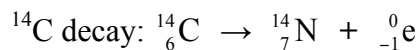
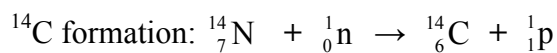


Marks
2

- Reaction of nitrogen-14 with a neutron forms two products, one of which is carbon-14. Radiocarbon dating involves the carbon-14 isotope which undergoes β -decay (emission of an electron from the nucleus). Write the two nuclear equations that illustrate the formation and decay of carbon-14.



- Complete the following table.

3

Orbital	Principal quantum number, n	Angular momentum quantum number, l	Number of spherical nodes	Number of planar nodes
$4s$	4	0	3	0
$3p$	3	1	1	1
$3d$	3	2	0	2

- It requires 151 kJ mol^{-1} to break the bond in I_2 . What is the minimum wavelength of light needed to break this bond? Give your answer in nm.

2

151 kJ mol^{-1} corresponds to:

$$\text{energy per molecule} = 151 \times 10^3 / 6.022 \times 10^{23} \text{ J} = 2.51 \times 10^{-19} \text{ J}$$

According to Planck's relationship between the energy and wavelength, λ , of light:

$$E = hc / \lambda$$

Hence

$$\begin{aligned} \lambda &= hc / E \\ &= (6.626 \times 10^{-34} \text{ J s}) \times (2.998 \times 10^8 \text{ m s}^{-1}) / (2.51 \times 10^{-19} \text{ J}) \\ &= 7.90 \times 10^{-7} \text{ m} = 790. \text{ nm} \end{aligned}$$

Answer: **790. nm**

THE REMAINDER OF THIS PAGE IS FOR ROUGH WORKING ONLY.