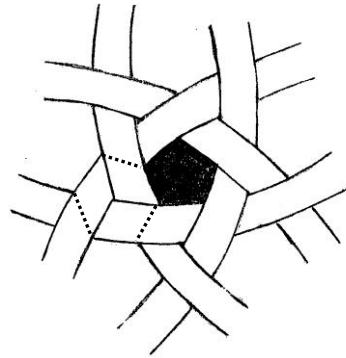


**Question:** How many patterns can we make by 6 colored bands?



Making a regular pentagon

**Answer:** 24 patterns

Let 6 colors be A to F, and A be fixed at Equator.

Left 5 colors which are B to F make pentagon. By *circular permutation* different patterns are

$$(5 - 1)! = 4! = 24.$$

But sequences of colors are inverted at North Pole and South Pole (Fig.1).

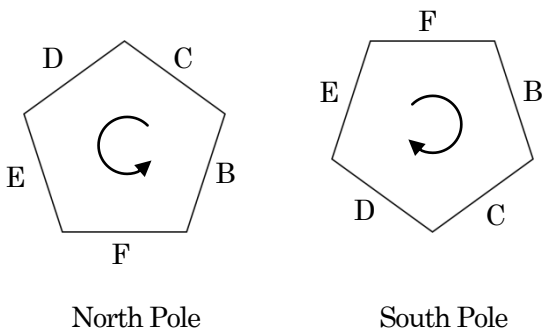


Fig.1 Sequences of colors are inverted at North Pole and South Pole.

And then, there are 12 patterns by color (Fig. 2)

$$\frac{24}{2} = 12.$$

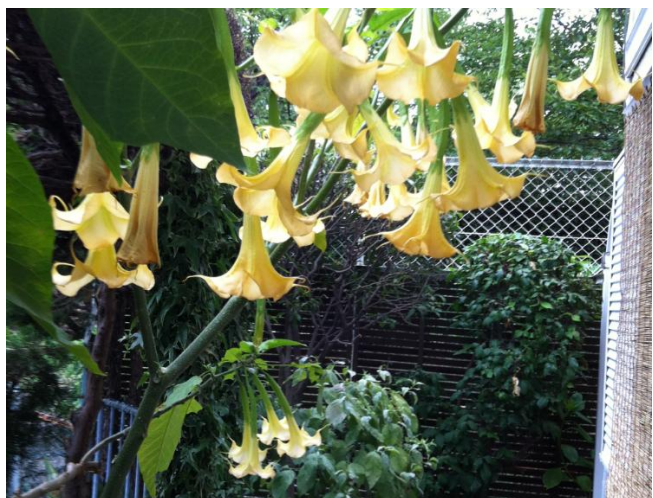




Fig.2 12 patterns by color

Moreover, there are two way of winding band. (Fig. 3)

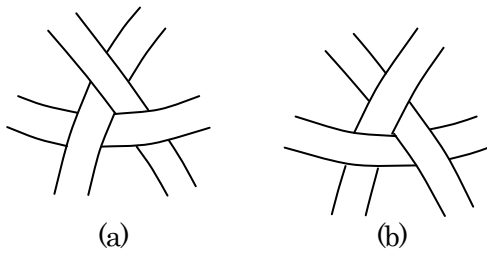


Fig.3 Two ways of winding in three-way locks

And so there are two different balls of same color sequence. (Fig. 4)



Fig.4 different balls of same color sequence.

$$12 \times 2 = 24$$

That is answer.

### Reference

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