Macomb Elementary Science Olympiad

2027 Event Rules

A is for ANATOMY

DESCRIPTION: Students will identify anatomical structures of the human cardiovascular, respiratory, and **lymphatic** systems. Only the scientific names of the structures will be utilized and accepted as correct.

TEAM SIZE: 1 or 2 students **APPROXIMATE TIME:** 30 minutes

Students must bring: pencil	**Students may bring:**
Students may not bring: notes, cell phone, smart watch, clipboard, smart glasses, air pods/buds	**What we provide:** ZipGrade answer sheet
More information and resources may be found at: https://macombso.org/anatomy FAQs are also posted, which clarify how these rules are applied.	

THE COMPETITION: Twenty-two stations will be set up around the room. Each station will have models or pictures of anatomical structures. Questions will relate to the identity of those structures.

The teams will move around the room, one team per station, answering the questions at each station as they go. This is a timed exercise. A facilitator will direct the students to move to a new station at one-minute intervals. The answers will be recorded on the provided ZipGrade answer sheet with a #2 pencil. Students should bring pencils.

SCORING: There will be twenty-one stations with four multiple choice questions per station. Each question will be worth one or two points**.** The team with the highest point total will be the winner.

Ties will be broken by the four questions at station #22. These questions will be open-ended (not multiple choice) and will be recorded on the answer sheet. Only the correct spelling of scientific names of the structures will be accepted!

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CARDIOVASCULAR SYSTEM STUDY GUIDE

AORTA
Aortic arch
Ascending aorta
Descending aorta

CHAMBERS and associated structures
Auricle
Fossa ovalis
Interatrial septum
Interventricular septum
Left atrium
Left ventricle
Right atrium
Right ventricle

VALVES and associated structures
Aortic semilunar valve
Bicuspid (mitral) valve
Pulmonic (pulmonary) semilunar valve
Tricuspid valve
Chordae tendineae
Papillary muscle

BLOOD VESSELS OF MYOCARDIUM
Cardiac veins
Coronary arteries
Left coronary artery
Circumflex artery
Left anterior descending artery
Opening to the coronary arteries
Opening to the coronary sinus
Right coronary artery
Marginal artery
Posterior interventricular artery

PULMONARY VESSELS and associated structures
Pulmonary trunk
Pulmonary arteries (right & left)
Pulmonary veins (right & left)
Ligamentum arteriosum

VENA CAVAE
Inferior vena cava
Superior vena cava

HEART TISSUES and CAVITY
Parietal pericardium
Pericardial cavity
Visceral pericardium (epicardium)
Endocardium
Myocardium

*Follow the path of blood through the heart.

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RESPIRATORY SYSTEM STUDY GUIDE

NOSE/ ORAL CAVITY / PHARYNX	**LARYNX**	**LUNGS**
Naris (plural, nares)	Hyoid	Right upper lobe
Nasal conchae	Epiglottis	Right middle lobe
-Superior	Thyroid cartilage	Right lower lobe
-Middle	Arytenoid cartilage	Left upper lobe
-Inferior	Cricoid cartilage	Left lower lobe
Nasal cavity	Cricothyroid membrane	Horizontal fissure (right lung)
Oral cavity	Vocal folds (cords)	Oblique fissure (right & left lung)
Tongue	**TRACHEOBRONCHIAL TREE**	**MUSCLES OF BREATHING**
Hard palate	Carina	Diaphragm
Soft palate	Trachea	External intercostal muscles
Uvula	Right Bronchus	Internal intercostal muscles
Lingual tonsil	Left Bronchus	
Palatine tonsil	Bronchioles	**PLEURA**
Pharyngeal tonsil	Alveoli	Parietal pleura
Nasopharynx		Pleural cavity
Oropharynx		Visceral pleura
Laryngopharynx		
		*Follow the path of air through the respiratory system.

LYMPHATIC SYSTEM STUDY GUIDE

LYMPHATIC ORGANS

Red bone marrow
Spleen
Thymus gland

LYMPH NODES and associated structures

Axillary lymph nodes
Cervical lymph nodes
Cisterna chyli
Inguinal lymph nodes
Lacteal
Lymphatic vessels
Right lymphatic duct
Thoracic duct

***Follow the path of lymph from the tissue spaces back to the blood.**

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AMAZING ARTHROPODS

DESCRIPTION: Students will be required to demonstrate an understanding of the major arthropod groups. This knowledge will also be applied to recognize the arthropods in their own neighborhood by assembling a collection of arthropod specimens or specimen photographs and identifying them in advance of the tournament.

TEAM SIZE: 1 or 2 students **APPROXIMATE TIME:** 30 minutes

Students must bring: pencil with eraser	**Students may bring:** arthropod collection (*not for practice tournaments*) one 8.5" x 11" 2-sided sheet of notes per team
Students may not bring: cell phone, smart watch, smart glasses, air pods/buds	**What we provide:** ZipGrade form
More information and resources may be found at: https://macombso.org/arthropods FAQs are also posted, which clarify how these rules are applied.	

THE COMPETITION:

Part 1: A test consisting of multiple choice**,** matching and true or false questions presented in a station-based format. Teams will rotate among approximately 20 stations with about 1 minute at each station. Each station may include 3 to 6 questions. Students will record their answers on a ZipGrade form. One station will be designated as tiebreaker questions and will have a fill-in-the-blank format. The scope of subjects listed below will be the basis for questions on the test.

For the groups listed in more detail in Table 1 and Table 2, students should be able to:

Arthropod Classes and Insect Orders *(Table 1)*	Know the key characteristics of each listed arthropod Class and insect Order, visually recognize specimens that belong to each, and answer questions about their basic biology & anatomy.
Arthropod Species *(Table 2)*	Visually recognize each species, and answer questions about the species' unique physical and behavioral characteristics, the habitat in which it lives, and the niche which this species holds in our ecosystem

Beyond identification of arthropods, students can expect questions on the following topics::

- Linnaean classification
- Basic arthropod anatomy
- How to use dichotomous keys
- Arthropod life cycles
- Arthropod defenses
- Arthropod feeding adaptations
- Economic impacts (e.g., crop pests)
- Pest control tactics
- **Michigan status (such as endangered or non-native/invasive)**

For more details on these topics, refer to the study guide and other resources listed at the end of this document. These resources will help set the students up for success.

Table 1: Arthropod Classes and	**Insect Orders**	
Arachnida	**Blattodea**	Lepidoptera
Chilopoda	Coleoptera	Mantodea
Diplopoda	Diptera	Megaloptera
Insecta	Ephemeroptera	Odonata
Malacostraca	Hemiptera	Orthoptera
	Hymenoptera	**Siphonaptera**

Table 2: Arthropod Species		
Class: Order	**Common Name**	**Scientific Name**
Insecta: **Diptera**	**Asian tiger mosquito**	***Aedes albopictus***
	Winsome fly or Feather-legged fly	***Istocheta aldrichi***
	Common drone fly	***Eristalis tenax***
	Clubbed mydas fly	***Mydas clavatus***
	Giant eastern crane fly	***Pedicia albivitta***
	Goldenrod gall fly	***Eurosta solidaginis***
Insecta: **Hymenoptera**	**Bicolored striped sweat bee**	***Agapostemon virescens***
	European honeybee	***Apis mellifera***
	Eastern cicada killer	***Sphecius speciosus***
	Hornworm wasp	***Cotesia congregata***
	Chestnut gall wasp	***Dryocosmus kuriphilus***
	Allegheny mound ant	***Formica exsectoides***
Arachnida	Lone Star tick	*Amblyomma americanum*
	American dog tick	*Dermacentor variabilis*
	Carolina wolf spider	*Hogna carolinensis*
	Northern black widow	***Latrodectus variolus***
	Banded garden spider	*Argiope trifasciata*
Malacostraca	Common pill-bug	*Armadillidium vulgare*
	Common rough woodlouse	*Porcellio scaber*
	Tiger scud	*Gammarus tigrinus*

Part 2: An arthropod collection that is brought to the *regional* tournament (not the practice tournament). The collection may either be pinned or presented as photographs of the actual specimen that the student found, but not a mix.

General requirements

- Specimens that can be found in the Great Lakes region (***not limited to classes and orders in Table 1****;* no specimens kept as pets or available from pet stores/supply houses)
- The team number and students' names should be clearly identifiable on the collection.
- Immature specimens will be accepted for species undergoing gradual metamorphosis (e.g., nymphs). Immature specimens will NOT be accepted for species undergoing complete or incomplete metamorphosis (e.g., larvae, pupae, naiads). Please refer to the Amazing Arthropods Study Guide for more details on metamorphosis.
- All specimens were collected or photographed within the prior year of the competition, and by members who are actively studying the Arthropod event, including Alternate team members. Adults are not team members.
- All specimens or photos must bear collection data associated with each individual specimen. Collection data should be on a paper card below pinned specimens or photo (unless date and time are part of the photograph itself). Labels must consist of the following data:
    1. Date collected (month, day, year) (**date stamp required as part of photos**)
    2. Location collected (State, County, and nearest City)

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3. Brief behavior or habits observed during collection (e.g., eating a leaf)
4. Name of collector

- All specimens should be identified to Class. Further, all specimens in Class Insecta should be identified to Order. *No specimens should be identified to genus or species.*
- Specimens should be grouped by Class first, then sub-grouped by Order (insects only). No further identification below this level is needed (or wanted!) for this event.

Requirements specific to pinned collections

- Collections should be housed in a sturdy cardboard or wooden box with a lid, not to exceed 16.5" x 19". Styrofoam or similarly porous and flexible material should be placed on the bottom for the pins to stick into.
- Professional insect pins must be used (#2 is a good size) for all specimens from Class Insecta, whether directly through the thorax or, if the thorax is too small, through a paper triangle.
- Professional vials should be used for Arthropod specimens in all Classes *except Insecta*.

Requirements specific to photographic collections

- The collection must be housed in a photo album or put on one poster, not to exceed 24" by 36".
- List the camera used to take the pictures (this, along with the date and time, can be programmed to appear on each picture by most cameras and cell phones; **(date stamp required)**
- Photos must be in focus and allow for proper identification of the specimen (showing necessary features, like number of legs, wings, etc.) and cropped to reduce excess background.
- Photos must be of only one specimen.

SCORING:

Test: Approximately 67% of the total score

- Each question may be assigned a value of 2 or 3 points, based on question difficulty.

Collection: Approximately 33% of the total score

- 4 points for each unique Arthropod Class collected and properly identified (not including Insecta)
- 3 points for each unique Insect Order collected and properly identified (up to 10 orders)
- 1 point per specimen (up to 30 specimens). Duplicate specimens will not be counted.
- Up to 20 points awarded for quality of work and adherence to the rules (e.g., a proper size box)

Note: Points may be deducted at the Supervisor's discretion if it appears that the student misrepresented their Arthropod collection or if it appears that the collection was assembled by an adult.

Tie Breaker: Total points of the tiebreaker, fill-in-the-blank format questions.

SUPPORTING RESOURCES: (highly recommended)

These are posted on the Macomb Science Olympiad website:

- Amazing Arthropods Study Guide
- Arthropod Species Student Workbook
- Anatomy Worksheets
- Collection Scoring Rubric

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CHARGED UP

DESCRIPTION

Students will be tested on their knowledge of electricity and related concepts. The exam will cover circuits, conductors, insulators, lamps, diodes, resistors, voltage, current, resistance, schematic drawings, meter reading, electrical sources and safety.

TEAM SIZE: 1 or 2 Students **APPROXIMATE TIME**: 30 Minutes

Students must bring: pencil	**Students may bring:**
Students may not bring: notes, cell phone, smart watch, smart glasses, air pods/buds	**What we provide:** multimeter, resistor color code chart, at specific stations, all electrical components required to build circuits, ZipGrade answer sheet
More information and resources may be found at: https://macombso.org/charged-up FAQs are also posted, which clarify how these rules are applied.	

THE COMPETITION

The test will be given in a station format with multiple questions per station. Two or three essay questions or tasks will be included as tiebreakers.

Students need to understand the terms: conductor, insulator, open circuit, short circuit and know the difference between normally open and normally closed switches, series circuits, parallel circuits, and series-parallel circuits. They should be familiar with electrical safety practices, meter reading, voltage, current, resistance, diodes and sources of electricity. Students should know how to calculate the voltage or resistance of a series circuit. Students should be able to draw circuits using schematic symbols from written instructions and construct circuits from written instructions or schematic symbol circuit diagrams.

Examples of possible items at the stations:

- Schematic drawings with questions regarding the circuits.
- Questions about what happens when a switch is closed or opened, or whether a lamp in a given circuit will light or not.
- Identification of series, parallel, and series-parallel circuits.
- Questions about insulators, conductors and conductivity of various materials.
- Questions about meter reading, generators or voltage.
- Given a written description or a schematic drawing, construct an actual circuit.
- Identification of internally-connected circuits on mystery cards.
- Construct a circuit tester.
- Identify the resistance of a given resistor using the 4-band color code.
- Definitions of electrical terms.
- Questions on general electrical safety.
- Using a meter, measure voltage, resistance, and current of components.

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SCORING

Points will be awarded for correct answers. The team with the highest total number of points will be the winner. Predetermined tiebreaker questions or tasks will be used to break ties.

NOTE: Direct current (DC) circuits using low-voltage batteries will be used.
120V (AC) CIRCUITS WILL NOT BE USED!

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CODE WARRIORS

DESCRIPTION:
Students will be tested on the concepts of computer science and computational mathematics, and are challenged to apply these concepts to solve hands-on computer programming problems. The programming language is Python.

TEAM SIZE: 1 or 2 students **APPROXIMATE TIME**: 30 minutes

Students must bring: pencil	**Students may bring:** one 8.5" x 11" sheet of notes per team (2-sided), one non-programmable calculator per team
Students may not bring: cell phone, smart watch, smart glasses, air pods/buds	**What we provide:** two computers, open to a complier and the Part 2 online interactive challenge; ZipGrade answer sheet
More info and resources may be found at: https://macombso.org/code-warriors FAQs are also posted, which clarify how these rules are applied.	

THE COMPETITION:
Students may work independently or may talk quietly.

Part 1: Multiple-Choice Questions

Students will be presented with multiple-choice questions which cover the scope of concepts listed below. Answers must be recorded on the ZipGrade answer sheet.

- Variables and types
- Operators (=, +, -, *, and /)
- Order of operations
- Control flow
  - if/else statements
  - For loops
  - While loops
- Logical operators
  - And
  - Or
  - Not
  - Greater than
  - Less than
  - Equal to
- Output using print( ) statements
- Functions
  - Calling functions
  - Writing functions
- String manipulation
- Lists (aka Arrays)

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Part 2: Interactive Challenges

Students will be presented with a series of online, interactive challenges or puzzles of varying difficulty. The solution to these challenges will require students to demonstrate an understanding of the coding concepts listed in Part 1. The exact format of these challenges will not be announced in advance.

SCORING:

High score wins. Total points available will be distributed approximately on this basis:

Part 1: 50%,
Part 2: 50%

Tie-Breaking:

In the event of a tie, the team with the higher score on Part 2 will win. If there is a tie in Part 2, the number of difficult questions answered correctly from Part 1 will prevail.

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CODEBUSTERS

DESCRIPTION: Students will be tested on their ability to decode encrypted messages using cryptanalysis techniques and show skills with ciphers by decrypting a series of messages.

TEAM SIZE: 1 or 2 students **APPROXIMATE TIME:** 30 minutes

Students must bring: pencil	**Students may bring:**
Students may not bring: notes, cell phone, smart watch, smart glasses, air pods/buds	**What we provide:** a resource sheet with English letter frequencies, Atbash, and Dancing Men tables; scratch paper
More info and resources may be found at: https://www.macombso.org/codebusters FAQs are also posted, which clarify how these rules are applied. Go to https://toebes.com/codebusters/ for help with how each cipher works and for help creating practice tests. Thanks to John Toebes and his team, who created this event.	

THE COMPETITION:

Students may answer the questions in any order, working individually or in pairs. *Students will not be able to finish the test*. They will pick which problems they will attempt to solve.

Students must not open the exam packet until the test starts. Test can be taken apart so students can work independently on problems. Students must write their answers legibly.

The code types that may be used on the exam are:

Name	Details
Atbash	A decryption table will be provided.
Caesar	A shift of no more than 3 characters in either direction.
Aristocrat	No letter can ever decrypt to itself. A hint may be provided depending on the level of difficulty.
Tap Code	**Decryption table is not included. Students must know how to create the table.**
Pig Pen	**Decryption table is not included. Students must know how to create the table.**
Dancing Men	A decryption table will be provided.

SCORING:

High score wins. Based on difficulty, each question will be worth a clearly indicated number of points. Points are awarded for each letter that is correct and additional points are given for each cypher that is 100% correct. The points per letter are greater for more difficult cyphers.

Ties will be broken based on: 1) the number of problems that are decrypted 100% correctly; 2) the number of points awarded on the more difficult problems.

CRASH CAR EGGSPERT

DESCRIPTION: Each team will build a structure on top of a PineCar Racer. The structure will be designed to hold and protect one or two eggs as the car is rolled down a progressively steeper series of ramps and crashes into an immovable barrier.

TEAM SIZE:1 or 2 students

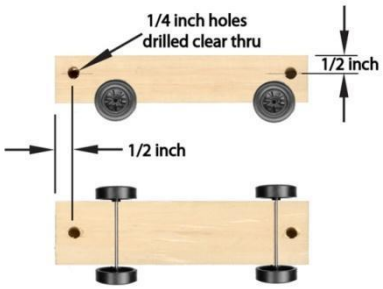
APPROXIMATE TIME: Building time: 20 minutes
Ramp time: 15 minutes

Students must bring:	**Students may bring:** 2 pairs of scissors, a ruler, 2 pencils and a pair of pliers
Students may not bring: notes, cell phone, smart watch, smart glasses, air pods/buds	**What we provide:** PineCar Racer, build kit, up to 2 eggs
More info and resources may be found at: https://www.macombso.org/crashcar FAQs are also posted, which clarify how these rules are applied.	

CONSTRUCTION:

1. Teams will be provided with a basic assembled PineCar Racer that will be modified with four ¼" holes that are drilled all the way through the wood body. Two of the holes will be drilled through the side, both will be ½" from the top, one ½" from the front and one ½" from the back. The other two holes will be drilled through the top, on center, one ½" from the front and one ½" from the back.

2. Additionally, teams will be provided with most of the following materials:



   (4) Cotton balls
   (4) 2 5/8" long round wooden toothpicks
   (3) 12" natural rubber latex balloons
   (1) 36" piece of 3 lb. twisted cotton twine
   (4) 12" long "Fuzzy Stick" brand pipe cleaners
   (6) Paper clips size #1 plated steel
   (4) 7 ⅝" long, ¼" diameter flexible drinking straws
   (4) Goody® brand 2" long bobby pins (Stk. no. 03705)
   (4) Bicycle® brand standard playing cards
   (4) 4 ½" long x 3/8" wide x 1/16" thick wood craft sticks (aka popsicle sticks)
   (14) ¼" dia. self-adhesive reinforcement labels (equivalent Avery # 6755)
   (1) 12" x 10 3/4" sheet of aluminum foil (may come folded)
   The 10 ¾" x 5 1/8" x 3 ¼" paper lunch bag holding these materials MAY be used in building the structure

3. Up to three of the items listed in rule 2 may be omitted, or have their quantity reduced. The quantity of some items may be increased. The paper lunch bag will not be omitted. Students will not know the exact material list until they begin building. If the students believe they are missing any material that is on the list they should immediately alert the Supervisor. DO NOT WAIT until the structure is built.

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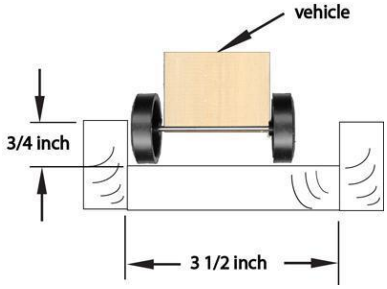
4. The Supervisor will provide Large Grade A raw chicken eggs. Team members are responsible for the care and handling of their eggs from the time they take possession. If they wish, they may exchange an egg that they are given for another, but they must do so immediately after receiving them.
5. A team may design the structure to carry one egg (the 'driver') or two eggs (the 'driver' and 'passenger'). They must declare that intent when they are given their egg(s). The Supervisor will mark the eggs to differentiate between 'driver' and 'passenger'.
6. Each team may bring 2 pairs of scissors, a ruler, 2 pencils and a pair of pliers. No other tools or materials are allowed.
7. The structure must be built in a way that allows each 'test egg' to fall free when the vehicle is inverted during inspection. Students will remove the egg by inverting their car. They are not allowed to disassemble their device to extract the egg. Pieces of the vehicle that fall away cannot be reattached. There is no vehicle repair allowed between runs.
8. No part of the structure may come in contact with the wheels on the PineCar Racer or the ramp. Wheels of the car must be able to rotate freely and no part of the structure shall slow the car's descent by making contact with the ramp.
9. Each team will be given 20 minutes to construct their crash structure. Times will be recorded to use as a tie breaker.
10. They will return at a later time, based on a pre-determined schedule, to roll their crash car down the ramps. Cars will be impounded until ramp time.
11. Competitors will be required to transport their completed crash car from the construction zone, to impound, to the competition area. The egg must be in the structure, from the end of construction, until removal after the car's first crash.

THE COMPETITION:

1. The Supervisor will provide three eight-foot ramps with a slope somewhere between 20 and 60 degrees. A fixed barrier will be located at the immediate end of each ramp. The ramp slopes will be posted 30 minutes prior to the beginning of the construction time.



The ramps will be made from 8' lengths of 1"x 4" pine lumber with 1"x 2" side guides.

2. Supervisors will inspect the crash car to make sure there are no violations of construction rules# 7 and 8. If any are found, students will have 2 minutes to correct them.
3. The students who place their car on the ramps must be the students who built the structure.
4. Each team will begin at the ramp with the lowest slope. The car will be rolled down the ramp and will crash into the barrier. Students will be instructed to remove the egg from their structure and show it to the supervisor. The egg is considered to have survived as long as it does not leave a wet spot on a paper towel.

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5. If the egg leaves the crash car during the crash, it will be considered to have broken, whether it actually did so or not.
6. After the ramp 1 crash, then again after the ramp 2 crash, the team will evaluate the condition of their vehicle and decide:
    a. to continue to the next ramp to earn additional points, or
    b. to continue to the next ramp without the passenger egg, or
    c. to stop, and protect the points earned and not risk injuring the driver egg and falling to tier 2.

    The car can continue with an injured or unloaded passenger, but must have an intact driver.
7. An unbroken passenger egg that a team decided to hold back from a ramp drop can be reintroduced for later drops,
8. Crash cars and eggs that advance to the next ramp will do so in an as is condition. Structures may not be repaired or refurbished between crashes.
9. Students determine which end of their car is the front, and where their passenger egg will ride as they prepare to load their car onto the ramp. They can change that orientation between runs, but don't forget rule #8.

SCORING:

1. Teams will accumulate points as described in the chart below:

Points Awarded after each run

	Driver Egg Intact?	***Passenger Egg***	
		Intact?	***Bleeding?***
Ramp 1	100	55	-15
Ramp 2	150	85	-25
Ramp 3	200	115	-35

2. If a team's driver egg is intact during device testing, they will be ranked in Tier 1 regardless of when they decided to stop.
3. A broken driver egg will move a team to Tier 2. A broken passenger egg has a point cost but does not affect the score tier.
4. Teams with a construction violation that can't be modified within two minutes of discovery will be ranked in Tier 3.
5. Teams whose egg broke prior to the first ramp run will be assigned a 100-point penalty.
6. Ties will be broken based on construction time, shortest time first, longest time last.

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DESCRIPTION:

Students will evaluate crime scene evidence to determine who committed a crime. Students will be expected to test unknown powders, use paper chromatography to identify ink, match fingerprints, footprints, tire prints, and more.

TEAM SIZE: 1 or 2 students **APPROXIMATE TIME**: 30 minutes**

Students must bring:	**Students may bring:**
Splash-proof OSHA-approved chemical safety goggles, 3 pencils	One 2-sided index card/sheet of paper up to 8.5" ×11" per team, with any notes on it (typed or handwritten). Sticky notes and other appendages on the sheet that can be flipped or folded are not permitted. Two magnifying glasses per team.
Students may not bring:	**What we provide:**
Cell phone, smart watch, smart glasses, air pods/buds, camera	List of possible powders, tap water, vinegar (CH_3COOH), and iodine solution (KI_3)* to test powders only, plastic cups, wooden spoons, black paper, and toothpicks. Materials to make one chromatogram, including isopropyl rubbing alcohol and chromatography paper marked with ink samples. ZipGrade answer sheet.
More information and resources may be found at: https://macombso.org/crime FAQs are also posted, which clarify how these rules are applied.	

THE COMPETITION:

All parts will be provided at the same time, and they are to be completed in no particular order.

Part 1: Powder identification

- The powders may include: powdered Alka-Seltzer, baking soda, calcium carbonate powder, cornstarch, flour, gelatin, salt, white corn meal, white granulated sugar, yeast.
- Each team will be given 6 cups containing powders. Each cup will contain 1, 2 or 3 powders. Cup 1 will contain the powders collected as evidence at the crime scene, and Cups A-E will contain powders collected from each of the suspects.
- Students will be asked to identify all powders in all cups, match the powders in Cup 1 to one or two of the other cups.
- Combinations of powders that will NOT occur: flour and cornstarch; any combination among Alka-Seltzer, baking soda, and calcium carbonate.
- Touching, tasting, feeling, or sniffing of the powders is not allowed.

Part 2: Chromatography

Students will be asked to make a chromatogram using isopropyl rubbing alcohol and chromatography paper pre-marked with 6 ink samples. Sample 2 is an ink sample from the crime scene, and Samples A-E are ink samples from the suspects. Students will use the chromatogram to help identify the criminal(s) by comparing the separation pattern of Sample 2 to the separation pattern of Samples A-E. The chromatogram will be turned in with the answer sheet and ZipGrade form. Students are permitted only one chromatography paper.

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Parts 3-5: Prints

Students will be asked to compare Fingerprints, Footprints or Shoe Prints, and Tire Prints from the suspects to prints found at the crime scene. Evidence from the crime scene will be labeled with numbers (e.g., Fingerprints 3, Shoe Prints 4, Tire Prints 5), and suspect prints will be labeled A-E. Partial or obscured prints may be used.

Part 6: Unspecified evidence

Students will be given one piece of "unspecified" evidence recovered from the crime scene that does not fall under any of the previous categories. This evidence will focus on students' critical thinking skills. Examples of unspecified evidence can include but are not limited to: handwriting samples, fake hair samples, and liquid samples with varying pH. Ample instructions and assistance will be given if needed.

Part 7: Criminal identification

After all the evidence is collected, the students will identify the one or two suspects who committed the crime in ZipGrade Question 7. No more than two suspects will be implicated.

Note:

- Teams are not permitted to touch test materials until instructed to by the Event Supervisor.
- Testing materials (ZipGrade answer sheet, chromatogram, and answer sheet) must be collected by the Event Supervisor before the team may leave the event room.
- Any additional personal belongings (including but not limited to bags, water bottles, etc.) are not allowed by the team's event station. Personal belongings can be placed at the front or back of the event room.
- Safety goggles must be worn by students for the duration of the event.
- Cheating of any kind is not permitted, including, but not limited to, looking at other teams' answers and taking photos or videos of the test materials or the event.
- Failure to follow any rules may result in point deduction or disqualification.

SCORING:

Students will earn points for:

- Correctly identifying powders in each cup
- Creating a neat, clear chromatogram
- Matching of all evidence to the suspects
- Identifying the criminal(s)

Students may lose points for (including but not limited to):

- Identifying incorrect or extra powders, suspects, or criminals
- Missing, incomplete, messy, or unsuccessful chromatograms

Any ties will be broken using one or more tie breaker questions within the scope of the event. If tie breaker questions are insufficient, ties will be broken by chromatogram quality. If the tie cannot be broken by chromatogram quality, then the tie will be broken by overall performance in powder identification.

* Note: Povidone Iodine or a colored solution of Tincture of Iodine will work for practice sessions. These can be purchased at many pharmacies. Decolorized Iodine will not work.

** Note: Some competition time is allocated to providing instructions, collecting tests and other logistics.

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MYSTERY ARCHITECTURE

DESCRIPTION: Students will be given a mystery set of materials to build a freestanding tower as tall as they can. The tower should be constructed to support a tennis ball at its top.

TEAM SIZE: 1 or 2 students **APPROXIMATE TIME**: 30 minutes

Students must bring:	**Students may bring:** scissors, ruler or tape measure, pliers
Students may not bring: cell phone, smart watch, smart glasses, air pods/buds	**What we provide:** a bag of building materials, a tennis ball
More information and resources may be found at: www.macombso.org/mystery FAQs are also posted, which clarify how these rules are applied.	

COMPETITION:

1. Each team of students will be given a container of building materials. All teams will receive exactly the same materials. The materials might include: straight pins, paper cups, drinking straws, paper clips, tape, string, paper, etc. The actual materials may be anything that the supervisor deems appropriate.
2. Each team will have a maximum time of 20 minutes to construct a tower to support the tennis ball at its highest point. The top of the tennis ball must be higher than any part of the structure.
3. Only those materials supplied in the container, may be used to construct the tower. No other materials or adhesives may be part of the finished tower. Students may bring scissors, a ruler and a pair of pliers to use as tools while building the tower. Teams will be provided a tennis ball to use while building, and it will match the ball used by the event supervisor. *The measurements of an "official" tennis ball are: Diameter: 2 1/2 inches (6.5 centimeters); Weight: 2 - 2 1/16 ounces (56.7 - 58.5 grams).*
4. The students will inform the judges when they finish their tower. Measurements will be made at the point of construction. Students will not be required to move their tower. The overall height and width of the structure (across its widest points) will be measured before placing the tennis ball on it. These measurements will be used to rank towers that are unable to support the ball, and as a tie-breaker. The tower must be completely free standing. It cannot be attached to, or receive additional stability or support from any surface or object (e.g., a table, floor, wall or ceiling).
5. Students will then place the tennis ball provided by the event supervisor on the top of their tower. Students are allowed up to 10 seconds to place and stabilize the ball on the top of the tower. The tower must remain standing long enough to complete the height measurement.
6. No coaching of the students will be allowed during the competition. Remember, we are assessing the STUDENT'S ability to think on their feet.

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SCORING:

1. The height of the tower will be measured as precisely as possible by the judges. Since no building materials are to extend above it, the top of the tennis ball will be considered the highest point of the tower.
2. All towers that support the tennis ball will be ranked above those that do not. The towers in each of these groups will be ranked according to their height. Tallest tower first, the shortest tower last.
3. In the event of a tie, the winner of the tie will be the tower with the smaller base measurement.

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OZO ORBIT

DESCRIPTION

Students will direct an Ozobot robot to navigate a field toward specific objectives, either through sequential logic or conditional logic programming. Teams will accrue points when the robot progresses down the field and by accomplishing available tasks en route.

TEAM SIZE: 1 or 2 students **APPROXIMATE TIME**: 45 minutes

Students must bring:	**Students may bring:**
Students may not bring: cell phone, smart watch, smart glasses, air pods/buds	**What we provide:** Ozobot robot, computer, wired mouse, timer, scratch paper and pencil, robot charging cable, Field Layout mat
More info and resources may be found on the Macomb Science Olympiad website at: https://macombso.org/ozo-orbit FAQs are also posted, which clarify how these rules are applied.	

EVENT PARAMETERS

1. Each team will be provided one tournament robot, one laptop computer with a wired mouse, to use at the tournament. Scratch paper and a pencil will also be available.
2. Teams will be asked to choose which Field Layout they will compete on at the tournament, and will only be provided that layout.
3. The Field Layouts will not be public information before, during, or after the competition.
4. The robot will be paired with the laptop computer by Bluetooth. The Supervisor will monitor students as they work to ensure that no outside help or interference occurs.
5. The Ozobot includes light, color, rotation and distance sensors, all of which may be utilized to control the motion and position of the robot.
6. Teams may need to install a provided attachment on the robot before the run to accomplish certain objectives.
7. Students may not bring anything into the competition area, or leave with any documentation of the field layouts.

FIELD LAYOUTS

1. The competition layout options be printed on **1.5 ft. x 5 ft.** white paper, which may be laminated.
2. **The Lane 1 layout** includes objectives that only require sequential movement logic, and will generally have lower point values.
3. **The Lane 2 layout** includes objectives that will require more sophisticated constructs (e.g., conditional logic, loops) and will generally have higher point values. There will be multiple variants of Lane 2 to accomplish uncertainty in specific design elements (e.g., color, wall position, etc.).
4. **The point values of specific objectives will be visible on the field.**
5. There may be objects on the field which incur a penalty if the robot interacts with them.
6. The competition field will have lines that connect most areas where the robot may navigate, but it is not required that the robot follow them to achieve objectives. Wooden blocks used as walls will block some paths, and may incur a penalty if touched by the robot.

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COMPETITION

1. When they arrive, teams must choose between Lane 1 and Lane 2 field layouts, and develop their program accordingly.
2. Each team will be allowed a maximum of **30** minutes to create a program for controlling their robot. Teams may test their program at will by running the Ozobot on the chosen layout. Teams will need to maintain the robot battery level by keeping the robot plugged in and charging when it is not actively in use. Teams will be given a timer, and the Supervisor will warn teams when the **30** minutes is nearly up.
3. Teams will transition to testing with Event Staff. Each team will be allowed a maximum of **3** robot runs; all will be scored. However, if more than **8** minutes has passed, no additional runs will be begun. If the robot has started a run before time expires, it may finish. Teams may **not** use testing time to adjust their program between runs. The testing timer will not stop when the Supervisor is measuring, recording results, and resetting the layout at the end of each run.
4. **Teams that choose Lane 1 will compete on the same field mat they have already been using. Teams that chose Lane 2 will compete on one of the other variant Lane 2 designs, but which variant will not be known in advance.**
5. Once the robot has been released from a start point, the team may not touch the robot or the field until the Supervisor asks them to pick it up. If the team would like to end the run before the robot has stopped, they may ask the Supervisor to pick up the robot to end the run.
6. If the robot has stopped progressing for 5 seconds or leaves the field, a run ends.
7. The distance score is based on the furthest distance the robot progresses down the field, regardless of where the robot is when the run ends. If the two are not the same, it is the Supervisor's responsibility to determine the distance accomplished.
8. Any movable objectives or objects will be reset between runs. Random-placed objects may be moved between runs.

SCORING

1. Scores will be calculated based on the distance the robot progresses down the competition field, plus credits and penalties accrued by the robot along that path, and based on the difficulty of the path taken by the robot.
2. The high score from among the recorded runs will be the basis of the team's final score.
3. Penalties: A standard penalty could be assessed if:
    a. The entire robot leaves the field perimeter to the sides.
    b. Each time the robot touches a wall obstacle.
    c. If the robot interacts with, moves, or disturbs any yellow or otherwise penalty-designated game element. Penalty elements will be clearly marked on the Field Layout provided during the competition.
    d. Any time a student interacts with or manipulates the robot, field, or game pieces during an official testing run.
    e. Additional opportunities for penalties may be added to the event at the supervisor's discretion. Students will be clearly informed of those at the start of the event.
4. In the event of a tie, the team with fewer lines of code will win the tie.

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REFLECTION RELAY

DESCRIPTION: A team of three students will work cooperatively to reflect a beam of light to a target using a series of plane mirrors.

TEAM SIZE: 3 students **APPROXIMATE TIME:** 20 minutes

Each team will select a "Team Leader" from among the 3 students.

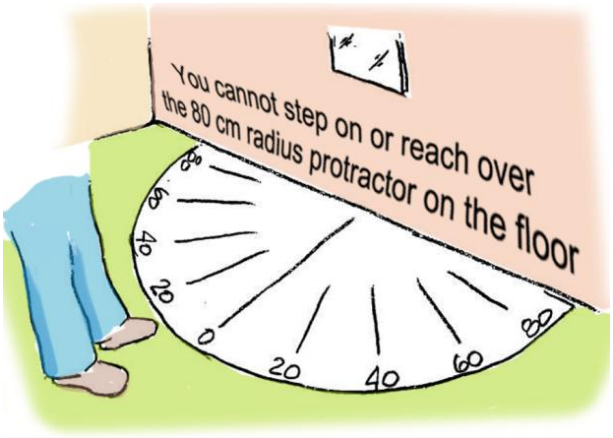
Students must bring:	**Students may bring:** rulers, protractors, straight edge, string, pencils, markers, tape, notes, transparencies
Students may not bring: any light source, mirrors, targets, timer, cell phone, smart watch, smart glasses, air pods/buds	**What we provide:** **3D Challenge:** light source (MagLite model ST3D016), 3 handheld mirrors, floor protractor, stationary mirror, fixed targets **2D Challenge:** target, laser, 1.5' x 3' paper area, 4 movable mirrors
More information and resources may be found at: https://macombso.org/reflection FAQs are also posted, which clarify how these rules are applied.	

THE COMPETITION:

3D CHALLENGE: Three team members, supplied with four mirrors approximately 3" x 4", cooperate to reflect a light beam onto a predetermined target. One of the mirrors will be mounted on the wall and cannot be moved. Team members must use the mirrors provided by the judge.

1. The light must reflect off of all four mirrors before hitting the target. There may be obstacles that the beam of light will have to be directed around.

2. A large protractor (radius of 80 cm) will be placed on the floor in front of the mirror. This will mark the distance the participants must stay away from the mirror and will also provide a measuring device if the participants choose to use it. The protractor will have 0 degrees at its center, continuing up to 90 degrees on both the left and right sides.



3. Each team will be given up to one minute of preparation time before the clock is started.

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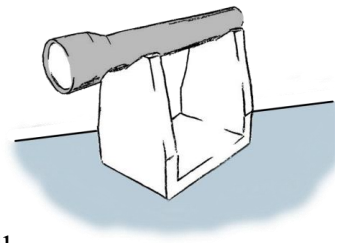
4. Materials that will be provided for each team:

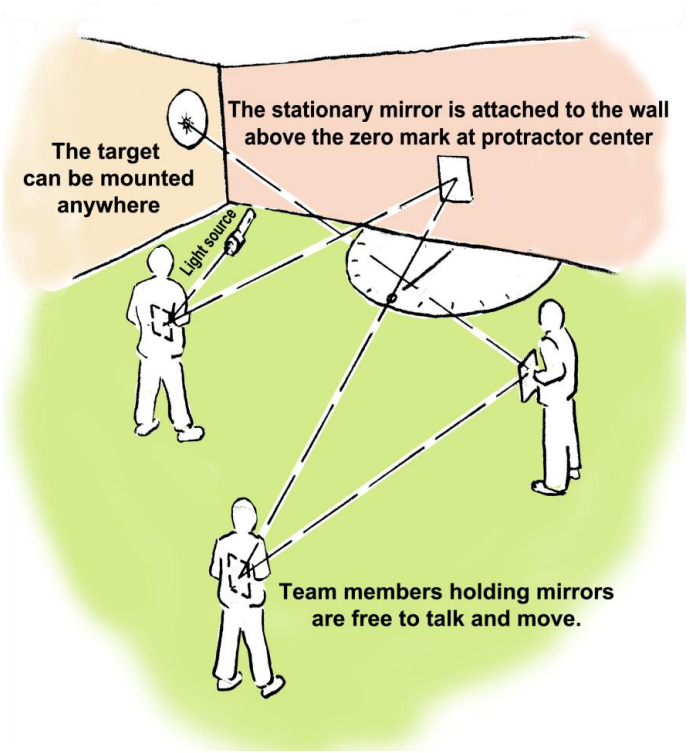


   - A light source ('Mag-Lite' LED focusable flashlight on a wooden stand). The light source will already be in position and focused.
   - 3 movable 'handheld' mirrors (3" x 4")
   - 1 protractor (80 cm radius), will already be positioned on floor
   - 1 non-moveable mirror (3" x 4"), will already be attached to the wall; The fixed mirror will be directly over the protractor center "zero degree" line. The mirror height can vary between 6 inches higher to 6 inches lower than the light source.
   - Targets, already fixed in some location. Targets are flat and circular, between 5 and 12 inches in diameter.

     Students may bring any other equipment they deem necessary, with the exception of their own light source.

5. Each team will be given two different reflection relay challenges. The target size for the 1st and 2nd challenges may differ.

6. If spectators are allowed in the room, talking or signaling (verbal or nonverbal) among these guests will NOT be tolerated until the 2nd challenge is completed. Photographs are not allowed at any time and cell phones MUST not be visible. Violations will be cause for immediate team disqualification for this challenge solely based on the discretion of the staff running the event.



3D CHALLENGE SCORING:

1. The team's planning time (1 minute maximum) will be recorded and used as a tie-breaker. The team leader will be responsible for telling the judge the team is ready.

2. Each challenge will be timed. The objective is to attain the lowest elapsed time in seconds. One point will be added for each second.

3. The beam of light must rest on the target for 3 seconds (without wandering off) before the judge stops the timer. The minimum score for each challenge will be 3 points.

4. No team will be allowed to use more than one minute to accomplish each challenge. Maximum score for each challenge will be 60 points.

5. The AVERAGE time of the two 3D challenges will be used to calculate the final score.

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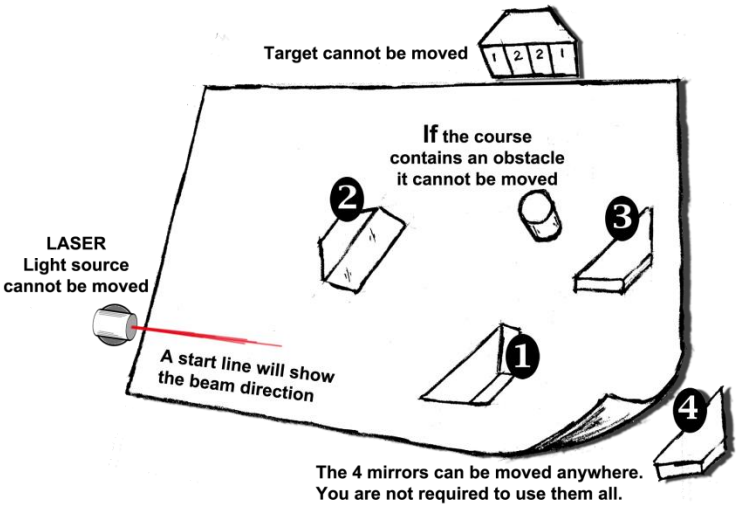
2D CHALLENGE:

1. For the table top Reflection Relay challenge each team will be given a new 1.5 x 3 foot paper area to work on. A laser light source will already be secured to the table top and cannot be moved. A six inch line will be drawn on the paper starting at the laser to show the exact direction of the beam.

2. A target will also be secured to the table top, and cannot be moved. There may also be obstacles placed on the playing field. The team is not allowed to disturb any obstacles.



3. Four movable mirrors (3" x 4") mounted on stands will be provided. The mirrors will be the same height as the laser.

4. The three team members have 5 minutes to work together, positioning the movable mirrors (while the laser is turned off) to reflect the beam onto the target. When planning their mirror placement, the team has a choice as to how many of the mirrors they want to use. *Using more mirrors increases difficulty, but earns additional points.*

5. The students may begin work when the timer starts, and the supervisor will warn the team when there is only 1 minute of prep time remaining. All team members must immediately step back from the playing field when the supervisor signals that time is up. Absolutely no further adjustments are allowed, no matter how subtle.

6. Participants may bring any other equipment they deem necessary, with the exception of a light source.

7. If spectators are allowed in the room, talking or signaling (verbal or nonverbal) among these guests will NOT be tolerated until after the challenge and scoring is completed. Photographs are not allowed and cell phones MUST not be visible. Violations will be cause for immediate team disqualification for this challenge solely based on the discretion of the staff running the event.

   Event staff will review the 2D scoring with student team members and answer their questions. To complete the scoring process the student team leader will be asked to initial the score sheet, accepting the team 2D score. If they do not, because of an open issue regarding the appropriate score, any guests will be excused from the room and the Event Supervisor will be summoned to conduct a final review and judgment.

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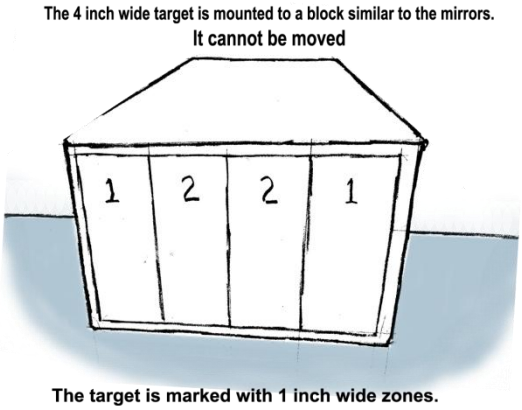
2D CHALLENGE SCORING:



At the end of 5 minutes the supervisor switches on the laser to check the beam path.

The team starts with 60 points.
Points are subtracted for mirrors reflecting the laser:

1 mirror	-1 point
2 mirrors	-3 points
3 mirrors	-6 points
4 mirrors	-10 points

The beam striking the target will be scored:
Zone 1 - 4X mirror points
Zone 2 - 6X mirror points

FINAL SCORE -

(2D score) + (**average** 3D time) = Final Score Lowest total score wins.

Example 1:

Team 91 tried to use all 4 mirrors to reach the 2D target, but they only hit 3 mirrors (and missed the target). Their 3D challenge times were 18 seconds and 12 seconds.

60 (starting points)
- 6 (mirror points)

54 points (2D score) *54 (2D score) + 15 (average 3D time) = Total score 69*

Example 2:

For their 2D challenge, Team 89 successfully reflected from 2 mirrors and hit the target in a zone 1. Their 3D challenge times were 21 seconds and 14 seconds

60 (starting points)
- 12 (4X the mirror points)

48 points (2D score) *48 (2D score) + 17.5 (average 3D time) = Total score 65.5*

In case of a tie, the team with the shortest combined preparation times for both 3D challenges will be declared the winner.

Scores will range from 3-120.

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ROCK HOUND

DESCRIPTION: Students will identify various rock and mineral specimens and answer questions about the characteristics of these specimens. They will also answer questions about the various processes that are involved with formation of these rocks and minerals.

TEAM SIZE: 1 or 2 students **APPROXIMATE TIME**: 30 minutes

Students must bring: pencil	**Students may bring:** one 8.5" x 11" sheet of notes per team (information can be placed on BOTH sides of the sheet)
Students may not bring: cell phone, smart watch, smart glasses, air pods/buds	**What we provide:** ZipGrade answer sheet
More information and resources may be found at: https://macombso.org/rocks FAQs are also posted, which clarify how these rules are applied.	

THE COMPETITION:

1. Teams will rotate through approximately 20 stations where they will identify rock and mineral specimens and answer questions about them. Answers will be recorded on a Zip Grade (scantron style) sheet. Most stations will have boxes with one or more specimens inside. Each station will include 4-6 multiple-choice or true/false style questions. Students are allowed to pick-up and more closely examine the specimens at each station unless otherwise instructed. Teams will have approximately 1 minute per station and will be directed to switch stations by the event staff.
2. The rocks and minerals that students need to be able to identify and answer questions about are listed on the next page. There are additional **metamorphic** rocks and associated minerals that have been added to this year's scope (shown in **BOLD** on page 2)**.** Minerals denoted with an * may not have physical specimens to examine during the test; however, students should be prepared to answer questions pertaining to mineral characteristics listed in bullet #6.
3. Rock characteristic questions may be about their color, texture, uses, physical characteristics, special properties (reaction to 3 molar hydrochloric acid) and environments of formation.
4. The students also need to have an understanding of the rock cycle, the processes of the formation of igneous (extrusive, intrusive, volcanic glass), sedimentary (erosion, deposition, lithification) and metamorphic rocks. (the effects of heat and pressure on existing rocks).
5. **Special questions relating to this year's metamorphic focus may be asked. These could include questions relating to textures (foliated, non-foliated), types of metamorphism (regional, contact, subduction zone and dynamic), factors that control the formation of metamorphic rocks and metamorphic facies and the significance of index minerals in metamorphic rocks.**

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6. Mineral characteristic questions may be about their color, luster, density, relative hardness (Mohs Hardness Scale), reaction to hydrochloric acid, crystal shape, texture, cleavage, fracture, special properties (conductivity, fluorescence, optical properties, reaction to flame), uses and environment of formation. **Some stations may ask the student to test a mineral's streak using a porcelain streak plate, or test a mineral's hardness using a penny, fingernail, steel nail, or glass plate. Volunteers will be present at these stations to assist students.**
7. Prior to the tournament, students may prepare a one-page chart that can be used to help them during the event. One chart is allowed per team, limited to 8 ½" x 14" in size. Both sides may be used and any information the students find helpful may be included. Students should bring their completed chart with them to the tournament. The only items that the teams will be allowed to bring into the event will be pencils and their chart. The chart will not be turned in.

SCORING:
Each question answered correctly will be worth between 1 and 4 points. The team with the highest total score will be the winner. Ties will be broken using predetermined tiebreaker questions.

ROCKS:

Igneous	Sedimentary	Metamorphic
basalt	bituminous coal	anthracite coal
granite	chert	**garnet schist**
obsidian	conglomerate	gneiss
pumice	limestone - fossiliferous	marble
rhyolite	limestone - oolitic	**mica schist**
scoria	sandstone	**phyllite**
	shale	quartzite
		slate
		staurolite schist

MINERALS:

amethyst	graphite	pyrite
apatite	gypsum (satin-spar)	quartz (crystal)
chalcopyrite	gypsum (selenite)	quartz (citrine)
calcite	halite	quartz (milky)
copper	hematite	quartz (rose)
diamond*	kaolinite	quartz (smoky)
feldspar (pink)	**kyanite**	**staurolite**
fluorite	mica - biotite	sulfur*
galena*	mica - lepidolite	talc*
garnet	mica - Muscovite	

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SIMPLE MACHINES

DESCRIPTION: Participants will identify, use, and answer questions about simple machines and recognize the relationships between work, force and distance as they apply to each simple machine. Knowledge of the following six simple machines will be demonstrated: lever, inclined plane, pulley, screw, wheel and axle, and wedge. Students should know and understand the concept of mechanical advantage and be able to estimate it by comparing the ratio of forces or distances.

TEAM SIZE: 1 or 2 students **APPROXIMATE TIME**: 30 minutes

Students must bring: pencil	**Students may bring:**
Students may not bring: notes, cell phone, smart watch, smart glasses, air pods/buds	**What we provide:** ZipGrade answer sheet
More info and resources may be found at: https://macombso.org/machines FAQs are also posted, which clarify how these rules are applied.	

THE COMPETITION:

Participant(s) will move between stations containing pictures or examples of devices made up of one or more simple machines. Teams must move at the time indicated by the event supervisor to ensure that all teams have equal opportunity to use the equipment at each station (e.g., 2 minutes per station). Students may carefully handle and manipulate objects found at each station.

At each station students will answer questions designed to test their ability to:

- Identify the simple machines illustrated
- Identify parts of the simple machines (e.g. load, effort, fulcrum)
- Use equipment to measure some variable(s) such as length, force or weight
- Recognize the relationships between work, force and distance as they apply to each simple machine
- Know and understand the concept of mechanical advantage and be able to estimate it by comparing the ratio of forces or distances
- Perform simple calculations

Possible question formats could include:

- Identifying simple machines as parts of an object (yes or no for each type)
- Matching
- Multiple choice
- True/false

SCORING:

Points will be awarded for correct answers. Questions will be worth either 1 or 2 points. The team with the highest total points for all stations will win. Ties will be broken by a predetermined set of questions.

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STARRY, STARRY NIGHT

DESCRIPTION: This event will test students' knowledge of astronomical facts and concepts relating to the earth, moon, solar system, celestial sphere, stars and constellations. This year, they will also be tested on **galaxies, nebulae, and telescopes**.

TEAM SIZE: 1 or 2 students **APPROXIMATE TIME**: 30 minutes

Students must bring: pencil	**Students may bring:**
Students may not bring: notes, cell phone, smart watch, smart glasses, air pods/buds	**What we provide:** test packet
More information and resources may be found at: https://macombso.org/stars FAQs are also posted, which clarify how these rules are applied.	

THE COMPETITION:
The students will take a written test, consisting of a variety of question formats, including: true/false, multiple choice, matching, fill in the blank, short answer, and sketch a diagram.

Part I: A series of written questions about our solar system:

A. General Solar System
   1. Glossary of terms
B. Orbital Mechanics
   1. Distinguish between the motions of rotation and revolution.
   2. Explain the astronomical basis for units of time--day, month, year – and how they relate to the periods of the Earth and Moon.
C. Seasons – Know the terms and explain the causes for seasons on the earth.
D. Moon Phases - Identify the phases of the moon and understand why they occur.
E. Eclipse - Compare solar and lunar eclipses and the conditions that produce them.

Part II:

A. Celestial Sphere **-** Demonstrate knowledge about the celestial sphere and the following concepts: zenith, nadir, horizon, celestial meridian, celestial poles, celestial equator and ecliptic.

B. Constellations **-** Be able to identify these constellations and specific stars or star cluster, galaxy or nebula on a star chart of any month with no constellation lines visible.

Constellation	Star or Star Cluster
Andromeda	Andromeda galaxy (M31)
Bootes	Arcturus
Canis Major	Sirius
Cassiopeia	
Cepheus	
Cygnus	
Draco	
Gemini	Castor, Pollux

Constellation	Star or Star Cluster
Hercules	Kornephoros, Hercules Cluster (M13)
Leo	
Orion	Betelgeuse, Rigel, Orion Nebula (M42)
Scorpius	
Taurus	Aldebaran, Pleiades
Ursa Major	
Ursa Minor	Polaris
Virgo	Spica

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Part III: A series of written questions and visual identification of galaxies and nebulae, as well as questions about the life cycle of stars. Know glossary terms specific to galaxies, nebulae and life cycle of stars.

A. Galaxies
1. **What are they?**
2. **Recognize shapes – spiral, elliptical and irregular**
3. **Know the characteristics of each type of galaxy**

B. Nebulae
1. **What are they?**
2. **Understand differences among reflection, emission, and dark nebulae**
3. **Two other types of nebulae (planetary nebula and supernova remnant) will be considered below**

C. Stellar evolution
1. **Understand the main stages – birth, main sequence, red giant, death, remnant**
2. **Understand the size-dependent differences in star death, leading to various types of remnants - planetary nebula, white dwarf, neutron star, black hole or a supernova remnant**

D. Visually identify specific galaxies and nebulae.

Part IV: Telescopes: A series of written questions on specific earth- and space-based telescopes.

A. Be able to recognize a basic description of each telescope.
B. Know the important findings or proposed research goals for each telescope.
C. Visually identify telescopes.

Space-based Telescopes
Nancy Grace Roman Space Telescope (Roman)
TESS (Transiting Exoplanet Survey Satellite)
James Webb Space Telescope (JWST)
Euclid

Ground-based Telescopes
W. M. Keck Observatory
Atacama Large Millimeter Array (ALMA)
Extremely Large Telescope (ELT)

SCORING: One (1), two (2) or three (3) points will be awarded for each correct answer, depending on the level of difficulty. There will be about 65 questions that add up to about 130 points. Tiebreaker questions will be included on the test.

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WATER ROCKETS

DESCRIPTION:

Prior to the tournament, contestants use 2-liter soda/pop bottles to build one or more rockets propelled by pressurized air and water. Rockets will be launched at the Tournament and time aloft recorded. The rocket that stays aloft for the longest time will win.

TEAM SIZE: 1-3 students **APPROXIMATE TIME**: 30 Minutes

Students must bring: 1 or 2 rockets, goggles	**Student may bring:** a second rocket, repair kit
Students may not bring: cell phone, smart watch, smart glasses, air pods/buds	**What we provide:** water, launcher
More info and resources may be found at: https://www.macombso.org/rockets FAQs are also posted, which clarify how these rules are applied.	

CONSTRUCTION:

1. New rockets must be designed and built by members of this year's Science Olympiad team. Rockets or rocket components from previous years may not be used.
2. The school name, team number, and the year must be clearly marked on all rockets with permanent marker.
3. Each rocket must be made from a **clear** color 2-liter soda/pop bottle that is used to hold water and pressurized air, which propels the rocket when released. The bottle itself must not be altered in any way (e.g., holes, scratches, increasing the volume, restricting the bottle opening).
4. Fins, parachutes and other items may be added to the outside of the bottle to increase the time aloft. Elastic devices may be used to aid in nosecone and parachute deployment.
5. Items not allowed are: a) commercially made rocket components, b) sharp/pointed objects, c) parts made from glass and metal (except for small snap swivels for attaching parachutes). There are no specific prohibitions on the use of glues. The Event Supervisor may publish separate information about glues that have been tested in some fashion, but will not endorse any specific glue. Teams should take care not to damage the pressure vessel.
6. Minimum nose tip radius: The nose of the rocket must be rounded or blunt at the tip and designed such that when a standard - liter bottle cap (~3.1 cm diameter x 1.25 cm tall) is placed on top of the nose, no portion of the nose touches the inside top of the bottle cap (see Figure 1). Teams must not use a nose that is sharp, pointed, or consisting of a rigid spike regardless of the material used.
7. Fins and other parts added to the bottle must be 5 cm (2 inches) or higher above the level of the bottle's opening, to ensure that the rockets will fit on the launcher (see Figure 2).

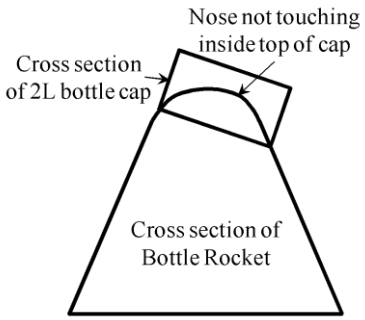

Figure 1

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8. Energy to propel the rocket must come exclusively from the water and pressurized air in the bottle. Other sources of potential or kinetic energy are not allowed. Only plain tap water may be used in the rocket. No other material of any type may be put in the bottle or added to the water. A water level line may be marked on the bottle to aid in adding water.
9. Parts of the rocket may separate during flight, but they must remain attached together by a string/lanyard.

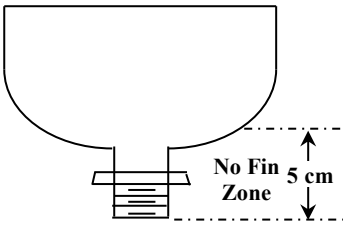

Figure 2

THE COMPETITION:

1. Contestants may bring repair kits containing tools, spare parts and extra parachutes. At the published competition time, the rocket(s) and repair kits will be inspected prior to launch. Any parts found to be dangerous (e.g., glass or metal), illegal (e.g., commercially made rocket parts), or that prevent a rocket from fitting on the launch pad, must be removed before the rocket can be launched. Any on-site repairs or modifications must be made by the competing students. Adult coaching help is not permitted. Rockets that are modified to meet the construction requirements after the inspection process has begun will be penalized 20% of their score. If the team is unable to remedy the construction violation, the rocket launch results will be ranked in Tier 2. Rockets that cannot be made to fit on the launcher, or those that, in the event supervisor's judgment, are unsafe will not be launched.
2. If the rocket(s) contain parachute(s), competitors may be required to fully open and repack them for the event supervisor during inspection, before the water is added to the rocket.
3. Two launches will be allowed. Different rockets may be used for each launch. Contestants must use the water, launch pad and source of pressure provided by the event supervisor. The contestants will add the desired amount of water to the rocket before each flight and may make alterations or repairs to rockets between launches. Outside assistance/coaching from the sidelines is not permitted.
4. The judges will pressurize the rocket to 75 psi. Anyone within 30 feet of a pressurized rocket must wear safety goggles. Contestants may not touch their rocket during or after pressurization. When practicing, only the coaches should pressurize the rocket and they should never exceed 75 psi.
5. Once a rocket has been pressurized it must be launched. In case of high winds, the supervisors will launch the rocket as quickly as possible.

SCORING:

1. Judges will measure and record the time aloft for each flight. Time starts when the rocket is launched and stops when any part of the rocket touches the ground, any object in contact with the ground (e.g. tree, building) or disappears from sight. Teams will be scored using only the flight that will produce the better score/rank.
2. If a construction violation is fixed during the inspection process, a 20% penalty on flight time for that rocket will be recorded.

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3. Flights of rockets whose parts do not remain attached together during the entire flight, or that cannot be changed to meet the construction requirements, will be ranked in Tier 2. A rocket which bursts on the launch pad will be scored as an official launch with a construction violation.
4. Teams whose rockets cannot be launched for any reason will receive participation points only.
5. The longest time aloft wins. Ties will be broken using the team's lesser flight time. Teams with two flights will win ties over teams with only one flight.

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WEATHER OR NOT

DESCRIPTION: Students will be tested on their knowledge of meteorology (weather and climate).

TEAM SIZE: 1 or 2 students **APPROXIMATE TIME**: 30 minutes

Students must bring: pencil	**Students may bring:** One 8 ½" x 11" page of notes (both sides) per team
Students may not bring: cell phone, smart watch, smart glasses, air pods/buds	**What we provide:** test packets, ZipGrade answer sheet
More info and resources may be found at: https://www.macombso.org/weather FAQs are also posted, which clarify how these rules are applied.	

THE COMPETITION:

Student teams will answer questions regarding weather concepts. Students will remain seated, with a copy of the complete test, during the entire session.

Part 1: Teams will answer multiple-choice format questions related to photographs and videos projected on a screen. Each item will be projected for a specific period of time.

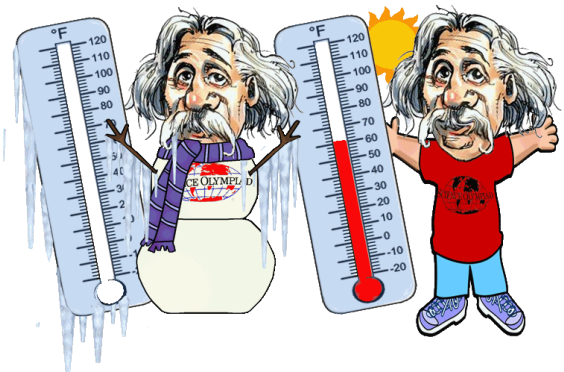
Part 2: Teams will answer multiple-choice format questions in a written test. They may be answered by each team at their own pace, within the allotted time.

Topics may include, but are not limited to, clouds and cloud formation, weather instruments, fronts, the atmosphere, the water cycle, severe weather, wind, seasons, weather terms, and precipitation types. The topics of **air masses, fronts, and winds** will be emphasized for this season.

SCORING:

The team with the highest score will win. The questions will be in multiple-choice format of 2, 3, or 4 options. Each question will be worth 1, 2, or 3 points based on the difficulty of the question.

The first tie breaker will be based on the number of 3-point questions that are correct. The second tie breaker will ask a short answer question. Correct spelling and legibility are recommended to help prevent errors in scoring.



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WILDLIFE SAFARI

DESCRIPTION: In this event students will demonstrate their ability to identify wildlife and their habitats, as well as answer general information about the animals, through the use of field guides.

TEAM SIZE: 1 or 2 Students **APPROXIMATE TIME:** 30 Minutes

Students must bring: pencil	**Students may bring:** one field guide per student
Students may not bring: clipboard, cell phone, smart watch, smart glasses, air pods/buds	**What we provide:** ZipGrade answer sheet
More info and resources may be found at: https://macombso.org/wildlife FAQs are also posted, which clarify how these rules are applied.	

THE COMPETITION:

Students will demonstrate their ability to identify Michigan **mammals** using the ***Mammals of Michigan Field Guide.*** Students will also demonstrate their understanding of basic ecological concepts such as food chains, food webs and the impact of humans on the ecology of Michigan. Students should be familiar with the entire book because questions may be selected from any part of it. **That scope includes the scientific name of each species.**

Teams will rotate between 18 and 22 stations **where they may view photographs or biofact of mammals, furs, tracks, skulls and/or photographs of habitats.** Each station will consist of 3 to 5 questions and each team will have about 1 minute to answer all questions at a station. Questions will vary in degree of difficulty. Question format will be multiple choice and true/false. An answer sheet will be provided.

Students will be responsible for bringing pencils and up to two field guides per team (one per student). A field guide may be either the ***Mammals of Michigan*** publication, or a student-created field guide. Students may write, highlight and/or place tabs in the ***Mammals of Michigan*** field guide to assist them in using it. A student-created field guide must be contained in a standard-sized binder or notebook (no larger than 11 inches), with no loose pages. No other materials will be allowed in the competition (e.g., no clipboards, bags, phones).

All questions will be based on information derived from or found directly in the ***Mammals of Michigan*** field guide.

SCORING:

Each correct answer will be worth between 1 and 4 points. Tie-breakers will be based on the total number of questions answered correctly.

RESOURCES: *(NEW!)*

Mammals of Michigan Field Guide, ***2nd Edition***
By Stan Tekiela
ISBN-10: ***1647555639***
ISBN-13: ***978-1647555634***

Publisher: Adventure Publications
Publication date: ***2025***
Pages: 312

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ZOWIE ESTIMATION

DESCRIPTION:

Presented with a variety of tasks, students will be asked to estimate mass in grams, number of objects in a container, and volume in cubic centimeters.

TEAM SIZE: 1 or 2 students **APPROXIMATE TIME**: 30 minutes

Students must bring:	**Students may bring:**
Students may not bring: measuring devices, fingers with pre-marked lines on them, notes, cell phone, smart watch, smart glasses, air pods/buds	**What we provide:** pencils, TI-108 calculator, score sheet
More information and resources may be found at: https://macombso.org/zowie FAQs are also posted, which clarify how these rules are applied.	

THE COMPETITION:

The competition will consist of three stations.

Station 1 Students will place an estimated 100 grams of a substance such as sand, cereal, corn meal, or paper clips in a given container.

Station 2 Students will estimate the number of objects in three different containers holding from 100 to 20,000 pennies, beans, golf balls, etc.

Station 3 Students will estimate the volume of three different boxes between 100 and 4000 cubic centimeters. (Volume = length × width × height)

NOTE: The pencils and calculators may not be used as measuring devices. Students are allowed to handle and pick up the material at Station #1, and the boxes at Station #3. The containers at Station #2 may be touched but not picked up.

SCORING:

The score for each estimation will depend on how close the students' estimate comes to the correct value. The maximum score for each estimation is 100 and the minimum score is zero. Any estimate double the actual number, or larger, will result in a score of zero.

Example:

Estimate lower than actual: The students' estimate 3500 and the actual number is 4000. Their score will be: 3500/4000 = 0.875 x 100 = 87.5 points.

Estimate higher than actual: The students' estimate is 5000 and the actual number is 4000. Their score will be: 5000/4000 = 1.25 – 2 = - 0.75 x 100 = 75 points. Notice that the negative sign is dropped to get the score

The overall score for the event will be the sum of the scores for Stations 1, 2, and 3. A perfect score for all three stations will total 700 points.

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