

- Explain, in terms of the quantum theory of electrons, why the electronic energy is decreased by the delocalisation of the valence electrons in the metallic bond.

2

Electrons in atoms have wavelengths of similar length to the size of the atoms they are confined in. Delocalization of the electrons increases their wavelength. de Broglie's equation,

$$p = \frac{h}{\lambda}$$

where h is Planck's constant, suggests that longer wavelengths are associated with lower momentum and hence *lower* kinetic energy (T) since this is related to the momentum and the electron mass, m_e :

$$T = \frac{p^2}{2m_e} = \frac{h^2}{2m_e \lambda^2}$$