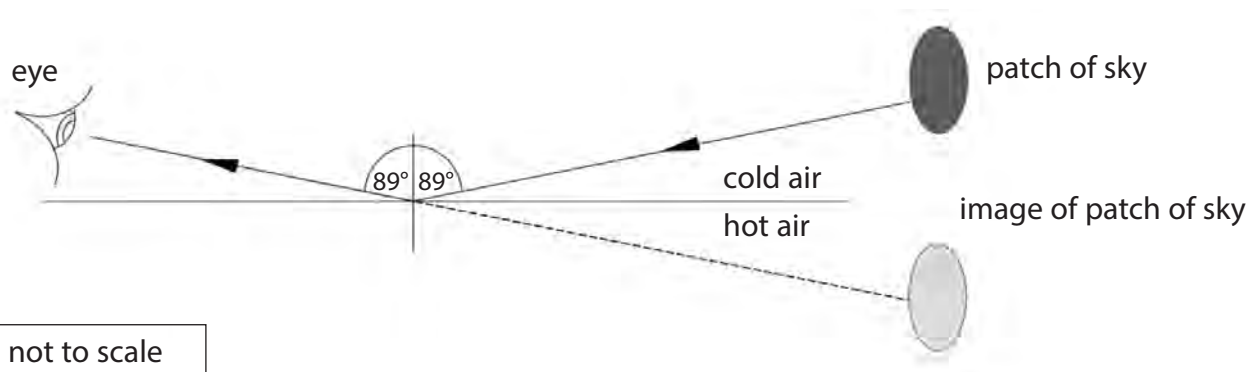


8 This question is about atmospheric optical illusions.

- (a) A mirage is an optical illusion formed due to total internal reflection of light from the sky at the boundary between cold air and hot air.

Diagram 1 shows how a mirage is formed.



not to scale

**Diagram 1**

- (i) State the formula linking critical angle and refractive index.

(1)

- (ii) The critical angle of the cold air at the boundary is  $88.500^\circ$

Calculate the refractive index of the cold air.

Give your answer to 5 significant figures.

(3)

refractive index = .....

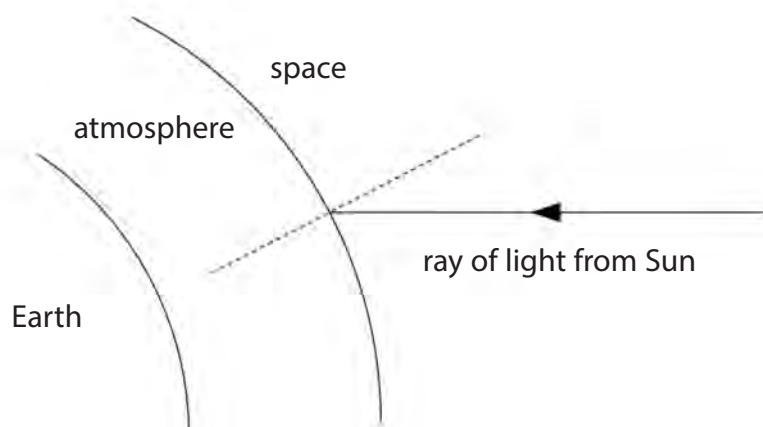


- (b) (i) Diagram 2 shows a ray of light from the Sun.

The refractive index of the atmosphere is greater than the refractive index of space.

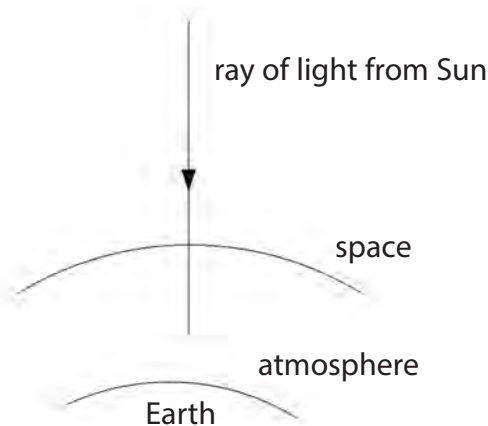
Complete the diagram by drawing the path of the ray of light through the atmosphere.

(2)



**Diagram 2**

- (ii) Diagram 3 shows a ray of light from the Sun when the Sun is directly overhead.



**Diagram 3**

Explain why the ray of light does not change direction when it enters the atmosphere.

(2)

.....

.....

.....

.....



(iii) Explain why the wavelength of the light reduces when it enters the atmosphere.

(2)

(iv) Suggest why the Sun appears not to be circular when it is close to the horizon at sunset.

(1)

**(Total for Question 8 = 11 marks)**

