# Mechanics 4 – Forces

Please **complete** this homework by _____. Start it early. If you can't do a question you will then have time to ask your teacher for help or go to a drop in session.

Section 1 – Review of previous topics. Please complete all questions.

1. Find the missing values for s, u, v, a or t in each case:
   (a) s = 120 m, u = 0, v = 100 ms^{-1}
   (b) u = 0, v = 12 ms^{-1}, a = 2.4 ms^{-2}
   (c) s = 240 m, v = 18 ms^{-1}, t = 8 s
   (d) s = 130 m, u = 12 ms^{-1}, a = 0.2 ms^{-2}

2. A ball is rolling down a hill with a constant acceleration of 0.25 ms^{-2}. It travels 930 m in one minute. What was the initial speed of the ball and what was its speed after one minute?

3. A ball is thrown upwards at 10 m/s and strikes the ground at 14.5 m/s. How far above the ground was the ball thrown?

4. A particle moves with constant acceleration along a straight line ABCD, passing B 10 seconds after A and passing C 20 seconds after B. AB is 110 m and BC is 580 m.
   (a) Find the acceleration of the particle
   (b) Find the velocity of the particle at B
   (c) Given that AD is 1.75 km, how long does it take the particle to travel from B to D?

Section 2 – Consolidation of this week's topic. Please complete all questions.

1. In each of the following scenarios, the forces acting on the body cause it to accelerate as shown. In each case, find the values of the given letter.
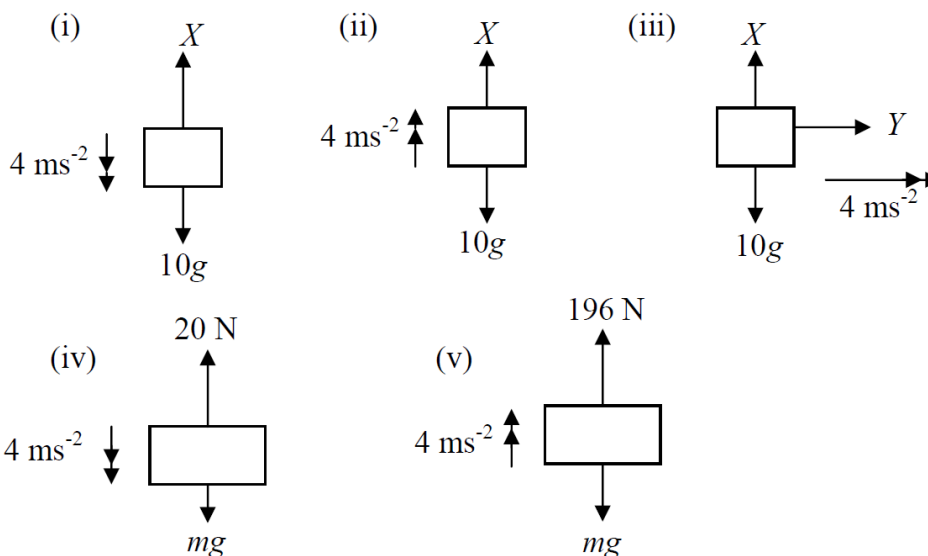
(3+3+5+4+4 = 19 marks)

2. A resultant force of 40 N which is acting on a particle of mass m kg produces an acceleration of 2 ms^{-2}. Find a value for m.

(2 marks)

3. A package of mass 8 kg is lowered by means of a vertical cable with a downward acceleration of 2 ms^{-2}. Find the tension in the cable.

(3 marks)

4. A bucket is lowered into a well. The bucket has a mass of 5 kg when empty and 15 kg when full. It is lowered into the well with a constant acceleration of 4 ms^{-2}. When full it is then raised at a constant speed of 3 ms^{-1}. Assuming that the rope is light, find the tension in the rope
   (a) when the bucket was being lowered
   (b) when the full bucket was being raised.

(3+3 = 6 marks)

5. A lift descends with an acceleration of 1.5 ms^{-2}, then moves at a constant speed until it is retarded at 1 ms^{-2}. A package of mass 20 kg stands on the floor of the lift during the journey. Find the magnitude of the force it exerts on the floor during each stage.

(9 marks)

6. A vehicle of mass 2000 kg is travelling along a straight horizontal road at 90 kmh^{-1}. It is brought to rest in a distance of 500 m by a force of magnitude P Newtons. Find P and the time taken to come to rest.

(9 marks)

7. A particle of mass 5 kg is at rest 2 m from the edge of a horizontal table. The particle is subjected to a thrust of X N and the resistance to motion is 250 N. Find the value of X given that:
   (a) the particle does not accelerate
   (b) the particle accelerates at 2 ms^{-2}
   (c) the particle falls off the edge of the table after 0.5 seconds.

(3+3+6 = 12 marks)

(Total 60 marks)

Section 3 – Extension questions. If you are aiming for a top grade, you should attempt these questions.

Past exam question (Jan 05)

A stone *S* is sliding on ice. The stone is moving along a straight line *ABC*, where *AB* = 24 m and *AC* = 30 m. The stone is subject to a constant resistance to motion of magnitude 0.3 N. At *A* the speed of *S* is 20 m s^{-1}, and at *B* the speed of *S* is 16 m s^{-1}. Calculate
(*a*) the deceleration of *S*,
(*b*) the speed of *S* at *C*.
(*c*) Show that the mass of *S* is 0.1 kg.