Marks

- 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. **2**

^{14}C formation: $^{14}_{7}N + {}^{1}_{0}n \rightarrow {}^{14}_{6}C + {}^{1}_{1}p$

^{14}C decay: $^{14}_{6}C \rightarrow {}^{14}_{7}N + {}^{0}_{-1}e$

- Complete the following table. **3**

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

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

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

$E = hc / \lambda$

Hence

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

Answer: **790. nm**

THE REMAINDER OF THIS PAGE IS FOR ROUGH WORKING ONLY.