Question Number	Scheme	Marks
3. (a)	[D = distance achieved] $\mathrm{P}(D > 4.3) = \mathrm{P}\left(Z > \dfrac{4.3-3.8}{0.9}\right)$ or $\mathrm{P}(Z > 0.555\ldots)$	M1
	$= 1 - 0.7123$ (tables)	M1
	$= 0.2877$ (tables) or $0.289257\ldots$ (calc) awrt **0.288** or awrt **0.289**	A1
		(3)
(b)	$\dfrac{d-3.8}{0.9} = -0.8416$ (calc $-0.84162123\ldots$)	M1 ; B1
	$d = 3.0425\ldots$ awrt **3.04**	A1
		(3)
(c)	$\mathrm{P}(D > g \mid D > 4.3) = \dfrac{\mathrm{P}(D > g)}{\mathrm{P}(D > 4.3) \text{ or (a)}}$ $\left[= \dfrac{1}{3}\right]$ (o.e.)	M1
	$\therefore \mathrm{P}(D > g) = \frac{1}{3}(\text{a}) = 0.096419\ldots$	A1ft (o.e)
	$\dfrac{g-3.8}{0.9} = 1.302228\ldots$	dM1
	so $g = 4.97200..$ awrt **4.97** or awrt **4.98**	A1
		(4)
(d)	P(no gold medals) $= \left(\frac{2}{3}\right)^3$	M1
	P(at least one gold) $= 1 - \left(\frac{2}{3}\right)^3$	M1
	$= \frac{19}{27}$	A1
		(3)
		[13]

	Notes
(a)	1st M1 for standardising 4.3 with 3.8 and 0.9 (allow $\pm$) 2nd M1 for $1 - p$ (where $0.7 < p < 0.8$) A1 for awrt 0.288 or 0.289 (calc. 0.289257) (correct answer only 3/3)
(b)	M1 for standardising with d, 3.8 and 0.9 and setting equal to a z value $0.8 < \lvert z \rvert < 0.9$ B1 for $z = \pm 0.8416$ or better used A1 for awrt 3.04 (condone $d \geqslant \ldots$)
Ans only	For awrt 3.0425 or 3.0426 score 3/3 For awrt 3.04 score M1B0A1
(c)	1st M1 for either expression for the conditional prob. [or sight of $\frac{1}{3}$(a)] (ft their answer to (a) to 2 sf) 1st A1ft for $\mathrm{P}(D > g) = 0.096$ or better (0.289 gives 0.09633… calc 0.096419…) The $\mathrm{P}(D > g)$ may be clearly shown on a diagram. 1st M1A1 can be awarded for $\mathrm{P}(D > g) = \frac{1}{3}$(a) or for $\mathrm{P}(D < g) = 1 - \frac{1}{3}$(a) [ft their (a) to 2 sf] 2nd dM1 (dep on 1st M1) for standardising with g, 3.8 and 0.9 and put equal to a z value where $\lvert z \rvert > 1$ 2nd A1 for awrt 4.97 or 4.98 (Correct answer with no incorrect working seen 4/4) (condone $g \geqslant \ldots$)
SC	**(Medals v Certificates)** 1st B1 for $[\mathrm{P}(D > g) =] \frac{1}{3} \times 0.8 = \frac{4}{15}$ or 0.267 (score as 1st M0 1st A1) 2nd B1 for g = awrt 4.36 (4.358 tables, 4.3606..calc) (score as 2nd M0 2nd A1)
(d)	1st M1 for a correct probability of no gold medals or 2 of: $3\left(\frac{2}{3}\right)^2 \times \frac{1}{3}$ or $3\left(\frac{1}{3}\right)^2 \times \frac{2}{3}$ or $\left(\frac{1}{3}\right)^3$ 2nd M1 for $1 - p^3$ or $3(p)^2(1-p) + 3p(1-p)^2 + (1-p)^3$ where $0 < p < 1$ A1 for $\frac{19}{27}$ (or exact equivalent) only e.g. $0.\dot{7}0\dot{3}$