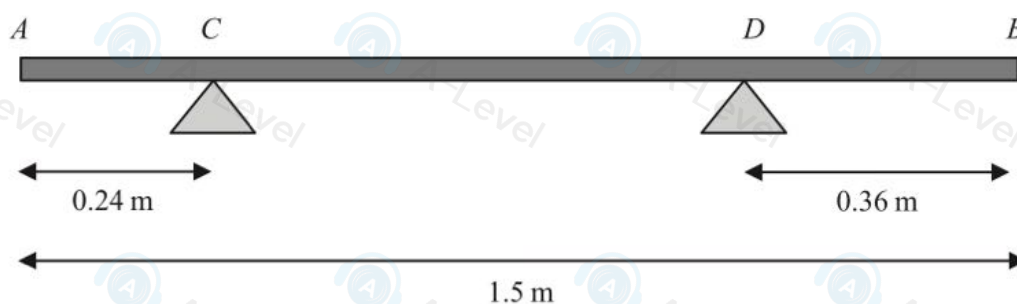


4.

**Figure 1**

A branch AB , of length 1.5 m, rests horizontally in equilibrium on two supports.

The two supports are at the points C and D , where $AC = 0.24$ m and $DB = 0.36$ m, as shown in Figure 1.

When a force of 150 N is applied vertically upwards at B , the branch is on the point of tilting about C .

When a force of 225 N is applied vertically downwards at B , the branch is on the point of tilting about D .

The branch is modelled as a non-uniform rod AB of weight W newtons.

The distance from the point C to the centre of mass of the rod is x metres.

Use the model to find

(i) the value of W

(ii) the value of x

(8)



1. Particle A has mass $4m$ and particle B has mass $3m$.

The particles are moving in opposite directions along the same straight line on a smooth horizontal surface when they collide directly.

Immediately **before** the collision, the speed of A is $2x$ and the speed of B is x .

Immediately **after** the collision, the speed of A is y and the speed of B is $5y$.

The direction of motion of each particle is reversed as a result of the collision.

(a) Show that $y = \frac{5}{11}x$.

(3)

- (b) Find, in terms of m and x , the magnitude of the impulse received by A in the collision.

(3)

Handwritten solution area with horizontal lines.

The diagram shows a horizontal beam of length 4m, labeled AB. A downward arrow at point A is labeled 0.6m. An upward arrow at point C is labeled 4m. A dimension line below the beam indicates the distance between A and C is 1m.

A diving board AB consists of a wooden plank of length 4 m and mass 30 kg. The plank is held at rest in a horizontal position by two supports at the points A and C , where $AC = 0.6$ m, as shown in Figure 1. The force on the plank at A acts vertically downwards and the force on the plank at C acts vertically upwards.

(a) Find

- the magnitude of the force acting on the plank at A ,
- the magnitude of the force acting on the plank at C .

(6)

(b) Find, in kg, the greatest integer mass of a diver who can stand on the board at B without breaking the support at A .

(3)

- (c) Explain how you have used the fact that the diver is modelled as a particle.

(1)



2. Two particles, A and B , are moving in a straight line in opposite directions towards each other on a smooth horizontal surface when they collide directly.

Particle A has mass $3m$ kg and particle B has mass m kg.

Immediately before the collision, both particles have a speed of 1.5 ms^{-1}

Immediately after the collision, the direction of motion of A is unchanged and the difference between the speed of A and speed of B is 1 ms^{-1}

- (a) Find (i) the speed of A immediately after the collision,
(ii) the speed of B immediately after the collision.

(5)

- (b) Find, in terms of m , the magnitude of the impulse exerted on B in the collision.

(3)



