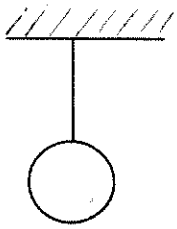
FREE-BODY DIAGRAMS (FBDs)

- Free-body diagrams are diagrams used to show the relative magnitude and direction of all forces acting upon an object in a given situation.
- Knowing that F_N is a force exerted by a surface of contact, it is customary not to draw this surface or the ground.
- FBD shows only an object (usually a dot with a rectangle around it) and forces (arrows) acting on the object.
- Length of the arrows should be relative to the magnitude of the forces.
- Direction of the arrows should show exact direction of the forces.

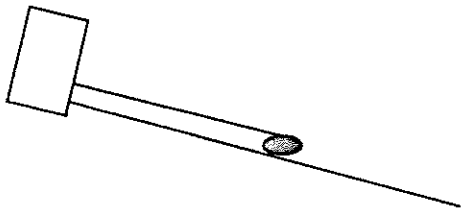
Practice: Assume that the object is stationary and friction is negligible unless stated otherwise.

1. A free - falling ball.

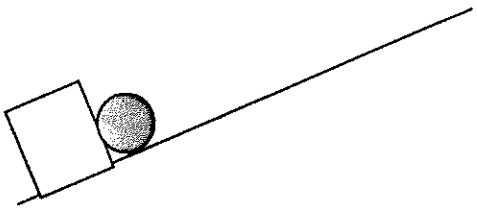
2.



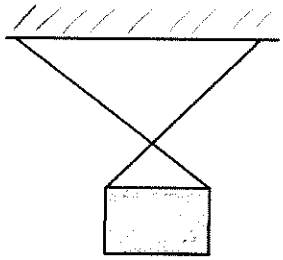
3.



4.

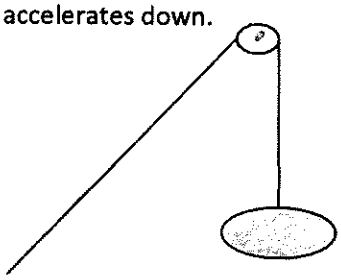


5.

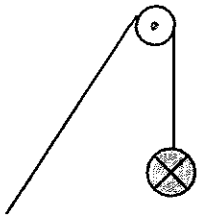


6.

7. An object is hung over a frictionless pulley and accelerates down.

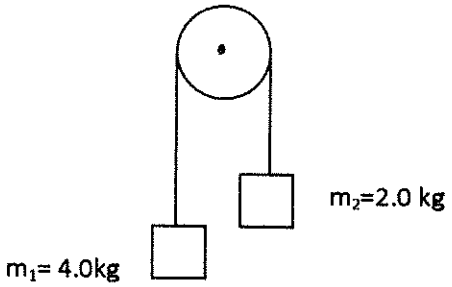


8. An object is hung over a frictionless pulley and accelerates up.



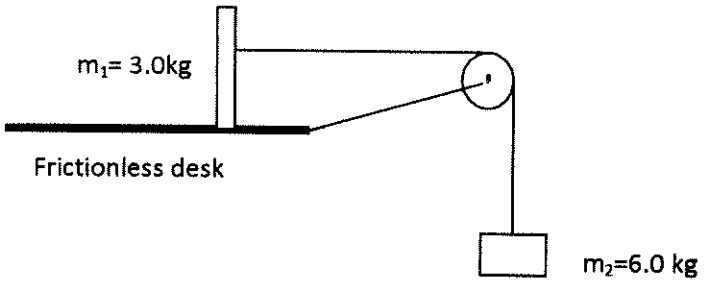
Homework:

1. Consider the following scenario:



a) State your assumptions.
b) Draw FBDs for each block.
c) Find the tension in the rope. **(26 N)**
d) Find the magnitude and direction of the acceleration of each block. **(3.3m/s^2[up for m_2 and down for m_1])**

2. Consider the following scenario:



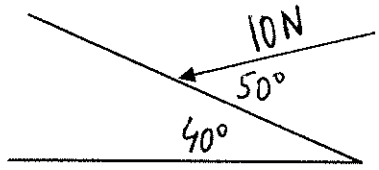
a) State your assumptions.
b) Draw FBDs for each block.
c) Find the tension in the rope. **(20 N)**
d) Find the magnitude and direction of the acceleration of each block.**(6.5 m/s^2[right for m_1 and down for m_2])**

3. Consider a 10.0-kg object on a 25°-inclined plane. What is the minimal coefficient of friction required to keep the object at rest? **($\mu_s \geq 0.47$)**

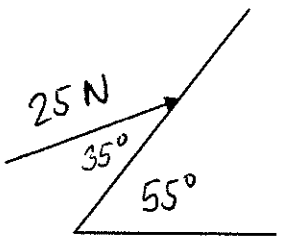
4. What is the force parallel with the inclined plane required to accelerate an object by 10 m/s^2? The coefficient of static friction between the surfaces is 0.2 and the object is at rest and its weight is 49N. θ=10.**($F_{pull\ or\ push}$ = 51 N)**

5. Find components of the following forces acting on an inclined plane at an angle. One component has to be parallel (//) with the inclined plane and the other component has to be perpendicular to the surface of the inclined plane ($\perp$). (Hint: Construct a right triangle that has the given vector as a hypotenuse and place the right angle at the inclined plane)

a)



b)



c) Note that $\theta = \alpha$ whenever the force acting on the inclined plane is strictly vertical