1		$\frac{28}{72}$	P1	for $\frac{6}{8}$ or $\frac{2}{8}$ or $\frac{7}{8}$ or $\frac{1}{8}$ oe seen on diagram or in a calculation
			P1	for $\frac{7}{9}\times\frac{2}{8}$ or $\frac{2}{9}\times\frac{7}{8}$ or $\frac{14}{72}$ oe for $\frac{7}{9}\times\frac{6}{8}$ or $\frac{2}{9}\times\frac{1}{8}$ or $\frac{42}{72}$ or $\frac{2}{72}$ or $\frac{44}{72}$ oe
			P1	for $\frac{7}{9}\times\frac{2}{8}+\frac{2}{9}\times\frac{7}{8}$ or "$\frac{14}{72}$"+"$\frac{14}{72}$"oe for $1-(\frac{7}{9}\times\frac{6}{8}+\frac{2}{9}\times\frac{1}{8})$ or $1-$("$\frac{42}{72}$"+"$\frac{2}{72}$") or $1-$"$\frac{44}{72}$" oe
			A1	oe SC B1 for $\frac{14}{81}$ B2 for $\frac{28}{81}$

2		98	P1	for process to find P(1), eg. 1 – 0.17 – 0.18 – 0.09 – 0.15 – 0.1 (= 0.31) or for a process to find P(1 or 3), eg. 1 – 0.17 – 0.09 – 0.15 – 0.1 (= 0.49)
			P1	for process to find the number of 3s eg. 0.18 × 200 (=36) or process to find the number of 1s, e.g. P(1) × 200 (= 62), or process to find the number of (1 or 3)s, eg [P(1) + 0.18] × 200 or for process to find any expected frequency using any probability × 200 eg. 0.17 × 200
			A1	cao
				OR
			P1	for process to find P(2 or 4 or 5 or 6), eg. 0.17 + 0.09 + 0.15 + 0.1 (= 0.51)
			P1	for process to find the number of (2 or 4 or 5 or 6)s, eg. "0.51" × 200 (= 102)
			A1	cao

3		$\frac{1}{11}$	P1	for starting the process, eg by writing down a correct ratio or using a given number of cubes for one relationship, eg 2B 1Y or B:Y = 2:1 or 4G 1B or G:B = 4:1 or 8G, 1Y or G:Y = 8:1 oe or yellow = 2, blue = 4, or states 2:1:8 oe in any order (can be algebraic)
			P1	for complete process to find possible number of each colour or equivalent ratio, eg 8G 2B 1Y or G:B:Y = 8:2:1 oe or yellow = 2, blue = 4, green = 16 oe (can be algebraic)
			A1	$\frac{1}{11}$ oe

4 (a)		$\frac{1}{55}$	M1	for $\frac{4}{12}\times\frac{3}{11}\times\frac{2}{10}$
			A1	for $\frac{1}{55}$ oe
(b)		Conclusion (supported)	C1	starts correct argument, eg by calculating a relevant probability, eg $\frac{5}{15}\times\frac{4}{14}\times\frac{3}{13}$
			C1	statement of "more likely" from eg comparison of probabilities, ft answer to (a) eg $\frac{1}{55}$ (= 0.018…) and $\frac{2}{91}$ (= 0.021…or 0.022)

5 (a)		Mel (supported)	B1	Mel with reference to greatest number of throws
(b)		$\frac{2}{9}$	M1	selects overall total and multiplies P(point up)×P(point down) eg $\frac{50}{150}\times\frac{100}{150}$ oe (accept $\frac{14}{45}\times\frac{31}{45}$ or $\frac{27}{80}\times\frac{53}{80}$ or $\frac{9}{25}\times\frac{16}{25}$)
			A1	for $\frac{2}{9}$ oe

6	(a)		0.05	B1	for 0.05 oe
	(b)		20	C1	for stating that at least 20 required
			Reason	C1	for reason eg explains that number of each colour must be a whole number or that there must be (at least) 1 red counter or shows that $0.05 = \frac{1}{20}$

7	0.12	P1	for process to start eg $(1 - 0.2) \div (3 + 17)$ $(= 0.04)$ **or** $(3 + 17) \div (1 - 0.2)$ oe $(= 25)$ **or** $(100 - 20) \div (3 + 17)$ $(= 4)$ **or** 3×4 $(= 12)$ and 17×4 $(= 68)$	Just $1 - 0.2 = 0.8$ is **not** sufficient for P1 May be seen in a ratio
		P1	full process to find the required probability eg $3 \times$ "0.04" **or** $\frac{3}{20} \times (1 - 0.2)$ oe **or** $3 \div$ "25" or $3 \times$ "4" $\div 100$	
		A1	oe	0.12 using incorrect probability notation gets P2

8	(a)	8	P1	for process to find sum of unknown probabilities, eg $1 - 0.45 - 0.25$ $(= 0.3)$ **OR** to find the total number of counters in the bag, eg $\frac{18}{0.45}$ $(= 40)$ **OR** to find the number of yellow counters, eg $\frac{0.25}{0.45} \times 18$ $(= 10)$	Award mark for any two probabilities given that sum to 0.3 eg given in the table.
			P1	for process to find P(red) = 0.2 oe **or** P(white) = 0.1 oe **OR** for process to find the total number of red and white counters, eg "40" – 18 – "10" (=12) **OR** for process to derive an equation in x, eg $2x + x = 1 - 0.45 - 0.25$ or $2x + x =$ "0.3" or $x = 0.1$	Award P2 for P(red) or P(white) (could be shown in table) Equations could be given as written statements or working but must be fully equivalent.
			P1	for a complete process to find the number of red counters, eg $\frac{2 \times 0.1}{0.45} \times 18$ or $\frac{2}{3} \times$ "12" or $0.2 \times$ "40" or $\frac{0.2}{0.025}$	
			A1	cao	
	(b)	Explanation	C1	for explanation eg 0.5 multiplied by an odd number will never be a whole number, for half of a number to be an integer that number must be even, you can't have half a marble	

9	(a)	0.4, 0.4	P1	for process to find sum of unknown probabilities, eg $1 - 0.2$ $(= 0.8)$	Award mark for any two probabilities given that sum to 0.8, eg given in the table
			A1	oe	Accept any equivalent fraction or 40%
	(b)	60	P1	for complete process to find total number of cubes, eg $12 \div 0.2$ **or** 12×5 **or** ("0.4" $\div$ 0.2) $\times 12$ + ("0.4" $\div$ 0.2) $\times 12 + 12$ **OR** states 0.1 = 6 **or** 0.4 = 24	
			A1	cao	

10	(i)	65	M1	for working with proportion eg $10 \div 30 \times 195$ (=65)	Condone use of 200 for 195
			A1	cao	
	(ii)	statement	C1	for statement **Acceptable examples** sample is representative (otherwise answer wrong) random sample (otherwise answer will be different) the 30 students are from the 195 (otherwise not accurate) 10 out of every 30 want to go to the Theme Park (otherwise answer will be different/wrong) there is no bias **Not acceptable examples** There would be more than 10 people who want to go to the Theme Park I rounded my answer	

11	72	M1	for $\frac{5}{30}=\frac{12}{p}$ oe, eg $\frac{12}{p}\times 30 = 5$ or $12 \div \frac{5}{30}$ **or** $5 : 30 = 12 : p$ **or** 1 in 6 ($30 \div 5$) counters are yellow, so $12 \times$ "6" **or** using equivalent ratios to 5 : 30, eg. 2 : 12 and 10 : 60 and adding to give 2 + 10 : 12 + 60	
		A1	cao	

12	$\frac{52}{72}$	P1	for $\frac{4}{9}\times\frac{3}{8}\left(\frac{12}{72}\right)$ **or** $\frac{4}{9}\times\frac{5}{8}$ **or** $\frac{5}{9}\times\frac{4}{8}\left(\frac{20}{72}\right)$	
		P1	for $1-\left(\frac{5}{9}\times\frac{4}{8}\right)$ **or** $\frac{4}{9}\times\frac{3}{8}+\frac{4}{9}\times\frac{5}{8}+\frac{5}{9}\times\frac{4}{8}$ oe	
		A1	for $\frac{52}{72}$, $\frac{13}{18}$ oe SC B1 for answer of $\frac{56}{81}$ (replacement)	Accept equivalent fractions, decimals (0.72…) or percentages (72.22…..%)

13	$\frac{1}{81}$	M1	for finding the probability of heads eg $\sqrt[4]{\frac{16}{81}}$ $(=\frac{2}{3})$ **or** for finding the probability of tails $1-\sqrt[4]{\frac{16}{81}}$ $(=\frac{1}{3})$	Seeing a probability of $\frac{2}{3}$ or $\frac{1}{3}$ is enough for this mark
		A1	oe	

14	0.42	P1	for appropriate multiplication eg 0.3×0.7 (=0.21) **or** 0.3×0.1 (=0.03) **or** 0.3×0.6 (=0.18)	Probabilities could also be given in fraction or percentage form
		P1	(dep) for complete process eg $0.3 \times 0.7 + 0.7 \times 0.3$ **or** $0.3 \times 0.1 + 0.3 \times 0.6 + 0.6 \times 0.3 + 0.1 \times 0.3$	
		A1	oe	Acceptable equivalents are 42% or $\frac{42}{100}$ oe

15	$\frac{180}{336}$	P1	for $\frac{3}{7}$ or $\frac{4}{7}$ or $\frac{5}{7}$ as probability for second counter	May be seen in a calculation or on a diagram
		P1	for one correct product eg $\frac{3}{8}\times\frac{5}{7}\times\frac{4}{6}$ $(=\frac{60}{336})$ **or** $\frac{5}{8}\times\frac{3}{7}\times\frac{4}{6}$ $(=\frac{60}{336})$ **or** $\frac{5}{8}\times\frac{4}{7}\times\frac{3}{6}$ $(=\frac{60}{336})$	
		P1	for a complete process eg $\frac{3}{8}\times\frac{5}{7}\times\frac{4}{6}+\frac{5}{8}\times\frac{3}{7}\times\frac{4}{6}+\frac{5}{8}\times\frac{4}{7}\times\frac{3}{6}$	
		A1	oe, eg $\frac{15}{28}$ SC B1 for answer of $\frac{225}{512}$ (replacement)	Accept equivalent fractions, decimals (0.53... or 0.54) or percentages (53% or 54%)

16	0.748	P1	for a process to find a correct probability product for 2 consecutive days, eg. 0.7×0.8 (rain M + T) **or** 0.7×0.2 (rain M + no rain T) **or** 0.3×0.6 (no rain M + rain on T) **or** 0.3×0.4 (no rain M + T)	Throughout accept probabilities given as fractions or percentages Could be for Tuesday and Wednesday also
		P1	for process to find a correct triple probability product for it raining on Wednesday, eg. $0.7 \times 0.8 \times 0.8$ (rain M + T + W) (= 0.448 **or** $\frac{56}{125}$ oe) **or** $0.7 \times 0.2 \times 0.6$ (rain M + no rain T + rain W) (= 0.084 **or** $\frac{21}{250}$ oe) **or** $0.3 \times 0.6 \times 0.8$ (no rain M + rain T + rain W) (= 0.144 **or** $\frac{18}{125}$ oe) **or** $0.3 \times 0.4 \times 0.6$ (no rain M + no rain T + rain W) (= 0.072 **or** $\frac{9}{125}$ oe)	
		P1	for complete process, eg. "0.448" + "0.084" + "0.144" + "0.072"	
		A1	oe eg, $\frac{187}{250}$	NB: correct answer without supportive working gets 0 marks

17	(a)	0.5, 0.3	P1	for $1 - 0.05 - 0.15$ (= 0.8)	Award this mark for any two probabilities that sum to 0.8
			A1	oe	
	(b)	120	M1	$18 \div 0.15$ oe **or** $6 + 18 + a + b$ where $a + b = 96$	
			A1	cao	

18	$1 - \left(\frac{1}{2}\right)^n - \left(\frac{1}{2}\right)^n$	M1	for $\left(\frac{1}{2}\right)^n$ oe	
		A1	oe eg $1 - \left(\frac{1}{2}\right)^{n-1}$	