

**W3.12****DYNAMICS  $\Sigma F \neq 0$** **Word problems**

For each question sketch a picture and draw a FBD.

- 1) A 10-kg “dead donkey in cement” is pulled to the right across a rough floor ( $\mu \neq 0$ ) by a horizontal force of 40 N. If the “donkey” accelerates to the right at  $1 \text{ m/s}^2$ , what is the  $\mu$  between the floor and the “donkey”?
- 2) A horizontal force pushes a 20-kg crate to the right across a rough floor where  $\mu = 0.5$ . If the crate accelerates to the right at  $6 \text{ m/s}^2$ , what is the magnitude of the horizontal push?
- 3) A 40-kg safe is pulled to the right across a rough floor ( $\mu \neq 0$ ) by a rope angled at  $36.87^\circ$  above the horizontal. If the tension in the rope is 200 N and the safe accelerates to the right at  $2.5 \text{ m/s}^2$ , what is the  $\mu$  between the safe and the floor?
- 4) A large 1kg basketball falls 20 meters in 4 seconds starting from rest. (Hint: What is the acceleration?) What is the average drag force (air resistance) acting upwards on the ball as it falls?
- 5) A 4-kg book is pressed horizontally against a rough wall ( $\mu \neq 0$ ) by a force. If the book accelerates downward at  $2 \text{ m/s}^2$  and the coefficient of friction between the wall and the book is 0.4, what is the size of the force?
- 6) Drew, Bill and Keith push horizontally on Chuck (100-kg). Drew and Bill each push to the right with a force of “ $2F$ ” and Keith pushes to the left with a force of “ $F$ ”. Chuck moves and accelerates to the right at  $2 \text{ m/s}^2$  across the rough floor where  $\mu = 0.5$ . What is the magnitude of Keith’s push?
- 7) A block of unknown mass is pulled across a horizontal surface with a force of 50 N. If the  $\mu$  between the surfaces is 0.2 and the acceleration of the block is  $5 \text{ m/s}^2$ , what is the mass of the block?
- 8) A 10-kg child is pushed up a  $36.87^\circ$  ramp by a force,  $P$  (parallel to the surface of the ramp). If the child accelerates at  $4 \text{ m/s}^2$  (up the ramp) and the  $\mu$  between the surfaces is 0.2, what is the magnitude of  $P$ ?