|  |  |
| --- | --- |
| **Circular Motion** | IB Physics Content Guide |

# Big Ideas

* Objects moving in a circle are experiencing acceleration since the direction of the velocity is constantly changing
* Centripetal acceleration and centripetal force are always directed toward the center of the circle
* The net force for a body in circular motion is equal to the centripetal force
* It is useful to draw a free body diagram to determine what forces are present at a given position

# Content Objectives

|  |  |
| --- | --- |
| 1 – Defining Circular Motion |  |
| I can convert between angular displacement in revolutions and radians |  |  |  |
| I can describe and calculate the properties of period and frequency |  |  |  |
| I can calculate angular velocity |  |  |  |
| I can describe and calculate tangential velocity based on the angular velocity and radius |  |  |  |
| I can determine the direction and magnitude of centripetal acceleration and centripetal force |  |  |  |

|  |  |
| --- | --- |
| 2 – Vertical Circular Motion |  |
| I can draw correctly proportioned free body diagrams for horizontal and vertical circular motion |  |  |  |
| I can compare the forces on an object at different positions in vertical circular motion |  |  |  |
| I can identify the combination of forces that make up the net force that results in circular motion. |  |  |  |
| I can determine the magnitude and direction of the forces needed to move in a vertical circle |  |  |  |

|  |  |
| --- | --- |
| 3 – Circular Motion, Friction, and Angles |  |
| I can draw a free body diagram when circular motion is produced by a reaction or friction force  |  |  |  |
| I can solve problems that involve friction to create circular motion |  |  |  |
| I can solve circular motion problems that incorporate components of an angled force |  |  |  |

|  |  |
| --- | --- |
| **Circular Motion** | Shelving Guide |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | Variable Symbol | Unit |  | *Draw in* *vectors* *for v, ac,* *and Fc 🡪* |  |
| Distance | d | m |  |
| Angular Distance | θ | rad |  |
| Angular Velocity | ω | rad s-1 |  | *Data Booklet Equations:* |
| Linear Velocity | v | m s-1 |  | $v=ωr$  |
| Centripetal Acceleration | *a* | m s-2 |  | $a=\frac{v^{2}}{r}=\frac{4π^{2}r}{T^{2}}$  |
| Centripetal Force | Fc | N |  | $F=\frac{mv^{2}}{r}=mω^{2}r$  |

## Defining Circular Motion

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | Period | T | s | Angular Velocity | ω | rad s-1 |
| Time per revolution | $$ω=\frac{2π}{T}$$ |

## Vertical Circular Motion

|  |  |  |
| --- | --- | --- |
|  | Top: | Bottom:  |
| Fnet = Fc = FT + Fg | Fnet = Fc = FT - Fg |
|  |  |  |
| Top: | Bottom: |
|  |  |  |  |
| Fnet = Fc = Fg - R | Fnet = Fc = R - Fg |

## Circular Motion with Friction and Angles

|  |  |  |
| --- | --- | --- |
|  |  | Relationships between variables:$$F\_{f}=F\_{g}$$$$F\_{c}=R$$ |

|  |  |  |
| --- | --- | --- |
|  |  | Relationships between variables:$$R=F\_{g}$$$$F\_{c}=F\_{f}$$ |

|  |  |  |
| --- | --- | --- |
| Image result for pendulum circle |  | Relationships between variables: $$T\_{y}=F\_{g}$$$$F\_{c}=T\_{x}$$ |