Planes and Pulleys

Directions: Show the solutions (i.e. your work) to these on a separate sheet of paper. The answers on the side use the convention that positive (+) is up the plane, and negative (-) down. F|| is the component of the weight parallel to the plane, and Fperp is the component perpendicular.

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| a) 12.1 N, 17.3 N  b) -5.62 m/s/s (down)  c) +12.1 N (up)  d) +3.24 N (up) | 1. A 2.15 kg block of wood is on a frictionless inclined plane that makes an angle of 35.0o with the horizontal. a) Find F||, and Fperp b) If the block is released on the plane, what will be its acceleration down the plane? c) What force in what direction would prevent it from accelerating down the plane? d) If the block accelerates down the plane at only 4.12 m/s/s, what other force must be acting on the block? | |
| a) 36 N, 33 N  b) -7.2 m/s/s (down)  c) 1.9 s  d) +58 N (up)  e) +13 N (up) | 2. A 5.00 kg block of wood is on a frictionless 13 m long inclined plane that makes an angle of 47o with the horizontal. a) Find F||, and Fperp b) If the block is released on the plane, what will be its acceleration down the plane? c) What time will it take to slide down the plane if it is released at the top from rest? d) What force in what direction will make the block accelerate up the plane at 4.50 m/s/s? e) What force in what direction will make the block accelerate down the plane at 4.50 m/s/s? | |
| a) -5.6 m/s/s (down)  b) -5.2 N (down)  c) +2.2 m (up)  d) 1.8 s | 3. A block of Spam is on a frictionless inclined plane that makes an angle of 35o with the horizontal. a) If the Spam is released on the plane, what will be its acceleration down the plane? b) If the block of Spam accelerates at 7.9 m/s/s down the plane, what other force must be acting on the block? (use 2.3 kg as the mass) If the Spam is given a velocity of 5.0 m/s up the plane, c) how far up the plane will the block slide before coming back down, and d) what time will it take for the block to come back down to where it was released? | |
| a) -7.2 m/s/s (down)  b) .94 s  c) 34 N (up) | 4. A thing is on a frictionless 3.2 m long inclined plane that makes an angle of 47o with the horizontal. a) If the thing is released on the plane, what will be its acceleration down the plane? b) What time will it take to slide down the plane if it is released at the top from rest? c) Suppose it has a mass of 8.6 kg, and it takes 1.42 s to slide down the plane from rest, what other force must be acting on the thing? | |
| a) 44.4 N, 1.92 m/s/s  b) 9.81 N, 0.00382 m/s2  c) 9.79 N, 9.79 m/s/s  d) 16.6 kg  e) 47.8 N, 1.32 m/s/s | 5.  B  A | **The plane and pulley are frictionless**  **for a) – d). e) has a bit o’ friction**  a) If A has a mass of 23.1 kg, and B has a mass of 5.63 kg, what is the tension in the string, and the acceleration of the system?  b) If A has a mass of 2567 kg, and B has a mass of 1.00 kg, what is the tension in the string, and the acceleration of the system?  c) If A has a mass of 1.00 kg, and B has a mass of 500. kg, what is the tension in the string, and the acceleration of the system?  d) If A has a mass of 35.0 kg, What does Bneed to be so that the system has an acceleration of 3.15 m/s/s?  e) Answer part a) but include a 17.2 N friction force on the block on the plane that resists the acceleration as it moves to the right. |
| a) 2.8 m/s/s, 35 N  b) -0.48 m/s/s, 18 N  c) 3.54 kg  d) 7.5 kg | 6. | **The plane and pulley are frictionless.**  a) If A and B both have a mass of 5.0 kg, and the plane makes an angle of 25o with the horizontal, what is the acceleration and the tension in the cable?  b) Solve as in problem a), but give A a mass of 5.0 kg, and B a mass of 1.78 kg.  c) Suppose A has a mass of 4.51 kg, and accelerates from rest 3.27 m up the ramp in 1.81 seconds. What must the mass of B be? (use 25.0o)  d) If the plane angle is 30o and A is 15 kg, what should the mass of B be to prevent acceleration? |

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| a) 6.43 m/s/s 14.6 N  b) .468 kg  c) 27.2 N | 7. | **The plane and pulley are frictionless, and the plane makes an angle of 21.0o with horizontal.**  a) If A has a mass of 5.00 kg, and B 4.30 kg, what are the acceleration and the tension in the cable?  b) If A has a mass of 3.12 kg, and the tension in the cable is 2.56 N, what must the mass of B be?  c) Using the masses from part a), suppose you observed an acceleration of only 3.50 m/s/s. What frictional force must exist between A and the plane? (assume the plane is not frictionless) |
| A = 606 N  B = 299 N | 8. | Cable A makes an angle of 63.0o with the horizontal, and B makes an angle of 23.0o with the horizontal. What is the tension in each cable for there to be no acceleration of the system? |
| B = 17 N  C = 27 N | 9. | Cable A has a force of 23 N along it, what must be the tensions in cable C and B for there to be no acceleration of the system? |
| 23.16 N At 292.8o (Trig) (23 and 290 with SF) | 10. | Find the third force (the equilibrant) that would prevent the system from accelerating. |
| 6.000 N At 348.9o (Trig) (6.0 and 350 with SF) | 11. | Find the third force (the equilibrant) that would prevent the system from accelerating. |