

## Five Star Science 2007

(Some sample topics for the 5 content areas created by coaches that attended the Hammond Coaches Clinic)

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### Inquiry & Data Analysis

Graphing

Data tables (finding outliers)

Interpolation/extrapolation

Given data or graph and interpret

Significant figures

Best-fit curves

Matrices

Use trig for determining height

Calculate time of day or latitude from shadows

Determine the thickness of foil given its density and a ruler

Given an object with a portion missing, calculate the volume of the missing piece

Find the volume of water that fell onto a football field during a rainstorm with a given depth per hour (2 inches per hour for 6 hours) of rainfall

### Chemistry

Titration

Measure pH

Conductivity

Density

Balancing equations (stoichiometry)

Chromatography

Combustion

$PV=nRT$

Predict elements on periodic table

Periodic trends

Qualitative analysis

Starch or lipid activity

Electromagnetic radiation

Redox reactions

Orbitals

Quantum numbers

Electron configuration

Lewis diagrams

Bonding

Radioactive decay

Arrhenius acids

Lewis acids

Bronstead acids

Basic chemical reactions

Specific heat of a metal by measuring water temperature change

Use a titration curve to determine the equivalence point and/or the concentration of an unknown acid or base

Micro scale determination activity series of nonmetals

Calorimetry experiment (piece of metal in boiling water is removed and placed in water, change in temp and mass of metal recorded, identity of metal determined by calculating specific heat of metal.)

## Physics

Pendulums

Calculate velocity

Acceleration

Force

Power

Work

Torque

Energy

Momentum

Angular Momentum

Bernoulli effect

Conservation laws

Simple lenses

Reading v/t or d/t graphs

Calculating or measuring current, voltage, resistance

Wave intensity

Coefficient of friction of Z surfaces

Measure G

Photoelectric effect

Rolling a ball off a ramp and determining its KE based on the distance it flies through the air

Measure the acceleration of gravity by dropping an object

Confirm experimentally that the gravitational pull of the earth is  $9.8 \text{ N/kg}$ , or that objects fall at  $9.8 \text{ m/s}^2$

Electromagnetic induction

Photoelectric effect – ex. measure the work function of a material inside a photocell

Ratio's - ex. if the earth is the size of a basketball, how large or far away will \_\_\_\_\_ be?

Measure the index of refraction of a material

Confirm that the conservation of energy works

Calculate the mechanical advantage or torque of a simple machine

Find the focal point of a lens

Young's Modulus problem (stress and strain)

Archimedes principle lab (buoyancy)

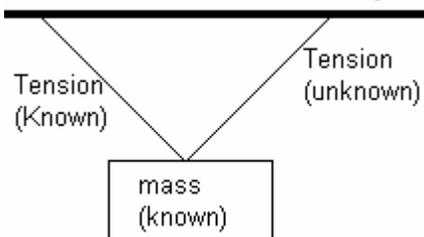
Calorimetry problem

Kirchoff's law problem

Magnetic field around a wire (electromagnetism)

Given a 3x5 card, a meter stick and lens, determine the focal length of the lens with the equipment provided and your knowledge of optics (should be in physics)

Static equilibrium problem regarding Newton's second law – ex. Have a known mass suspended from two strings that are hung from the ceiling at an angle. If one of the tensions of one of the strings is known, figure out the tension of the other string.



## Biology

Photosynthesis

Meiosis

Mitosis

## **Biology (cont'd)**

Cell structures (nuclei, mitochondria, ribosomes, etc.)

Amino acids

Nucleic acids

DNA

Biomes

Punnet squares

Pedigrees

Classification

Graphing predator/prey

Sampling population densities

Triangulate animal locations

Infer situation from map of footprints

Construction of dichotomous keys

Reading dichotomous keys

Specimens/make food web

Activities on a cellular level

Adaptation of animals

Flow of blood thru the heart

Flow of oxygen thru the body

Hardy-Weinberg problems

Calculate field of view of a microscope and then estimate the size of the object. Convert to micrometers

Kreb's cycle

## **Earth/Space Science**

Tectonics

Glaciology

Cartography

Oceanography

Spectroscopy

Layers of the atmosphere

Density of minerals

Angle of repose

Organize rocks or minerals

Calculate epicenter

Predict location of oil field given cross section

Measure turbidity

Predict weather from maps

Calculate relative humidity

Measure recession of glaciers

Calculate stream gradients

Interpret HR diagram

Calculate from remote pictures forest area lost or area flooded by a dam

Stellar evolution (sort pictures)

Ratio, parallax & equations

Displacement of water

Read or use topographical maps

What is the first of the 3 stages of coal to form from peat? ans: Lignite

Determine sequence of cross-cutting relationships.

Calculate age of samples using radiometric-dating techniques.

Predict weather given a weather map and current conditions.