**Question 5 (4 marks)**

The Bohr Radius (rBohr) is a physical constant that represents the most probable distance between the nucleus of a Hydrogen atom and its ground-state electron. The Bohr Radius is approximately 5.292 x 10-11 m. An electron can occupy this orbit only if its de Broglie wavelength fits an integer number of times into the orbital circumference. Determine, with justification, whether or not an electron with a kinetic energy of 2.18 x 10-18 J could occupy this orbit:

1

1

1

de Broglie wavelength fits an integer number of times (i.e. 1) into orbital circumference, so yes, electron could occupy this orbit.

1

**Question 9 (4 marks)**

A light-emitting diode (LED) is comprised of a semiconducting material that contains two electron bands – a valence band and a conduction band. When the LED is connected to a circuit with that exceeds some minimum operating voltage, electrons jump from the valence band up to the conduction band. When an excited electron falls back to the valence band it will emit a photon. With this knowledge, describe how an operating coloured LED and a voltmeter could be used to estimate Planck’s constant. Include the measurements or data that would need to be obtained and any calculations required.

Measure the threshold voltage across the LED when it turns on 1

Obtain the wavelength (or frequency) of the LED based on colour 1

Perform calculation

() 1-2





