4. (b) The intensity of solar radiation at the surface of the Earth is 1.38 kW $m^{-2}$. The orbital radii of Earth and Mars are respectively $1.496 \times 10^8$ km and $2.280 \times 10^8$ km. Estimate the surface temperature of Mars assuming that both planets behave like blackbodies.

[6 marks]

5. (b) Radioactive nucleus A with half-life of 1 hour decays into another radioactive nucleus B which has a half-life of 6 hours. Nucleus B decays into nucleus C which is stable. At time $t = 0$, a specimen contains $10^{-3}$ mole of A but none of B and C. Nucleus B in the specimen reaches a maximum quantity of $X$ nuclei at time t = $T$ hours. Find $X$ and $T$.

[For the first order differential equation, $\frac{dy}{dx} + c_1 y = c_2 e^{-kx}$,

where $c_1, c_2$ & $k$ are constants, the solution is

$$y = \frac{c_2}{c_1 - k}\left(e^{-kx} - e^{-c_1 x}\right)$$ ]

[6 marks]