Question Number	Scheme	Marks
Throughout the paper the candidates may use different letters to the ones given in the mark scheme.		
1. (a)	[X ~ the number of pansy seeds that do not germinate or Y = the number…that do germinate]	
	$X \sim \mathrm{B}(20, 0.05)$ or $Y \sim \mathrm{B}(20, 0.95)$	B1
(i)	$\mathrm{P}(X \leqslant 4) - \mathrm{P}(X \leqslant 2) = 0.9974 - 0.9245$ or	
	$\binom{20}{3}0.05^3 \times 0.95^{17} + \binom{20}{4}0.05^4 \times 0.95^{16} = 0.05958... + 0.01332...$	M1
	$= 0.072909\ldots$ awrt **0.0729**	A1
(ii)	$\mathrm{P}(X \leqslant 1)$ or $\mathrm{P}(Y \geqslant 19) = 20 \times (0.95)^{19}(0.05) + (0.95)^{20}$	M1
	$= 0.7358$ $= 0.735839\ldots$ awrt **0.736**	A1 (5)
(b)	[Let W = no. of packets where $Y > 18$] $\mathrm{P}(W = 5) = (\text{"0.7358..."})^5$	M1
	$= 0.21573\ldots$ awrt **0.216**	A1 (2)
(c)	$\mathrm{H}_0 : p = 0.05$ $\mathrm{H}_1 : p > 0.05$	B1 (1)
(d)	[V= no. of seeds that do not germinate $V \sim \mathrm{B}(100, 0.05)$ approximates to] $V \sim \mathrm{Po}(5)$	M1A1
	CR for 1-tail in (c): $\mathrm{P}(V \geqslant 9) = 0.0681$, $\mathrm{P}(V \geqslant 10) = 0.0318$, CR $V \geqslant 10$ oe CR for 2-tail in (c): $\mathrm{P}(V \geqslant 10) = 0.0318$, $\mathrm{P}(V \geqslant 11) = 0.0137$, CR $V \geqslant 11$ oe	
	$\mathrm{P}(V \geqslant 8) = 1 - \mathrm{P}(V \leqslant 7)$ $= 1 - 0.8666$ $= 0.1334$	M1 A1
	Accept H_0 or not significant or 8 does not lie in the critical region	dM1
	Data consistent with ***Spany*'s claim** or Insufficient evidence for ***Jem's* belief** or insufficient evidence that **percentage** of **seeds not germinating** is more than **5%** (o.e.)	A1cso (6)
		Total 14

Notes

(a) **B1:** writing or using $\mathrm{B}(20, 0.05)$ [Allow $Y \sim \mathrm{B}(20, 0.95)$ if Y is clearly defined]. Implied by 1 correct prob.

(i) **M1:** for $\mathrm{P}(X \leqslant 4) - \mathrm{P}(X \leqslant 2)$ and one correct prob. or $\mathrm{P}(X = 3) + \mathrm{P}(X = 4)$ and 1 correct prob.

(ii) **M1:** for $\mathrm{P}(X \leqslant 1)$ or $[20] \times (0.95)^{19}(0.05) + (0.95)^{20}$ - condone missing 20

(b) **M1:** for $(\text{their(a)(ii)})^5$

(c) **B1:** both hypotheses correct with p or π

(d) **1st M1:** for realising a Poisson approximation is appropriate. NB Po(95) is M0A0
1st A1: writing or using $V \sim \mathrm{Po}(5)$ i.e correct mean for the Poisson.
2nd M1: for writing or using $1 - \mathrm{P}(V \leqslant 7)$ or $\mathrm{P}(V \leqslant 7) = 0.8666$
or writing $\mathrm{P}(V \geqslant 10) = 0.0318$ or $\mathrm{P}(V \geqslant 9) = 0.0681$ or $\mathrm{P}(V \geqslant 11) = 0.0137$ **leading to a CR**.
Implied by correct CR or probability = awrt 0.133
2nd A1: for awrt 0.133 or $V \geqslant 10$ oe (e.g. $V > 9$) or $V \geqslant 11$ oe allow any letter but CR must match part(c)
3rd dM1: dep on 2nd M1. ft their CR or probability. A correct statement based on comparing 8 with their CR or their prob with 0.05 or 0.025 [condone $0.866 < 0.95$]– contradicting non-contextual comments M0
3rd A1 cso: all previous marks must be awarded. A **correct** statement in context. Need **Bold words.**
NB award M1A1 for a correct contextual statement on its own.
If there are no hypotheses or they are the wrong way around, then 3rd M0 3rd A0

SC1 **Normal approximation:** Award marks in pairs with 2, 4 or 6 marks available
Sight of $\mathrm{N}(5 \text{ or } 95, \sqrt{4.75}^2)$ M1A1; probability awrt 0.125/6 M1A1; Correct contextual concl' dM1A1

SC2 **No approximation:** Use of $\mathrm{B}(100, 0.05)$ M0A0; probability awrt 0.128 or CR $\geqslant 10$ M1A1; then M0A0