- Ionising radiation is defined as radiation that has energy greater than 1.93×10^{-18} J per photon. Using this criterion, determine whether UV light of $\nu = 1.00 \times 10^{16}$ Hz would be ionising.

Marks 2

The energy of electromagnetic radiation with frequency ν is given by:

   $E = h\nu$

where $h = 6.626 \times 10^{-34}$ J s (Planck's constant).

For UV light of $\nu = 1.00 \times 10^{16}$ Hz,

   $E = (6.626 \times 10^{-34}$ J s$) (1.00 \times 10^{16}$ s$^{-1}) = \underline{6.63 \times 10^{-18}}$ J

This energy is greater than 1.93×10^{-18} J so the radiation is ionizing

- The atoms in both iodine and diamond are joined by covalent bonds. However, iodine is a soft, low-melting point solid while diamond is very hard and has an extremely high melting point. Account for these differences in properties.

2

Iodine consists of discrete I_2 molecules. The intermolecular forces between these I_2 units are weak dispersion forces, so the solid is soft with a low melting point. (The strength of the I-I bond is essentially irrelevant.) Diamond consists of a giant 3-dimensional array of carbon atoms in a tetrahedral arrangement. Each atom is covalently bonded to its neighbour to give one giant molecule (covalent network solid). The C-C covalent bond is very strong, so diamond is hard with a high melting point.