a codon.) Four different codons have three kinds of nucleotides: *ABC, ABD, ACD,* and *BCD.* This is 20 in all, so three nucleotides per codon is sufficient. To see whether we can get by with only two nucleotides per codon, list all possible codons of two nucleotides: *AA, BB, CC, DD, AB, AC, AD, BC, BD, CD.* Since there are only 10 of these, two is not enough.

AP Sample Test

AP1. **C.** It's far more likely the teacher won't be abducted by extraterrestrials than that she will be abducted. It's only if we assume that the events are equally likely that we can conclude the probability is $\frac{1}{2}$ for each of the two events.

AP2. E, because $P(\textit{1 on the first die}) = \frac{1}{6} = P(\textit{1 on the first die} \mid \textit{doubles})$. The answer is not choice A, for example, because $P(\textit{sum of 8}) = \frac{5}{36}$, but $P(\textit{sum of 8} \mid \textit{doubles}) = \frac{1}{6}$.

AP3. B, because it is impossible to get a sum of 3 and doubles on the same roll.

AP4. C. This correctly simulates which days are successful.

AP5. E. This question cannot be answered without knowing if being female and getting an A are independent events. If all of the students getting A's were female, then the answer would be 30%; if none of the students getting A's were female, then the answer would be 0%. Any answer between 0% and 30% is possible.

AP6. C. This is easiest to see by constructing a table. The problem gives the percentages that go in the four cells. After filling in the cells, add across and down to get the marginal totals. The probability a smoker gets lung cancer is $\frac{4}{26}$.

	Smoker	Non-Smoker	Total
Lung Cancer	4	8	**12**
No Lung Cancer	22	66	**88**
Total	**26**	**74**	**100%**

AP7. D. The easiest way to do this problem is by finding the complement: $1 - P(\textit{none get it right}) = 1 - 0.3^3$, or 0.973.

AP8. D. There's a 50% chance that the main antenna continues to function. When the main antenna fails (the remaining 50% of the time), there's a 20% chance of having a working backup antenna. The probability of at least one working antenna is then $0.5 + 0.5(0.2) = 0.6$. Alternatively, the probability of at least one working antenna is $1 - P(\textit{no working antenna}) = 1 - (0.5)(0.8) = 0.6$. These probabilities also can be organized in a two-way table with one way being *survive/fail* for the main antenna and the other way being *survive/fail* for the backup antenna.

AP9. Encourage students to tell an interesting story with only the calculations that are necessary. Students may make far more computations than they need to prove the important points, such as that although class mattered, being female was more important to survival. Note these interesting probabilities:

$$P(\textit{survived}) = \frac{499}{1316} \approx 0.379$$

$$P(\textit{survived} \mid \textit{3rd class}) = \frac{178}{706} \approx 0.252$$

$$P(\textit{survived} \mid \textit{1st class}) = \frac{203}{325} \approx 0.625$$

$$P(\textit{survived} \mid \textit{1st class female}) = \frac{141}{145} \approx 0.972$$

$$P(\textit{survived} \mid \textit{3rd class female}) = \frac{90}{196} \approx 0.459$$

$$P(\textit{survived} \mid \textit{1st class male}) = \frac{62}{180} \approx 0.344$$

$$P(\textit{survived} \mid \textit{3rd class male}) = \frac{88}{510} \approx 0.173$$