

**Marks**  
**2**

- The radioactive isotope  $^{99m}\text{Tc}$  has a half life of 6.0 hours. How much time after production of the  $^{99m}\text{Tc}$  isotope do radiologists have to examine a patient if at least 35 % of the original activity is required to get useful exposures?

**If the half life is 6.0 hours, the activity coefficient,  $\lambda$ , is:**

$$\lambda = \ln 2 / t_{1/2} = \ln 2 / (6.0 \text{ hours}) = 0.116 \text{ hours}^{-1}$$

**As the activity is proportional to the number of nuclei present, the activity at a time  $t$  is related to the original activity by:**

$$\ln(A_0 / A_t) = \lambda t$$

**If  $A_t = 0.35 \times A_0$  then:**

$$\ln(1/0.35) = (0.116 \text{ hours}^{-1})t$$

$$t = 9.1 \text{ hours}$$

**Answer: 9.1 hours**