One-day Lesson Plan Outline

*Lesson Title: \_Microbes in art\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_*

*Grade level =X \_*Middle or High*\_\_ Amount of time for this lesson = \_\_50\_\_\_\_\_\_ minutes (Each Day) 4 days.*

1. Standards and Safety and Materials:

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| A. Standards - (Both Wyoming and NGSS. Number and write it out) | LS1.C: Organization for Matter and Energy Flow in Organisms. Plants, algae (including phytoplankton), and many microorganisms use the energy from light to make sugars (food) from carbon dioxide from the atmosphere and water through the process of photosynthesis, which also releases oxygen.  |
| B. Safety Concerns: If none – “minimal safety concerns with regular class activity” | Minimal safety concerns with regular class activity. For the painting activity students will be using paint, salt, vinegar, and alcohol, so for safety precautions, the teacher should have the students wear safety goggles.  |
| C. Materials (List of all materials needed for class including **technology** – like probes, tools, computer use, etc…) | Paint, common rubbing alcohol, household vinegar, table salt, rock salt resist for the painting, silk material, paint brushes, charcoal, containers to hold paint. |

1. Objectives: (List them and make sure all are measurable! **Bold** the verbs. Three different levels!) Students will be able to…

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| A. SWBAT… ***use*** *a measurable verb* | **Demonstrate** how to scale up the size of selected microbe to fit their silk canvas, using mathematics. |
| B. SWBAT…  | **Identify** at least three purposes to scale something up or down. |
| C. SWBAT…  | **Identify** cause and effect techniques used in painting their microbe. |

1. Connections, Misconceptions, and Crosscutting Concepts:

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| A. Real world connections: (List them; e.g. Careers, Societal issues, etc…) | Careers in science often also require the knowledge and use of other disciplines. This could consist of a geologist drawing maps while doing field work, a biologist sketching a new plant, or a chemist drawing the interaction of molecules. In our everyday world, we often scale things up or down, to study something, build something, or find something. Examples are the scaling down of the universe to study it better, scaling down roads to make road maps, or building plans. Scientists frequently use microscopes or some other method to increase the size of microbes or other life forms, to study them better.  |
| B. Student connections: (List them; With what do they connect? Music, food, etc…) | Fungus on shower shoes, why we wash our hands although they make look clean, the spread of diseases and illnesses, green moldy bread. |
| C. Misconceptions: (List those AAAS misconceptions related to your content) | **MOM002**: A model is always a three-dimensional object. Therefore, pictures, diagrams, graphs, written descriptions, abstract mathematical or conceptual models are not models. (Grosslight, et al., Penner et al., 1997; Treagust, et al., 2002; Schwartz & White, 2005). 36% grades 6-8; 43% grades 9-12.**CEM001**: All cells are the same size and shape, i.e., there is a generic cell (AAAS Project 2061, n.d.). Grades 6-8 43&; Grades 9-12 37%.**CEM005:** There are no single-celled organisms (AAAS Project 2061, n.d.). grades 6-8 39%, Grades 9-12 30%. |
| D. Crosscutting Concepts: (List them and explain how they are used – e.g. patterns, cause/effect, scale/proportion/quantity, systems/system models, energy/matter, structure/function, and/or stability/change) | **Scale, Proportion and Quantity:** Phenomena that can be observed at one scale may not be observable at another scale (MS-LS-1).**Structure and Function:** Complex and microscopic structures and systems can be visualized, modeled, and used to describe how their function depends on the relationships among its parts; therefore, complex natural and designed structures/systems can be analyzed to determine how they function (MS-LS1-2).**Connections to Engineering, Technology, and Applications of Science**:*Interdependence of Science, Engineering, and Technology:* Engineering advances have led to important discoveries in virtually every field of science, and scientific discoveries have led to the development of entire industries and engineered systems (MS-LS1-1). **Connections to Nature of Science:***Science is a Human Endeavor:* Scientists and engineers are guided by habits of mind, such as intellectual honesty, tolerance of ambiguity, skepticism, and openness to new ideas. (MS-LS1-3).  |
| E. Academic Language: [List the words/prefixes/suffixes that are addressed (focus on science vocabulary as well as instructions such as analyze, compare/contrast, etc…). *What* will the teacher do? *How* does the teacher address the words/prefixes/suffixes? *How* does the teacher get students to use those words, prefixes, and/or suffixes?] | Microbe, resist (needed for silk painting), silk batik, cause and effect, scale (with regards to increasing or decreasing the size of something). The teacher will define each term, giving the students, an example of the term used in a sentence and how it relates to the class. The teacher will demonstrate how to use the resist, objects which are scaled up or down, and give a demonstration of cause and effect on a previously completed silk batik project.  |

1. Catch/*Engagement*: (Hook them quickly – use all 5 senses at different times – should be no longer than 5 minutes.)

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| Hook: How to get student/class attention | <https://www.youtube.com/watch?v=1TmHlcMDIOQ> 2:45 An introductory video to marine microbes. |

1. Pre-test: (Same as post-test and short – to the point… **Bold** the objectives you are using – same as above!)

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| Pre-test and Post-test question(s)Put the pre-test at the end of this day’s lesson plan (along with PowerPoint etc…)! | 1) Using mathematics, **demonstrate** how to scale up a microbe to a specific size. 2) **List** three reasons we scale something up or down.3) **List** at least two cause and effect relationships that occur while painting ( could include mixing of colors, how paints acts on the silk, effect of salt on the paint, etc…) |

1. Activity/*Exploration*: (**Bold** the verbs that match the objectives. Can have as many parts as needed – step by step directions.
 *(Remember: Include at least 1 science writing activity and probe activity for the unit!)*

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| 1. Beginning of lesson
 | 1) Students will be shown the marine microbe video (2:45) 2) The teacher will review the objectives for the day.3) The teacher will define microbes, ask students for examples of microbes in their everyday life.4) Discuss what a cause and effect relationship is. Cold call students to give examples of cause and effect relationships. Examples are preferably related to science but don’t have to be.5) Discuss what scaling of an object is. Demonstrate to students how to scale the size of a micro-organism up. 6) Pass out the lab handout, at the top are two scaling practice problems. Have the students complete the problems and then go over the problems as a class. |
| 1. Middle of lesson
 | 7) Discuss what silk batik is, the materials they will be using and why they are completing the project. 8) Show the students an example of the completed project.9) Go over the handout, which contains directions for completing the activity and divide students into groups 2-3 people. 10) Using the microbe sorting cards from the previous microbe lesson, have the groups pick out a microbe they want to paint and discuss. (Students will be given a rubric for the project.) Groups cannot choose the same microbe. 11) Have students properly (with mathematics) scale up their chosen microbe to the silk batik square they are given.12) Using charcoal, have students begin the outlining of their microbe on the silk, followed by application of the resist.  |
| 1. End of lesson
 | 13) Explain to students, the painting will take place for the next 2 class periods, the 4th class period will be a presentation of their panting and a description of the chosen microbe. 14) Review concepts introduced at beginning of class, use either cold call or show of hands.15) If time permits, have students start researching their microbe. |
| 1. Are lecture (<11 min), lab, etc… clearly explained? Are directions and student expectations explicit?*Did you do this? Yes or No*
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| 1. PowerPoints, lab sheets, notes, answer keys, etc… included?*Did you do this? Yes or No*
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1. Review/Essential Questions/*Explanation*: (Should be closely related to pre/post tests!)

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| A. Low Level Questions – (Knowledge/Remembering and/or Comprehension/Understanding) | 1) What is a microbe?2) What is a cause and effect relationship?  |
| B. Middle Level Questions – (Application/Applying and/or Analysis/Analyzing) | 3) Give an example of a cause and effect relationship? 4) Given a microbe of the size 0.3 mm, show how much would the microbe be scaled up to a 450mm silk batik square. (450/0.3 = 1500) 1500X the original size. |
| C. High Level Questions – (Synthesis/Evaluating and/or Evaluation/Creating) | 5) Why would an object need to be scaled up or down?6) How did scaling up the microbe help you? |

1. Assessments (Post-test)/*Evaluation*: (**Bold** the verbs that match the objectives and are in the activity.)

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| A. Formative: (Check for learning in class?)e.g. Oral questions? | 1) While students are working on the scale problems, walk around the class, checking answers at a glance.2) During lecture and discussion, teacher is using hands and cold call to gain a formative assessment of the understanding of microbe and cause and effect relationships. |
| B. Post-test: ( “Same as pre-test”; Compare w/pre-test to inform teaching!) | 1) Using mathematics, **demonstrate** how to scale up a microbe to a specific size. 2) **List** three reasons we scale something up or down.3) **List** at least two cause and effect relationships that occur while painting (could include mixing of colors, how paints acts on the silk, effect of salt on the paint, etc.) |
| C. Summative: (Check for final learning/understanding) – e.g. Students turn in **constructed** project and **take** 20 question multiple choice test. | Students will have a summative assessment of their final project and presentation. |
| D. Explain how the data informs tomorrow’s teaching. For example, “The class post-test average must be a 80% or the next class begins with a 10 minute review/discussion of today’s material followed by another post-test of the same material.” | A post-test average of 75% or better will inform the teacher that the class knows what microbes are will be ready to advance to a lesson on the roles microbes play in our daily lives. Otherwise, there will be a review at the beginning of class, defining microbes, how scaling up helps scientists when studying microbes. |

1. Timeline for your lesson:

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| A. Catch 2:45 minB. Pre-test 3 minC. Activity – 4 parts 39 minD. Review and Post-test 5 min Add/change as needed |  |

1. Enrichment/*Elaboration*: (Include one enrichment activity for students that might finish early)

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| What enrichment activities are offered for students in this lesson (beyond what is taught)? | Students can research fresh water microorganisms, explain how they differ from marine microorganisms, the role they play in the environment. |

1. IEP Accommodations/Differentiation/Diversity: What accommodations will you use to support struggling learners?

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| What accommodations are used to support struggling learners? | Depending upon the needs of the student, the teacher can give extra assistance, allow the student to choose the group they’ll be working with and where in the classroom they’ll be working, offer both written and auditory copies of the lecture. The student may need to be exempted from the presentation part of the project, in which case a 2 page written report could replace the presentation.  |

