

## Wallace Community College – Science Decathlon

### Activity Descriptions

#### What on Earth Synopsis

Student teams will have a combined total of 25 different rock and mineral samples to identify. Students will enter the classroom and be assigned to a station. The station will consist of the rock or mineral sample placed behind a partition. Once time is called, students will have one minute to identify the rock or mineral at the assigned station. After one minute, an announcement will be made for teams to rotate to the next station. Once all the teams are in place, students will have one minute to identify the next rock or mineral sample. The process will repeat until all teams have had a chance to identify the sample at each station. Once the event is complete, students will remain in the classroom quietly until time to participate in the next activity.

#### Division I- Life Science

##### ***What Would Nature Do?***

Event Description:

The “*What Would Nature Do?*” event encompasses the fundamentals of ecology and conservation biology. The students will analyze terrestrial food webs, calculate energy available in ecological pyramids, use a dichotomous key, recognize symbiotic relationships, test drinking water for common contaminants, and analyze a conservation biology issue. This event is divided into four stations for a total of 100 possible points.

**Station 1 – Fundamentals of Ecology** - The students will analyze a terrestrial food web, identify organisms at each trophic level and calculate the amount of energy available at each level of an energy pyramid. The team will answer 10 multiple choice questions for this station, each question worth 2 points each for a total of 20 points.

**Station II – Identify Invertebrate Specimens** - The students will use a dichotomous key to identify 5 invertebrate specimens worth 4 points each (20 points). The team will also analyze 2 species interaction scenarios and identify the correct symbiotic relationship for each scenario worth 5 points each (10 points). This station is worth 30 points total.

**Station III – Water Monitoring and Analysis** - The students will use a water quality testing kit to determine at least 2 common contaminants in drinking water (worth 5 points each). Each team will answer 10 questions (worth 2 points each) related to data interpretations and testing procedures. This station is worth 30 points total.

**Station IV – Conservation** – Each team will be presented with an environmental crisis issue and they will be required to identify the source of the problem and answer questions related to conservation planning. This station includes 10 multiple choice questions worth 2 points each for a total of 20 points.

The study packet consists of presentations and printable notes from which the hands-on event, the quiz bowl, and the written exam will be formed.

#### Division I- Physical Science

##### ***Stop, Drop and Eggroll***

Event Description:

The “*Stop, Drop and Eggroll*” event allows students the opportunity to explore the concepts of gravitational force, free-fall, and wind resistance. The objective will be to drop a large raw egg from a second floor balcony without breaking the egg! This can involve slowing decent, resisting the force of gravity, and/or reducing the force of impact. The students will work in teams of 2 to design and build an **EDD** (egg drop device). Each team will test their device by dropping an egg off the second floor balcony of the Science Building. The students will be given a budget and a defined list of materials that they may “purchase” to protect their egg. Each team should strive to be successful using the lowest budget possible. The students should be able to describe, define, and do simple calculations concerning the basic Newtonian Physics concepts of Force, Mass, Speed/Velocity, and Acceleration.

**Station 1 – Design and Build** – The students will have 20 minutes to design their device, purchase materials, and build their EDD. Each team will send one team member to “purchase” materials from the *Stop, Drop and Eggroll* supplies store. The team will work together to build the device using at least 5 items off the materials list. Each team may use more than 5 items off of the material list. The materials list will be included in the study packet for the event as well as the “cost” for each item. The cost for each team’s device will be used in the event of a tie (lowest cost wins) therefore students are encouraged to be successful using the lowest budget possible.

**Station 2 – Egg Drop** – Each team will drop their eggs off the second floor balcony of the Science Building. The balcony is large enough for 2 teams to drop at a time. The egg drop is worth 50 points (see scoring rubric for

details) and each team's egg drop will be timed by a Decathlon member. A data table (provided in the study packet) must also be completed. The data table will involve determining mass and performing simple calculations concerning force, mass, speed/velocity and acceleration. The completed data table is worth 50 points. The entire event is worth 100 points.

Each team must bring 3 raw large eggs. The materials for constructing the egg drop device will be supplied by Wallace Community College. The list of materials and the cost for each material will be included in the study packet. The balcony drop dimensions will be included in the study packet as well. In addition, the study packet consists of printable notes and a data table from which the hands-on event, the quiz bowl, and the written exam will be formed.

## **Ramp It Up**

### **Long Description**

Teams will construct a car with a mass that does not exceed 200.00 grams, a length of 11.5 cm, and a width of 5.5 cm. Teams cannot buy any type of pre-made kit to construct their car or any pre-fabricated car. In addition, students cannot construct any type of car with a motor. If students try to compete with a pre-fabricated car, a car built from a kit, or a car that contains a motor, the teams will be disqualified. However, teams can purchase pre-made wheels. Student teams will enter the classroom and will be instructed to position their vehicle at the top of an inclined track. The track will have been constructed by Wallace Community College Science Faculty. When instructed to do so, student teams will release their car at the top of the track. The track length is approximately 1.2 meters long. The car will propel itself down the track with gravitational potential energy. The time it took the car to reach the target point at the end of the track will be recorded. If a problem arises during the run due to the car not being positioned correctly at the top of the ramp, then student teams will be permitted to repeat the run only once. After the vehicle has reached the target point, and the time has been recorded, then student teams will use mass, distance, and time data to answer three questions. Vehicles will be weighed and impounded when teams first arrive on campus in the morning. Once teams have turned in their car, students will not be allowed to handle their cars until they are instructed to place the vehicle at the top of the track.

## **Microbial Mysteries**

### **Division II Event**

This event will spotlight the incredibly mysterious microbial world. Not only will this event target infectious diseases and outbreaks, but also microbial anatomy, physiology, basic metabolism and pathogenicity. We will explore water and food borne illnesses; vector mediated illnesses as well as emerging and reemerging infectious disease. For each of these topics, teams will be asked questions concerning microbial anatomy, physiology, basic metabolism and pathogenicity. They will be expected to visually identify these microorganisms as well extract information from case studies to determine the causative agent. Students may be asked to interpret charts, complete basic calculations, graphs and microbial slides/images. Basic microscopy may be utilized. Therefore, students entered in this event should possess the necessary microscope skills. (Basic microscopy is covered in the Forensic Frenzy Decathlon Event.)

#### **Station 1 – Basic Microbial Anatomy, Physiology, Metabolism and Terminology**

This station will consist of general microbial terminology, prokaryotic and eukaryotic cell structure and function, and viral structure and function. This terminology used in this unit is also applicable to each of the other stations in this event.

#### **Station 2 – Infectious Diseases and Outbreaks**

A disease outbreak is the occurrence of cases of disease in excess of what would normally be expected in a defined community, geographical area or season. An outbreak may occur in a restricted geographical area, or may extend over several countries. It may last for a few days or weeks, or for several years. A single case of a communicable disease long absent from a population, or caused by an agent (e.g. bacterium or virus) not previously recognized in that community or area, or the emergence of a previously unknown disease, may also constitute an outbreak and should be reported and investigated.

This station will consist of general microbial vocabulary, correlation of condition, transmission vehicle, etiologic agent, signs, symptoms, risk factor, visual identification and treatment for major infectious diseases and outbreaks. When studying for this event, emphasis should be placed on the Center for Disease Controls (CDC) major outbreaks that have occurred in the last three to five years.

#### **Station 3 – Water borne illnesses**

Water borne diseases are caused by pathogenic microorganisms that most commonly are transmitted in contaminated fresh water. Infection commonly results during bathing, washing, drinking, in the preparation of

food, or the consumption of food thus infected. Various forms of waterborne diarrheal disease probably are the most prominent examples, and affect mainly children in developing countries; according to the World Health Organization, such disease account for an estimated 4.1% of the total DALY global burden of disease, and cause about 1.8 million human deaths annually. The World Health Organization estimates that 88% of that burden is attributable to unsafe water supply, sanitation and hygiene.

### **Have you got a Clue Complete Synopsis**

Students will enter the assigned classroom and will be directed to the appropriate station. At each station, samples of the seven solutions will be present in labeled beakers. In addition, students will be provided with stirring rods, litmus paper for pH testing, iodine solution, dialysis tubing, transfer pipets, deionized water, graduated cylinders, and beakers. After students are assigned to the appropriate station, the teams will be given the signal to begin. Teams will then have 40 minutes to perform basic laboratory tests to determine if each solution is an example of an acid, base, hypotonic solution, etc. Once students determine the identity of each solution, then teams will record the identity on the provided answer document. During the activity, students may discuss the results of testing with their team members. However, discussion between teams is prohibited. Students are only allowed to bring safety goggles, aprons, gloves, and pencils into the room. These items will be checked prior to the event beginning. If students bring any other items into the room, the items will be confiscated and returned at the end of the day. Student teams caught cheating during the event or discussing results with other teams will be disqualified. Once student teams complete the event, the answer document must be turned in. The time at which the sheet was turned in will be notated at the top of the page. Teams will remain quietly in the room until time to proceed to the next event.

### **Division II- Life Science**

#### ***BLOOD is thicker than WATER***

Event Description:

The ***BLOOD is thicker than WATER*** Division II- Life Science event encompasses the overall anatomy and physiology (structure and function) of selected human body systems, the effects of aging, and diagnosing the disease process on these systems. The two systems for this year's event are the Circulatory/Cardiovascular and Urinary systems.

#### **Fall 2013 Body Systems:**

**Circulatory/Cardiovascular system**

**Urinary system**

Each team in the event will analyze and label models of the heart, veins and arteries, kidneys, and the nephron. They will perform a blood typing sample and use knowledge of blood typing scenarios to answer generic questions on blood types. The team will use whole blood smears to identify formed elements, and identify the five types of WBCs. Finally, each team will use a selected urine sample for a basic urinalysis profile. From their observations, knowledge of these two systems, and/or results from the activities mentioned, the team will answer questions about a major disease or make an educated diagnosis from sample scenarios. For each of these, teams will be asked questions related to terminology, anatomy and/or physiology of these two systems and use their knowledge to interpret two individual case studies. One case study will focus on abnormal circulatory/cardiovascular information based on a normal vs. abnormal EKG reading. One case study will focus on an abnormal urinary condition. Students will be asked to interpret charts, graphs, models, etc. related to these two systems as they rotate around the ten stations throughout the room. The study packet consists of presentations and printable notes from which the hands-on event, the quiz bowl, and the written exam will be formed.

Related Alabama COS Objectives:

### **HUMAN ANATOMY AND PHYSIOLOGY ELECTIVE CORE**

9. Identify structures and functions of the cardiovascular system.

- Tracing the flow of blood through the body
- Identifying components of blood
- Describing blood cell formation
- Distinguishing among human blood groups
- Describing common cardiovascular diseases and disorders

*Examples: myocardial infarction, mitral valve prolapse, hypertension, arteriosclerosis, EKG*

13. Identify structures and functions of the urinary system.

- Tracing the filtration of blood from the kidneys to the urethra
- Recognizing diseases and disorders of the urinary system

*Examples: kidney stones, urinary tract infections, renal failure*

### **Complete Synopsis Fallout!**

Teams will enter the chemistry lab and go to an assigned station. At each station, five different sets of reagents will be pre-weighed, labeled, and placed in weighing dishes. Each station will also contain five different 250 mL beakers and 3 stirring rods. Deionized water will be available for students to dissolve and mix reagents. Chem wipes and deionized water will also be available for cleaning the stirring rods. After students are assigned to the appropriate stations and each station is checked, students will be instructed to begin. Teams will have 40 minutes to mix each set of reagents and determine if a precipitate forms. If a precipitate forms, then students will need to write the balanced chemical equation, net ionic equation, and name the precipitate on their answer sheet. If no precipitate forms, then students need to state no precipitate forms on their answer document. Once students complete the event, teams may turn in their answer document. The time at which the document was turned in will be notated at the top of the page. Students can then return to their station and remain quiet until the event ends. Once time is called, all remaining answer documents will be collected. During the event, team members may consult quietly with each other in order to complete the answer sheet. Students are allowed to bring in safety goggles, aprons, and gloves. These items will be checked prior to the event beginning. Students are not allowed to bring any other items into the chemistry lab. If teams violate this rule, then the items will be confiscated and returned at the end of the day. Any team caught cheating will be disqualified from the event.

### **Division II- Life Science**

#### **FORENSICS FRENZY**

Event Description:

*FORENSICS FRENZY* Division II- Life Science event encompasses the overall concepts taught in the Elective Core of the Forensics Science class.

Each team in the event will analyze fingerprints and hair samples as evidence left at a crime scene. They will perform an ink chromatography for sample evidence left at the scene of the crime. The team will be responsible for vocabulary and generalized forensics concepts as well as lab safety and techniques. Finally, each team will determine the profile of the perpetrator of the crime based on the previous analysis. Students will be asked to interpret information related to forensics as they rotate around the five stations throughout the room.

The study packet consists of a presentation and printable documents from which the hands-on event, the quiz bowl, and the written exam will be formed.

Related Alabama COS Objectives: Biology Core #1; Forensic Science Elective Core #s 2 and 10

### **The Crafty Cell**

In this activity, students will work in pairs to build a model of a plant or animal cell, using craft materials to represent different cell parts and organelles. Once the models are assembled, student pairs will complete a chart identifying (1) which craft material was used to indicate the organelle, (2) the similarity of that craft material to the actual organelle and (3) the function of the organelle. Student pairs must also be prepared to (4) compare and contrast the contents and structure of the plant and animal cell models.

Student pairs will draw for a plant or animal cell as they enter the lab. Once assigned a plant or animal cell they will proceed to a designated lab station where **15** different craft materials will be available to create the assigned model. Students will also be provided a scoring rubric and pencils to complete the four (4) sections on the chart listed above. (See study packet for organelle list and other important information.)

Models must be constructed and the answer sheet completed within a **35 minute time limit**.

