Question Number	Scheme	Marks
3 (a)	The vacuum **tubes shatter** independently	B1
	The probability of a vacuum **tube shattering** is constant	B1
		(2)
(b)	$C \sim B(15, 0.35)$ plus $[P(C \leqslant 1) =]0.0142$ or $[P(C \geqslant 10) =]0.0124$ or $[P(C \leqslant 9) =]0.9876$	M1
	Critical regions $[0 \leqslant] C \leqslant 1$ or $10 \leqslant C [\leqslant 15]$	M1
	$[0 \leqslant] C \leqslant 1$ and $10 \leqslant C [\leqslant 15]$ plus $P(C \leqslant 1) = 0.0142$ and $P(C \geqslant 10) = 0.0124$	A1
		(3)
(c)	0.0266	B1ft
		(1)
(d)	[4 is not in the CR therefore] there is no evidence to reject **Rowan's** belief	B1ft
		(1)
(e)	$F \sim B(40, 0.35)$	
	$H_0: p = 0.35$ and $H_1: p < 0.35$	B1
	$P(F \leqslant 8) = 0.0303$ or CR $F \leqslant 8$	M1A1
	Sufficient evidence to reject H_0 or significant or 8 lies in the Critical region	M1
	There is sufficient evidence to support that the **proportion** of type *B* vacuum **tubes** that shatter when exposed to alternating high and low temperatures is less than 35%	A1
		(5)

	Notes	**Total 12**
(a)	**B1**	for one correct reason which must mention tube(s) and shatter/shattering or 2 correct reasons not in context
	B1	for 2 correct reasons which must mention tube(s) and shatter/shattering at least once
(b)	**M1**	for using the correct distribution to find awrt 0.0142 or awrt 0.0124 or awrt 0.988 Allow B(15, 0.35) is written **and** one of awrt 0.014 or awrt 0.012 or awrt 0.99 is seen
	M1	for lower CR or $C \leqslant 1$ oe e.g. $C < 2$ or upper CR $C \geqslant 10$ oe e.g. $C > 9$ Allow other notation and any letter(s) for CR Do not allow CR written as a probability statement
	A1	for both CR correct with the relevant probabilities (3 sf and must be seen in part (b)). Do not allow CR written as a probability statement
(c)	**B1ft**	for awrt 0.0266 or 2.66% or ft the sum of the probabilities in (b) for "their 2 critical regions" if seen. If no probabilities for their CR given then the answer must be 0.0266
(d)	**B1ft**	for a correct statement consistent with their CR Must mention **Rowan/his/her** or a correct conclusion based on Rowan's belief with the words highlighted in bold e.g. no evidence to suggest that the **proportion/probability/number/amount** (allow **35%** as proportion) of **tubes** that shatter has changed oe
(e)	**B1**	for both hypotheses correct in terms of p or π
	M1	for using or writing $P(F \leqslant 8)$ or awrt 0.0303
	A1	for awrt 0.0303 or correct CR Allow $F \leqslant 8$ or $F < 9$ but not if part of a probability statement
	M1	for a correct conclusion – need not be in context. ft their probability or CR. Ignore hypotheses. do not allow contradicting non contextual comments. May be implied by a correct contextual statement on its own
	A1	for a correct conclusion – must be in context, with words highlighted in bold. ft their probability or CR only. Independent of hypotheses. Do not allow contradicting statements. Allow probability/number/amount/35% for proportion. Allow decreased for less than 35%

Question	Scheme	Marks