# IB LEARNER PROFILE

IB Programs aim to develop internationally minded people who are striving to become:

<table>
<thead>
<tr>
<th>Role</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Inquirers</td>
<td>Their natural curiosity is nurtured. They acquire the skills necessary to conduct constructive inquiry and research, and become independent active learners. They actively enjoy learning and this love of learning will be sustained throughout their lives.</td>
</tr>
<tr>
<td>Knowledgeable</td>
<td>They explore concepts, ideas and issues, which have global relevance and importance. In so doing, they acquire, and are able to make use of, a significant body of knowledge across a range of disciplines.</td>
</tr>
<tr>
<td>Critical thinkers</td>
<td>They exercise initiative in applying thinking skills critically and creatively to approach complex problems and make reasoned decisions.</td>
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<tr>
<td>Communicators</td>
<td>They understand and express ideas and information confidently and creatively in more than one language and in a variety of modes of communication.</td>
</tr>
<tr>
<td>Risk-takers</td>
<td>They approach unfamiliar situations with confidence and forethought, and have the independence of spirit to explore new roles, ideas and strategies. They are courageous and articulate in defending those things in which they believe.</td>
</tr>
<tr>
<td>Principled</td>
<td>They have a sound grasp of the principles of moral reasoning. They have integrity, honesty, a sense of fairness and justice and respect for the dignity of the individual.</td>
</tr>
<tr>
<td>Caring</td>
<td>They show empathy, compassion and respect towards the needs and feelings of others. They have a personal commitment to action and service to make a positive difference to the environment and to the lives of others.</td>
</tr>
<tr>
<td>Open-minded</td>
<td>Through an understanding and appreciation of their own culture, they are open to the perspectives, values and traditions of other individuals and cultures and are accustomed to seeking and considering a range of points of view.</td>
</tr>
<tr>
<td>Well-balanced</td>
<td>They understand the importance of physical and mental balance and personal well being for themselves and others. They demonstrate perseverance and self-discipline.</td>
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<tr>
<td>Reflective</td>
<td>They give thoughtful consideration to their own learning and personal development. They are able to analyze their strengths and weaknesses in a constructive manner.</td>
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Physics SL

Course Description

The IB Diploma Program physics course exposes students to this most fundamental experimental science, which seeks to explain the universe itself—from the very smallest particles to the vast distances between galaxies. Students develop traditional practical skills and techniques and increase facility in the use of mathematics, the language of physics. They also develop interpersonal skills as well as information and communication technology skills, which are essential in modern scientific endeavors—and are important life-enhancing, transferable skills in their own right. Students, moreover, study the impact of physics on society, the moral and ethical dilemmas, and the social, economic and environmental implications of the work of physicists.
<table>
<thead>
<tr>
<th>Unit</th>
<th>Topic</th>
<th>Suggested Timing</th>
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<tbody>
<tr>
<td>Unit 1</td>
<td>Kinematics &amp; Dynamics (One and Two dimensions)</td>
<td>12 Weeks</td>
</tr>
<tr>
<td>Unit 2</td>
<td>Universal Gravitation and Circular Motion</td>
<td>5 Weeks</td>
</tr>
<tr>
<td>Unit 3</td>
<td>Momentum and Energy</td>
<td>12 Weeks</td>
</tr>
<tr>
<td>Unit 4</td>
<td>Thermal Physics</td>
<td>5 Weeks</td>
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</tbody>
</table>
Educational Technology Standards


- **Technology Operations and Concepts**
  - Create a personal digital portfolio which reflects personal and academic interests, achievements, and career aspirations by using a variety of digital tools and resources.
  - Produce and edit a multi-page digital document for a commercial or professional audience and present it to peers and/or professionals in that related area for review.

- **Creativity and Innovation**
  - Apply previous content knowledge by creating and piloting a digital learning game or tutorial.

- **Communication and Collaboration**
  - Develop an innovative solution to a real world problem or issue in collaboration with peers and experts, and present ideas for feedback through social media or in an online community.

- **Digital Citizenship**
  - Demonstrate appropriate application of copyright, fair use and/or Creative Commons to an original work.
  - Evaluate consequences of unauthorized electronic access and disclosure, and on dissemination of personal information.
  - Compare and contrast policies on filtering and censorship both locally and globally.

- **Research and Information Literacy**
  - Produce a position statement about a real world problem by developing a systematic plan of investigation with peers and experts synthesizing information from multiple sources.

- **Critical Thinking, Problem Solving, Decision Making**
  - Evaluate the strengths and limitations of emerging technologies and their impact on educational, career, personal and or social needs.
Career Ready Practices

Career Ready Practices describe the career-ready skills that all educators in all content areas should seek to develop in their students. They are practices that have been linked to increase college, career, and life success. Career Ready Practices should be taught and reinforced in all career exploration and preparation programs with increasingly higher levels of complexity and expectation as a student advances through a program of study.

CRP1. Act as a responsible and contributing citizen and employee
Career-ready individuals understand the obligations and responsibilities of being a member of a community, and they demonstrate this understanding every day through their interactions with others. They are conscientious of the impacts of their decisions on others and the environment around them. They think about the near-term and long-term consequences of their actions and seek to act in ways that contribute to the betterment of their teams, families, community and workplace. They are reliable and consistent in going beyond the minimum expectation and in participating in activities that serve the greater good.

CRP2. Apply appropriate academic and technical skills.
Career-ready individuals readily access and use the knowledge and skills acquired through experience and education to be more productive. They make connections between abstract concepts with real-world applications, and they make correct insights about when it is appropriate to apply the use of an academic skill in a workplace situation.

CRP3. Attend to personal health and financial well-being.
Career-ready individuals understand the relationship between personal health, workplace performance and personal well-being; they act on that understanding to regularly practice healthy diet, exercise and mental health activities. Career-ready individuals also take regular action to contribute to their personal financial wellbeing, understanding that personal financial security provides the peace of mind required to contribute more fully to their own career success.
Career Ready Practices

CRP4. Communicate clearly and effectively and with reason.
Career-ready individuals communicate thoughts, ideas, and action plans with clarity, whether using written, verbal, and/or visual methods. They communicate in the workplace with clarity and purpose to make maximum use of their own and others’ time. They are excellent writers; they master conventions, word choice, and organization, and use effective tone and presentation skills to articulate ideas. They are skilled at interacting with others, they are active listeners and speak clearly and with purpose. Career-ready individuals think about the audience for their communication and prepare accordingly to ensure the desired outcome.

CRP5. Consider the environmental, social and economic impacts of decisions.
Career-ready individuals understand the interrelated nature of their actions and regularly make decisions that positively impact and/or mitigate negative impact on other people, organization, and the environment. They are aware of and utilize new technologies, understandings, procedures, materials, and regulations affecting the nature of their work as it relates to the impact on the social condition, the environment and the profitability of the organization.

CRP6. Demonstrate creativity and innovation.
Career-ready individuals regularly think of ideas that solve problems in new and different ways, and they contribute those ideas in a useful and productive manner to improve their organization. They can consider unconventional ideas and suggestions as solutions to issues, tasks or problems, and they discern which ideas and suggestions will add greatest value. They seek new methods, practices, and ideas from a variety of sources and seek to apply those ideas to their own workplace. They take action on their ideas and understand how to bring innovation to an organization.

CRP7. Employ valid and reliable research strategies.
Career-ready individuals are discerning in accepting and using new information to make decisions, change practices or inform strategies. They use reliable research process to search for new information. They evaluate the validity of sources when considering the use and adoption of external information or practices in their workplace situation.
### Career Ready Practices

**CRP8. Utilize critical thinking to make sense of problems and persevere in solving them.**
Career-ready individuals readily recognize problems in the workplace, understand the nature of the problem, and devise effective plans to solve the problem. They are aware of problems when they occur and take action quickly to address the problem; they thoughtfully investigate the root cause of the problem prior to introducing solutions. They carefully consider the options to solve the problem. Once a solution is agreed upon, they follow through to ensure the problem is solved, whether through their own actions or the actions of others.

**CRP9. Model integrity, ethical leadership and effective management.**
Career-ready individuals consistently act in ways that align personal and community-held ideals and principles while employing strategies to positively influence others in the workplace. They have a clear understanding of integrity and act on this understanding in every decision. They use a variety of means to positively impact the directions and actions of a team or organization, and they apply insights into human behavior to change others’ action, attitudes and/or beliefs. They recognize the near-term and long-term effects that management’s actions and attitudes can have on productivity, morals and organizational culture.

**CRP10. Plan education and career paths aligned to personal goals.**
Career-ready individuals take personal ownership of their own education and career goals, and they regularly act on a plan to attain these goals. They understand their own career interests, preferences, goals, and requirements. They have perspective regarding the pathways available to them and the time, effort, experience and other requirements to pursue each, including a path of entrepreneurship. They recognize the value of each step in the education and experiential process, and they recognize that nearly all career paths require ongoing education and experience. They seek counselors, mentors, and other experts to assist in the planning and execution of career and personal goals.

**CRP11. Use technology to enhance productivity.**
Career-ready individuals find and maximize the productive value of existing and new technology to accomplish workplace tasks and solve workplace problems. They are flexible and adaptive in acquiring new technology. They are proficient with ubiquitous technology applications. They understand the inherent risks-personal and organizational-of technology applications, and they take actions to prevent or mitigate these risks.
**Career Ready Practices**

<table>
<thead>
<tr>
<th>CRP12. Work productively in teams while using cultural global competence.</th>
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<tr>
<td>Career-ready individuals positively contribute to every team, whether formal or informal. They apply an awareness of cultural difference to avoid barriers to productive and positive interaction. They find ways to increase the engagement and contribution of all team members. They plan and facilitate effective team meetings.</td>
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## Differentiated Instruction

**Strategies to Accommodate Students Based on Individual Needs**

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<tr>
<th>Time/General</th>
<th>Processing</th>
<th>Comprehension</th>
<th>Recall</th>
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</thead>
<tbody>
<tr>
<td>• Extra time for assigned tasks</td>
<td>• Extra Response time</td>
<td>• Precise step-by-step directions</td>
<td>• Teacher-made checklist</td>
</tr>
<tr>
<td>• Adjust length of assignment</td>
<td>• Have students verbalize steps</td>
<td>• Short manageable tasks</td>
<td>• Use visual graphic organizers</td>
</tr>
<tr>
<td>• Timeline with due dates for reports and projects</td>
<td>• Repeat, clarify or reword directions</td>
<td>• Brief and concrete directions</td>
<td>• Reference resources to promote independence</td>
</tr>
<tr>
<td>• Communication system between home and school</td>
<td>• Mini-breaks between tasks</td>
<td>• Provide immediate feedback</td>
<td>• Visual and verbal reminders</td>
</tr>
<tr>
<td>• Provide lecture notes/outline</td>
<td>• Provide a warning for transitions</td>
<td>• Small group instruction</td>
<td>• Graphic organizers</td>
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<tr>
<td></td>
<td>• Reading partners</td>
<td>• Emphasize multi-sensory learning</td>
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</tbody>
</table>

### Assistive Technology
- Computer/whiteboard
- Tape recorder
- Spell-checker
- Audio-taped books

### Tests/Quizzes/Grading
- Extended time
- Study guides
- Shortened tests
- Read directions aloud

### Behavior/Attention
- Consistent daily structured routine
- Simple and clear classroom rules
- Frequent feedback

### Organization
- Individual daily planner
- Display a written agenda
- Note-taking assistance
- Color code materials
<table>
<thead>
<tr>
<th>Enrichment</th>
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<tbody>
<tr>
<td><strong>Strategies Used to Accommodate Based on Students Individual Needs:</strong></td>
</tr>
<tr>
<td>• Adaption of Material and Requirements</td>
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<tr>
<td>• Evaluate Vocabulary</td>
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<tr>
<td>• Elevated Text Complexity</td>
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<tr>
<td>• Additional Projects</td>
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<tr>
<td>• Independent Student Options</td>
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<tr>
<td>• Projects completed individual or with Partners</td>
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<tr>
<td>• Self Selection of Research</td>
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<tr>
<td>• Tiered/Multilevel Activities</td>
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<tr>
<td>• Learning Centers</td>
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<td>• Individual Response Board</td>
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<tr>
<td>• Independent Book Studies</td>
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<tr>
<td>• Open-ended activities</td>
</tr>
<tr>
<td>• Community/Subject expert mentorships</td>
</tr>
</tbody>
</table>
## Assessments

### Suggested Formative/Summative Classroom Assessments

- Timelines, Maps, Charts, Graphic Organizers
- Teacher-created Unit Assessments, Chapter Assessments, Quizzes
- Teacher-created DBQs, Essays, Short Answer
- Accountable Talk, Debate, Oral Report, Role Playing, Think Pair, and Share
- Projects, Portfolio, Presentations, Prezi, Gallery Walks
- Homework
- Concept Mapping
- Primary and Secondary Source analysis
- Photo, Video, Political Cartoon, Radio, Song Analysis
- Create an Original Song, Film, or Poem
- Glogster to make Electronic Posters
- Internal and External IB Assessments
### Interdisciplinary Connections

#### English Language Arts
- Journal writing
- Close reading of industry-related content
- Create a brochure for a specific industry
- Keep a running word wall of industry vocabulary

#### Social Studies
- Research the history of a given industry/profession
- Research prominent historical individuals in a given industry/profession
- Use historical references to solve problems

#### World Language
- Translate industry-content
- Create a translated index of industry vocabulary
- Generate a translated list of words and phrases related to workplace safety

#### Math
- Research industry salaries for a geographic area and juxtapose against local cost of living
- Go on a geometry scavenger hunt
- Track and track various data, such as industry's impact on the GDP, career opportunities or among of individuals currently occupying careers

#### Fine & Performing Arts
- Create a poster recruiting young people to focus their studies on a specific career or industry
- Design a flag or logo to represent a given career field

#### Science
- Research the environmental impact of a given career or industry
- Research latest developments in industry technology
- Investigate applicable-careers in STEM fields
Next Generation Science Standards (NGSS):

HS-PS1 Matter and its interactions

HS-PS1-1. Use the periodic table as a model to predict the relative properties of elements based on the patterns of electrons in the outermost energy level of atoms.

HS-PS1-3. Plan and conduct an investigation to gather evidence to compare the structure of substances at the bulk scale to infer the strength of electrical forces between particles.

HS-PS1-8. Develop models to illustrate the changes in the composition of the nucleus of the atom and the energy released during the processes of fission, fusion, and radioactive decay.

HS-PS2 Motion and Stability: Forces and Interactions

HS-PS2-1. Analyze data to support the claim that Newton’s second law of motion describes the mathematical relationship among the net force on a macroscopic object, its mass, and its acceleration.

HS-PS2-2. Use mathematical representations to support the claim that the total momentum of a system of objects is conserved when there is no net force on the system.

HS-PS2-3. Apply scientific and engineering ideas to design, evaluate, and refine a device that minimizes the force on a macroscopic object during a collision.*

HS-PS2-4. Use mathematical representations of Newton’s Law of Gravitation and Coulomb’s Law to describe and predict the gravitational and electrostatic forces between objects.

HS-PS2-5. Plan and conduct an investigation to provide evidence that an electric current can produce a magnetic field and that a changing magnetic field can produce an electric current.

HS-PS3 Energy

HS-PS3-. Create a computational model to calculate the change in the energy of one component in a system when the...
change in energy of the other component(s) and energy flows in and out of the system are known.

HS-PS3-2. Develop and use models to illustrate that energy at the macroscopic scale can be accounted for as a combination of energy associated with the motions of particles (objects) and energy associated with the relative positions of particles (objects)

HS-PS3-3. Design, build, and refine a device that works within given constraints to convert one form of energy into another form of energy.*

HS-PS3-4. Plan and conduct an investigation to provide evidence that the transfer of thermal energy when two components of different temperature are combined within a closed system results in a more uniform energy distribution among the components in the system (second law of thermodynamics).

HS-PS3-5. Develop and use a model of two objects interacting through electric or magnetic fields to illustrate the forces between objects and the changes in energy of the objects due to the interaction.

**HS-PS4 Waves and their Applications in Technologies for Information Transfer**

HS-PS4-1. Use mathematical representations to support a claim regarding relationships among the frequency, wavelength, and speed of waves traveling in various media.
Course: Physics SL  
Unit: Unit 2 Year I  
Grade Level: 11-12

**Unit Overview:** Students will explore the science gravity and circular motion.

**Next Generation Science Standards (NGSSS):** HS-PS2-4

<table>
<thead>
<tr>
<th>Student Learning Objectives (SLOs)</th>
<th>Essential Questions</th>
<th>Content</th>
<th>Activities and Assessments</th>
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</tr>
</thead>
</table>
| Discover the centripetal forces such as tension, friction, gravitational, electrical or magnetic.  
NGSS: HS-PS2-1.  
NGSS: HS-PS2-4. | How do centripetal forces affect motion?  
How can force vary in circular motion? | ➢ Tension  
➢ Friction  
➢ Gravitational, electrical or magnetic force | Turning Point Response System  
Paper 1 style questions  
Paper 2 style problems  
Simulations:  
Open Form Writing  
On-line quizzes  
Lab/Simulation Report  
PhET Simulations, University of Colorado: [https://phet.colorado.edu](https://phet.colorado.edu)  
The King’s Centre for Visualization in Science: [http://www.kcvs.ca/site/projects/physics.html](http://www.kcvs.ca/site/projects/physics.html) |
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</table>
| Solve problems involving centripetal force, centripetal acceleration, period frequency, angular displacement, linear speed and angular velocity. NGSS: HS-PS2-1. NGSS: HS-PS2-4. | What strategies can we use to solve problems involving centripetal force, centripetal acceleration, period frequency, angular displacement, linear speed and angular velocity? What is the relationship between centripetal force and centripetal acceleration? | ➢ Utilize the proper formulas to solve problems involving centripetal force, centripetal acceleration, period frequency, angular displacement, linear speed and angular velocity. | Turning Point Response System  
Paper 1 style questions  
Paper 2 style problems  
Simulations:  
PhET Simulations, University of Colorado: https://phet.colorado.edu/ |
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<td>Paper 1 style test</td>
<td>Roller Coaster Database: <a href="https://rcdb.com/">https://rcdb.com/</a></td>
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<td>Paper 2 style test</td>
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| Qualitatively and quantitatively describe examples of circular motion including vertical and horizontal circular motion. | Why must problems involving vertical and horizontal circular movement be handled differently?  
How does gravity impact circular motion calculations? | ➢ Analyze and explain the similarities and differences between circular motion in both vertical and horizontal directions.  
➢ Solve problems for motion in both directions. | Turning Point Response System  
Paper 1 style questions  
Paper 2 style problems  
Simulations:  
Open Form Writing  
On-line quizzes  
Lab/Simulation Report  
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Paper 1 style test  
Physics with Vernier  
ISBN 978-1-929075-93-6  
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The King’s Centre for Visualization in Science: http://www.kcvs.ca/site/projects/physics.html  
The Physics Aviary: http://www.thephysicsaviary.com/  
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| **Apply Newton’s law of gravitation to the motion of an object in circular orbit around a point mass.**  
**NGSS:** HS-PS2-1.  
**NGSS:** HS-PS2-4. | What is the relationship between an object in circular motion and it’s point mass?  
What is the relationship between momentum and orbit?  
➢ Analyze how the density of a point mass affects an object in orbit around it.  
➢ Centripetal force | Paper 1 style test  
Paper 2 style test  
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</table>
| Solve problems involving gravitational force, gravitational field strength, orbital speed and orbital period. | What strategies can be used to solve problems involving gravitational force, gravitational field strength, orbital speed and orbital period? | ➢ Use the proper equations to solve problems involving gravitational force, gravitational field strength, orbital speed and orbital period. | Turning Point Response System  
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| NGSS: HS-PS2-1.  
NGSS: HS-PS2-4. | | | Simulations:  
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| | | | | Roller Coaster Database: |
### Student Learning Objectives (SLOs)

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<tr>
<th>Determine the resultant gravitational field strength due to two bodies.</th>
</tr>
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<tbody>
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<td><strong>NGSS</strong>: HS-PS2-1.</td>
</tr>
<tr>
<td><strong>NGSS</strong>: HS-PS2-4.</td>
</tr>
</tbody>
</table>

### Essential Questions

- How can the resultant gravitational field strength due to two bodies be determined?
- How would you recognize a gravitational field generated by two bodies?

### Content

- Given the mass and distance of two masses calculate the gravitation field strength that exists.
- Mathematically show what happens if either mass doubles or is halved.
- Mathematically show what happens if distance is increased or decreased.

### Activities and Assessments

- Turning Point Response System
- Paper 1 style questions
- Paper 2 style problems
- Simulations:
- Open Form Writing
- On-line quizzes
- Lab/Simulation Report
- Extended Essay Style question response
- Paper 1 style test
- Paper 2 style test

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<tr>
<th>Student Learning Objectives (SLOs)</th>
<th>Essential Questions</th>
<th>Content</th>
<th>Activities and Assessments</th>
<th>Resources</th>
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</thead>
<tbody>
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<td>Roller Coaster Database: <a href="https://rcdb.com/">https://rcdb.com/</a></td>
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<tr>
<td>Unit 2 Vocabulary</td>
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<tr>
<td>( \nu = \omega r )</td>
<td>➢ Period</td>
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<tr>
<td>( a = \frac{\nu^2}{r} = \frac{4\pi^2 r}{T^2} )</td>
<td>➢ Frequency</td>
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<tr>
<td>( F = \frac{m\nu^2}{r} = m\omega^2 r )</td>
<td>➢ Time</td>
<td></td>
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<tr>
<td>( F = G \frac{Mm}{r^2} )</td>
<td>➢ Centripetal force</td>
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<tr>
<td>( g = \frac{F}{m} )</td>
<td>➢ Centripetal acceleration</td>
<td></td>
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<tr>
<td>( g = G \frac{M}{r^2} )</td>
<td>➢ Angular momentum</td>
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<tr>
<td></td>
<td>➢ orbit</td>
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<td></td>
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<tr>
<td></td>
<td>➢ Point mass</td>
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## TOK Connections

Foucault's pendulum gives a simple observable proof of the rotation of the Earth, which is largely unobservable. How can we have knowledge of things that are unobservable?

## Contribution to the Development of Students’ Approached to Learning Skills

This course helps students hone their thinking skills as they strive to solve a variety of complex problems. Working on lab assignments contributes to the development of students social and communication skills as they work with each other to replicate physical phenomena or prove concepts through experimentation. As students work on their Internal Assessment they are guided in the development of research and self-management skills.
## Contributions to the Development of the Attribute(s) of the Learner Profile

Students must be inquirers since the forces acting in circular motion and universal gravitation are wholly invisible. They must solve problems which involve forces they cannot see or manipulate.

## Contribution to the Development of International Mindedness

International collaboration is needed in establishing effective rocket launch sites to benefit space programs.