



MESA DAY CONTEST RULES

2021-2022

(FINAL / OFFICIAL)

Crime Scene Science (Pilot Competition)

LEVEL:	High School (HS)
DIVISION(S):	Grades 9-12 (combined)
COMPOSITION OF TEAM:	2-3 students per team
NUMBER OF TEAMS:	Preliminary – Determined by your local MESA center Regional – NO regional event
SPONSORS:	University of Southern California MESA College Prep Fresno State MESA College Prep

OVERVIEW: Are you interested in science and solving mysteries? Are you able to showcase your knowledge of life science? This is your opportunity! Your team is invited to collaborate using your knowledge of science to solve this new mystery working your way through the crime scene using your knowledge of punnett squares, blood, and plant cells including designing and constructing a DNA model that tests your science skills! **Participation logistics, limits, and competition facilities may vary by host site. Advisors and students are responsible for verifying this information with their local MESA center.** This competition will be either in-person or virtual for 2021-2022, depending on your local MESA center. These competition rules are designed for in-person events; recommendations for virtual events are provided in the Attachments/Appendix.

A science journal is a required component of this competition. The purpose of the Science Journal is not only to help guide students through some of the information surrounding the competition but also aligns with the process that scientists follow while completing research. MESA projects are not designed to be completed in a single class period or day, but to be the result of thoughtful research, planning, analysis and evaluation. Keeping a science journal throughout the process will help to keep a designer on track, using a logical progression of planning, in order to develop their project efficiently.

MATERIALS: For the Science Journal, **electronic submissions will be required.** Teams should use an electronic portal/application such as Google Docs to keep and maintain a science journal. Access and permission to the science journal is then given to MESA Day staff and judges OR science journal is submitted electronically (e.g.,

PDF file) for review. **Please check with your local MESA center for the deadline and submission platform to submit your team's science journal for local events.**

For the DNA model:

- All materials are legal with the exception of food, hazardous materials, or unsafe energy. The use of recycled and repurposed materials is highly encouraged.
- No kits allowed.

The Host Center will provide the following:

- Answer Sheet
- A series of questions will be given to each team
- Pencils
- Any materials/tools if required by the challenge.
- Stopwatch
- Microscope
- Table

GENERAL RULES:

- 1) The students' full name, grade level, school name, and MESA center must be clearly labeled on the DNA model. A 10% penalty in the score will be assessed for failing to properly label.
- 2) Each team members' name, school name, and MESA Center must be completely filled out on the answer sheet.
- 3) Teams must consist of 2 to 3 students. Teams consisting of 1 student will not be allowed to compete.
- 4) Teams will be allotted 15 minutes to solve the crime.
- 5) **All parts on** the DNA model must be **CLEARLY** labeled and bonds placed correctly to display the double helix. **(Students MUST create a DNA model in order to compete).** Required and labeled parts to be included:
 - a. Adenine
 - b. Thymine
 - c. Guanine
 - d. Cytosine
 - e. Sugar phosphate backbone
- 6) The DNA model must have **MINIMUM** width of 26 cm by 26 cm and **MAXIMUM** width of 38 cm by 38 cm with a **HEIGHT** minimum of 26 cm and maximum 38 cm.
- 7) All materials are legal with the exception of food, hazardous materials, or unsafe energy.
- 8) Answer sheets will be placed in front of judges; students must return to the answer sheet after every question and write answers in front of judges.
 - a. Students may NOT change answers once submitted.
- 9) Each clue must be answered before moving on to the next clue and receiving the next clue in the case.
- 10) Only answers submitted in the designated format or location will be scored.
- 11) The clues will be based on the ones provided by the host and vary from punnett squares, genotypes, phenotypes, and types of cells including plants and animals.

- 12) Scratch paper is not allowed as each clue is printed on a separate sheet of paper. Teams may use both sides of the clue sheet to solve the clue if needed. Any additional work done on the blank part of the answer sheet or clue sheet will NOT be used for scoring purposes.
 - a. Only answers written on the final answer sheet are evaluated for scoring purposes.
- 13) Books, notes, or other resource materials may not be used on the day of the competition.
- 14) Cell phones, laptops, ipads, smart watches, or any other electronic devices are strictly prohibited.
- 15) Teams will be required to submit a science journal with the following requirements **(an incomplete science journal with 1 or 2 missing requirements will receive a 20% penalty/deduction from total score and one missing 3 or more requirements or not submitted will receive a 50% penalty/deduction from the total score)**:
 - a. The students' full name, grade level, school name and MESA center must be clearly labeled/identified in the Science Journal. A 10% penalty in the score will be assessed for failing to properly label.
 - b. Using two to three sentences, answer the following questions:
 - i. What is transcription?
 - ii. What is translation?
 - iii. What are the 3 main types of RNA?
 - c. Sketch of DNA with labeled parts (Sketches can be hand drawn or computer generated):
 - i. Adenine
 - ii. Thymine
 - iii. Guanine
 - iv. Cytosine
 - v. Sugar phosphate backbone
 - d. Define the scientific terms and provide **THREE (3) examples** for each of the following:
 - i. Phenotype
 - ii. Genotype
 - iii. Punnett squares
 1. Please use THREE parent pairs of your choosing AND identify genotypes AND phenotypes when creating your punnett squares.
 2. Identify dominant and recessive genes for each parent and offspring.
 3. Determine the percent of each phenotype and genotype for each of the following sets.
 - e. Using four to five sentences, what are the differences between animal and plant cells?
 - i. Please include a sketch of an animal and plant cells with labeled parts (Sketches can be hand drawn or computer generated).
 - ii. Create a venn diagram highlighting the similarities and differences.
 - iii. Determine whether each is a prokaryotic or eukaryotic cell and include written answers under each sketch. Example: "Type of cell: _____"
 - f. Sketch of Microscope with labeled parts (sketches can be hand drawn or computer generated):
 - i. Arm
 - ii. Head
 - iii. Ocular Lens/Eyepiece
 - iv. Nose Piece
 - v. Objective Lens
 - vi. Slide Holder Clips
 - vii. Coarse Focus

- viii. Fine Focus
- ix. On/Off Switch
- x. Illuminator/Light Source
- xi. Base
- xii. Stage
- xiii. Condenser
- xiv. Iris Diaphragm
- xv. Diopter Adjustment

JUDGING:

- 1) Lead contest judge will assemble all teams and review the event guidelines and judging criteria.
- 2) Teams will be assigned a random number to determine the order teams will compete in.
- 3) Teams will be asked to wait outside of the room. One team will enter the room for competition (centers may choose to have more than one team to compete at a time.)
- 4) A table will be placed in front of the room where an answer sheet will be placed for each individual team.
- 5) Microscope and materials needed for competition will be placed on another table for competing teams.
- 6) Each team will receive details about the crime scene and Question #1 in a sealed envelope. When the team has the answer, they must go to the table where the answer sheet is and enter their answer. Once they enter an answer, they will receive the next question envelope; **even if the previous answer is incorrect they will proceed to the next question.**
- 7) Once the lead judge has signaled the beginning of the competition, teams may open the envelope and begin solving the first clue. Teams must not open the first sealed envelope until instructed to do so. If teams open the envelope beforehand teams will be disqualified.
- 8) Teams will have 15 minutes to complete the investigation. Once the 15 minutes are over teams will be asked to stop and to place materials down and will not be allowed to enter answers on the answer sheet.
- 9) Proctors will record the time for completion (i.e., the total time the team used to complete all of the clues); this recorded time will be used in the tie-breaker process.

SCORING:

- 1) DNA Model= up to 50 points
- 2) Science Journal= up to 75 points
- 3) Crime Clues= up to 103 points
- 4) Tiebreaker: recorded time where the team who completed the questions faster (in the least amount of time with more time left) will place ahead of the other.

AWARDS:

- Ribbons will be awarded for 1st, 2nd, and 3rd place.
- Pilot competition concludes at the preliminary event and will not move on to the regional event.

ATTACHMENTS/APPENDIX:

- Next Generation Science Standards
- Science Concept Resources
- Virtual Competition Recommendations
- Score Sheet for Crime Scene Science

Next Generation Science Standards

HS-LS1-4 Use a model to illustrate the role of cellular division (mitosis) and differentiation in producing and maintaining complex organisms. [*Assessment Boundary: Assessment does not include specific gene control mechanisms or rote memorization of the steps of mitosis.*]

HS-LS3-1 Ask questions to clarify relationships about the role of DNA and chromosomes in coding the instructions for characteristic traits passed from parents to offspring. [*Assessment Boundary: Assessment does not include the phases of meiosis or the biochemical mechanism of specific steps in the process.*]

HS-LS3-2 Make and defend a claim based on evidence that inheritable genetic variations may result from (1) new genetic combinations through meiosis, (2) viable errors occurring during replication, and/or (3) mutations caused by environmental factors. [Clarification Statement: Emphasis is on using data to support arguments for the way variation occurs.] [Assessment Boundary: Assessment does not include the phases of meiosis or the biochemical mechanism of specific steps in the process.]

HS-LS3-3 Apply concepts of statistics and probability to explain the variation and distribution of expressed traits in a population. [Clarification Statement: Emphasis is on the use of mathematics to describe the probability of traits as it relates to genetic and environmental factors in the expression of traits.] [*Assessment Boundary: Assessment does not include Hardy-Weinberg calculations.*]

Science Concept Resources

The following science concepts can be used in any variation in the challenges:

- DNA structure
- Microscope: identification of parts and how to use it.
- Types of cells including animal and plant.
- Pattern identification.
- Phenotype
- Genotype
- Punnett squares
- Parts of the cell: both animal and plant.

Vocabulary:

- Hereditary
- Genes
- Alleles
- Dominant
- Recessive
- Genotype

- Phenotype
- Punnett square
- Homozygous
- Heterozygous
- Incomplete dominance
- Complete dominance
- Codominance
- Traits
- Inherit

Virtual Competition Recommendations

- Students will join a Zoom meeting at a designated time set by the host MESA center and will go through the problems virtually while sharing their screen with the proctor.
- Each participating team must complete the competition via competition link in one sitting with an additional 5 minutes given for uploading pictures into the host designated submission form (e.g., Wufoo Forms, Google Forms, etc.). **Teams will be allotted 20 minutes to work through competition.**
- Each participating team must upload pictures of the DNA model with front and back view and any additional angles showing correctly labeled parts with no obstructions and no blurry pictures. Up to 4 pictures can be added if needed via model submission link; these pictures are to be submitted **ONE WEEK PRIOR TO COMPETITION.** If pictures are unclear, models will not be judged and no points will be awarded.
- ***ONLY if virtual,*** the DNA model has **NO SIZE LIMITATIONS** but must clearly show correctly labeled parts.
- Science Journal will be submitted virtually in PDF format through submission link provided by the host MESA center **ONE WEEK PRIOR TO COMPETITION.**

SCORE SHEET FOR CRIME SCENE SCIENCE

High School - Grades 9-12

Copies of this score sheet will be provided by the MESA Day Host Center.

Student Names:

SCHOOL: _____ HS CENTER: _____

DNA MODEL RUBRIC						TOTAL
MODEL LABELING	Adenine ____/5	Thymine ____/5	Guanine ____/5	Cytosine ____/5	Sugar Phosphate Backbone ____/10	____/50
	Correct Adenine + Thymine bond ____/10		Correct Guanine + Cytosine bond ____/10			
SCIENCE JOURNAL						TOTAL
Transcription (1pt), Translation (1pt), RNA types(3 pt) ____/5	Sketch of DNA with correctly labeled parts: ____/5	Phenotype Definition & Examples: ____/8	Genotype Definition & Examples: ____/8	Punnett Squares Definition & Examples: ____/10	Plant v.s. animal cell written differences: ____/5	____/75
Plant cell sketch with correct labels: ____/5	Animal cell sketch with correct labels: ____/5	Type of cell correctly defined. (prokaryotic or eukaryotic) ____/4	Venn Diagram ____/5	Sketch of microscope with correctly labeled parts: ____/15		
QUESTION SET RUBRIC						
Intro 1:			/ 15 pts			
Clue # 1a:			/ 5 pts			

Clue # 1b:	/10 pts	
Clue # 2:	/ 5 pts	
Clue # 3a:	/ 16 pts	
Clue # 3b:	/ 12 pts	
Clue # 4:	/ 5 pts	
Clue # 5:	/ 10 pts	
Final Location and Suspect:	/ 15 pts	
Claim and evidence	/10 pts	
Recorded Time:		
TOTAL Question Set (max of 103 pts)		
OVERALL SCORE		
DNA MODEL SCORE(X/50 POINTS): ____/50		
SCIENCE JOURNAL TOTAL(X/75):____/75		
QUESTION SET TOTAL(X/103 POINTS): ____/103		
LABELING DEDUCTION(-10%): YES/NO:		
20% or 50% DEDUCTION FOR SCIENCE JOURNAL*: YES/NO		
OVERALL SCORE(X/228 POINTS): ____/228		

* Science Journal Penalty

- ☐ Incomplete = missing 1 or 2 specified criteria = 20% penalty
- ☐ Missing = not submitted or missing 3 or more specified criteria = 50% (not eligible to place)