## Lesson 1.5 (Chapter 2.3): Newton's Law

So far, we have reviewed:

- Newton's 1, 2, 3 Law of motion
- Free body diagram in 1D and 2D, adding forces and breaking down components

Question 1:

Block A, with a mass of 4.2 kg, is suspended from a vertical string as shown in **Figure 10**. The string passes over a pulley and is attached to block B. The mass of block B is 1.8 kg. The pulley and the surface of the ramp are essentially frictionless. Calculate (a) the acceleration of the blocks and (b) the tension in the string. T/I [ans: (a) 5.3 m/s$^2$; (b) 19 N]

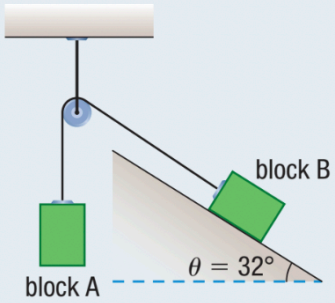
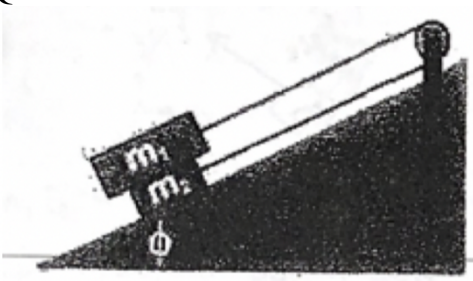



**Figure 10**

Question 2:




a. A 20.0 kg block, $m_1$, is sliding on a 10.0 kg block, $m_2$. The blocks are on a 20° (2 s.d.) slope and are connected by a light string looped over a pulley. All surfaces are frictionless. Find the magnitude of the acceleration of each block and the tension in the sting that connects the blocks.

b. Derive a formula for the acceleration of the blocks and the tension in the string, in terms of $m_1$, $m_2$, g, and θ.

**Questions involved both kinematics and dynamics:**

Question 3:

Starting from rest a 56.0 kg curler pushes out of the hack with a force of 145.0 N [forwards] and moves 5.50 m. She then moves at a constant velocity for 5.5 s before slowing down by dragging her foot. When she drags her foot she causes a net force of 42.0 N [backward] to slow her before she stops.

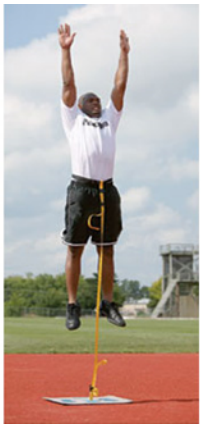
How far does she slide?

Question 4:

An exceptional standing jump would raise a person 0.80 m off the ground. To do this, a 61 kg person crouches 0.20 m and pushes off from the ground, exerting a force on it. By Newton's third law, the ground pushes back with an equal and opposite force, which accelerates the person off the ground.

a) What is the jumper's speed just as he leaves the ground?

b) What force must he exert on the ground to perform the 0.80 m jump?



Question 5:

The driver attaches a new string to the teletubby, ties the string to the mirror and starts driving again. At a certain point in time, the car is driving at a constant speed of 75 km/h. The driver of the car sees Pikachu run out on to the road, 45.0 m in front of the car. The driver brakes sharply, to try to avoid hitting the confused creature (it shouldn't be in this world). During the time it takes to stop, the car accelerates uniformly and the string attached to the teletubby makes an angle of 35°, with the vertical. Does the car hit Pikachu, and if not, how close does it come to Pikachu before it stops?