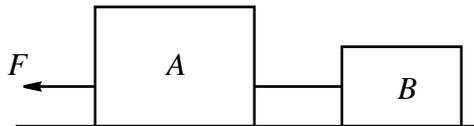


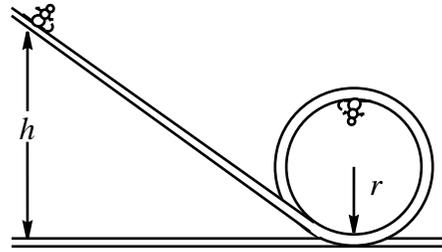
1.

Two blocks,  $A$  and  $B$  connected by a cord and are being accelerated on a frictionless surface by a force  $F$  pulling on  $A$ . Block  $A$  has a larger mass than  $B$ .



- (a) Draw a free body diagram of each of the two blocks showing all the forces acting on the them, and indicating which forces have the same magnitude, and why.
- (b) Is the tension in the cord connecting the two blocks greater than  $F$ , less than  $F$  or equal to  $F$ ? Explain.
- (c) If the two blocks were in the opposite order would the tension in the cord increase, decrease or remain the same? Explain.
- (d) If the blocks were in the opposite order would the acceleration of the blocks increase, decrease or stay the same? Explain.

2. A sled slides down a frictionless track as shown and loops the loop upside down without falling. Let  $h = 60$  m and  $r = 10$  m.



- (a) How does the sled manage to loop the loop without falling? Is there a force pushing the sled up against the track? Explain.

- (b) Draw a free body diagram labeling the forces that act on the sled at the top of the loop.

- (c) Using conservation of energy find

- (i) the speed of the sled as it enters the loop?

- (ii) the speed at the top of the loop?

- (d) Hence find the value of the centripetal acceleration at the top of the loop. In what direction does this acceleration act?

3. A 30 g ball is attached to the end of a string of length  $L = 50$  cm to form a pendulum. The ball is pulled back to an angle of  $53^\circ$  and released. At the lowest point in its path it makes a totally inelastic collision with stationary piece of clay of mass 100 g.

(a) What was the velocity of the ball just before the collision?

(b) Assuming the clay originally rested on a frictionless surface how high do the ball and clay rise after the collision?

(c) What fraction of the initial mechanical energy is lost during the collision?

4. A force of 120 N is used to lift a 10 kg box to a height of 5.0 m.

(a) What work was done by the applied force?

(b) What is the change in potential energy of the box?

(c) If the box started from rest what is the kinetic energy of the box by the time it reaches a height of 5.0 m?