

### Dynamics Worksheet 3

1. A student pulls a box of books on a smooth horizontal floor with a force of 100 N in a direction of  $37^\circ$  above the horizontal. The mass of the box and the books is 40.0 kg. Calculate the acceleration of the box.
2. A box of mass 20 kg is pulled along a rough horizontal surface at a constant speed of 4 m/s by a force of 30 N inclined at an angle of  $20^\circ$  to the horizontal.
  - (a) Calculate the force of friction acting on the block.
  - (b) Calculate the coefficient of friction between the block and the surface.
3. A block weighing 10 N is on a ramp inclined at  $30^\circ$  above the horizontal. A 3 N force of friction acts on the block as it is pulled up the ramp at a constant velocity with force F, which is parallel to the ramp. Calculate the magnitude of force F.
4. A block of mass 2 kg is released from rest on a rough plane inclined at an angle  $60^\circ$  to the horizontal. The coefficient of friction between the particle and the plane is 0.4. Calculate the acceleration of the block.
5. Two particles A and B of mass 6 kg and 4 kg respectively, are on a smooth horizontal plane and connected by a light inextensible string. A horizontal force P is applied to A in the direction BA and when the string is taut the particles move with acceleration  $0.5 \text{ m/s}^2$ .
  - (a) Calculate the tension in the string joining A and B
  - (b) Calculate the magnitude of P.
6. A truck of mass 1500 kg is towing a car of mass 750 kg along a straight horizontal road. The vehicles are accelerating at  $4 \text{ m/s}^2$ . Ignore friction and air resistance.
  - (a) Calculate the tension in the cable joining the vehicles.
  - (b) Calculate the driving force exerted by the car's engine.
7. Two particles P and Q of mass 5.0 kg and 3.0 kg respectively are connected by a light inextensible string which passes over a smooth pulley. The particles are released from rest. Calculate the acceleration of P.
8. Particle A, of mass 2.0 kg, is suspended by a string. Particle B of mass 3.0 kg is suspended from A by means of a second string. Both strings are light and inelastic. When a force P is applied vertically upwards to the upper string the particles accelerate upwards at  $2.2 \text{ m/s}^2$ .
  - (a) Calculate the tension in the string joining the particles.
  - (b) Calculate the magnitude of P.
9. Two particles P and Q of masses 5.0 kg and 3.0 kg respectively are connected by a light inextensible string which passes over a smooth pulley. P is on a rough horizontal table while Q hangs freely. The coefficient of friction between P and the table is 0.20.
  - (a) Calculate the acceleration of the system.
  - (b) Calculate the tension in the string.