

$$\therefore \text{Number of words formed with all T's together} = \frac{8!}{4!2!} = \frac{8 \times 7 \times 6 \times 5 \times 4!}{4! \times 2!} = 840$$

Hence the number of words in which T's do not occur together = $34650 - 840 = 33810$

11. In how many ways can the letters of the word PERMUTATIONS be arranged if the
- words start with P and end with S
 - vowels are all together,
 - there are always 4 letters between P and S?

Solution

There are 12 letters of which T is repeated twice.

- When the words start in P and end in S, the number of words formed = $\frac{10!}{2!} = 1814400$
- There are 5 vowels and 7 consonants. When the vowels are kept all together, then there are 7 consonants and one group of 5 vowels.

This can be arranged in $\frac{8!}{2!}$ ways (T is repeated two times)

In each of such arrangements, 5 vowels can be arranged in $5!$ ways.

$$\therefore \text{Required number of words} = 5! \times \frac{8!}{2!} = 2419200$$

- There are exactly 4 letters between P and S.

P and S can occupy in 1^{st} and 6^{th} places or 2^{nd} and 7^{th} places or 3^{rd} and 8^{th} places or 4^{th} and 9^{th} places or 5^{th} and 10^{th} places or 6^{th} and 11^{th} places or 7^{th} and 12^{th} places i.e., P and S can be placed in 7 ways as above.

Also P and S can interchange their positions. Thus P and S can be placed in 14 ways.

Since positions of P and S are fixed, the remaining ten places in $\frac{10!}{2!}$ ways (since T is repeated two times)

$$\therefore \text{Total number of words} = 14 \times \frac{10!}{2!} = 25401600$$

ADDITIONAL QUESTIONS FOR PRACTICE 7.3

- Find r if ${}^{10}P_r = 2 \cdot {}^7P_r$
- Find n . i. $2 \cdot {}^nP_3 = {}^nP_4$ ii. $3 \cdot {}^nP_4 = 5 \cdot {}^{n-1}P_4$ iii. $12 \cdot {}^{n-1}P_3 = 5 \cdot {}^{n-1}P_5$ (March 2012)
- Seven songs are to be rendered in a programme. In how many different orders could they be rendered?
- Find the number of 4 digit numbers that can be formed using the digits 1, 2, 3, 4 and 5 if no digit is used more than once in a number. How many of these numbers will be even?

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Table of Contents Part I Mathematics

1. Understanding the eBook Part I Mathematics
 - The Rise of Digital Reading Part I Mathematics
 - Advantages of eBooks Over Traditional Books
2. Identifying Part I Mathematics
 - Exploring Different Genres
 - Considering Fiction vs. Non-Fiction
 - Determining Your Reading Goals
3. Choosing the Right eBook Platform
 - Popular eBook Platforms
 - Features to Look for in an Part I Mathematics
 - User-Friendly Interface
4. Exploring eBook Recommendations from Part I Mathematics
 - Personalized Recommendations
 - Part I Mathematics User Reviews and Ratings
 - Part I Mathematics and Bestseller Lists

5. Accessing Part I Mathematics Free and Paid eBooks
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 - Part I Mathematics eBook Subscription Services
 - Part I Mathematics Budget-Friendly Options
6. Navigating Part I Mathematics eBook Formats
 - ePub, PDF, MOBI, and More
 - Part I Mathematics Compatibility with Devices
 - Part I Mathematics Enhanced eBook Features
7. Enhancing Your Reading Experience
 - Adjustable Fonts and Text Sizes of Part I Mathematics
 - Highlighting and Note-Taking Part I Mathematics
 - Interactive Elements Part I Mathematics
8. Staying Engaged with Part I Mathematics
 - Joining Online Reading Communities
 - Participating in Virtual Book Clubs
 - Following Authors and Publishers Part I Mathematics
9. Balancing eBooks and Physical Books Part I Mathematics
 - Benefits of a Digital Library
 - Creating a Diverse Reading Collection Part I Mathematics
10. Overcoming Reading Challenges
 - Dealing with Digital Eye Strain
 - Minimizing Distractions
 - Managing Screen Time
11. Cultivating a Reading Routine Part I Mathematics
 - Setting Reading Goals Part I Mathematics
 - Carving Out Dedicated Reading Time
12. Sourcing Reliable Information of Part I Mathematics
 - Fact-Checking eBook Content of Part I Mathematics
 - Distinguishing Credible Sources
13. Promoting Lifelong Learning

- Utilizing eBooks for Skill Development
 - Exploring Educational eBooks
14. Embracing eBook Trends
- Integration of Multimedia Elements
 - Interactive and Gamified eBooks

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