Suggested problems
Chapter 09

The quiz questions will be same or very similar to the following text-book problems.
Refer to the course website for the latest version of this document.
You are encouraged to seek the help of your instructor during his office hours.

2. Figure 9-35 shows a three particle system, with masses m_1 = 3.0 kg, m_2 = 4.0 kg, and m_3 = 8.0 kg. The scales on the axes are set by x_s = 2.0 m and y_s = 2.0 m. What are (a) the x coordinate and (b) the y coordinate of the system's center of mass? (c) If m_3 is gradually increased, does the center of mass of the system shift toward or away from that particle, or does it remain stationary?

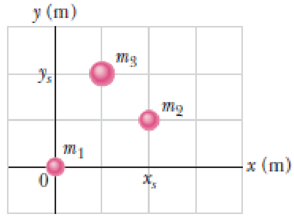

Fig. 9-35 Problem 2.

Answer: (a) 1.1 m, (b) 1.3 m, (c) towards

10. A 1000 kg automobile is at rest at a traffic signal. At the instant the light turns green, the automobile starts to move with a constant acceleration of 4.0 m/s^2. At the same instant a 2000 kg truck, traveling at a constant speed of 8.0 m/s, overtakes and passes the automobile. (a) How far is the com of the automobile–truck system from the traffic light at t = 3.0 s? (b) What is the speed of the com then?

Answer: (a) 22 m, (b) 9.3 m/s

34. Basilisk lizards can run across the top of a water surface (Fig. 9-52).With each step, a lizard first slaps its foot against the water and then pushes it down into the water rapidly enough to form an air cavity around the top of the foot. To avoid having to pull the foot back up against water drag in order to complete the step, the lizard withdraws the foot before water can flow into the air cavity. If the lizard is not to sink, the average upward impulse on the lizard during this full action of slap, downward push, and withdrawal must match the downward impulse due to the gravitational force. Suppose the mass of a basilisk lizard is 90.0 g, the mass of each foot is 3.00 g, the speed of a foot as it slaps the water is 1.50 m/s, and the time for a single step is 0.600 s. (a) What is the magnitude of the impulse on the lizard during the slap? (Assume this impulse is directly upward.) (b) During the 0.600 s duration of a step, what is the downward impulse on the lizard due to the gravitational force? (c) Which action, the slap or the push, provides the primary support for the lizard, or are they approximately equal in their support?

Fig. 9-52 Problem 34. Lizard running across water. *(Stephen Dalton/Photo Researchers)*

Answer: (a) 4.50×10^{-3} N·s (b) 0.529 N·s (c) push

38. In the overhead view of Fig. 9-54, a 300 g ball with a speed v of 6.0 m/s strikes a wall at an angle u of 30° and then rebounds with the same speed and angle. It is in contact with the wall for 10 ms. In unitv ector notation, what are (a) the impulse on the ball from the wall and (b) the average force on the wall from the ball?

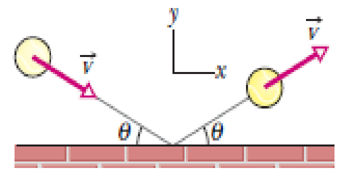

Fig. 9-54 Problem 38.

Answer: (a) (1.8 N s) $\hat{j}$, (b) (−180 N) $\hat{j}$

51. In Fig. 9-58 a, a 3.50 g bullet is fired horizontally at two blocks at rest on a frictionless table. The bullet passes through block 1 (mass 1.20 kg) and embeds itself in block 2 (mass 1.80 kg). The blocks end up with speeds v_1 = 0.630 m/s and v_2 = 1.40 m/s (Fig. 9-58 b). Neglecting the material removed from block 1 by the bullet, find the speed of the bullet as it (a) leaves and (b) enters block 1.

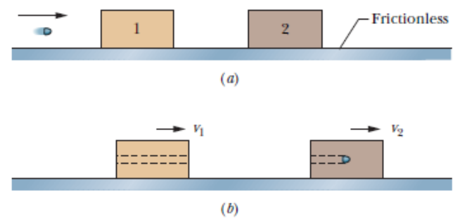

Fig. 9-58 Problem 51.

Answer: (a) 721 m/s,(b) 937 m/s

59. In Fig. 9-63, block 1 (mass 2.0 kg) is moving rightward at 10 m/s and block 2 (mass 5.0 kg) is moving rightward at 3.0 m/s. The surface is frictionless, and a spring with a spring constant of 1120 N/m is fixed to block 2. When the blocks collide, the compression of the spring is maximum at the instant the blocks have the same velocity. Find the maximum compression.

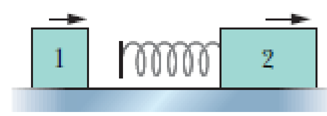

Fig. 9-63 Problem 59.

Answer: 0.25 m