Mighty Physics Problem Set

FORCES & NEWTON'S LAWS

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1. If Billy kicks a stone with a horizontal velocity of 3.50 m/s, and it lands in the water a horizontal distance of 5.40 m from where he is standing, what is the height of the bridge? If the stone had been kicked harder, how would this affect the time it would take to fall?
2. Elizabeth kicks a 0.600 kg soccer ball with a force of 80.0N. How much does she accelerate the soccer ball from rest in the process? *Ans: 133 m/s²*
3. If a runner's 7.0kg leg hits the pavement so that it comes to rest with an acceleration of -200.0 m/s² on each hit, how much force must the runner's leg withstand on each step? *Ans: 1400 N*
4. A 0.140 kg baseball traveling at 35.0 m/s strikes the catcher's mitt, which, in bringing the ball to rest, recoils backward in 11.0 cm. What was the average force applied by the ball on the glove? *Ans: 780. N*
5. How much force must a rope withstand if it is used to accelerate a 960 kg car horizontally along a frictionless sufrace at 1.20 m/s². *Ans: 1152 N*
6. What is the minimal force a mother must exert to lift her 5.0kg baby out of its crib? *Ans: 50. N*
7. On the moon, the gravity is 1/6 that of Earth. While on the moon, Buzz Aldrin carried on his back a support system that would weight over 1760N on Earth. A) What did the backpack weigh on the moon? B) What was its mass on the moon? *Ans: a) 293 N, b) 176 kg*
8. How much tension must a rope withstand if it is used to accelerate a 1200. Kg car vertically upward at 0.80 m/s2? *Ans: 12,960 N*
9. A 20.0 kg box rests on a table. A) What is the weight of the box and the normal force acting on it? B) A 10.0 kg box is placed on top of the 20.0 kg box. Determine the normal force that the table exerts on the 20.0 kg box. C) Determine the Normal force that the 20.0 kg box exerts on the 10.0 kg box. *Ans: a) 200 N, 200 N, b) 300 N, 100 N*
10. A person stands on a bathroom scale in a motionless elevator. When the elevator begins to move, the scale briefly reads 1.25 times the person's regular weight. Calculate the acceleration of the elevator, and find the direction of the acceleration. *Ans: 2.45 m/s²*
11. Sarah, whose mass is 40.0kg, is on her way to school after a winter storm when she accidentally slips on a patch of ice whose coefficient of sliding friction is 0.060. What force of friction will eventually bring Sarah to a stop? *Ans: 24 N*
12. Molly puts a 1.0kg mass on a 2.0kg block of wood. She pulls the combination across another wooden board with a constant speed to determine the coefficient of sliding friction between the two surfaces. If Molly must pull with a force of 6.0N, what coefficient of sliding friction does she calculate for wood on wood? *Ans: 0.20*
13. Barker is unloading 20kg bottles of water from this delivery truck when one of the bottles tips over and slides down the truck ramp that is inclined at an angle of 30 degrees to the ground. What amount of force moves the bottle down the ramp? *Ans: 100 N*
14. A 1250kg slippery hippo slides down a mud covered hill inclined at an angle of 18 degrees to the horizontal. A) if the coefficient of sliding friction between the hippo and the mud is 0.0900, what force of friction impedes the hippo's motion down the hill? B) If the hill were steeper, how would this affect the coefficient of sliding friction? *Ans: a) 1070 N b) same*