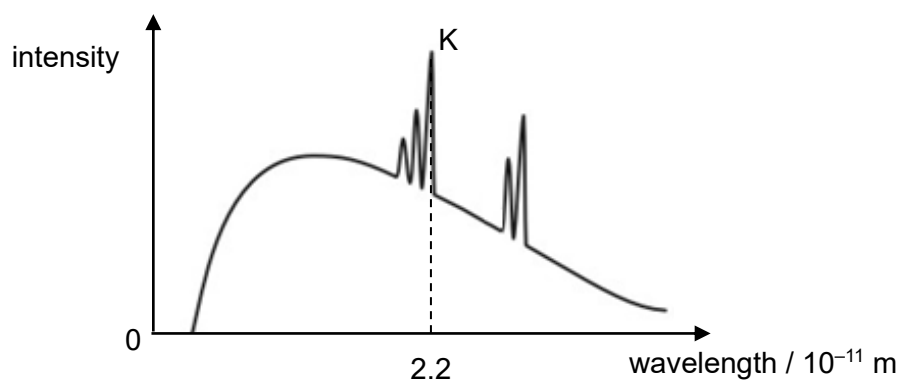


- 7 (a) X-rays are produced in an X-ray tube when high-speed electrons are accelerated toward and hit a metal target. Fig. 7.1 shows the variation with wavelength of the intensity of X-ray radiation emitted.



**Fig. 7.1**

- (i) Explain why there is a continuous distribution of wavelengths.

.....

.....

.....

.....

.....

.....

.....

.....

..... [2]

(ii) A series of characteristic lines shown by the high intensity peaks, such as K, are observed in Fig. 7.1.

1. Calculate the energy difference, in keV, associated with the characteristic line K.

energy difference = ..... keV [2]

2. Suggest why there are other series of characteristic lines produced at wavelengths longer than K.

.....

.....

.....

.....

.....

.....

.....

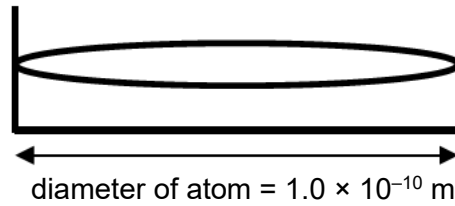
.....

.....

..... [2]

**Question 7 continues on the following page.**

- (b) A simple model of an atom with one electron can be represented by the electron as a stationary wave confined in a box of length  $1.0 \times 10^{-10}$  m equal to the diameter of the atom, as shown in Fig. 7.2.



**Fig. 7.2**

- (i) State the uncertainty in locating the position of the electron.

uncertainty in position = ..... m [1]

- (ii) Calculate the uncertainty in the velocity of the electron.

uncertainty in velocity = .....  $\text{m s}^{-1}$  [1]

- (iii) The diameter of a nucleus is  $10^4$  times smaller than the diameter of an atom.  
Using the model above, suggest why an electron cannot be found inside the nucleus.

.....  
 .....  
 .....  
 .....  
 .....  
 .....[1]

[Total: 9]



### Section B

Answer **one** question from this Section in the spaces provided.