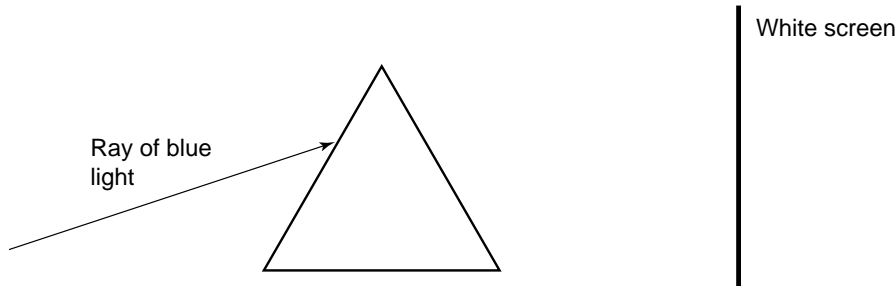


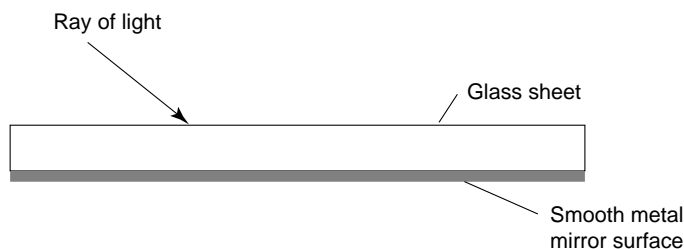
# Refraction

- 1a Using a ruler, draw on the diagram below the path of the blue ray of light as it passes through the prism and onto the screen:



- b Show, by labelling on the diagram, the two angles where the ray is refracted.
- c i If the ray of blue light were replaced by a ray of white light, what would you see on the screen? .....
- ii If a red filter was then placed between the prism and the screen, what would you see on the screen? .....
- iii Explain fully how the red filter causes the change you described in part (ii).  
 .....  
 .....

- 2 Mirrors are made from very smooth polished metal. Most mirrors have a sheet of glass in front of the metal surface, as in the diagram below.



- a Give **two** reasons why a glass sheet is put in front of the metal mirror surface.  
 .....
- b Using a ruler, draw on the diagram the complete path of the light ray reflected from the mirror.
- 3 The **refractive index** ( $n$ ) of a transparent substance is a number which describes how much a light ray is bent when it enters the substance from the air, which is given a refractive index  $n = 1.0$ . Diamond, for example, bends light a lot; it has a refractive index  $n = 2.4$ . The formula which you can use to calculate the refractive index of a substance is given by:

$$n = \frac{\text{Speed of light in air}}{\text{Speed of light in substance}}$$

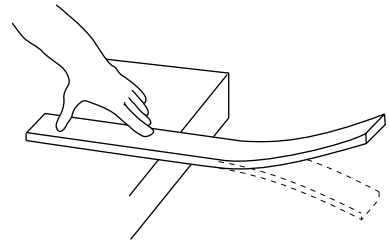
- a If the speed of light in air is 300 000 000 m/s and in water is 225 000 000 m/s, calculate the refractive index of water. ....
- b If  $n = 1.5$  for glass, calculate the speed of light in glass. ....

# Sound

1 Sound waves are 'compressions' and 'rarefactions' of air. Compression means that the air particles are being squashed together. What does the word 'rarefaction' mean?

.....

2 An object which is vibrating causes compressions and rarefactions of the air. The 'twanging' of a ruler on the edge of a table, as shown in the diagram, causes the ruler to vibrate and make a sound. What other objects can you find at home that vibrate? Name at least three and say exactly what is vibrating.

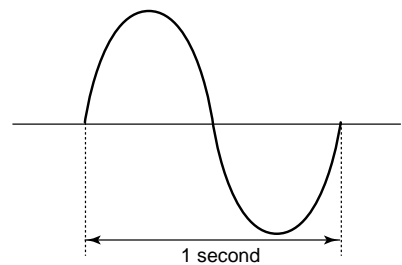


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 .....  
 .....

3 The frequency of a sound wave is the number of vibrations which occur in one second. The unit of frequency is the *hertz* (Hz). Find out why this name was given to the unit of frequency.

.....  
 .....

4a What is the name of the curve (or wave) shown in the diagram?



.....

b If the speed of the wave is 500 m/s, calculate its wavelength. (Hint: Speed = Wavelength x Frequency.)

.....  
 .....

5 The table shows the speed at which sound travels through different substances:

Substance	Speed of sound (m/s)
Alcohol	1430
Nitrogen	354
Oil	1460
Steel	5980
Water	1510

a Does sound travel fastest through solids, liquids or gases?

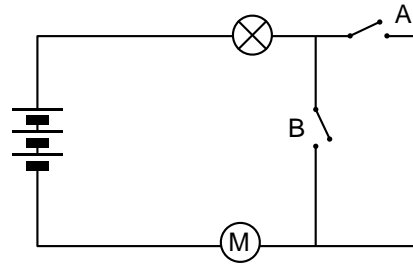
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b Calculate approximate values for the speed of sound in 1:1 mixtures of:

- i alcohol and water .....
- ii alcohol and oil .....
- iii oil and water. ....

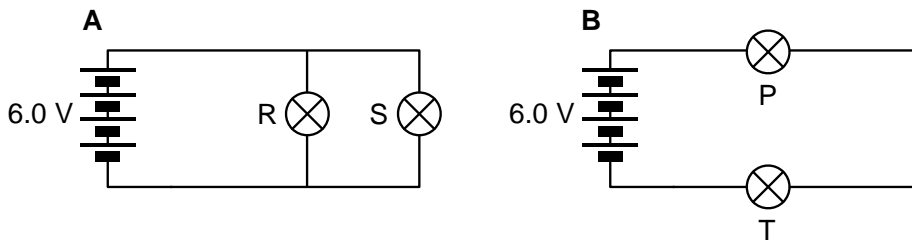
# More electrical circuits

1 Look at the electrical circuit and then fill in the table below with the words 'ON' and 'OFF'.



Switch A	Switch B	Lamp	Motor
Open	Open		
Open	Closed		
Closed	Open		
Closed	Closed		

2 Diagram A shows two identical lamps connected in a parallel circuit. Diagram B shows two of the same identical lamps connected in a series circuit.



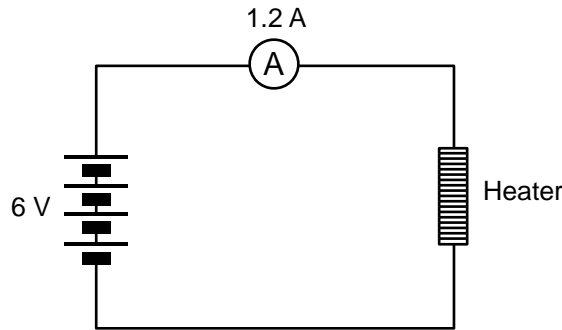
- a What is the voltage across lamp **R** in diagram **A**? .....
- b What is the voltage across lamp **S** in diagram **A**? .....
- c What is the voltage across lamp **P** in diagram **B**? .....
- d What is the voltage across lamp **T** in diagram **B**? .....

Each lamp has a resistance of 12  $\Omega$ .

- e i In diagram **A** what current flows through lamp **R**? .....
- ii In diagram **A** what current flows through lamp **S**? .....
- f i In diagram **B** what current flows through lamp **P**? .....
- ii In diagram **B** what current flows through lamp **T**? .....
- g Is lamp **R** brighter, dimmer or the same brightness as lamp **S** in circuit **A**? .....
- h Is lamp **P** brighter, dimmer or the same brightness as lamp **T** in circuit **B**? .....
- i Looking at both circuits, write down which two lamps are the brightest of all four.

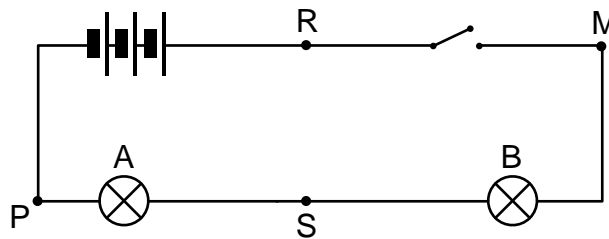
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3 Calculate the resistance of the heater in the circuit below.



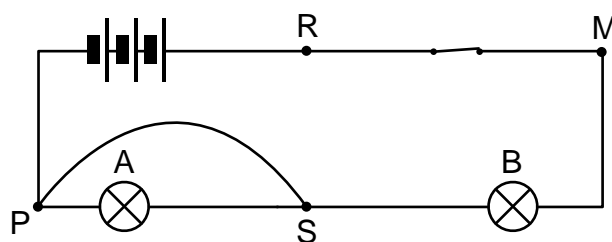
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 .....

4 In the circuit below, imagine that a piece of copper wire is connected between point **R** and point **S**.



- a Which lamps, if any, will be lit? .....
- b The wire between **R** and **S** is now removed and another one is put in which connects point **M** with point **P**. Which lamps, if any, now light up? .....

The wire connection between **M** and **P** is now removed. The switch is closed and both lamps light up, but not very brightly. A wire is then put in to connect point **P** with point **S**, giving the circuit as shown below:



- c What is the appearance of lamp **A** now? .....
- d What is the appearance of lamp **B** now?.....

The wire connection between point **P** and point **S** is now removed and a wire is connected between point **R** and point **S**.

- e What is the appearance of lamp **A**? .....
- f What is the appearance of lamp **B**?.....