

E1 transition rates in hydrogen. (all allowed to N=6).

ni, li → nf, lf

(2, 1) → (1, 0)

2P → 1S

$$\text{"rate = "}, \frac{(2)^8}{(3)^8}, \text{" m c}^2 \alpha^5 / \hbar\text{"}$$

3, 0, → 2, 1

3S → 2P

$$\text{"rate = "}, \frac{(2)^8 (3)}{(5)^9}, \text{" m c}^2 \alpha^5 / \hbar\text{"}$$

3, 1, → 1, 0

3P → 1S

$$\text{"rate = "}, \frac{1}{(2)^5 (3)}, \text{" m c}^2 \alpha^5 / \hbar\text{"}$$

3, 1, → 2, 0

3P → 2S

$$\text{"rate = "}, \frac{(2)^{13}}{(3)^9 (5)}, \text{" m c}^2 \alpha^5 / \hbar\text{"}$$

3, 2, → 2, 1

3D → 2P

$$\text{"rate = "}, \frac{(2)^{16} (3)}{(5)^{11}}, \text{" m c}^2 \alpha^5 / \hbar\text{"}$$

4, 0, → 2, 1

(2)<sup>8</sup>

$$\text{"rate = "}, \frac{(2)^8}{(5)^{11}}, \text{" m c}^2 \alpha^5 / \hbar\text{"}$$

13  
(3)

"

4, 0, " -> ", 3, 1

$$\text{"rate = ", } \frac{(2)^{16} (13)^2}{(7)^{13}}, \text{ " m c}^2 \alpha^5 / \text{hbar"}$$

"

4, 1, " -> ", 1, 0

$$\text{"rate = ", } \frac{(2)^9 (3)^4}{(5)^{10}}, \text{ " m c}^2 \alpha^5 / \text{hbar"}$$

"

4, 1, " -> ", 2, 0

$$\text{"rate = ", } \frac{(2)^6 (5)^5}{(3)^{12}}, \text{ " m c}^2 \alpha^5 / \text{hbar"}$$

"

4, 1, " -> ", 3, 0

$$\text{"rate = ", } \frac{(2)^9 (5)^3 (17)^2}{(7)^{13}}, \text{ " m c}^2 \alpha^5 / \text{hbar"}$$

"

4, 1, " -> ", 3, 2

$$\text{"rate = ", } \frac{(2)^{21}}{(7)^{13}}, \text{ " m c}^2 \alpha^5 / \text{hbar"}$$

"

4, 2, " -> ", 2, 1

$$\text{"rate = ", } \frac{(2)^{11}}{(3)^{13}}, \text{ " m c}^2 \alpha^5 / \text{hbar"}$$

"

4, 2, " -> ", 3, 1

19 4



13  
(7)

"

5, 1, " -> ", 3, 0

$$\text{"rate = ", } \frac{(5) \quad (37)^2}{26}, \text{ " m c}^2 \text{ alpha}^5 \text{ / hbar"}$$

(2)

"

5, 1, " -> ", 3, 2

$$\text{"rate = ", } \frac{(5)^4}{26}, \text{ " m c}^2 \text{ alpha}^5 \text{ / hbar"}$$

(2)

"

5, 1, " -> ", 4, 0

$$\text{"rate = ", } \frac{(2)^{16} \quad (5) \quad (13)^4 \quad (47)^2}{37}, \text{ " m c}^2 \text{ alpha}^5 \text{ / hbar"}$$

(3)

"

5, 1, " -> ", 4, 2

$$\text{"rate = ", } \frac{(2)^{19} \quad (5)^4 \quad (127)^2}{37}, \text{ " m c}^2 \text{ alpha}^5 \text{ / hbar"}$$

(3)

"

5, 2, " -> ", 2, 1

$$\text{"rate = ", } \frac{(2)^{16} \quad (3)^5 \quad (5)^2}{14}, \text{ " m c}^2 \text{ alpha}^5 \text{ / hbar"}$$

(7)

"

5, 2, " -> ", 3, 1

$$\text{"rate = ", } \frac{(3)^4 \quad (5)^2 \quad (7)}{26}, \text{ " m c}^2 \text{ alpha}^5 \text{ / hbar"}$$

(2)

"

"

5, 2, " -> ", 4, 1

21

3

2

$$\text{"rate = ", } \frac{(2) \quad (5) \quad (7) \quad (29)}{34}, \text{ " m c}^2 \text{ alpha}^5 \text{ / hbar"}$$

(3)

---

5, 2, " -> ", 4, 3

$$\text{"rate = ", } \frac{(2) \quad (5)}{34}, \text{ " m c}^2 \text{ alpha}^5 \text{ / hbar"}$$

(3)

---

5, 3, " -> ", 3, 2

$$\text{"rate = ", } \frac{(3) \quad (5)}{29}, \text{ " m c}^2 \text{ alpha}^5 \text{ / hbar"}$$

(2)

---

5, 3, " -> ", 4, 2

$$\text{"rate = ", } \frac{(2) \quad (5)}{34}, \text{ " m c}^2 \text{ alpha}^5 \text{ / hbar"}$$

(3)

---

5, 4, " -> ", 4, 3

$$\text{"rate = ", } \frac{(2) \quad (5)}{39}, \text{ " m c}^2 \text{ alpha}^5 \text{ / hbar"}$$

(3)

---

6, 0, " -> ", 2, 1

$$\text{"rate = ", } \frac{(3)}{16}, \text{ " m c}^2 \text{ alpha}^5 \text{ / hbar"}$$

(2)

---

6, 0, " -> ", 3, 1

$$\text{"rate = ", } \frac{(2) \quad (11)}{22}, \text{ " m c}^2 \text{ alpha}^5 \text{ / hbar"}$$

(2)

(3)<sup>--</sup>

"-----"

6, 0, " -> ", 4, 1

$$\text{"rate = ", } \frac{(2)^6 (3) (3329)^2}{(5)^{20}}, \text{ " m c}^2 \alpha^5 / \text{hbar"}$$

"-----"

6, 0, " -> ", 5, 1

$$\text{"rate = ", } \frac{(2)^{13} (3) (5) (67)^2 (14969)^2}{(11)^{21}}, \text{ " m c}^2 \alpha^5 / \text{hbar"}$$

"-----"

6, 1, " -> ", 1, 0

$$\text{"rate = ", } \frac{(2)^8 (5)^{10}}{(3) (7)^{14}}, \text{ " m c}^2 \alpha^5 / \text{hbar"}$$

"-----"

6, 1, " -> ", 2, 0

$$\text{"rate = ", } \frac{(5) (7)}{(2)^{16} (3)}, \text{ " m c}^2 \alpha^5 / \text{hbar"}$$

"-----"

6, 1, " -> ", 3, 0

$$\text{"rate = ", } \frac{(2)^8 (5)^5 (7)}{(3)^{23}}, \text{ " m c}^2 \alpha^5 / \text{hbar"}$$

"-----"

6, 1, " -> ", 3, 2

$$\text{"rate = ", } \frac{(2)^{16} (7)}{(3)^{23}}, \text{ " m c}^2 \alpha^5 / \text{hbar"}$$

"-----"

6, 1, " -> ", 4, 0

"rate = ",  $\frac{(2)^8 (7) (421)^2}{\text{-----}}$ , " m c^2 alpha^5 / hbar"

(3) (5)<sup>18</sup>

"-----"

6, 1, " -> ", 4, 2

$$\text{"rate = ", } \frac{(2)^{11} (3)^3 (7) (17)^2}{(5)^{19}}, \text{ " m c}^2 \text{ alpha}^5 \text{ / hbar"}$$

"-----"

6, 1, " -> ", 5, 0

$$\text{"rate = ", } \frac{(2)^8 (5)^4 (7) (257)^2 (2131)^2}{(3) (11)^{21}}, \text{ " m c}^2 \text{ alpha}^5 \text{ / hbar"}$$

"-----"

6, 1, " -> ", 5, 2

$$\text{"rate = ", } \frac{(2)^{16} (3)^3 (5)^4 (6323)^2}{(11)^{21}}, \text{ " m c}^2 \text{ alpha}^5 \text{ / hbar"}$$

"-----"

6, 2, " -> ", 2, 1

$$\text{"rate = ", } \frac{(3) (7)}{(2)^{16}}, \text{ " m c}^2 \text{ alpha}^5 \text{ / hbar"}$$

"-----"

6, 2, " -> ", 3, 1

$$\text{"rate = ", } \frac{(2)^{19} (7)}{(3)^{22}}, \text{ " m c}^2 \text{ alpha}^5 \text{ / hbar"}$$

"-----"

6, 2, " -> ", 4, 1

$$\text{"rate = ", } \frac{(2)^{16} (3) (7) (61)^2}{(5)^{20}}, \text{ " m c}^2 \text{ alpha}^5 \text{ / hbar"}$$

"

6, 2, " -> ", 4, 3

$$\text{"rate = ", } \frac{\binom{19}{2} \binom{5}{3}}{\binom{20}{5}}, \text{ " m c}^2 \text{ alpha}^5 \text{ / hbar"}$$

"

6, 2, " -> ", 5, 1

$$\text{"rate = ", } \frac{\binom{19}{2} \binom{3}{3} \binom{7}{5} \binom{12269}{2}}{\binom{21}{11}}, \text{ " m c}^2 \text{ alpha}^5 \text{ / hbar"}$$

"

6, 2, " -> ", 5, 3

$$\text{"rate = ", } \frac{\binom{28}{2} \binom{5}{3} \binom{3}{5} \binom{47}{2}}{\binom{21}{11}}, \text{ " m c}^2 \text{ alpha}^5 \text{ / hbar"}$$

"

6, 3, " -> ", 3, 2

$$\text{"rate = ", } \frac{\binom{22}{2}}{\binom{22}{3}}, \text{ " m c}^2 \text{ alpha}^5 \text{ / hbar"}$$

"

6, 3, " -> ", 4, 2

$$\text{"rate = ", } \frac{\binom{21}{2} \binom{6}{3}}{\binom{19}{5}}, \text{ " m c}^2 \text{ alpha}^5 \text{ / hbar"}$$

"

6, 3, " -> ", 5, 2

$$\text{"rate = ", } \frac{\binom{22}{2} \binom{6}{3} \binom{6}{5} \binom{2}{13} \binom{2}{17}}{\binom{21}{7} \binom{11}{11}}, \text{ " m c}^2 \text{ alpha}^5 \text{ / hbar"}$$

"

6, 3, " -> ", 5, 4

$$\text{"rate = ", } \frac{\binom{30}{2} \binom{7}{3} \binom{6}{5}}{\binom{21}{7} \binom{11}{11}}, \text{ " m c^2 alpha^5 / hbar"}$$

"-----"

6, 4, " -> ", 4, 3

$$\text{"rate = ", } \frac{\binom{25}{2} \binom{5}{3}}{\binom{20}{5}}, \text{ " m c^2 alpha^5 / hbar"}$$

"-----"

6, 4, " -> ", 5, 3

$$\text{"rate = ", } \frac{\binom{30}{2} \binom{5}{3} \binom{9}{5}}{\binom{21}{11}}, \text{ " m c^2 alpha^5 / hbar"}$$

"-----"

6, 5, " -> ", 5, 4

$$\text{"rate = ", } \frac{\binom{32}{2} \binom{7}{3} \binom{10}{5}}{\binom{23}{11}}, \text{ " m c^2 alpha^5 / hbar"}$$

"-----"

".....exiting....."