Marks

- Balance the following nuclear reactions by identifying the missing nuclear particle or nuclide. **3**

$${}^{63}_{28}\text{Ni} \rightarrow {}^{63}_{29}\text{Cu} + \boxed{{}^{0}_{-1}\boldsymbol{\beta}}$$

$${}^{53}_{26}\text{Fe} + {}^{0}_{-1}\text{e} \rightarrow \boxed{{}^{53}_{25}\textbf{Mn}}$$

$${}^{28}_{14}\text{Si} + {}^{2}_{1}\text{H} \rightarrow {}^{1}_{0}\text{n} + \boxed{{}^{29}_{15}\textbf{P}}$$

- Calculate the energy (in J) and the wavelength (in nm) of the photon of radiation emitted when the electron in Be^{3+} drops from an n = 3 state to an n = 2 state. **3**

As Be^{3+} has one electron, the equation $E_n = \frac{-E_R Z^2}{n^2}$ where $E_R = 2.18\times10^{-18}$ J can be used. Beryllium has Z = 4. The energies of the n = 3 and n =2 levels are:

$$E_2 = \frac{-E_R (4)^2}{(2)^2} = -4E_R \quad \text{and} \quad E_3 = \frac{-E_R (4)^2}{(3)^2} = -\frac{16}{9} E_R = 1.78E_R$$

The separation is $(4 - 1.78)E_R = 2.22E_R = 2.22 \times (2.18 \times 10^{-18}) = 4.84 \times 10^{-18}$ J.

As $E = \frac{hc}{\lambda}$, $\lambda = \frac{hc}{E} = \frac{(6.626\times10^{-34})\times(2.998\times10^{8})}{(4.84\times10^{-18})} = 4.10\times10^{-8}$ **m=41.0 nm**

Energy: **4.84×10^{-18} J**	Wavelength: **4.10×10^{-8} m or 41.0 nm**