1. 设$A =$" X为奇数 ", $B =$" $X < 8$ "

$P(AB) = P($" $X = 3$ "$) + P($" $X = 5$ "$) + P($" $X = 7$ "$) = \frac{2+4+6}{6^2} = \frac{1}{3}$

$P(A) = P($" $X \in \{3, 5, 7, 9, 11\}$ "$) = P(AB) + P($" $X = 9$ "$) + P($" $X = 11$ "$)$

$= \frac{1}{3} + \frac{4+2}{6^2} = \frac{1}{2}$

则$P(B|A) = \frac{P(AB)}{P(A)} = \frac{2}{3}$

答：在X为奇数的条件下，$X < 8$的概率为$\frac{2}{3}$.

3. $P(\bar{A}|\bar{B}) = \frac{P(\bar{A}\bar{B})}{P(\bar{B})} = \frac{P(\overline{A+B})}{1-P(B)} = \frac{(1-P(A+B))}{\frac{2}{3}}$

$= \frac{3}{2}(1 - (P(A) + P(B) - P(AB))) = \frac{3}{2}(\frac{1}{3} + P(AB)) = \frac{3}{2}(\frac{1}{3} + P(A|B)P(B))$

$= \frac{3}{2}(\frac{1}{3} + \frac{1}{6} \times \frac{1}{3}) = \frac{7}{12}$.

4. $P($" 第一只为红球，第二只为白球 "$) = \frac{r}{r+w} \times \frac{w}{r+w-1} = \frac{rw}{(r+w)(r+w-1)}$

答："第一只为红球，第二只为白球"概率为$\frac{rw}{(r+w)(r+w-1)}$.

6. 设$A =$" 第三次比赛时取出的3个球都是新球 ", $B_i =$" 第二次比赛取出了i个新球 "

则$P(A) = P(A|B_0)P(B_0) + P(A|B_1)P(B_1) + P(A|B_2)P(B_2) + P(A|B_3)P(B_3)$

$= \frac{C_9^3}{C_{12}^3} \times \frac{C_3^3}{C_{12}^3} + \frac{C_8^3}{C_{12}^3} \times \frac{C_3^2 C_9^1}{C_{12}^3} + \frac{C_7^3}{C_{12}^3} \times \frac{C_3^1 C_9^2}{C_{12}^3} + \frac{C_6^3}{C_{12}^3} \times \frac{C_9^3}{C_{12}^3}$

$= \frac{441}{3025} \approx 0.146$

8.

设$A =$" 从选择的罐子中任取两个球，发现两个都是黑球 ", $B =$" 选到4个白球、6个黑球的罐子 ",
$C =$" 选到5个白球、5个黑球的罐子 ", $D =$" 有5个白球和3个黑球留在选出的罐子中 "

$P(A) = P(A|B)P(B) + P(A|C)P(C) = \frac{C_6^2}{C_{10}^2} \times \frac{n}{n+1} + \frac{C_5^2}{C_{10}^2} \times \frac{1}{n+1}$

$P(AD) = P(AD|B)P(B) + P(AD|C)P(C) = P(AD|C)P(C) = P(A|C)P(C) = \frac{C_5^2}{C_{10}^2} \times \frac{1}{n+1}$

则$\frac{1}{7} = P(D|A) = \frac{P(AD)}{P(A)} = \frac{\frac{C_5^2}{C_{10}^2} \times \frac{1}{n+1}}{\frac{C_6^2}{C_{10}^2} \times \frac{n}{n+1} + \frac{C_5^2}{C_{10}^2} \times \frac{1}{n+1}} = \frac{C_5^2 \times 1}{C_6^2 \times n + C_5^2 \times 1} = \frac{2}{3n+2}$

解得$n = 4$.