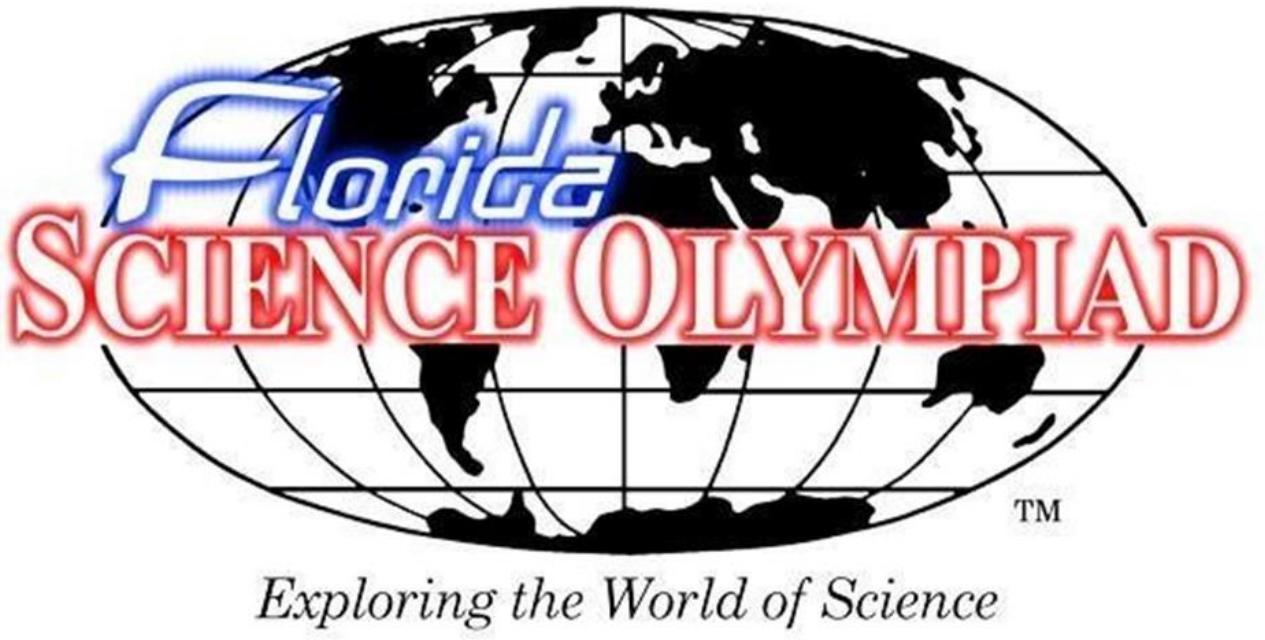


Elementary Science Olympiad at FAU

April 27, 2024

Rules Manual

A IS FOR ANATOMY

DESCRIPTION: Teams will demonstrate knowledge of human organs and organ systems.

COMPETITORS BRING:

- Pencil/writing utensil;
- 3-ring binder of any size with any research/reference material. The binder may contain any item, such as a book, computer generated printout, or student created paperwork. No electronic materials are allowed. All materials must be securely bound inside the binder, so that when it is opened vertically (upside down) and given a light shake test no materials will fall out.

NUMBER OF PARTICIPANTS: Maximum of 2 **IMPOUND: NO**

THE COMPETITION:

1. The competition may be run as timed stations.
2. Teams will either be asked questions or will be required to complete experiments or make observations as they relate to the topics below.
3. The **topics** that may be tested or in which an experiment may be conducted include:
    a. Identification of the major organs in the human body and description of their functions.
        i. Organs are limited to the skin, brain, heart, lungs, stomach, liver, intestines, pancreas, muscles and skeleton, kidneys, bladder, and sensory organs.
        ii. Skin/Integumentary system:
            1. Students will not be required to identify specific parts of the integumentary system nor describe functions of those parts.
            2. Students do not need to identify layers of the skin.
            3. Students may be asked questions about the role of the skin related to the immune system.
            4. Questions will only focus on the overall function of the skin and identification of the skin on a diagram of the body.
        iii. Muscles/Muscular system:
            1. Students may be asked about the difference in structure and function of cardiac, skeletal, and smooth muscles.
            2. Students may be asked how the skeletal muscles move bone, maintain posture, and produce heat.
            3. Students will not be required to identify specific muscles or explain the function of specific muscles.
        iv. Bones/Skeletal system:
            1. Students may be asked identify structures in a cross section of bones limited to bone marrow, nerves, blood vessels, osteocytes, lamellae
            2. Students may be asked about differences in structure and function of compact and spongy bones.
            3. Students will not be asked to identify specific bones in the body.
            4. Sensory organs:
            5. Questions are limited to eyes, ears, tongue, skin, and nose.
            6. Questions will focus on general identification and function but not specific parts of those organs.
    b. Explaining how organs and organ systems work together to maintain health.
    c. Comparing and contrasting the function of organs and other physical structures of humans to other organisms such as plants/animals.
    d. Content related to the standards below.

RELATED FLORIDA STANDARDS:

- **SC.5.L.14.1** Identify the organs in the human body and describe their functions, including the skin, brain, heart, lungs, stomach, liver, intestines, pancreas, muscles and skeleton, reproductive organs, kidneys, bladder, and sensory organs.
- **SC.2.L.14.1** Distinguish human body parts (brain, heart, lungs, stomach, muscles, and skeleton) and their basic functions.
- **SC.5.L.14.2** Compare and contrast the function of organs and other physical structures of plants and animals, including humans, for example: some animals have skeletons for support -- some with internal skeletons others with exoskeletons -- while some plants have stems for support.

SCORING:

- **High score wins.**
- Each question or station will be assigned a predetermined set of points, assigned by the event supervisor and communicated to the teams (preferably- points are identified on the test/station paperwork).
- Ties will be broken with predetermined questions.

BACKYARD BIOLOGIST

DESCRIPTION: Teams will be assessed on their knowledge of living organisms that they may encounter in their own backyard. The focus for 2024 will be **shrubs** and insects.

COMPETITORS BRING/NEED:

- Writing utensil;
- 3-ring binder of any size with any research/reference material. The binder may contain any item, such as a book, computer generated printout, or student created paperwork. No electronic materials are allowed, such as a computer, calculator or smartphone. All materials must be securely bound inside the binder, so that when it is opened vertically (upside down) and given a light shake test no materials will fall out.

NUMBER OF PARTICIPANTS: **Maximum of** 2 **IMPOUND:** **NO**

THE COMPETITION:

1. **The competition may be run as timed stations and/or as timed slides/PowerPoint presentation.**
2. Teams will be asked to identify organisms from the list based on images and/or descriptions.
    a. No more than 50% of the test will be identification.
    b. Identification questions may ask for common names and/or scientific names (*Genus species*).
    c. Identification questions related to **SHRUBS** may ask about the following specific characteristics:
        i. Light range
        ii. **Soil needs: moisture, soil texture, pH**
        iii. **Reproduction/Propagation**
        iv. **Potential diseases/pest problems**
    d. Identification questions related to INSECTS may ask about the following specific characteristics:
        i. Life history and development (metamorphosis)
        ii. Distribution
        iii. Anatomy and physiology
        iv. Reproductive strategies and behaviors
        v. Habitat characteristics
        vi. Diet
        vii. Behavior
3. In addition to identification questions, teams may be asked questions related to the following:
    a. The structure and function of roots, stems, leaves, seeds, and flower parts
    b. **Planting and establishing shrubs (see source at https://gardeningsolutions.ifas.ufl.edu/care/planting/planting-shrubs.html)**
    c. Needs of plants, including nutrients received from the soil and air
    d. Classification of flowering and nonflowering plants into major groups such as those that produce seeds or those like ferns and mosses that produce spores, according to their physical characteristics.
    e. Compare and/or contrast the function of organs and/or other physical structures of plants and/or animals.
    f. General structure of insects, including classification
    g. Process of pollination
    h. Benefits of pollinators for plants and for humans
    i. Types of metamorphosis and stages of metamorphosis
4. Ways humans have impacted the environment and insects/plantsTeams may also be asked to analyze data from experiments related to **plants** and insects or to design an experiment to test a question related to insects or plants.

RELATED FLORIDA STANDARDS:

- **SC.3.L.17.2** Recognize that plants use energy from the Sun, air, and water to make their own food.
- **SC.3.L.14.1** Describe structures in plants and their roles in food production, support, water and nutrient transport, and reproduction.
- **SC.3.N.1.1 R** Raise questions about the natural world, investigate them individually and in teams through free exploration and systematic investigations, and generate appropriate explanations based on those explorations.
- **SC. N.1.3** Keep records as appropriate, such as pictorial, written, or simple charts and graphs, of investigations conducted.
- **SC.4.L.16.4** Compare and contrast the major stages in the life cycles of Florida plants and animals, such as those that undergo incomplete and complete metamorphosis, and flowering and nonflowering seed-bearing plants.
- **SC.4.L.17.4** Recognize ways plants and animals, including humans, can impact the environment
- **SC.5.L.14.2** Compare and contrast the function of organs and other physical structures of plants and animals, including humans, for example: some animals have skeletons for support -- some with internal skeletons others with exoskeletons -- while some plants have stems for support.

SCORING:

- **High score wins.**
- Each question or station will be assigned a predetermined set of points, assigned by the event supervisor **and communicated to the teams.**
- Ties will be broken with pre-determined tie-breaker questions **which are communicated to teams.**

2024 Backyard Biologist organism list

SHRUBS

Azalea
Banana Shrub
Bay Laurel
Beautyberry
Bottlebrush
Buttonbush
Camellias
Crepe Jasmine
Elderberry
Firebush
Golden Dewdrop
Indian Hawthorn
Japanese Plum Yew
Mahonia
Necklace Pod
Oakleaf Hydrangea
Oleander
Pineapple Guava
Saltbush
Sparkleberry
Star Anise Shrubs
Tea Olive
Thryallis
Walter's Viburnum
Weeping Yaupon Holly
Wild Coffee

INSECTS

American Bluet Damselfly
American Bumble Bee
American Rubyspot Damselfly
Antelope Beetle
Aphids
Army Cutworm Moth
Asian Multicolored Lady Beetle
Assassin Bug
Atlantis Fritillary Butterfly
Bed Bug
Bee Fly
Big Dipper Firefly
Black Blow Fly
Black Soldier Fly
Black Swallowtail
Brown Marmorated Stink Bug
Cicada
Click Beetle
Cloudless Sulphur
Darkling Beetle
Dobsonfly
Dung Beetle
Florida Predatory Stink Bug
Giant Mayfly
Goldenrod Soldier Beetle
Great Golden Digger Wasp
Gulf Fritillary
Mangrove Skipper
Pipevine Swallowtail
Tachinid Flies
Viceroy Butterfly
Zebra Longwing

Resources:

- https://gardeningsolutions.ifas.ufl.edu/plants/trees-and-shrubs/shrubs/ If you click the name of the plant in the above link, you can find additional links similar to those below that will be really helpful:
  - Sample for Azalea: https://edis.ifas.ufl.edu/publication/mg019
  - Sample for Banana Shrub: https://edis.ifas.ufl.edu/publication/FP403
- https://www.insectidentification.org/insects-by-state.php?thisState=Florida

BALLOON RACERS

DESCRIPTION: Teams will build a balloon powered car ("racer") that will move down a track in a straight line during a race against other teams. This is a **PREBUILD EVENT.**

NUMBER OF PARTICIPANTS: **Maximum of 3** **IMPOUND : YES**

COMPETITORS BRING:

- Up to 2 prebuilt balloon racer cars;
- 9" balloons (bring extras);
- Hand held balloon pump;
- Materials needed to make quick repairs to racer;
- Safety goggles

THE COMPETITION:

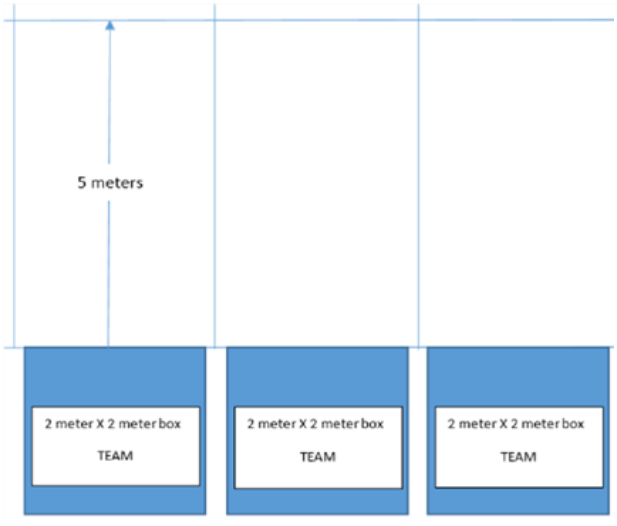
CONSTRUCTION:

1. Prior to the competition, students will design, construct and test up to two "racers" that are each powered by no more than 2 balloons. The *racer* should be capable of traveling at least 5 meters and should travel straight.
2. *Balloon Racers* must be designed and built by students and cannot be pre-purchased balloon powered cars. Each team may have up to 2 *racers*.
    a. *Racers* must have at least 3 wheels and should roll on the ground as it is propelled forward.
    b. Racers should be built out of materials normally not used for toy cars and may not have sharp edges that could cause injuries. Examples of materials are plastic water bottles, Styrofoam, straws, Popsicle sticks, corrugated board, cardboard, orange sherbet "Push-Ups" circles for wheels, foam, bottle caps, etc.
    c. The wheels (or any part of the vehicle that touches the ground) should not cause damage or leave any marks on floors when moving. If the supervisor determines that the device will damage the venue's floor, teams may not be able to compete and will earn Participation points only.
    d. *Racers* that are deemed to be hazardous by the Event Supervisor will not be allowed to run- if you think it might be hazardous/dangerous, don't use it. Cars deemed hazardous will earn the team Participation points only.
    e. Students will not have time to "put together" components of the car at race time- *racer* should be able to go into race configuration quickly. Consider this when designing the attachment of the balloons. You should be able to blow up and attach the balloons quickly.
    f. Different teams from the same school cannot use the same *racer.*
    g. *Racers* MUST have the team number visibly marked. No team number marked will place the team in Tier 2.
3. Balloons used may be no larger than 9" in diameter.
    a. You may use the energy from 1 or 2 balloons and these balloons do not need to be the same size.
    b. Teams may place one balloon inside the other to make a 2-layer balloon but this counts as 2 balloons.
    c. Balloons must be able to be blown up quickly upon arrival at the racing site.
    d. Competitors may use a handheld balloon pump to inflate their balloons.
    e. Competitors should bring additional balloons to the event in case of breakage.
4. Design Log
    a. All teams must create a design log and turn it in at impound.
    b. Design logs will be worth 50 points and should include:
        i. Labeled diagram of *racer/s* with parts labeled
        ii. Data table with 10 trials showing <u>speed</u> (distance/time) data for the following variables

iii. Various diameters of inflated balloon
iv. Mass of *racer* (you may add mass to a racer using gram masses, coins, etc. instead of changing the overall design)
v. Graph of distance vs. time data

IMPOUND:

1. At least one team member will impound their racer/s and all materials that may be needed to prepare for racing. All additional materials (ex. tape, handheld pump, extra balloons) must be impounded at the same time in a container (cardboard box/baggie) labeled with the team number.
2. Impound must be done at the scheduled time (usually first thing in the morning). Teams who do not impound on time will be placed in Tier 2 for competition, if the supervisor allows them to compete.
3. Design logs must be impounded in order to earn points.
4. Supervisors will check for safety and measure the mass of each *racer* during impound time.



RACE:

1. The race track will be set up for **3 teams**.
2. There will be a starting line and a finish line marked- blue painters tape may work well; check with the venue to ensure that you are not affecting the floors. The starting line and finish line should be 5 meters apart.
3. Each team should have an area in front of the starting line to release their car from. This area should be 2 meters X 2 meters, if possible.
4. The team areas should be as far apart as the venue allows.
5. Each lane should be marked so the track looks similar to the one above.
6. **Supervisors should do their best to have each race include a similar number of participants. This works well if all teams compete at the same time and each of the 3 teams for each race are drawn randomly.**
7. **Supervisors will need a timer for EACH lane- it is encouraged to have two timers for each lane so you can average the score to limit errors. Timing should be from release until the car crosses the 5-meter mark.**
8. Once participants arrive at their race area, they must put their safety goggles on. These goggles must stay on for the entire period. Supervisors will give one goggle warning**.** Additional warnings will place the team in Tier 2 and/or remove them from competition.
9. No one except competitors and judges are allowed in the competition area. Outside interference or coaching will cause the team to be placed in Tier 2 and may result in disqualification if the violation is repeated. Judges have the right to have distracting or disruptive spectators removed from the room.
10. Three teams will be called at random for each race. Teams will have **3-minutes** to get ONE *racer*, blow up their balloon/s, make last minute fixes (using only the materials that were impounded), and place their *racer* at the starting line. Teams who impounded two racers must leave the second at the impound location until the second race. **Teams who do not meet this time will earn only Participation points.**
11. At the end of the **3-minutes** (or when everyone is ready, if that is before the 5-minutes), the Supervisor will instruct the teams on releasing their cars to race by saying something like "3, 2, 1…go" **once the timers are in place.**
12. Teams must stay within their 2X2 meter "box" and may release their balloon racer anywhere in the box up to the starting line. Teams that release past the starting line will forfeit that run.

13. Teams must not push their racer and may only release it to be fully powered by the balloon/s. Pushing a racer will result in the team earning on Participation points for the event.
14. The supervisor may elect to restart any race if it is determined that this is necessary for safety or fairness. For example, if a car leaves its lane and hits another racer, causing that racer to potentially not run as effectively, the supervisor may determine that it is fairer to restart that race.

15. Supervisors/judges will determine if the racers crossed the 5-meter mark. **Teams who do not cross the 5-meter mark will earn Participation points only.**
16. Supervisors/judges will determine the 1st and 2nd place winners of the race. 1st place winners receive 100 points and 2nd place winners receive 50 points.
17. **Supervisors will also collect the actual time of each racer's run and record it on the score sheet.**
18. Any racer that leaves their team's lane will result in a 50-point penalty for that team.

19. Once all information has been collected from the first race, the supervisor will allow teams to collect their racers and prepare for the second race.
20. Prior to the second race, any team that wants to change out their racer must notify the Supervisor prior to doing so.
21. **All additional races will run just like the first and will be completed until all teams have 2 race scores.**

22. Scoring will be the sum of the **Time Score, the best Run Score, and the Design Log Score.**
23. Ties will be broken by the mass of the racer used in the best run score. The highest mass is the winner of the tie.

RELATED FLORIDA STANDARDS:

- **SC.3.N.1.3** Keep records as appropriate, such as pictorial, written, or simple charts and graphs, of investigations conducted.
- **SC.4.N.1.1** Raise questions about the natural world, use appropriate reference materials that support understanding to obtain information (identifying the source), conduct both individual and team investigations through free exploration and systematic investigations, and generate appropriate explanations based on those explorations. (**SC.5.N.1.1** ; **SC.3.N.1.1**)
- **SC.5.N.1.3** Recognize and explain the need for repeated experimental trials.
- **SC.5.N.1.5** Recognize and explain that authentic scientific investigation frequently does not parallel the steps of "the scientific method".
- **SC.4.P.10.4** Describe how moving ~~water and~~ air are sources of energy and can be used to move things.
- **SC.4.P.12.1** Recognize that an object in motion always changes its position and may change its direction.
- **SC.4.P.12.2** Investigate and describe that the speed of an object is determined by the distance it travels in a unit of time and that objects can move at different speeds.
- **SC.5.P.13.2** Investigate and describe that the greater the force applied to it, the greater the change in motion of a given object.
- **SC.5.P.13.3** Investigate and describe that the more mass an object has, the less effect a given force will have on the object's motion.

SCORING :

- **High score wins.**
- Score = Time Score + best Run Score + Design Log score
- Time Score is based on ranking of ALL times based on the following
    - 1st place (best time) = 100 pts
    - 2nd place = 90 pts
    - 3rd place = 80 pts
    - 4th place = 70 pts
    - 5th place = 60 pts
    - 6th place = 50 pts
    - No points earned for additional places
- Design log is scored out of 50 pts

- Points earned for the **Run Score** include:
    - 1st racer to cross the finish line= 100 pts
    - 2nd racer to cross the finish line = 50 pt
- 50 points will be subtracted for teams whose *racers* veer off into another team's lane.
- Ties will be broken by the *racer* that had the highest mass on their best run.

Balloon Racers Scoring Sheet

THIS RUBRIC IS A SAMPLE AND GUIDE- IN CASES OF CONFLICT WITH THE RULES, THE RULES TAK PRECEDENCE OVER THE RUBRIC

TEAM # _____ SCHOOL NAME: _____

TIER:

IMPOUND		
2. Racer pre purchased/not built by students	**Y= Tier 2**	
2c./2d. Racer/s deemed safe to compete?	**N= Participation points only**	
2g. Device has team number on it?	**N= Tier 2**	
Impounded on time	**N = Tier 2**	
Mass of racer 1 _____ g Mass of racer 2 _____ g	**(TIEBREAKER)**	
RACE:		
1. Outside assistance violation?	**Y= Tier 2; Repeated violations may result in DQ**	
2. Safety goggle violation?	**1st time= Warning; 2nd time = Tier 2; Repeated violations may result in DQ**	
TIER ?		

DESIGN LOG:

i. Labeled diagram of racer/s	**Depending on quality- up to 10 pts**	
ii. 2 data tables with 10 trials each showing speed data for BOTH variables (Balloon diameter/Racer Mass)	**Up to 20 pts**	
iii. Graph of distance vs. time data	**Depending on quality- up to 20 pts**	
Design log impounded?	**N= No points for Design Log**	
DESIGN LOG SCORE=		

RUN 1: (Racer #: ____)	Score
Racer passed the 5-meter mark? ***N= Participation***	
Racer came in 1st place? ***Y=100 pts***	
Racer came in 2nd place? Y=50 pts	
Racer left the assigned lane? Y= -50 pts	
RACE 1 SCORE=	
Time to 5 meter mark	

RUN 2: (Racer #: ____)	Score
Racer passed the 5-meter mark? ***N= Participation***	
Racer came in 1st place? Y=100 pts	
Racer came in 2nd place? Y=50 pts	
Racer left the assigned lane? Y= -50 pts	
RACE 2 SCORE=	
Time to 5 meter mark	

FINAL SCORE = TIME SCORE (see rules) + BEST RUN SCORE + DESIGN LOG SCOREFINAL SCORE

CAN'T JUDGE A POWDER

DESCRIPTION: Students will test and characterize one pure substance and then, based only on the data they collect, answer a series of questions about that substance. Students will NOT be asked to identify the substance. The emphasis of the event is on the quality of the data collected, answering questions about the powder, and providing data to support their answers.

NUMBER OF PARTICIPANTS: **Maximum of 2** **IMPOUND:** NO

SAFETY PARAMETERS:

Proper lab safety precautions MUST be used.

- Participants dress for the event must include close-toe shoes, long pants, and long sleeve shirt (or lab coat).
- Participants must wear safety goggles
- Participants should have a lab coat or apron.
- Shoulder length hair must be tied back.
- Taste testing is strictly prohibited.
- Students must wash their hands prior to leaving the event.

COMPETITORS BRING:

- Writing utensil;
- 2 copies of "Powder Properties Chart" (1 will be turned into the supervisor
- Calculator
- Gloves (optional)
- Safety goggles (NOTE- See appropriate dress requirements above)

THE COMPETITION:

EVENT PARAMETERS:

1. Students will be collecting data on ONE unknown powder. Powders are limited to: granulated sugar, salt, flour, cornstarch, baking soda, calcium carbonate (chalk), or powdered Alka-Seltzer ©
2. The supervisor will provide the following tools for data collection:
    a. Vinegar
    b. Iodine
    c. Water
    d. 2 different writing instruments (red pen and black pen)
    e. Waste container
    f. Well plate/spot plate
    g. Hand lens
    h. Pipettes
    i. Paper towels
    j. Balance/scale
    k. Other equipment (ex. Hot plate, microscope, probes, pH paper, etc.)

POWDER PROPERTIES CHART:

1. Prior to the tournament, students will create a "Powder Properties Chart" that has information describing the physical and chemical properties of each possible powder in this event. This may be a table that lists each powder and describes the properties.

2. One copy of the "Powder Properties Chart" will be provided to the supervisor upon entry into the event. The other copy may be used during the event.
3. The quality of the "Powder Properties Chart" will be used as a tie-breaker.

THE COMPETITION:

1. Teams will be given a sample of 1 powder and this will be the same for all teams. Teams will use the tools to collect data on this sample.
2. Teams will be provided 30 minutes to complete relevant tests using the materials provided. The tests performed are determined by the competitors and NOT the supervisor. Some examples of data collected from tasks performed may be:
    a. The density of the sample is 30 g/mL
    b. The sample bubbles when mixed with vinegar.
    c. The powder sample has a shiny luster.
    d. The pH of the vinegar was 3.
    e. The temperature of the water was 30° Celsius.
3. Data is to be recorded ONLY in Column 1 using the pen provided by the supervisor.
4. Number each observation. Each observation should have its own row- if you need more space, go to the next row and indent.
5. Data collected should be neat and organized. Any mistakes should be neatly crossed out.
6. Teams should record observations and not inferences. Inferences will score less points than observations
7. After 30 minutes, teams will be expected to have their station clean and ready to move on.

8. For the second part, the sample will be removed from students and no further testing may be completed.
9. The supervisor will provide the competitors with a list of questions and another color pen. Teams will NOT have access to these questions during part 1.
10. For this section, the ability to answer the questions provided by the supervisor will be dependent on the quality and thoroughness of the data collected during the investigation period. Questions will have answers that derive from student observations.
11. For each question, the competitor will find the answer on their observation sheet. If the team has sufficient data or observations to support the answer to the question, the participant should write ONLY the question number in Column 2 next to the proper observation.
12. Each question will have a point value of 5 points. The number of points will be awarded depending on the quality of the data and/or observation. **Inferences can be awarded at most 3 points.**
13. Topics for questions may include, but are not limited to:
    a. Solubility and reactions with water
    b. Density
    c. Reactions with vinegar
    d. Reactions with Iodine
    e. Crystal properties
    f. Mass
    g. pH
14. Some **example** questions
    a. Is the substance soluble in water?
    b. Was there a reaction that occurred when the sample was mixed with water?
    c. How does the density of the sample compare to the density of water?
    d. Does the substance react with vinegar to produce a gas?

RELATED FLORIDA STANDARDS:

- **SC.5.N.1.5** Recognize and explain that authentic scientific investigation frequently does not parallel the steps of "the scientific method".
- **SC.5.N.1.1** Define a problem, use appropriate reference materials to support scientific understanding, plan and carry out scientific investigations of various types.
- **SC.4.N.1.6** Keep records that describe observations made, carefully distinguishing actual observations from ideas and inferences about the observations.
- **SC.3.N.1.3** Keep records as appropriate, such as pictorial, written, or simple charts and graphs, of investigations conducted.
- **SC.3.N.1.6** Infer based on observation.
- **SC.4.N.1.4** Attempt reasonable answers to scientific questions and cite evidence in support.
- **SC.5.P.8.1**Compare and contrast the basic properties of solids, liquids, and gases, such as mass, volume, color, texture, and temperature.
- **SC.5.P.8.2** Investigate and identify materials that will dissolve in water and those that will not and identify the conditions that will speed up or slow down the dissolving process.
- **MA.3.M.1** Measure attributes of objects and solve problems involving measurements (length, mass, volume, temperature)

SCORING :

1. **High score wins.**
2. Scoring is based on the sum of the point value of each question that was answered and identified in Column 2 of the answer sheet.
3. Ties are broken by the quality of the "Powder Property Chart".
4. Teams who do not have proper safety equipment cannot compete. They may leave to find someone to lend them the equipment but will not receive any time back to make up for lost time. Supervisor may provide safety equipment, if available, but there will be a penalty of 10% given. This penalty is taken off the overall score that the team gets.
5. A penalty of 10% will be given if the lab station is not cleaned up as instructed by the event supervisor at the end of the event.

CAN'T JUDGE A POWDER OBSERVATION SHEET TEAM #: _____

COLUMN 1:

- You have 30 minutes to write as many observations as possible.
- Write only ONE observation per line. If your observation does not fit on one line, indent the next line and continue.
- Number each observation.
- The station must be cleaned by the end of this section. Not cleaning up will result in a penalty.

COLUMN 2:

- Do not write in column 2 until told to do so.
- After you have cleaned up and completed Column 1, you will have 15 minutes to complete this section. The question sheet provided by the supervisor is for reference only.
- In column 2, write the QUESTION number that you are answering.

COLUMN 1: OBSERVATIONS	COLUMN 2: TEST
COLUMN 1: OBSERVATIONS	COLUMN 2: TEST

TOTAL SCORE: _____

PENALTIES: _____

FINAL SCORE: _____

CIRCUIT LAB

DESCRIPTION : The event will challenge student's knowledge of direct current (DC) circuits using low voltage batteries. Wall socket (AC) current will not be used.

COMPETITORS BRING:

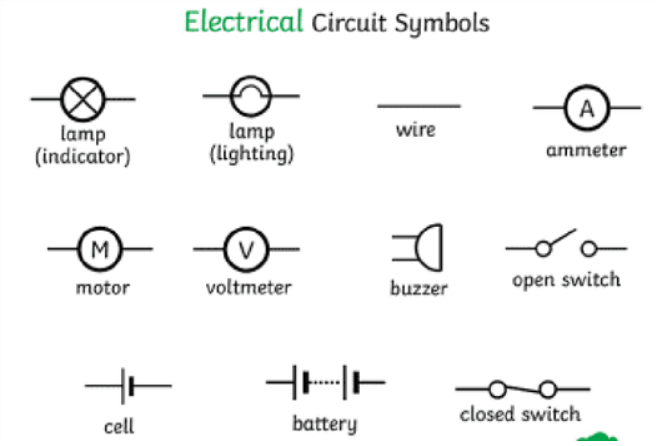
- Pencil/writing utensil;
- 3-ring binder of any size with any research/reference material. The binder may contain any item, such as a book, computer generated printout, or student created paperwork. No electronic materials are allowed. All materials must be securely bound inside the binder, so that when it is opened vertically (upside down) and given a light shake test no materials will fall out.

NUMBER OF PARTICIPANTS: Maximum of 3

IMPOUND : NO

THE COMPETITION:

1. The event may be run as a set of stations or a test that should include at least one hands-on task.
2. Questions and tasks shall **NOT** require students to calculate voltage, amperage, etc. but may ask comparative voltage questions (ex. which setup would include more voltage)
3. Questions may address the following topics.
    a. Energy transfers between electricity and other energy form
    b. How electricity is generated and how it gets into households (basics of the power grid)
    c. Parallel vs. series-parallel circuits
    d. Circuit drawings including the symbols shown to the right
    e. Conduction and insulation



4. Hands-on activities may include, but are not limited to:
    a. Students will build a continuity tester from the materials provided (battery, lamp, and wires) and use it to complete tasks.
    b. Given five different circuit cards or circuit boxes having contact points labeled A, B, C, etc. that are internally connected to form one or more multi-point circuits, determine which combinations or points on each card are connected together
    c. Given a tray of common household items, classify them as conductors or insulators
    d. Given circuits, draw each circuit using the schematic symbols and answer questions about the circuits.
    e. Construct a circuit based on a series of instructions.

RELATED FLORIDA STANDARDS:

- **SC.3.N.1.3** Keep records as appropriate, such as pictorial, written or simple charts and graphs, of investigations conducted
- **SC.5.P.10.1** Observe and describe some basic forms of energy, including light, heat, sound, electrical, chemical, and mechanical
    - **SC.4.P.10.1** Observe and describe some basic forms of energy, including light, heat, sound, electrical, and the energy of motion.
    - **SC.3.P.10.1** Identify some basic forms of energy such as light, heat, sound, electrical, and mechanical.
- **SC.3.P.10.2** Recognize that energy has the ability to cause motion or create change.

- **SC.5.P.10.3** Investigate and explain that an electrically-charged object can attract an uncharged object and can either attract or repel another charged object without any contact between the objects.
- **SC.5.P.10.4** Investigate and explain that electrical energy can be transformed into heat, light, and sound energy, as well as the energy of motion.
- **SC.5.P.11.1** Investigate and illustrate the fact that the flow of electricity requires a closed circuit (a complete loop).
- **SC.5.P.11.2** Identify and classify materials that conduct electricity and materials that do not.

SCORING:

- **High score wins.**
- Each question or station will be assigned a predetermined set of points, assigned by the event supervisor **and communicated to the teams.**
- Ties will be broken with pre-determined tie-breaker questions **which are communicated to teams.** Supervisors may use the time needed to complete a task as a tiebreaker, if that is communicated to teams prior to the event.

CODEBUSTERS

DESCRIPTION: Teams will cryptanalyze and decode encrypted messages using techniques for historical and advanced ciphers.

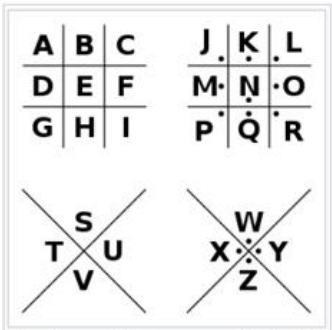
COMPETITORS BRING:

- Pencil/writing utensil;
- Calculators

NUMBER OF PARTICIPANTS: **Maximum of** 2 **IMPOUND:** **NO**

THE COMPETITION:

1. This event consists of participants using cryptanalysis techniques and ciphers to decrypt and encrypt messages on a written or computer-based exam.
2. Teams will be provided scratch paper and any tables needed for the questions on the exam.
3. The code types that can be used include:
    a. **Caesar's cipher**- a substitution cipher in which each letter in the plaintext is replaced by another letter some fixed positions down the alphabet. For example, with a left shift of 3, D would be replaced by A, E by B, etc.
    b. **Atbash** – a monoalphabetic substitution cipher where the alphabet is mapped to its reverse, so that the first letter becomes the last letter, the second letter becomes the second to last letter, etc.
    c. **Pig Pen/Masonic**- This is a geometric simple substitution cipher which exchanges letters for symbols that are fragments of a grid. The grid is shown above and to the right. **Supervisors are required** to provide the pigpen cipher grids to participants on the test.
    d. **Tap Code**- Encode text messages on a letter-by-letter basis in a very simple way. The message is transmitted using a series of tap sounds. In this case, the sounds will be shown as dots. See Latin alphabet tap code table and example of the tap code for the word "hello" below. **Supervisor must provide** the "Latin alphabet tap code table" to participants in the test.
4. The code that is to be used should be identified in the question. For example, "Solve this Caesar Cipher which is a quote by Enola Holmes and starts with the letter O" or "Albert Einstein left a message using the Tap Code cipher. What does it say?"
5. No more than 1/3 of the questions will require encryption, other questions for be decryption questions.
6. Questions may provide improperly decoded sample answers and require students to "debug" or provide the correct answer and an explanation of where the original decoder went wrong.
7. Supervisors will identify a "Timing Bonus" question. This question may be completed with a judge/supervisor at a separate station while the rest of the teams are completing the paper/pencil test OR should be the first question in the test. In this case, the "Timing Bonus" question should be a separate sheet of paper only provided when the team is called to that station.
8. Questions should be given point values that correspond with the number of letters in the plaintext and/or the difficulty of the problem. (see scoring information below)



The pigpen cipher uses graphical symbols assigned according to a key similar to the above diagram.[1]

Latin alphabet tap code table

	1	2	3	4	5
1	A	B	C/K	D	E
2	F	G	H	I	J
3	L	M	N	O	P
4	Q	R	S	T	U
5	V	W	X	Y	Z

H	E	L	L	O
2, 3	1, 5	3, 1	3, 1	3, 4
.. ...	. .....	... .	... .	... .

RELATED FLORIDA STANDARDS:

- **CS.35.CS-CP.1.4** Collect, organize, graph, and analyze data to answer a question using a database or spreadsheet.
- **CS.35.CS-CS.2.4** Solve real-world problems in science and engineering using computational thinking skills.
- **SC.35.CS-CS.2.9** Explain how to correct logical errors in algorithms; written, mapped, live action, or digital.

SCORING:

- **High score wins.**
- Each question will be assigned a predetermined set of points, assigned by the event supervisor and communicated to the teams (preferably- points are identified on the test/station paperwork).
    - For questions such as cryptograms, with answers composed of letters, the final points will be determined based on the number of correct letters from the decoded plaintext or the encoded ciphertext.
- A timing bonus is earned based on the number of seconds it takes a team to correctly decode/encode the identified question. The timing bonus is equal to 2 X (point value of the question – number of seconds). Students will earn the number of points for the question itself and for the timing bonus. The timing bonus may only be awarded if the students correctly decode/encode the entire phrase/quote.
- Ties will be broken with predetermined questions as identified by the supervisors.

RESOURCES: Use https://toebes.com/codebusters/ to make practice test and find information about this event.

ENERGY MATTERS

DESCRIPTION: Teams will be asked questions and/or will conduct experiments at stations as they relate to the properties of energy. **Safety goggles are required.**

COMPETITORS BRING/NEED:

- Safety goggles;
- Writing utensil;
- 3-ring binder of any size with any research/reference material. The binder may contain any item, such as a book, computer generated printout, or student created paperwork. No electronic materials are allowed, such as a computer, calculator or smartphone. All materials must be securely bound inside the binder, so that when it is opened vertically (upside down) and given a light shake test no materials will fall out.

NUMBER OF PARTICIPANTS: **Maximum of 2** **IMPOUND:** **NO**

THE COMPETITION:

1. **The competition may be run as timed stations and/or a written test.**
2. Teams will either be asked questions or will be required to complete experiments or make observations as they relate to forms of energy such as light, heat, sound, electrical, chemical, and mechanical.
3. Topics are limited to:
    a. Descriptions of light, heat, sound, electrical, chemical, and mechanical energy. Topics may include:
        i. Characteristics of sound waves: Wavelength, amplitude, frequency, time period, velocity
        ii. Sound waves begin with vibrating matter
        iii. Sound waves need a medium to travel through
        iv. Heat can move via conduction, convection, and radiation
        v. Friction
        vi. The Sun provides heat energy through radiation
        vii. Light moves in a straight line unless it strikes matter
        viii. Light can be reflected, refracted, or absorbed
        ix. Law of Conservation of Energy
        x. Energy can transfer from one form to another
        xi. Kinetic versus potential energy
    b. Analysis of data from experiments on light, heat, sound, electrical, or mechanical energy

RELATED FLORIDA STANDARDS :

- **SC.5.P.10.1** Observe and describe some basic forms of energy, including light, heat, sound, electrical, chemical, and mechanical.
    - **SC.4.P.10.1** Observe and describe some basic forms of energy, including light, heat, sound, electrical, and the energy of motion.
    - **SC.3.P.10.1** Identify some basic forms of energy such as light, heat, sound, electrical, and mechanical
- **SC.3.P.10.2** Recognize that energy has the ability to cause motion or create change.
- **SC.4.P.10.3** Investigate and explain that sound is produced by vibrating objects and that pitch depends on how fast or slow the object vibrates
    - **SC.3.P.10.3** Demonstrate that light travels in a straight line until it strikes an object or travels from one medium to another.
- **SC.5.P.10.3** Investigate and explain that electrical energy can be transformed into heat, light, and sound energy, as well as the energy of motion.
- **SC.4.P.10.4** Describe how moving water and air are sources of energy and can be used to move things.
    - **SC.3.P.10.4** Demonstrate that light can be reflected, refracted, and absorbed.
- **SC.4.P.11.1** Recognize that heat flows from a hot object to a cold object and that heat flow may cause materials to change temperature.

- **SC.3.P.11.1** Investigate, observe, and explain that things that give off light often also give off heat.
- **SC.P.11.2** Investigate, observe, and explain that heat is produced when one object rubs against another, such as rubbing one's hands together.
- **SC.3.E.6.1** Demonstrate that radiant energy from the Sun can heat objects and when the Sun is not present, heat may be lost.
- **MA.3.M.1** Measure attributes of objects and solve problems involving measurements (length, mass, volume, temperature
- **MA.4.M.1** Measure the length of objects and solve problems involving measurement; Convert within a single system of measurements using the units: yards, feet, inches; kilometers, meters, centimeters; pounds, ounces; kilograms, grams; gallons, quarts, pints, cups; liter, milliliter; and hours, minutes, seconds.
- **MA.5.M.1** Convert measurement units to solve multi-step problems.

SCORING :

1. **High score wins.**
2. Each question or station will be assigned a predetermined set of points, assigned by the event supervisor **and communicated to the teams (preferably- points are identified on the test/station paperwork).**
3. Ties will be broken with pre-determined tie-breaker questions **which are communicated to teams.**

EXPERIMENTAL DESIGN

DESCRIPTION : Teams will be asked to design, complete, and write up an experiment.

COMPETITORS BRING :

- Pencil/writing utensil;
- 1 sheet of 8.5 X 11" paper with notes on both sides
- Calculator

NUMBER OF PARTICIPANTS : Maximum of 3 **IMPOUND : NO**

THE COMPETITION :

1. Teams will be asked to design, complete, and write up an experiment focused on a topic provided by the supervisor. The lab write up should include the following:
    a. Statement of problem
    b. Hypothesis- predicts the relationship between the dependent and independent variable, gives direction to the prediction, and provides a rationale for the hypothesis
    c. Variables including the independent variable, dependent variable, constants (controlled variables)
    d. Experimental control (when appropriate)
    e. Materials
    f. Procedure and set up diagrams – provided in a list form with labeled diagrams
    g. Qualitative observations
    h. Quantitative data (data table)
    i. Possible experimental errors – at least 2
    j. Conclusion – Hypothesis is restated. A claim made regarding hypothesis being supported or not, data is outlined as evidence of the claim, and a rationale is provided.
2. Students may request additional lined paper from the supervisor.
3. Students must clean their station as per the directions of the supervisor. Failure to do so will include a 75%-point deduction off the score. *So, if students get a score of 75, this would be multiplied by .75 and that value deducted from the original score to give them 18.75 points.*
4. Student experiments that do not focus on the topic provided will earn a penalty of 50% off their score.
5. Students who do not physically complete and experiment and collect data will earn a penalty of 25% off their score.

RELATED FLORIDA STANDARDS :

- **SC.5.N.1.1** Define a problem, use appropriate reference materials to support scientific understanding, plan and carry out scientific investigations of various types such as: systematic observations, experiments requiring the identification of variables, collecting and organizing data, interpreting data in charts, tables, and graphics, analyze information, make predictions, and defend conclusions.
- **SC.5.N.1.2** Explain the difference between an experiment and other types of scientific investigation.
- **SC.5.N.1.4** Identify a control group and explain its importance in an experiment.
- **SC.4.N.1.8** Recognize that science involves creativity in designing experiments.
- **SC.3.N.1.4** Recognize the importance of communication among scientists.
- **SC.5.N.2.1** Recognize and explain that science is grounded in empirical observations that are testable; explanation must always be linked with evidence.
- **SC.3.N.1.7** Explain that empirical evidence is information, such as observations or measurements that is used to help validate explanations of natural phenomena.
- **SC.4.N.1.3** Explain that science does not always follow a rigidly defined method ("the scientific method") but that science does involve the use of observations and empirical evidence.
- **SC.4.N.1.7** Recognize and explain that scientists base their explanations on evidence.

- **SC.5.N.1.5** Recognize and explain that authentic scientific investigation frequently does not parallel the steps of "the scientific method."
- **SC.5.N.1.6** Recognize and explain the difference between personal opinion/interpretation and verified observation.

- **MA.3.M.1** Measure attributes of objects and solve problems involving measurements (length, mass, volume, temperature)
- **MA.4.M.1** Measure the length of objects and solve problems involving measurement; Convert within a single system of measurements using the units: yards, feet, inches; kilometers, meters, centimeters; pounds, ounces; kilograms, grams; gallons, quarts, pints, cups; liter, milliliter; and hours, minutes, seconds.
- **MA.5.M.1** Convert measurement units to solve multi-step problems.

SCORING:

- **High score wins.**
- **Possible penalties include:**
    - **Not cleaning up : 75% point deduction off the Part 1 score**
    - **Experiment off topic : 75% point deduction off the Part 1 score**
    - **Not completing experiment : 25% point deduction off the Part 1 score.**
- Ties will be broken with predetermined tie-breaker questions

EXPERIMENTAL DESIGN STUDENT ANSWER SHEET

TEAM #: _____ SCHOOL : _____

TEAM MEMBERS : _____

Student Section	**Supervisor Only**
	Points earned/notes
[2 pts] Statement of Problem:	
[6 pts- Tiebreaker 1] Hypothesis:	
[3 pts] Independent Variable:	
[3 pts] Dependent Variable:	
[4 pts] Constants:	
[4 pts- Tiebreaker 2] Experimental Control/Control Group:	
[4 pts] Materials:	

TEAM # _____	
[15 pts- Tiebreaker 3] Procedures	

TEAM # _____	
[8 pts] Qualitative Observations:	
[14 pts] Quantitative Data (Data Table):	
[4 pts] Possible Experimental Errors:	

TEAM # _____	
[8 pts] Conclusion:	

FOSSIL FRENZY

DESCRIPTION: This event focused on **their knowledge of geologic time, dinosaur fossils and the process of fossilization.**

COMPETITORS BRING/NEED:

- Writing utensil;
- ONE sheet of 8.5 X 11" paper with notes (handwritten or printed) on both sides; This may be in a page protector, but there cannot be additional notes or post-its on the page protector that would add the amount of notes

NUMBER OF PARTICIPANTS : Maximum of 2 **IMPOUND : NO**

THE COMPETITION :

1. The competition may be run as timed stations, a slideshow and/or a written test.
2. Identification of fossils is limited to 50% of the total score. Students will be able to identify fossils of the Clade Dinosauria from pictures, replicas, actual specimens, etc. and answer questions on the following:
    a. If the dinosaur was a carnivore, omnivore, and herbivore
    b. The specific environment that the dinosaur lived in- marine, terrestrial, freshwater, etc.
    c. The geologic time period the dinosaur is from (Triassic, Jurassic, or Cretaceous)
    d. Specific physical adaptations
3. Fossil identification is limited to the following.
    a. Order Saurischia (lizard-hipped dinosaurs) to include **Adasaurus, Albertosaurus, Anchiornis, Apatosaurus, Carnotaurus, Caudipteryx, Epidexipteryx, Nomingia, Spinosaurus, Tarbosaurus**
    b. Order Ornithischia (bird-hipped dinosaurs) to include **Abrictosaurus, Agujaceratops, Camptosaurus, Centrosaurus, Echinodon, Gastonia, Gigantspinosaurus, Lambeosaurus, Monoclonius, Nanyangosaurus**
4. Teams may also be assessed in any of the following topics:
    a. The conditions required for a plant or animal to become fossilized.
    b. Distinguish between modes of preservation: petrification, mineral replacement, cast/mold, imprint, encasement in amber/copal, mummification, freezing, entrapment in tar/asphalt.
    c. Make inferences about dinosaurs from footprints, teeth, and body structures.
    d. Understand the Geologic Time Scale and be able to distinguish between era, period, and epoch and know where dinosaurs and humans fit on that time scale.
    e. Describe possible causes of extinction

RELATED FLORIDA STANDARDS :

- **SC.3.N.1.7** Explain that empirical evidence is information, such as observations or measurements, that is used to help validate explanations of natural phenomena.
    - **SC.4.N.1.7** Recognize and explain that scientists base their explanations on evidence.
- **SC.4.N.1.6** Keep records that describe observations made, carefully distinguishing actual observations from ideas and inferences about the observations.
- **SC.3.L.15.1** Classify animals into major groups (mammals, birds, reptiles, amphibians, fish, arthropods, vertebrates and invertebrates…) according to their physical characteristics and behaviors.
- **SC.5.L.15.1** Describe how, when the environment changes, differences between individuals allow some plants and animals to survive and reproduce while others die or move to new locations.
- **SC.5.L.17.1** Compare and contrast adaptations displayed by animals and plants that enable them to survive in different environments such as life cycle variations, animal behaviors and physical characteristics.
- **SC.4.E.6.1** Identify the three categories of rocks: igneous, (formed from molten rock); sedimentary (pieces of other rocks and fossilized organisms); and metamorphic (formed from heat and pressure).

SCORING :

- **High score wins.**
- Each question or station will be assigned a predetermined set of points, assigned by the event supervisor **and communicated to the teams (preferably- points are identified on the test/station paperwork).**
- Ties will be broken with pre-determined tie-breaker questions **which are communicated to teams.**

KEYED TO SCIENCE

DESCRIPTION : This event focused on **classification and using tools for classification** .

COMPETITORS BRING/NEED :

- Writing utensil;
- ONE sheet of 8.5 X 11" paper with notes (handwritten or printed) on both sides; This may be in a page protector, but there cannot be additional notes or post-its on the page protector that would add the amount of notes

NUMBER OF PARTICIPANTS : **Maximum of** 2 **IMPOUND :** **NO**

THE COMPETITION :

1. The competition may be run as timed stations and/or a written test.
2. Teams will be tested on their ability to classify, sort, and categorize using Dichotomous keys, field guides, or other tools
3. Specific knowledge students might need to know to complete tasks:
    a. General classification of arthropods- what makes something an insect vs. an arachnid; These tasks may require specific organism identification only with the use of a dichotomous key or field guide as students are not expected to know specific organisms by sight.
    b. Classification of **three**-dimensional figures based on defining attributes such as **number and shape of faces, number and shape of bases, apex, curved or straight edges, curved or flat faces. Figures are limited to right pyramids, right prisms, right circular cylinders, right circular cones and spheres**
    c. Types of metamorphosis and classification of insects that go through metamorphosis.
    d. Classification of flowering vs. non-flowering plants
4. Students are not expected to know scientific names of organisms.
5. Students may be asked about the concept of binomial nomenclature and how an organism is identified by a scientific name.
6. All other classification tasks will not require specific prior content knowledge and students will be able to complete those tasks using basic scientific processing.
7. Sample activities may include, but are not limited to:
    a. Given a Dichotomous Key, identify animal tracks (footprints).
    b. Given images of leaves, create a Dichotomous Key to classify them.
    c. Use a field guide to identify an unknown bird from images provided.
    d. Given three categories, sort random objects into the most appropriate category.
    e. Answer questions using a field guide, Dichotomous key, or other tools such as tables and charts.
    f. Given images of organisms, identify which are arachnids and explain what makes something an arachnid.
    g. Given images of 2-dimensional objects, classify them by shape.

RELATED FLORIDA STANDARDS :

- **SC.4.L.16.4** Compare and contrast the major stages in the life cycles of Florida plants and animals, such as those that undergo incomplete and complete metamorphosis, and flowering and nonflowering seed-bearing plants.
- **SC.1.L.14.3** Differentiate between living and nonliving things.
- **SC.3.L.15.2** Classify flowering and nonflowering plants into major groups such as those that produce seeds, or those like ferns and mosses that produce spores, according to their physical characteristics.
- **SC.3.L.15.1** Classify animals into major groups (mammals, birds, reptiles, amphibians, fish, arthropods, vertebrates and invertebrates, those having live births and those which lay eggs) according to their physical characteristics and behaviors.
- **MA.3.M.1** Measure attributes of objects and solve problems involving measurements (length, mass, volume, temperature)
- **MA.4.M.1** Measure the length of objects and solve problems involving measurement; Convert within a single system of measurements using the units: yards, feet, inches; kilometers, meters, centimeters; pounds, ounces; kilograms, grams; gallons, quarts, pints, cups; liter, milliliter; and hours, minutes, seconds.

- **MA.5.M.1** Convert measurement units to solve multi-step problems.
- **MA.5.GR.1** Classify two-dimensional figures and three-dimensional figures based on defining attributes. (2-D: Triangles including scalene, isosceles, equilateral, acute, obtuse, and rights; quadrilaterals include parallelograms, rhombi, rectangles, squares and trapezoids. 3-D: Attributes include number and shape of faces, number and shape of bases, apex, curved or straight edges, curved or flat faces. Figures are limited to right pyramids, right prisms, right circular cylinders, right circular cones and spheres.)

SCORING :

- **High score wins.**
- Each question or station will be assigned a predetermined set of points, assigned by the event supervisor **and communicated to the teams (preferably- points are identified on the test/station paperwork).**
- Ties will be broken with pre-determined tie-breaker questions **which are communicated to teams.**

METRIC MANIA

DESCRIPTION: Teams will demonstrate their understanding of metric measurements by estimating and measuring length (meter), mass (gram), fluid volume (liter), angles, and temperature (Celsius) and making calculations based on these measurements.

COMPETITORS BRING:

- Pencil/writing utensil;
- Calculator, metric ruler, protractor

NUMBER OF PARTICIPANTS: 2 **IMPOUND :** NO

THE COMPETITION:

1. The event may be run as a set of stations or a test that should include at least one hands-on task.
2. In addition to the tools that the teams may bring, supervisors may be provide the following tools to be used during the event:
    a. Meter stick/meter tape
    b. Electronic or triple beam balance
    c. Beakers
    d. Erlenmeyer flasks
    e. Graduated cylinders
    f. Caliper
    g. Thermometer
3. Questions/tasks may relate to the following topics:
    a. Scale of metric units (ex. 10 mm = 1 cm)
    b. Appropriate units to measure various items, or for calculations
    c. How to make measurement estimations
    d. Drawing and identifying lines and angles
    e. Analyzing shapes based on lines and angles
    f. Measuring and calculating volume of rectangular prisms, liquid in a container, irregular objects using displacement
4. Hands-on activities may include, but are not limited to:
    a. Given a protractor, draw and label a 58^{o} angle (angle ABC) and classify the angle as obtuse, acute, or right
    b. Use two blocks at the station and measure the mass and volume of each.
    c. Given a pencil, estimate how many pencils would be in a pile that had a mass of 10 kg.
    d. Use a caliper to measure the outside diameter of a ring and then the thickness of the metal ring in mm.

RELATED FLORIDA STANDARDS:

- **SC.3.N.1.3** Keep records as appropriate, such as pictorial, written or simple charts and graphs, of investigations conducted
- **MA.3.M.1** Measure attributes of objects and solve problems involving measurements (length, mass, volume, temperature)
- **MA.4.M.1** Measure the length of objects and solve problems involving measurement; Convert within a single system of measurements using the units: yards, feet, inches; kilometers, meters, centimeters; pounds, ounces; kilograms, grams; gallons, quarts, pints, cups; liter, milliliter; and hours, minutes, seconds.
- **MA.5.M.1** Convert measurement units to solve multi-step problems.
- **MA.5.GR.1** Classify two-dimensional figures and three-dimensional figures based on defining attributes. (2-D: Triangles including scalene, isosceles, equilateral, acute, obtuse, and rights; quadrilaterals include parallelograms, rhombi, rectangles, squares and trapezoids. 3-D: Attributes include number and shape of faces, number and shape of bases, apex, curved or straight edges, curved or flat faces. Figures are limited to right pyramids, right prisms, right circular cylinders, right circular cones and spheres.)

SCORING:

- **High score wins.**
- Each question or station will be assigned a predetermined set of points, assigned by the event supervisor **and communicated to the teams.**
- Ties will be broken with pre-determined tie-breaker questions which are communicated to teams. Supervisors may use the time needed to complete a task as a tiebreaker, if that is communicated to teams prior to the event.

MYSTERY ARCHITECTURE

DESCRIPTION: At the beginning of the event, teams will be given a bag of building materials and instructions for designing and building a device that can be tested. This is an **ON-SITE BUILD EVENT.**

NUMBER OF PARTICIPANTS*:* **Maximum of 3**

IMPOUND: NO but all teams will build at the same time.

COMPETITORS BRING:

- Writing utensil;
- Scissors;
- Ruler;
- Safety goggles

THE COMPETITION:

BUILD:

1. All teams will build at the same time. Teams will have 25-minutes to build. Once teams enter the area to build, they may not leave the area or receive outside assistance, materials, or communication until after they are finished building. **Violation of this rule places a team in Tier 2.**
2. Once participants arrive at their build area, they must put their safety goggles on. These goggles must stay on for the entire build period. Supervisors will give one goggle warning**. Additional warnings will place the team in Tier 2 and/or remove them from competition.**
3. Each team will be given a bag containing the same materials and a working area.
    a. Examples of materials are: paper cups, drinking straws, paper clips, string, tape, paper, Play Doh ©, and Popsicle sticks. Materials are not limited to this list but will not include anything potentially hazardous.
    b. Teams may not use any outside materials, other than what is provided to them by the event supervisor or their scissors and ruler.
    c. The bag that the materials come in cannot be part of the package and should be used to hold all waste at the end of the build.
    d. The materials provided may be altered as needed, using the allowable tools.
    e. The allowable materials (scissors, pencil, ruler) may NOT be part of the package.
4. The team will create a device based on the instructions of the supervisor. The information will be provided during the morning build time.
    a. Samples of devices to be built are limited to a tower, a bridge, a floatation device such as a boat, or a cantilever.
    b. The supervisor's directions must include at least one **primary dimension** and must include whether the device must support a load and the duration of the load supported. This must be provided prior to building and must be the same for all teams. Sample directions may be:
        i. Build the **tallest** tower that is freestanding for at least 30 seconds when a tennis ball is placed on top.
        ii. Build the **shortest** bridge that spans at least 30 cm and can hold a load of at least 500 g for a minimum of 10 seconds.
        iii. Build the **longest** cantilever that attaches to a given backpiece at the provided hook. This cantilever will hold 500 g for a minimum of 10 seconds.
        iv. Build the **smallest** floatation device that can holds a specific mass of marbles for a minimum of 10 seconds.
    c. If the device is to support a load, a separate and identical load of the same dimensions and weight used for testing will be provided for teams to view and feel. Teams may not take the sample load back to their building location.
    d. Unless specifically stated by the supervisor, devices must be freestanding and must not be attached to a tabletop, floor, ceiling, or other support.

e. Any loading should be able to be completed and device ready to test within 1-minute of the testing time.
f. The device must have the team number on it. **Devices without team numbers will be placed in Tier 2.**

5. At the end of the build time, teams must clean up their build area by placing all trash and extra materials in the bag.
    a. The remaining supplies will be massed and this will be used as a tie-breaker (those with more supplies left over will place higher in the tie).
    b. Prior to leaving the build area, teams must ensure that their area is clean and all instructions have been followed. **Failure to follow this rule will place teams in Tier 2.**
    c. Teams should store their devices in a location noted by the event supervisor. It is suggested that the event supervisor/judges do not touch student devices and instead have them place them in a location that will be monitored throughout the day.

TEST:

1. Teams will return to test at some point later in the day- this may be via self-scheduling or based on a set schedule.
2. Once participants arrive at their test area, supervisors will have them collect their device and give instructions for measuring the primary dimension and the mass of the waste baggie. This will be noted on the score sheet.
3. Teams will them be provided the load, if applicable, and they have 1-minute to load and call for timing to begin. **Teams who cannot test within 1-minute will earn only Participation points.**
4. **Teams whose device cannot hold the load will earn Participation points.**
5. The supervisor/judge will time to determine if the device was able to hold the load for the minimum time requirement. **Teams whose devices cannot hold the load for the minimum time but whose devices hold the load will be placed in Tier 2.**
6. Teams have one chance to test their device. There are no trial runs or do-overs.
7. Teams will remove the load according to the supervisor's instructions and return their device to the location where they are being stored. Teams may pick up devices at the end of the day, if desired.

RELATED FLORIDA STANDARDS:

- **SC.5.N.1.5** Recognize and explain that authentic scientific investigation frequently does not parallel the steps of "the scientific method".
- **SC.5.P.13.1** Identify familiar forces that cause objects to move, such as pushes or pulls, including gravity acting on falling objects.
- **MA.3.M.1** Measure attributes of objects and solve problems involving measurements (length, mass, volume, temperature)
- **MA.4.M.1** Measure the length of objects and solve problems involving measurement; Convert within a single system of measurements using the units: yards, feet, inches; kilometers, meters, centimeters; pounds, ounces; kilograms, grams; gallons, quarts, pints, cups; liter, milliliter; and hours, minutes, seconds.

SCORING :

1. **High or low score wins depending on instructions.**
2. The primary dimension will be measured to the nearest 0.1 cm by the event supervisor. Devices will be ranked as follows:
    a. Devices that held the load for the duration will be ranked in order of the primary dimension. (ex. If the instructions are to build the shortest bridge that spans 30 cm and holds 1 kg, the bridges will be ranked with the shortest bridge being in 1st place and the longest bridge in last place for this tier)
    b. Devices that held the load but not for the duration will be ranked within Tier 2 in order of primary dimension.

Team# _____

School Name: _____

Mystery Architecture Scoring Sheet

BUILD:

		TIER
1. Outside assistance violation?	**Y= Tier 2; Repeated violations may result in DQ**	
2. Safety goggles violation?	**1 st time= Warning; 2 nd time = Tier 2; Repeated violations may result in DQ**	
3. Device made only of allowable materials?	**N= Participation points only**	
4f. Device has team number on it?	**N= Tier 2**	
5b. Building area cleaned up as instructed?	**N = Tier 2**	
Team did not show up at build time?	**Y= Participation points only**	
	TIER?	

TEST:

Primary Dimension: _____	Measurement:	_____
Mass of bag with "waste"	_____ g (TIE-BREAKER)	
3. Loaded within 1-minute?	**N= Participation points only**	
4. Device held the load?	**N= Participation points only**	
5. Device held load but not for required time	**N = Tier 2**	
	MEASUREMENT OF PRIMARY DIMENSION=	

PLEASE NOTE THAT THIS RUBRIC IS A SAMPLE AND GUIDE- IN CASES OF CONFLICT WITH THE RULES, THE RULES TAKE PRECEDENCE OVER THE RUBRIC.

PRECISION PING PONG PROPULSION

DESCRIPTION: Students will build and calibrate their own free-standing (not hand held) launching device to propel ping pong balls at a target that is placed within a given range. **This is a PREBUILD event.**

COMPETITORS BRING:

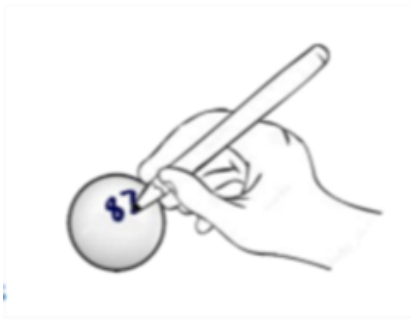
- Student built launching device;
- 15 regulation ping pong balls (see details below for specifics);
- Prepared graph/chart;
- Safety goggles

NUMBER OF PARTICIPANTS: **Maximum of 2** **IMPOUND:** **YES**

CONSTRUCTION/IMPOUND :

LAUNCHING DEVICE:

1. Prior to the competition, students will design, construct and test a launching device. The device should be capable of accurately and consistently shooting a ping pong ball a range of distances.
2. The balls must be launched using energy stored in the device. Gravitational potential energy, elastic energy, and compressed air are appropriate (e.g. stretching or compressing a component). Students may pull back on the launcher to launch. No electricity, batteries, or flammable gas allowed.
3. Balls may be loaded individually or all together, but not before approaching the launch line.
4. There are minimal material and size restrictions for the launcher. But, consider the following when designing:
    a. Devices that are deemed to be hazardous by the Event Supervisor will not be allowed to launch- if you think it might be hazardous/dangerous, don't use it. **Devices deemed hazardous will earn the team Participation points only.**
    b. ALL devices MUST sit upon rubber or soft material "feet" to prevent floor damage when moving. **If supervisor determines that the device will damage the venue's floor, teams may not be able to launch and will earn Participation points only**
    c. Devices will have to be moved and placed by the student at launch time- consider this when building.
    d. Students will not have time to "put together" components of the launcher at launch time- devices should be able to go into launch configuration quickly.
    e. Teams from the same school cannot use the same launcher and a new launcher must be designed and built by members of the current year's team (teams cannot use previously used launchers).
    f. Device MUST have the team number visibly marked. **No team number marked will incur a 20-point penalty.**
5. PING PONG BALLS:
    a. Teams must bring 15 regulation 40mm ping pong balls
    b. 10 balls should be white
    c. 4 balls should be orange
    d. One ball should be orange marked with a black band around the circumference using a permanent marker.
    e. Each ball must be clearly marked with the team number in two places on opposite sides using a black permanent marker.



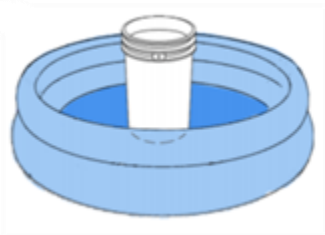
f. Team numbers MUST be underlined to aid in identification.
g. No other alterations to the ping pong balls are allowed.
h. Teams without ping pong balls may be unable to compete. **In instances where Supervisors are willing and able to provide ping pong balls, teams will be placed in Tier 2.**

PRACTICE LOG:

1. At impound, the team should submit 2 identical copies of a practice log.
    a. Each copy should be labeled with the school name and team number.
    b. One copy will remain with the device during launching and the 2nd copy will be held for scoring purposes.
    c. The second log will not be returned.
2. **Teams without practice logs at impound will be placed in Tier 2.**
3. The practice log should include a minimum of three variables and 20 launches related to launch performance. Examples of appropriate variables might include:
    a. Score
    b. Distance to the target
    c. Elevation or angle of shooting
    d. Stretched elastomeric membrane length
    e. Type of Elastomeric membrane
    f. Size of Elastomeric membrane
4. Practice logs will be judged in terms of data completeness, clarity, and depth, as part of the tie-breaking process.

IMPOUND:

1. At impound, the team should impound:
    a. Launching device and any tools/supplies that might be needed to adjust prior to launch
    b. Ping pong balls, colored and labeled as outlined in the rules, in a clear, Ziploc type baggie.
    c. 2 copies of the Practice log
2. **Teams who do not impound during the impound time may earn Participation points OR be placed in Tier 2** .



THE COMPETITION:

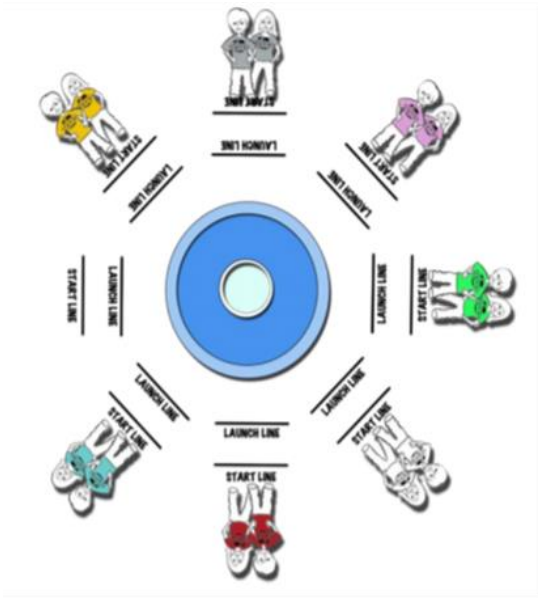
TARGET/LAUNCHING AREA:

1. The target is a 5-gallon plastic bucket with the handle removed placed in the center of an inflatable wading pool.
2. The target and launch area will be on a hard surface such as a tiled floor or hardwood gymnasium floor.
3. Launch line will be marked on the floor **3 to 6** meters from the center of the target at half meter intervals (see diagram on the next page). A starting line will be marked approximately 2 meters back from each launch line.
4. Competitors will be notified of the distance to the target at the time of their individual shooting round.
5. The target is surrounded by several launch lines. The chaos of multiple simultaneous launches is part of this event. Expect to see mid-air collisions, unfortunate bounces, and unbelievable lucky bounces.
6. Supervisors are encouraged to balance the number of teams shooting at one time so that this is similar throughout the day.
7. Supervisors may choose to do ONE or TWO rounds of shooting depending on the number of teams participating. If TWO rounds are used, the score will be the BEST of the two rounds.

LAUNCHING:

1. Safety goggles must be worn in the competition area at ALL times. Teams who are warned about not wearing goggles once testing begins will be placed in Tier 2.
2. No one except competitors and judges are allowed in the competition area.

3. The teams will wait with their launcher behind their assigned starting line. When they hear the Event Supervisor's signal, all teams may advance to the launch line, set up their launcher, and begin launching.
    a. Once in launch position, no part of the launcher may cross the launch line. Teams whose launchers cross the line will earn a 50 point penalty and may be disqualified for repeated infractions.
    b. No participant may manually weigh down or manually support the front edge of the device during active shooting.
    c. Students must stay behind the launching line.
    d. Students may adjust their launchers during the launching time as needed unless the adjustment causes a safety concern. Launchers must be in a position that makes them unable to launch at that time.
    e. Misfired balls that do not pass the launch line may be picked up and relaunched. Balls that go outside the launch line may not be relaunched.



4. A total of 4 minutes are allowed to set up and launch all 15 balls. The team decides what order to launch their different colored balls.
5. The supervisor will announce when there is one minute remaining and signal at the end of the 4 minutes. At that time, all launching must cease.
6. Penalty points or disqualification may be caused if the Supervisor has to intervene during the testing. The Event Supervisor will immediately intervene if:
    a. A team's device or behavior appears unsafe for any reason. This will likely cause immediate disqualification.
    b. If any part of the device crossed the launch line. This will cause a penalty of 50 points the first time and may cause disqualification for additional instances.
    c. If there is any interference or coaching from outside the competition area. This will cause a penalty of 50 points the first time and disqualification for other instances.
7. When the final whistle sounds, the Event Supervisor/judges will count the balls, by color contained inside the target. Any ball that is outside the target at the final whistle will have no value, even if it was in earlier and was somehow ejected.

RELATED FLORIDA STANDARDS:

- **SC.5.N.1.3** Recognize the need for repeated experimental trials.
    - **SC.3.N.1.3** Keep records as appropriate, such as pictorial, written, or simple charts and graphs, of investigations conducted.
- **SC.5.N.1.5** Recognize and explain that authentic scientific investigation frequently does not parallel the steps of "the scientific method"
- **SC.4.N.1.6** Keep records that describe observations made, carefully distinguishing actual observations from ideas and inferences about the observations.
- **SC.5.P.11.1** Identify familiar forces that case objects to move, such as pushes or pulls, including gravity acting on falling objects.
- **SC.5.P.13.2** Investigate and describe that the greater the force applied to it, the greater the change in motion of a given object.
- **SC.4.P.12.2** Investigate and describe that the speed of an object is determined by the distance it travels in a unit of time and that objects can move at different speeds.
- **SC.5.P.13.3** Investigate and describe that the more mass an object has, the less effect a given force will have on the object's motion.
- **SC.5.P.13.4** Investigate and explain that when a force is applied to an object but it does not move, it is because another opposing force is being applied by something in the environment so that the forces are balanced.

RESOURCE: MACOMB SCIENCE OLYMPIAD - https://macombso.org/index.php/esoevents/precision-ping-pong-propulsion and https://youtu.be/ekeyxZmgtBc

Scoring:

1. **High score wins.**

2. Score is calculated based on the balls that are contained inside the target and the quality of the practice log.
    a. Each ball that is in the pail at the target center is worth 25 points.
    b. Each ball that is inside the pool but outside the pail is worth 9 points.
    c. Practice logs are worth up to 50 points.
3. A point multiplier will be applied for the orange colored balls.
    a. Orange balls count 3 times the normal value.
    b. Orange ball with the black band counts 5 times the normal value.
4. Penalties may be assessed according to the rules, including:
    a. Outside interference causes a penalty of 50 points.
    b. If any part of the launching device crosses the launch line, a penalty of 50 points is incurred.
5. Ties will be broken by:
    a. Total points in bucket
    b. Total points scored by colored balls
    c. Quality of Practice log

Team #: _____ **School/Team Name: _____**

Precision Ping Pong Propulsion Scoring Rubric

IMPOUND :

		Does the Catapult meet the requirements? (Y/N)
a. Catapult determined to be safe?	**N= Cannot compete; Participation only**	
b. Catapult sits upon rubber or soft material as to not damage floor?	**N = Participation only** ***(supervisor discretion)***	
c. Catapult labeled with team #?	**N= -20 points**	
d. Ping pong balls impounded and labeled	**N= Participation only OR Tier 2**	
e. 2 copies of Practice log provided?	**N = Tier 2**	
f. Impound on time?	**N = Participation only OR Tier 2**	
	TIER?	

LAUNCH SCORE :

		Points
a. Number of WHITE balls in bucket-	_____ X 25	
b. Number of WHITE balls in pool-	_____ X 9	
b. Number of ORANGE balls in bucket-	_____ X 75	
b. Number of ORANGE balls in pool-	_____ X 27	
b. Points for ORANGE ball with BLACK BAND (5X multiplier)	**In bucket? = 125 points; In pool? = 45 points**	
	TOTAL=	

LAUNCH PENALTIES :

		Penalty
a. Catapult labeled with team #? (see above)	**N= -20 points**	
b. Student or device crosses launch line?	**Y = -50 points**	
c. Outside interference?	**Y= -50 points**	
	TOTAL=	

Launch score	-	Penalty Points	+	Practice Log =	**FINAL SCORE (High score Wins)**
	+		-		_____

ROLLER COASTER

DESCRIPTION : Prior to the competition, teams design, build, and test a roller coaster track to guide a sphere that uses gravitational potential energy as its sole means of propulsion to travel as close as possible to a target time. Students MUST bring and wear impact resistant safety goggles. This is a PRE-BUILT EVENT.

COMPETITORS BRING:

- Roller Coaster device;
- Tools needed to adjust the device, if necessary;
- Design log including technical diagrams and data;
- Safety goggles
- Clear glass marbles

NUMBER OF PARTICIPANTS: Maximum of 3

IMPOUND: YES

THE COMPETITION:

CONSTRUCTION:

DEVICE CONSTRUCTION

1. Teams will design and build a roller coaster that allows a ball to travel from a starting point to an ending point in 45 seconds.
2. The device should be designed and built by the students (adult construction assistance is OK). Each device should be designed to operate safely at all times. No points will be awarded for design.
3. Students may not use metal or any sharp material in their build. The device must be safe to move and use. Suggested materials for building include foam pipes, pool noodles, pvc pipe, cardboard, manila folders, paper, etc.
4. Students may not use any pre-fabricated roller coaster kits such as K'nect. Teams may use paper templates that they have to cut and assemble themselves as part of the design. The supervisor should be able to ask questions to the students to determine that they designed the roller coaster for the challenge.
5. The entire device must fit in a 80 cm^2 taped area on the floor of the testing area and must be no taller than 1 meter.
6. The device must be freestanding and able to move from impound to the testing site with ease.
7. Team members may not stand on chairs, tables or anything else to release the ball.
8. Print the team number prominently on the roller coaster. Teams without their team number on the device will be given an initial warning prior to penalty.
9. Teams from the same school may NOT use the same device for a tournament.
10. The marble must run through the track using only gravitational energy. (i.e. no rubber bands or motors)
11. Teams will earn 20-points for each of the following elements that are incorporated into their coaster. In order for these to count toward the score, the marble must successfully pass through the element on the way to the end. Each of these can only count toward the score once but may be used as many times as desired to reach the target time.
    a. DROP- this is a downward portion of track that forms at least a 45-degree angle
    b. INVERSION- portion of the track that turns the marble upside down
    c. HELIX- portion of track that turns at least 360 degrees in an upward or downward spiral
    d. JUMP- track breaks and marble passes over open portion of **at least 10 cm** to the other "side"

12. The marble must stay in the device at the end of the run. This will earn the team 20-points.
13. The total run score will be out of 100 points.

DESIGN LOG

1. The design log should include technical diagrams and a graph/chart showing the speed of the marble.
2. Students must create labeled, technical diagrams of the device. These should include:
    a. At least 2 diagrams showing different views and details of the track
    b. Accurate metric measurements
    c. Labels of any scorable elements (helix, jump, etc.)
3. Prior to the competition, teams should prepare a graph or data chart, with data on the **speed** of the marble using various track adjustments.
4. Teams without a graph or data chart will be placed in Tier 3 and scored below all other teams.

IMPOUND

1. Teams will impound their Roller Coaster, marbles, any tools that may be needed for adjustments before testing (this includes things like tape and rubber bands), and a completed design log. Teams may pick up their design log after testing, as long as there are no arbitrations.
2. During impound, Event Supervisors will evaluate all devices for safety and determine if the device is suitable for testing.
3. Supervisors should note to students possible violations prior to testing so students may arbitrate, if necessary.

TESTING :

1. At testing time, supervisors may request teams move their device to a location other than impound. Students should be able to do this without adult supervision.
2. Once the team is called to set up for testing, no coaching or support from outside is allowed.
3. Any adjustments to the device can only be made with impounded materials. Any adjustments must take less than 5-minutes.
4. Impact-resistant safety goggles (or glasses) are required during launch time. If team members do not wear safety goggles while they are setting up and running their device, they will be given an initial warning and allowed to correct. If a second warning is given, the team will not be allowed to compete **and will receive participation points only**.
5. Teams should show the supervisor where the start and end points are.
6. Teams must give ample warning to the supervisors/timers prior to launch. Warning may be “3,2,1 launching…” etc.
7. Using their marble, the students will release it at the “beginning point”. The ball must be released and not pushed. The event supervisor may have the team redo a launch if pushing is determined.
8. The timers will time the entire run of the device until the marble stops at the “end”.
9. If the ball falls off the track or stops during the run, the students may touch or put the ball back to continue the motion. Each touch earns a **penalty** .
10. If possible, the supervisor will announce their run time to the students.

RELATED FLORIDA STANDARDS :

- **SC.3.N.1.3** Keep records as appropriate, such as pictorial, written, or simple charts and graphs, of investigations conducted.
- **SC.4.P.10.2** Investigate and describe that energy has the ability to cause motion or create change.
- **SC.4.P.12.1** Recognize that an object in motion always changes its position and may change its direction.
- **SC.4.P.12.2** Investigate and describe that the speed of an object is determined by the distance it travels in a unit of time and that objects can move at different speeds.
- **SC.5.P.13.1** Identify familiar forces that cause objects to move, such as pushes or pulls, including gravity acting on falling objects.
- **SC.5.P.13.3** Investigate and describe that the more mass an object has, the less effect a given force will have on the object’s motion.
- **SC.5.P.13.4** Investigate and explain that when a force is applied to an object but it does not move, it is because another opposing force is being applied by something in the environment so that the forces are balanced.

SCORING:

1. **High score wins.**
2. Score is the sum of the RUN SCORE, the LOG SCORE, and the TIME SCORE.
3. Penalties may be assessed as listed in the rules.
4. **Ties will be broken by the lowest vertical height of the Roller Coaster.**

Roller Coaster Scoring Rubric Team Number: A_____

Team Name: _____
Student Names: _____

TIER- DID STUDENTS FOLLOW ALL DIRECTIONS AND SAFETY REQUIREMENTS ?

Were the device and design log impounded before the deadline? **N= Tier 3**	Y	N
Dimensions of the device are no larger than 80 cm X 80 cm X 1 meters **N=Tier 3**		
Vertical height: _____ (used as tiebreaker)	Y	N
Device is safe but has other construction violations. **Y=Tier 2**		
Device was inspected and determined to be safe **N= CANNOT RUN *(Tier 3 and earn participation points only)***	Y	N
Teams received outside assistance during set up or run. **Y=DQ**	Y	N

SCORING

RUN SCORE	**POINTS EARNED**
SCORABLE ELEMENTS (Check each element included and successfully completed) _____ DROP- a downward portion of the track that forms at least a 45 degree angle _____ INVERSION- portion of the track that turns the marble upside down _____ HELIX- portion of track that turns at least 360 degrees in an upward or downward spiral _____ JUMP- track breaks and marble passes over open portion of at least 10 cm to the other "side" _____ **X 20 =**	_____
At the end of the coaster, did the marble stay in the device? **Y= 20 pts; N= 0 points**	_____
Number of times device had to be restarted (MAX penalty of -15 points) _____ **X -5 =**	_____
TOTAL RUN SCORE	_____
TIME SCORE	**POINTS**
What was the run time? AVG TIME: _____ + **1 point for each second up to 45 seconds; -1 point for each second longer than 45 seconds and up to 1.5 min.** TIMER 1: _____ TIMER 2: _____ TIMER 3: _____	_____ (MAY BE NEGATIVE)
LOG SCORE	**POINTS**
____ Quality of Diagram 1 including measurements and labels of any scorable elements (helix, jump, etc.) **(up to 20 pts)** ____ Quality of Diagram 2 including measurements and labels of any scorable elements (helix, jump, etc.) **(up to 20 pts)** ____ Graph or data chart, with data on the **speed** of the marble using various track adjustments **(up to 20 pts)**	_____

FINAL SCORE= RUN SCORE (_____) + TIME SCORE (_____) + LOG SCORE (_____) = _____

PLEASE NOTE THAT THIS RUBRIC IS A SAMPLE AND GUIDE- IN CASES OF CONFLICT WITH THE RULES, THE RULES TAKE PRECEDENCE.

STARRY, STARRY NIGHT

DESCRIPTION: Teams will demonstrate knowledge of astronomical concepts relating to stars and planets.

COMPETITORS BRING:

- Pencil/writing utensil;
- 3-ring binder of any size with any research/reference material. The binder may contain any item, such as a book, computer generated printout, or student created paperwork. No electronic materials are allowed, such as a computer, calculator or smartphone. All materials must be securely bound inside the binder, so that when it is opened vertically (upside down) and given a light shake test no materials will fall out.

NUMBER OF PARTICIPANTS: **Maximum of 2** **IMPOUND:** **NO**

THE COMPETITION:

1. The event may be run as stations, may include a slideshow of images, or may be a "pencil and paper" test.
2. Teams will identify stars and planets from images. Planet identification are limited to those in our solar system and stars are limited to the following:
    - Altair
    - Procyon
    - Castor
    - Sirius
    - Deneb
    - Pollux
    - Regulus
    - Rigel
    - Polaris
    - Vega
    - Antares
    - Spica
    - Betelgeuse
    - Pleiades
    - Sun
3. No more than half of the questions on the exam will be identification questions.
4. Additional questions may be from any of the following topics:
    a. Characteristics of the Sun including:
        i. Atmosphere
        ii. Temperature
        iii. Composition
        iv. Solar winds
        v. Flares
        vi. Sunspots
    b. Characteristics of stars including brightness, color, surface temperature, size, and mass. Students are not expected to know the specific characteristics of individual stars but instead be able to generalize comparisons between the characteristics listed above.
    c. Characteristics of the planets in our solar system- Mercury, Venus, Earth, Mars, Jupiter, Saturn, Uranus, Neptune. Characteristics may include:
        i. Atmosphere
        ii. Relative sizes
        iii. Temperature
        iv. Rotation periods
        v. Distance from the Sun
        vi. Orbital periods
        vii. Number of moons
    d. Distinguish between the motions of rotation and revolution and explain the effects produced by rotation and revolution on Earth.
    e. Describe how understanding of the solar system was changed by the invention of the telescope.

RELATED FLORIDA STANDARDS:

- **SC.4.E.5.1** Observe that the patterns of stars in the sky stay the same although they appear to shift across the sky nightly, and different stars can be seen in different seasons.
    - **SC.3.E.5.1** Explain that stars can be different; some are smaller, some are larger, and some appear brighter than others; all except the Sun are so far away that they look like points of light.
    - **SC.1.E.5.1** Observe and discuss that here are more stars in the sky than anyone can easily count and that they are not scattered evenly in the sky.
- **SC.5.E.5.2** Recognize the major common characteristics of all planets and compare/contrast the properties of inner and outer planets.
- **SC.4.E.5.3** Recognize that the Earth revolves around the Sun in a year and rotates on its axis in a 24-hour day
    - **SC.3.E.5.3** Recognize that the Sun appears large and bright because it is the closest star to Earth.
- **SC.4.E.5.4** Relate that the rotation of Earth (day and night) and apparent movement of the Sun, Moon, and stars are connected
- **SC.3.E.5.5** Investigate that the number of stars that can be seen through telescopes is dramatically greater than those seen by the unaided eye.

SCORING:

- **High score wins.**
- Each question or station will be assigned a predetermined set of points, assigned by the event supervisor **and communicated to the teams (preferably- points are identified on the test/station paperwork).**
- Ties will be broken with pre-determined tie-breaker questions **which are communicated to teams.**

SPECIAL EVENT: PROFESSOR JENSEN'S POTIONS

DESCRIPTION: This event is in memory of Mrs. Samantha Jensen, a supporter of Florida Science Olympiad whose passing was a huge loss to the Florida Science Olympiad community. Teams will be asked questions and/or will conduct experiments at stations as they relate to **science laboratory equipment, chemical reactions, toxins and antidotes. Safety goggles are required.**

COMPETITORS BRING/NEED:

- Safety goggles
- Writing utensil;
- 3-ring binder of any size with any research/reference material. The binder may contain any item, such as a book, computer generated printout, or student created paperwork. No electronic materials are allowed, such as a computer, calculator or smartphone. All materials must be securely bound inside the binder, so that when it is opened vertically (upside down) and given a light shake test no materials will fall out.

NUMBER OF PARTICIPANTS: Maximum of 2 **IMPOUND: NO**

THE COMPETITION:

1. This event leans heavily on elements from the Harry Potter series, a favorite of Ms. Jensen.
2. Each team will move from one station to another. There will be 5 stations that can be completed in any order even though they have numbers. Each station should take approximately the same amount of time.

Station 1: First Year Potions Class

a. This station focuses on activities related to lab safety and laboratory equipment such as:
   i. What is the importance of PPE in the laboratory?
   ii. What are standard safety expectations in a laboratory?
   iii. What are the uses of common laboratory equipment, including graduated cylinders, beakers, flasks, hot water baths, bunsen burners, mortar and pestle, pipettes, pH paper, microscopes, test tubes, well plates, gloves, goggles, aprons, eye wash stations, etc..

Station 2: Second Year Potions Class

a. At Hogwarts, second-year students focused on a specific element of potions and brewed simple potions.
b. This station focuses on simple chemical reactions that include Sodium Bicarbonate (baking soda), Acetic Acid (vinegar), Calcium Carbonate (egg shells), Calcium Chloride, water, and/or Ascorbic Acid (Vitamin C). Sample tasks may include:
   i. Describing the physical and chemical properties of the compounds listed above.
   ii. Performing simple experiments and collecting data using the compounds above
   iii. Identifying the characteristics of a chemical change
   iv. Writing simple chemical equations using the compounds listed above.

Station 3: Third Year Potions Class

a. At Hogwarts, third-year students focused on "Undetectable Poisons".
b. This station focuses on toxic plants. Students will need to be able to identify these plants from images, explain the symptoms of poisoning from these plants, and describe possible remedies/antidotes. The plants that students may be tested on are:
   i. Wolfsbane (*aconitum sp.*)
   ii. Jack-in-the-pulpit (*Arum maculatum*)
   iii. Lily of the Valley (*Convallaria majalis*)
   iv. Poison sumac (*Toxicodendron vernix*)
   v. Poison Ivy (*Toxicodendron radicans*)
   vi. Water Hemlock (*Cicuta maculata*)
   vii. Tobacco (*Nicotiana tabacum)*
   viii. Mistletoe (*Viscum album*)

Station 4: Fourth Year Potions Class

a. At Hogwarts, fourth-year students focused on "Poison Antidotes"
b. This station focuses on toxic animals. Students will need to be able to identify these animals from images, explain the symptoms of poisoning/envenomation from these animals, and describe possible remedies/antidotes. The animals that students may be tested on are:
    i. Poison dart frogs (*Dendrobates sp*)
    ii. Portuguese man o'war (*Physalia physalis*)
    iii. Fattail scorpion (*Androctonus australis*)
    iv. Cone snails (*Class Conoidea*)
    v. Cane toad (*Rhinella marina*)
    vi. Box jellyfish (*Carukia barnesi*)
    vii. Fire salamander (*Salamandra salamandra*)
    viii. Olive Sea Snake (*Aipysurus laevis*)

Station 5: Fifth Year Potions Class

a. At Hogwarts, fifth-year students focused on properly brewing potions using directions.
b. Students will be asked to complete a lab activity following directions from the supervisor which may include:
    i. Mixing reagents and measuring: reaction rate, production of gas, color change, development of a precipitate
    ii. Separating mixtures
    iii. Determination of pH

RELATED FLORIDA STANDARDS:

- **SC.5.P.8.1** Compare and contrast the basic properties of solids, liquids, and gases, such as mass, volume, color, texture, and temperature
- **SC.3.P.8.1** Measure and compare temperatures of various samples of solids and liquids.
- **SC.3.P.8.2** Measure and compare the mass and volume of solids and liquids.
- **SC.5.P.8.3** Demonstrate and explain that mixtures of solids can be separated based on observable properties of their parts such as particle size, shape, color, and magnetic attraction.
- **SC.5.P.8.2** Investigate and identify materials that will dissolve in water and those that will not and identify the conditions that will speed up or slow down the dissolving process.
- **SC.5.P.9.1** Investigate and describe that many physical and chemical changes are affected by temperature.

SCORING:

1. **High score wins.**
2. Each question or station will be assigned a predetermined set of points, assigned by the event supervisor **and communicated to the teams (preferably- points are identified on the test/station paperwork).**
3. Ties will be broken by predetermined questions.