Practice Question Set For A-Level
Subject : Physics
Paper-1 Topic: Waves

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Name of the Student:_____
Max. Marks : 20 Marks **Time : 20 Minutes**

Q1.

The table shows results of an experiment to investigate how the de Broglie wavelength λ of an electron varies with its velocity v.

v / 10^7 m s^{-1}	λ / 10^{-11} m
1.5	4.9
2.5	2.9
3.5	2.1

(a) Show that the data in the table are consistent with the relationship $\lambda \propto \frac{1}{v}$

_____

(2)

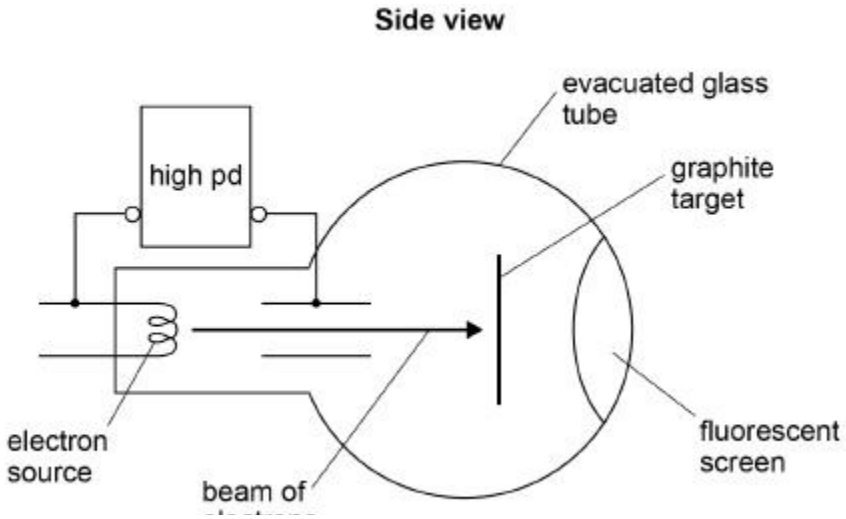
(b) Calculate a value for the Planck constant suggested by the data in the table.

Planck constant = _____ J s

(2)

(c) **Figure 1** shows the side view of an electron diffraction tube used to demonstrate the wave properties of an electron.

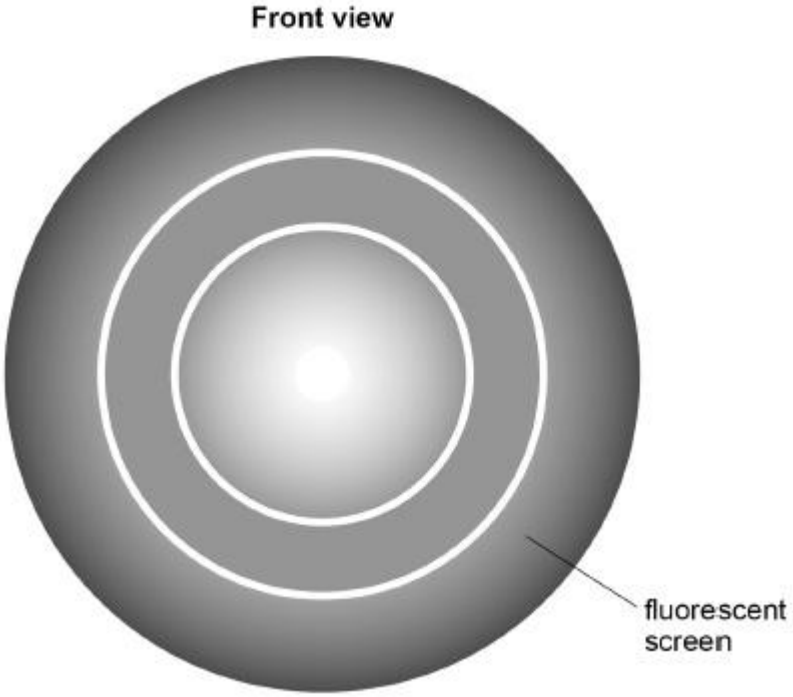
Figure 1



An electron beam is incident on a thin graphite target that behaves like the slits in a diffraction grating experiment. After passing through the graphite target the electrons strike a fluorescent screen.

Figure 2 shows the appearance of the fluorescent screen when the electrons are incident on it.

Figure 2



Explain how the pattern produced on the screen supports the idea that the electron beam is behaving as a wave rather than as a stream of particles.

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(3)

(d) Explain how the emission of light from the fluorescent screen shows that the electrons incident on it are behaving as particles.

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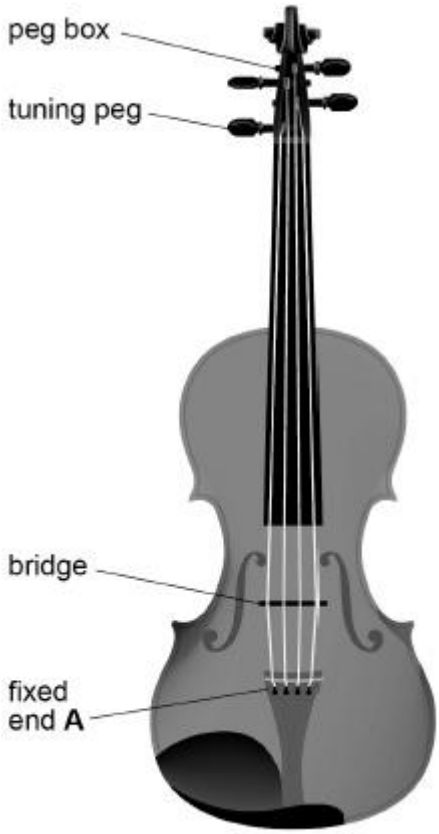
(3)

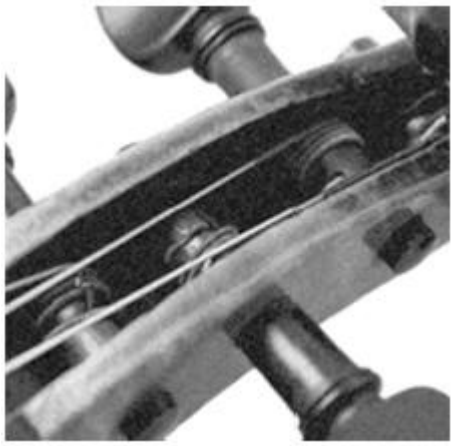
(Total 10 marks)

Q2.

Figure 1 shows the structure of a violin and **Figure 2** shows a close-up image of the tuning pegs.

Figure 1 **Figure 2**





The strings are fixed at end **A**. The strings pass over a bridge and the other ends of the strings are wound around tuning pegs that have a circular cross-section. The tension in the strings can be increased or decreased by rotating the tuning pegs.

(a) Explain how a stationary wave is produced when a stretched string is plucked.

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(3)

(b) The vibrating length of one of the strings of a violin is 0.33 m
When the tension in the string is 25 N, the string vibrates with a first-harmonic frequency of 370 Hz

Show that the mass of a 1.0 m length of the string is about 4×10^{-4} kg

(2)

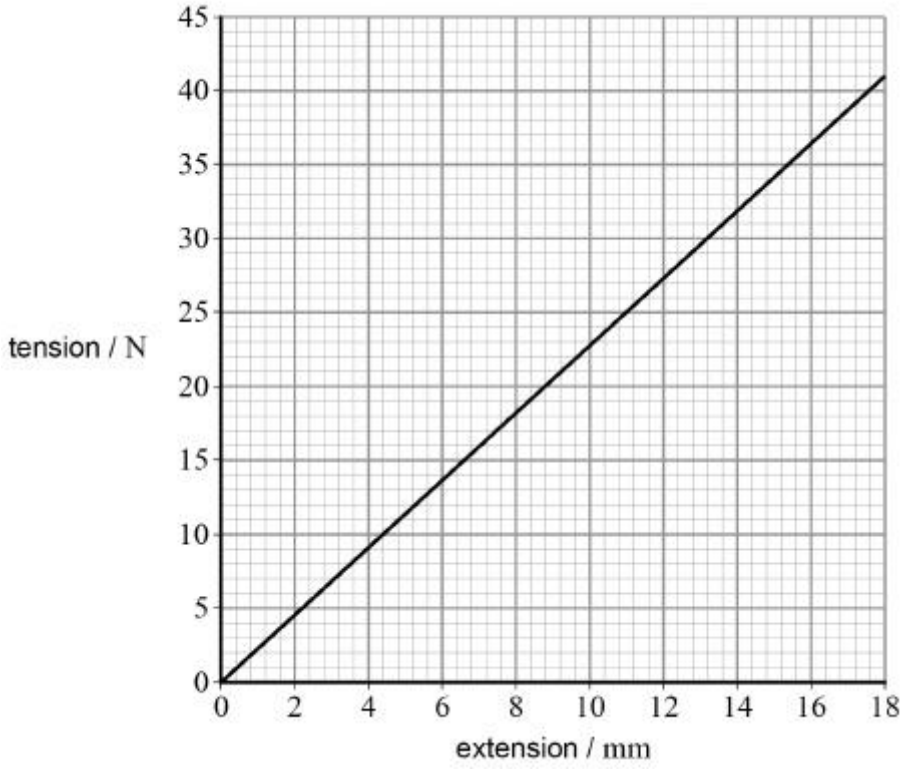
(c) Determine the speed at which waves travel along the string in question **(b)** when it vibrates with a first-harmonic frequency of 370 Hz

speed of waves = _____ m s^{-1}

(1)

(d) **Figure 3** shows how the tension in the string in question **(b)** varies with the extension of the string.

Figure 3



The string with its initial tension of 25 N is vibrating at a frequency of 370 Hz
The diameter of the circular peg is 7.02 mm

Determine the higher frequency that is produced when the string is stretched by rotating the tuning peg through an angle of 75°

Assume that there is no change in the diameter of the string.

frequency = _____ Hz

(4)

(Total 10 marks)