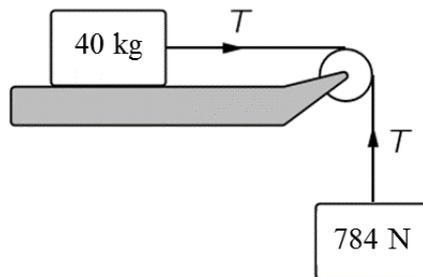
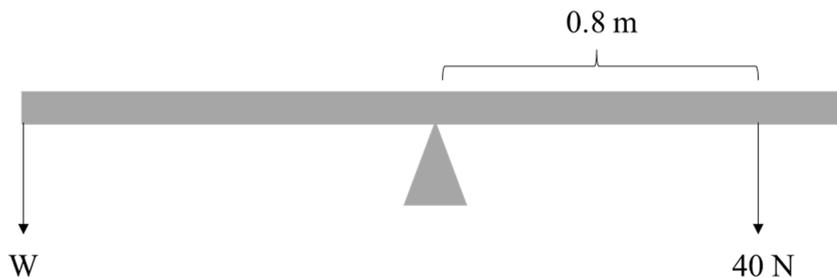


Lab Tutorial #2

1. Calculate the mass of the earth given that the radius of the earth is $R_E = 6.38 \times 10^6 \text{ m}$, $g = 9.8 \text{ ms}^{-2}$ and $G = 6.67 \times 10^{-11} \text{ Nm}^2 \text{ kg}^{-2}$.
2. Determine the acceleration due to gravity for a satellite in orbit 200 km above the surface of the earth. Use the data from no. 1.
3. A block of mass 40 kg on a table is attached to a block of weight 784 N by a rope passing over a pulley as shown in the diagram alongside. Ignoring all frictional effects and assuming the pulley to be massless, determine
 - (a) the acceleration of the two blocks and
 - (b) the tension in the cord.



4. Two objects A and B, of masses 10 kg each, are connected by a cord of negligible mass, which passes over a frictionless pulley. If 2 kg is shifted from A to B what
 - (a) acceleration result and
 - (b) the tension?
5. Two children are playing on a see-saw. The total length of the see-saw is 2.0 m and it is pivoted exactly in the middle, as shown in the diagram below. One child weighs 40 N and sits 0.8 m from the pivot. If the other child sits at the end of the see-saw, what is its weight?



6. A 26 kg box is held in place by 2 ropes of the same size and material, which are fixed at points P and Q. The ropes of the length 26 cm make an angle of 25° with the vertical. Determine the tension T in the ropes.
7. A student is skateboarding down a ramp that is 6.0 m long and inclined at 18° with respect to the horizontal. The initial speed of the skateboarder at the top of the ramp is 2.6 ms^{-1} . Neglect friction and find
 - (a) the speed at the bottom of the ramp and
 - (b) the acceleration.

8. A bullet of a mass 9.5 g is fired at a speed of 950 ms^{-1} . When it hit the target which is 1500 m away its speed is 948 ms^{-1} . Compute the amount of work done by air drag to reduce the speed of the bullet.
9. Calculate the power developed by a 40 kg person who, runs up stairs that have a vertical height of 6.5 m in 15 seconds.
10. A ball of a mass 200 g is travelling with a speed of $+9 \text{ ms}^{-1}$, collides with 100 g ball travelling at $+7 \text{ ms}^{-1}$. If, after the collision, the speed of the 200 g ball is $+5 \text{ ms}^{-1}$, what is the speed of the 100 g?
11. A ball of a mass 200 g is travelling with a speed of $+9 \text{ ms}^{-1}$, collides with 100 g ball travelling at -7 ms^{-1} . If, after the collision, the speed of the 200 g ball is $+3 \text{ ms}^{-1}$, what is the speed of the 100 g?
12. A 10.5 g bullet is fired into a stationary 3.0 kg block of wood suspended by a light cord. The bullet remains embedded in the block. The impact causes the centre of gravity of the block to rise 10 cm. If the bullet and the block just after the impact moved at 3.6 ms^{-1} , calculate the velocity of the bullet before the impact.
13. A spring with a certain spring constant k has a length of 5.5 cm when not under load. If the force 0.5 N is applied to compress the spring to half its length, what is the spring constant?
14. A steel rod ($Y = 20.0 \times 10^{10} \text{ Pa}$) has a length of 1.5 m and a cross-sectional area of 3.0 mm^2 . If it is subjected to a longitudinal stress of $1.4 \times 10^8 \text{ Pa}$, determine
 - (a) the strain in the rod and
 - (b) the total strain energy stored in the rod.
15. A wire is gradually allowed to take the weight of a 15 kg load and so stretches by 2.0 mm. How much work is done in stretching the wire?
16. A load of a mass 50 kg is suspended from an aluminium wire of a diameter 1.5 mm.
 - (a) Determine the stress in the wire.
 - (b) If Young's modulus for aluminium is $7.0 \times 10^{10} \text{ Pa}$ and the wire stretches by 2.0 mm, how long is it?