

## GENETICS UNIT SKETCH

**Essential Question: Why do our offspring look like us?**

<b>WEEK 1</b>	<b>Lesson 1</b>	<b>Lesson 2</b>	<b>Lesson 3</b>	<b>Lesson 4</b>	<b>Lesson 5</b>
<b>Essential and Guiding Questions</b>	Where do our traits come from?	What can we learn from the study of chromosomes?	What can we learn from the study of chromosomes? Cont..	What are genes made up?	How can a model of DNA be made?
<b>Learning Opportunities</b>	<p>Introduce essential question.</p> <p>Ask students to make observations to identify specific traits. Ask: In what sense are all of you similar or different?</p> <p>Lead the class to an open discussion on chromosomes and genes as units of heredity</p>	<p>Introduce guiding question. Brainstorm.</p> <p>Distribute karyotype and ask questions. Have students work in groups and present videodisc. Have students cut out chromosomes and sort them out. Next day</p>	<p>Have students analyze results. Answer questions.</p> <p>Feedback.</p>	<p><b>Motivation:</b> What do you need to build an airplane? What does it take to create a new organism? Brainstorm.</p> <p>Compare and contrast after video analysis. Have group discussion on genes and DNA</p>	<p>After introduction, lead class to an open discussion about how to construct a model. Distribute materials and have students design a model of DNA. Have students share views and opinions. If necessary show videodisc or chart. Analysis questions</p>
<b>Assessment and Reflection</b>	Worksheets and oral presentation	Observation group work. Modeling and oral presentation. Lab report	Lab report	Observation of group discussion, video analysis	Observation of group work. Analysis questions and modeling
<b>Standards</b>	2.1a, 2.1b, 2.1d, 2.1e	2.1a, 2.1c, 2.1d	2.1a, 2.1c, 2.1d	2.1c, 2.1f	2.1c, 2.1f

## GENETICS UNIT SKETCH

**Essential Question: Why do our offspring look like us?**

<b>WEEK 2</b>	<b>Lesson 6</b>	<b>Lesson 7</b>	<b>Lesson 8</b>	<b>Lesson 9</b>	<b>Lesson 10</b>
<b>Essential and Guiding Questions</b>	<b>How does the structure of DNA allow the molecule to store such a vast amount of information?</b>	<b>How does the Structure of DNA allow the molecule to reproduce the information?</b>	<b>Is a change in DNA good or bad?</b>	<b>Is it possible to create a new type of organism?</b>	<b>Is it possible to create a new type of organism?</b>
<b>Learning Opportunities</b>	<b>Introduce guiding question. Brainstorm and use direct instruction to explain major concepts. Use audio-visual material to teach pairing bases. Make use of worksheets to assess understanding</b>	<b>Introduce guiding question. Have students design ways to create a replication model of DNA. Have them present to the class their process. Make use of chart or transparency to reinforce concept</b>	<b>Introduce g guiding question. Motivate students by using an analogy. Have students work in groups. Distribute materials (worksheets) and instruct them to search for mutations.</b>	<b>Motivate students by reading a short story about animal breeding. Make use of videodisc to illustrate the main steps of genetic recombination. Distribute worksheets to check for understanding. Class discussion</b>	<b>Review yesterday's lesson and have groups model the process genetic recombination. Group work and oral presentation. Questioning</b>
<b>Assessment and Reflection</b>	<b>Worksheets and questioning</b>	<b>Oral presentation and modeling. Worksheets</b>	<b>Worksheets and observation. Informal assessment by asking questions</b>	<b>Class discussion, questions and worksheets</b>	<b>Modeling, oral presentation and questioning</b>
<b>Standards</b>	<b>2.1f</b>	<b>2.1f</b>	<b>2.1f</b>	<b>2.2a, 2.2b, 2.2c, 2.2d</b>	<b>2.2a, 2.2b, 2.2c, 2.2d</b>

**Unit Topic/Essential Question: Why do our offspring look like us?****Aim/Guiding Question: Where do our traits come from?****Objectives*****Students will be able to:***

- Appreciate that specific traits distinguish one organism from the other.
- Understand how traits are determined by specific instructions contained in segments of DNA called genes.
- Understand that the passage of these instructions from generation to generation is called heredity.

**New Terms:**

**genes**                      **traits**  
**chromosomes**        **heredity**

**Materials/Preparations:**

Videodisc, monitor, charts, transparency, or overhead projector

<b>Time (min)</b>	<b>Development</b>	<b>Instructional Strategies</b>
5	<i>Write on the board:</i> Look closely at your classmates and describe the appearance of two of them. If students hesitate, give examples of important characteristics such as height, color, hair, etc. Ask some students to read their descriptions to the class. Write on the board some of these characteristics. Introduce essential question : <b>Are offspring copies of their parents ?</b>	Do Now, Motivation
5	<i>Pose</i> the following questions: <ul style="list-style-type: none"> <li>• <i>In what sense are of you the same?</i></li> <li>• <i>In what sense are you different?.</i></li> </ul> Lead class to an open discussion. Point out that all humans share common characteristics such as eyes, arms and legs and in that sense we are all the same. But no two of them are exactly alike. We all have unique characteristics that make us different, such as skin, eye and hair color, behavior, etc. <i>Ask: What do we call those characteristics that help to identify an organism?</i> Ans. <b>TRAITS.</b> Write definition on board.	Guiding questions, Class discussion, Note taking
15	<i>Write</i> the following questions on board: <ul style="list-style-type: none"> <li>• <i>Whom do you look like?</i></li> <li>• <i>Do you look like your mother, or your father, or a mixture of both?</i></li> <li>• <i>Is there any reason for this?</i></li> <li>• <i>What does it take to make a human being?</i></li> </ul>	Guiding questions, Class discussion, Direct

	<p>Allow some time for discussion. Point out what they already learned: <i>during fertilization, male and female sex cells join. These sex cells contain materials with specific instructions that control the development of the embryo. These instructions also control the traits that are passed on from parents to offspring.</i></p> <p>Ask if they know what these " materials and instructions" are. Introduce the concept of <b>CHROMOSOMES AND GENES.</b></p> <p><i>Genes are like blueprints for building a house, except that they carry the plans for building cells, tissues, organs, and bodies. Specify that they have the instructions for making the thousands of chemical building blocks in the body. These building blocks are called proteins. Some proteins are responsible for the size, shape and structure of the parts making up your body. Other proteins, known as enzymes, make possible the thousands of chemical reactions that occur constantly in body and in all other living things.</i></p> <p><i>Point out that if you look like your father it is because many of the genes that control your father's traits also control yours (you got those genes from your father) The same thing can happen with your mother's genes.</i></p> <p>Introduce the concept of <b>HEREDITY and GENETICS.</b> Define <b>heredity</b> as the passage of these instructions from one generation to another. This concept of heredity explains why a human mother always has a human baby and why a female dog has puppies, not kittens. It is also the reason offspring look like their parents.</p>	<p>instruction, Note taking, Observation, Vocabulary development</p>
10	<p>Use a chart or transparency. Present to the class a diagram of two karyotypes (male and female chromosomes). Pose the following questions on board:</p> <ul style="list-style-type: none"> <li>• How many chromosomes does a human species have?</li> <li>• Where does each one of these chromosomes come from?</li> </ul> <p>Take this opportunity to assess students understanding on meiosis. Point out that during fertilization we only receive half the amount of chromosomes from each parent and that's a reason why we always have traits from both parents. If it is necessary show a diagram of the process of meiosis and fertilization. A videodisc would help to reinforce this concept.</p> <p>Take a moment to explain that chromosomes come in pairs and that the last pair determines the sex of the baby. XX=female, XY=male.</p>	<p>Guiding questions, Assess prior knowledge</p>
10	<p><i>Distribute</i> assessment sheet in which students have to explain the relationship between genes and chromosomes.</p> <p>Also include some different karyotypes and have students recognize if they are normal or abnormal and differentiate between male and female.</p> <p><i>Ask</i> students to explain the genetic basis of sexual and asexual reproduction. You might want to call some students to the front of the class to explain some of these questions. You might want to ask some students to summarize the lesson and explain the major concepts in today's lesson.</p>	<p>Assessment, Oral presentation</p>

**Suggested Homework:**

Have students prepare a report on karyotyping and its importance in clinical genetic. There are interesting web sites in which students can research about karyotypes. They will use this information for the next activity.

**References:**

**Standards Addressed:**

*Key ideas 2.1a, 2.1b, 2.1d, 2.1e*

**Unit Topic/Essential Question: Why do our offspring look like us?**

**Aim/Guiding Question: Is it possible to see chromosomes?  
What can we learn from the study of chromosomes?**

**Objectives**

*Students will be able to:*

- Identify the pairs of homologous chromosomes in a human cell
- Model the construction of a karyotype
- Describe the identity of various chromosomal abnormalities
- Determine the sex of an individual from a karyotype

**New Terms:**

**karyotype**                      **down syndrome**  
Klinefelter syndrome    Turner syndrome

**Materials/Preparations:**

Videodisc, monitor, charts, transparency, overhead projector, scissors, glue, karyotype sheets, and normal and abnormal chromosomes (see attachment)

<b>Time (min)</b>	<b>Development</b>	<b>Instructional Strategies</b>
5	<i>Introduce</i> the guiding question. Lead the class to a discussion about ways in which scientists can study chromosomes. You might want to review the homework if they did the research on karyotyping.	Do Now, Review homework
10	<i>Distribute</i> copies of human karyotypes (male, female, normal and abnormal) <i>Ask</i> the class to share what they have learned so far about chromosomes. <i>Ask</i> students to think about the following questions: <ul style="list-style-type: none"> <li>• How is a karyotype constructed?</li> <li>• What information do doctors learn from a karyotype?</li> <li>• How can a karyotype be used to identify chromosomal abnormalities?</li> </ul> At this point a videodisc or videotape about karyotyping would help in engaging the students into the next activity. If it is available use it to introduce the technique used to construct a karyotype. If this cannot be done you may use any textbook or article that illustrate this process and have students read aloud. Discuss with students the importance of a karyotype.	Guiding questions, Demonstration, Multi-media instruction, Think-pair-share
25	Have students work in groups of 3 or 4. <i>Distribute</i> copies of normal and abnormal chromosomes. See attachment. In order to shorten the activity tell students that they will be working with only one copy of each pair of chromosomes (instead of 46 they will have just 23). But in order to identify the sex, both chromosomes will be present. Along with these copies distribute scissors, glue, and white paper. Instruct	Group work, Modeling, Problem solving approach, Compare/contrast

	<p>students that they will cut out and paste these chromosomes onto the white paper.</p> <p>As they work they should keep in mind the following questions:</p> <ul style="list-style-type: none"> <li>• What important characteristics helped you identify the position of each chromosome?</li> <li>• Is the karyotype normal or abnormal?</li> <li>• Is the karyotype male or female?</li> </ul> <p>As students work, go around and make sure that they all remain on task. Help if it is necessary.</p>	
5	<p>After students have finished cutting and pasting single chromosomes into their respective positions. Ask them to return all materials and clean up their desks. Go around the classroom and make sure that students finished their work. Tell them that the next day they will discuss their findings.</p>	Self-evaluation

**Suggested Homework:**

Ask students to prepare a report on their findings (normal or abnormal karyotype)

The following questions will direct their thinking:

1. The three questions mentioned above (activity)
2. Give examples of major chromosomal abnormalities. E.g, Down Syndrome, etc.
3. Can we determine the karyotype of an unborn baby? Explain.

**References:**

**Standards Addressed:**

Key Ideas 2.1a, 2.1c, 2.1d

**Unit Topic/Essential Question: Why do our offspring look like us?****Aim/Guiding Question: How can karyotype analysis explain genetic disorders?****Objectives*****Students will be able to:***

- Analyze prepared karyotypes for chromosomes abnormalities.
- Hypothesize how karyotype analysis can be used to explain the presence of a genetic disorder

**New Terms:**

**Trisomy**            **monosomy**  
 disjunction      non-disjunction

**Materials/Preparations:**

Charts, transparency, large sheets of paper, (monitor and videodisc or videotape if available), finished work from the day before (karyotypes)

<b>Time (min)</b>	<b>Development</b>	<b>Instructional Strategies</b>
5	<p>Ask students to join their original group. Write on the board the following questions:</p> <ul style="list-style-type: none"> <li>• What is a karyotype?</li> <li>• How is a karyotype constructed?</li> </ul> <p>Give students some time to discuss these two questions and let them take note.</p>	Do Now, Guiding questions, Group work
5	<p>If videodisc or tape is available you might let them use it to review these questions. As they watch the videodisc segment ask them to look for information that will help them answer the questions.</p> <p>Have each group prepare a mini-presentation. Lead a class discussion.</p> <p><i>Point out that a karyotype is a picture in which the chromosomes of a cell undergoing mitosis so that the banding pattern of the chromosomes appears. The cells are then photographed through the microscope, and the photograph is enlarged. The chromosomes are cut from the photograph and arrange in pairs according to size arm length and banding patterns.</i></p>	Group discussion, Review, Note taking, Think-pair-share, Video analysis
15	<p>Ask each group to review their research from homework in which they collected information about chromosome abnormalities. (They should have information about monosomy, trisomy etc.) Ask them to compare this information with their group work from the previous day and hypothesize about possible mechanism that could lead to an abnormal number of chromosomes. It is recommended to have a transparency or chart on meiosis illustrating the process of disjunction available if students require them.</p> <p>Distribute large sheets of paper and have each group organize and illustrate their responses.</p>	Group work, Hypothesize, Think-pair-share



20	<p>Have each group make a presentation and explain their findings. Ask them to suggest a possible mechanism that might lead to any specific abnormality. In their presentations students may want to use large sheet of paper, transparency and the overhead projector, or videodisc.</p> <p>The following questions will guide student presentations:</p> <ul style="list-style-type: none"> <li>• How many chromosomes are present in your karyotype?</li> <li>• What is the sex of your karyotype?</li> <li>• You have been working with single chromosomes, what is the advantage of having both sex chromosomes present?</li> <li>• Which chromosomes appear to be abnormal?</li> <li>• What type of chromosomal problem is it?</li> </ul>	Oral presentation, Assessment
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**Suggested Homework:**

Ask students to prepare a report on different techniques used to obtain sample cells from an unborn child to prepare a karyotype.

You also might want to ask them to research the incidence of common congenital conditions such as trisomy 21 (Down Syndrome)

**References**

**Standards Addressed**

Key Ideas: 2.1a, 2.1c, 2.1d

**Unit Topic/Essential Question: Why do our offspring look like us?****Aim/Guiding Question: What are genes made of?****Objectives*****Students will be able to:***

- Understand that specific coded instructions are needed for specifying the characteristics of an organism
- Understand these instructions are coded in a molecule called DNA

**New Terms:**

Deoxyribonucleic Acid (DNA)

**Materials/Preparations:**

Monitor, videotape on DNA structure, charts or transparencies

Time (min)	Development	Instructional Strategies
5	<p>Write the following question on the board:</p> <ul style="list-style-type: none"> <li>• <i>What do you need to build an airplane?</i></li> </ul> <p>Brainstorm and write possible answers on the board or transparency.</p>	Do-Now, Motivation Guiding question
10	<p>Lead the class to an open discussion about the need to have a detailed plan or blueprint to build a safe airplane.</p> <p>Write the following question on the board:</p> <ul style="list-style-type: none"> <li>• <i>What does it take to create a new organism?</i></li> </ul> <p>Brainstorm some possible responses. Brainstorm from students that living things are made up of organ systems, and organ systems are made up of organs, organs are made up of tissues and tissues are made up of cells. Stress out the need to have a code of instructions for the thousands of traits that are characteristics of each organism. Instructions that will be used to direct the development of the cells.</p> <p>Pose the next question:</p> <ul style="list-style-type: none"> <li>• <i>Where can we find the set of instructions to make a new living thing?</i></li> </ul> <p>Brainstorm some responses and lead the class to a review about chromosomes and genes. Stress out that these instructions are found stored in units called genes and genes form part of chromosomes that can be found in the nucleus of the cell.</p> <p>Make a diagram on the board to illustrate the relationship between genes and chromosomes.</p>	Guiding questions, Direct instruction
20	<p>Point out that if genes control traits and traits are determined by specific information (genetic information)</p> <ul style="list-style-type: none"> <li>• How is that genetic information stored in the genes? To answer this question, what do we need to know first?</li> <li>• What are genes made up of?</li> </ul>	Video analysis, Group work, Think-pair-share

	<ul style="list-style-type: none"> <li>• Which molecule can store the extraordinary amount of information that results in formation of a new organism?</li> </ul> <p>Tell students that in order to answer these questions, they will watch videotape on the genetic material (DNA).  <i>Ask</i> them that as they watch the video look for information that will help them to answer these questions. Encourage them to take notes. Stop and rewind the tape as necessary.</p>	
10	<p>Arrange students in groups of 3. Tell them that with the information they have, tomorrow they will model the structure of the molecule they just watched in the videotape.</p> <p>Each group will proceed to share with their teammates the information they wrote in their notebooks. This will help to start up the next day.</p>	<p>Group discussion,          Think-pair-share</p>

**Suggested Homework:**

Ask students to research about the Watson and Crick Model of DNA. They are allow to bring computer printouts of the model or any other information about DNA

**References:**

**Standards Addressed:**

Key Ideas: 2.1c, 2.1f

**Unit Topic/Essential Question: Why do our offspring look like us?****Aim/Guiding Question: How can a model of DNA be made?****Objectives*****Students will be able to:***

- Design and construct a model for DNA replication
- Demonstrate, with a model, DNA replication

**New Terms:**

nitrogen bases            adenine            thymine  
 cytosine                    guanine            double helix  
 template

**Materials/Preparations:**

Construction paper in six different colors, 10 pieces of each color per group, scissors, 2 per group; masking tape. If it is available bring a pre-constructed model of DNA, videotapes if it's necessary

Time (min)		Instructional Strategies
5	Have students join their group formed the day before. <i>Write</i> on the board: What is a Model? Have each group discuss this question and take notes	Do-Now, Group work
5	<i>Have</i> students explain their understanding of what a model is. After a brief discussion point out that Modeling is a tool for understanding structures and processes that may be difficult to observe directly.	Guiding question, Think-pair-share
20	Distribute materials: Construction papers, 6 colors, ten pieces of each color per group; scissors, 2 per group; masking tape Experimental plan: <ul style="list-style-type: none"> <li>• The six colors will correspond to the six different molecules that make up the DNA molecule</li> <li>• Decide what shapes you will use to represent each of the six molecules</li> <li>• Using paper and pencil, brainstorm, in your group, a list of possible ways various shaped placards could be held by students as they move through a presentation of the process of DNA replication</li> <li>• Select the best idea</li> <li>• Label each placard with name of the molecule it represents</li> <li>• Decide how you will demonstrate your model</li> </ul>	Group work, Modeling, Think-pair-share
15	<i>Have</i> each group make a presentation and demonstrate their model. <i>Ask</i> students to use these analysis questions: 1. What did you learn from making a model of DNA?	Group work, Oral presentation, Modeling,

	<ol style="list-style-type: none"><li>2. Did you use the ladder comparison to make your model? If so what kind of molecules made up the sides of the ladder? What molecules made the rungs?</li><li>3. What was the easiest part of making your model? What was the most difficult part?</li><li>4. Describe the complete structure of a molecule of DNA</li><li>5. How do you think this model will help you understand how DNA stores information?</li></ol>	Guiding questions, Assessment
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**Suggested Homework:**

Ask students prepare a report on their final product and explain how the structure of DNA helps explain how:

1. How DNA carries information
2. Help reproduce the information
3. Help translate the information

**Reference:**

**Standards Addressed:**

Key Ideas: 2.1c,2.1f

**Unit Topic/Essential Question: Why do our offspring look like us?****Aim/Guiding Question: How does the structure of DNA allow the molecule to store such a vast amount of information?****Objectives*****Students will be able to:***

- Understand that DNA carries information in the sequences of base pairs
- Identify the complementary strand of a given strand of DNA
- Demonstrate how DNA replicates
- Model the process of DNA replication

**New Terms:**

template      nucleotides  
 replication

**Materials/Preparations:**

Transparency, overhead projector, charts and models of DNA and model of DNA constructed by students, prepared worksheets

Time (min)	Developments	Instructional Strategies
5	<p>Introduce the guiding question: <i>How is it possible for a molecule of DNA to store so much information?</i></p> <p>Point out that if genes are made up of DNA, this implies that DNA does all the genes must do, and so far we know that genes do three things: (try to brainstorm from the class):</p> <ol style="list-style-type: none"> <li>1. <i>It must be able to carry information</i></li> <li>2. <i>It must be able to help reproduce the information</i></li> <li>3. <i>It must be able to translate the information</i></li> </ol> <p><i>How can one molecule accomplish all these things?</i></p> <p>Remind students that today they will study the structure of DNA in more detail and, that you will be referring to their previous work constantly.</p> <p>Ask them to stand up and demonstrate to the class how the model they constructed the day before can explain the function of this marvelous molecule. Allow some time until some students refer to the sequence of bases</p>	Do-Now, Guiding question, Motivation, Reviewing
5	<p>After students have discussed these questions, ask them to take a closer look at the structure of DNA.</p> <p>At this point they should be familiar with the four types of nitrogen bases that make up the DNA:</p> <ul style="list-style-type: none"> <li>• A= Adenine</li> <li>• T= Thymine</li> </ul>	Group work, Think-pair-share, Modeling

	<ul style="list-style-type: none"> <li>• C= Cytosine</li> <li>• G= Guanine</li> </ul> <p>Ask students if they recall how these molecules match: A=T, C=G Ask them to review the structure of DNA (the model they constructed the day before) Point out that: <i>If a DNA molecule is made of only four different nitrogen bases, How is possible that these four bases can carry the information needed to specify the shape, position and the function of every cell in the body of a plant or animal?</i></p>	
15	<p><b>Pose the following question:</b></p> <ul style="list-style-type: none"> <li>• <i>What does the word information mean?</i></li> </ul> <p>Call on some volunteers to explain their understanding of the word <b>information</b> until they agree on that information is a MESSAGE. Write the following message: 'GENES ARE THE UNITS OF HEREDITY" Ask: <i>What is this message made up?</i> Collect some responses until they understand that this message is made up of letters. Point out that there are 26 letters on the alphabet, in other words there is a FINITE number of letters, but yet there is an INFINITE number of messages that can be written with these letters. Ask: <i>How can a cell write infinite numbers of instructions with only 4 different types of letters?</i> Lead students to understand that by placing the letters in the right SEQUENCE it is possible to make any message that the cell requires. Draw on the board different sequences with the same letters to illustrate that what matter is the sequence of bases in a DNA molecule.</p>	Guiding questions Group work, Direct instruction, Compare/contrast
15	<p><b>Ask: If DNA can carry information in the sequence of base pairs, we must then wonder; How does DNA help reproduce this information and retain in each copy exactly the same base sequence that is present in the original molecule?</b></p> <p>Let students use their models of DNA to demonstrate how this process takes place. Go around the class and make sure that students understand the process.</p>	Direct instruction, Modeling, Solving problem
5	<p><b>Distribute worksheets on DNA. Check for understanding on matching bases.</b></p> <p>Tell students that the next day they will model the process by which this molecule of DNA reproduce (DNA replication)</p>	Assessment

**Suggested Homework:**

Bring a report on DNA replication. Illustration of the entire process is necessary since they will use it during the next class in which they will be modeling DNA replication.

**References:**

**Standards Addressed:**

**Unit Topic/Essential Question: Why do our offspring look like us?****Aim/Guiding Question: How does the structure of DNA allow the molecule to store such a vast amount of information?****Objectives*****Students will be able to:***

- Understand that DNA carries information in the sequences of base pairs
- Identify the complementary strand of a given strand of DNA
- Demonstrate how DNA replicates
- Model the process of DNA replication

**New Terms:**

template      nucleotides  
 replication

**Materials/Preparations:**

Transparency, overhead projector, charts and models of DNA and model of DNA constructed by students, prepared worksheets

<b>Time (min)</b>	<b>Developments</b>	<b>Instructional Strategies</b>
10	<p><b>Review homework.</b></p> <p>Ask some volunteers to summarize yesterday lesson about how information is carried in the molecule of DNA.</p> <p>Make sure that students understand the major concept: In all organisms the coded instructions for specifying the characteristics of the organism are carried in DNA, a large molecule formed from subunits arranged in a sequence with bases of four kinds, A, T, G, C</p> <p>Review with different strands of DNA; ask students to write the complementary one.</p>	Do-Now, Guiding question, Motivation, Review
15	<p>Ask students to join their original group. And using their materials demonstrate to the class how a molecule of DNA replicates. Make sure that all students understand the basic process of DNA replication. Go around the class and help each group, if necessary. Check for understandin.</p>	Group work, Think-pair-share, Modeling
20	<p><i>After students have decided how to demonstrate the process to the class, ask them to use any tools or materials to make their presentations.</i></p> <p><i>Call each group to move to the front and demonstrate in front of the class the process of replication. At the end review with them the major concepts:</i></p> <p>Point out that if the two strands are complementary, each strand has all the information needed to specify the sequence of the other strand, in other words each strand serves as a TEMPLATE.</p> <p><i>And one possible way to reproduce this would be by separating the original strands between matching bases. Then, arranging new complementary bases along the original strands. In this way a final product would be two identical strands of DNA.</i></p> <p><b>Point out that this process is called DNA replication.</b></p>	Assessment, Modeling, Oral presentation



**Suggested Homework:**

**References**

**Standards Addressed**

Key Ideas: 2.1f

**Unit Topic/Essential Question: Why do our offspring look like us?****Aim/Guiding Question: How do your cells use the information that is stored in your DNA to build and maintain the physical being that is you?****Objectives*****Students will be able to:***

- Understand how the DNA molecules code for the production of proteins
- Explain how the environment affect gene expression

**New Terms:**

gene expression                      polypeptide  
amino acids

**Materials/Preparations:**

Transparency, overhead projector, charts and models of DNA and model of DNA constructed by students, prepared worksheets

<b>Time (min)</b>	<b>Developments</b>	<b>Instructional Strategies</b>
5	<p><i>Write on board: How does genetic information maintain the continuity of a species from one generation to the next?</i></p> <p>Ask the class to think about this question. Proceed to brainstorm possible answers to this question. Write on the board or transparency.</p> <p>Point out that they have learned how DNA molecule is able to act as a template for its own replication, and in doing so, they have discovered how genetic information maintains the continuity of a species form one generation to the next. Point out that they also know that genetic information is used to build and maintain the characteristics of an individual organism.</p>	<p>Do Now, Motivation, Note taking, Brainstorming</p>

15	<p><i>Introduce</i> the guiding question (see above). Let students suggest possible ways of doing this.</p> <ul style="list-style-type: none"> <li>• <i>What instructions do DNA give to a cell?</i></li> </ul> <p>Explain that our body is made up of thousands of chemical building blocks called <b>proteins</b>. Some of these proteins are responsible for the size, shape and structure of the parts making our body. Other proteins, known as <b>enzymes</b>, make possible the thousands of chemical reactions that occur constantly in your body and in all living things. <i>The process by which the cell makes a protein according to the instructions carried by genes is known as gene expression.</i></p> <p>Take this opportunity to present a transparency that illustrates this process. Make sure that students understand that <i>the sequence of bases in their DNA determine the type of proteins they will produce and these proteins are responsible for the specific traits of the body</i></p> <p>You might want to make a diagram on the board illustrating this process if students find it hard to understand.</p> <p>You might want to review the structure of proteins and point out that proteins are made up of amino acids. Hundreds of amino acids may be linked to form long chains called polypeptide molecules. Two or more polypeptides may be joined to make a particular protein.</p>	Guiding questions, Direct instruction
15	<p>Write on board: <i>Do genes control all life?</i></p> <p><b>You might want to introduce the essential question at this point.</b></p> <p>Use this opportunity to present a videodisc about identical twins. If a video is not available you can use any picture that shows identical twins raised apart, in different environment.</p> <p>As they watch the tape or videodisc ask them to look for information that could help them answer the question.</p>	Video analysis, Guiding questions, Think-pair-share
10	<p>After students have finished watching the tape and discussing the question, call some of them to explain their answers.</p> <p>Point out that genes have powerful effects, but they do not control all life. Most characteristics result from a combination of heredity and the environment.</p> <p>Ask students to give some examples of this situation.</p> <p>For example you may have inherited a talent for playing the piano. But you will not be able to play unless you take lessons and practice. The talent is hereditary. The lessons and practice are environmental.</p> <p>The same example is what they learned from the tape. Two identical twins may look different if they are raised in different environments.</p>	Oral presentation, Discussion, Assessment

**Suggested Homework:**

**References**

**Standards Addressed**

Key Ideas: 2.1a, 2.1b, 2.1c, 2.1g, 2.1i

Lesson #: 8

**Unit Topic/Essential Question:** Why do our offspring look like us?

**Aim/Guiding Question:** Is a change in DNA good or bad?

**Objectives**

*Students will be able to:*

- Infer several ways in which genetic variation may arise.
- Understand how changes in DNA take place
- Compare sequences of DNA bases to find mutations
- Understand the effect of some mutations in humans

**New Terms:**

mutations cancer  
carcinogen ionizing radiation

**Materials/Preparations:**

Transparency, overhead projector, charts and models of DNA and model of DNA constructed by students, prepared worksheets

Time (min)	Developments	Instructional Strategies
5	<p>Write on the board: <i>Have you ever copied one homework incorrectly?</i> <i>What happen the next day, when you bring your homework?</i></p> <p>Tell students that everybody makes mistakes. Sometimes the consequence of these mistakes may be serious or not. Tell them that DNA is usually replicated correctly, but mistakes do occur. Some of these mistakes can have important consequences for organism and their offspring</p>	Motivation, Do-Now, Guiding questions
10	<p>Review with students the process of DNA replication. You may want to distribute worksheets or use a transparency with two segments of DNA undergoing replication. Make sure that one of them has a mismatched base (for example: C-T). Ask the students what is wrong in this diagram. They should be able to identify the mismatched bases. Ask them <i>What do you think happened?</i> Discuss with them that this is a mistake that took place during the process of DNA replication, and that this is called <i>a mutation</i>. (Write on board the definition of mutation).</p> <p>Discuss with students that mutations can occur in the DNA of any cell in the body of an organism. Ask: <i>What would happen if mutations occur in cells that give rise to reproductive gametes?</i> Allow some time for discussion. Explain that the mutation will be passed along to offspring.</p>	Review, Guiding questions, Direct instruction.
20	<p>Distribute worksheets: <i>A Simulation of DNA Mutations and Cancer</i> (from biotech manual, Addison Wesley- enclosed)</p> <p>Have students read the introduction and explain that they will be tracking some mutations and relate these mutations to some abnormal conditions such as cancer.</p> <p>As students read make sure that they understand the major causes of mutations.</p>	Compare/contrast, Questioning

10	Have students describe or explain their major findings. Go over questions.	Oral presentation, Informal assessment
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**Suggested Homework:**

Have students bring a report in which they describe at least one helpful mutation and some disadvantageous mutations

**References**

**Standards Addressed**

Key Ideas: 2.1f , 2.1h

**Unit Topic/Essential Question: Why do our offspring look like us?****Aim/Guiding Question: Is it possible to create a new type of organism?****Objectives*****Students will be able to:***

- Describe at least one method used by plant and animal breeders to improve their crops and animals
- Give example of selective breeding
- List the sequence of events that take place in genetic engineering

**New Terms:**

breeding                      genetic engineering      recombinant DNA      gene splicing  
selective breeding      plasmid                      restriction enzymes

**Materials/Preparations:**

Transparency, overhead projector, charts and models of DNA and model of DNA constructed by students, prepared worksheets, construction paper different color

<b>Time (min)</b>	<b>Developments</b>	<b>Instructional Strategies</b>
10	Introduce guiding question: <b>Is it possible to create a new type of organism?</b> Allow some time for discussion. Lead the class to an open discussion about what humans have been doing for ages: breeding plants and animals <b>selectively</b> . Ask: <i>What does Selective-breeding mean?</i> Allow some time for discussion. Explain: In selective breeding humans cross plants or animals having desirable traits to produce new generations. In this way the expression of the desired traits becomes more and more prominent with successive generations. In other words you can produce organisms with desirable traits.	Motivation, (Do-Now)
15	Videodisc or video on genetic engineering. Tell the class that they will be watching a video about genetic engineering. Ask them to pay careful attention to the sequence of events that lead to the formation of a new molecule of DNA or recombinant DNA. Distribute worksheet: Interpreting graphics (enclosed) <i>Genetic Engineering and Recombinant DNA</i> . Ask them to examine the worksheets and read the questions on the other page (part A and B). Remind them that they will answer these questions as they watch the video.	Audio-visual work Direct instruction, Guiding questions
20	After students have finished watching the video give them 10 more minutes to complete the questions and interpret the graph. They must explain step by step the diagram in the graphic (worksheet)  Lesson to continue next day-	Oral presentation, Guiding questions

### **Suggested Homework:**

Assign to the class to bring a complete diagram illustrating the basic steps in genetic engineering, which they will use the next day.

### **References**

### **Standards Addressed**

Key Ideas: 2.2a, 2.2b, 2.2c, 2.2d

**Unit Topic/Essential Question: Why do our offspring look like us?****Aim/Guiding Question: Is it possible to create a new type of organism?****Objectives*****Students will be able to:***

- Describe at least one method used by plant and animal breeders to improve their crops and animals
- Give example of selective breeding
- List the sequence of events that take place in genetic engineering
- Modeling gene transfer with a plasmid

**New Terms:**

breeding                      genetic engineering      recombinant DNA      gene splicing  
selective breeding      plasmid                      restriction enzymes

**Materials/Preparations:**

Transparency, overhead projector, charts and models of DNA and model of DNA constructed by students, prepared worksheets, construction paper different color

<b>Time (min)</b>	<b>Developments</b>	<b>Instructional Strategies</b>
5	Write on the board: How can we transfer a segment of DNA from one organism to another? After discussing this question, review homework. Lead a class discussion about yesterday lesson: videodisc, sequence of events that lead to recombinant DNA.	Motivation, (Do-Now) Review
20	Tell students that they will be modeling the technique of genetic engineering: <i>Modeling Gene Transfer with a Plasmid</i> . They will work in groups of 2 Review the steps of genetic engineering. Distribute worksheets (attached) and materials: 2 pieces of construction paper: yellow and orange, transparent tape	Group work, Manipulatives, Questions
20	Have each group explain their work. Go over questions.	Oral presentation, Guiding questions

**Suggested Homework:**

Assign a report on the "Application of genetic engineering on human health".

**References****Standards Addressed**

Key Ideas: 2.2a, 2.2b, 2.2c, 2.2d



**Unit Topic/Essential Question: Why do our offspring look like us?****Aim/Guiding Question: Is it possible to create a new type of organism?****Objectives*****Students will be able to:***

- Explain the steps in making recombinant DNA
- Explain some important applications of recombinant DNA
- Give specific examples of this technology application

**New Terms:****Materials/Preparations:**

Transparency, overhead projector, charts and models of DNA and model of DNA constructed by students, prepared worksheets

<b>Time (min)</b>	<b>Developments</b>	<b>Instructional Strategies</b>
5	<p>Introduce guiding question: How can we benefit from recombinant DNA Technology?</p> <p>Have students brainstorm important applications of this technology and write them on the board. You might want to review with your students the steps in genetic engineering.</p>	Motivation Brainstorming,
15	<p><i>Present</i> the following problem to the class:</p> <p>"Cotton plants often are attacked by a pest called a bollworm, which damages cotton crops and costs millions of dollars each year to control. Researchers, however, have known for a long time that if a bollworm eats the common bacterium called <i>Bacillus thuringiensis</i>, a protein produced in the bacteria is partially digested in the worm's gut and poisons the worm. Because this protein is so effective, for years farmers have sprayed B.t. bacteria on their cotton crops to discourage the bollworms from eating the crops. This protective measure has its drawbacks though: sunlight degrades B.t., and rainfall easily washes it off the plants."</p> <p><b><i>How can we overcome these drawbacks through genetic engineering?</i></b> Give students some time to answer this question.</p> <p>After you have discussed possible ways to do this, distribute worksheet E189 from BSCS (attachment) and ask them to study and analyze <b>fig. E12.15 Genetic engineering of cotton</b>. After they have studied the diagram, ask some students to go to the overhead and explain the process (you should make a transparency of this diagram).</p>	Brainstorming, Guiding questions, Read aloud, Direct instruction, Oral presentation
10	Distribute diagram of <b>fig. E12.16</b> , Producing a recombinant DNA molecule containing the human insulin gene for expression in bacteria. Ask students to	Oral presentation

	proceed in the same way as before and explain the entire process.	
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**Suggested Homework:**

**References:**

BSCS Biology – A Human Approach:

**Standards Addressed:**

Key Ideas: 2.2c, 2.2d, 2.2e,

**Unit Topic/Essential Question: Were you born to be the way you are?  
What is that stuff that makes you, you?**

**Aim/Guiding Question: Is it possible to create a new type of organism?**

**Objectives**

*Students will be able to:*

- Describe at least one method used by plant and animal breeders to improve their crops and animals
- Give example of selective breeding
- List the sequence of events that take place in genetic engineering

**New Terms:**

Breeding                      genetic engineering      recombinant DNA      gene splicing  
Selective breeding      plasmid                      restriction enzymes

**Materials/Preparations:**

Transparency, overhead projector, charts and models of DNA and model of DNA constructed by students, prepared worksheets, construction paper different color

Time (min)	Developments	Instructional Strategies
10	Introduce guiding question: <b>Is it possible to create a new type of organism?</b> Allow some time for discussion. Lead the class to an open discussion about what humans have been doing for ages: breeding plants and animals <b>selectively</b> . Ask: <i>What does Selective-breeding mean?</i> Allow some time for discussion. Explain: In selective breeding humans cross plants or animals having desirable traits to produce new generations. In this way the expression of the desired traits becomes more and more prominent with successive generations. In other words you can produce organisms with desirable traits.	Motivation, (Do-Now)
15	Videodisc or video on genetic engineering. Tell the class that they will be watching a video about genetic engineering. Ask them to pay careful attention to the sequence of events that lead to the formation of a new molecule of DNA or recombinant DNA. Distribute worksheet: Interpreting graphics (enclosed) <i>Genetic Engineering and Recombinant DNA</i> . Ask them to examine the worksheets and read the questions on the other page (part A and B). Remind them that they will answer these questions as they watch the video.	Audio-visual work Direct instruction, Guiding questions
20	After students have finished watching the video give them 10 more minutes to complete the questions and interpret the graph. They must explain step by step the diagram in the graphic (worksheet)  Lesson to continue next day-	Oral presentation, Guiding questions

Suggested Homework:

Assign to the class to bring a complete diagram illustrating the basic steps in genetic engineering, which they will use the next day.

**References**

**Standards Addressed**

Key Ideas: 2.2a, 2.2b, 2.2c, 2.2d

**Unit Topic/Essential Question: Why do our offspring look like us?****Aim/Guiding Question: Is it possible to create a new type of organism?****Objectives*****Students will be able to:***

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Transparency, overhead projector, charts and models of DNA and model of DNA constructed by students, prepared worksheets, construction paper different color

<b>Time (min)</b>	<b>Developments</b>	<b>Instructional Strategies</b>
5	Write on the board: How can we transfer a segment of DNA from one organism to another? After discussing this question, review homework. Lead a class discussion about yesterday lesson: videodisc, sequence of events that lead to recombinant DNA.	Motivation, (Do-Now) Review
20	Tell students that they will be modeling the technique of genetic engineering: <i>Modeling Gene Transfer with a Plasmid</i> . They will work in groups of 2 Review the steps of genetic engineering. Distribute worksheets (attached) and materials: 2 pieces of construction paper: yellow and orange, transparent tape	Group work, Manipulatives, Questions
20	Have each group explain their work. Go over questions.	Oral presentation, Guiding questions

**Suggested Homework:**

Assign a research paper. "Application of genetic engineering on human health"

**References****Standards Addressed**

Key Ideas: 2.2a, 2.2b, 2.2c, 2.2d

**Unit Topic/Essential Question: Why do our offspring look like us?****Aim/Guiding Question: Is it possible to create a new type of organism?****Objectives*****Students will be able to:***

- Explain the steps in making recombinant DNA
- Explain some important applications of recombinant DNA
- Give specific examples of this technology application

**New Terms:****Materials/Preparations:**

Transparency, overhead projector, charts and models of DNA and model of DNA constructed by students, prepared worksheets

Time (min)	Developments	Instructional Strategies
5	<p>Introduce guiding question: How can we benefit from recombinant DNA Technology?</p> <p>Have students brainstorm important applications of this technology and write them on the board. You might want to review with your students the steps in genetic engineering.</p>	Motivation Brainstorming,
15	<p><i>Present</i> the following problem to the class:</p> <p>"Cotton plants often are attacked by a pest called a bollworm, which damages cotton crops and costs millions of dollars each year to control. Researchers, however, have known for a long time that if a bollworm eats the common bacterium called <i>Bacillus thuringiensis</i>, a protein produced in the bacteria is partially digested in the worm's gut and poisons the worm. Because this protein is so effective, for years farmers have sprayed B.t. bacteria on their cotton crops to discourage the bollworms from eating the crops. This protective measure has its drawbacks though: sunlight degrades B.t., and rainfall easily washes it off the plants."</p> <p><b><i>How can we overcome these drawbacks through genetic engineering?</i></b> Give students some time to answer this question.</p> <p>After you have discussed possible ways to do this, distribute worksheet E189 from BSCS (attachment) and ask them to study and analyze <b>fig. E12.15 Genetic engineering of cotton</b>. After they have studied the diagram, ask some students to go to the overhead and explain the process (you should make a transparency of this diagram).</p>	Brainstorming, Guiding questions, Read aloud, Direct instruction, Oral presentation
10	<p>Distribute diagram of <b>fig. E12.16</b>, Producing a recombinant DNA molecule containing the human insulin gene for expression in bacteria. Ask students to proceed in the same way as before and explain the entire process.</p>	Oral presentation

**Suggested Homework:**

**References:**

BSCS Biology – A Human Approach:

**Standards Addressed:**

Key Ideas: 2.2c, 2.2d, 2.2e,