

OAPT Contest Topics

Based on the Ontario Curriculum for SPH3U Revision 2009

Note to Teachers:

The content of the OAPT Grade 11 Physics Contest is drawn from the Ontario SPH3U Grade 11 physics curriculum 2009 Revision, plus one question from current events in physics, and one question on the current Nobel Prize in physics, for a total of 30 multiple-choice questions. Contestants are expected to be familiar with SI units and dimensional analysis, as well as mathematics skills related to physics, including but not limited to ratio and proportion, graphing and estimation.

The contest will emphasize understanding of concepts over calculations, although students will be expected to know and be able to use relevant equations.

Best regards,

Rolly Meisel rollym@vaxxine.com

Margareta Cruceanu margaretac@web.bondacademy.ca

Contest authors

Kinematics (6 questions)

- time, distance, position, displacement, speed, velocity, and acceleration
- constant, average and instantaneous quantities
- position-time, velocity-time, and acceleration-time graphs
- one dimensional kinematics problems using

$$v_{av} = \frac{v_1 + v_2}{2} \quad \Delta d = \frac{v_1 + v_2}{2} \Delta t \quad \text{and} \quad \Delta d = v_1 \Delta t + \frac{1}{2} a (\Delta t)^2$$

- terminal velocity
- distance, position and displacement using vector diagrams
- uniform acceleration equations
- uniform and non-uniform linear motion in one and two dimensions
- projectile motion in two dimensions
- work with position-time, velocity-time, and acceleration-time graphs

Forces (6 questions)

- Newton's Laws of Motion
- free-body diagrams
- vector diagrams
- gravity, weight and free-fall
- static and kinetic friction

Energy and Society (5 questions)

- force, work and displacement
- transformations of energy in physical systems
- conservation of energy
- power
- energy input, output and efficiency
- heat problems involving $Q = mc\Delta T$, $Q = mL_t$ and $Q = mL_v$
- heating and cooling curves
- kinetic molecular theory
- conduction, convection and radiation
- mass-energy equivalence
- energy involved in nuclear fission and fusion
- nuclear isotopes
- nuclear radiation and half-life
- nuclear reactors
- methods of generating electric energy

Waves and Sound (5 questions)

- longitudinal and transverse waves
- cycle, frequency, period, amplitude, phase, wavelength
- speed of waves in a medium
- speed of sound in warm and cold air
- superposition of waves
- interference, standing waves, beats and resonance

- vibrating air columns
- vibrating strings
- the Doppler Effect (qualitative terms only)

Electricity and Magnetism (6 questions)

- electric charge
- current flow and electron flow
- potential difference and resistance
- direct and alternating current
- power and energy in electrical circuits
- series, parallel, and mixed circuits
- Ohm's Law
- Kirchhoff's Laws
- Oersted's principle
- magnetic field around a straight conductor
- magnetic field around a solenoid
- the motor principle
- Faraday's Law
- Lenz's Law and the right-hand rule
- generators
- transformers
- transmission of electrical energy

Current Events in Physics (1 question)

- a question based on a current event in physics as reported in the popular media

Current Nobel Prize in Physics (1 question)

- a question based on the winner of the current Nobel Prize in physics