

Fall and Winter Standards

HONORS PHYSICS

CVPM/G Const. Velocity Particle Model (Graphical)	Core Skills	Draw velocity graph, given position graph
		Understand the characteristics of x and v graphs that relate one graph to the other
	Proficiency Indicators	Draw position graph, given velocity graph
		Represent chosen direction of positive correctly and consistently with graphs
		Recognize and apply information about special cases of motion (no initial or final v , zero displacement, etc.)
		Differentiate graphically between instantaneous and average velocity
		Use motion graphs for quantitative problem-solving and motion modeling

CVPM Const. Velocity Particle Model	Core Skills	Identify situations with constant velocity motion from motion maps, graphs, equations, and observation
		Draw a diagram modeling the motion
		Use the definition of velocity to solve simple problems
	Proficiency Indicators	Use the definition of velocity to solve more complex problems
		Differentiate algebraically between average and instantaneous speed and velocity
		Recognize and apply information about special cases of motion (no initial or final v , zero displacement, etc.)
		Differentiate between distance and displacement
	Adv. Ind.	Solve complex (multi-equation system situation) problems

CAPM/G Const. Accel. Particle Model (Graphical)	Core Skills	Translate between velocity and acceleration graphs
		Understand the characteristics of x , v , and a graphs that relate one graph to another
		Recognize characteristic graphical shapes of CAPM motion
	Proficiency Indicators	Convert between position and velocity graphs
		Represent chosen direction of positive correctly and consistently with all graphs
		Recognize and apply information about special cases of motion (no initial or final v , zero displacement, etc.) using graphical models
		Differentiate graphically between instantaneous and average velocity
		Use motion graphs for quantitative problem-solving and motion modeling
	Advanced Indicators	Analyze non-constant acceleration motion using graphs

CAPM Const. Accel. Particle Model	Core Skills	Identify situations with constant acceleration motion from motion maps, graphs, equations, and observation
		Draw a diagram modeling the motion
		Use the definition of acceleration to determine the direction of the acceleration, and to solve simple problems
	Proficiency Indicators	Know and use kinematic equations to solve more complex problems
		Differentiate algebraically between average and instantaneous acceleration
		Recognize and apply information about special cases of motion (no initial or final v , zero displacement, etc.)
		Determine the direction of acceleration from information about the motion
	Adv. Ind.	Solve complex problems

BFPM Balanced Force Particle Model	Core Skills	Recognize when the forces on an object or system are balanced from observation, graphs, equations, or descriptions of the motion
		Identify the presence and directions of normal, tension, and weight forces
		Draw a force diagram (FBD) accurately showing directions and types of forces acting on an object or system
		Write net force equations describing an object or system; they should indicate that the forces are balanced
	Proficiency Indicators	Draw FBD correctly indicating that forces are balanced; recognize same
		Choose and consistently apply workable direction(s) of positive
		Correctly apply Newton's 3rd law
		Choose appropriate axes for force analysis
		Solve problems using net force equations and/or FBD

Friction	Core Skills	Identify situations in which friction forces are present and understand the microscopic model of friction forces
		Differentiate between static and kinetic friction
	Proficiency Indicators	Determine the direction of the friction force
		Use an appropriate expression for the magnitude of the friction force
		Understand the relationships among normal force, friction force and friction coefficients
		Solve problems using friction
	Adv. Ind.	Solve complex friction problems, including banked curves (not at design speed)
UFPM Unbalanced Force Particle Model	Core Skills	Recognize when the forces on an object or system are not balanced from observation, graphs, equations, or descriptions of the motion
		Identify the presence and directions of normal, tension, and weight forces
		Draw a force diagram (FBD) accurately showing directions and types of forces acting on an object or system
		Write net force equations describing an object or system; they should indicate that the forces are not balanced in the appropriate dimension(s)
	Proficiency Indicators	Draw FBD correctly indicating that forces are not balanced; recognize same
		Choose and consistently apply workable direction(s) of positive
		Correctly apply Newton's 3rd law
		Choose appropriate axes for force analysis
		Solve problems using net force equations and/or FBD
Motion (1D/2D)	Core Skills	Identify situations (and dimensions) with constant acceleration and constant v motion
		Draw a diagram modeling the motion
		Understand and apply the independence of dimensions
	Proficiency Indicators	Draw motion graphs and use graphical analysis to solve problems
		Recognize special cases of motion (no initial or final v, peak of motion, zero displacement, etc.)
		Solve motion problems
		Use the range equation and symmetry of time, distance, and velocity appropriately
	Adv. Ind.	Solve complex motion problems
Force Models	Core Skills	Recognize when the forces on an object are balanced or not balanced; understand the implications
		Identify the presence and directions of normal, tension, spring, and weight forces, and their molecular effects
	Proficiency Indicators	Draw a force diagram accurately giving the directions of all forces; vector lengths should indicate that the forces are balanced (or not)
		Write net force equations describing the system; they should indicate that the forces are balanced (or not)
		Correctly apply Newton's 3rd law
		Correctly and consistently apply direction(s) of positive
		Choose appropriate axes to use when dealing with forces in two dimensions
		Solve problems using net force equations
UCM Uniform Circular Motion	Core Skills	Identify situations in which circular motion is occurring, from graphical, textual, or diagrammatic information
		Determine the directions of acceleration and velocity in uniform circular motion
	Proficiency Indicators	Write net force equations for an object in UCM
		Choose an appropriate expression for the acceleration of an object in UCM
		Choose appropriate axes and direction of positive to analyze UCM
		Solve problems involving UCM
	Adv. Ind.	Analyze difficult UCM problems or non-uniform circular motion

CopM Cons. of Momentum Model	Core Skills	Draw an IF chart describing momentum before and after an interaction
		Treat momentum as a vector, correctly and consistently
	Proficiency Indicators	Identify situations in which momentum is conserved
		Write an accurate conservation equation describing the system
		Distinguish among inelastic, completely inelastic, and elastic collisions
		Determine the change in kinetic energy due to a collision
		Analyze elastic collisions using the speeds of approach and retreat
	Advanced Indicators	Analyze collisions using the center-of-mass reference frame
pTM Mom. Xfer Model	Core Skills	Recognize situations in which momentum is not conserved
	Proficiency Indicators	Draw an accurate IFF chart depicting the transfer of momentum into or out of a system
		Write an accurate equation describing the change in momentum of a system
		Use impulse to relate the change in momentum to the forces applied to an object or system over a period of time
		Use graphical analysis to determine the change in momentum of a system
CoEM Cons. of Energy Model	Core Skills	Draw LOL diagrams describing interactions
		Correctly identify situations in which gravitational PE, kinetic, elastic PE, and thermal energy are present
	Proficiency Indicators	Recognize situations in which the mechanical energy of a system is conserved (and where it is a useful approach)
		Write an accurate conservation of energy equation describing an interaction
		Determine an appropriate $h = 0$ definition
		Determine, interpret, and use a spring's force constant
	Adv. Ind.	Use thermal energy released by friction in conservation of energy applications
ETM Energy Xfer Model	Core Skills	Draw LOL diagrams describing interactions
		Recognize situations in which the mechanical energy of a system is increased or decreased by external forces
		Distinguish between the effects of positive, negative, and zero work done on a system
	Proficiency Indicators	Determine the work done by a force exerted over a distance
		Use graphical analysis to analyze the effects of forces applied to a system
Algebra	Core Skills	Determine the reasonableness of results before submitting them
		Use no numbers in algebraic manipulations – substitute numbers only when a final expression has been determined (NNTE)
	Proficiency Indicators	Be fluent in algebraic operations
		Recognize the need for an properly apply the quadratic formula
Units	Proficiency Indicators	Use ratios and percentages accurately and appropriately
		Always state units; know the correct (SI) units for every quantity
		Check expressions for proper unit cancellation
		Fluently use metric prefixes
		Easily convert units, given conversion factors
		Recognize unreasonable answers
	Adv. Ind.	Use appropriate prefixes for your answers
Vectors	Core Skills	Break a vector into components, along appropriate axes
	Proficiency Indicators	Recognize balanced and unbalanced sets of vectors
		Graphically add and subtract vectors
		Relate initial, final, and change vectors graphically and algebraically
		Use the components of a vector to find the whole vector's magnitude and direction
Writing	Core Skills	Write with proper grammar and linear structure
		Use a formal tone
	Proficiency Indicators	Reference data to support conclusions
		Be precise and specific; use appropriate physics vocabulary and use it accurately
		Structure assignments as directed
		Be as concise as possible, within the limits above
	Adv. Ind.	Have fluent and exceptional technical writing skills

Error Analysis	Core Skills	Identify specific sources of measurement uncertainty and specific deviations from assumptions made about the system being studied
		Do not cite "human error" (it's meaningless and misleading!)
	Proficiency Indicators	Accurately and appropriately calculate percent error and percent difference
		Discuss the effects of the sources of uncertainty on the measured quantities, distinguishing between random and systematic error
		Endeavor to explain any observed discrepancy between experimental results and predictions by referencing sources of uncertainty
	Adv. Ind.	Estimate measurement error appropriately, and use <i>crank three times</i> to determine the effect of the largest measurement error on calculated results