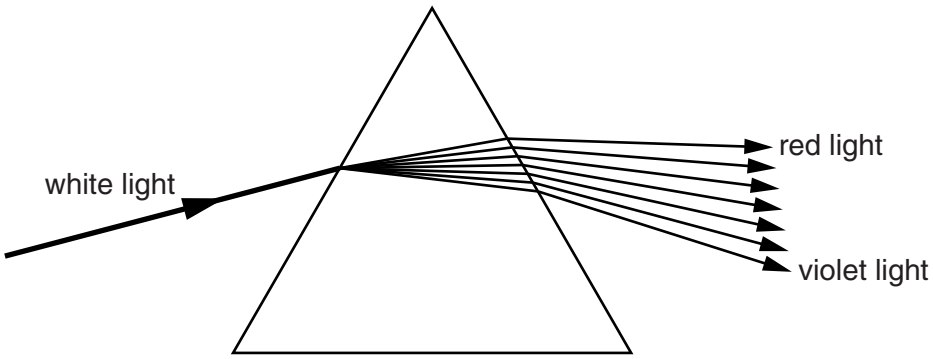
1 Chantal does some experiments using light.

She shines a beam of white light through a prism.

Look at the diagram.



The white light disperses to produce a visible spectrum of colours.

Explain why the white light disperses and why the colours deviate by different amounts.

The quality of written communication will be assessed in your answer to this question.

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

..... **[6]**

2 Helen does some research about the refractive index of different materials.

Material	Refractive index
glass (acrylic)	1.491
glass (arsenic trisulphide)	2.040
glass (common)	1.520
glass (71% lead)	1.805
water	1.333
air	1.000

The speed of light in a vacuum is 3.0×10^8 m/s.

Light travels at different speeds through different materials.

(a) Calculate the speed of light in water.

.....

.....

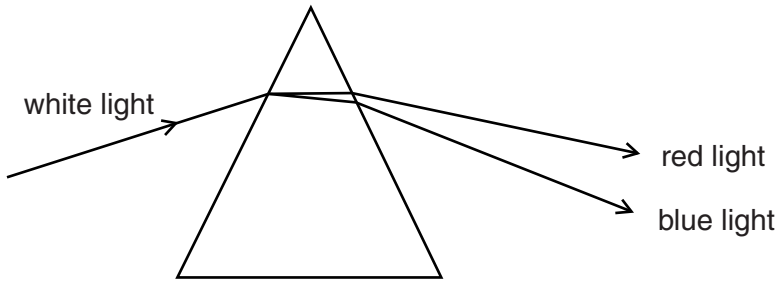
.....

answer ..... m/s **[2]**

(b) Which material in the table will have the lowest critical angle when light passes from the material to air?

..... **[1]**

(c) Look at the diagram. It shows the dispersion of white light by a prism made from acrylic glass.



Use the diagram to explain why blue light has a higher refractive index than red light in this glass.

.....

.....

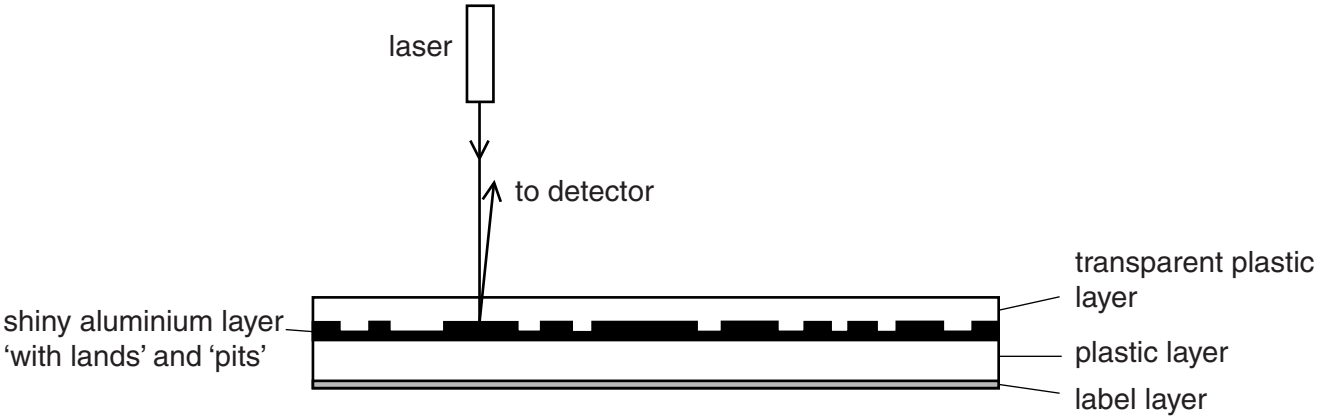
.....

..... **[2]**

[Total: 5]

3 CD players use lasers to read information from a disc.

Look at the simplified diagram of the laser and cross-section of part of a disc.



Describe the properties of a laser beam and explain how information is stored and read from the disc.

The quality of written communication will be assessed in your answer to the question.

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

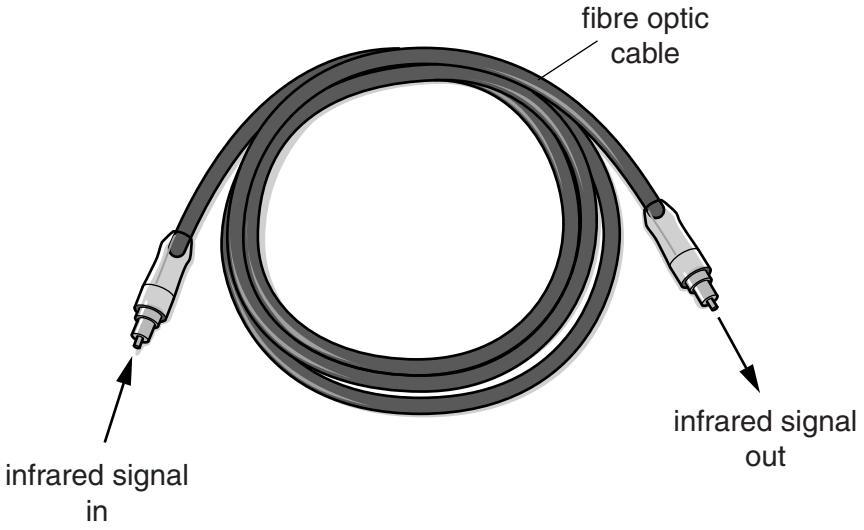
.....

..... **[6]**

4 Reeta is learning about different types of waves.

Electromagnetic waves are used for communication.

(a) (i) Infrared waves can transmit signals from one end of a fibre optic cable to the other.



Infrared waves of wavelength 1.5×10^{-6} m travel along this optical fibre.

The speed of the infrared waves in the fibre is 2.2×10^{8} m/s.

Calculate the frequency of the infrared waves.

Give your answer in **standard form** and to **2** significant figures.

.....

.....

.....

.....

answer ..... Hz **[2]**

(ii) When the infrared (IR) radiation leaves the fibre, it is refracted as it enters the air.

Reeta makes a table to compare the speed, wavelength and frequency of the IR signal in the air and in the optical fibre.

Complete the table by putting one tick (✓) in each **row**.

	In air > in fibre	**In air = to that in fibre**	**In air < in fibre**
Speed of IR			
Wavelength of IR			
Frequency of IR			

[2]

(b) Reeta learns that digital signals are used in optical fibres.

Digital signals are used to transmit signals over long distances. As the signal strength falls, it is amplified at points along the cable.

Describe and explain the advantages of using **digital** signals for transmitting information along optical fibres.

.....

.....

.....

.....

..... **[2]**

[Total: 6]