1. $5^{th} \rightarrow 2^{nd}$ $\lambda_1 = 520\ nm$ $E_{52} = E_5 - E_2$

$6^{th} \rightarrow 2^{nd}$ $\lambda_2 = 410\ nm$ $E_{62} = E_6 - E_2$

$6^{th} \rightarrow 5^{th}$ $\lambda_3 = ?$

$$E = hf = \frac{hc}{\lambda}$$

$$E_{52} = \frac{6.626 \times 10^{-34} \times 3 \times 10^{8}}{520 \times 10^{-9}}\ J = 3.82 \times 10^{-19}$$

$$E_{62} = \frac{6.626 \times 10^{-34} \times 3 \times 10^{8}}{410 \times 10^{-9}}\ J = 4.85 \times 10^{-19}$$

$$E_{65} = E_{62} - E_{52} = (4.85 - 3.82) \times 10^{-19}$$
$$= 1.03 \times 10^{-19}$$

$$E_{65} = \frac{hc}{\lambda_3}$$

$$\lambda_3 = \frac{6.626 \times 10^{-34} \times 3 \times 10^{8}}{1.03 \times 10^{-19}}$$

$$= 1929\ nm$$

5.

a) 3d subshell

n	1	2		3		
l	0	0	1	0	1	2

m_l	0		0		-1		0		1		0		-1		0		1		-2		-1		0		1		2						
m_s	$\frac{-1}{2}$	$\frac{1}{2}$	$\frac{-1}{2}$	$\frac{1}{2}$	$\frac{-1}{2}$	$\frac{1}{2}$	$\frac{-1}{2}$	$\frac{1}{2}$	$\frac{-1}{2}$	$\frac{1}{2}$	$\frac{-1}{2}$	$\frac{1}{2}$	$\frac{-1}{2}$	$\frac{1}{2}$	$\frac{-1}{2}$	$\frac{1}{2}$	$\frac{-1}{2}$	$\frac{1}{2}$	$\frac{-1}{2}$	$\frac{1}{2}$	$\frac{-1}{2}$	$\frac{1}{2}$	$\frac{-1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$						

10 sets of quantum numbers in 3d

6 sets of quantum numbers in 3p

3. $R = R_0 e^{-\lambda t}$

$$\frac{R}{R_0} = e^{-\lambda t}$$

$$\frac{8}{10} = e^{-\lambda t}$$

$$\ln \frac{8}{10} = -\lambda t$$

$$-0.223 = -\lambda t$$

$$\lambda = \frac{0.223}{14400}$$

$$= 1.549 \times 10^{-5}\ s^{-1}$$

$$T_{1/2} = \frac{\ln 2}{\lambda} = 44748\ s$$

$$= 12.43\ h$$

$$R_0 = N_0 \lambda$$

$$N_0 = \frac{R_0}{\lambda} = \frac{10 \times 10^{-3} \times 3.7 \times 10^{10}}{1.549 \times 10^{-5}}\ \text{atoms}$$

$$= 2.389 \times 10^{13}\ \text{atoms}$$

$R = R_0 e^{-\lambda t}$

$$= 10\, e^{-1.549\times10^{-5}\times 30\times60\times60} \times 10^{-3}\times 3.7\times10^{10}$$

$$= 69.45\times10^{6}\ \text{Bq}$$

$$= \underline{1.877\ \text{mCi}}$$