



Dynamics of a Particle

Questions

Suitable for:
Pearson Edexcel International A-Level (iAL) — Mechanics 1



Question 1

A particle of mass 5 kg is pulled along a smooth horizontal surface by a horizontal force of 20 N. Find the acceleration of the particle.

(2 marks)

Total for question = 2 marks



Question 2

A car of mass 1200 kg accelerates from rest to 24 m s^{-1} in 8 s along a horizontal road. The resistance to motion is constant at 400 N. Find the driving force produced by the engine.

(4 marks)

Total for question = 4 marks



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Question 3

A book of mass 2 kg rests in equilibrium on a horizontal table.

(a) State the two forces acting on the book.

(2 marks)

(b) State the force that the book exerts on the table, giving its magnitude and direction.

(2 marks)

Total for question = 4 marks





Question 4

A person of mass 70 kg stands on the floor of a lift. The lift accelerates upward at 1.5 m s^{-2} . The person is modelled as a particle. Take $g = 9.8 \text{ m s}^{-2}$.

Find the magnitude of the normal reaction of the lift floor on the person.

(3 marks)

Total for question = 3 marks



Question 5

A package of mass 5 kg rests on the floor of a lift. The lift is moving upward and decelerates at 2 m s^{-2} . Take $g = 9.8 \text{ m s}^{-2}$.

(a) Find the normal reaction of the floor on the package.

(3 marks)

(b) State whether the normal reaction is greater or less than the weight of the package, giving a reason.

(1 marks)

Total for question = 4 marks





Question 6

A person of mass 80 kg stands on the floor of a lift. The floor exerts a force of 1000 N on the person. Take $g = 9.8 \text{ m s}^{-2}$.

(a) Find the acceleration of the lift.

(3 marks)

(b) State one possible direction of motion of the lift, with justification.

(1 marks)

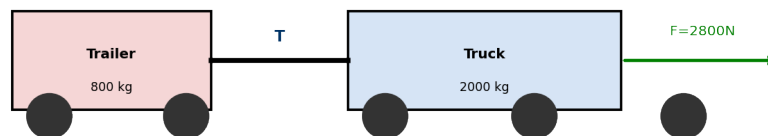
Total for question = 4 marks





Question 7

A truck of mass 2000 kg tows a trailer of mass 800 kg along a smooth horizontal road. The engine of the truck produces a driving force of 2800 N. Resistances to motion are negligible.



- (a) Find the acceleration of the system.

(2 marks)

- (b) Find the tension in the towbar.

(3 marks)

Total for question = 5 marks



Question 8

A lorry of mass 3000 kg tows a caravan of mass 1000 kg along a horizontal road. The engine exerts a driving force of 6000 N. The resistance to motion on the lorry is 500 N and on the caravan is 200 N.

(a) Find the acceleration of the system.

(3 marks)

(b) Find the tension in the towbar connecting the lorry to the caravan.

(3 marks)

Total for question = 6 marks



Question 9

A truck of mass 2500 kg tows a trailer of mass 1500 kg along a horizontal road. The brakes are applied, producing a total retarding force of 8000 N on the system. Resistances to motion are negligible.

(a) Find the deceleration of the system.

(2 marks)

(b) Find the magnitude of the force in the towbar, and state whether the towbar is in tension or compression.

(4 marks)

Total for question = 6 marks





Question 10

A particle of mass 5 kg slides down a smooth plane inclined at 30° to the horizontal. Take $g = 9.8 \text{ m s}^{-2}$.

(a) Find the acceleration of the particle.

(3 marks)

(b) Find the normal reaction of the plane on the particle.

(2 marks)

Total for question = 5 marks





Question 11

A particle of mass 4 kg is pushed up a smooth plane inclined at 25° to the horizontal by a force of 40 N acting parallel to and up the plane. Take $g = 9.8 \text{ m s}^{-2}$.

Find the acceleration of the particle.

(4 marks)

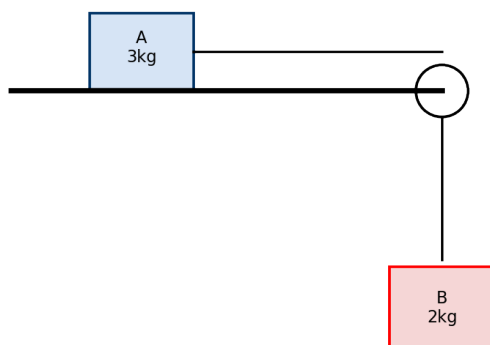
Total for question = 4 marks





Question 12

Particle A of mass 3 kg lies on a smooth horizontal table. It is connected by a light inextensible string passing over a smooth pulley at the edge of the table to particle B of mass 2 kg, which hangs freely. The system is released from rest. Take $g = 9.8 \text{ m s}^{-2}$.



(a) Find the acceleration of the system.

(3 marks)

(b) Find the tension in the string.

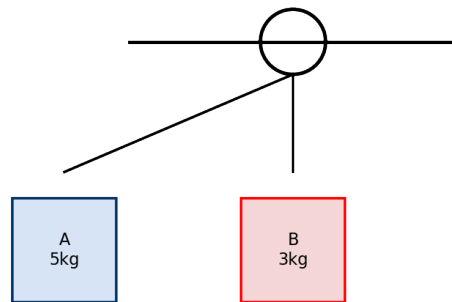
(2 marks)

Total for question = 5 marks



Question 13

Two particles A of mass 5 kg and B of mass 3 kg are connected by a light inextensible string passing over a smooth fixed pulley. The system is released from rest with both particles hanging freely. Take $g = 9.8 \text{ m s}^{-2}$.



(a) Find the acceleration of the system.

(3 marks)

(b) Find the tension in the string.

(2 marks)

(c) Find the distance travelled by each particle in the first 2 s.

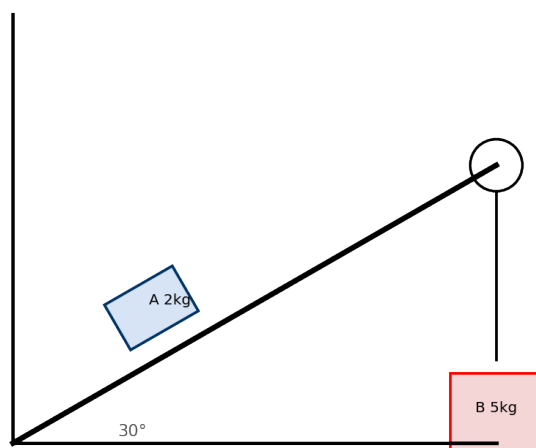
(3 marks)

Total for question = 8 marks



Question 14

Particle A of mass 2 kg lies on a smooth plane inclined at 30° to the horizontal. It is connected by a light inextensible string passing over a smooth pulley at the top of the plane to particle B of mass 5 kg, which hangs freely. The system is released from rest. Take $g = 9.8 \text{ m s}^{-2}$.



(a) Find the acceleration of the system.

(4 marks)

(b) Find the tension in the string.

(2 marks)

Total for question = 6 marks



Question 15

A lift of mass 500 kg carries passengers of total mass 300 kg. The lift is connected to a vertical cable. The cable, lift and passengers are modelled as particles. Take $g = 9.8 \text{ m s}^{-2}$.

Find the tension T in the cable when the lift

(a) moves at constant speed,

(2 marks)

(b) accelerates upward at 0.8 m s^{-2} ,

(2 marks)

(c) decelerates at 1.2 m s^{-2} while moving upward.

(2 marks)

Total for question = 6 marks



Question 16

A truck of mass 3000 kg tows a trailer of mass 1500 kg along a horizontal road. The engine produces a driving force of 9000 N. The total resistance to motion is 1500 N, of which 1000 N acts on the truck and 500 N acts on the trailer.

(a) Find the acceleration of the system.

(3 marks)

(b) Find the tension in the towbar.

(3 marks)

The towbar then breaks. The driving force and resistance on the truck remain unchanged.

(c) Find the new acceleration of the truck.

(2 marks)

Total for question = 8 marks

