

| Course: Science 9   | Unit: Biology | Timeline: Nov. to Jan. 2017-2018  |
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| <b>UNDERSTAND - Big Ideas</b><br><i>(from Curriculum Docs)</i>  |               | <b>Essential Questions</b><br><i>(WEIRD, WHOA, WOW and WHY)</i>   |
| <p>Cells are derived from cells.</p>  |               | <ul style="list-style-type: none"> <li>• How do organisms grow over time? What is happening on a cellular level?</li> <li>• Why do bacteria, yeast and mould spread so quickly?</li> <li>• Why is healthy cell division important?</li> <li>• Why are humans so genetically diverse even within one family?</li> <li>• How will new reproductive technologies and genetic engineering affect society?</li> <li>• Knowing that we are natural creations of God, what are the ethical implications when we try to manipulate cells deriving from other cells using science?</li> <li>• <b>How does the Catholic Church recognize the inherent dignity of every human person or embryo?</b></li> </ul> |
| <b>DO – Curricular Competencies</b><br><i>From Curriculum Docs</i>  |               | <b>KNOW – Content</b><br><i>(the vehicle with which they'll achieve the curricular competencies)</i>  |
| <p>Students will be able to....</p> <ul style="list-style-type: none"> <li>• Demonstrate a sustained intellectual curiosity about a scientific topic or problem of personal interest</li> <li>• Make observations aimed at identifying their own questions, including increasingly complex ones, about the natural world</li> <li>• Formulate multiple hypotheses and predict multiple outcomes</li> <li>• Collaboratively and individually plan, select, and use appropriate investigation methods, including field work and lab experiments, to collect reliable data (qualitative and quantitative)</li> <li>• Assess risks and address ethical, cultural and/or environmental issues associated with their proposed methods and those of others</li> <li>• Select and use appropriate equipment, including digital technologies, to systematically and accurately collect and record data</li> <li>• Ensure that safety and ethical guidelines are followed in their investigations</li> <li>• Experience and interpret the local environment</li> <li>• Apply First Peoples perspectives and knowledge, other ways of knowing, and local knowledge as sources of information</li> <li>• Construct, analyze and interpret graphs (including interpolation and extrapolation), models</li> </ul> |               | <ul style="list-style-type: none"> <li>• That cells are derived or replicated from other cells as a result of mitosis</li> <li>• How mitosis plays a role in growth of all organisms</li> <li>• Different forms of asexual reproduction: binary fission, budding, cloning, spores, grafting, regeneration</li> <li>• Why healthy cell division is important</li> <li>• The process of meiosis</li> <li>• Stem cell research</li> <li>• Sexual reproduction and the part it plays in diversity of life</li> <li>• Male and female reproductive systems</li> <li>• Stages of human development</li> <li>• Reproductive technologies and genetic engineering and ethics</li> </ul>                     |

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| <ul style="list-style-type: none"> <li>• and/or diagrams</li> <li>• Use knowledge of scientific concepts to draw conclusions that are consistent with evidence</li> <li>• Analyze cause-and-effect relationships</li> <li>• Evaluate their methods and experimental conditions, including identifying sources of error or uncertainty, confounding variables, and possible alternative explanations and conclusions</li> <li>• Describe specific ways to improve their investigation methods and the quality of the data</li> <li>• Evaluate the validity and limitations of a model or analogy in relation to the phenomenon modelled</li> <li>• Demonstrate an awareness of assumptions, question information given, and identify bias in their own work and secondary sources</li> <li>• Connect scientific explorations to careers in science</li> <li>• Exercise a healthy, informed skepticism, and use scientific knowledge and findings to form their own investigations and to evaluate claims in secondary sources</li> <li>• Consider social, ethical, and environmental implications of the findings from their own and others' investigations</li> <li>• Critically analyze the validity of information in secondary sources and evaluate the approaches used to solve problems</li> <li>• Contribute to care for self, others, community, and world through individual or collaborative approaches</li> <li>• Transfer and apply learning to new situations</li> <li>• Contribute to finding solutions to problems at a local and/or global level through inquiry</li> <li>• Consider the role of scientists in innovation</li> <li>• Formulate physical or mental theoretical models to describe a phenomenon</li> <li>• Communicate scientific ideas, claims, information, and perhaps a suggested course of action, for a specific purpose and audience, constructing evidence-based arguments and using appropriate scientific language, conventions, and representations</li> <li>• Express and reflect on a variety of experiences, perspectives, and worldviews through place</li> </ul> |   |
| <b>Catholic Worldview</b>   | <b>Aboriginal Worldview</b>   |
| <ul style="list-style-type: none"> <li>• The study of cell reproduction helps us understand the complexity, value and dignity of all life</li> <li>• <b>Tradition – Catholic Education guides us in the selection of excellent content, pedagogy and resources in the pursuit of Truth through faith and reason.</b></li> <li>• <b>Love: We will recognize the inherent dignity of every human person, and love and respect will be shown to all</b></li> </ul>   | <ul style="list-style-type: none"> <li>• Learning ultimately supports the well-being of the self, the family, the community, the land, the spirits, and the ancestors</li> <li>• Learning involves recognizing the consequences of one's actions</li> <li>• Learning involves generational roles and responsibilities</li> <li>• Learning requires exploration of one's identity</li> </ul> |

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| <p><b>individuals especially when sharing knowledge and asking questions</b></p> <ul style="list-style-type: none"> <li>• <b>Communion/Community – Catholic Education is inclusive and welcoming where every student is nurtured in developing a right relationship with God and others by balancing the rights of the individual with the Common Good.</b></li> </ul> | <ul style="list-style-type: none"> <li>• Learning involves recognizing that some knowledge is sacred and only shared with permission and/or in certain situations</li> <li>• Learning involves patience and time.</li> </ul> |
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**Evidence of Classroom Differentiation**

*How are the students actively learning? What different materials are being used? How else will the curricular competencies be practiced? What modelling and scaffolding is necessary? What learning experiences can be provided? How the lessons will be differentiated for all learners?*

- Direct instruction of content
- Use of interactive videos
- Use of video clips for abstract ideas
- Small group critiquing and selection of work
- Sharing and presentation of ideas
- Use of materials to represent a scientific phenomena
- Considering and commenting on the ethics of science

**Assessment**

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| <p>Formative</p> <ul style="list-style-type: none"> <li>• Class discussions</li> <li>• Class presentations</li> <li>• Comprehension questions</li> <li>• Comparison and contrasts</li> <li>• Class activities</li> </ul> | <p>Summative</p> <ul style="list-style-type: none"> <li>• Strawberry DNA extraction lab</li> <li>• Summative assignment: How do First Peoples apply their understanding of plant reproduction?</li> <li>• Mitosis Stop Motion Project and Analysis</li> <li>• Oncology Career Reflection</li> <li>• Cloning Article Critique</li> <li>• Errors in Meiosis and Human genetic disorders assignment</li> <li>• Tests</li> </ul> |
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**Resources (what will I need?)**

- Notes and worksheets
- Strawberry lab materials
- Tablet computer, and poster paper
- BC Science Connections 9
- Beads, paper bags and pipe cleaners

**Evaluation/Feedback  
(How did it go? What will I change?)**

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| Empty space for evaluation/feedback |
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| Lesson  | Curricular Competency  | Assessment Tasks<br>Achievement<br>Indicators   | Learning Opportunities<br>Instructional Strategies<br>Planning for Assessment   |
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| <p>1<br/>Introduction<br/>to forms of<br/>reproduction</p> <p>DNA</p> | <ul style="list-style-type: none"> <li>• Make observations aimed at identifying their own questions, including increasingly complex ones, about the natural world</li> <li>• Formulate multiple hypotheses and predict multiple outcomes</li> </ul>  | <ul style="list-style-type: none"> <li>• Formative worksheet</li> <li>• Class discussion</li> </ul> | <p>Students will:</p> <ul style="list-style-type: none"> <li>• Compare photos from babyhood, early childhood, and now and make observations about differences and changes</li> <li>• Come up with questions regarding these differences</li> <li>• Look at comparisons of trees and other animals and discuss why and how growth happens</li> <li>• Learn that cells are derived from other cells</li> <li>• Learn the definition of reproduction</li> <li>• Complete notes on DNA after viewing TED-ED clips on DNA</li> </ul> |
| <p>2<br/>DNA<br/>Extraction<br/>Lab</p>                               | <ul style="list-style-type: none"> <li>• Collaboratively and individually plan, select, and use appropriate investigation methods, including field work and lab experiments, to collect reliable data (qualitative and quantitative)</li> <li>• Select and use appropriate equipment, including digital technologies, to systematically and accurately collect and record data</li> <li>• Make observations aimed at identifying their own questions, including increasingly complex ones, about the natural world</li> <li>• Ensure that safety and ethical guidelines are followed in their investigations</li> <li>• Evaluate their methods and experimental conditions, including identifying sources of error or uncertainty, confounding variables, and possible alternative explanations and conclusions</li> </ul> | <ul style="list-style-type: none"> <li>• Summative lab</li> <li>• Class discussion</li> </ul>       | <p>Students will:</p> <ul style="list-style-type: none"> <li>• Perform the DNA Extraction lab</li> <li>• Ask further questions based on lab observations</li> <li>• Determine how they could have improved their results</li> </ul>   |

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|  | <ul style="list-style-type: none"> <li>Describe specific ways to improve their investigation methods and the quality of the data</li> </ul>   |   |   |
| <p>3<br/>Asexual Reproduction</p> <p>Fission<br/>Budding<br/>Regeneration<br/>Spores</p>                         | <ul style="list-style-type: none"> <li>Experience and interpret the local environment</li> <li>Transfer and apply learning to new situations</li> </ul>   | <ul style="list-style-type: none"> <li>Formative class discussions</li> </ul>   | <p>Students will:</p> <ul style="list-style-type: none"> <li>Learn about the definition and different methods of asexual reproduction specifically that of bacteria, yeast, and moss around them through a jigsaw activity</li> <li>Determine which organisms use which form of asexual reproduction based on knowledge of each method</li> </ul>   |
| <p>4<br/>Vegetative Reproduction</p> <p>Grafting</p> <p>Advantages and Disadvantages of Asexual Reproduction</p> | <ul style="list-style-type: none"> <li>Experience and interpret the local environment</li> <li>Transfer and apply learning to new situations</li> <li>Apply First Peoples perspectives and knowledge, other ways of knowing, and local knowledge as sources of information</li> </ul> | <ul style="list-style-type: none"> <li>Formative class discussions on Western farming</li> <li>Summative assignment: How do First Peoples apply their understanding of plant reproduction?</li> </ul> | <p>Students will:</p> <ul style="list-style-type: none"> <li>Learn about the definition and different methods of asexual reproduction specifically that of different plants we use for food</li> <li>Determine which organisms use which form of asexual reproduction based on knowledge of each method</li> <li>Complete the assignment “How do First People apply their understanding of plant reproduction”</li> <li>Come up with a list of advantages and disadvantages of asexual reproduction on a blank sheet of paper</li> <li>Watch Asexual Reproduction Video by Mark Drollinger</li> </ul> |
| <p>5<br/>Mitosis</p>   | <ul style="list-style-type: none"> <li>Use knowledge of scientific concepts to draw conclusions that are consistent with evidence</li> </ul>  | <ul style="list-style-type: none"> <li>Formative class discussion</li> </ul>  | <p>Students will:</p> <ul style="list-style-type: none"> <li>Think about how broken lips or knee scraps heal?</li> <li>Answer: If your knee was only made of one cell what happens?</li> <li>Students will watch the more complex Youtube clip – Mitosis: Splitting up is Complicated and have them add to their understanding of how they developed from babyhood</li> <li>Learn about the different phases of mitosis through a 15 minute lecture</li> </ul>  |
| <p>6<br/>Mitosis Project<br/>1</p>   | <ul style="list-style-type: none"> <li>Formulate physical or mental theoretical models to describe a phenomenon</li> </ul>  | <p>Summative assignment: Mitosis Stop Motion Project</p>  | <p>Students will:</p> <ul style="list-style-type: none"> <li>Watch Synchronized Swimming Mitosis and evaluate the validity of and limitations of a model or</li> </ul>  |

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|   | <ul style="list-style-type: none"> <li>Evaluate the validity of and limitations of a model or analogy in relation to the phenomenon modelled</li> <li>Evaluate their methods and experimental conditions, including identifying sources of error or uncertainty, confounding variables, and possible alternative explanations and conclusions</li> <li>Generate and introduce new or refined ideas when problem solving</li> </ul>   |   | <p>analogy in relation to the phenomenon modelled in groups of 4.</p> <ul style="list-style-type: none"> <li>Get into groups of 4 and will collaboratively create stop motion mitosis models formulating physical theoretical models to describe a phenomenon, taking into account the limitations they observed in the synchronized swimming clip</li> <li>They will have a whole other class to work on this</li> </ul>   |
| 7<br>Mitosis<br>Project<br>2  | <ul style="list-style-type: none"> <li>Formulate physical or mental theoretical models to describe a phenomenon</li> <li>Evaluate the validity of and limitations of a model or analogy in relation to the phenomenon modelled</li> <li>Evaluate their methods and experimental conditions, including identifying sources of error or uncertainty, confounding variables, and possible alternative explanations and conclusions</li> <li>Generate and introduce new or refined ideas when problem solving</li> </ul> | Summative assignment: Mitosis Stop Motion Project   | <p>Students will:</p> <ul style="list-style-type: none"> <li>Work on their Mitosis Stop Motion Project</li> </ul>   |
| 8<br>Mitosis<br>Review<br><br>Unhealthy<br>Mitosis<br><br>Mutations,<br>Mutagens,<br>Cancer | <ul style="list-style-type: none"> <li>Use knowledge of scientific concepts to draw conclusions that are consistent with evidence</li> <li>Connect scientific explorations to careers in science</li> <li>Consider the role of scientists in innovation</li> <li>Contribute to care for self, others, community, and world through individual or collaborative approaches</li> <li>Analyze cause-and-effect relationships</li> </ul>   | Summative assignment: Write a reflection about whether it is more effective to become a cancer researcher or a medical doctor if wanting to contribute to the field of oncology | <p>Students will:</p> <ul style="list-style-type: none"> <li>Discuss cell specialization and proteins that dictate cell growth and division</li> <li>Understand the need for proteins that control cell division and growth, and thus explore why it is necessary for these proteins to be healthy in order for complex cell division to take place safely, by learning about cancer, the result of unhealthy cell division</li> <li>Be led through a basic cause-and-effect relationship, students will determine what will happen after a specific cell protein scenario ie. a protein does not stop cells from dividing so what will happen next?</li> <li>Students will read job profiles of a medical doctor and a cancer researcher</li> <li>Then contributing to care for self, others, community, and world through personal or collaborative approaches, students will synthesize</li> </ul> |

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|                              |   |  | <p>what they have learned, and determine whether it is more effective to become a cancer researcher or a medical doctor if searching for a cure</p> <ul style="list-style-type: none"> <li>• <b>(L) LOVE – Catholic Education calls us to witness that God is love; and therefore, recognizes the inherent dignity of every human person, especially the marginalized and most vulnerable.</b></li> </ul>   |
| 9<br>Cloning                 | <ul style="list-style-type: none"> <li>• Contribute to finding solutions to problems at a local and/or global level through inquiry</li> <li>• Consider social, ethical, and environmental implications of the findings from their own and others' investigations</li> <li>• Assess risks and address ethical, cultural and/or environmental issues associated with their proposed methods and those of others</li> <li>• Critically analyze the validity of information in secondary sources and evaluate the approaches used to solve problems</li> </ul>         | Summative assignment: Cloning Article Critique | <p>Students will:</p> <ul style="list-style-type: none"> <li>• Learn about cloning as a form of asexual reproduction</li> <li>• Brainstorm the possible uses and/or solutions that cloning contributes to</li> <li>• Watch the video: Dolly the Sheep Feb 24, 1997 ABC news</li> <li>• Read about two examples of cloning as a class</li> <li>• Determine the ethical implications of cloning</li> <li>• Read journal article on cloning and write an article for or against using what they learned</li> </ul>   |
| 10<br>Cloning and Stem Cells | <ul style="list-style-type: none"> <li>• Demonstrate an awareness of assumptions, question information given, and identify bias in their own work and secondary sources</li> <li>• Contribute to finding solutions to problems at a local and/or global level through inquiry</li> <li>• Consider social, ethical, and environmental implications of the findings from their own and others' investigations</li> <li>• Assess risks and address ethical, cultural and/or environmental issues associated with their proposed methods and those of others</li> </ul> | Formative assignment: Bias Worksheet           | <p>Students will:</p> <ul style="list-style-type: none"> <li>• Learn about stem cell research</li> <li>• Brainstorm the possible uses and/or solutions that stem cell research contributes to</li> <li>• Discuss the ethics of stem cell research in light of Catholic teaching</li> <li>• Watch Eyes of Nye on Cloning</li> <li>• Learn about bias using the worksheet</li> <li>• Review for the test next class</li> <li>• <b>(L) LOVE – Catholic Education calls us to witness that God is love; and therefore, recognizes the inherent dignity of every human person, especially the marginalized and most vulnerable.</b></li> </ul> |
| 11<br>Assessment             | <ul style="list-style-type: none"> <li>• Construct, analyze and interpret graphs (including interpolation and extrapolation), models and/or diagrams</li> </ul>   | Summative Assessment                           | <ul style="list-style-type: none"> <li>• Students will write a skills and content based test focused on mitosis and asexual reproduction</li> </ul>   |

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| <p>12<br/>Sexual<br/>Reproduction</p> <p>Sex Cells and<br/>Fertilization</p> <p>Meiosis</p>                                   | <ul style="list-style-type: none"> <li>• Make observations aimed at identifying their own questions, including increasingly complex ones, about the natural world</li> <li>• Use knowledge of scientific concepts to draw conclusions that are consistent with evidence</li> </ul>  | <p>Formative bead activity and compare and contrast</p>  | <p>Students will:</p> <ul style="list-style-type: none"> <li>• Review what asexual reproduction is</li> <li>• Learn the definition of sexual reproduction</li> <li>• Complete a quick bead activity to illustrate the passing down of genetics in sexual reproduction</li> <li>• Create a Venn diagram comparing and contrasting asexual and sexual reproduction</li> <li>• Learn about sex cells and fertilization</li> <li>• Be introduced to the concept of meiosis</li> </ul>   |
| <p>13<br/>Meiosis</p>   | <ul style="list-style-type: none"> <li>• Use knowledge of scientific concepts to draw conclusions that are consistent with evidence</li> <li>• Construct, analyze and interpret graphs (including interpolation and extrapolation), models and/or diagrams</li> </ul>   | <p>Formative pipe cleaner activity</p>   | <p>Students will:</p> <ul style="list-style-type: none"> <li>• Learn about the phases of meiosis using the pipe cleaner activity</li> <li>• Compare meiosis to mitosis using a Venn diagram</li> <li>• Watch Youtube clip on meiosis by the amoeba sisters</li> </ul>   |
| <p>14<br/>Meiosis</p> <p>Human<br/>Diversity and<br/>Development</p> <p>Reproductive<br/>Systems</p>                          | <ul style="list-style-type: none"> <li>• Formulate physical or mental theoretical models to describe a phenomenon</li> <li>• Transfer and apply learning to new situations</li> </ul>   | <p>Formative Coin Flip Genetics Activity</p>   | <p>Students will:</p> <ul style="list-style-type: none"> <li>• Get into pairs to complete the Coin Flip Genetics Activity</li> <li>• View images of the Hemsworth Brothers, the Kardashians, and Puppies to discuss human diversity</li> <li>• Learn about the male and female reproductive parts and stages of human development through a ppt</li> </ul>  |
| <p>15<br/>Errors in<br/>Meiosis and<br/>Human<br/>Genetic<br/>Disorders<br/>Assignment</p> <p>Reproductive<br/>Technology</p> | <ul style="list-style-type: none"> <li>• Collaboratively and individually plan, select, and use appropriate investigation methods, including field work and lab experiments, to collect reliable data (qualitative and quantitative)</li> <li>• Communicate scientific ideas, claims, information, and perhaps a suggested course of action, for a specific purpose and audience, constructing evidence-based arguments and using appropriate scientific language, conventions, and representations</li> <li>• Express and reflect on a variety of experiences, perspectives, and worldviews through place</li> <li>• Select and use appropriate equipment, including digital technologies, to</li> </ul> | <p>Summative: Errors in Meiosis and Human genetic disorders assignment</p> <p>Formative class discussion</p> | <p>Students will:</p> <ul style="list-style-type: none"> <li>• Learn the basics of chromosomal mutations</li> <li>• Be introduced to the errors in meiosis and human genetic disorders assignment</li> <li>• Hopefully develop empathy for a human with a genetic disorder</li> <li>• Learn about the reproductive technologies used today and consider the ethical implications in light of Catholic teaching</li> <li>• Learn about the Sofia Vergara lawsuit – is it really that sensational? What does it say about embryos left over from IVF?</li> <li>• <b>(L) LOVE – Catholic Education calls us to witness that God is love; and therefore, recognizes the inherent dignity of every human person, especially the marginalized and most vulnerable.</b></li> </ul> |



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|   | <p>systematically and accurately collect and record data</p> <ul style="list-style-type: none"> <li>• Transfer and apply learning to new situations</li> <li>• Analyze cause-and-effect relationships</li> <li>• Contribute to care for self, others, community, and world through individual or collaborative approaches</li> <li>• Assess risks and address ethical, cultural and/or environmental issues associated with their proposed methods and those of others</li> <li>• Consider social, ethical, and environmental implications of the findings from their own and others' investigations</li> </ul>   |   | <ul style="list-style-type: none"> <li>• <b>(C) COMMUNION/COMMUNITY – Catholic Education is inclusive and welcoming where every student is nurtured in developing a right relationship with God and others by balancing the rights of the individual with the Common Good.</b></li> </ul>   |
| <p>16<br/>Advantages and Disadvantages of Sexual Reproduction</p> <p>Genetic Engineering Ethics</p> <p>CRISPR</p> | <ul style="list-style-type: none"> <li>• Demonstrate a sustained intellectual curiosity about a scientific topic or problem of personal interest</li> <li>• Make observations aimed at identifying their own questions, including increasingly complex ones, about the natural world</li> <li>• Transfer and apply learning to new situations</li> <li>• Contribute to care for self, others, community, and world through individual or collaborative approaches</li> <li>• Assess risks and address ethical, cultural and/or environmental issues associated with their proposed methods and those of others</li> <li>• Consider social, ethical, and environmental implications of the findings from their own and others' investigations</li> <li>• Exercise a healthy, informed skepticism, and use scientific knowledge and findings to form their own investigations and to evaluate claims in secondary sources</li> <li>• Connect scientific explorations to careers in science</li> </ul> | <p>Formative class discussion and genetic engineering questions sheet</p> | <p>Students will:</p> <ul style="list-style-type: none"> <li>• Determine the advantages and disadvantages of sexual reproduction based on what they've learned</li> <li>• Read the 3 gene baby news article</li> <li>• Create a t-chart with questions or concerns they have regarding this technological advancement on one side and who can best answer on the other side</li> <li>• Discuss or comment on the doctor's claim that "to save lives is the ethical thing to do" in this specific context</li> <li>• Watch the Youtube clip on genetic Engineering and take notes on it</li> <li>• Create a t-chart on their hopes and fears for genetic engineering</li> <li>• Learn about CRISPR advancements and watch the Youtube clip by In a Nutshell</li> <li>• Take a stance on CRISPR – what is acceptable? What is the course of action as a scientist? What is the role of a scientist?</li> <li>• <b>(L) LOVE – Catholic Education calls us to witness that God is love; and therefore, recognizes the inherent dignity of every human person, especially the marginalized and most vulnerable.</b></li> <li>• <b>(C) COMMUNION/COMMUNITY – Catholic Education is inclusive and welcoming where every student is nurtured in developing a</b></li> </ul> |

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|                  | <ul style="list-style-type: none"> <li>Consider the role of scientists in innovation</li> </ul>   |  | <b>right relationship with God and others by balancing the rights of the individual with the Common Good.</b>  |
| 17<br>Review     | <ul style="list-style-type: none"> <li>Evaluate their methods and experimental conditions, including identifying sources of error or uncertainty, confounding variables, and possible alternative explanations and conclusions</li> </ul> | Formative review work  | Students will: <ul style="list-style-type: none"> <li>Review the content learned so far and address areas of weakness in comprehension or uncertainty</li> </ul> |
| 18<br>Assessment | <ul style="list-style-type: none"> <li></li> </ul>  | Summative: Assessment based on meiosis and sexual reproduction | Students will write a content based test focused on meiosis and sexual reproduction  |