Physics 200 Name: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Newton’s Laws in 2 Dimensions

Bodies on Inclines



Practice Problem: Fill in the remaining cells in the table below.

|  |  |  |
| --- | --- | --- |
| **Item** | **Direction (When applicable)** | **Magnitude** |
| coefficient of friction | NA | 0.4 |
| θ (degrees)  | NA | 30 |
| Mass of object (kg) | NA | 2 |
| Weight of object (N) |  |  |
| Perpendicular Weight Component (N) |  |  |
| Parallel Weight Component (N) |  |  |
| Normal force (N) |  |  |
| Force of Friction ( N) |  |  |
| Net force on object (N) |  |  |
| Acceleration (m/s2) |  |  |

1a. The figure to the right shows a block on an incline. Draw and label the forces acting on the block. Resolve weight into perpendicular and parallel components, relative to the surface.

1b. Fill in the table below for the block on the ramp The block is the “item.”

|  |  |  |
| --- | --- | --- |
| **Item** | **Direction (When applicable)** | **Magnitude** |
| coefficient of friction | NA | .6 |
| θ (degrees) | NA | 60 |
| Mass of object (kg) | NA | 2 |
| Weight of object (N) |  |  |
| Perpendicular Weight Component (N) |  |  |
| Parallel Weight Component (N) |  |  |
| Normal force (N) |  |  |
| Force of Friction ( N) |  |  |
| Net force on object (N) |  |  |
| Acceleration (m/s2) |  |  |

2. Fill out the table for the 2kg block. Then find the masses’ accelerations and the tension in the string.

 a = \_\_\_\_\_\_\_\_\_\_\_\_\_

 Tension = \_\_\_\_\_\_\_\_\_\_\_\_\_

.

|  |  |  |
| --- | --- | --- |
| **Item (2kg block)** | **Direction (When applicable)** | **Magnitude** |
| coefficient of friction | NA | **0.5** |
| θ (degrees) | NA | **70** |
| Mass of object (kg) | NA | **2** |
| Weight of object (N) |  |  |
| Perpendicular Weight Component (N) |  |  |
| Parallel Weight Component (N) |  |  |
| Normal force (N) |  |  |
| Force of Friction ( N) |  |  |

3. In the diagram, the 6kg block has a µk of 0.5, but the 4kg block is frictionless. Fill in the tables. Then find the accelerations of the blocks and the tension in the string.

 a = \_\_\_\_\_\_\_\_\_\_\_\_\_

 Tension = \_\_\_\_\_\_\_\_\_\_\_\_\_

|  |  |  |
| --- | --- | --- |
| **Item (4kg block)** | **Direction (When applicable)** | **Magnitude** |
| coefficient of friction | NA | **0** |
| θ (degrees) | NA | **50** |
| Mass of object (kg) | NA | **4** |
| Weight of object (N) |  |  |
| Perpendicular Weight Component (N) |  |  |
| Parallel Weight Component (N) |  |  |
| Normal force (N) |  |  |
| Force of Friction ( N) |  |  |

|  |  |  |
| --- | --- | --- |
| **Item (6kg block)** | **Direction (When applicable)** | **Magnitude** |
| coefficient of friction | NA | **0.4** |
| θ (degrees) | NA | **50** |
| Mass of object (kg) | NA | **6** |
| Weight of object (N) |  |  |
| Perpendicular Weight Component (N) |  |  |
| Parallel Weight Component (N) |  |  |
| Normal force (N) |  |  |
| Force of Friction ( N) |  |  |

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Masses Hanging and Dragged at Angles – Newton’s Laws in 2 Dimensions



1. The 80kg mass is in static equilibrium. Find the tensions in the two segments of rope.

2. The 10kg mass is in static equilibrium. Find the tensions in the two segments of rope.

3. A 10kg mass is being accelerated horizontally by the tension in a rope that is attached to the mass as shown. Find the acceleration of the 10 kg mass.



4. A 5kg mass is being accelerated horizontally by the tension in a rope that is attached to the mass as shown. Find the acceleration of the 8kg mass.

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Last Year's Test Retake – Newton’s Laws in 2-D



For each problem, enter the correct answers into the table. Note that only the yellow (shaded, if black and white) cells will be graded (except on #1, where you may receive partial credit for the blank cells.)

1. Two segments of rope are supporting an object. Segments are angled at the same angle, relative to horizontal. Find the object’s weight and the tensions in the two ropes (yellow cells). You may receive partial credit for correctly entering the blue terms -- but you will not lose points if they are wrong.

|  |  |  |  |
| --- | --- | --- | --- |
| **Description** | **Magnitude** | **Units** | **Direction** |
| Rope 1 Angle (relative to vertical) | 35 | degrees | Right of downward |
| Rope 2 Angle (relative to vertical) | 65 | degrees | Left of downward |
| Hanging Mass  | 15 | kg | NA |
| T1x (in terms of T1 -- tension in Rope 1) |  | T1 | Leftward |
| T1y (in terms of T1) |  | T1 | Upward |
| T2x (in terms of T2) |  | T2 | Rightward |
| T2y (in terms of T2) |  | T2 | Upward |
| T1 (in terms of T2) |  | T2 | Along String |
| **Weight of the hanging mass** |  | N | Downward |
| **T2 (tension in Rope 2)** |  | N | Along String |
| **T1 (tension in Rope 1)** |  | N | Along string |

2. A sliding mass on an incline is connected via a string and pulley to a hanging mass. µk is given.

|  |  |  |  |
| --- | --- | --- | --- |
| **Description** | **Magnitude** | **Units** | **Direction** |
| Angle of incline to horizontal  | 30.00 | degrees | Above rightward |
| Sliding mass  | 10.00 | kg | NA |
| Hanging mass  | 10.00 | kg | NA |
| Coefficient of friction | 0.40 | NA | NA |
| Weight of sliding mass  |  |  |  |
| Perpendicular Component of sliding object weight  |  |  |  |
| Parallel Component of sliding object weight  |  |  |  |
| Weight of hanging object  |  |  |  |
| Normal Force acting on sliding object  |  |  |  |
| Friction  |  |  |  |
| Net Force  |  |  |  |
| Acceleration  |  |  |  |
| String Tension  |  |  |  |

3. An object is hanging by a rope from the ceiling of a train car. The rope makes a constant angle with the horizontal ceiling.

|  |  |  |  |
| --- | --- | --- | --- |
| **Description** | **Magnitude** | **Units** | **Direction** |
| Mass  | 7 | kg | NA |
| Angle between rope and horizontal ceiling  | 65 | degrees | below leftward |
| Weight of hanging object  |  |  |  |
| Vertical component of tension  |  |  |  |
| Tension  |  |  |  |
| Horizontal Component of tension  |  |  |  |
| Acceleration of Hanging Object  |  |  |  |

4. A sliding box is being pulled by a rope. The rope extends to the right of the mass at an upward angle, relative to horizontal. The box slides to the right.

|  |  |  |  |
| --- | --- | --- | --- |
| **Description** | **Magnitude** | **Units** | **Direction** |
| Box Mass | 20 | kg | NA |
| Angle of rope | 60 | degrees | Above leftward |
| Coefficient of Kinetic Friction | 0.2 | NA | NA |
| Force applied by rope | 100 | N | 60 degrees above leftward |
| Box Weight |  |  |  |
| Y component of Rope Pulling Force |  |  |  |
| X component of Rope Pulling Force |  |  |  |
| Normal Force of surface against box |  |  |  |
| Friction |  |  |  |
| Net Force acting on Box |  |  |  |
| Box Acceleration |  |  |  |

Practice Test #2 – Newton’s Laws in 2-D



