

15. Amplifiers: 3 choices

Compact disc players: 2 choices

Speakers: 5 choices

Total: $3 \cdot 2 \cdot 5 = 30$ ways

17. Math courses: 2

Science courses: 3

Social sciences and humanities courses: 5

Total: $2 \cdot 3 \cdot 5 = 30$ schedules

19. $2^6 = 64$

21. $26 \cdot 26 \cdot 26 \cdot 10 \cdot 10 \cdot 10 \cdot 10 = 175,760,000$

distinct license plate numbers

23. (a) $9 \cdot 10 \cdot 10 = 900$

(b) $9 \cdot 9 \cdot 8 = 648$

(c) $9 \cdot 10 \cdot 2 = 180$

(d) $6 \cdot 10 \cdot 10 = 600$

25. $40^3 = 64,000$

27. (a) $8 \cdot 7 \cdot 6 \cdot 5 \cdot 4 \cdot 3 \cdot 2 \cdot 1 = 40,320$

(b) $8 \cdot 1 \cdot 6 \cdot 1 \cdot 4 \cdot 1 \cdot 2 \cdot 1 = 384$

29. ${}_4P_4 = \frac{4!}{0!} = 4! = 24.$

31. ${}_8P_3 = \frac{8!}{5!} = 8 \cdot 7 \cdot 6 = 336$

33. ${}_5P_4 = \frac{5!}{1!} = 120$

35. ${}_{20}P_3 = 1,860,480$

37. ${}_{100}P_3 = 970,200$

39. $5! = 120$ ways

41. ${}_{12}P_4 = \frac{12!}{8!} = 12 \cdot 11 \cdot 10 \cdot 9 = 11,880$ ways

$$43. \frac{7!}{2!1!1!1!1!} = \frac{7!}{2!3!} = 420$$

$$45. \frac{7!}{2!1!1!1!1!1!1!} = \frac{7!}{2!} = 7 \cdot 6 \cdot 5 \cdot 4 \cdot 3 = 2520$$

47. ABCD BACD CABD DABC
ABDC BADC CADB DACB
ACBD BCAD CBAD DBAC
ACDB BCDA CBDA DBCA
ADBC BDAC CDAB DCAB
ADCB BDCA CDBA DCBA

$$49. {}_{15}P_6 = \frac{15!}{6!} = 1,816,214,400$$

different batting orders

$$51. {}_5C_2 = \frac{5!}{2!3!} = 10$$

$$53. {}_4C_1 = \frac{4!}{1!3!} = 4$$

$$55. {}_{25}C_0 = \frac{25!}{0!25!} = 1$$

$$57. {}_{20}C_4 = 4845$$

$$59. {}_{42}C_5 = 850,668$$

$$61. {}_6C_2 = 15$$

The 15 ways are listed below.

AB, AC, AD, AE, AF, BC, BD, BE, BF, CD, CE, CF,
DE, DF, FF

$$63. {}_{40}C_{12} = \frac{40!}{28!12!} = 5,586,853,480 \text{ ways}$$

$$65. {}_{35}C_5 = \frac{35!}{30!5!} = 324,632 \text{ ways}$$

67. There are 22 good units and 3 defective units.

$$(a) {}_{22}C_4 = \frac{22!}{4!18!} = 7315 \text{ ways}$$

$$(b) {}_{22}C_2 \cdot {}_3C_2 = \frac{22!}{2!20!} \cdot \frac{3!}{2!1!} = 231 \cdot 3 = 693 \text{ ways}$$

$$\begin{aligned}(c) {}_{22}C_4 \cdot {}_{22}C_3 \cdot {}_3C_1 + {}_{22}C_2 \cdot {}_3C_2 &= \frac{22!}{4!18!} + \frac{22!}{3!19!} \cdot \frac{3!}{1!2!} + \frac{22!}{2!20!} \cdot \frac{3!}{2!1!} \\ &= 7315 + 1540 \cdot 3 + 231 \cdot 3 \\ &= 12,628 \text{ ways}\end{aligned}$$