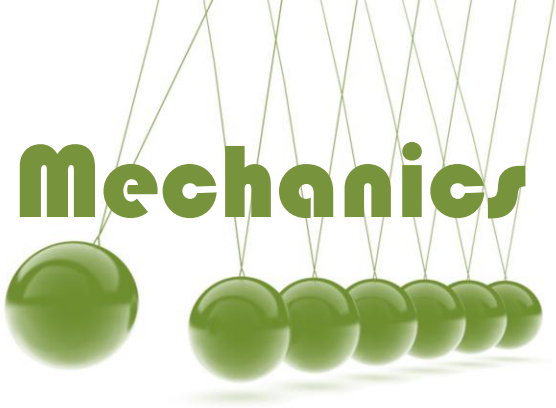


M1

Friction

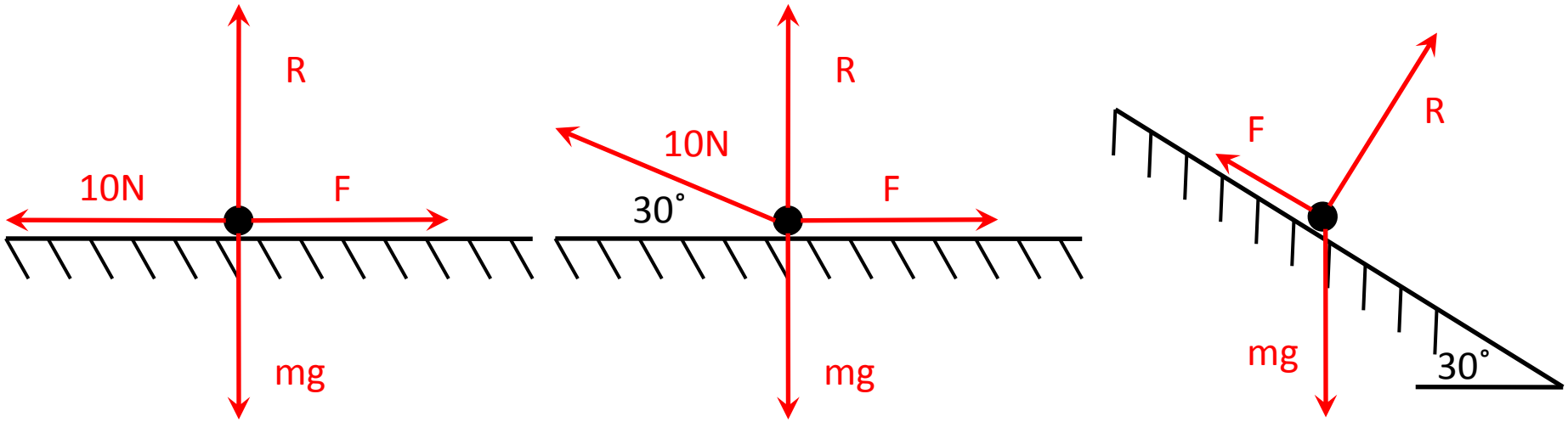
Objective: To understand what friction is, and to find the frictional force, including limiting friction

Friction

Friction is a resistive force that acts between an object and a rough surface. It resists the sliding motion of the object over the surface.

As a resistive force, similar to the normal reaction, friction will only be as great as it needs to be in order to maintain equilibrium. It will only ever act in the opposite direction to motion.

Each of the particles below is held in equilibrium by friction. Find the frictional force, F.



Limiting Friction

Friction can only provide a certain force. The maximum frictional force between a surface and an object is the **limiting friction**.

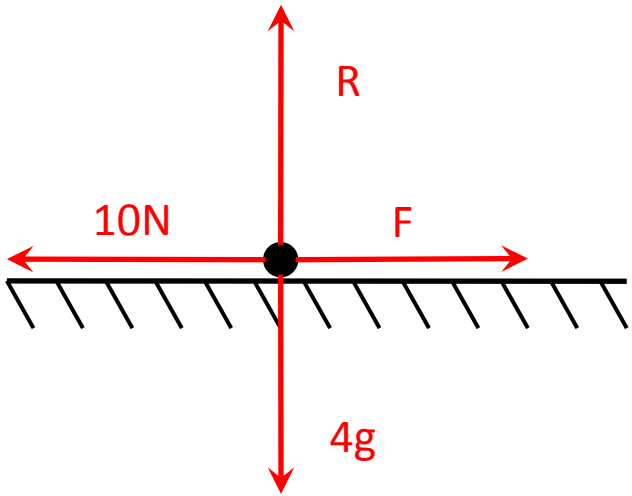
The limiting friction depends on the normal reaction force between the object and the surface (heavier objects are harder to pull!), as well as the roughness of the surface. It is a lot more difficult to move a heavy crate across carpet than a small box across an ice rink.

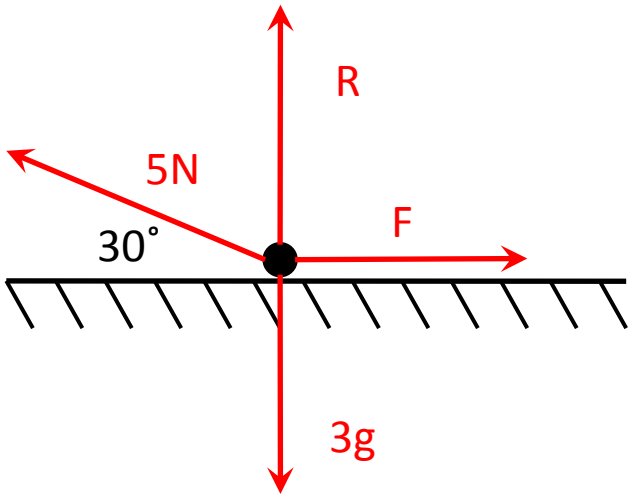
The relationship between the variables is: $F_{max} = \mu R$

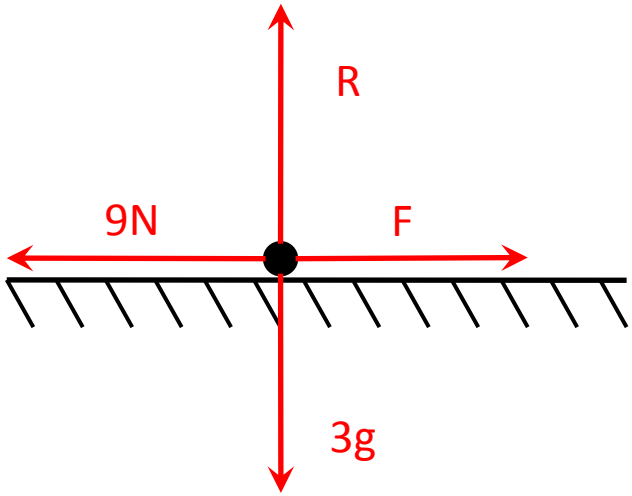
μ is the **coefficient of friction**, which is dependant on the materials in contact.

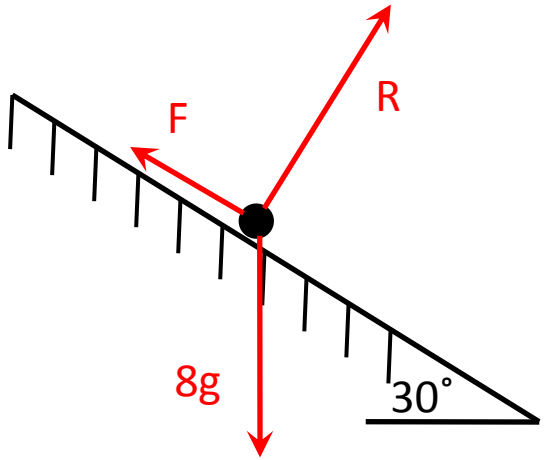
Each of the following systems have a coefficient of friction, μ, of 0.3. Determine if the particles remain in equilibrium or not.

$$F_{max} = \mu R$$



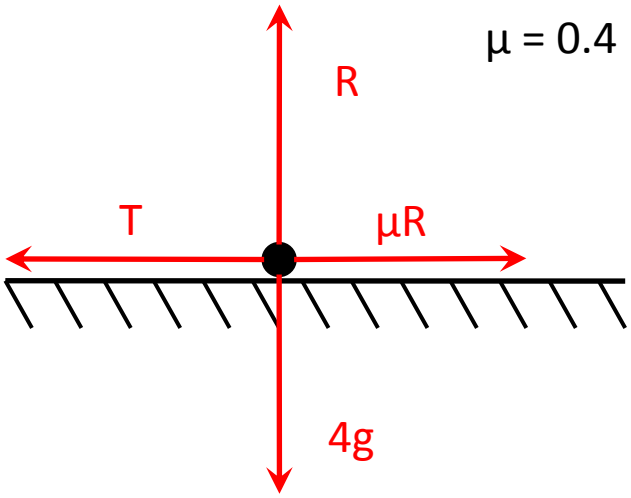


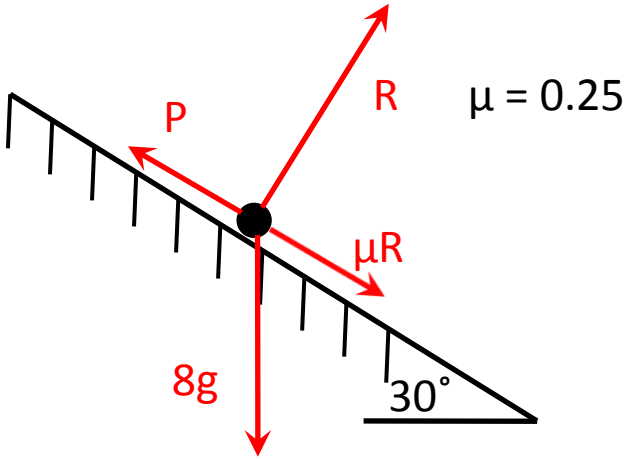




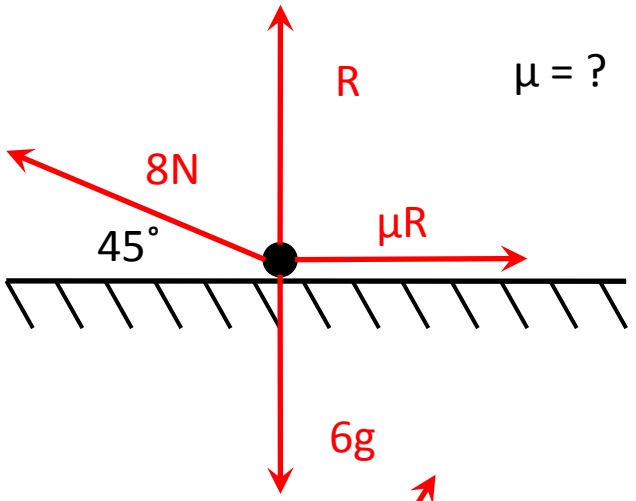
Limiting Equilibrium is the state of equilibrium that is achieved at the limit of friction.

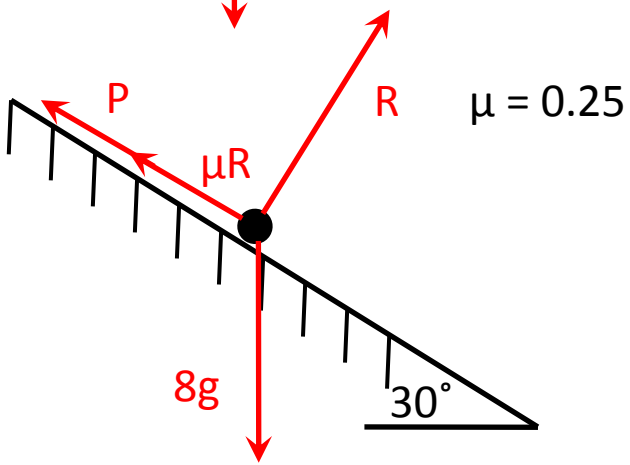
Each of the following particles is in limiting equilibrium. Find the missing values.





Force P is not quite enough to create movement **up** the slope.



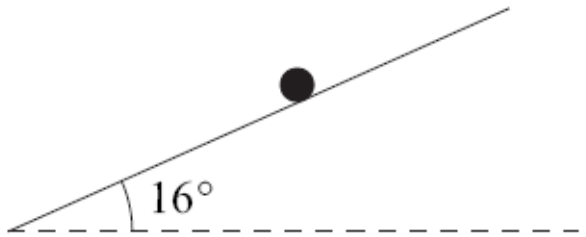


Force P is just enough to prevent movement **down** the slope.

A-Level Past Paper Question

AQA - M1 - June 2006

A stone rests in equilibrium on a rough plane inclined at an angle of 16° to the horizontal, as shown in the diagram. The mass of the stone is 0.5 kg.



(a) Draw a diagram to show the forces acting on the stone. *(1 mark)*

(b) Show that the magnitude of the frictional force acting on the stone is 1.35 newtons, correct to three significant figures. *(3 marks)*

(c) Find the magnitude of the normal reaction force between the stone and the plane. *(2 marks)*

(d) Hence find an inequality for the value of μ, the coefficient of friction between the stone and the plane. *(2 marks)*