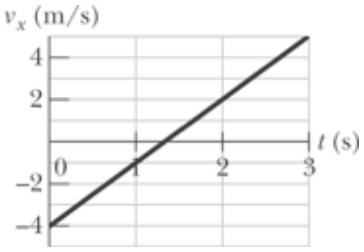
Chapter 5 – Problem Day

12. Two horizontal forces $\vec{F}_1$ and $\vec{F}_2$ act on a 4.0 kg disk that slides over frictionless ice, on which an *x*-*y* coordinate system is laid out. Force $\vec{F}_1$ is in the positive direction of the *x* axis and has a magnitude of 7.0 N. Force $\vec{F}_2$ has a magnitude of 9.0 N. The figure gives the *x* component v_x of the velocity of the disk as a function of time *t* during the sliding. What is the angle between the constant directions of forces $\vec{F}_1$ and $\vec{F}_2$?

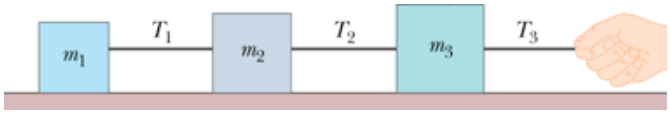


18. Tarzan, who weighs 820 N, swings from a cliff at the end of a 20.0 m vine that hangs from a high tree limb and initially makes an angle of 22.0° with the vertical. Assume that an *x*-axis extends horizontally away from the cliff edge and a *y*-axis extends upward. Immediately after Tarzan steps off the cliff, the tension in the vine is 760 N. Just then, what are (a) the magnitude and (b) angle, relative to the positive direction of the *x* axis, of the net force on him?

33. A 40 kg girl and an 8.4 kg sled are on the frictionless ice of a frozen lake, 15 m apart but connected by a rope. The girl exerts a horizontal 5.2 N force on the rope. What are the acceleration magnitudes of (a) the sled and (b) the girl? (c) How far from the girl's initial position do they meet?

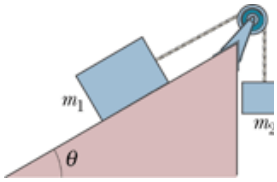
35. A block is projected up a frictionless inclined plane with initial speed $v_0 = 3.50$ m/s. The angle of incline is $\theta = 32.0°$. (a) How far up the plane does the block go? (b) How long does it take to get there? (c) What is its speed when it gets back to the bottom?

51. In the figure, three connected blocks are pulled to the right on a horizontal frictionless table by a force of magnitude $T_3 = 65.0$ N. If $m_1 = 12.0$ kg, $m_2 = 24.0$ kg, and $m_3 = 31.0$ kg, calculate (a) the magnitude of the system's acceleration, (b) the tension T_1, and (c) the tension T_2.

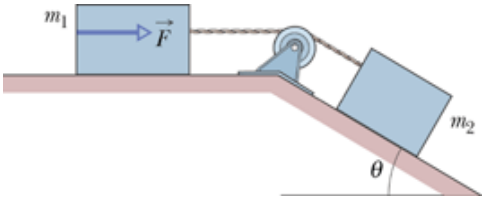


58. An 85 kg man lowers himself to the ground from a height of 10.0 m by holding onto a rope that runs over a pulley to a 65 kg sandbag. With what speed does the man hit the ground if he started from rest?

59. A block of mass $m_1 = 3.70$ kg on a frictionless plane inclined at $\theta = 30.0°$ is connected by a cord over a massless, frictionless pulley to a second block of mass $m_2 = 2.30$ kg as shown. What are (a) the magnitude of the acceleration of each block, (b) the direction of the acceleration of the hanging block, and (c) the tension in the cord?



66. The figure shows a box of mass $m_2 = 1.0$ kg on a frictionless plane inclined at angle $\theta = 30°$. It is connected by a cord to a box of mass $m_1 = 3.0$ kg on a horizontal frictionless surface. (a) If the magnitude of horizontal force $\vec{F}$ is 2.3 N, what is the tension in the connecting cord? (b) What is the largest value the magnitude of $\vec{F}$ may have without the cord becoming slack?



Chapter 5 Answers

12) 56°

18a) (285 N) i + (705 N) j
18b) (285 N) i – (115 N) j
18c) 307 N
18d) 22° below horizontal
18e) 3.67 m/s^2
18f) 22° below horizontal

33a) 0.62 m/s^2
33b) 0.13 m/s^2
33c) 2.6 m

35a) 1.18 m
35b) 0.674 s
35c) 3.5 m/s

51a) 0.970 m/s^2
51b) 11.6 N
51c) 34.9 N

58) 5.1 m/s

59a) 0.735 m/s^2
59c) 20.8 N

66a) 3.1 N
66b) 14.7 N