Experiments, Mini Project and Competition for Physics Enrichment Camp

Experiment: Deflection of electron in electric and magnetic field

Electrons are negatively charged particles and they can be produced by thermionic emission. Scientists can control its motion by using electric and magnetic field. In this experiment, students will be presented with an experimental setup which demonstrates how the motion of electrons will change under the influence of electric and magnetic field.

Students will also be presented how a uniform electric and magnetic field can be produced in an experiment, as well as how the motion of electron remains unchanged under the effect of both electric and magnetic field.

Experiment: Plane-polarized light

Light is an electromagnetic radiation and it is a transverse wave. The direction of oscillation of electric field in light is random in unpolarized light, while there is only one particular direction of oscillation in polarized light. In this experiment, students will be presented how polarized light can be produced from unpolarized light by using polarizer.

They will also be demonstrated how cross polar can be used to reduce the intensity of light. Apart from that, the presence of polarized light in everyday life will also be made known to them.
**Experiment: Wave, Resonance and Sound**

In this experiment, students will be exposed to some items which produce sound. They will also be introduced the idea of resonance, and how resonance actually brings lively sounds to our everyday lives.

Students will also get a chance to visit the acoustic lab in the department, which they will be able to listen to crisp sound inside the lab. They will also get to know the difference between the notes being produced by different instruments. So students, open up your ears and enjoy the good quality sound from the acoustic lab.

**Experiment: Physics of Fluids**

Fluids are all around us, and it is interesting to know about the physics of it. The principle of flotation allows us to feel lighter in water, and the airplane that we have in everyday life is an application of Bernoulli’s principle. The study of interaction between fluids between matters is an important aspect in car racing, swimming and other competitions as well.

Students will be demonstrated the working principles in fluids, as well as applications of them in everyday life. They will also be given a chance to experience Newtonian fluid and non-Newtonian fluid.
Experiment: Collision on Air Track

In this experiment students will discover the underlying Physics of colliding bodies, using data loggers, photo gates, and frictionless air track (see Figure).

Experiment: Circular Motion

In this experiment, students will delve into the relationship between centripetal force, radius of rotation, period, and rotating speed, using a centripetal force apparatus.
Experiment: Trajectories of a Projectile

An example of motion with constant acceleration is that of a projectile falling under the influence of gravity alone, near the surface of the earth. The parabolic trajectory of a projectile can be easily illustrated with a jet of water. In this experiment a water projection apparatus is used to produce a steady stream of water jet. The thrust angle and the speed of the jet may be varied. The trajectory formed by the jet of water can be traced with the help of a set of plastic strips mounted next to the jet as shown in Figure 1. The strips are equally spaced horizontally and the height of the jet can be read using the scale printed on them. By changing the thrust angle and the speed of the jet, the trajectories of a projectile can be studied.
Mini Project & Competition

**Competition 1: Cartesian Diver**

Cartesian diver is a toy based on the Pascal principle or Archimedes principle. Pascal principle states that the pressure applied to an enclosed fluid is transmitted undiminished to every part of the fluid. The Archimedes principle states that the buoyant force is equal to the weight of the fluid displaced. Depending on the design and competition requirements, one can design the diver such that it can fulfill the objectives.

Students will be provided raw materials on the spot, and there will be helpers teaching how to make a Cartesian diver. They can get themselves into groups to make a diver, in order for it to meet the requirements set by the organizer.

This competition will allow students to make their own physics toys and from the making of such toys, the concept of Pascal principle and Archimedes principle will be clearer to them.

**Competition 2: Racing with superconductor**

Superconductivity was first discovered by Heike Kamerlingh Onnes in 1911, by discovering the negligible resistance in mercury at 4.2K. It is a state which the resistance suddenly drops to zero when the temperature of the material is cooled below a critical temperature ($T_C$). Superconductors are able to levitate on top of a magnet, and this phenomenon is called Meissner effect.

Before high temperature superconductors were discovered, the common refrigerant for the superconductivity experiments was liquid helium, which was very expensive. The creation of high temperature superconductors (YBCO, $T_C = 98K$) allows people to use liquid nitrogen (b.p. 77K) as coolant, which is a cheaper alternative as nitrogen is in greater abundance than helium.

In this competition, students will get to play with YBCO and use them to compete on a “racing track”. They will also be able to see liquid nitrogen in action, learning the dangers in handling liquid nitrogen.