**PACE ACADEMY**
PHYSICS 1
**CURRICULUM GUIDE**
S.Y. 2020-2021

| Most Essential Learning Competencies | Science Lessons |
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| **FIRST QUARTER** | |
| Solve measurement problems involving conversion of units, expression of measurements in scientific notation | Lesson 1: Measurement in Physics |
| Differentiate accuracy from precision | Lesson 2: Uncertainties and deviations in measurement |
| Differentiate random errors from systematic errors | Lesson 3: Sources and types of errors |
| Estimate errors from multiple measurements of a physical quantity using variance | |
| Differentiate vector and scalar quantities | Lesson 4: Vectors and vector addition |
| Perform addition of vectors | |
| Rewrite a vector in component form | Lesson 5: Components of a vector |
| Convert a verbal description of a physical situation involving uniform acceleration in one dimension into a mathematical description | Lesson 6: Kinematic equations of motions |
| Interpret displacement and velocity, respectively, as areas under velocity vs. time and acceleration vs. time curves | Lesson 7: Graphical analysis of linear motion |
| Interpret velocity and acceleration, respectively, as slopes of position vs. time and velocity vs. time curves | |
| Construct velocity vs. time and acceleration vs. time graphs, respectively, corresponding to a given position vs. time-graph and velocity vs. time graph and vice versa | |
| Solve for unknown quantities in equations involving one-dimensional uniformly accelerated motion, including free fall motion | Lesson 8: Uniformly accelerated motion |
| | Lesson 9: Free-fall motion |
| Solve problems involving one-dimensional motion with constant acceleration in contexts such as, but not limited to, the "tail-gating phenomenon", pursuit, rocket launch, and free- fall problems | Lesson 10: One-dimensional uniformly acceleration problems |
| Describe motion using the concept of relative velocities in 1D and 2D | Lesson 11: Two-dimensional motion |
| Deduce the consequences of the independence of vertical and horizontal components of projectile motion | Lesson 12: Projectile motion |

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| Calculate range, time of flight, and maximum heights of projectiles | |
| Infer quantities associated with circular motion such as tangential velocity, centripetal acceleration, tangential acceleration, radius of curvature | Lesson 13: Circular motion |
| Define and identify different types of forces | Lesson 14: Force and its representations |
| Draw free-body diagrams | |
| Determine the net force | |
| Apply Newton's 1st law to obtain quantitative and qualitative conclusions about the contact and noncontact forces acting on a body in equilibrium | Lesson 15: Newton's first law |
| Differentiate the properties of static friction and kinetic friction | Lesson 16: Friction |
| Apply Newton's 2nd law and kinematics to obtain quantitative and qualitative conclusions about the velocity and acceleration of one or more bodies, and the contact and noncontact forces acting on one or more bodies | Lesson 17: Newton's second law |
| Identify action-reaction pairs | Lesson 18: Newton's third law |
| Determine the work done by a force acting on a system | Lesson 19: Work done by a force |
| Interpret the work done by a force in one- dimension as an area under a Force vs. Position curve | |
| Relate the gravitational potential energy of a system or object to the configuration of the system | Lesson 20: Potential energy |
| Relate the elastic potential energy of a system or object to the configuration of the system | |
| Explain the properties and the effects of conservative forces | Lesson 21: Conservation of energy |
| Use potential energy diagrams to infer force; stable, unstable, and neutral equilibria; and turning points | |
| Differentiate center of mass and geometric center | Lesson 22: Center of mass |
| Relate the motion of center of mass of a system to the momentum and net external force acting on the system | |
| Relate the momentum, impulse, force, and time of contact in a system | Lesson 23: Impulse and momentum |
| Compare and contrast elastic and inelastic collisions | Lesson 23: Collisions |
| Apply the concept of restitution coefficient in collisions | |
| **SECOND QUARTER** | |

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| Calculate the moment of inertia about a given axis of single-object and multiple-object systems | Lesson 24: Moment of inertia |
| Calculate magnitude and direction of torque using the definition of torque as a cross product | Lesson 25: Torque |
| Apply the rotational kinematic relations for systems with constant angular accelerations | Lesson 26: Rotational dynamics |
| Determine angular momentum of different systems | Lesson 27: Angular momentum |
| Apply the torque-angular momentum relation | |
| Use Newton's law of gravitation to infer gravitational force, weight, and acceleration due to gravity | Lesson 28: Newton's law of universal gravitation |
| Discuss the physical significance of gravitational field | |
| For circular orbits, relate Kepler's third law of planetary motion to Newton's law of gravitation and centripetal acceleration | Lesson 29: Kepler's law of planetary motion |
| Relate the amplitude, frequency, angular frequency, period, displacement, velocity, and acceleration of oscillating systems | Lesson 30: Periodic motion |
| Recognize the necessary conditions for an object to undergo simple harmonic motion | |
| Calculate the period and the frequency of spring mass, simple pendulum, and physical pendulum | |
| Differentiate underdamped, overdamped, and critically damped motion | |
| Define mechanical wave, longitudinal wave, transverse wave, periodic wave, and sinusoidal wave | Lesson 31: Production and properties of mechanical waves |
| From a given sinusoidal wave function infer the speed, wavelength, frequency, period, direction, and wave number | |
| Apply the inverse-square relation between the intensity of waves and the distance from the source | |
| Describe qualitatively and quantitatively the superposition of waves | |
| Apply the condition for standing waves on a string | |
| Relate density, specific gravity, mass, and volume to each other | Lesson 32: Density |
| Relate pressure to area and force | Lesson 33: Pressure |
| Relate pressure to fluid density and depth | |
| Apply Pascal's principle in analyzing fluids in various systems | |
| Apply the concept of buoyancy and Archimedes' principle | Lesson 34: Archimedes' principle and buoyancy |

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| Apply Bernoulli's principle and continuity equation, whenever appropriate, to infer relations involving pressure, elevation, speed, and flux | Lesson 35: Hydrodynamics |
| Convert temperatures and temperature differences in the following scales: Fahrenheit, Celsius, Kelvin | Lesson 35: Heat and temperature |
| Explain the connection between the Zeroth law of thermodynamics, temperature, thermal equilibrium, and temperature scales | |
| Define coefficient of thermal expansion and coefficient of volume expansion | Lesson 36: Thermal expansion |
| Calculate volume or length changes of solids due to changes in temperature | |
| Solve problems involving temperature, thermal expansion, heat capacity, heat transfer, and thermal equilibrium in contexts such as, but not limited to, the design of bridges and train rails using steel, relative severity of steam burns and water burns, thermal insulation, sizes of stars, and surface temperatures of planets | |
| Enumerate the properties of an ideal gas | Lesson 37: Thermal expansion of gases and gas laws |
| Solve problems involving ideal gas equations in contexts such as, but not limited to, the design of metal containers for compressed gases | |
| Interpret PV diagrams of a thermodynamic process | Lesson 38: The first law of thermodynamics |
| Compute the work done by a gas using dW=PdV | |
| State the relationship between changes internal energy, work done, and thermal energy supplied through the First Law of Thermodynamics | |
| Differentiate the following thermodynamic processes and show them on a PV diagram: isochoric, isobaric, isothermal, adiabatic, and cyclic | |
| Calculate the efficiency of a heat engine | Lesson 39: The first law of thermodynamics |
| Describe reversible and irreversible processes | |
| Explain how entropy is a measure of disorder | |
| State the 2nd Law of Thermodynamics | |
| Calculate entropy changes for various processes e.g., isothermal process, free expansion, constant pressure process, etc. | |

**References:**

Giancoli, D. C. (2014). Physics: Principles with applications (7th ed.). Addison-Wesley.

Serway, R., Faughn, J., & Vuille, C. (2009). College physics (8th ed.). Cengage Learning.

Silverio, A. A. (2017). Exploring through life series: General physics 1. Phoenix Publishing House.

Young, H. D., & Freedman, R. A. (2012). Sears and Zemansky's University physics with modern physics (13th ed.). Pearson.

The Physics Classroom. https://www.physicsclassroom.com/

**Time Allotment:** Four (4) synchronous sessions (40 minutes per session); Five (5) asynchronous sessions (40 minutes per session)

**Promotion/Retention:**

- Assessments will be categorized as the following with the corresponding weight:
    - Short Quizzes (20%)
    - Written Outputs (35%)
    - Product and Performance Tasks (45%)
- **Short Quizzes**. These include summative assessments after every lesson, group of related lessons, or chapter.
- **Written Outputs**. These include concept maps, data recording and analyses, laboratory reports and documentations, reaction/reflection papers, article reviews, and surveys.
- **Product and Performance Tasks**. These include portfolios, investigatory projects, models and diagrams construction, prototype building, research papers, debates, designing and implementation of action plans, designing various models, doing scientific investigations, issue-awareness campaigns, laboratory activity, multimedia presentations, simulation, skills demonstration, and verification experiments.