

# Diagrams and algebraic expressions at order 4 in BMBPT

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Valid diagrams: 59  
2N valid diagrams: 59  
2N canonical diagrams for the energy: 10  
2N canonical diagrams for a generic operator only: 6  
2N non-canonical diagrams: 43

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## 1 Time-structure diagrams

### 1.1 Tree diagrams

**Time-structure diagram T1:**



$$T1 = \frac{1}{(a_1 + a_2 + a_3)(a_2 + a_3)a_3} \quad (1)$$

Related Feynman diagrams: 59, 58, 57, 56, 53, 52, 51, 49, 45, 42, 41, 37, 36, 34, 33, 32, 30, 28, 26, 24, 22, 18, 17, 16, 15, 14, 13, 12, 11, 10, 8, 7, 5, 4, 3.

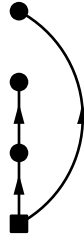
**Time-structure diagram T2:**



$$T2 = \frac{1}{(a_1 + a_2 + a_3)a_2a_3} \quad (2)$$

Related Feynman diagrams: 55, 46, 38, 35, 25, 23, 21, 19, 2, 1.

**Time-structure diagram T3:**



$$T3 = \frac{1}{(a_1 + a_2)a_2a_3} \quad (3)$$

Related Feynman diagrams: 54, 47, 44, 29.

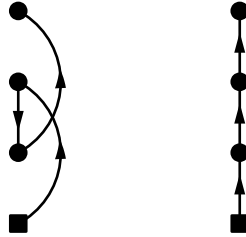
## 1.2 Non-tree diagrams

**Time-structure diagram T4:**



$$T4 = \frac{1}{(a_1 + a_3)(a_2 + a_1 + a_3)a_3} + \frac{1}{(a_1 + a_2 + a_3)(a_2 + a_3)a_3} \quad (4)$$

Equivalent tree diagrams: T1, T1.



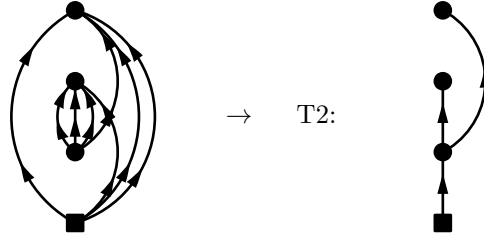
Related Feynman diagrams: 6, 9, 20, 27, 31, 39, 40, 43, 48, 50.

## 2 Two-body diagrams

### 2.1 Two-body energy canonical diagrams

Diagram 1:

$$\begin{aligned}
 \text{PO4.1} &= \lim_{\tau \rightarrow \infty} \frac{-(-1)^3}{(3!)^2} \sum_{k_i} O_{k_1 k_2 k_3 k_4}^{40} \Omega_{k_5 k_6 k_7 k_8}^{40} \Omega_{k_5 k_6 k_7 k_1}^{04} \Omega_{k_8 k_2 k_3 k_4}^{04} \int_0^\tau d\tau_1 d\tau_2 d\tau_3 \theta(\tau_2 - \tau_1) \theta(\tau_3 - \tau_1) e^{-\tau_1 \epsilon^{k_5 k_6 k_7 k_8}} e^{-\tau_2 \epsilon_{k_1 k_5 k_6 k_7}} e^{-\tau_3 \epsilon_{k_2 k_3 k_4 k_8}} \\
 &= \frac{-(-1)^3}{(3!)^2} \sum_{k_i} \frac{O_{k_1 k_2 k_3 k_4}^{40} \Omega_{k_5 k_6 k_7 k_8}^{40} \Omega_{k_5 k_6 k_7 k_1}^{04} \Omega_{k_8 k_2 k_3 k_4}^{04}}{\epsilon_{k_1 k_2 k_3 k_4} \epsilon_{k_1 k_5 k_6 k_7} \epsilon_{k_2 k_3 k_4 k_8}}
 \end{aligned} \tag{5}$$



$$T2 = \frac{1}{(a_1 + a_2 + a_3) a_2 a_3} \tag{6}$$

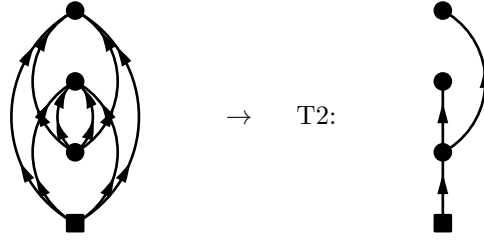
$$a_1 = \epsilon^{k_5 k_6 k_7 k_8}$$

$$a_2 = \epsilon_{k_1 k_5 k_6 k_7}$$

$$a_3 = \epsilon_{k_2 k_3 k_4 k_8}$$

Diagram 2:

$$\begin{aligned}
 \text{PO4.2} &= \lim_{\tau \rightarrow \infty} \frac{(-1)^3}{2(2!)^4} \sum_{k_i} O_{k_1 k_2 k_3 k_4}^{40} \Omega_{k_5 k_6 k_7 k_8}^{40} \Omega_{k_5 k_6 k_1 k_2}^{04} \Omega_{k_7 k_8 k_3 k_4}^{04} \int_0^\tau d\tau_1 d\tau_2 d\tau_3 \theta(\tau_2 - \tau_1) \theta(\tau_3 - \tau_1) e^{-\tau_1 \epsilon^{k_5 k_6 k_7 k_8}} e^{-\tau_2 \epsilon_{k_1 k_2 k_5 k_6}} e^{-\tau_3 \epsilon_{k_3 k_4 k_7 k_8}} \\
 &= \frac{(-1)^3}{2(2!)^4} \sum_{k_i} \frac{O_{k_1 k_2 k_3 k_4}^{40} \Omega_{k_5 k_6 k_7 k_8}^{40} \Omega_{k_5 k_6 k_1 k_2}^{04} \Omega_{k_7 k_8 k_3 k_4}^{04}}{\epsilon_{k_1 k_2 k_3 k_4} \epsilon_{k_1 k_2 k_5 k_6} \epsilon_{k_3 k_4 k_7 k_8}}
 \end{aligned} \tag{7}$$



$$T2 = \frac{1}{(a_1 + a_2 + a_3)a_2a_3} \quad (8)$$

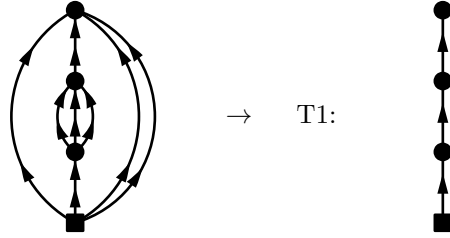
$$a_1 = \epsilon^{k_5 k_6 k_7 k_8}$$

$$a_2 = \epsilon_{k_1 k_2 k_5 k_6}$$

$$a_3 = \epsilon_{k_3 k_4 k_7 k_8}$$

**Diagram 3:**

$$\begin{aligned} \text{PO4.3} &= \lim_{\tau \rightarrow \infty} \frac{(-1)^3}{(3!)^2} \sum_{k_i} O_{k_1 k_2 k_3 k_4}^{40} \Omega_{k_5 k_6 k_7 k_1}^{31} \Omega_{k_8 k_5 k_6 k_7}^{13} \Omega_{k_8 k_2 k_3 k_4}^{04} \int_0^\tau d\tau_1 d\tau_2 d\tau_3 \theta(\tau_2 - \tau_1) \theta(\tau_3 - \tau_2) e^{-\tau_1 \epsilon_{k_1}^{k_5 k_6 k_7}} e^{-\tau_2 \epsilon_{k_5 k_6 k_7}^{k_8}} e^{-\tau_3 \epsilon_{k_2 k_3 k_4 k_8}} \\ &= \frac{(-1)^3}{(3!)^2} \sum_{k_i} \frac{O_{k_1 k_2 k_3 k_4}^{40} \Omega_{k_5 k_6 k_7 k_1}^{31} \Omega_{k_8 k_5 k_6 k_7}^{13} \Omega_{k_8 k_2 k_3 k_4}^{04}}{\epsilon_{k_1 k_2 k_3 k_4} \epsilon_{k_5 k_6 k_7 k_2 k_3 k_4} \epsilon_{k_2 k_3 k_4 k_8}} \end{aligned} \quad (9)$$



$$T1 = \frac{1}{(a_1 + a_2 + a_3)(a_2 + a_3)a_3} \quad (10)$$

$$\begin{aligned}
a_1 &= \epsilon_{k_1}^{k_5 k_6 k_7} \\
a_2 &= \epsilon_{k_5 k_6 k_7}^{k_8} \\
a_3 &= \epsilon_{k_2 k_3 k_4 k_8}
\end{aligned}$$

**Diagram 4:**

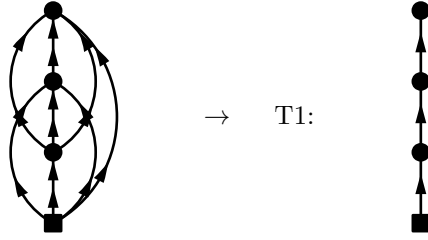
$$\begin{aligned}
\text{PO4.4} &= \lim_{\tau \rightarrow \infty} \frac{-(-1)^3}{(2!)^2} \sum_{k_i} O_{k_1 k_2 k_3 k_4}^{40} \Omega_{k_5 k_6 k_7 k_1}^{31} \Omega_{k_8 k_5 k_6 k_2}^{13} \Omega_{k_8 k_7 k_3 k_4}^{04} \int_0^\tau d\tau_1 d\tau_2 d\tau_3 \theta(\tau_2 - \tau_1) \theta(\tau_3 - \tau_1) \theta(\tau_3 - \tau_2) e^{-\tau_1 \epsilon_{k_1}^{k_5 k_6 k_7}} e^{-\tau_2 \epsilon_{k_2 k_5 k_6}^{k_8}} e^{-\tau_3 \epsilon_{k_3 k_4 k_7 k_8}} \\
&= \frac{-(-1)^3}{(2!)^2} \sum_{k_i} \frac{O_{k_1 k_2 k_3 k_4}^{40} \Omega_{k_5 k_6 k_7 k_1}^{31} \Omega_{k_8 k_5 k_6 k_2}^{13} \Omega_{k_8 k_7 k_3 k_4}^{04}}{\epsilon_{k_1 k_2 k_3 k_4} \epsilon_{k_2 k_5 k_6 k_3 k_4 k_7} \epsilon_{k_3 k_4 k_7 k_8}}
\end{aligned} \tag{11}$$

$$\text{T1} = \frac{1}{(a_1 + a_2 + a_3)(a_2 + a_3)a_3} \tag{12}$$

$$\begin{aligned}
a_1 &= \epsilon_{k_1}^{k_5 k_6 k_7} \\
a_2 &= \epsilon_{k_2 k_5 k_6}^{k_8} \\
a_3 &= \epsilon_{k_3 k_4 k_7 k_8}
\end{aligned}$$

**Diagram 5:**

$$\begin{aligned}
\text{PO4.5} &= \lim_{\tau \rightarrow \infty} \frac{(-1)^3}{(2!)^2} \sum_{k_i} O_{k_1 k_2 k_3 k_4}^{40} \Omega_{k_5 k_6 k_7 k_1}^{31} \Omega_{k_8 k_5 k_2 k_3}^{13} \Omega_{k_8 k_6 k_7 k_4}^{04} \int_0^\tau d\tau_1 d\tau_2 d\tau_3 \theta(\tau_2 - \tau_1) \theta(\tau_3 - \tau_1) \theta(\tau_3 - \tau_2) e^{-\tau_1 \epsilon_{k_1}^{k_5 k_6 k_7}} e^{-\tau_2 \epsilon_{k_2 k_3 k_5}^{k_8}} e^{-\tau_3 \epsilon_{k_4 k_6 k_7 k_8}} \\
&= \frac{(-1)^3}{(2!)^2} \sum_{k_i} \frac{O_{k_1 k_2 k_3 k_4}^{40} \Omega_{k_5 k_6 k_7 k_1}^{31} \Omega_{k_8 k_5 k_2 k_3}^{13} \Omega_{k_8 k_6 k_7 k_4}^{04}}{\epsilon_{k_1 k_2 k_3 k_4} \epsilon_{k_2 k_3 k_5 k_4 k_6 k_7} \epsilon_{k_4 k_6 k_7 k_8}}
\end{aligned} \tag{13}$$

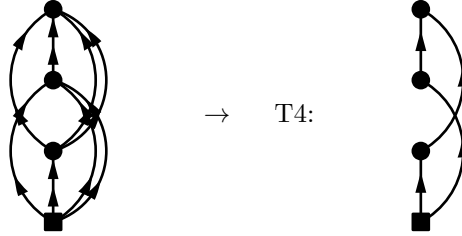


$$T1 = \frac{1}{(a_1 + a_2 + a_3)(a_2 + a_3)a_3} \quad (14)$$

$$\begin{aligned} a_1 &= \epsilon_{k_1}^{k_5 k_6 k_7} \\ a_2 &= \epsilon_{k_2 k_3 k_5}^{k_8} \\ a_3 &= \epsilon_{k_4 k_6 k_7 k_8} \end{aligned}$$

**Diagram 6:**

$$\begin{aligned} \text{PO4.6} &= \lim_{\tau \rightarrow \infty} \frac{-(-1)^3}{(3!)^2} \sum_{k_i} O_{k_1 k_2 k_3 k_4}^{40} \Omega_{k_5 k_6 k_7 k_1}^{31} \Omega_{k_8 k_2 k_3 k_4}^{13} \Omega_{k_8 k_5 k_6 k_7}^{04} \int_0^\tau d\tau_1 d\tau_2 d\tau_3 \theta(\tau_3 - \tau_1) \theta(\tau_3 - \tau_2) e^{-\tau_1 \epsilon_{k_1}^{k_5 k_6 k_7}} e^{-\tau_2 \epsilon_{k_2 k_3 k_4}^{k_8}} e^{-\tau_3 \epsilon_{k_5 k_6 k_7 k_8}} \\ &= \frac{-(-1)^3}{(3!)^2} \sum_{k_i} O_{k_1 k_2 k_3 k_4}^{40} \Omega_{k_5 k_6 k_7 k_1}^{31} \Omega_{k_8 k_2 k_3 k_4}^{13} \Omega_{k_8 k_5 k_6 k_7}^{04} \left[ \frac{1}{\epsilon_{k_1 k_8} \epsilon_{k_1 k_2 k_3 k_4} \epsilon_{k_5 k_6 k_7 k_8}} + \frac{1}{\epsilon_{k_1 k_2 k_3 k_4} \epsilon_{k_2 k_3 k_4 k_5 k_6 k_7} \epsilon_{k_5 k_6 k_7 k_8}} \right] \end{aligned} \quad (15)$$

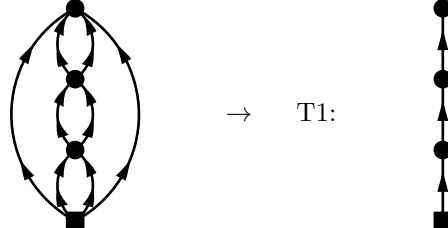


$$T4 = \frac{1}{(a_1 + a_3)(a_2 + a_1 + a_3)a_3} + \frac{1}{(a_1 + a_2 + a_3)(a_2 + a_3)a_3} \quad (16)$$

$$\begin{aligned}
a_1 &= \epsilon_{k_1}^{k_5 k_6 k_7} \\
a_2 &= \epsilon_{k_2 k_3 k_4}^{k_8} \\
a_3 &= \epsilon_{k_5 k_6 k_7 k_8}
\end{aligned}$$

**Diagram 7:**

$$\begin{aligned}
\text{PO4.7} &= \lim_{\tau \rightarrow \infty} \frac{(-1)^3}{(2!)^4} \sum_{k_i} O_{k_1 k_2 k_3 k_4}^{40} \Omega_{k_5 k_6 k_1 k_2}^{22} \Omega_{k_7 k_8 k_5 k_6}^{22} \Omega_{k_7 k_8 k_3 k_4}^{04} \int_0^\tau d\tau_1 d\tau_2 d\tau_3 \theta(\tau_2 - \tau_1) \theta(\tau_3 - \tau_2) e^{-\tau_1 \epsilon_{k_1 k_2}^{k_5 k_6}} e^{-\tau_2 \epsilon_{k_5 k_6}^{k_7 k_8}} e^{-\tau_3 \epsilon_{k_3 k_4 k_7 k_8}} \\
&= \frac{(-1)^3}{(2!)^4} \sum_{k_i} \frac{O_{k_1 k_2 k_3 k_4}^{40} \Omega_{k_5 k_6 k_1 k_2}^{22} \Omega_{k_7 k_8 k_5 k_6}^{22} \Omega_{k_7 k_8 k_3 k_4}^{04}}{\epsilon_{k_1 k_2 k_3 k_4} \epsilon_{k_5 k_6 k_3 k_4} \epsilon_{k_3 k_4 k_7 k_8}}
\end{aligned} \tag{17}$$



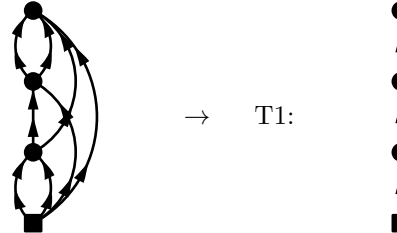
$$\text{T1} = \frac{1}{(a_1 + a_2 + a_3)(a_2 + a_3)a_3} \tag{18}$$

$$\begin{aligned}
a_1 &= \epsilon_{k_1 k_2}^{k_5 k_6} \\
a_2 &= \epsilon_{k_5 k_6}^{k_7 k_8} \\
a_3 &= \epsilon_{k_3 k_4 k_7 k_8}
\end{aligned}$$

**Diagram 8:**

$$\begin{aligned}
\text{PO4.8} &= \lim_{\tau \rightarrow \infty} \frac{-(-1)^3}{(2!)^2} \sum_{k_i} O_{k_1 k_2 k_3 k_4}^{40} \Omega_{k_5 k_6 k_1 k_2}^{22} \Omega_{k_7 k_8 k_5 k_3}^{22} \Omega_{k_7 k_8 k_6 k_4}^{04} \int_0^\tau d\tau_1 d\tau_2 d\tau_3 \theta(\tau_2 - \tau_1) \theta(\tau_3 - \tau_1) \theta(\tau_3 - \tau_2) e^{-\tau_1 \epsilon_{k_1 k_2}^{k_5 k_6}} e^{-\tau_2 \epsilon_{k_3 k_5}^{k_7 k_8}} e^{-\tau_3 \epsilon_{k_4 k_6 k_7 k_8}} \\
&= \frac{-(-1)^3}{(2!)^2} \sum_{k_i} \frac{O_{k_1 k_2 k_3 k_4}^{40} \Omega_{k_5 k_6 k_1 k_2}^{22} \Omega_{k_7 k_8 k_5 k_3}^{22} \Omega_{k_7 k_8 k_6 k_4}^{04}}{\epsilon_{k_1 k_2 k_3 k_4} \epsilon_{k_3 k_5 k_4 k_6} \epsilon_{k_4 k_6 k_7 k_8}}
\end{aligned} \tag{19}$$





$$T1 = \frac{1}{(a_1 + a_2 + a_3)(a_2 + a_3)a_3} \quad (20)$$

$$a_1 = \epsilon_{k_1 k_2}^{k_5 k_6}$$

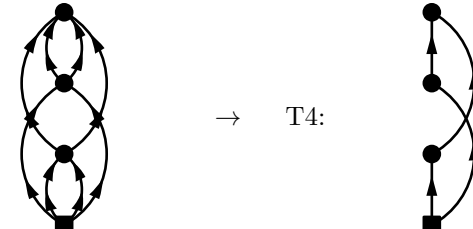
$$a_2 = \epsilon_{k_3 k_5}^{k_7 k_8}$$

$$a_3 = \epsilon_{k_4 k_6 k_7 k_8}$$

**Diagram 9:**

$$PO4.9 = \lim_{\tau \rightarrow \infty} \frac{(-1)^3}{2(2!)^4} \sum_{k_i} O_{k_1 k_2 k_3 k_4}^{40} \Omega_{k_5 k_6 k_1 k_2}^{22} \Omega_{k_7 k_8 k_3 k_4}^{22} \Omega_{k_7 k_8 k_5 k_6}^{04} \int_0^\tau d\tau_1 d\tau_2 d\tau_3 \theta(\tau_3 - \tau_1) \theta(\tau_3 - \tau_2) e^{-\tau_1 \epsilon_{k_1 k_2}^{k_5 k_6}} e^{-\tau_2 \epsilon_{k_3 k_4}^{k_7 k_8}} e^{-\tau_3 \epsilon_{k_5 k_6 k_7 k_8}}$$

$$= \frac{(-1)^3}{2(2!)^4} \sum_{k_i} O_{k_1 k_2 k_3 k_4}^{40} \Omega_{k_5 k_6 k_1 k_2}^{22} \Omega_{k_7 k_8 k_3 k_4}^{22} \Omega_{k_7 k_8 k_5 k_6}^{04} \left[ \frac{1}{\epsilon_{k_1 k_2 k_7 k_8} \epsilon_{k_1 k_2 k_3 k_4} \epsilon_{k_5 k_6 k_7 k_8}} + \frac{1}{\epsilon_{k_1 k_2 k_3 k_4} \epsilon_{k_3 k_4 k_5 k_6} \epsilon_{k_5 k_6 k_7 k_8}} \right] \quad (21)$$

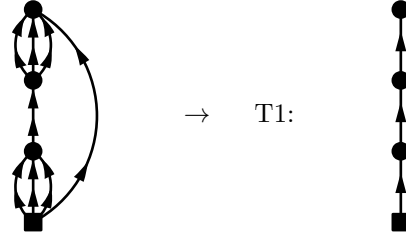


$$T4 = \frac{1}{(a_1 + a_3)(a_2 + a_1 + a_3)a_3} + \frac{1}{(a_1 + a_2 + a_3)(a_2 + a_3)a_3} \quad (22)$$

$$\begin{aligned}
a_1 &= \epsilon_{k_1 k_2}^{k_5 k_6} \\
a_2 &= \epsilon_{k_3 k_4}^{k_7 k_8} \\
a_3 &= \epsilon_{k_5 k_6 k_7 k_8}
\end{aligned}$$

**Diagram 10:**

$$\begin{aligned}
\text{PO4.10} &= \lim_{\tau \rightarrow \infty} \frac{(-1)^3}{(3!)^2} \sum_{k_i} O_{k_1 k_2 k_3 k_4}^{40} \Omega_{k_5 k_1 k_2 k_3}^{13} \Omega_{k_6 k_7 k_8 k_5}^{31} \Omega_{k_6 k_7 k_8 k_4}^{04} \int_0^\tau d\tau_1 d\tau_2 d\tau_3 \theta(\tau_2 - \tau_1) \theta(\tau_3 - \tau_2) e^{-\tau_1 \epsilon_{k_1 k_2 k_3}^{k_5}} e^{-\tau_2 \epsilon_{k_5 k_6 k_7 k_8}^{k_8}} e^{-\tau_3 \epsilon_{k_4 k_6 k_7 k_8}^{k_8}} \\
&= \frac{(-1)^3}{(3!)^2} \sum_{k_i} \frac{O_{k_1 k_2 k_3 k_4}^{40} \Omega_{k_5 k_1 k_2 k_3}^{13} \Omega_{k_6 k_7 k_8 k_5}^{31} \Omega_{k_6 k_7 k_8 k_4}^{04}}{\epsilon_{k_1 k_2 k_3 k_4} \epsilon_{k_5 k_4} \epsilon_{k_4 k_6 k_7 k_8}}
\end{aligned} \tag{23}$$



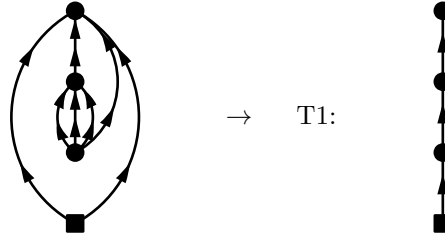
$$\text{T1} = \frac{1}{(a_1 + a_2 + a_3)(a_2 + a_3)a_3} \tag{24}$$

$$\begin{aligned}
a_1 &= \epsilon_{k_1 k_2 k_3}^{k_5} \\
a_2 &= \epsilon_{k_5}^{k_6 k_7 k_8} \\
a_3 &= \epsilon_{k_4 k_6 k_7 k_8}
\end{aligned}$$

## 2.2 Two-body canonical diagrams for a generic operator only

Diagram 11:

$$\begin{aligned}
 \text{PO4.11} &= \lim_{\tau \rightarrow \infty} \frac{(-1)^3}{(2!)(3!)} \sum_{k_i} O_{k_1 k_2}^{20} \Omega_{k_3 k_4 k_5 k_6}^{40} \Omega_{k_7 k_3 k_4 k_5}^{13} \Omega_{k_7 k_6 k_1 k_2}^{04} \int_0^\tau d\tau_1 d\tau_2 d\tau_3 \theta(\tau_2 - \tau_1) \theta(\tau_3 - \tau_1) \theta(\tau_3 - \tau_2) e^{-\tau_1 \epsilon^{k_3 k_4 k_5 k_6}} e^{-\tau_2 \epsilon^{k_7 k_3 k_4 k_5}} e^{-\tau_3 \epsilon_{k_1 k_2 k_6 k_7}} \\
 &= \frac{(-1)^3}{(2!)(3!)} \sum_{k_i} \frac{O_{k_1 k_2}^{20} \Omega_{k_3 k_4 k_5 k_6}^{40} \Omega_{k_7 k_3 k_4 k_5}^{13} \Omega_{k_7 k_6 k_1 k_2}^{04}}{\epsilon_{k_1 k_2} \epsilon_{k_3 k_4 k_5 k_1 k_2 k_6} \epsilon_{k_1 k_2 k_6 k_7}}
 \end{aligned} \tag{25}$$



$$\text{T1} = \frac{1}{(a_1 + a_2 + a_3)(a_2 + a_3)a_3} \tag{26}$$

$$a_1 = \epsilon^{k_3 k_4 k_5 k_6}$$

$$a_2 = \epsilon^{k_7 k_3 k_4 k_5}$$

$$a_3 = \epsilon_{k_1 k_2 k_6 k_7}$$

Diagram 12:

$$\begin{aligned}
 \text{PO4.12} &= \lim_{\tau \rightarrow \infty} \frac{(-1)^3}{(2!)^2} \sum_{k_i} O_{k_1 k_2}^{20} \Omega_{k_3 k_4 k_5 k_6}^{40} \Omega_{k_7 k_3 k_4 k_1}^{13} \Omega_{k_7 k_5 k_6 k_2}^{04} \int_0^\tau d\tau_1 d\tau_2 d\tau_3 \theta(\tau_2 - \tau_1) \theta(\tau_3 - \tau_1) \theta(\tau_3 - \tau_2) e^{-\tau_1 \epsilon^{k_3 k_4 k_5 k_6}} e^{-\tau_2 \epsilon_{k_1 k_3 k_4 k_5}} e^{-\tau_3 \epsilon_{k_2 k_5 k_6 k_7}} \\
 &= \frac{(-1)^3}{(2!)^2} \sum_{k_i} \frac{O_{k_1 k_2}^{20} \Omega_{k_3 k_4 k_5 k_6}^{40} \Omega_{k_7 k_3 k_4 k_1}^{13} \Omega_{k_7 k_5 k_6 k_2}^{04}}{\epsilon_{k_1 k_2} \epsilon_{k_1 k_3 k_4 k_2 k_5 k_6} \epsilon_{k_2 k_5 k_6 k_7}}
 \end{aligned} \tag{27}$$

$$T1 = \frac{1}{(a_1 + a_2 + a_3)(a_2 + a_3)a_3} \quad (28)$$

$$a_1 = \epsilon^{k_3 k_4 k_5 k_6}$$

$$a_2 = \epsilon_{k_1 k_3 k_4}^{k_7}$$

$$a_3 = \epsilon_{k_2 k_5 k_6 k_7}$$

**Diagram 13:**

$$\begin{aligned}
 \text{PO4.13} &= \lim_{\tau \rightarrow \infty} \frac{(-1)^3}{(2!)(3!)} \sum_{k_i} O_{k_1 k_2}^{20} \Omega_{k_3 k_4 k_5 k_6}^{40} \Omega_{k_7 k_3 k_1 k_2}^{13} \Omega_{k_7 k_4 k_5 k_6}^{04} \int_0^\tau d\tau_1 d\tau_2 d\tau_3 \theta(\tau_2 - \tau_1) \theta(\tau_3 - \tau_1) \theta(\tau_3 - \tau_2) e^{-\tau_1 \epsilon^{k_3 k_4 k_5 k_6}} e^{-\tau_2 \epsilon_{k_1 k_2 k_3}^{k_7}} e^{-\tau_3 \epsilon_{k_4 k_5 k_6 k_7}} \\
 &= \frac{(-1)^3}{(2!)(3!)} \sum_{k_i} \frac{O_{k_1 k_2}^{20} \Omega_{k_3 k_4 k_5 k_6}^{40} \Omega_{k_7 k_3 k_1 k_2}^{13} \Omega_{k_7 k_4 k_5 k_6}^{04}}{\epsilon_{k_1 k_2} \epsilon_{k_1 k_2 k_3 k_4 k_5 k_6} \epsilon_{k_4 k_5 k_6 k_7}} \quad (29)
 \end{aligned}$$

$$T1 = \frac{1}{(a_1 + a_2 + a_3)(a_2 + a_3)a_3} \quad (30)$$

$$\begin{aligned}
a_1 &= \epsilon^{k_3 k_4 k_5 k_6} \\
a_2 &= \epsilon_{k_1 k_2 k_3}^{k_7} \\
a_3 &= \epsilon_{k_4 k_5 k_6 k_7}
\end{aligned}$$

**Diagram 14:**

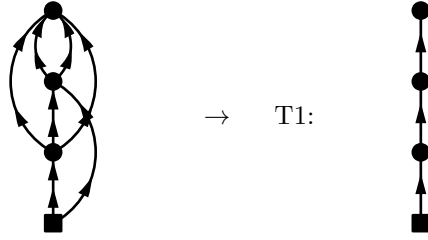
$$\begin{aligned}
\text{PO4.14} &= \lim_{\tau \rightarrow \infty} \frac{(-1)^3}{(2!)^2} \sum_{k_i} O_{k_1 k_2}^{20} \Omega_{k_3 k_4 k_5 k_1}^{31} \Omega_{k_6 k_7 k_3 k_4}^{22} \Omega_{k_6 k_7 k_5 k_2}^{04} \int_0^\tau d\tau_1 d\tau_2 d\tau_3 \theta(\tau_2 - \tau_1) \theta(\tau_3 - \tau_1) \theta(\tau_3 - \tau_2) e^{-\tau_1 \epsilon_{k_1}^{k_3 k_4 k_5}} e^{-\tau_2 \epsilon_{k_3 k_4}^{k_6 k_7}} e^{-\tau_3 \epsilon_{k_2 k_5 k_6 k_7}} \\
&= \frac{(-1)^3}{(2!)^2} \sum_{k_i} \frac{O_{k_1 k_2}^{20} \Omega_{k_3 k_4 k_5 k_1}^{31} \Omega_{k_6 k_7 k_3 k_4}^{22} \Omega_{k_6 k_7 k_5 k_2}^{04}}{\epsilon_{k_1 k_2} \epsilon_{k_3 k_4 k_2 k_5} \epsilon_{k_2 k_5 k_6 k_7}}
\end{aligned} \tag{31}$$

$$\text{T1} = \frac{1}{(a_1 + a_2 + a_3)(a_2 + a_3)a_3}$$

$$\begin{aligned}
a_1 &= \epsilon_{k_1}^{k_3 k_4 k_5} \\
a_2 &= \epsilon_{k_3 k_4}^{k_6 k_7} \\
a_3 &= \epsilon_{k_2 k_5 k_6 k_7}
\end{aligned}$$

**Diagram 15:**

$$\begin{aligned}
\text{PO4.15} &= \lim_{\tau \rightarrow \infty} \frac{(-1)^3}{(2!)^2} \sum_{k_i} O_{k_1 k_2}^{20} \Omega_{k_3 k_4 k_5 k_1}^{31} \Omega_{k_6 k_7 k_3 k_2}^{22} \Omega_{k_6 k_7 k_4 k_5}^{04} \int_0^\tau d\tau_1 d\tau_2 d\tau_3 \theta(\tau_2 - \tau_1) \theta(\tau_3 - \tau_1) \theta(\tau_3 - \tau_2) e^{-\tau_1 \epsilon_{k_1}^{k_3 k_4 k_5}} e^{-\tau_2 \epsilon_{k_2 k_3}^{k_6 k_7}} e^{-\tau_3 \epsilon_{k_4 k_5 k_6 k_7}} \\
&= \frac{(-1)^3}{(2!)^2} \sum_{k_i} \frac{O_{k_1 k_2}^{20} \Omega_{k_3 k_4 k_5 k_1}^{31} \Omega_{k_6 k_7 k_3 k_2}^{22} \Omega_{k_6 k_7 k_4 k_5}^{04}}{\epsilon_{k_1 k_2} \epsilon_{k_2 k_3 k_4 k_5} \epsilon_{k_4 k_5 k_6 k_7}}
\end{aligned} \tag{33}$$

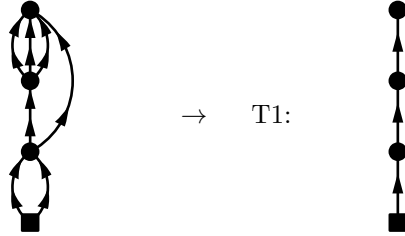


$$T1 = \frac{1}{(a_1 + a_2 + a_3)(a_2 + a_3)a_3} \quad (34)$$

$$\begin{aligned} a_1 &= \epsilon_{k_1}^{k_3 k_4 k_5} \\ a_2 &= \epsilon_{k_2 k_3}^{k_6 k_7} \\ a_3 &= \epsilon_{k_4 k_5 k_6 k_7} \end{aligned}$$

**Diagram 16:**

$$\begin{aligned} \text{PO4.16} &= \lim_{\tau \rightarrow \infty} \frac{(-1)^3}{(2!)(3!)} \sum_{k_i} O_{k_1 k_2}^{20} \Omega_{k_3 k_4 k_1 k_2}^{22} \Omega_{k_5 k_6 k_7 k_3}^{31} \Omega_{k_5 k_6 k_7 k_4}^{04} \int_0^\tau d\tau_1 d\tau_2 d\tau_3 \theta(\tau_2 - \tau_1) \theta(\tau_3 - \tau_1) \theta(\tau_3 - \tau_2) e^{-\tau_1 \epsilon_{k_1 k_2}^{k_3 k_4}} e^{-\tau_2 \epsilon_{k_3}^{k_5 k_6 k_7}} e^{-\tau_3 \epsilon_{k_4 k_5 k_6 k_7}} \\ &= \frac{(-1)^3}{(2!)(3!)} \sum_{k_i} \frac{O_{k_1 k_2}^{20} \Omega_{k_3 k_4 k_1 k_2}^{22} \Omega_{k_5 k_6 k_7 k_3}^{31} \Omega_{k_5 k_6 k_7 k_4}^{04}}{\epsilon_{k_1 k_2} \epsilon_{k_3 k_4} \epsilon_{k_4 k_5 k_6 k_7}} \end{aligned} \quad (35)$$



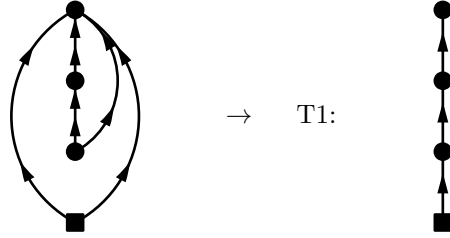
$$T1 = \frac{1}{(a_1 + a_2 + a_3)(a_2 + a_3)a_3} \quad (36)$$

$$\begin{aligned}
a_1 &= \epsilon_{k_1 k_2}^{k_3 k_4} \\
a_2 &= \epsilon_{k_3}^{k_5 k_6 k_7} \\
a_3 &= \epsilon_{k_4 k_5 k_6 k_7}
\end{aligned}$$

### 2.3 Two-body non-canonical diagrams

Diagram 17:

$$\begin{aligned}
\text{PO4.17} &= \lim_{\tau \rightarrow \infty} \frac{(-1)^3}{(2!)} \sum_{k_i} O_{k_1 k_2}^{20} \Omega_{k_3 k_4}^{20} \Omega_{k_5 k_3}^{11} \Omega_{k_5 k_4 k_1 k_2}^{04} \int_0^\tau d\tau_1 d\tau_2 d\tau_3 \theta(\tau_2 - \tau_1) \theta(\tau_3 - \tau_1) \theta(\tau_3 - \tau_2) e^{-\tau_1 \epsilon_{k_3 k_4}^{k_5}} e^{-\tau_2 \epsilon_{k_3}^{k_5}} e^{-\tau_3 \epsilon_{k_1 k_2 k_4 k_5}} \\
&= \frac{(-1)^3}{(2!)} \sum_{k_i} \frac{O_{k_1 k_2}^{20} \Omega_{k_3 k_4}^{20} \Omega_{k_5 k_3}^{11} \Omega_{k_5 k_4 k_1 k_2}^{04}}{\epsilon_{k_1 k_2} \epsilon_{k_3 k_1 k_2 k_4} \epsilon_{k_1 k_2 k_4 k_5}}
\end{aligned} \tag{37}$$

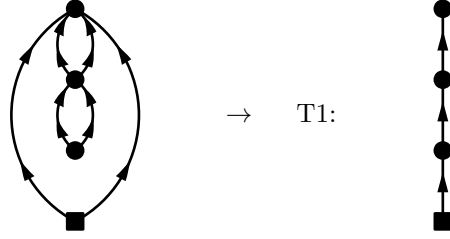


$$\text{T1} = \frac{1}{(a_1 + a_2 + a_3)(a_2 + a_3)a_3} \tag{38}$$

$$\begin{aligned}
a_1 &= \epsilon_{k_3 k_4}^{k_5} \\
a_2 &= \epsilon_{k_3}^{k_5} \\
a_3 &= \epsilon_{k_1 k_2 k_4 k_5}
\end{aligned}$$

**Diagram 18:**

$$\begin{aligned}
\text{PO4.18} &= \lim_{\tau \rightarrow \infty} \frac{(-1)^3}{(2!)^3} \sum_{k_i} O_{k_1 k_2}^{20} \Omega_{k_3 k_4}^{20} \Omega_{k_5 k_6 k_3 k_4}^{22} \Omega_{k_5 k_6 k_1 k_2}^{04} \int_0^\tau d\tau_1 d\tau_2 d\tau_3 \theta(\tau_2 - \tau_1) \theta(\tau_3 - \tau_2) e^{-\tau_1 \epsilon^{k_3 k_4}} e^{-\tau_2 \epsilon_{k_3 k_4}^{k_5 k_6}} e^{-\tau_3 \epsilon_{k_1 k_2 k_5 k_6}} \\
&= \frac{(-1)^3}{(2!)^3} \sum_{k_i} \frac{O_{k_1 k_2}^{20} \Omega_{k_3 k_4}^{20} \Omega_{k_5 k_6 k_3 k_4}^{22} \Omega_{k_5 k_6 k_1 k_2}^{04}}{\epsilon_{k_1 k_2} \epsilon_{k_3 k_4 k_1 k_2} \epsilon_{k_1 k_2 k_5 k_6}}
\end{aligned} \tag{39}$$



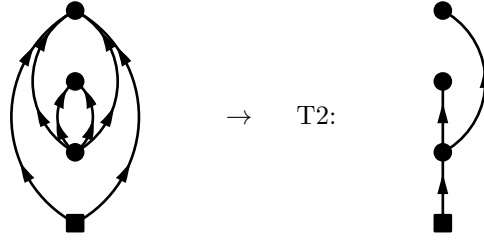
$$\text{T1} = \frac{1}{(a_1 + a_2 + a_3)(a_2 + a_3)a_3} \tag{40}$$

$$\begin{aligned}
a_1 &= \epsilon^{k_3 k_4} \\
a_2 &= \epsilon_{k_3 k_4}^{k_5 k_6} \\
a_3 &= \epsilon_{k_1 k_2 k_5 k_6}
\end{aligned}$$

**Diagram 19:**

$$\begin{aligned}
\text{PO4.19} &= \lim_{\tau \rightarrow \infty} \frac{(-1)^3}{(2!)^3} \sum_{k_i} O_{k_1 k_2}^{20} \Omega_{k_3 k_4 k_5 k_6}^{40} \Omega_{k_3 k_4}^{02} \Omega_{k_5 k_6 k_1 k_2}^{04} \int_0^\tau d\tau_1 d\tau_2 d\tau_3 \theta(\tau_2 - \tau_1) \theta(\tau_3 - \tau_1) e^{-\tau_1 \epsilon^{k_3 k_4 k_5 k_6}} e^{-\tau_2 \epsilon_{k_3 k_4}} e^{-\tau_3 \epsilon_{k_1 k_2 k_5 k_6}} \\
&= \frac{(-1)^3}{(2!)^3} \sum_{k_i} \frac{O_{k_1 k_2}^{20} \Omega_{k_3 k_4 k_5 k_6}^{40} \Omega_{k_3 k_4}^{02} \Omega_{k_5 k_6 k_1 k_2}^{04}}{\epsilon_{k_1 k_2} \epsilon_{k_3 k_4} \epsilon_{k_1 k_2 k_5 k_6}}
\end{aligned} \tag{41}$$





$$T2 = \frac{1}{(a_1 + a_2 + a_3)a_2a_3} \quad (42)$$

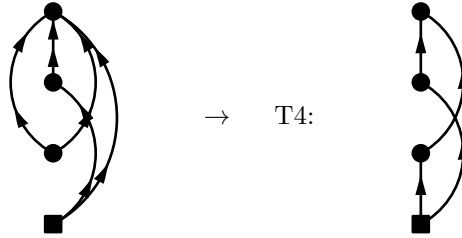
$$a_1 = \epsilon^{k_3k_4k_5k_6}$$

$$a_2 = \epsilon_{k_3k_4}$$

$$a_3 = \epsilon_{k_1k_2k_5k_6}$$

**Diagram 20:**

$$\begin{aligned} \text{PO4.20} &= \lim_{\tau \rightarrow \infty} \frac{(-1)^3}{(2!)} \sum_{k_i} O_{k_1k_2}^{20} \Omega_{k_3k_4}^{20} \Omega_{k_5k_1}^{11} \Omega_{k_5k_3k_4k_2}^{04} \int_0^\tau d\tau_1 d\tau_2 d\tau_3 \theta(\tau_3 - \tau_1) \theta(\tau_3 - \tau_2) e^{-\tau_1 \epsilon^{k_3k_4}} e^{-\tau_2 \epsilon_{k_1}^{k_5}} e^{-\tau_3 \epsilon_{k_2k_3k_4k_5}} \\ &= \frac{(-1)^3}{(2!)} \sum_{k_i} O_{k_1k_2}^{20} \Omega_{k_3k_4}^{20} \Omega_{k_5k_1}^{11} \Omega_{k_5k_3k_4k_2}^{04} \left[ \frac{1}{\epsilon_{k_2k_5} \epsilon_{k_1k_2} \epsilon_{k_2k_3k_4k_5}} + \frac{1}{\epsilon_{k_1k_2} \epsilon_{k_1k_2k_3k_4} \epsilon_{k_2k_3k_4k_5}} \right] \end{aligned} \quad (43)$$

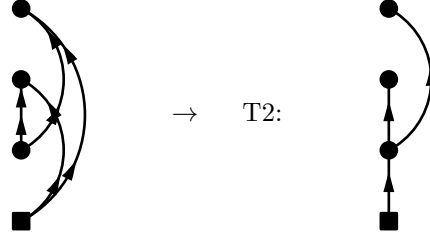


$$T4 = \frac{1}{(a_1 + a_3)(a_2 + a_1 + a_3)a_3} + \frac{1}{(a_1 + a_2 + a_3)(a_2 + a_3)a_3} \quad (44)$$

$$\begin{aligned}
a_1 &= \epsilon^{k_3 k_4} \\
a_2 &= \epsilon_{k_1}^{k_5} \\
a_3 &= \epsilon_{k_2 k_3 k_4 k_5}
\end{aligned}$$

**Diagram 21:**

$$\begin{aligned}
\text{PO4.21} &= \lim_{\tau \rightarrow \infty} \frac{-(-1)^3}{2} \sum_{k_i} O_{k_1 k_2}^{20} \Omega_{k_3 k_4}^{20} \Omega_{k_3 k_1}^{02} \Omega_{k_4 k_2}^{02} \int_0^\tau d\tau_1 d\tau_2 d\tau_3 \theta(\tau_2 - \tau_1) \theta(\tau_3 - \tau_1) e^{-\tau_1 \epsilon^{k_3 k_4}} e^{-\tau_2 \epsilon_{k_1 k_3}} e^{-\tau_3 \epsilon_{k_2 k_4}} \\
&= \frac{-(-1)^3}{2} \sum_{k_i} \frac{O_{k_1 k_2}^{20} \Omega_{k_3 k_4}^{20} \Omega_{k_3 k_1}^{02} \Omega_{k_4 k_2}^{02}}{\epsilon_{k_1 k_2} \epsilon_{k_1 k_3} \epsilon_{k_2 k_4}}
\end{aligned} \tag{45}$$



$$T2 = \frac{1}{(a_1 + a_2 + a_3) a_2 a_3} \tag{46}$$

$$\begin{aligned}
a_1 &= \epsilon^{k_3 k_4} \\
a_2 &= \epsilon_{k_1 k_3} \\
a_3 &= \epsilon_{k_2 k_4}
\end{aligned}$$

**Diagram 22:**

$$\begin{aligned}
\text{PO4.22} &= \lim_{\tau \rightarrow \infty} \frac{-(-1)^3}{(2!)} \sum_{k_i} O_{k_1 k_2}^{20} \Omega_{k_3 k_4}^{20} \Omega_{k_5 k_6 k_3 k_1}^{22} \Omega_{k_5 k_6 k_4 k_2}^{04} \int_0^\tau d\tau_1 d\tau_2 d\tau_3 \theta(\tau_2 - \tau_1) \theta(\tau_3 - \tau_1) \theta(\tau_3 - \tau_2) e^{-\tau_1 \epsilon^{k_3 k_4}} e^{-\tau_2 \epsilon_{k_1 k_3}^{k_5 k_6}} e^{-\tau_3 \epsilon_{k_2 k_4 k_5 k_6}} \\
&= \frac{-(-1)^3}{(2!)} \sum_{k_i} \frac{O_{k_1 k_2}^{20} \Omega_{k_3 k_4}^{20} \Omega_{k_5 k_6 k_3 k_1}^{22} \Omega_{k_5 k_6 k_4 k_2}^{04}}{\epsilon_{k_1 k_2} \epsilon_{k_1 k_3 k_2 k_4} \epsilon_{k_2 k_4 k_5 k_6}}
\end{aligned} \tag{47}$$

$$\begin{aligned}
& \text{Diagram} \rightarrow \text{T1:} \\
& \text{T1} = \frac{1}{(a_1 + a_2 + a_3)(a_2 + a_3)a_3} \\
& a_1 = \epsilon^{k_3 k_4} \\
& a_2 = \frac{\epsilon^{k_5 k_6}}{\epsilon_{k_1 k_3}} \\
& a_3 = \epsilon_{k_2 k_4 k_5 k_6}
\end{aligned} \tag{48}$$

**Diagram 23:**

$$\begin{aligned}
\text{PO4.23} &= \lim_{\tau \rightarrow \infty} \frac{-(-1)^3}{(3!)} \sum_{k_i} O_{k_1 k_2}^{20} \Omega_{k_3 k_4 k_5 k_6}^{40} \Omega_{k_3 k_1}^{02} \Omega_{k_4 k_5 k_6 k_2}^{04} \int_0^\tau d\tau_1 d\tau_2 d\tau_3 \theta(\tau_2 - \tau_1) \theta(\tau_3 - \tau_1) e^{-\tau_1 \epsilon^{k_3 k_4 k_5 k_6}} e^{-\tau_2 \epsilon_{k_1 k_3}} e^{-\tau_3 \epsilon_{k_2 k_4 k_5 k_6}} \\
&= \frac{-(-1)^3}{(3!)} \sum_{k_i} \frac{O_{k_1 k_2}^{20} \Omega_{k_3 k_4 k_5 k_6}^{40} \Omega_{k_3 k_1}^{02} \Omega_{k_4 k_5 k_6 k_2}^{04}}{\epsilon_{k_1 k_2} \epsilon_{k_1 k_3} \epsilon_{k_2 k_4 k_5 k_6}}
\end{aligned} \tag{49}$$

$$\begin{aligned}
& \text{Diagram} \rightarrow \text{T2:} \\
& \text{T2} = \frac{1}{(a_1 + a_2 + a_3)a_2 a_3}
\end{aligned} \tag{50}$$

$$a_1 = \epsilon^{k_3 k_4 k_5 k_6}$$

$$a_2 = \epsilon_{k_1 k_3}$$

$$a_3 = \epsilon_{k_2 k_4 k_5 k_6}$$

**Diagram 24:**

$$\begin{aligned} \text{PO4.24} &= \lim_{\tau \rightarrow \infty} \frac{(-1)^3}{(2!)} \sum_{k_i} O_{k_1 k_2}^{20} \Omega_{k_3 k_4}^{20} \Omega_{k_5 k_3 k_4 k_1}^{13} \Omega_{k_5 k_2}^{02} \int_0^\tau d\tau_1 d\tau_2 d\tau_3 \theta(\tau_2 - \tau_1) \theta(\tau_3 - \tau_2) e^{-\tau_1 \epsilon^{k_3 k_4}} e^{-\tau_2 \epsilon_{k_1 k_3 k_4}^{k_5}} e^{-\tau_3 \epsilon_{k_2 k_5}} \\ &= \frac{(-1)^3}{(2!)} \sum_{k_i} \frac{O_{k_1 k_2}^{20} \Omega_{k_3 k_4}^{20} \Omega_{k_5 k_3 k_4 k_1}^{13} \Omega_{k_5 k_2}^{02}}{\epsilon_{k_1 k_2} \epsilon_{k_1 k_3 k_4 k_2} \epsilon_{k_2 k_5}} \end{aligned} \quad (51)$$

$$\text{T1} = \frac{1}{(a_1 + a_2 + a_3)(a_2 + a_3)a_3} \quad (52)$$

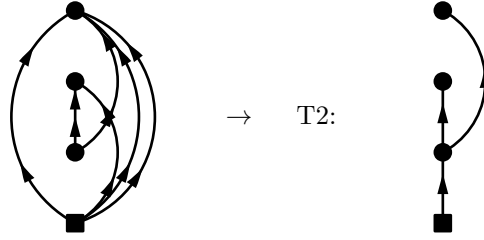
$$a_1 = \epsilon^{k_3 k_4}$$

$$a_2 = \epsilon_{k_1 k_3 k_4}^{k_5}$$

$$a_3 = \epsilon_{k_2 k_5}$$

**Diagram 25:**

$$\begin{aligned} \text{PO4.25} &= \lim_{\tau \rightarrow \infty} \frac{-(-1)^3}{(3!)} \sum_{k_i} O_{k_1 k_2 k_3 k_4}^{40} \Omega_{k_5 k_6}^{20} \Omega_{k_5 k_1}^{02} \Omega_{k_6 k_2 k_3 k_4}^{04} \int_0^\tau d\tau_1 d\tau_2 d\tau_3 \theta(\tau_2 - \tau_1) \theta(\tau_3 - \tau_1) e^{-\tau_1 \epsilon^{k_5 k_6}} e^{-\tau_2 \epsilon_{k_1 k_5}} e^{-\tau_3 \epsilon_{k_2 k_3 k_4 k_6}} \\ &= \frac{-(-1)^3}{(3!)} \sum_{k_i} \frac{O_{k_1 k_2 k_3 k_4}^{40} \Omega_{k_5 k_6}^{20} \Omega_{k_5 k_1}^{02} \Omega_{k_6 k_2 k_3 k_4}^{04}}{\epsilon_{k_1 k_2 k_3 k_4} \epsilon_{k_1 k_5} \epsilon_{k_2 k_3 k_4 k_6}} \end{aligned} \quad (53)$$



$$T2 = \frac{1}{(a_1 + a_2 + a_3)a_2a_3} \quad (54)$$

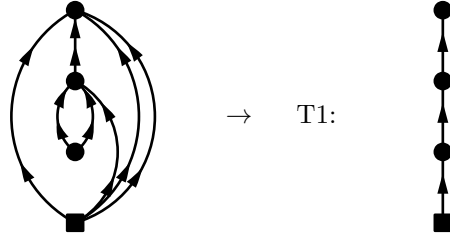
$$a_1 = \epsilon^{k_5 k_6}$$

$$a_2 = \epsilon_{k_1 k_5}$$

$$a_3 = \epsilon_{k_2 k_3 k_4 k_6}$$

**Diagram 26:**

$$\begin{aligned} \text{PO4.26} &= \lim_{\tau \rightarrow \infty} \frac{(-1)^3}{(2!)(3!)} \sum_{k_i} O_{k_1 k_2 k_3 k_4}^{40} \Omega_{k_5 k_6}^{20} \Omega_{k_7 k_5 k_6 k_1}^{13} \Omega_{k_7 k_2 k_3 k_4}^{04} \int_0^\tau d\tau_1 d\tau_2 d\tau_3 \theta(\tau_2 - \tau_1) \theta(\tau_3 - \tau_2) e^{-\tau_1 \epsilon^{k_5 k_6}} e^{-\tau_2 \epsilon_{k_1 k_5 k_6}^{k_7}} e^{-\tau_3 \epsilon_{k_2 k_3 k_4 k_7}} \\ &= \frac{(-1)^3}{(2!)(3!)} \sum_{k_i} \frac{O_{k_1 k_2 k_3 k_4}^{40} \Omega_{k_5 k_6}^{20} \Omega_{k_7 k_5 k_6 k_1}^{13} \Omega_{k_7 k_2 k_3 k_4}^{04}}{\epsilon_{k_1 k_2 k_3 k_4} \epsilon_{k_1 k_5 k_6 k_2 k_3 k_4} \epsilon_{k_2 k_3 k_4 k_7}} \end{aligned} \quad (55)$$

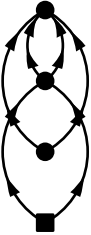



$$T1 = \frac{1}{(a_1 + a_2 + a_3)(a_2 + a_3)a_3} \quad (56)$$

$$\begin{aligned}
a_1 &= \epsilon^{k_5 k_6} \\
a_2 &= \epsilon_{k_1 k_5 k_6}^{k_7} \\
a_3 &= \epsilon_{k_2 k_3 k_4 k_7}
\end{aligned}$$

**Diagram 27:**

$$\begin{aligned}
\text{PO4.27} &= \lim_{\tau \rightarrow \infty} \frac{(-1)^3}{(2!)^3} \sum_{k_i} O_{k_1 k_2}^{20} \Omega_{k_3 k_4}^{20} \Omega_{k_5 k_6 k_1 k_2}^{22} \Omega_{k_5 k_6 k_3 k_4}^{04} \int_0^\tau d\tau_1 d\tau_2 d\tau_3 \theta(\tau_3 - \tau_1) \theta(\tau_3 - \tau_2) e^{-\tau_1 \epsilon^{k_3 k_4}} e^{-\tau_2 \epsilon_{k_1 k_2}^{k_5 k_6}} e^{-\tau_3 \epsilon_{k_3 k_4 k_5 k_6}} \\
&= \frac{(-1)^3}{(2!)^3} \sum_{k_i} O_{k_1 k_2}^{20} \Omega_{k_3 k_4}^{20} \Omega_{k_5 k_6 k_1 k_2}^{22} \Omega_{k_5 k_6 k_3 k_4}^{04} \left[ \frac{1}{\epsilon_{k_5 k_6} \epsilon_{k_1 k_2} \epsilon_{k_3 k_4 k_5 k_6}} + \frac{1}{\epsilon_{k_1 k_2} \epsilon_{k_1 k_2 k_3 k_4} \epsilon_{k_3 k_4 k_5 k_6}} \right] \quad (57)
\end{aligned}$$

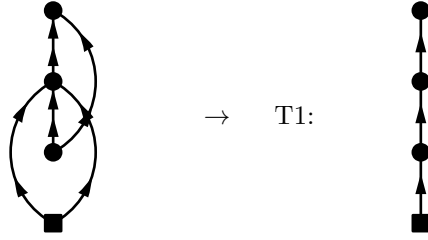

→ T4:


$$\text{T4} = \frac{1}{(a_1 + a_3)(a_2 + a_1 + a_3)a_3} + \frac{1}{(a_1 + a_2 + a_3)(a_2 + a_3)a_3} \quad (58)$$

$$\begin{aligned}
a_1 &= \epsilon^{k_3 k_4} \\
a_2 &= \epsilon_{k_1 k_2}^{k_5 k_6} \\
a_3 &= \epsilon_{k_3 k_4 k_5 k_6}
\end{aligned}$$

**Diagram 28:**

$$\begin{aligned}
\text{PO4.28} &= \lim_{\tau \rightarrow \infty} \frac{(-1)^3}{(2!)} \sum_{k_i} O_{k_1 k_2}^{20} \Omega_{k_3 k_4}^{20} \Omega_{k_5 k_3 k_1 k_2}^{13} \Omega_{k_5 k_4}^{02} \int_0^\tau d\tau_1 d\tau_2 d\tau_3 \theta(\tau_2 - \tau_1) \theta(\tau_3 - \tau_1) \theta(\tau_3 - \tau_2) e^{-\tau_1 \epsilon^{k_3 k_4}} e^{-\tau_2 \epsilon_{k_1 k_2 k_3}^{k_5}} e^{-\tau_3 \epsilon_{k_4 k_5}} \\
&= \frac{(-1)^3}{(2!)} \sum_{k_i} \frac{O_{k_1 k_2}^{20} \Omega_{k_3 k_4}^{20} \Omega_{k_5 k_3 k_1 k_2}^{13} \Omega_{k_5 k_4}^{02}}{\epsilon_{k_1 k_2} \epsilon_{k_1 k_2 k_3 k_4} \epsilon_{k_4 k_5}} \quad (59)
\end{aligned}$$



$$T1 = \frac{1}{(a_1 + a_2 + a_3)(a_2 + a_3)a_3} \quad (60)$$

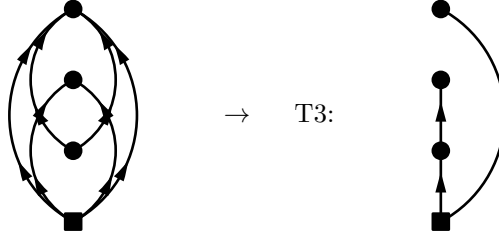
$$a_1 = \epsilon^{k_3 k_4}$$

$$a_2 = \epsilon_{k_1 k_2 k_3}^{k_5}$$

$$a_3 = \epsilon_{k_4 k_5}$$

**Diagram 29:**

$$\begin{aligned} \text{PO4.29} &= \lim_{\tau \rightarrow \infty} \frac{(-1)^3}{(2!)^3} \sum_{k_i} O_{k_1 k_2 k_3 k_4}^{40} \Omega_{k_5 k_6}^{20} \Omega_{k_1 k_2}^{02} \Omega_{k_5 k_6 k_3 k_4}^{04} \int_0^\tau d\tau_1 d\tau_2 d\tau_3 \theta(\tau_3 - \tau_1) e^{-\tau_1 \epsilon^{k_5 k_6}} e^{-\tau_2 \epsilon_{k_1 k_2}} e^{-\tau_3 \epsilon_{k_3 k_4 k_5 k_6}} \\ &= \frac{(-1)^3}{(2!)^3} \sum_{k_i} \frac{O_{k_1 k_2 k_3 k_4}^{40} \Omega_{k_5 k_6}^{20} \Omega_{k_1 k_2}^{02} \Omega_{k_5 k_6 k_3 k_4}^{04}}{\epsilon_{k_3 k_4} \epsilon_{k_1 k_2} \epsilon_{k_3 k_4 k_5 k_6}} \end{aligned} \quad (61)$$

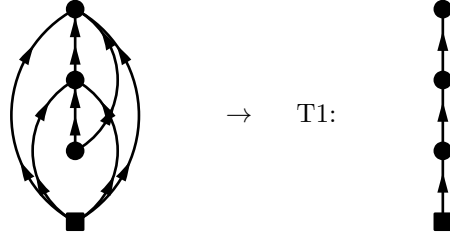


$$T3 = \frac{1}{(a_1 + a_2)a_2 a_3} \quad (62)$$

$$\begin{aligned}
a_1 &= \epsilon^{k_5 k_6} \\
a_2 &= \epsilon_{k_3 k_4 k_5 k_6} \\
a_3 &= \epsilon_{k_1 k_2}
\end{aligned}$$

**Diagram 30:**

$$\begin{aligned}
\text{PO4.30} &= \lim_{\tau \rightarrow \infty} \frac{(-1)^3}{(2!)^2} \sum_{k_i} O_{k_1 k_2 k_3 k_4}^{40} \Omega_{k_5 k_6}^{20} \Omega_{k_7 k_5 k_1 k_2}^{13} \Omega_{k_7 k_6 k_3 k_4}^{04} \int_0^\tau d\tau_1 d\tau_2 d\tau_3 \theta(\tau_2 - \tau_1) \theta(\tau_3 - \tau_1) \theta(\tau_3 - \tau_2) e^{-\tau_1 \epsilon^{k_5 k_6}} e^{-\tau_2 \epsilon_{k_1 k_2 k_5}^{k_7}} e^{-\tau_3 \epsilon_{k_3 k_4 k_6 k_7}} \\
&= \frac{(-1)^3}{(2!)^2} \sum_{k_i} \frac{O_{k_1 k_2 k_3 k_4}^{40} \Omega_{k_5 k_6}^{20} \Omega_{k_7 k_5 k_1 k_2}^{13} \Omega_{k_7 k_6 k_3 k_4}^{04}}{\epsilon_{k_1 k_2 k_3 k_4} \epsilon_{k_1 k_2 k_5 k_3 k_4 k_6} \epsilon_{k_3 k_4 k_6 k_7}}
\end{aligned} \tag{63}$$



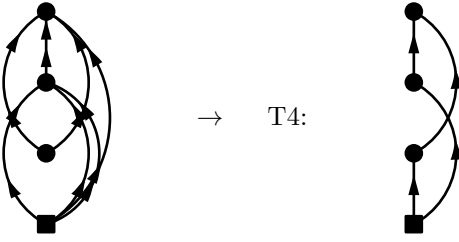
$$\text{T1} = \frac{1}{(a_1 + a_2 + a_3)(a_2 + a_3)a_3} \tag{64}$$

$$\begin{aligned}
a_1 &= \epsilon^{k_5 k_6} \\
a_2 &= \epsilon_{k_1 k_2 k_5}^{k_7} \\
a_3 &= \epsilon_{k_3 k_4 k_6 k_7}
\end{aligned}$$

**Diagram 31:**

$$\begin{aligned}
\text{PO4.31} &= \lim_{\tau \rightarrow \infty} \frac{(-1)^3}{(2!)(3!)} \sum_{k_i} O_{k_1 k_2 k_3 k_4}^{40} \Omega_{k_5 k_6}^{20} \Omega_{k_7 k_1 k_2 k_3}^{13} \Omega_{k_7 k_5 k_6 k_4}^{04} \int_0^\tau d\tau_1 d\tau_2 d\tau_3 \theta(\tau_3 - \tau_1) \theta(\tau_3 - \tau_2) e^{-\tau_1 \epsilon^{k_5 k_6}} e^{-\tau_2 \epsilon_{k_1 k_2 k_3}^{k_7}} e^{-\tau_3 \epsilon_{k_4 k_5 k_6 k_7}} \\
&= \frac{(-1)^3}{(2!)(3!)} \sum_{k_i} O_{k_1 k_2 k_3 k_4}^{40} \Omega_{k_5 k_6}^{20} \Omega_{k_7 k_1 k_2 k_3}^{13} \Omega_{k_7 k_5 k_6 k_4}^{04} \left[ \frac{1}{\epsilon_{k_4 k_7} \epsilon_{k_1 k_2 k_3 k_4} \epsilon_{k_4 k_5 k_6 k_7}} + \frac{1}{\epsilon_{k_1 k_2 k_3 k_4} \epsilon_{k_1 k_2 k_3 k_4 k_5 k_6} \epsilon_{k_4 k_5 k_6 k_7}} \right]
\end{aligned} \tag{65}$$



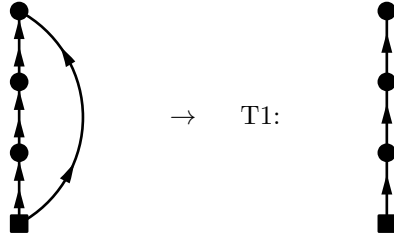


$$\text{T4} = \frac{1}{(a_1 + a_3)(a_2 + a_1 + a_3)a_3} + \frac{1}{(a_1 + a_2 + a_3)(a_2 + a_3)a_3} \quad (66)$$

$$\begin{aligned} a_1 &= \epsilon^{k_5 k_6} \\ a_2 &= \epsilon_{k_1 k_2 k_3}^{k_7} \\ a_3 &= \epsilon_{k_4 k_5 k_6 k_7} \end{aligned}$$

**Diagram 32:**

$$\begin{aligned} \text{PO4.32} &= \lim_{\tau \rightarrow \infty} (-1)^3 \sum_{k_i} O_{k_1 k_2}^{20} \Omega_{k_3 k_1}^{11} \Omega_{k_4 k_3}^{11} \Omega_{k_4 k_2}^{02} \int_0^\tau d\tau_1 d\tau_2 d\tau_3 \theta(\tau_2 - \tau_1) \theta(\tau_3 - \tau_2) e^{-\tau_1 \epsilon_{k_1}^{k_3}} e^{-\tau_2 \epsilon_{k_3}^{k_4}} e^{-\tau_3 \epsilon_{k_2 k_4}} \\ &= (-1)^3 \sum_{k_i} \frac{O_{k_1 k_2}^{20} \Omega_{k_3 k_1}^{11} \Omega_{k_4 k_3}^{11} \Omega_{k_4 k_2}^{02}}{\epsilon_{k_1 k_2} \epsilon_{k_3 k_2} \epsilon_{k_2 k_4}} \end{aligned} \quad (67)$$



$$\text{T1} = \frac{1}{(a_1 + a_2 + a_3)(a_2 + a_3)a_3} \quad (68)$$

$$\begin{aligned}
a_1 &= \epsilon_{k_1}^{k_3} \\
a_2 &= \epsilon_{k_3}^{k_4} \\
a_3 &= \epsilon_{k_2 k_4}
\end{aligned}$$

**Diagram 33:**

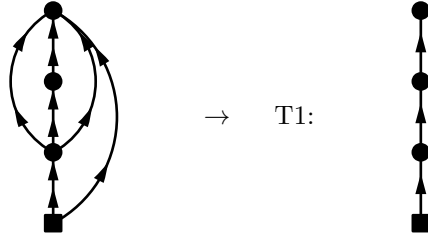
$$\begin{aligned}
\text{PO4.33} &= \lim_{\tau \rightarrow \infty} \frac{(-1)^3}{(3!)} \sum_{k_i} O_{k_1 k_2}^{20} \Omega_{k_3 k_1}^{11} \Omega_{k_4 k_5 k_6 k_3}^{31} \Omega_{k_4 k_5 k_6 k_2}^{04} \int_0^\tau d\tau_1 d\tau_2 d\tau_3 \theta(\tau_2 - \tau_1) \theta(\tau_3 - \tau_2) e^{-\tau_1 \epsilon_{k_1}^{k_3}} e^{-\tau_2 \epsilon_{k_3}^{k_4 k_5 k_6}} e^{-\tau_3 \epsilon_{k_2 k_4 k_5 k_6}} \\
&= \frac{(-1)^3}{(3!)} \sum_{k_i} \frac{O_{k_1 k_2}^{20} \Omega_{k_3 k_1}^{11} \Omega_{k_4 k_5 k_6 k_3}^{31} \Omega_{k_4 k_5 k_6 k_2}^{04}}{\epsilon_{k_1 k_2} \epsilon_{k_3 k_2} \epsilon_{k_2 k_4 k_5 k_6}}
\end{aligned} \tag{69}$$

$$T1 = \frac{1}{(a_1 + a_2 + a_3)(a_2 + a_3)a_3} \tag{70}$$

$$\begin{aligned}
a_1 &= \epsilon_{k_1}^{k_3} \\
a_2 &= \epsilon_{k_3}^{k_4 k_5 k_6} \\
a_3 &= \epsilon_{k_2 k_4 k_5 k_6}
\end{aligned}$$

**Diagram 34:**

$$\begin{aligned}
\text{PO4.34} &= \lim_{\tau \rightarrow \infty} \frac{(-1)^3}{(2!)} \sum_{k_i} O_{k_1 k_2}^{20} \Omega_{k_3 k_4 k_5 k_1}^{31} \Omega_{k_6 k_3}^{11} \Omega_{k_6 k_4 k_5 k_2}^{04} \int_0^\tau d\tau_1 d\tau_2 d\tau_3 \theta(\tau_2 - \tau_1) \theta(\tau_3 - \tau_1) \theta(\tau_3 - \tau_2) e^{-\tau_1 \epsilon_{k_1}^{k_3 k_4 k_5}} e^{-\tau_2 \epsilon_{k_3}^{k_6}} e^{-\tau_3 \epsilon_{k_2 k_4 k_5 k_6}} \\
&= \frac{(-1)^3}{(2!)} \sum_{k_i} \frac{O_{k_1 k_2}^{20} \Omega_{k_3 k_4 k_5 k_1}^{31} \Omega_{k_6 k_3}^{11} \Omega_{k_6 k_4 k_5 k_2}^{04}}{\epsilon_{k_1 k_2} \epsilon_{k_3 k_2 k_4 k_5} \epsilon_{k_2 k_4 k_5 k_6}}
\end{aligned} \tag{71}$$



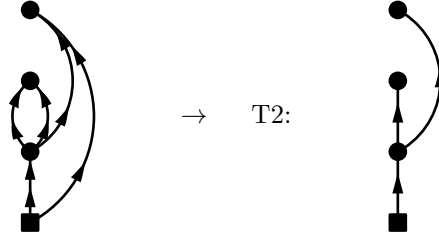
→ T1:

$$T1 = \frac{1}{(a_1 + a_2 + a_3)(a_2 + a_3)a_3} \quad (72)$$

$$\begin{aligned} a_1 &= \epsilon_{k_1}^{k_3 k_4 k_5} \\ a_2 &= \epsilon_{k_3}^{k_6} \\ a_3 &= \epsilon_{k_2 k_4 k_5 k_6} \end{aligned}$$

**Diagram 35:**

$$\begin{aligned} \text{PO4.35} &= \lim_{\tau \rightarrow \infty} \frac{(-1)^3}{(2!)} \sum_{k_i} O_{k_1 k_2}^{20} \Omega_{k_3 k_4 k_5 k_1}^{31} \Omega_{k_3 k_4}^{02} \Omega_{k_5 k_2}^{02} \int_0^\tau d\tau_1 d\tau_2 d\tau_3 \theta(\tau_2 - \tau_1) \theta(\tau_3 - \tau_1) e^{-\tau_1 \epsilon_{k_1}^{k_3 k_4 k_5}} e^{-\tau_2 \epsilon_{k_3 k_4}} e^{-\tau_3 \epsilon_{k_2 k_5}} \\ &= \frac{(-1)^3}{(2!)} \sum_{k_i} \frac{O_{k_1 k_2}^{20} \Omega_{k_3 k_4 k_5 k_1}^{31} \Omega_{k_3 k_4}^{02} \Omega_{k_5 k_2}^{02}}{\epsilon_{k_1 k_2} \epsilon_{k_3 k_4} \epsilon_{k_2 k_5}} \end{aligned} \quad (73)$$



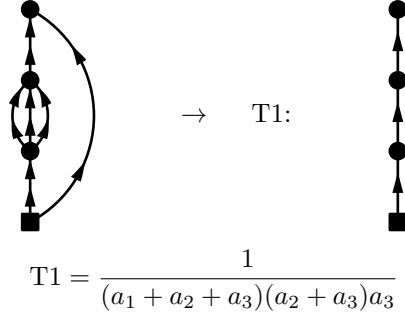
→ T2:

$$T2 = \frac{1}{(a_1 + a_2 + a_3)a_2 a_3} \quad (74)$$

$$\begin{aligned}
a_1 &= \epsilon_{k_1}^{k_3 k_4 k_5} \\
a_2 &= \epsilon_{k_3 k_4} \\
a_3 &= \epsilon_{k_2 k_5}
\end{aligned}$$

**Diagram 36:**

$$\begin{aligned}
\text{PO4.36} &= \lim_{\tau \rightarrow \infty} \frac{(-1)^3}{(3!)} \sum_{k_i} O_{k_1 k_2}^{20} \Omega_{k_3 k_4 k_5 k_1}^{31} \Omega_{k_6 k_3 k_4 k_5}^{13} \Omega_{k_6 k_2}^{02} \int_0^\tau d\tau_1 d\tau_2 d\tau_3 \theta(\tau_2 - \tau_1) \theta(\tau_3 - \tau_2) e^{-\tau_1 \epsilon_{k_1}^{k_3 k_4 k_5}} e^{-\tau_2 \epsilon_{k_3 k_4 k_5}^{k_6}} e^{-\tau_3 \epsilon_{k_2 k_6}} \\
&= \frac{(-1)^3}{(3!)} \sum_{k_i} \frac{O_{k_1 k_2}^{20} \Omega_{k_3 k_4 k_5 k_1}^{31} \Omega_{k_6 k_3 k_4 k_5}^{13} \Omega_{k_6 k_2}^{02}}{\epsilon_{k_1 k_2} \epsilon_{k_3 k_4 k_5 k_2} \epsilon_{k_2 k_6}}
\end{aligned} \tag{75}$$



$$\text{T1} = \frac{1}{(a_1 + a_2 + a_3)(a_2 + a_3)a_3}$$

$$\begin{aligned}
a_1 &= \epsilon_{k_1}^{k_3 k_4 k_5} \\
a_2 &= \epsilon_{k_3 k_4 k_5}^{k_6} \\
a_3 &= \epsilon_{k_2 k_6}
\end{aligned}$$

**Diagram 37:**

$$\begin{aligned}
\text{PO4.37} &= \lim_{\tau \rightarrow \infty} \frac{(-1)^3}{(3!)} \sum_{k_i} O_{k_1 k_2 k_3 k_4}^{40} \Omega_{k_5 k_1}^{11} \Omega_{k_6 k_5}^{11} \Omega_{k_6 k_2 k_3 k_4}^{04} \int_0^\tau d\tau_1 d\tau_2 d\tau_3 \theta(\tau_2 - \tau_1) \theta(\tau_3 - \tau_2) e^{-\tau_1 \epsilon_{k_1}^{k_5}} e^{-\tau_2 \epsilon_{k_5}^{k_6}} e^{-\tau_3 \epsilon_{k_2 k_3 k_4 k_6}} \\
&= \frac{(-1)^3}{(3!)} \sum_{k_i} \frac{O_{k_1 k_2 k_3 k_4}^{40} \Omega_{k_5 k_1}^{11} \Omega_{k_6 k_5}^{11} \Omega_{k_6 k_2 k_3 k_4}^{04}}{\epsilon_{k_1 k_2 k_3 k_4} \epsilon_{k_5 k_2 k_3 k_4} \epsilon_{k_2 k_3 k_4 k_6}}
\end{aligned} \tag{77}$$

$$T1 = \frac{1}{(a_1 + a_2 + a_3)(a_2 + a_3)a_3} \quad (78)$$

$$a_1 = \epsilon_{k_1}^{k_5}$$

$$a_2 = \epsilon_{k_5}^{k_6}$$

$$a_3 = \epsilon_{k_2 k_3 k_4 k_6}$$

**Diagram 38:**

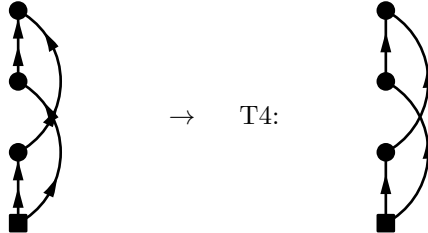
$$\begin{aligned}
 \text{PO4.38} &= \lim_{\tau \rightarrow \infty} \frac{(-1)^3}{(2!)(3!)} \sum_{k_i} O_{k_1 k_2 k_3 k_4}^{40} \Omega_{k_5 k_6 k_7 k_1}^{31} \Omega_{k_5 k_6}^{02} \Omega_{k_7 k_2 k_3 k_4}^{04} \int_0^\tau d\tau_1 d\tau_2 d\tau_3 \theta(\tau_2 - \tau_1) \theta(\tau_3 - \tau_1) e^{-\tau_1 \epsilon_{k_1}^{k_5 k_6 k_7}} e^{-\tau_2 \epsilon_{k_5 k_6}} e^{-\tau_3 \epsilon_{k_2 k_3 k_4 k_7}} \\
 &= \frac{(-1)^3}{(2!)(3!)} \sum_{k_i} \frac{O_{k_1 k_2 k_3 k_4}^{40} \Omega_{k_5 k_6 k_7 k_1}^{31} \Omega_{k_5 k_6}^{02} \Omega_{k_7 k_2 k_3 k_4}^{04}}{\epsilon_{k_1 k_2 k_3 k_4} \epsilon_{k_5 k_6} \epsilon_{k_2 k_3 k_4 k_7}}
 \end{aligned} \quad (79)$$

$$T2 = \frac{1}{(a_1 + a_2 + a_3)a_2 a_3} \quad (80)$$

$$\begin{aligned}
a_1 &= \epsilon_{k_1}^{k_5 k_6 k_7} \\
a_2 &= \epsilon_{k_5 k_6} \\
a_3 &= \epsilon_{k_2 k_3 k_4 k_7}
\end{aligned}$$

**Diagram 39:**

$$\begin{aligned}
\text{PO4.39} &= \lim_{\tau \rightarrow \infty} \frac{-(-1)^3}{2} \sum_{k_i} O_{k_1 k_2}^{20} \Omega_{k_3 k_1}^{11} \Omega_{k_4 k_2}^{11} \Omega_{k_4 k_3}^{02} \int_0^\tau d\tau_1 d\tau_2 d\tau_3 \theta(\tau_3 - \tau_1) \theta(\tau_3 - \tau_2) e^{-\tau_1 \epsilon_{k_1}^{k_3}} e^{-\tau_2 \epsilon_{k_2}^{k_4}} e^{-\tau_3 \epsilon_{k_3 k_4}} \\
&= \frac{-(-1)^3}{2} \sum_{k_i} O_{k_1 k_2}^{20} \Omega_{k_3 k_1}^{11} \Omega_{k_4 k_2}^{11} \Omega_{k_4 k_3}^{02} \left[ \frac{1}{\epsilon_{k_1 k_4} \epsilon_{k_1 k_2} \epsilon_{k_3 k_4}} + \frac{1}{\epsilon_{k_1 k_2} \epsilon_{k_2 k_3} \epsilon_{k_3 k_4}} \right]
\end{aligned} \tag{81}$$



$$\text{T4} = \frac{1}{(a_1 + a_3)(a_2 + a_1 + a_3)a_3} + \frac{1}{(a_1 + a_2 + a_3)(a_2 + a_3)a_3} \tag{82}$$

$$\begin{aligned}
a_1 &= \epsilon_{k_1}^{k_3} \\
a_2 &= \epsilon_{k_2}^{k_4} \\
a_3 &= \epsilon_{k_3 k_4}
\end{aligned}$$

**Diagram 40:**

$$\begin{aligned}
\text{PO4.40} &= \lim_{\tau \rightarrow \infty} \frac{-(-1)^3}{(3!)} \sum_{k_i} O_{k_1 k_2}^{20} \Omega_{k_3 k_1}^{11} \Omega_{k_4 k_5 k_6 k_2}^{31} \Omega_{k_4 k_5 k_6 k_3}^{04} \int_0^\tau d\tau_1 d\tau_2 d\tau_3 \theta(\tau_3 - \tau_1) \theta(\tau_3 - \tau_2) e^{-\tau_1 \epsilon_{k_1}^{k_3}} e^{-\tau_2 \epsilon_{k_2}^{k_4 k_5 k_6}} e^{-\tau_3 \epsilon_{k_3 k_4 k_5 k_6}} \\
&= \frac{-(-1)^3}{(3!)} \sum_{k_i} O_{k_1 k_2}^{20} \Omega_{k_3 k_1}^{11} \Omega_{k_4 k_5 k_6 k_2}^{31} \Omega_{k_4 k_5 k_6 k_3}^{04} \left[ \frac{1}{\epsilon_{k_1 k_4 k_5 k_6} \epsilon_{k_1 k_2} \epsilon_{k_3 k_4 k_5 k_6}} + \frac{1}{\epsilon_{k_1 k_2} \epsilon_{k_2 k_3} \epsilon_{k_3 k_4 k_5 k_6}} \right]
\end{aligned} \tag{83}$$

$$T4 = \frac{1}{(a_1 + a_3)(a_2 + a_1 + a_3)a_3} + \frac{1}{(a_1 + a_2 + a_3)(a_2 + a_3)a_3} \quad (84)$$

$$a_1 = \epsilon_{k_1}^{k_3}$$

$$a_2 = \epsilon_{k_2}^{k_4 k_5 k_6}$$

$$a_3 = \epsilon_{k_3 k_4 k_5 k_6}$$

**Diagram 41:**

$$PO4.41 = \lim_{\tau \rightarrow \infty} \frac{(-1)^3}{(2!)} \sum_{k_i} O_{k_1 k_2}^{20} \Omega_{k_3 k_1}^{11} \Omega_{k_4 k_5 k_3 k_2}^{22} \Omega_{k_4 k_5}^{02} \int_0^\tau d\tau_1 d\tau_2 d\tau_3 \theta(\tau_2 - \tau_1) \theta(\tau_3 - \tau_2) e^{-\tau_1 \epsilon_{k_1}^{k_3}} e^{-\tau_2 \epsilon_{k_2 k_3}^{k_4 k_5}} e^{-\tau_3 \epsilon_{k_4 k_5}}$$

$$= \frac{(-1)^3}{(2!)} \sum_{k_i} \frac{O_{k_1 k_2}^{20} \Omega_{k_3 k_1}^{11} \Omega_{k_4 k_5 k_3 k_2}^{22} \Omega_{k_4 k_5}^{02}}{\epsilon_{k_1 k_2} \epsilon_{k_2 k_3} \epsilon_{k_4 k_5}} \quad (85)$$

$$T1 = \frac{1}{(a_1 + a_2 + a_3)(a_2 + a_3)a_3} \quad (86)$$

$$\begin{aligned}
a_1 &= \epsilon_{k_1}^{k_3} \\
a_2 &= \epsilon_{k_2 k_3}^{k_4 k_5} \\
a_3 &= \epsilon_{k_4 k_5}
\end{aligned}$$

**Diagram 42:**

$$\begin{aligned}
\text{PO4.42} &= \lim_{\tau \rightarrow \infty} \frac{-(-1)^3}{(2!)} \sum_{k_i} O_{k_1 k_2}^{20} \Omega_{k_3 k_4 k_5 k_1}^{31} \Omega_{k_6 k_3 k_4 k_2}^{13} \Omega_{k_6 k_5}^{02} \int_0^\tau d\tau_1 d\tau_2 d\tau_3 \theta(\tau_2 - \tau_1) \theta(\tau_3 - \tau_1) \theta(\tau_3 - \tau_2) e^{-\tau_1 \epsilon_{k_1}^{k_3 k_4 k_5}} e^{-\tau_2 \epsilon_{k_2 k_3 k_4}^{k_6}} e^{-\tau_3 \epsilon_{k_5 k_6}} \\
&= \frac{-(-1)^3}{(2!)} \sum_{k_i} \frac{O_{k_1 k_2}^{20} \Omega_{k_3 k_4 k_5 k_1}^{31} \Omega_{k_6 k_3 k_4 k_2}^{13} \Omega_{k_6 k_5}^{02}}{\epsilon_{k_1 k_2} \epsilon_{k_2 k_3 k_4 k_5} \epsilon_{k_5 k_6}}
\end{aligned} \tag{87}$$

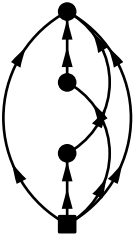
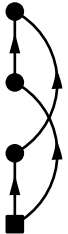
$$\text{T1} = \frac{1}{(a_1 + a_2 + a_3)(a_2 + a_3)a_3}$$

$$\begin{aligned}
a_1 &= \epsilon_{k_1}^{k_3 k_4 k_5} \\
a_2 &= \epsilon_{k_2 k_3 k_4}^{k_6} \\
a_3 &= \epsilon_{k_5 k_6}
\end{aligned}$$

**Diagram 43:**

$$\begin{aligned}
\text{PO4.43} &= \lim_{\tau \rightarrow \infty} \frac{-(-1)^3}{2(2!)} \sum_{k_i} O_{k_1 k_2 k_3 k_4}^{40} \Omega_{k_5 k_1}^{11} \Omega_{k_6 k_2}^{11} \Omega_{k_6 k_5 k_3 k_4}^{04} \int_0^\tau d\tau_1 d\tau_2 d\tau_3 \theta(\tau_3 - \tau_1) \theta(\tau_3 - \tau_2) e^{-\tau_1 \epsilon_{k_1}^{k_5}} e^{-\tau_2 \epsilon_{k_2}^{k_6}} e^{-\tau_3 \epsilon_{k_3 k_4 k_5 k_6}} \\
&= \frac{-(-1)^3}{2(2!)} \sum_{k_i} O_{k_1 k_2 k_3 k_4}^{40} \Omega_{k_5 k_1}^{11} \Omega_{k_6 k_2}^{11} \Omega_{k_6 k_5 k_3 k_4}^{04} \left[ \frac{1}{\epsilon_{k_1 k_3 k_4 k_6} \epsilon_{k_1 k_2 k_3 k_4} \epsilon_{k_3 k_4 k_5 k_6}} + \frac{1}{\epsilon_{k_1 k_2 k_3 k_4} \epsilon_{k_2 k_3 k_4 k_5} \epsilon_{k_3 k_4 k_5 k_6}} \right]
\end{aligned} \tag{89}$$



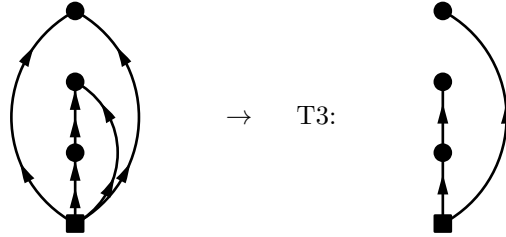

→ T4:


$$T4 = \frac{1}{(a_1 + a_3)(a_2 + a_1 + a_3)a_3} + \frac{1}{(a_1 + a_2 + a_3)(a_2 + a_3)a_3} \quad (90)$$

$a_1 = \epsilon_{k_1}^{k_5}$   
 $a_2 = \epsilon_{k_2}^{k_6}$   
 $a_3 = \epsilon_{k_3 k_4 k_5 k_6}$

**Diagram 44:**

$$\begin{aligned}
\text{PO4.44} &= \lim_{\tau \rightarrow \infty} \frac{(-1)^3}{(2!)} \sum_{k_i} O_{k_1 k_2 k_3 k_4}^{40} \Omega_{k_5 k_1}^{11} \Omega_{k_5 k_2}^{02} \Omega_{k_3 k_4}^{02} \int_0^\tau d\tau_1 d\tau_2 d\tau_3 \theta(\tau_2 - \tau_1) e^{-\tau_1 \epsilon_{k_1}^{k_5}} e^{-\tau_2 \epsilon_{k_2 k_5}} e^{-\tau_3 \epsilon_{k_3 k_4}} \\
&= \frac{(-1)^3}{(2!)} \sum_{k_i} \frac{O_{k_1 k_2 k_3 k_4}^{40} \Omega_{k_5 k_1}^{11} \Omega_{k_5 k_2}^{02} \Omega_{k_3 k_4}^{02}}{\epsilon_{k_1 k_2} \epsilon_{k_2 k_5} \epsilon_{k_3 k_4}}
\end{aligned} \quad (91)$$

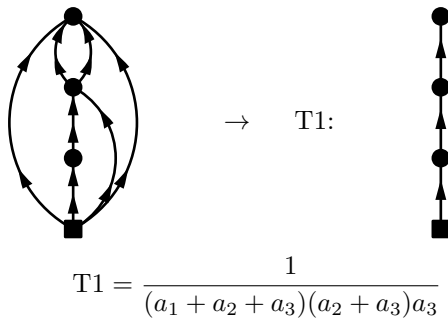


$$T3 = \frac{1}{(a_1 + a_2)a_2 a_3} \quad (92)$$

$$a_3 = \epsilon_{k_3 k_4}$$

Diagram 45:

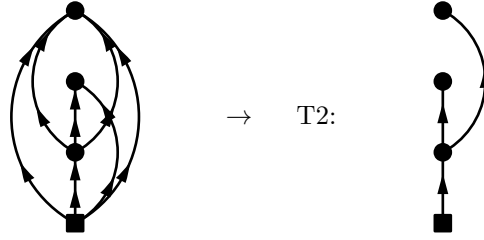
$$\begin{aligned} \text{PO4.45} &= \lim_{\tau \rightarrow \infty} \frac{(-1)^3}{(2!)^2} \sum_{k_i} O_{k_1 k_2 k_3 k_4}^{40} \Omega_{k_5 k_1}^{11} \Omega_{k_6 k_7 k_5 k_2}^{22} \Omega_{k_6 k_7 k_3 k_4}^{04} \int_0^\tau d\tau_1 d\tau_2 d\tau_3 \theta(\tau_2 - \tau_1) \theta(\tau_3 - \tau_2) e^{-\tau_1 \epsilon_{k_1}^{k_5}} e^{-\tau_2 \epsilon_{k_2 k_5}^{k_6 k_7}} e^{-\tau_3 \epsilon_{k_3 k_4 k_6 k_7}^{k_5}} \\ &= \frac{(-1)^3}{(2!)^2} \sum_{k_i} \frac{O_{k_1 k_2 k_3 k_4}^{40} \Omega_{k_5 k_1}^{11} \Omega_{k_6 k_7 k_5 k_2}^{22} \Omega_{k_6 k_7 k_3 k_4}^{04}}{\epsilon_{k_1 k_2 k_3 k_4} \epsilon_{k_2 k_5 k_3 k_4} \epsilon_{k_3 k_4 k_6 k_7}} \end{aligned} \quad (93)$$



$$a_3 = \epsilon_{k_3 k_4 k_6 k_7}$$

Diagram 46:

$$\begin{aligned} \text{PO4.46} &= \lim_{\tau \rightarrow \infty} \frac{(-1)^3}{(2!)^2} \sum_{k_i} O_{k_1 k_2 k_3 k_4}^{40} \Omega_{k_5 k_6 k_7 k_1}^{31} \Omega_{k_5 k_2}^{02} \Omega_{k_6 k_7 k_3 k_4}^{04} \int_0^\tau d\tau_1 d\tau_2 d\tau_3 \theta(\tau_2 - \tau_1) \theta(\tau_3 - \tau_1) e^{-\tau_1 \epsilon_{k_1}^{\epsilon_5 \epsilon_6 \epsilon_7}} e^{-\tau_2 \epsilon_{k_2}^{\epsilon_5}} e^{-\tau_3 \epsilon_{k_3 k_4 k_6 k_7}^{\epsilon_5}} \\ &= \frac{(-1)^3}{(2!)^2} \sum_{k_i} \frac{O_{k_1 k_2 k_3 k_4}^{40} \Omega_{k_5 k_6 k_7 k_1}^{31} \Omega_{k_5 k_2}^{02} \Omega_{k_6 k_7 k_3 k_4}^{04}}{\epsilon_{k_1 k_2 k_3 k_4} \epsilon_{k_2 k_5} \epsilon_{k_3 k_4 k_6 k_7}} \end{aligned} \quad (95)$$

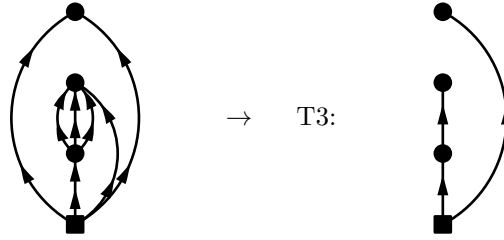


$$T2 = \frac{1}{(a_1 + a_2 + a_3)a_2a_3} \quad (96)$$

$$\begin{aligned} a_1 &= \epsilon_{k_1}^{k_5 k_6 k_7} \\ a_2 &= \epsilon_{k_2 k_5} \\ a_3 &= \epsilon_{k_3 k_4 k_6 k_7} \end{aligned}$$

**Diagram 47:**

$$\begin{aligned} \text{PO4.47} &= \lim_{\tau \rightarrow \infty} \frac{(-1)^3}{(2!)(3!)} \sum_{k_i} O_{k_1 k_2 k_3 k_4}^{40} \Omega_{k_5 k_6 k_7 k_1}^{31} \Omega_{k_5 k_6 k_7 k_2}^{04} \Omega_{k_3 k_4}^{02} \int_0^\tau d\tau_1 d\tau_2 d\tau_3 \theta(\tau_2 - \tau_1) e^{-\tau_1 \epsilon_{k_1}^{k_5 k_6 k_7}} e^{-\tau_2 \epsilon_{k_2 k_5 k_6 k_7}} e^{-\tau_3 \epsilon_{k_3 k_4}} \\ &= \frac{(-1)^3}{(2!)(3!)} \sum_{k_i} \frac{O_{k_1 k_2 k_3 k_4}^{40} \Omega_{k_5 k_6 k_7 k_1}^{31} \Omega_{k_5 k_6 k_7 k_2}^{04} \Omega_{k_3 k_4}^{02}}{\epsilon_{k_1 k_2} \epsilon_{k_2 k_5 k_6 k_7} \epsilon_{k_3 k_4}} \end{aligned} \quad (97)$$

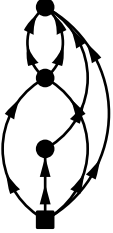


$$T3 = \frac{1}{(a_1 + a_2)a_2a_3} \quad (98)$$

$$\begin{aligned}
a_1 &= \epsilon_{k_1}^{k_5 k_6 k_7} \\
a_2 &= \epsilon_{k_2 k_5 k_6 k_7} \\
a_3 &= \epsilon_{k_3 k_4}
\end{aligned}$$

**Diagram 48:**

$$\begin{aligned}
\text{PO4.48} &= \lim_{\tau \rightarrow \infty} \frac{(-1)^3}{(2!)^2} \sum_{k_i} O_{k_1 k_2 k_3 k_4}^{40} \Omega_{k_5 k_1}^{11} \Omega_{k_6 k_7 k_2 k_3}^{22} \Omega_{k_6 k_7 k_5 k_4}^{04} \int_0^\tau d\tau_1 d\tau_2 d\tau_3 \theta(\tau_3 - \tau_1) \theta(\tau_3 - \tau_2) e^{-\tau_1 \epsilon_{k_1}^{k_5}} e^{-\tau_2 \epsilon_{k_2 k_3}^{k_6 k_7}} e^{-\tau_3 \epsilon_{k_4 k_5 k_6 k_7}} \\
&= \frac{(-1)^3}{(2!)^2} \sum_{k_i} O_{k_1 k_2 k_3 k_4}^{40} \Omega_{k_5 k_1}^{11} \Omega_{k_6 k_7 k_2 k_3}^{22} \Omega_{k_6 k_7 k_5 k_4}^{04} \left[ \frac{1}{\epsilon_{k_1 k_4 k_6 k_7} \epsilon_{k_1 k_2 k_3 k_4} \epsilon_{k_4 k_5 k_6 k_7}} + \frac{1}{\epsilon_{k_1 k_2 k_3 k_4} \epsilon_{k_2 k_3 k_4 k_5} \epsilon_{k_4 k_5 k_6 k_7}} \right] \quad (99)
\end{aligned}$$

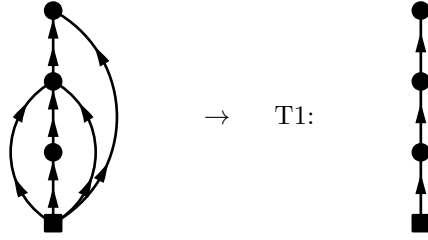


$$\text{T4} = \frac{1}{(a_1 + a_3)(a_2 + a_1 + a_3)a_3} + \frac{1}{(a_1 + a_2 + a_3)(a_2 + a_3)a_3} \quad (100)$$

$$\begin{aligned}
a_1 &= \epsilon_{k_1}^{k_5} \\
a_2 &= \epsilon_{k_2 k_3}^{k_6 k_7} \\
a_3 &= \epsilon_{k_4 k_5 k_6 k_7}
\end{aligned}$$

**Diagram 49:**

$$\begin{aligned}
\text{PO4.49} &= \lim_{\tau \rightarrow \infty} \frac{(-1)^3}{(2!)} \sum_{k_i} O_{k_1 k_2 k_3 k_4}^{40} \Omega_{k_5 k_1}^{11} \Omega_{k_6 k_5 k_2 k_3}^{13} \Omega_{k_6 k_4}^{02} \int_0^\tau d\tau_1 d\tau_2 d\tau_3 \theta(\tau_2 - \tau_1) \theta(\tau_3 - \tau_2) e^{-\tau_1 \epsilon_{k_1}^{k_5}} e^{-\tau_2 \epsilon_{k_2 k_3 k_5}^{k_6}} e^{-\tau_3 \epsilon_{k_4 k_6}} \\
&= \frac{(-1)^3}{(2!)} \sum_{k_i} \frac{O_{k_1 k_2 k_3 k_4}^{40} \Omega_{k_5 k_1}^{11} \Omega_{k_6 k_5 k_2 k_3}^{13} \Omega_{k_6 k_4}^{02}}{\epsilon_{k_1 k_2 k_3 k_4} \epsilon_{k_2 k_3 k_5 k_4} \epsilon_{k_4 k_6}} \quad (101)
\end{aligned}$$

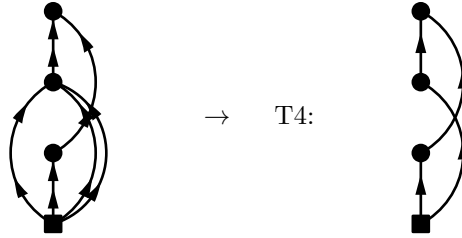


$$T1 = \frac{1}{(a_1 + a_2 + a_3)(a_2 + a_3)a_3} \quad (102)$$

$$\begin{aligned} a_1 &= \epsilon_{k_1}^{k_5} \\ a_2 &= \epsilon_{k_2 k_3 k_5}^{k_6} \\ a_3 &= \epsilon_{k_4 k_6} \end{aligned}$$

**Diagram 50:**

$$\begin{aligned} \text{PO4.50} &= \lim_{\tau \rightarrow \infty} \frac{-(-1)^3}{(3!)} \sum_{k_i} O_{k_1 k_2 k_3 k_4}^{40} \Omega_{k_5 k_1}^{11} \Omega_{k_6 k_2 k_3 k_4}^{13} \Omega_{k_6 k_5}^{02} \int_0^\tau d\tau_1 d\tau_2 d\tau_3 \theta(\tau_3 - \tau_1) \theta(\tau_3 - \tau_2) e^{-\tau_1 \epsilon_{k_1}^{k_5}} e^{-\tau_2 \epsilon_{k_2 k_3 k_4}^{k_6}} e^{-\tau_3 \epsilon_{k_5 k_6}} \\ &= \frac{-(-1)^3}{(3!)} \sum_{k_i} O_{k_1 k_2 k_3 k_4}^{40} \Omega_{k_5 k_1}^{11} \Omega_{k_6 k_2 k_3 k_4}^{13} \Omega_{k_6 k_5}^{02} \left[ \frac{1}{\epsilon_{k_1 k_6} \epsilon_{k_1 k_2 k_3 k_4} \epsilon_{k_5 k_6}} + \frac{1}{\epsilon_{k_1 k_2 k_3 k_4} \epsilon_{k_2 k_3 k_4 k_5} \epsilon_{k_5 k_6}} \right] \end{aligned} \quad (103)$$



$$T4 = \frac{1}{(a_1 + a_3)(a_2 + a_1 + a_3)a_3} + \frac{1}{(a_1 + a_2 + a_3)(a_2 + a_3)a_3} \quad (104)$$

$$\begin{aligned}
a_1 &= \epsilon_{k_1}^{k_5} \\
a_2 &= \epsilon_{k_2 k_3 k_4}^{k_6} \\
a_3 &= \epsilon_{k_5 k_6}
\end{aligned}$$

**Diagram 51:**

$$\begin{aligned}
\text{PO4.51} &= \lim_{\tau \rightarrow \infty} \frac{(-1)^3}{(2!)} \sum_{k_i} O_{k_1 k_2}^{20} \Omega_{k_3 k_4 k_1 k_2}^{22} \Omega_{k_5 k_3}^{11} \Omega_{k_5 k_4}^{02} \int_0^\tau d\tau_1 d\tau_2 d\tau_3 \theta(\tau_2 - \tau_1) \theta(\tau_3 - \tau_1) \theta(\tau_3 - \tau_2) e^{-\tau_1 \epsilon_{k_1 k_2}^{k_3 k_4}} e^{-\tau_2 \epsilon_{k_3}^{k_5}} e^{-\tau_3 \epsilon_{k_4 k_5}} \\
&= \frac{(-1)^3}{(2!)} \sum_{k_i} \frac{O_{k_1 k_2}^{20} \Omega_{k_3 k_4 k_1 k_2}^{22} \Omega_{k_5 k_3}^{11} \Omega_{k_5 k_4}^{02}}{\epsilon_{k_1 k_2} \epsilon_{k_3 k_4} \epsilon_{k_4 k_5}}
\end{aligned} \tag{105}$$

$$T1 = \frac{1}{(a_1 + a_2 + a_3)(a_2 + a_3)a_3}$$

$$\begin{aligned}
a_1 &= \epsilon_{k_1 k_2}^{k_3 k_4} \\
a_2 &= \epsilon_{k_3}^{k_5} \\
a_3 &= \epsilon_{k_4 k_5}
\end{aligned}$$

**Diagram 52:**

$$\begin{aligned}
\text{PO4.52} &= \lim_{\tau \rightarrow \infty} \frac{(-1)^3}{(2!)^3} \sum_{k_i} O_{k_1 k_2}^{20} \Omega_{k_3 k_4 k_1 k_2}^{22} \Omega_{k_5 k_6 k_3 k_4}^{22} \Omega_{k_5 k_6}^{02} \int_0^\tau d\tau_1 d\tau_2 d\tau_3 \theta(\tau_2 - \tau_1) \theta(\tau_3 - \tau_2) e^{-\tau_1 \epsilon_{k_1 k_2}^{k_3 k_4}} e^{-\tau_2 \epsilon_{k_3 k_4}^{k_5 k_6}} e^{-\tau_3 \epsilon_{k_5 k_6}} \\
&= \frac{(-1)^3}{(2!)^3} \sum_{k_i} \frac{O_{k_1 k_2}^{20} \Omega_{k_3 k_4 k_1 k_2}^{22} \Omega_{k_5 k_6 k_3 k_4}^{22} \Omega_{k_5 k_6}^{02}}{\epsilon_{k_1 k_2} \epsilon_{k_3 k_4} \epsilon_{k_5 k_6}}
\end{aligned} \tag{107}$$

$$\begin{aligned}
& \rightarrow \quad \text{T1:} \\
& \text{T1} = \frac{1}{(a_1 + a_2 + a_3)(a_2 + a_3)a_3} \\
& a_1 = \epsilon_{k_1 k_2}^{k_3 k_4} \\
& a_2 = \epsilon_{k_3 k_4}^{k_5 k_6} \\
& a_3 = \epsilon_{k_5 k_6}
\end{aligned} \tag{108}$$

**Diagram 53:**

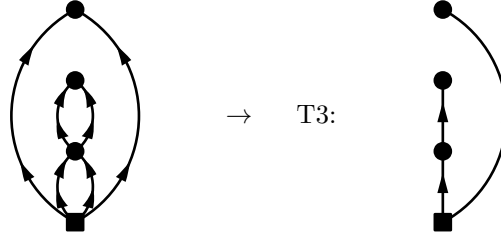
$$\begin{aligned}
\text{PO4.53} &= \lim_{\tau \rightarrow \infty} \frac{(-1)^3}{(2!)^2} \sum_{k_i} O_{k_1 k_2 k_3 k_4}^{40} \Omega_{k_5 k_6 k_1 k_2}^{22} \Omega_{k_7 k_5}^{11} \Omega_{k_7 k_6 k_3 k_4}^{04} \int_0^\tau d\tau_1 d\tau_2 d\tau_3 \theta(\tau_2 - \tau_1) \theta(\tau_3 - \tau_1) \theta(\tau_3 - \tau_2) e^{-\tau_1 \epsilon_{k_1 k_2}^{k_5 k_6}} e^{-\tau_2 \epsilon_{k_5 k_6}^{k_7}} e^{-\tau_3 \epsilon_{k_3 k_4 k_6 k_7}} \\
&= \frac{(-1)^3}{(2!)^2} \sum_{k_i} \frac{O_{k_1 k_2 k_3 k_4}^{40} \Omega_{k_5 k_6 k_1 k_2}^{22} \Omega_{k_7 k_5}^{11} \Omega_{k_7 k_6 k_3 k_4}^{04}}{\epsilon_{k_1 k_2 k_3 k_4} \epsilon_{k_5 k_3 k_4 k_6} \epsilon_{k_3 k_4 k_6 k_7}}
\end{aligned} \tag{109}$$

$$\text{T1} = \frac{1}{(a_1 + a_2 + a_3)(a_2 + a_3)a_3} \tag{110}$$

$$\begin{aligned}
a_1 &= \epsilon_{k_1 k_2}^{k_5 k_6} \\
a_2 &= \epsilon_{k_5}^{k_7} \\
a_3 &= \epsilon_{k_3 k_4 k_6 k_7}
\end{aligned}$$

**Diagram 54:**

$$\begin{aligned}
\text{PO4.54} &= \lim_{\tau \rightarrow \infty} \frac{(-1)^3}{(2!)^3} \sum_{k_i} O_{k_1 k_2 k_3 k_4}^{40} \Omega_{k_5 k_6 k_1 k_2}^{22} \Omega_{k_5 k_6}^{02} \Omega_{k_3 k_4}^{02} \int_0^\tau d\tau_1 d\tau_2 d\tau_3 \theta(\tau_2 - \tau_1) e^{-\tau_1 \epsilon_{k_1 k_2}^{k_5 k_6}} e^{-\tau_2 \epsilon_{k_5 k_6}} e^{-\tau_3 \epsilon_{k_3 k_4}} \\
&= \frac{(-1)^3}{(2!)^3} \sum_{k_i} \frac{O_{k_1 k_2 k_3 k_4}^{40} \Omega_{k_5 k_6 k_1 k_2}^{22} \Omega_{k_5 k_6}^{02} \Omega_{k_3 k_4}^{02}}{\epsilon_{k_1 k_2} \epsilon_{k_5 k_6} \epsilon_{k_3 k_4}}
\end{aligned} \tag{111}$$



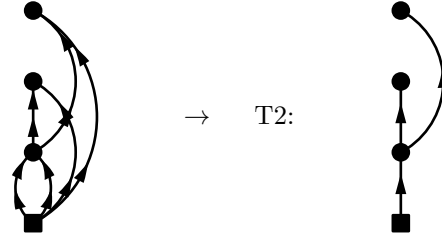
$$\text{T3} = \frac{1}{(a_1 + a_2) a_2 a_3} \tag{112}$$

$$\begin{aligned}
a_1 &= \epsilon_{k_1 k_2}^{k_5 k_6} \\
a_2 &= \epsilon_{k_5 k_6} \\
a_3 &= \epsilon_{k_3 k_4}
\end{aligned}$$

**Diagram 55:**

$$\begin{aligned}
\text{PO4.55} &= \lim_{\tau \rightarrow \infty} \frac{-(-1)^3}{2(2!)} \sum_{k_i} O_{k_1 k_2 k_3 k_4}^{40} \Omega_{k_5 k_6 k_1 k_2}^{22} \Omega_{k_5 k_3}^{02} \Omega_{k_6 k_4}^{02} \int_0^\tau d\tau_1 d\tau_2 d\tau_3 \theta(\tau_2 - \tau_1) \theta(\tau_3 - \tau_1) e^{-\tau_1 \epsilon_{k_1 k_2}^{k_5 k_6}} e^{-\tau_2 \epsilon_{k_3 k_5}} e^{-\tau_3 \epsilon_{k_4 k_6}} \\
&= \frac{-(-1)^3}{2(2!)} \sum_{k_i} \frac{O_{k_1 k_2 k_3 k_4}^{40} \Omega_{k_5 k_6 k_1 k_2}^{22} \Omega_{k_5 k_3}^{02} \Omega_{k_6 k_4}^{02}}{\epsilon_{k_1 k_2 k_3 k_4} \epsilon_{k_3 k_5} \epsilon_{k_4 k_6}}
\end{aligned} \tag{113}$$





$$T2 = \frac{1}{(a_1 + a_2 + a_3)a_2a_3} \quad (114)$$

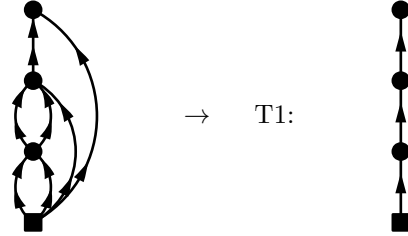
$$a_1 = \epsilon_{k_1 k_2}^{k_5 k_6}$$

$$a_2 = \epsilon_{k_3 k_5}$$

$$a_3 = \epsilon_{k_4 k_6}$$

**Diagram 56:**

$$\begin{aligned} \text{PO4.56} &= \lim_{\tau \rightarrow \infty} \frac{(-1)^3}{(2!)^2} \sum_{k_i} O_{k_1 k_2 k_3 k_4}^{40} \Omega_{k_5 k_6 k_1 k_2}^{22} \Omega_{k_7 k_5 k_6 k_3}^{13} \Omega_{k_7 k_4}^{02} \int_0^\tau d\tau_1 d\tau_2 d\tau_3 \theta(\tau_2 - \tau_1) \theta(\tau_3 - \tau_2) e^{-\tau_1 \epsilon_{k_1 k_2}^{k_5 k_6}} e^{-\tau_2 \epsilon_{k_3 k_5 k_6}^{k_7}} e^{-\tau_3 \epsilon_{k_4 k_7}} \\ &= \frac{(-1)^3}{(2!)^2} \sum_{k_i} \frac{O_{k_1 k_2 k_3 k_4}^{40} \Omega_{k_5 k_6 k_1 k_2}^{22} \Omega_{k_7 k_5 k_6 k_3}^{13} \Omega_{k_7 k_4}^{02}}{\epsilon_{k_1 k_2 k_3 k_4} \epsilon_{k_3 k_5 k_6 k_4} \epsilon_{k_4 k_7}} \end{aligned} \quad (115)$$

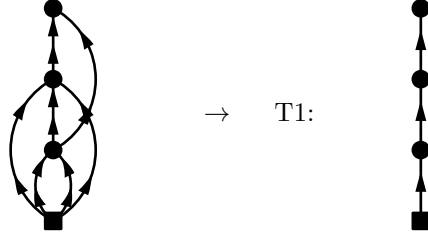


$$T1 = \frac{1}{(a_1 + a_2 + a_3)(a_2 + a_3)a_3} \quad (116)$$

$$\begin{aligned}
a_1 &= \epsilon_{k_1 k_2}^{k_5 k_6} \\
a_2 &= \epsilon_{k_3 k_5 k_6}^{k_7} \\
a_3 &= \epsilon_{k_4 k_7}
\end{aligned}$$

**Diagram 57:**

$$\begin{aligned}
\text{PO4.57} &= \lim_{\tau \rightarrow \infty} \frac{(-1)^3}{(2!)^2} \sum_{k_i} O_{k_1 k_2 k_3 k_4}^{40} \Omega_{k_5 k_6 k_1 k_2}^{22} \Omega_{k_7 k_5 k_3 k_4}^{13} \Omega_{k_7 k_6}^{02} \int_0^\tau d\tau_1 d\tau_2 d\tau_3 \theta(\tau_2 - \tau_1) \theta(\tau_3 - \tau_1) \theta(\tau_3 - \tau_2) e^{-\tau_1 \epsilon_{k_1 k_2}^{k_5 k_6}} e^{-\tau_2 \epsilon_{k_3 k_4 k_5}^{k_7}} e^{-\tau_3 \epsilon_{k_6 k_7}} \\
&= \frac{(-1)^3}{(2!)^2} \sum_{k_i} \frac{O_{k_1 k_2 k_3 k_4}^{40} \Omega_{k_5 k_6 k_1 k_2}^{22} \Omega_{k_7 k_5 k_3 k_4}^{13} \Omega_{k_7 k_6}^{02}}{\epsilon_{k_1 k_2 k_3 k_4} \epsilon_{k_3 k_4 k_5 k_6} \epsilon_{k_6 k_7}}
\end{aligned} \tag{117}$$

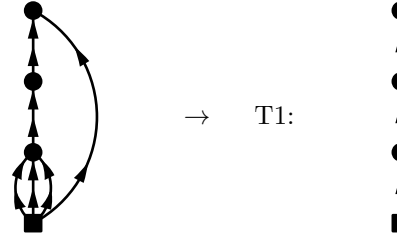


$$T1 = \frac{1}{(a_1 + a_2 + a_3)(a_2 + a_3)a_3} \tag{118}$$

$$\begin{aligned}
a_1 &= \epsilon_{k_1 k_2}^{k_5 k_6} \\
a_2 &= \epsilon_{k_3 k_4 k_5}^{k_7} \\
a_3 &= \epsilon_{k_6 k_7}
\end{aligned}$$

**Diagram 58:**

$$\begin{aligned}
\text{PO4.58} &= \lim_{\tau \rightarrow \infty} \frac{(-1)^3}{(3!)} \sum_{k_i} O_{k_1 k_2 k_3 k_4}^{40} \Omega_{k_5 k_1 k_2 k_3}^{13} \Omega_{k_6 k_5}^{11} \Omega_{k_6 k_4}^{02} \int_0^\tau d\tau_1 d\tau_2 d\tau_3 \theta(\tau_2 - \tau_1) \theta(\tau_3 - \tau_2) e^{-\tau_1 \epsilon_{k_1 k_2 k_3}^{k_5}} e^{-\tau_2 \epsilon_{k_5 k_6}^{k_7}} e^{-\tau_3 \epsilon_{k_4 k_6}} \\
&= \frac{(-1)^3}{(3!)} \sum_{k_i} \frac{O_{k_1 k_2 k_3 k_4}^{40} \Omega_{k_5 k_1 k_2 k_3}^{13} \Omega_{k_6 k_5}^{11} \Omega_{k_6 k_4}^{02}}{\epsilon_{k_1 k_2 k_3 k_4} \epsilon_{k_5 k_4} \epsilon_{k_4 k_6}}
\end{aligned} \tag{119}$$



$$T1 = \frac{1}{(a_1 + a_2 + a_3)(a_2 + a_3)a_3} \quad (120)$$

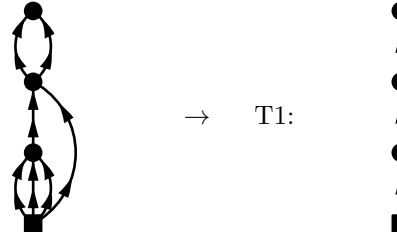
$$a_1 = \epsilon_{k_1 k_2 k_3}^{k_5}$$

$$a_2 = \epsilon_{k_5}^{k_6}$$

$$a_3 = \epsilon_{k_4 k_6}$$

**Diagram 59:**

$$\begin{aligned}
 \text{PO4.59} &= \lim_{\tau \rightarrow \infty} \frac{(-1)^3}{(2!)(3!)} \sum_{k_i} O_{k_1 k_2 k_3 k_4}^{40} \Omega_{k_5 k_1 k_2 k_3}^{13} \Omega_{k_6 k_7 k_5 k_4}^{22} \Omega_{k_6 k_7}^{02} \int_0^\tau d\tau_1 d\tau_2 d\tau_3 \theta(\tau_2 - \tau_1) \theta(\tau_3 - \tau_2) e^{-\tau_1 \epsilon_{k_1 k_2 k_3}^{k_5}} e^{-\tau_2 \epsilon_{k_4 k_5}^{k_6}} e^{-\tau_3 \epsilon_{k_6 k_7}} \\
 &= \frac{(-1)^3}{(2!)(3!)} \sum_{k_i} \frac{O_{k_1 k_2 k_3 k_4}^{40} \Omega_{k_5 k_1 k_2 k_3}^{13} \Omega_{k_6 k_7 k_5 k_4}^{22} \Omega_{k_6 k_7}^{02}}{\epsilon_{k_1 k_2 k_3 k_4} \epsilon_{k_4 k_5} \epsilon_{k_6 k_7}}
 \end{aligned} \quad (121)$$



$$T1 = \frac{1}{(a_1 + a_2 + a_3)(a_2 + a_3)a_3} \quad (122)$$

$$a_1 = \epsilon_{k_1 k_2 k_3}^{k_5}$$

$$a_2 = \epsilon_{k_4 k_5}^{k_6 k_7}$$

$$a_3 = \epsilon_{k_6 k_7}$$