

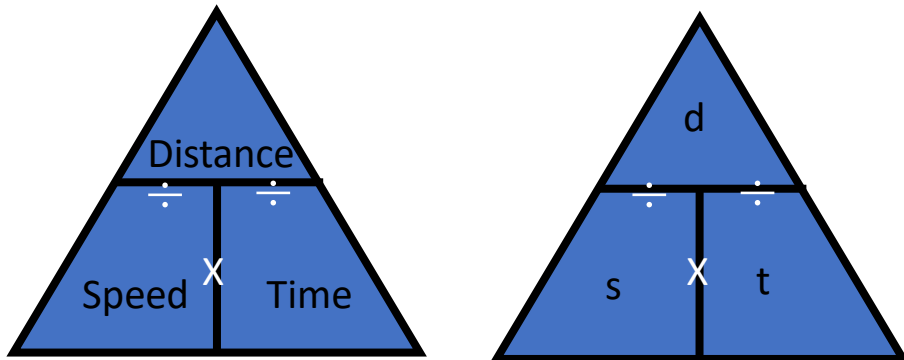
EB Education Revision Guide



How to work with Speed, Density and Pressure

What is speed?

Speed is the distance travelled per unit of time. It is usually measured in miles per hour, km per hour or in metres per second - the standard unit used in science is the meter per second. These units are known as compound units as they involve two different types of measurement (distance and time). You need to be able to rearrange the formula – and a formula triangle is an easy way of doing this.



How to use it?

- Cover up the letter which represents what you're trying to calculate with your finger.
- Write down what is left showing in the triangle.
- Check which units it provides you with in the question.

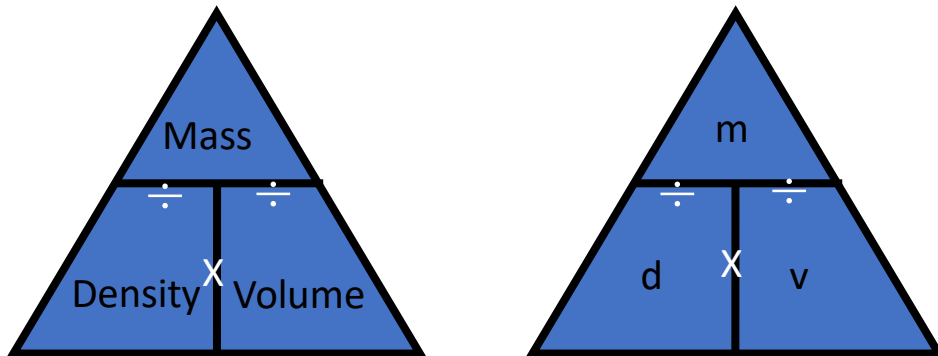
Josh throws a ball that moves at an average speed of 35 metres per second and travels for a total of 4.5 seconds. Work out the distance travelled by the ball?

$$\begin{aligned}\text{Distance} &= \text{Speed} \times \text{Time} \\ &= 35 \times 4.5 \\ &= 157.5\text{m}\end{aligned}$$

Density

What is density?

Density is a measure of the amount of substance contained in a certain volume. It is usually measured in kg/m^3 or g/cm^3 . These are compound units. The density of a substance is its mass divided by its volume.



How to use it?

- Cover up the letter which represents what you're trying to calculate with your finger.
- Write down what is left showing in the triangle.
- Check which units it provides you with in the question.

The density of air is 1.3kg/m^3 . Calculate the mass of air in a balloon which contains 0.035m^3 of air?

$$\begin{aligned}\text{Mass} &= \text{Density} \times \text{Volume} \\ &= 1.3 \times 0.035 \\ &= 0.0455 \text{ kg}\end{aligned}$$

Density

Example:

Liquid A has a density of 0.7 g/cm^3 .

Liquid B has a density of 1.6 g/cm^3 .

140g of liquid A and 128g of liquid B are mixed to make liquid C.

Work out the density of liquid C.

You can get questions like this using density.

You may find it easier to lay out your answers in a table – then you can complete calculations in steps.

	Liquid A	Liquid B	Liquid C
Mass	140g	128g	
Volume			
Density	0.7 g/cm^3	1.6 g/cm^3	????

How to do it?

	Liquid A	Liquid B	Liquid C
Mass	140g	128g	268g
Volume	200 cm^3	80 cm^3	280 cm^3
Density	0.7 g/cm^3	1.6 g/cm^3	????

1. Work out the total mass.

$$140 + 128 = 268 \text{g}$$

2. Work out the volume of Liquid A.

$$\text{Volume} = \text{Mass/Density} \quad 140/0.7 = 200 \text{ cm}^3$$

3. Work out the volume of Liquid B.

$$\text{Volume} = \text{Mass/Density} \quad 128/1.6 = 80 \text{ cm}^3$$

4. Work out the total volume.

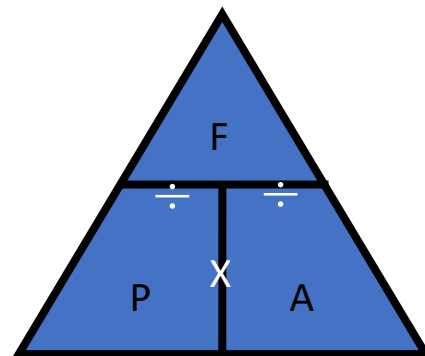
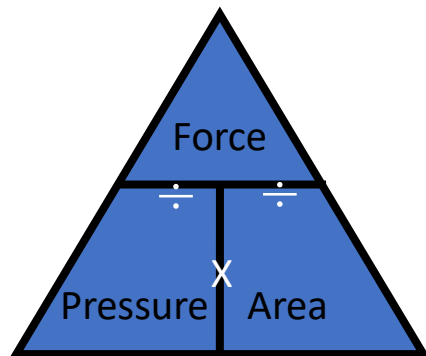
$$200 + 80 = 280 \text{ cm}^3$$

5. Work out the density of Liquid C.

$$\text{Density} = \text{Mass/Volume} \quad 268/280 = 0.957 \text{ g/cm}^3$$

What is pressure?

Pressure is the amount of force acting on a certain area. It is usually measured in N/m^2 or pascals (Pa). These are compound units.



How to use it?

- Cover up the letter which represents what you're trying to calculate with your finger.
- Write down what is left showing in the triangle.
- Check which units it provides you with in the question.

A crate exerts a force of 120 newtons on a table. The pressure on the table is 15 newtons/ m^2 . Calculate the area of the crate that is in contact with the table? Include suitable units.

$$\begin{aligned}\text{Area} &= \text{Force/Pressure} \\ &= 120/15 \\ &= 8\text{m}^2\end{aligned}$$

Pressure

Example

A force of 70 newtons acts on an area of 20cm^2 .

The force is increased by 10 newtons.
The area is increased by 10cm^2 .

Susan says,
“The pressure decreases by less than 20%”

Is she correct?
You must show how you get your answer.

How to do it?

1. Calculate the pressure.

$$70/20 = 3.5\text{N/cm}^2$$

$$\text{Pressure} = \frac{\text{force}}{\text{area}}$$

2. Calculate the pressure after the increases.

$$80/30 = 2.6\dot{6}\text{N/cm}^2$$

3. Calculate the decrease in pressure.

$$3.5 - 2.6\dot{6} = 0.8\dot{3}$$

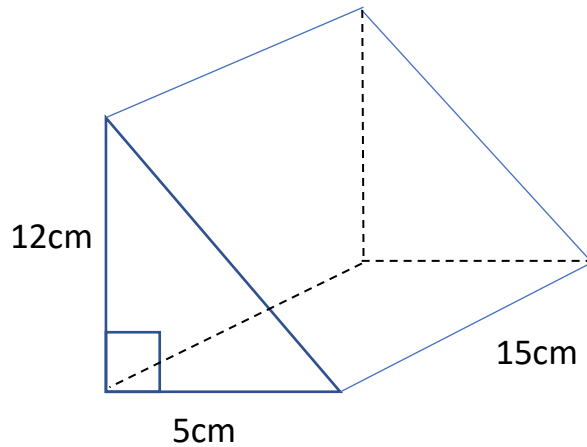
4. Calculate the % decrease in pressure.

$$\frac{\text{Change}}{\text{Original}} \times 100 = \frac{0.8\dot{3}}{3.5} \times 100 = 24\%.$$

Therefore she is incorrect.
24% is greater than 20%.



1. The triangular prism below is not drawn accurately.

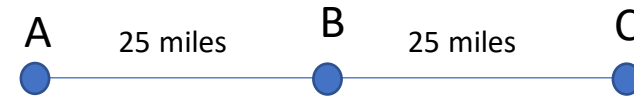


It is made from metal, and the density of the metal is 6.6 grams per cm^3 .

Calculate the mass of the prism.

Your turn:

- 2.



On a motorway there are 3 service stations: A, B and C.

From A to B is 25 miles

From B to C is 25 miles.

Aliya drives from A to C.

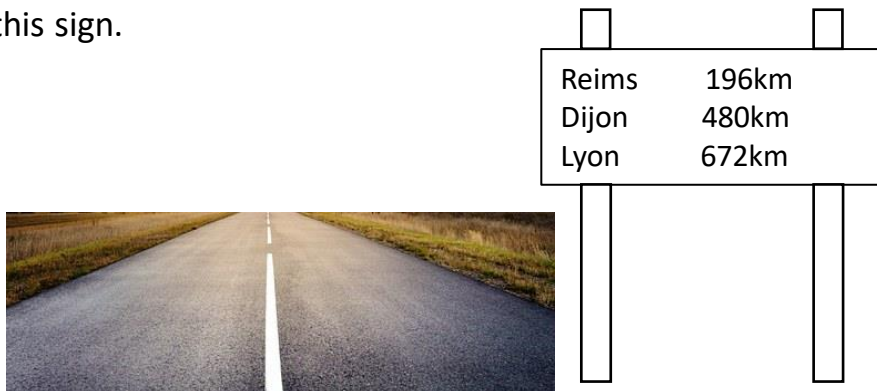
She drives at an average speed of 50mph from A to B, and at an average speed of 60mph from B to C.

Calculate the difference in the time Aliya takes to drive from a to B, and the time she takes to drive from B to C.

Give your answer in minutes.

Your turn:

3. Isabella is driving through France and sees this sign.



She is planning to drive to Dijon at an average speed of 50 miles per hour.
Calculate how long it should take Emily to get to Dijon.

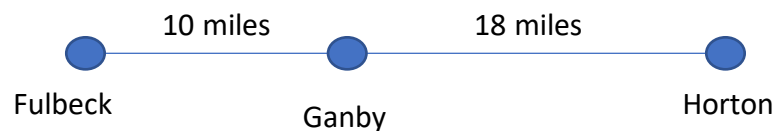
4. To make an alloy, 200g of aluminium and 200g of copper are mixed together.
Aluminium has a density of 2.7g/cm^3 .
Copper had a density of 8.9g/cm^3 .

What is the density of the alloy?

Your turn:

5. Rekha is driving from Fulbeck to Ganby. She will then drive to Horton.

It is 10 miles from Fulbeck to Ganby, and 18 miles from Ganby to Horton.



She leaves Fulbeck at 10am and drives at an average speed of 40mph.

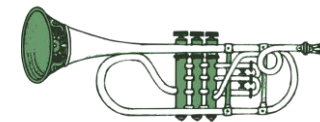
She needs to get to Horton at 10.35am.

Calculate the average speed Rekha must drive at from Ganby to Horton.

6. An alloy of brass, used for making trumpets, is made by mixing copper and zinc together.

Copper has a density of 8.9g/cm^3 .

Zinc has a density of 7.1g/cm^3 .



1 kg of brass is made by mixing 630g of copper with 370g of zinc.

Calculate the density of the brass correct to 1 decimal place.

Your turn:

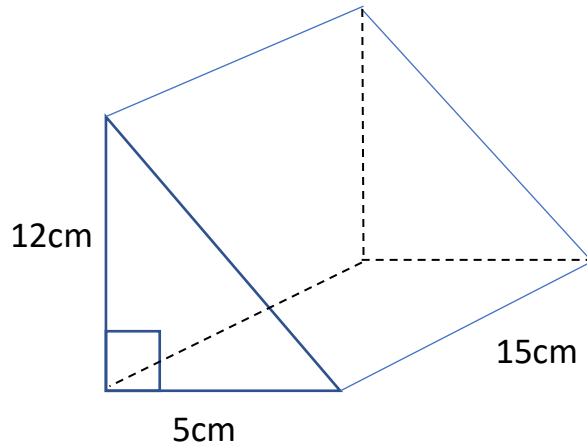
7. A hammer hits a nail with a force of 50 N into some wood. The point of the nail has an area of 0.02 cm^2 . What is the pressure the nail puts on the wood?

8. Sonia uses a glue stick with an area of 4 cm^2 , exerting a pressure of 0.5 N/cm^2 on her book. Calculate the force she puts on the glue stick.

9. A dart hits the dartboard with a force of 10N and pressure of 2000 N/cm^2 . Calculate the area of the dart.



1. The triangular prism below is not drawn accurately.



Volume of prism:
Area of cross section x length

Area of triangle
= 1/2 x base x height

It is made from metal, and the density of the metal is 6.6 grams per cm³.

Calculate the mass of the prism.

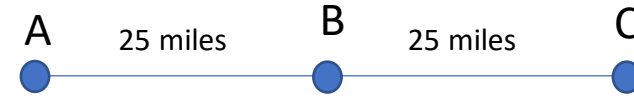
Mass = Density x Volume

Volume = (1/2 x 5 x 12) x 15 = 450cm³

6.6 x 450 = 2970g

Answers:

2.



On a motorway there are 3 service stations: A, B and C.
From A to B is 25 miles
From B to C is 25 miles.

Aliya drives from A to C.
She drives at an average speed of 50mph from A to B, and at an average speed of 60mph from B to C.

Calculate the difference in the time Aliya takes to drive from a to B, and the time she takes to drive from B to C.

Give your answer in minutes.

Time = Distance/Speed

A to B = 25/50 = 0.5

B to C = 25/60 = 0.416̇

0.5 - 0.416̇ = 0.083̇ hours

0.083̇ x 60 = 5 minutes

Answers:

3. Isabella is driving through France and sees this sign.

1 mile = 1.6 km



Reims	196km
Dijon	480km
Lyon	672km

She is planning to drive to Dijon at an average speed of 50 miles per hour.
Calculate how long it should take Emily to get to Dijon.

$$\begin{aligned} \text{Time} &= \text{Distance/Speed} \\ &= 480/(50 \times 1.6) \\ &= 6 \text{ hours} \end{aligned}$$

4. To make an alloy, 200g of aluminium and 200g of copper are mixed together.
Aluminium has a density of 2.7g/cm^3 .
Copper had a density of 8.9g/cm^3 .

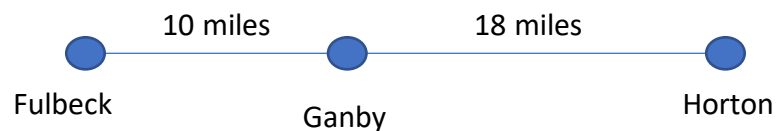
What is the density of the alloy? **Density = Mass/Volume**

	Aluminium	Copper	Alloy
Mass	200	200	400
Volume	$200/2.7 = 74$	$200/8.9 = 22.5$	$74 + 22.5 = 96.5$
Density	2.7	8.9	$400/96.5 = 4.14$

4.14g/cm^3

Answers:

5. Rekha is driving from Fulbeck to Ganby. She will then drive to Horton. It is 10 miles from Fulbeck to Ganby, and 18 miles from Ganby to Horton.



She leaves Fulbeck at 10am and drives at an average speed of 40mph. She needs to get to Horton at 10.35am.

Calculate the average speed Rekha must drive at from Ganby to Horton.

$$\text{Time} = \text{Distance}/\text{Speed}$$

$$\text{F to G: } 10/40 = \frac{1}{4} \text{ hour} = 15 \text{ minutes}$$

$$10\text{am} + 15 \text{ minutes} = 10.15.$$

$$10.35 - 10.15 = 20 \text{ minutes } (20/60 = \frac{1}{3} \text{ hour})$$

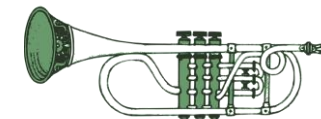
$$\text{G to H: } 18/0.3 = 54\text{mph}$$

(Or 18×3)

6. An alloy of brass, used for making trumpets, is made by mixing copper and zinc together.

Copper has a density of 8.9g/cm^3 .

Zinc has a density of 7.1g/cm^3 .



1 kg of brass is made by mixing 630g of copper with 370g of zinc.

Calculate the density of the brass correct to 1 decimal place.

	Copper	Zinc	Brass
Mass	630	370	1000
Volume	$630/8.9 = 70.8$	$370/7.1 = 52.1$	$70.8 + 52.1 = 122.9$
Density	8.9	7.1	$1000/122.9 = 8.1$

$$8.1\text{g/cm}^3$$

Your turn:

7. A hammer hits a nail with a force of 50 N into some wood. The point of the nail has an area of 0.02 cm². What is the pressure the nail puts on the wood?

$$\begin{aligned}\text{Pressure} &= \text{Force}/\text{Area} \\ &= 50/0.02 &= 2500\text{Pa}\end{aligned}$$

8. Sonia uses a glue stick with an area of 4cm², exerting a pressure of 0.5 N/cm² on her book. Calculate the force she puts on the glue stick.

$$\begin{aligned}\text{Force} &= \text{Pressure} \times \text{Area} \\ &= 0.5 \times 4 &= 2\text{N}\end{aligned}$$

9. A dart hits the dartboard with a force of 10N and pressure of 2000 N/cm². Calculate the area of the dart.

$$\begin{aligned}\text{Area} &= \text{Force}/\text{Pressure} \\ &= 2000/10 &= 200\text{cm}^2\end{aligned}$$



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