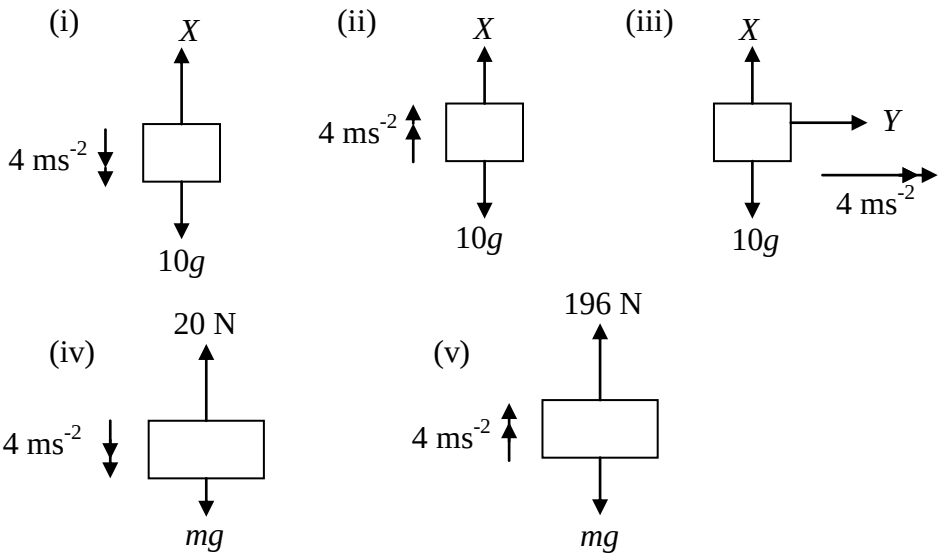
Edexcel Mechanics 1 Dynamics

Section 1: Newton's Laws of motion

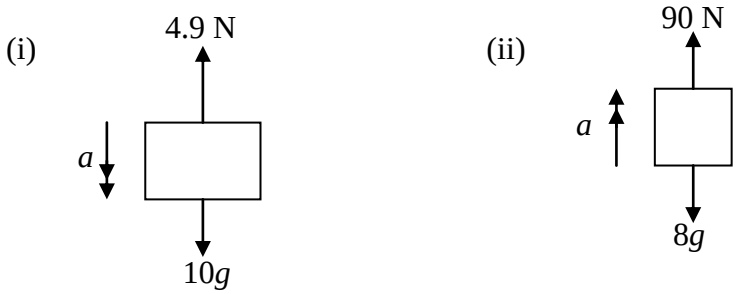
Exercise

Take g = 9.8 ms^{-2} throughout this exercise.

1. In each force diagram, the downwards force represents the weight of the object. Find the quantities marked with a letter.



2. Find the acceleration in each case.



3. A mass of 45 kg is acted on by a single force of 9 N. Find the acceleration of the particle.

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

5. A particle of mass 10 kg is pulled along a smooth horizontal plane by a horizontal string. Find the tension in the string when the particle is accelerating at 5 ms^{-2}.

6. 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.

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7. Jack and Jill went up the hill to fetch a pail of water. The pail had a mass 5 kg when empty and 15 kg when full. The pail was lowered into the well at a constant acceleration of 4 ms^{-2}. When the pail was full it was raised at a constant speed 3 ms^{-1}.
   Neglecting the weight of the rope, find the tension in the rope
   (i) when the pail was being lowered,
   (ii) when the full pail was being raised.

8. 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 of the lift at each stage.

9. 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.

10. A disc of mass 5 kg is projected up a smooth plane inclined at an angle of θ to the horizontal, where $\sin\theta = \frac{1}{5}$. The disc is given an initial velocity of 7 ms^{-1}. How far up the plane will the disc move before coming to rest?

11. A slide consists of a sloping section followed by a horizontal section. Both sections are 5 m long. The sloping section is inclined at an angle α to the horizontal such that $\sin\alpha = \frac{5}{13}$. A girl of mass 30 kg starts from rest from the top of the sloping section and is subject to a constant resistance of 50 N along both the sloping and horizontal sections. Calculate
   (i) the acceleration down the slope,
   (ii) speed at the bottom of the slope,
   (iii) retardation on the horizontal section,
   (iv) the speed at the end of the horizontal section.

12. A crate of weight 275 N is pulled up a smooth plane inclined at 45° to the horizontal by a light inextensible rope which is parallel to the slope. The crate is accelerating at 0.8 ms^{-2}. Find the tension in the rope.

13. A particle of mass 5 kg is pulled across a rough horizontal plane by a string inclined at 45° to the horizontal. The coefficient of friction between the particle and the plane is 0.6. Find the acceleration of the particle when the tension in the string is 55 N.

14. A block of mass 20 kg rests on a rough plane inclined at an angle of θ to the horizontal such that $\sin\theta = \frac{7}{25}$. The coefficient of friction between block and plane is 0.45.
   (i) Find the acceleration of the block when a force of 50 N acts on it, parallel to the plane and down the plane.
   (ii) What force acting parallel to the plane would be required to give an equal acceleration up the plane?

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