Physics 11

More Challenging Problems

1. What average force is required to stop an 1100 kg car in 8.0 s if it is traveling at 90 km/h?

2. The cable supporting a 2 100 kg elevator has a maximum strength of 21 750 N. What maximum upward acceleration can it give the elevator without breaking?

3. A 0.140 kg baseball traveling 45.0 m/s strikes the catcher's mitt, which, in bringing the ball to rest, recoils backward 11.0 cm. What was the average force applied by the ball on the glove?

4. A 6500 kg helicopter accelerates upward at 0.60 m/s^2 while lifting a 1200 kg car.
   a) What is the lift force exerted by the air on the rotors?
   b) What is the tension in the cable (ignore its mass) that connects the car to the helicopter?

5. A flatbed truck is carrying a heavy crate. The coefficient of static friction between the crate and the bed of the truck is 0.75. What is the maximum rate at which the driver can accelerate and still avoid having the crate slide against the cab?

6. A box is given a push so that it slides across the floor. How far will it go, given that the coefficient of kinetic friction is 0.20 and the push imparts an initial speed of 4.0 m/s?

7. An ice skater moving at 12 m/s coast to a halt in 95 m on an ice surface. What is the coefficient of friction between ice and skates?

8. A coffee cup on a dashboard of a car slides forward on the dash when the driver decelerates from 40 km/h to rest in 3.5 s or less but not if she accelerates in a longer time. What is the coefficient of static friction between the cup and the dash?

9. Show that the minimum stopping distance for an automobile traveling at speed v is equal to $v^2/2\mu_s g$ where μ_s is the coefficient of static friction between the tires and the road and g is the acceleration of gravity.

Solutions

1. 3.4×10^3 N, opposite to the velocity
2. 0.557 m/s^2
3. 1290 N
4. a) 8.0×10^4 N
   b) 1.25×10^4 N
5. -7.4 m/s^2
6. 4.1 m
7. 0.077
8. 0.32