Question Number	Scheme	Marks
4(a)	Non random sampling/description of non random sampling oe	B1
	from (different groups of the) population until each quota has been met	B1
		(2)
(b)	H_0 : Subject enjoyed the most and group are independent H_1 : Subject enjoyed the most and group are not independent	B1
	Expected: Maths / Physics / Chemistry / Total Group *A*: 21.06 / 8.97 / 8.97 / (39) Group *B*: 32.94 / 14.03 / 14.03 / (61) Total: (54) / (23) / (23) / (100)	M1
	Observed / Expected / $\frac{(O-E)^2}{E}$ / $\frac{O^2}{E}$ 16 / 21.06 / 1.215745… / 12.15575… 10 / 8.97 / 0.118272… / 11.14827… 13 / 8.97 / 1.81058… / 18.84058… 38 / 32.94 / 0.77728… / 43.83728… 13 / 14.03 / 0.075617… / 12.04562… 10 / 14.03 / 1.157584… / 7.127584… Totals / 5.155… / 105.155…	dM1
	$\left[X^2 =\right]\sum\frac{(O-E)^2}{E}$ or $\sum\frac{O^2}{E} - 100$	dM1
	= 5.155… awrt 5.16 or awrt 5.15	A1
	$\nu = (3-1)(2-1) = 2$	B1
	$\chi^2_2(0.05) = 5.991$	B1ft
	[not in CR/not significant/Do not reject H_o] There is not sufficient evidence to suggest that subject enjoyed and group are not independent	A1
		(8)
(c)(i)	No change (as the test is still the same)	B1
(ii)	No change (as $\nu = 2$ still)	B1
(iii)	Test statistics would double (= 10.310…) (as all observed and expected values are doubled.)	B1
(iv)	Conclusion is the opposite (There is sufficient evidence to suggest that subject enjoyed and group are not independent) as test statistic is now greater than the critical value (10.31 > 5.991)	B1
		(4)

	Notes	**Total 14**
(a)	**B1**	for a correct statements referring to non-random sampling or a description of a non-random method for selecting participants e.g. choosing people as they leave the school . Do not allow labelling or numbering
	B1	for a correct statement referring to selection from different groups until quota is filled
(b)	**B1**	both hypotheses correct. Must mention "Subject" and "group" at least once. (may be written in terms of association)
	M1	Some attempt at $\frac{(\text{Row Total})\times(\text{Column Total})}{\text{Grand Total}}$ Can be implied by at least one correct E_i to 1 dp
	dM1	dependent on 1st M1 for at least 2 correct terms for $\frac{(O-E)^2}{E}$ or $\frac{O^2}{E}$ or correct expressions with their E_i Accept 2 sf accuracy

	dM1	dependent on 2nd M1 for applying $\sum \frac{(O-E)^2}{E}$ or $\sum \frac{O^2}{E} - 100$
	A1	awrt 5.16
	SC	If no expected frequencies shown, then an answer of awrt 5.16 scores M0M0M1A1
	B1	$\nu = 2$ may be implied by a correct critical value of 5.991
	B1ft	5.991 allow ft from their stated degrees of freedom (may see 3.841, 7.815, 9.488, 11.070)
	A1	dependent on 3rd M1 and 3rd B1. A correct contextualised conclusion which is not rejecting H_o Must mention subject and group. Contradictory statements score A0 e.g. "significant, do not reject H_o" If no hypotheses or hypotheses wrong way round do not award.
(c)(i)	**B1**	a correct statement
(ii)	**B1**	a correct statement
(iii)	**B1**	a correct statement which must state that the test statistic doubles
(iv)	**B1**	a correct statement with correct reasoning