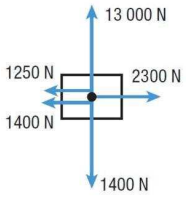
SPH3U UNIVERSITY PHYSICS

FORCES

- Net Force (P.119-120)

Free-Body Diagrams & Net Force

Since a single force seldom acts on an object it is often necessary to find the sum of several forces acting on an object. The vector sum of all the forces acting on an object is called the ***net force (F_{net})*** *or the* ***resultant force****.*



Free-Body Diagrams & Net Force

NET FORCE (F_{net})

- the vector sum of all the forces acting on an object
- also known as the resultant force

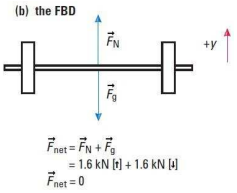
$$\vec{F}_{net} = \vec{F}_1 + \vec{F}_2 + \ldots$$

where F_{net} is the net force on the object (N)
$F_{1,2,\ldots}$ are the individual forces acting on the object (N)

Free-Body Diagrams & Net Force

NOTE!

In order to determine the net force acting on an object, the use of a free-body diagram (FBD) is necessary. For example, consider a weight-lifter who holds a weight above their head by exerting a force of 1.6 kN[↑]. The force of gravity acting on the weight is 1.6 kN[↓]. The FBD of the weight and the net force acting on the weight are as follows:

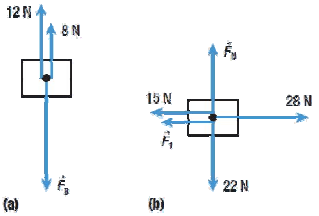


Free-Body Diagrams & Net Force

PRACTICE

1. If the following objects are at rest, what is the missing force on each FBD shown?

   (a) F_g = 20 N[down]
   (b) F_1 = 13 N[left]
   F_N = 22 N[up]

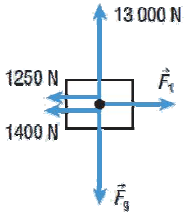


Free-Body Diagrams & Net Force

PRACTICE

2. The FBD is for a car at rest on the ground.
   (a) Determine F_1 and F_g.
   (b) How would your answers change if the car was moving at a constant velocity? Assume none of the forces change.

   (a) F_1 = 2650 N[right]
   F_g = 13000 N[down]
   (b) they wouldn't – the values would remain the same



Free-Body Diagrams & Net Force

PRACTICE

3. Two children are fighting over a toy. One pulls with a force of 20 N[E] and the other pulls with a force of 5.0 N[W]. Draw a FBD of the toy and find the resultant force acting on it.

F_{net} = 15 N[E]

Free-Body Diagrams & Net Force

PRACTICE

4. A trunk is acted upon by forces of 30 N[N] and 40 N[E]. Draw a FBD of the trunk and find the net force acting on it.

F_{net} = 50 N[N53°E]

Free-Body Diagrams & Net Force

PRACTICE

5. A clerk pushes a parcel toward a customer with a force of 7.6 N[E]. The frictional resistance on the parcel is 6.5 N[W], and both the force of gravity and the normal force have a magnitude of 9.9 N. Draw a FBD of the parcel and determine the net force acting on it.

F_{net} = 1.1 N[E]

Free-Body Diagrams & Net Force

PRACTICE

6. A person was reported to have attached weather balloons to a lawn chair and then flew to a height of about 16,000 feet. Is this possible? What would the FBD for this situation be?

✔ Check Your Learning

TEXTBOOK

P.122 Q.16