MESA DAY CONTEST RULES 2026-2027

(DRAFT)

Crime Scene Science

LEVEL: High School (HS)

DIVISION(S): Grade 9/10 and Grades 11/12

COMPOSITION OF TEAM: 2-3 students per team

NUMBER OF TEAMS: Preliminary – Determined by your local MESA center
Regional – # of teams per division at the discretion of each region (Northern, Central, LA/Central Coast, and Southern)

SPONSORS: University of Southern California MESA College Prep
University of California San Francisco MESA College Prep

OVERVIEW: Are you interested in science and solving mysteries? Are you able to showcase your knowledge of forensic science? This is your opportunity! Your team is invited to collaborate using your knowledge of science to a) complete a science journal, b) design and construct a DNA model, c) solve a mystery working your way through a crime scene using your knowledge of biology and forensics.
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.

RESOURCES: Crime Scene Science 2026-27 Online Training Modules

SCIENCE JOURNAL: 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 to also align 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.

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.** See

"HSCrime-Scene-Science-Journal-Template-Google-Doc-2026-27" at https://mesa.ucop.edu/.

MATERIALS:

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
- Crime Scene including any materials/tools
- Stop watch
- 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' full name, grade level, school name, and MESA center must be completely filled out on the answer sheet or the answer sheet may not be scored.
3) Teams must consist of 2 to 3 students. Teams consisting of 1 (one) student will not be allowed to compete.
4) Teams will be required to submit a **science journal** with the following requirements:
    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) Investigation Process:
        i) Correctly sequence the six major crime scene investigation steps, from first to last.
        ii) Identify why following an established sequence of steps is important to the reliability of an investigation.
    c) Finger Prints:
        i) Match each fingerprint ridge description to its correct basic pattern type (arch, loop, or whorl).
        ii) Lift your own fingerprint using a pencil and tape. Attach or draw a representation of your fingerprint, and identify the fingerprint pattern in your electronic science journal.
    d) 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
        vi) 5′ end
        vii) 3′ end

viii) Identify which statement correctly describes the directionality of the two DNA strands.

e) Forensic Evidence:
   i) Classify given examples of evidence as physical evidence or testimonial evidence.
   ii) Identify which scenario best demonstrates Locard's Exchange Principle.
   iii) Identify an example of trace evidence.

f) Measurements & Analysis in Forensics:
   i) Using the provided footprint length and estimation formula, calculate and show your work for the estimated height of the person who left the footprint.
   ii) Explain why an estimated height from a footprint should not be used as the only evidence to identify a suspect.

g) Hair and Fiber Evidence:
   i) Identify which characteristic is most useful when comparing two fiber samples under a microscope.
   ii) Determine the best conclusion that can be drawn when a crime scene fiber and a suspect's fiber share similar color and microscopic characteristics.

h) Biological/DNA Evidence:
   i) Using a provided DNA profile (STR locus data) for the crime scene and for multiple suspects, determine which suspect(s) cannot be excluded from the investigation, and explain the role this evidence plays in the investigation.

i) Microscope Use and Analysis:
   i) Identify which objective lens should generally be used first when beginning to view a specimen.
   ii) Explain what happens to the field of view when switching from a lower-power to a higher-power objective.
   iii) Identify the microscope component used to adjust the amount of light passing through a specimen.
   iv) Identify the adjustment used to sharpen a blurry image after switching to a higher-power objective.
   v) Explain why a specimen should be centered in the field of view before switching to a higher-power objective.
   vi) Explain why a forensic scientist might examine a hair or fiber under different magnifications.

5) Teams will be required to submit a DNA model. <u>All parts</u> 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.)**

   a) Required and labeled parts to be included for **DNA Model**:
      i) Adenine
      ii) Thymine
      iii) Guanine
      iv) Cytosine
      v) Sugar phosphate backbone
      vi) 5′ to 3′ strand directionality
      vii) Major and minor groove

   b) The DNA model must have a **MINIMUM** width/length of 26 cm by 26 cm and **MAXIMUM** width/length of 38 cm by 38 cm with a **HEIGHT** minimum of 26 cm and maximum 38 cm.

   i) If the model does NOT meet minimum and/or maximum width, length, and height requirements, the team will receive ZERO points for their model.
   ii) Teams are still eligible to compete and place with an incorrectly sized model.
c) All materials are legal with the exception of food and hazardous materials.
d) No kits allowed.

6) The model and science journal must be the original work of the students. Judges may ask questions to confirm authenticity.
7) For the **crime scene analysis:**
   a) Teams will be allotted **30 minutes** to solve the crime scene.
   b) Cell phones, laptops, iPads, smart watches, or any other electronic devices are strictly prohibited.
   c) Digital media (e.g., photos, video recordings, etc.) will not be accepted for judging purposes.
8) **All judging decisions are final.**

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 (hosts may choose to have more than one team to compete at a time).
4) A crime scene will be set up.
5) Once the lead judge has signaled the beginning of the competition, teams may begin to analyze and solve their crime scene.
6) Teams will have 30 minutes to analyze and solve a crime scene. Once the 30 minutes are over, teams will be asked to stop, to place materials down, and will not be allowed to enter answers on the answer sheet.
   a) At the start of the round, one sealed manila envelope containing evidence and case materials from the crime scene will be distributed to each team.
   b) Teams may open the envelope only when instructed by the event proctor.
   c) Inside the envelope, teams will find a variety of forensic evidence (such as fingerprints, fibers, powders, or witness statements) to analyze.
   d) Teams will use forensic tactics and techniques to evaluate the evidence, identify possible suspects, and determine their final conclusion.
   e) Teams may take notes and discuss findings collaboratively, but they may not use outside resources (e.g., internet, phones, books, etc.).
   f) When the 30 minutes have ended, the proctor will announce “Time.”
   g) At that signal, all teams must immediately stop working, place all materials and tools down, and stop writing on their answer sheets.
   h) Teams will turn in their answer sheets and all evidence materials to the proctor before leaving the competition area.
   i) Any team continuing to write or work after time is called may be disqualified at the judges’ discretion.
7) 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) Science Journal = up to 50 points
2) DNA Model = up to 50 points

3) Crime Scene Analysis = up to 100 points
4) **TIEBREAKER:** if there is a tie, the team that completes the competition in the least amount of time will be the winner.

AWARDS:

- Teams who do not submit a Science Journal or DNA model will NOT be eligible for any awards.
- Awards will be given for each division: Grades 9/10 and Grades 11/12.
- Medals will be awarded for 1st, 2nd, and 3rd place based on the highest Final Team Score.
- Ribbons will be awarded for Creative Model Design.
- Only teams that place in Overall Score will advance to Regional MESA Day; please check with your MESA center to determine the # of teams that advance to Regional MESA Day.

ATTACHMENTS/APPENDIX:

- Crime Scene Science 2026-27 Online Training Modules
    - Learn about the project, get clarifications on competition rules, and consider important Life Science and Forensic Science concepts (includes Judging Resources)
- A: Next Generation Science Standards
- B: DNA Model Labeling Example
- C: Science Concept Resources
- D: Suggested Microscope and Materials
- E: Crime Scene Science Specification Checklist
- F: Score Sheet for Crime Scene Science

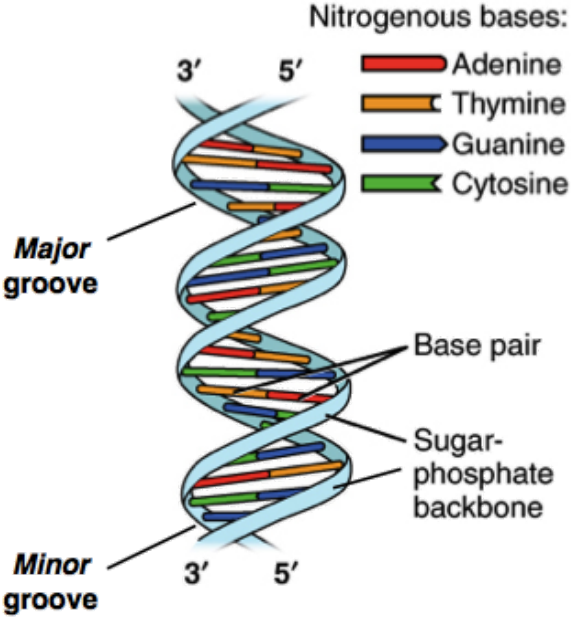
A: Next Generation Science Standards

The specific Next Generation Science Standard link this competition covers is below:

- HS-LS1-1 – From Molecules to Organisms: Structures and Processes
  - Construct an explanation based on evidence for how the structure of DNA determines the structure of proteins, which carry out the essential functions of life through systems of specialized cells. [Clarification Statement: Emphasis is on the conceptual understanding that DNA structure provides the code for protein production, connecting directly to the DNA model component of this competition.]
- HS-LS3-1 – Heredity: Inheritance and Variation of Traits
  - Ask questions to clarify relationships about the role of DNA and chromosomes in coding the instructions for characteristic traits passed from parents to offspring. [Clarification Statement: Emphasis is on using DNA structure and base pairing to explain how genetic information is stored and passed on, relevant to the DNA modeling and sketching tasks.]
- HS-PS1-2 – Matter and Its Interactions
  - Construct and revise an explanation for the outcome of a simple chemical reaction based on the outermost electron states of atoms, trends in the periodic table, and knowledge of the patterns of chemical properties. [Clarification Statement: Emphasis is on the chemical basis of hydrogen bonding between base pairs and the properties of trace evidence.]
- HS-ETS1-3 – Engineering Design
  - Evaluate a solution to a complex real-world problem based on prioritized criteria and trade-offs that account for a range of constraints, including cost, safety, reliability, and aesthetics as well as possible social, cultural, and environmental impacts. [Clarification Statement: Emphasis is on evaluating conflicting evidence and justifying a final conclusion using a systematic, criteria-based process.]

B: DNA Model Labeling Example

This picture functions as a reference for labeling DNA models.



C: Science Concept Resources

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

- Microscope: Parts and how to use it
- Pattern identification (fingerprints, fibers)
- Fingerprint types: arches, loops, whorls
- Fiber types: natural vs. synthetic
- Measurement skills: using a ruler or caliper
- Properties of materials: color, texture, shape
- Using evidence to support a claim

Vocabulary:

- Trace evidence
- Latent print
- Locard's Exchange Principle
- Chain of custody
- Fiber
- Sketch
- Scale
- Testimonial vs. Physical Evidence

D: Suggested Microscope and Materials

Recommendations: Please coordinate with your school's Life Sciences/Biology department to arrange for loaner microscopes. If this is not feasible, you can find microscope purchase recommendations at the following link:

- Microscope

E: Crime Scene Science Specification Checklist

This checklist is provided **ONLY** as a reference for teams to "pre-inspect" their Crime Scene Science DNA models and Science Journals to ensure they meet the rules specifications. Teams may check-off each of the following items after comparing their competition-ready DNA models and Science Journals with the rules. **This checklist will NOT be used by judges.**

- ☐ 2026-2027 rules are used.
- ☐ Science Journal is properly labeled with team members' names, grade level, school name, and MESA center.
- ☐ DNA model is properly labeled with team members' names, grade level, school name, and MESA center.
- ☐ DNA model meets size requirements of **MINIMUM** width/length of 26 cm by 26 cm and **MAXIMUM** width/length of 38 cm by 38 cm with a **HEIGHT** minimum of 26 cm and maximum 38 cm.
- ☐ Know and understand the forensic investigation process.
- ☐ Know how to operate a microscope and analyze/differentiate fibers using a microscope.
- ☐ Know how to lift a fingerprint and analyze it under a microscope.

F: SCORE SHEET FOR CRIME SCENE SCIENCE

High School - Grades 9/10 and Grades 11/12

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

Student Names: _____ Grade: **9/10** or **11/12** (circle one)

SCHOOL:_____ HS CENTER:_____

Science Journal Submitted: ☐ Yes ☐ No

Teams who do not submit a Science Journal or DNA model will NOT be eligible for any awards.

DNA MODEL RUBRIC						TOTAL
MODEL LABELING	Adenine __/5	Thymine __/5	Guanine __/5	Cytosine __/5	Correct 5'-3' Anti-Parallel Sugar Phosphate Backbone __/10	
	Major and Minor Groove ___/10	Correct Adenine + Thymine bond ___/5		Correct Guanine + Cytosine bond ___/5		___/50*

**If the model does not meet size requirements, 0 points will be awarded for the model.*

SCIENCE JOURNAL				TOTAL
Investigation Process (crime scene steps & sequencing): _____/7	Finger Prints (pattern matching & lifting own print): _____/5	DNA Structure (sketch, labeled parts & strand directionality): _____/8	Forensic Evidence (physical vs. testimonial, Locard's, trace evidence): _____/6	
Measurements & Analysis (footprint calculation & reasoning): _____/6	Hair and Fiber Evidence: _____/4	Biological/DNA Evidence (DNA profile analysis): _____/8	Microscope Use and Analysis: _____/6	_____/50

CRIME SCENE ANALYSIS RUBRIC		
Intro: What is the crime you are solving?	/ 5 pts	
Clue # 1:	/ 15 pts	
Clue # 2:	/ 15 pts	
Clue # 3:	/ 15 pts	
Clue # 4:	/ 15 pts	
Final Suspect:	/ 15 pts	
Written Defense & Overall Justification	/ 20 pts	
Recorded Time:		
TOTAL Crime Scene Analysis (max of 100 pts)		

OVERALL SCORE
SCIENCE JOURNAL SCORE(X/50):___/50
SCIENCE JOURNAL LABELING DEDUCTION(-10%): YES/NO:
Science Journal SUBTOTAL: _____.
DNA MODEL SCORE (X/50):____/50
DNA MODEL LABELING DEDUCTION(-10%): YES/NO:
DNA Model SUBTOTAL: _____.
CRIME SCENE ANALYSIS TOTAL(X/100 POINTS): _____/100
OVERALL TOTAL SCORE = science journal + model + crime analysis (X/200 POINTS): _____/200