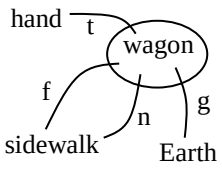
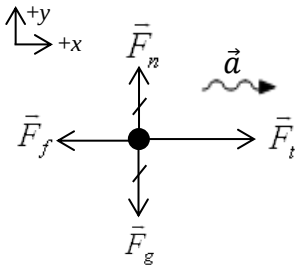
SPH3U: Forces Unit Rubrics

Use these rubrics to help assess the quality of your representations.

Interaction Diagrams

An attempt (1-2)	Needs some improvement (3-4)	Acceptable (5)	Exemplar = 5/5
Interaction diagram is constructed but contains many errors or a major error: • Missing or extra interactions (for the appropriate interval of time) • Missing or extra objects (for the appropriate interval of time)	Interaction diagram contains no major errors, but might have a few minor errors.	• The diagram contains all appropriate interactions and only the interacting objects. • System objects are enclosed in a shape (circle) • Each interaction is shown by one line (without arrows) connecting specific objects in the system or environment • Each interaction is labeled with a single letter (not a force symbol) • Each object's name is written only once	

Force Diagrams

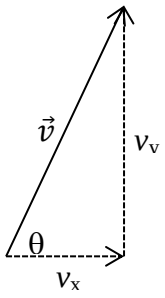
An attempt (1-2)	Needs some improvement (3-4)	Acceptable (5)	Exemplar = 5/5
Force diagram is constructed but contains many errors or a major error: • Missing or extra forces (not matching with the interaction diagram) • Incorrect directions of arrows or incorrect relative length of force arrows.	Force diagram contains no major errors, but might have a few minor errors.	• The diagram is large, clear and has a coordinate system • It contains all appropriate forces and matches the interaction diagram. • Each force is labeled with a unique symbol that has a vector arrow. • 3rd law force notation ($F_{g\ e\text{-}b}$) is used if there are multiple systems or similar forces • Relative lengths of force arrows are correct, equal sized forces are shown with a "tick" mark. • Acceleration vector is drawn if appropriate.	

Newton's 2nd Law Expressions

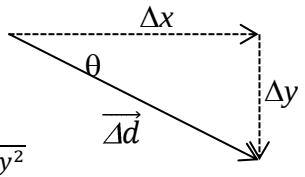
An attempt (1-2)	Needs some improvement (3-4)	Acceptable (5)	Exemplar = 5/5
Expressions for Newton's 2nd Law are constructed but contain many errors or a major error: • missing or extra forces (not matching with the force diagram) • *x*- and *y*- forces are appear in wrong equation • one equation contains forces from both *x*- and *y*- directions	Force diagram contains no major errors, but might have a few minor errors.	• The process begins by writing the original 2nd law equation for each direction that has forces (i.e. $F_{net\ x} = ma_x$) • Each force is written with a unique force symbol and does not have a vector arrow symbol. • 3rd law force notation ($F_{g\ e\text{-}b}$) is used if there are multiple systems / similar forces • Direction of the force is shown using the sign convention. • If there is no acceleration, the equation equals zero.	$F_{net\ x} = ma_x$ $F_t - F_f = ma_x$ $F_{net\ y} = ma_y$ $F_n - F_g = 0$

SPH4U: Motion Unit Rubrics

Component Triangles

An attempt (1-2)	Needs some improvement (3-4)	Acceptable (5)	Exemplar = 5/5
Triangle is constructed but contains many errors or a major error: • Vector's direction is misleading • The angle is not at the tail of the vector • The diagram is mislabeled	Component triangle contains no major errors, but might have a few minor errors.	• Components are drawn as arrows with dashed or coloured lines. • All three sides are labeled • The angle is shown at the **tail** of the vector. • Triangle clearly shows which component is larger • Vector's direction is reasonable • Components are labeled with the same symbol as the vector plus a subscript. (Displacement is the exception)	

Component Math

An attempt (1-2)	Needs some improvement (3-4)	Acceptable (5)	Exemplar = 5/5
Math is present but contains many errors or a major error: • Steps are missing • Component triangle missing • Problem with vector ideas	Work contains no major errors, but might have a few minor errors	• Component triangle included with math work • Appropriate physics symbols used • Substitutions have units • Both quantities on each side of the equals sign are written with vector or component notation (see pg.22) • Final 2-D vector written with vector notation	Δx = 3.1 m, Δy = -2.7 m  $\Delta d = \sqrt{\Delta x^2 + \Delta y^2}$ $= \sqrt{(3.1\ m)^2 + (-2.7\ m)^2}$ = 4.111 m $\theta = \tan^{-1}\left(\frac{\lvert\Delta y\rvert}{\lvert\Delta x\rvert}\right) = \tan^{-1}\left(\frac{\lvert -2.7\ m\rvert}{\lvert 3.1\ m\rvert}\right)$ $= 41.05^o$ $\therefore \Delta\vec{d}$ = 4.11 m [E 41.1°S]

Vector Math

An attempt (1-2)	Needs some improvement (3-4)	Acceptable (5)	Exemplar = 5/5
• Direction is missing	Work contains no major errors, but might have a few minor errors	• Only vector or square-bracket notation is used • Directions are included every time a vector quantity is written out	$\Delta\vec{d} = \vec{v}\Delta t$ = 6.7 m/s [E 41.1°S] (0.6134 s) = 4.11 m [E 41.1°S]

Projectile Solutions

An attempt (1-2)	Needs some improvement (3-4)	Acceptable (5)	Exemplar = 5/5
Solution contains many errors or a major error: • Components are not used	Solution contains no major errors, but might have a few minor errors.	• Part A: includes a component triangle • Part A: component calculations use sign convention correctly • Part A: list of horizontal and vertical information • Part B: motion diagram shows dot pattern for horizontal, vertical, and combined motions. • Vector notation ($\vec{v}$) is only used to label diagrams or with square bracket notation	

SPH4U Forces Unit Rubrics

Interaction Diagrams

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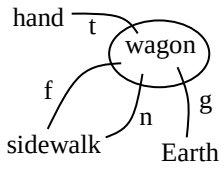
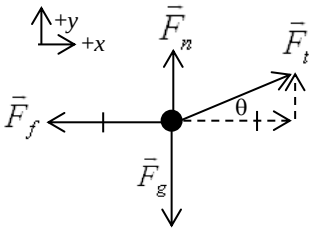
Interaction diagram is constructed but contains many errors or a major error: • Missing or extra interactions (for the appropriate interval of time) • Missing or extra objects (for the appropriate interval of time)	Interaction diagram contains no major errors, but might have a few minor errors.	• The diagram contains all appropriate interactions and only the interacting objects. • System objects are enclosed in a shape (circle) • Each interaction is shown by one line (without arrows) connecting specific objects in the system or environment • Each interaction is labeled with a single letter (not a force symbol) • Each object's name is written only once	

Force Diagrams

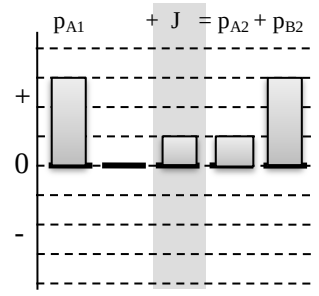
An attempt (1-2)	Needs some improvement (3-4)	Acceptable (5)	Exemplar = 5/5
Force diagram is constructed but contains many errors or a major error: • Missing or extra forces (not matching with the interaction diagram) • Incorrect directions of arrows or incorrect relative length of force arrows.	Force diagram contains no major errors, but might have a few minor errors.	• The diagram is large, clear and has a coordinate system • It contains all appropriate forces and matches the interaction diagram. • Each force is labeled with a unique symbol that has a vector arrow. • 3rd law force notation ($F_{g\ e\text{-}b}$) is used if there are multiple systems or similar forces • Relative lengths of force arrows are correct, equal sized forces or components are shown with a "tick" mark. • Components are shown using dashed lines (or coloured lines) with arrowheads and an angle is shown at the tail of the vector. • Acceleration vector is drawn if appropriate.	

Newton's 2nd Law Expressions

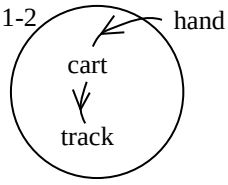
An attempt (1-2)	Needs some improvement (3-4)	Acceptable (5)	Exemplar = 5/5
Expressions for Newton's 2nd Law are constructed but contain many errors or a major error: • missing or extra forces (not matching with the force diagram) • *x*- and *y*- forces are appear in wrong equation • one equation contains forces from both *x*- and *y*-directions	Force diagram contains no major errors, but might have a few minor errors.	• The process begins by writing the original 2nd law component equation (i.e. $F_{net\ x} = ma_x$) • Each force is written with a unique force symbol and does not have a vector arrow symbol. • 3rd law force notation ($F_{g\ e\text{-}b}$) is used if there are multiple systems / similar forces • Force components are written with a *sin* or *cos* function • Direction of the force or component is shown using the sign convention. • If there is no acceleration, the equation equals zero.	$F_{net\ x} = ma_x$ $F_t \cos\theta - F_f = 0$ $F_{net\ y} = ma_y$ $F_n + F_t \sin\theta - F_g = 0$

SPH4U: Energy and Momentum Unit Rubrics

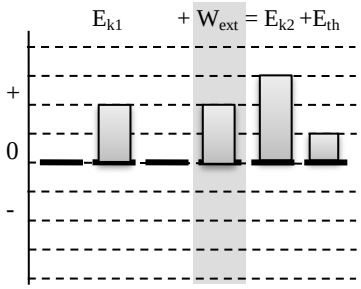
Momentum Bar Charts

An attempt (1-2)	Needs some improvement (3-4)	Acceptable (5)	Exemplar = 5/5
Bar chart is constructed but contains many errors or a major error: • Missing or extra bars • Bar chart math does not work out (Initial + change = final)	Momentum bar chart contains no major errors, but might have a few minor errors.	• Momentum bars are labeled with numbers for moments in time and letters for objects ("p_{A1}") • Labels for the bars form an impulse-momentum equation. • Bars reflect a reasonable estimation of the mass and velocities of the objects • Bars show correct direction for momenta • Bars show the important differences or changes in momentum	

Energy Flow Diagrams

An attempt (1-2)	Needs some improvement (3-4)	Acceptable (5)	Exemplar = 5/5
Energy flow diagram is constructed but contains many errors or a major error: • Missing or extra energy flow lines • Inappropriate objects in system or environment	Energy flow diagram contains no major errors, but might have a few minor errors.	• Event numbers show the initial and final moments in time that are being compared • Each interaction involved in a flow of energy is represented by a single line with an arrow head • Only objects names are written and only objects that are involved in an energy flow are shown • Energy flow diagram shows the same transfers as the energy bar chart.	 (agrees with work-energy bar chart below)

Work-Energy Bar Chart

An attempt (1-2)	Needs some improvement (3-4)	Acceptable (5)	Exemplar = 5/5
Work-energy bar chart is constructed but contains many errors or a major error: • Missing or extra bars • Bar chart math does not work out (Initial + change = final)	Work-energy bar chart contains no major errors, but might have a few minor errors.	• Energy bars are labeled with numbers for moments in time and letters for energy label ("E_{k1}") • Labels for the bars form a work-energy equation. • Bars reflect a reasonable estimation of the quantities • Bars show correct sign for energies • Bars show the important differences or changes in energy • Bar chart shows the same energy transfers as the energy flow diagram	 (agrees with energy flow diagram above)