1 (i)	(*A*) P(both rest of UK) = 0.20×0.20 = 0.04 (*B*) *Either:* **All 5 case** P(at least one England) = (0.79 x 0.20) + (0.79 x 0.01) + (0.20 x 0.79) + (0.01 x 0.79) + (0.79 x 0.79) = 0.158 + 0.0079 + 0.158 + 0.0079 + 0.6241 = 0.9559 *Or* P(at least one England) = 1 – P(neither England) = 1 – (0.21 $\times$ 0.21) = 1 – 0.0441 = 0.9559 or listing all = 1 –{ (0.2 x 0.2) + (0.2 x 0.01) + (0.01 x 0.20) + (0.01x 0.01)} = 1 – (**) = 1 – { 0.04 + 0.002 + 0.002 + 0.0001) = 1 – 0.0441 = 0.9559 Or: **All 3 case** P(at least one England) = = $0.79 \times 0.21 + 0.21 \times 0.79 + 0.79^2$ = 0.1659 + 0.1659 + 0.6241 = 0.9559 _____ (*C*)*Either* 0.79 x 0.79 + 0.79 x 0.2 + 0.2 x 0.79 + 0.2 x 0.2 = 0.9801 *Or* $0.99 \times 0.99 = 0.9801$ Or 1 – { 0.79 x 0.01 + 0.2 x 0.01 + 0.01 x 0.79 + 0.01 x 0.02 + 0.01^2 } = 1 – 0.0199 = 0.9801	M1 for multiplying A1cao M1 for any correct term (3case or 5case) M1 for correct sum of all 3 (or of all 5) with **no extras** A1cao (condone 0.96 www) *Or* M1 for 0.21×0.21 or for (**) fully enumerated or 0.0441 seen M1**dep** for 1 – (1st part) A1cao See above for 3 case _____ M1 for sight of all 4 correct terms summed A1 cao (condone 0.98 www) *or* M1 for 0.99 x 0.99 A1cao ***Or*** M1 for everything 1 – {…..} A1cao	**2** **3** **2**
(ii)	P(both the rest of the UK | neither overseas) $= \frac{\text{P(the rest of the UK } \textit{and} \text{ neither overseas)}}{\text{P(neither overseas)}}$ $= \frac{0.04}{0.9801} = 0.0408$ {Watch for: $\frac{answer(A)}{answer(C)}$ as evidence of method (p <1)}	M1 for numerator of 0.04 or 'their answer to (i)(A)' M1 for denominator of 0.9801 or 'their answer to (i) (C)' A1 FT (0 < p < 1) 0.041 at least	**3**

(iii)	(*A*) Probability = $1 - 0.79^5$ $= 1 - 0.3077$ $= 0.6923$ (accept awrt 0.69) see additional notes for alternative solution	M1 for 0.79^5 or 0.3077... M1 for $1 - 0.79^5$ dep A1 CAO	
	(*B*) $1 - 0.79^n > 0.9$ **EITHER:** $1 - 0.79^n > 0.9$ or $0.79^n < 0.1$ (condone = and $\geq$ throughout) but not reverse inequality $n > \frac{\log \mathbf{0.1}}{\log \mathbf{0.79}}$, so n > 9.768… Minimum *n* = 10 Accept n $\geq$ 10	M1 for equation/inequality in n (accept either statement opposite) M1(indep) for process of using logs i.e. $\frac{\log a}{\log b}$ A1 CAO	**3**
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	OR (using trial and improvement): Trial with 0.79^9 or 0.79^{10} $1 - 0.79^9 = 0.8801$ (< 0.9) or $0.79^9 = 0.1198$ (> 0.1) $1 - 0.79^{10} = 0.9053$ (> 0.9) or $0.79^{10} = 0.09468$ (< 0.1) Minimum *n* = 10 Accept n $\geq$ 10	M1(indep) for sight of 0.8801 **or** 0.1198 M1(indep) for sight of 0.9053 **or** 0.09468 A1 dep **on both M's** cao	**3**
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	NOTE: *n* = 10 unsupported scores SC1 only		
		TOTAL	**16**

2 (i)	Probability = $0.3 \times 0.8 = 0.24$	M1 for 0.8 from (1-0.2) A1	**2**
(ii)	*Either:* $P(A \cup B) = P(A) + P(B) - P(A \cap B)$ $= 0.3 + 0.2 - 0.3 \times 0.2$ $= 0.5 - 0.06 = 0.44$ *Or:* $P(A \cup B) = 0.7 \times 0.2 + 0.3 \times 0.8 + 0.3 \times 0.2$ $= 0.14 + 0.24 + 0.06 = 0.44$ *Or:* $P(A \cup B) = 1 - P(A' \cap B')$ $= 1 - 0.7 \times 0.8 = 1 - 0.56 = 0.44$	M1 for adding 0.3 and 0.2 M1 for **subtraction** of (0.3×0.2) A1 **cao** M1 either of first terms M1 for last term A1 M1 for 0.7×0.8 or 0.56 M1 for complete method as seen A1	**3**
(iii)	$P(A\|B) = \frac{P(A \cap B)}{P(B)} = \frac{0.06}{0.44} = \frac{6}{44} = 0.136$	M1 for numerator of their 0.06 only M1 for 'their 0.44' in denominator A1 FT (must be valid p)	**3**
		TOTAL	**8**

3 (i)	Impossible because the competition would have finished as soon as Sophie had won the first 2 matches	E1	**1**
(ii)	**SS, JSS, JSJSS**	B1, B1, B1 (-1 each error or omission)	**3**
(iii)	$0.7^2 + 0.3 \times 0.7^2 + 0.7 \times 0.3 \times 0.7^2 = 0.7399$ or 0.74(0) { 0.49 + 0.147 + 0.1029 = 0.7399}	M1 for any correct term M1 for any other correct term M1 for sum of all three correct terms A1 cao	**4**
		TOTAL	**8**

4 **(i)**	(*A*) P(at least one) $= \frac{36}{50} = \frac{18}{25} = 0.72$ (*B*) P(exactly one) $= \frac{9+6+5}{50} = \frac{20}{50} = \frac{2}{5} = 0.4$	B1 aef M1 for (9+6+5)/50 A1 aef	**3**
(ii)	P(not paper | aluminium) $= \frac{13}{24}$	M1 for denominator 24 or 24/50 or 0.48 A1 CAO	**2**
(iii)	P(one kitchen waste) $= 2 \times \frac{18}{50} \times \frac{32}{49} = \frac{576}{1225} = 0.470$	M1 for both fractions M1 for 2 × product of both, or sum of 2 pairs A1	**3**
		TOTAL	**8**