

## Projectiles Launched at Angles

- 1) A cannon ball is launched on a flat field at an angle of  $30.0^\circ$  above the horizontal and has an initial velocity of 120 m/s.
  - a) Sketch the setup of the cannon showing the location of the cannon, ball, and field.
  - b) Calculate the initial horizontal and vertical velocity.
  - c) What is the time of flight?
  - d) What height does the cannon ball reach?
  - e) What is the horizontal distance that the cannon ball travels?
  
- 2) A soccer ball is kicked from ground level. The ball stays in the air for 4.3 s and the ball hits the field 55 m away from where it was kicked.
  - a) Sketch the soccer ball, trajectory, and field.
  - b) Calculate the horizontal velocity.
  - c) Calculate the vertical initial velocity and the final velocity upon impact.
  - d) What maximum height does the ball reach?
  - e) Calculate the velocity of the ball when it was kicked.
  
- 3) In a circus, a “human cannonball” is launched from a cannon and lands in a net. The cannon releases him at the same height as the net. His initial velocity is 18.3 m/s in a direction  $40.0^\circ$  above the horizontal.
  - a) Sketch the setup of the human showing the location of the cannon, human, and net.
  - b) Calculate the initial horizontal and vertical velocity.
  - c) For how much time will he be in the air?
  - d) How far does he travel horizontally?
  - e) What height does he reach?
  
- 4) The circus manager from the previous question wants to make the stunt more dramatic by firing the stuntman through a hoop 9.0 m high then land in a safety net at the same height as the cannon. The cannon’s angle is changed to  $45.0^\circ$  and the velocity is increased to 21.0 m/s. The manager needs to know where to place the hoop and safety net.
  - a) Sketch the setup of the stunt showing the location of the cannon, hoop and net.
  - b) Calculate the initial horizontal and vertical velocity.
  - c) What is the time required to reach the height of the hoop?
  - d) How far from the cannon should the hoop be placed?
  - e) How far from the cannon should the safety net be placed?