Q1.(a) (i) Describe how Newton used the corpuscular theory to explain the refraction of light as it passes from one substance into a substance of higher optical density.

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(3)

(ii) Huygens used a wave theory to explain refraction.

Explain why the corpuscular theory was rejected in favour of a wave theory to explain refraction.

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(2)

(iii) Describe and explain the difference in the appearance of the fringes in Young's double-slit experiment that are predicted by the corpuscular theory and by the wave theory for light.

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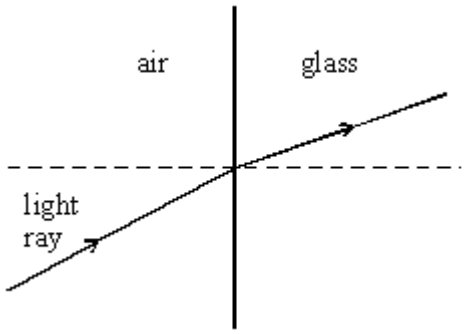
(2)

(b) Electromagnetic waves and matter are now known to exhibit both particle and wave behaviour. The photons for a particular X-ray wavelength have energy 5.0 keV.

Calculate the potential difference through which an electron has to be accelerated so that its de Broglie wavelength is the same as that of this X-ray.

(4)
(Total 11 marks)

Q2. (a) The diagram below shows the path followed by a light ray travelling from air into glass.



Use Newton's theory of light to explain the refraction of the light ray at the air/glass boundary.

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(3)

(b) Newton's theory of light was eventually abandoned in favour of Huygens' wave theory which correctly predicted the speed of light in glass in comparison with the speed of light in air.

(i) What did each theory predict about the speed of light in glass in comparison with the speed of light in air?

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(ii) Describe **one** further piece of evidence that supports Huygens' wave theory.

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(3)
(Total 6 marks)