Key words

gravity
parallel
resultant

1 Adding parallel forces

- Forces are vector quantities, having both magnitude and direction. A force is often represented as an arrow, whose length represents the relative magnitude of the force, and direction indicates the direction in which the force acts.
- A *resultant* force is a single force that produces the same effect as two or more forces.
- *Parallel* forces act in either the same direction or in opposite directions.

2 Adding forces

- Extend the spring by pulling two force meters in different directions. The force exerted by the upper force meter is 6 N, and by the lower force meter, 4 N.
- The spring can be extended by the same amount by pulling a single force meter in a horizontal direction by 8 N.

3 The parallelogram

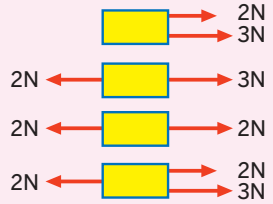
- Remove the equipment and draw a line 6 cm long representing the 6 N force between c and f, mark the end A.
- To represent the 4 N force draw a line 4 cm long between c and g. Mark end B.
- Complete the parallelogram by making a 4 cm arc centered on A and a 6 cm arc centered on B.
- The diagonal of the parallelogram is 8 cm long, the size of the resultant force in the experiment.

4 Components of weight

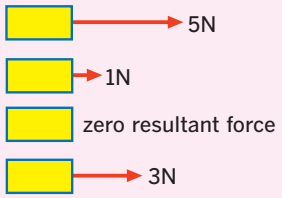
- Weight is the force that an object exerts on the ground by virtue of being pulled down by *gravity*. The weight of an object can be resolved into two forces (C_1 and C_2)acting perpendicularly to each other.
- Cos $\theta = C_2/F$ therefore $C_2 = F \cos \theta$
- Cos $\alpha = C_1/F$ therefore $C_1 = F \cos \alpha$ however cos α = sin θ therefore $C_1 = F \sin \theta$.

Adding forces

1 Adding parallel forces

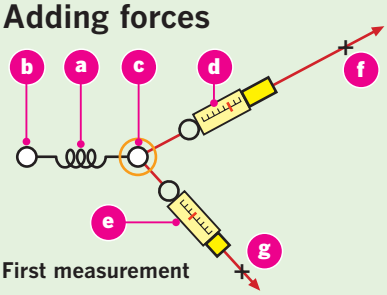


parallel forces

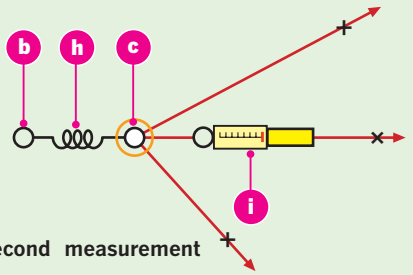


resultant forces

2 Adding forces



First measurement

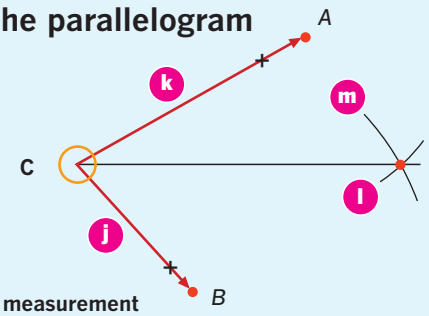


Second measurement

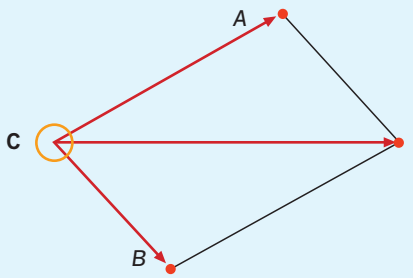
a stretched spring
b fixed end
c metal ring with circle drawn round to mark position
d force meter reads 6 N

e force meter reads 4 N
f mark direction of 6 N
g mark direction of 4 N
h stretched spring with same extension
i force meter reads 8 N

3 The parallelogram



First measurement

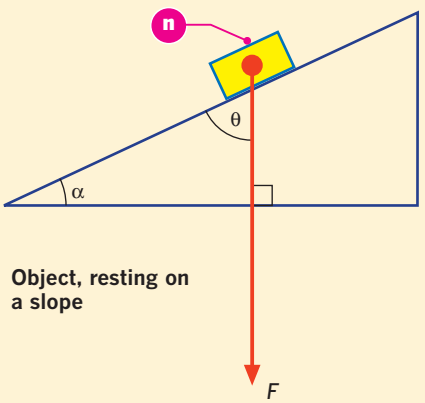


Showing how the forces add

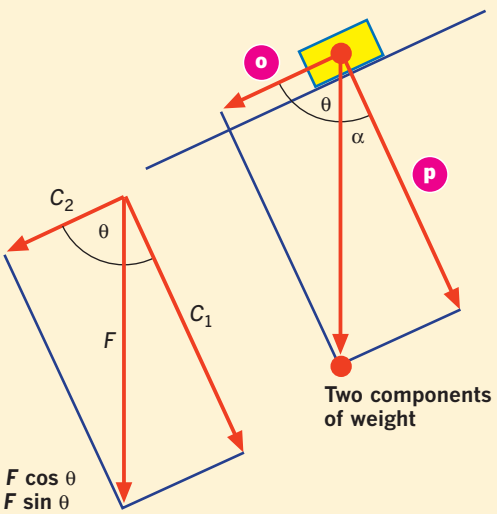
j 4 cm line to represent 4 N
k 6 cm line to represent 6 N

l point of arc radius 4 cm centered on ***A***
m point of arc radius 6 cm centered on ***B***

4 Components of weight



Object, resting on a slope



Two components of weight

n object
o weight down the plane
p weight perpendicular to plane

$C_2 = F \cos \theta$
$C_1 = F \sin \theta$