19 The lens in the eye of an octopus focuses light onto the retina at the back of the eye.

The octopus focuses on objects at different distances from the eye by changing the shape of the eye to move the lens closer or further from the retina.

(a) (i) The power of an octopus lens is 118 D.

Show that the focal length of the lens is about 8.5 mm.

(2)

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(ii) Calculate the shortest distance from the eye at which an object may be focused clearly on the retina.

maximum distance from lens to retina = 2.0 cm

(2)

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Shortest distance from the eye = ...

(iii) The lens in the eye of an octopus is in contact with seawater. The refractive index of freshwater is less than the refractive index of seawater.

Deduce what would happen to the shortest distance from the eye at which an object may be focused clearly if the octopus was in freshwater.

(3)

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(iv) Calculate the speed of light in seawater.

refractive index of seawater = 1.37

(2)

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Speed of light in seawater = ...

(b) An octopus can detect the orientation of polarised light.

State what is meant by polarised light.

(2)

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(Total for Question 19 = 11 marks)