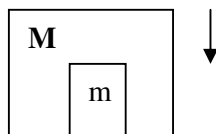
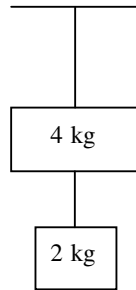


Review Paper for MST

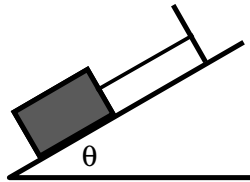
1. Evaluate i) $\frac{25.2 \times 1374}{33.3}$
 ii) $24.36 + 0.0623 + 256.2$
2. Newton's law of universal gravitation is represented by $F = \frac{GMm}{r^2}$, where F is the force, M and m are masses of the two objects and r is the centre to centre distance between the two objects. Find the dimension of G and hence state its SI unit.
3. When a spherical object moves through a liquid, the liquid opposes the motion with a force F . The magnitude of F depends on the coefficient of viscosity, η of the liquid (whose dimensions are $ML^{-1}T^{-1}$), the speed, v of the object and the radius, r of the object. Assuming that F is proportional to different powers of these quantities, guess a formula for F using the method of dimensions.
4. The position of a particle (x) moving along the x-axis as function of time (t) is given by $x = at^3 + bt^2 + ct + d$. The numerical values of a , b , c and d are 1, 4, -2 and 5 respectively and SI units are used for x and t . Find:
 - i) the SI unit of a , b , c and d .
 - ii) the velocity of the particle at $t = 4s$.
 - iii) the acceleration of the particle at $t = 4s$.
 - iv) the average velocity between $t = 0$ and $t = 4s$
5. A particle moves in the X-Y plane with a constant acceleration of 1.5 m/s^2 in the direction making at an angle of 37° with the X-axis. At $t = 0$ the particle is at the origin and its velocity is 8.0 m/s along the X-axis. Find
 - i) the velocity of the particle at $t = 4.0 \text{ s}$.
 - ii) the position of the particle at $t = 4.0 \text{ s}$.
6. A stone is thrown vertically upward from a point on a bridge located 40 m above the water. Knowing that it strikes the water 4 s after release, determine
 - i) the speed with which the stone was thrown upward,
 - ii) the speed with which the stone strikes the water.
7. A box of mass **M** contains an object of mass **m** as shown in the below. What should be the acceleration of the box during its descent if the object exerts a force of **mg/4** on the floor of the box?



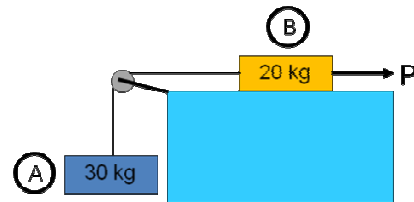
8. A 4 kg block is suspended from the roof of an elevator. A 2 kg block is suspended from the 4 kg block (see figure below) . When the elevator accelerates upwards 2.2 m/s^2 , find the magnitudes of the tensions in the strings.



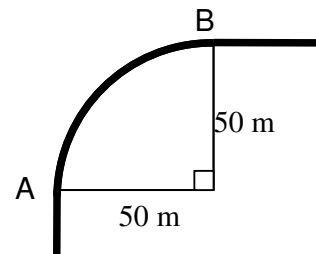
9. A block of mass 42 kg rests on a slope with a smooth surface. It is tied by a string to a post. The string can withstand a maximum tension of 300 N. Determine the angle at which the string is about to snap.



10. A force P is acting on block B as shown. If $P = 200 \text{ N}$, find the tension of the string and the acceleration of the system.



11. A car of mass 1000 kg is travelling along a road at a constant speed of 72 km h^{-1} . It enters a bend at A and exits at B. The bend has a radius of 50 m.
 (a) What is the magnitude of the centripetal force that is experienced by the car?
 (b) If your answer in (a) is the largest force that the car can withstand, what is the maximum speed of the car if the radius is 32 m instead?

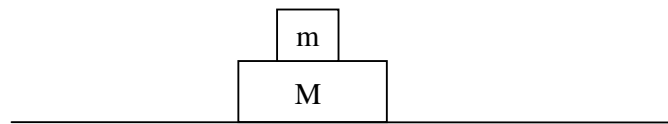


12. A clock has its minute hand 4.0cm long. Find the average velocity of the tip of the minute hand

- (a) Between 6:00am to 6:30am and
 (b) Between 6:00am to 6:30pm.

13. A particle travelled between two points. It travels half the distance with a velocity v_0 while the remaining part of the distance was covered with velocity v_1 for half the time and with velocity v_2 for the other half of the time. Find the average velocity during the journey. (Assume the particle travels in a straight line.)

14. The sum of two vectors, \mathbf{p} and \mathbf{q} is perpendicular to \mathbf{p} . Find the angle between \mathbf{p} and \mathbf{q} .
15. An aircraft is flying horizontally with speed v at altitude h . If it drops a packet to be collected by a man standing on the ground, at what distance from the man should the packet be dropped? (The man stands in the vertical plane of the aircraft's motion.)
16. A 50-kg box, starting from rest, is pulled for 2 m across a floor with a constant horizontal force of 200 N. The coefficient of kinetic friction is 0.03.
(a) What is the net force acting on the object?
(b) Find the final velocity of the box.
17. A 35 kg child swings to and fro on a swing supported by two chains each 3 m long. The tension in each chain at the lowest point of the motion is 280 N. At the lowest point, find the
(a) force exerted by the seat on the child (Ignore the mass of the seat).
(b) child's speed assuming that it does not hold the chain at the lowest point.
18. In the figure below a block of mass M lies on a surface that is smooth. A smaller block of mass m lies on the bigger block. The coefficient of static friction between the two blocks is μ . What is the maximum horizontal force that can be applied on the bigger block so that the blocks move together?



**** End ****