Rearranging Formulas

Formulas are generally straightforward, but sometimes you have to rearrange them before they're of any use. Don't panic though — there are just a few simple steps to follow to get everything swapped about.

Example

A car is travelling at 6 m/s. It accelerates at a rate of 1.54 m/s² for 2.6 seconds. What is its final velocity?

1 Decide which formula you need to use.

You know the acceleration, the time and the car's initial velocity. You want to find out its final velocity. So you need to find a formula that includes those four things.

The one you want here is: $a = \frac{v - u}{t}$ ← a stands for acceleration, v stands for final velocity, u stands for initial velocity, and t stands for time.

2 Decide what you need to make the subject.

You need to find out the final velocity so you need to get v on its own.

$$a = \frac{v - u}{t}$$

3 Rearrange the formula. You should always do the same thing to each side. To get rid of something you need to do the opposite. Keep going until you have the thing you want on its own.

$$a = \frac{v - u}{t}$$ ← The opposite of ÷t is ×t, so multiply both sides by t.

$$a \times t = \frac{v - u}{t} \times t \quad (\times t)$$

$$a \times t = v - u$$ ← The opposite of −u is +u, so add u to both sides.

$$(a \times t) + u = v - u + u \quad (+ u)$$

$$(a \times t) + u = v$$

$$v = (a \times t) + u$$ ← Switch the sides round so that v is at the front.

The opposite of + is − and the opposite of − is +. The opposite of × is ÷ and the opposite of ÷ is ×.

4 Now you can just substitute the numbers in, and calculate the answer.

The acceleration (a) is 1.54 m/s².
Time (t) is 2.6 s.
The initial velocity (u) is 6 m/s.

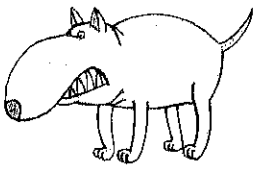
$$v = (a \times t) + u$$

$$v = (1.54 \times 2.6) + 6$$

$$v = \underline{10 \text{ m/s}} \text{ (2 s.f.)}$$

You might need to round your answer to a sensible number of significant figures — see p.6 if you need a hand with that.

5 Stroke a dog.

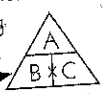


Maybe not this one.

Rearranging Formulas

Right, your go. These formulas need a good swap about before you can answer the questions.

Q1 What is the mass of 4.2 moles of carbon ($A_r = 12$)? CHEMISTRY

TIP: you can use a formula triangle to help you rearrange a formula. If the formula you're using is A = B × C, the triangle should look like this: 

All you do is put your finger over the bit you want and read off the formula. E.g. if you want to find B, you put your finger over that and it leaves behind A ÷ C.

$$\text{number of moles} = \frac{\text{mass (g)}}{A_r}$$

..... g

Q2 A lamp is connected to a 2 V battery. The power of the lamp is 0.8 W. Calculate the current flowing through the lamp. PHYSICS

power (W) = potential difference (V) × current (A)

..... A

Q3 A radio wave in a vacuum has a frequency of 95.4×10^6 Hz. The speed of all electromagnetic waves in a vacuum is 3.00×10^8 m/s. Calculate the wavelength of the radio wave. PHYSICS

wave speed (m/s) = frequency (Hz) × wavelength (m)

..... m

Q4 The real length of a bacterial cell is 6 μm. The cell is magnified by ×40. What is the length of the image?

BIOLOGY

$$\text{magnification} = \frac{\text{image size}}{\text{real size}}$$

..... μm

Q5 A spring has an extension of 2.5 cm when a force of 16 N is applied to it. Calculate the spring constant.

PHYSICS

$$\text{force (N)} = \text{spring constant (N/m)} \times \text{extension (m)}$$

..... N/m

Q6 A student dissolved 0.04 kg of sodium chloride in water to make a solution. The concentration of the solution is 160 g/dm^3. What volume of water did the student use?

CHEMISTRY

$$\text{concentration (g/dm}^3\text{)} = \frac{\text{mass of solute (g)}}{\text{volume of solution (dm}^3\text{)}}$$

..... dm^3

Q7 Copper has a specific heat capacity (SHC) of 385 J/kg°C. PHYSICS

change in thermal energy (J) = mass (kg) × SHC (J/kg°C) × temperature change (°C)

a) A copper pot gives out 40 kJ of energy as it cools from 76 °C to 34 °C.
What is the mass of the pot?

..... kg

b) 33 kJ of energy is used to heat a 6.5 kg lump of copper.
The copper starts off at 18 °C. What temperature will it reach?

..... °C

Q8 A car accelerates over 200 m from an initial velocity of 13.4 m/s to a final velocity of 31.2 m/s. What is the car's acceleration? PHYSICS

final velocity^2 (m/s) – initial velocity^2 (m/s) = 2 × acceleration (m/s^2) × distance (m)

..... m/s^2

Q9 Phil has a BMI of 21.6. He has a body mass of 57 000 g. How tall is he? BIOLOGY

$$\text{BMI} = \frac{\text{body mass (kg)}}{\text{height}^2\text{ (m)}}$$

TIP: The opposite of squaring something (^{2}) is to square root it ($\sqrt{}$).

..... m