

## **Week 3**

### **Detailed learning goals**

By completing this topic, you should be able to:

- Represent forces acting on an object using force vectors
- Explain and use a free-body diagram to find the net force acting on an object
- Describe static and kinetic friction
- Calculate the magnitude of static and kinetic friction
- Explain drag force
- Define terminal speed and explain the factors that contribute to it

### **Prescribed readings for SLE123 content**

Please read the following sections from Giambattista Physics (5th ed.). New York: McGraw-Hill:

- Section 4.6 Contact Forces.
- Section 4.11 Air Resistance.

### **Practice questions:**

1. For the problems (a)-(c), identify all the forces acting on the object and draw a free-body diagram of the object.
  - (a) Your car is sitting in a car-park.
  - (b) A box is being dragged across the floor at a constant speed by a rope pulling horizontally on it. Friction is not negligible.
  - (c) A skydiver has his parachute open and is floating downward through the air at a constant speed.
2. A man pulls a 20kg trolley with a force of 100 N. The friction is 50N. What is the net force and acceleration?
3.
  - a. A person pulls a 50 kg table with a force of 100 N. If  $\mu_s=0.1$ , will the table move?
  - b. A tractor pulls a 200 kg log with a force of 1000 N. If  $\mu_s=0.8$ , will the log move?
4. A football player is pushing a 60 kg tackling bag across the ground at a constant speed. The coefficient of kinetic friction between the grass and the bag is 0.30. How much force must she apply to the bag?
  - a. 18 N
  - b. 60 N
  - c. 176.4 N
  - d. 588 N

5. A 5 kg block of ice is being pushed across an icy lake. Ice on ice has a static friction co-efficient of 0.1. What is the minimum force that must be applied to the ice-block for it to move (correct to 1 decimal place).
- a. 0.5 N
  - b. 49 N
  - c. 4.9 N
  - d. 490 N
6. Ice on ice has a kinetic friction co-efficient of 0.03. An ice block is pushed with a constant force of 15N across the surface of an icy lake. If it's mass is 3kg, what is its acceleration?
- a.  $9.42 \text{ m/s}^2$
  - b.  $1.35 \text{ m/s}^2$
  - c.  $4.71 \text{ m/s}^2$
  - d.  $0.45 \text{ m/s}^2$