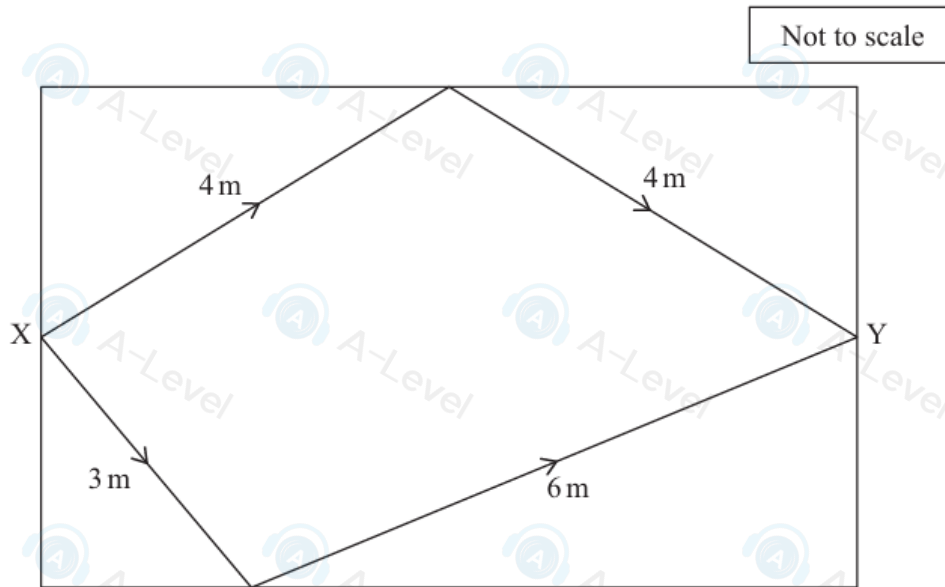


- 7: Two waves, of wavelength 2 m, are produced by a source at point X, as shown. Both waves are initially in phase.

The waves travel different distances and meet at point Y.



Which of the following is the phase difference, in radians, between the two waves at point Y?

- ☐ A 0
- ☐ B $\frac{\pi}{4}$
- ☐ C $\frac{\pi}{2}$
- ☐ D π

(Total for Question 7 = 1 mark)

- 9 An ultrasound pulse-echo technique is used to produce an image by reflection from many boundaries.

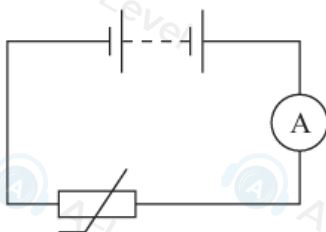
If the transmitted pulse is too long, the image produced is of poor quality.

This could be because the

- ☐ A energy of the pulse is too high.
- ☐ B frequency of the ultrasound is too high.
- ☐ C time between consecutive transmitted pulses is too short.
- ☐ D wavelength of the ultrasound is too long.

(Total for Question 9 = 1 mark)

5 The circuit shown includes a thermistor.



Which of the following explains the change in the ammeter reading as the temperature of the thermistor decreases?

- ☒ A The number of conduction electrons decreases so the ammeter reading decreases.
- ☒ B The number of conduction electrons decreases so the ammeter reading increases.
- ☒ C The number of conduction electrons increases so the ammeter reading decreases.
- ☒ D The number of conduction electrons increases so the ammeter reading increases.

(Total for Question 5 = 1 mark)

2 Light from a discharge tube is viewed through a diffraction grating. An emission line spectrum is observed.

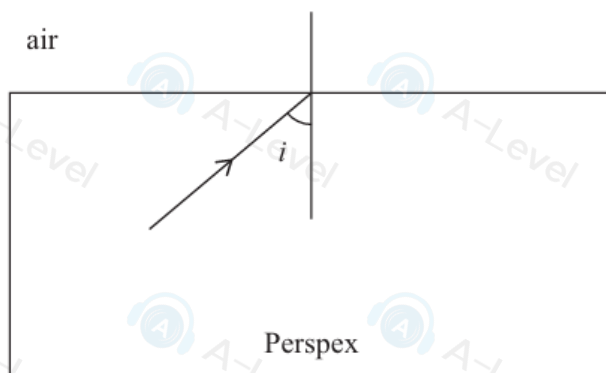
Which of the following explains how electrons in the discharge tube produce the emission line spectrum?

- ☒ A Excited electrons move to higher energy levels and absorb photons.
- ☒ B Excited electrons move to higher energy levels and emit photons.
- ☒ C Excited electrons move to lower energy levels and absorb photons.
- ☒ D Excited electrons move to lower energy levels and emit photons.

(Total for Question 2 = 1 mark)

2: A ray of light is incident on the boundary between Perspex and air, as shown.

The angle of incidence i is greater than the critical angle for the Perspex-air boundary.

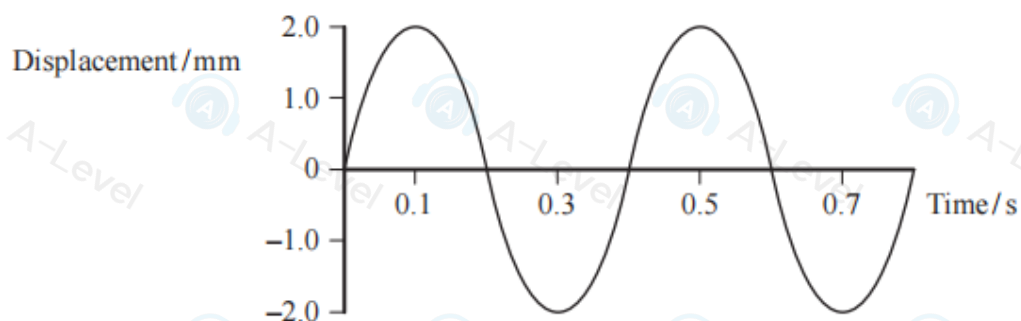


Which of the following statements is correct for the Perspex-air boundary?

- ☐ A All the light is refracted.
- ☐ B All the light is transmitted.
- ☐ C All the light is reflected.
- ☐ D Some light is reflected and some light is refracted.

(Total for Question 2 = 1 mark)

2 A wave is travelling across the surface of a tank of water. The graph shows how the displacement of the water at one position on the surface varies with time.



Which property of the wave **cannot** be determined using only the information from this graph?

- ☐ A amplitude
- ☐ B frequency
- ☐ C time period
- ☐ D wavelength

(Total for Question 2 = 1 mark)

2 A filament lamp is a source of unpolarised light.

A polarising filter is placed between a filament lamp and an observer. The filter is rotated in the plane perpendicular to the direction of travel of the light.

Which of the following is observed as the filter is rotated through an angle of 90° ?

- ☐ A The light intensity changes from maximum to minimum.
- ☐ B The light intensity changes from minimum to maximum.
- ☐ C The light intensity does not change.
- ☐ D The light intensity is zero throughout the rotation.

(Total for Question 2 = 1 mark)

10 Sound waves travel through air and pass into a concrete wall. The energy of the sound wave transmitted into the concrete wall is much less than the energy of the sound wave in air.

Which of the following wave properties is the reason for this?

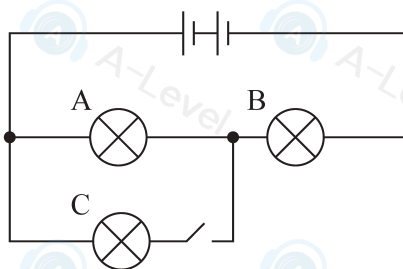
- ☐ A absorption
- ☐ B diffraction
- ☐ C reflection
- ☐ D refraction

(Total for Question 10 = 1 mark)

TOTAL FOR SECTION A = 10 MARKS



19 (a) A student sets up the circuit shown with three identical lamps and a switch.



Each lamp is marked 1.5 V and two 1.5 V cells of negligible internal resistance are used as a power supply.

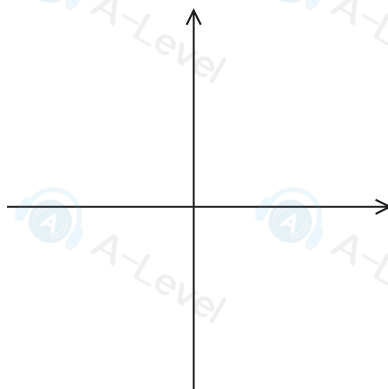
The two lamps labelled A and B light with normal brightness when the switch is open.

Explain what will happen to the brightness of each lamp when the switch is closed.

(6)



- (b) (i) Sketch a current-potential difference graph for a filament lamp on the axes below. (2)



- (ii) Explain the shape of this graph in terms of electron movement through the lattice. (4)

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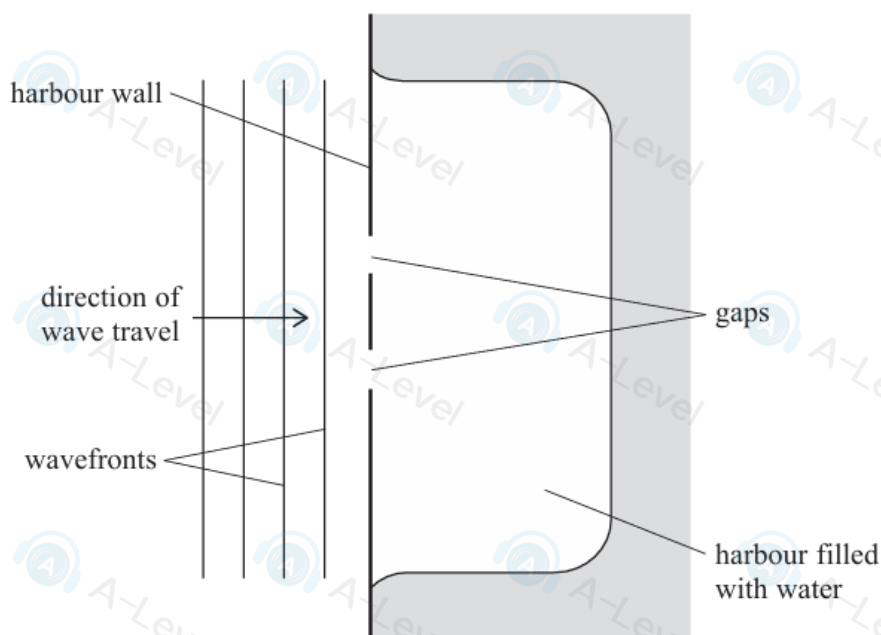
(Total for Question 19 = 12 marks)

TOTAL FOR SECTION B = 70 MARKS
TOTAL FOR PAPER = 80 MARKS



17 Boats can shelter from waves on the sea in a harbour.

The diagram shows a harbour where boats can enter and leave through two gaps in the harbour wall.



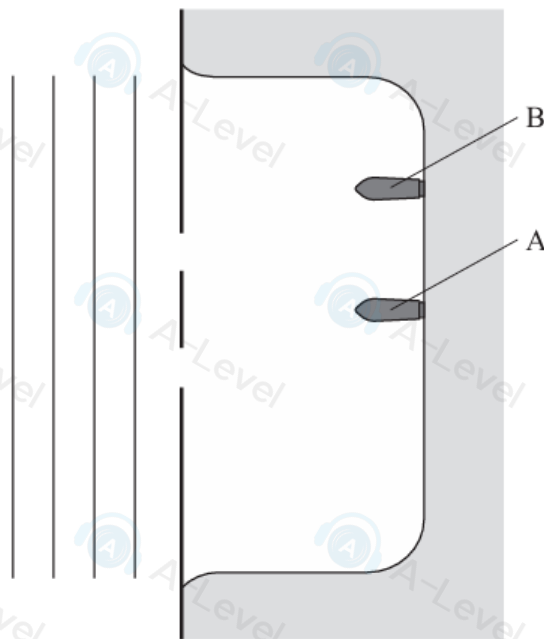
Waves on the sea are diffracted as they pass through the gaps in the harbour wall.

- (a) Describe how Huygens' construction can be used to predict the shape of diffracted wavefronts.

(2)

- * (b) The wavefronts in the sea arrive parallel to the harbour wall. The wavelength of the waves varies as the weather varies.

There are identical boats at two positions, A and B, in the harbour, as shown.



As the wavelength of the waves varies:

- the boat at position A always oscillates with a large amplitude
- the boat at position B sometimes oscillates with a large amplitude and sometimes oscillates with a very small amplitude.

