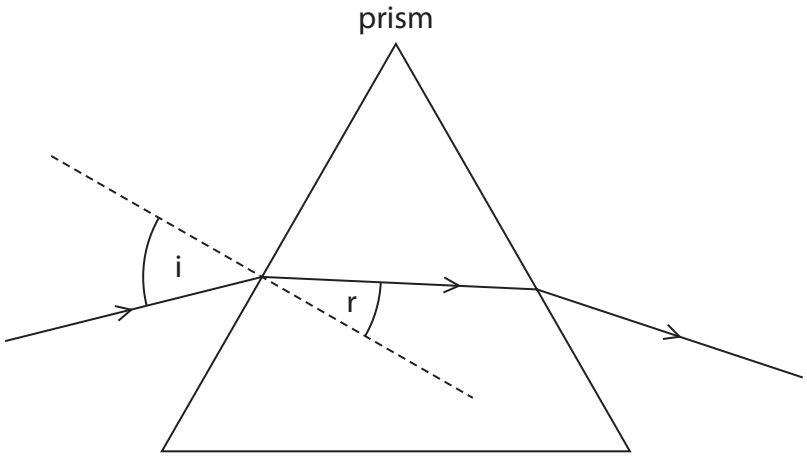
7 (a) A glass prism can be used to refract light.



(i) State the name of the piece of equipment used to measure angles.

(1)

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(ii) Measure the angle of incidence and the angle of refraction for the light entering the prism.

(2)

angle of incidence = ... degrees

angle of refraction = ... degrees

(iii) State the formula linking refractive index, angle of incidence and angle of refraction.

(1)

(iv) Calculate the refractive index of the glass.

(2)

refractive index = ...

(b) Two galaxies, A and B, emit red light with a reference wavelength of 630 nm.

An astronomer measures the wavelength of red light from galaxy A when the light arrives at the Earth.

The astronomer's value for the wavelength is 645 nm.

(i) Calculate the difference between the astronomer's value for the wavelength and the reference wavelength of red light.

(1)

difference in wavelength = ... nm

(ii) The change in wavelength happens because galaxy A is moving away from the Earth.

Calculate the speed of galaxy A.

[speed of light = 3.0×10^8 m / s]

(3)

speed = ... m / s

(iii) Light from galaxy B has twice the redshift as light from galaxy A.

Galaxy B is twice as far away from Earth as galaxy A.

Explain how these observations support the Big Bang theory of the origin of the Universe.

(2)

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(Total for Question 7 = 12 marks)