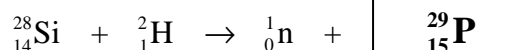
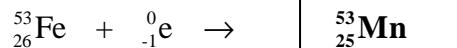
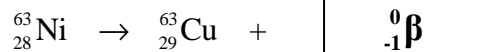


- Balance the following nuclear reactions by identifying the missing nuclear particle or nuclide.

**Marks**  
**3**



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

**3**

As  $\text{Be}^{3+}$  has one electron, the equation  $E_n = \frac{-E_R Z^2}{n^2}$  where  $E_R = 2.18 \times 10^{-18} \text{ J}$  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  $(4 - 1.78)E_R = 2.22E_R = 2.22 \times (2.18 \times 10^{-18}) = 4.84 \times 10^{-18} \text{ J}$ .

$$\text{As } E = \frac{hc}{\lambda}, \quad \lambda = \frac{hc}{E} = \frac{(6.626 \times 10^{-34}) \times (2.998 \times 10^8)}{(4.84 \times 10^{-18})} = 4.10 \times 10^{-8} \text{ m} = 41.0 \text{ nm}$$

Energy:  $4.84 \times 10^{-18} \text{ J}$

Wavelength:  $4.10 \times 10^{-8} \text{ m}$  or **41.0 nm**