Version 1.0



General Certificate of Education (A-level) June 2012

**Mathematics** 

MS/SS1B

(Specification 6360)

**Statistics 1B** 



PMT

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## Key to mark scheme abbreviations

М	mark is for method
m or dM	mark is dependent on one or more M marks and is for method
А	mark is dependent on M or m marks and is for accuracy
В	mark is independent of M or m marks and is for method and accuracy
E	mark is for explanation
$\checkmark$ or ft or F	follow through from previous incorrect result
CAO	correct answer only
CSO	correct solution only
AWFW	anything which falls within
AWRT	anything which rounds to
ACF	any correct form
AG	answer given
SC	special case
OE	or equivalent
A2,1	2 or 1 (or 0) accuracy marks
–x EE	deduct <i>x</i> marks for each error
NMS	no method shown
PI	possibly implied
SCA	substantially correct approach
c	candidate
sf	significant figure(s)
dp	decimal place(s)

## No Method Shown

Where the question specifically requires a particular method to be used, we must usually see evidence of use of this method for any marks to be awarded.

Where the answer can be reasonably obtained without showing working and it is very unlikely that the correct answer can be obtained by using an incorrect method, we must award **full marks**. However, the obvious penalty to candidates showing no working is that incorrect answers, however close, earn **no marks**.

Where a question asks the candidate to state or write down a result, no method need be shown for full marks.

Where the permitted calculator has functions which reasonably allow the solution of the question directly, the correct answer without working earns **full marks**, unless it is given to less than the degree of accuracy accepted in the mark scheme, when it gains **no marks**.

## Otherwise we require evidence of a correct method for any marks to be awarded.

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Q	Solution	Marks	Total	Comments
1 (a)	$r = \frac{S_{xy}}{\sqrt{S_{xx} \times S_{yy}}} = \frac{-0.410}{\sqrt{2.030 \times 1.498}} = -0.235$	M1 A1	2	Correct substitution into <b>correct</b> formula May be implied by a <b>correct</b> answer AWRT (-0.235115)
(b)	Some / (very) weak / (very) little / (very)slight negative correlation/relationship/association/link	Adep1		Dependent on -0.235 or -0.24 OE; must qualify strength and state negative Ignore extra words unless contradict Not 'no', 'low', 'small', 'unlikely' or 'trend'
	width and thickness of lengths of steel	B1	2	Context; do <b>not</b> allow 'cms' or 'mms'
SC	$r = (+)0.235 \implies M1 \text{ A0 Adep0 B1 max}$			
	Total		4	

Q	Solution	Marks	Total	Comments
2 (a)(i)	Mode = $23$	B1	1	САО
( <b>ii</b> )	Median (88 <sup>th</sup> value) = $\underline{22}$	B1		CAO
	Upper quartile $(132^{nd} value) = 23$	<b>B</b> 1		$C\Delta\Omega$ , either
	Lower quartile (44 <sup>th</sup> value) = $\underline{20}$	DI		May be implied by $IQR = 3$
	Interquartile range = $\underline{3}$	B1	3	CAO; do <b>not</b> award if <b>seen</b> to be not based on 23 and 20
<b>(b)</b>	Mean = $22.3$	B2		CAO; but only award B1 (22.3) if incorrect mid-points or $\Sigma$ fr seen
	Mean = $21$ to $23$	(B1)		AWFW $(\Sigma fx = 3902.5)$
	Standard deviation = $\frac{6.37 \text{ or } 6.39}{5 \text{ to } 7}$	B2 (B1)	4	AWRT $(s = 6.391 \ \sigma = 6.372)$ AWFW $(\Sigma f x^2 = 94132.25)$
SC	Only if B0 B0 or B1 B0 then award as follows but only up <b>1</b> At least 2 correct mid-points 4.5, 14.5, 27, 32, 37, 44.5, 54 <b>2</b> Clear use of $\Sigma fx/(175 \text{ or } 174) \Rightarrow M1$	to a <b>maxim</b> seen ⇒	<b>um total p</b> a M1	art mark of 2
(c)	Mean = (c's mean from (b)) + $\frac{280}{175}$	M1		Adding (1.6 or equivalent) CAO to (c's mean from (b)) <b>or</b> to (c's new mean)
	-22.5 + 1.0 Mean $= 23.9$	AF1	2	F on (c's mean from (b)) or on (c's new mean)
	Total		10	

QSolutionMarksTotalComments3b (gradient) = $2.27$ b (gradient) = $2.21$ to $2.3$ (B1)B2 (B1)AWRT(2.27075) AWFWa(intercept) = $4.16$ to $4.2$ a (intercept) = $3 \pm 0.7$ B2 (B1)AWFW(2.27075) AWFWAttempt at $\sum x \sum^{2} \sum y \& \sum x' (\sum y')$ or Attempt at $\sum x \sum^{2} \sum y \& \sum x' (\sum y')$ (M1)(B1)AWFW(4.16981) AWFWAttempt at $\sum x \sum^{2} \sum y \& \sum x' (\sum y')$ (Attempt at correct formula for b (gradient) b (gradient) = $2.27$ (A1)(M1)5300 & 12035 (27608) (both attempted)Notes1 Values of a and b interchanged and equation $y = a + b$ stated in (a) $\Rightarrow$ max of 4 marks 2 Values of a and b interchanged and equation $y = a + b$ stated in (a) $\Rightarrow$ max of 4 marks 2 Values of a and b interchanged and equation $y = a + b$ stated in (a) $\Rightarrow$ max of 4 marks 2 Values of a and b interchanged and equation $y = a + b$ stated in (a) $\Rightarrow$ max of 4 marks 2 Values of a and b interchanged and equation $y = a + b$ stated in (a) $\Rightarrow$ max of 4 marks 2 Values of a and b interchanged and equation $y = a + b$ stated in (a) $\Rightarrow$ max of 4 marks 2 Values of a and b interchanged and equation $y = a + b$ stated in (a) $\Rightarrow$ max of 4 marks 2 Values of a and b interchanged and equation $y = a + b$ stated in (a) $\Rightarrow$ max of 4 marks 2 Values of a can b interchanged and equation $y = a + b$ stated in (a) $\Rightarrow$ max of 4 marks 2 Values of a can b interchanged and equation $y = a + b$ stated in (a) $\Rightarrow$ 0 marks a 20 (300 $\approx$ 1.2 a 3 also apply) 5 some all of marks can be scorent (n) (b) (4 (ii), event forecally of marks are lost in (a) anothe be recoursel by subsequent working in (b)(b)Correct stratight line drawn on scatter dingram correct sthortened and/or frechand line drawn on<	MS/SS1B	(cont)	1	1	T	
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$a \text{ (intercept)} = \frac{4.16 \text{ to } 4.2}{3 \text{ to } 7} \text{ (B1)} B2 \\ a \text{ (intercept)} = \frac{3 \text{ to } 7}{3 \text{ to } 7} \text{ (B1)} AWFW (4.16981) $		$b (\text{gradient}) = \frac{2.2 \text{ to } 2.3}{2.3}$	(B1)		AWFW	
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$ \begin{array}{ c c c c c c c c c c c c c c c c c c c$		Attempt at <b>correct</b> formula for $b$ (gradient)	(m1)			
a (intercept) = 4.16 to 4.2 (A1)(A1)4AWFWNotes1 Values of a and b interchanged and equation $y = ax + b$ stated in (a) $\Rightarrow$ max of 4 marks 2 Values or a and b interchanged and equation $y = a + bx$ stated in (a) $\Rightarrow$ 0 marks 3 Values are not identified or simply $a = #$ and $b = #$ , then $z \ge 10 \cdot 23 \Rightarrow B1$ and 3 to $7 \Rightarrow B1$ but accept, for example, as 		$b (\text{gradient}) = \underline{2.27}$	(A1)		AWRT	
Notes1Values of a and b interchanged and equation $y = a + b$ stated in (a) $\Rightarrow$ max of 4 marks2Values of a and b interchanged and equation $y = a + b$ stated in (a) $\Rightarrow$ 0 marks3Values of a and b interchanged and equation $y = a + b$ stated in (a) $\Rightarrow$ 0 marks3Values or a otioentified or simply $a = \#$ and $b = \#$ , then $2 \ge 10 \ge 3 \Rightarrow 11$ and $3 to 7 \Rightarrow B1$ and $3 to 7 \Rightarrow B1$ but accept, for example, as identification, $[a = \#, b = \frac{1}{2}, 0) \Rightarrow 0$ , otherwise B1 if fraction equates to $2 \ge 0 \ge 3$ (Notes 1, $2 \& 3$ also apply)4 $b = \frac{22U(23)}{20071060}$ CAO $\Rightarrow$ B2, otherwise B1 if fraction equates to $2 \ge 0 \ge 3$ (Notes 1, $2 \& 3$ also apply)5Some/all of marks can be scored in (b), and in c(ii) & (iii), even if some/all of marks are lost in (a) but marks lost in (a) cannot be recouped by subsequent working in (b)(b)Correct straight line drawn on scatter diagram Correct shortened and/or freehand line drawn on scatter diagramCorrect shortened and/or freehand line drawn on scatter or incorrect) marked on scatter diagram Correct shortened and/or freehand line drawn on scatter diagram(c)(i)Correct straight line drawn on scatter diagram Correct shortened and/or freehand line drawn on scatter diagram(b)Correct straight line drawn on scatter diagram Correct shortened and/or freehand line drawn on scatter diagram(b)If B0 but seen correct attempt at $\ge 2$ points even if incorrectly evaluated $\Rightarrow$ M1(c)(i)Correct shortened and/or freehand line drawn on scatter diagram Correct shortened and/or freehand line drawn on scatter diagram(B1)2Line must go from $x \le 20$ to $x \ge 70$ and fall between the following 2 lines: Lower: (10, 60) (80, 75)(iii)1 f B0 but		a (intercept) = 4.16  to  4.2	(A1)	4	AWFW	
(b)Correct straight line drawn on scatter diagram Correct shortened and/or freehand line drawn on scatter diagramB2Line must go from $x \le 20$ to $x \ge 70$ and fall between the following 2 lines: Lower: (10, 25) (80, 180) Upper: (10, 30) (80, 190)Notes1 If B0 but seen correct attempt at $\ge 2$ points even if incorrectly evaluated $\Rightarrow$ MI 2 If B0 but no seen evidence to support $\ge 2$ points (correct or incorrect) marked on scatter diagram Correct shortened and/or freehand line drawn on scatter diagramB2Line must go from $x \le 20$ to $x \ge 70$ and fall between the following 2 lines: Lower: (10, 60) (80, 75) Upper: (10, 65) (80, 85)Notes1 If B0 but seen correct attempt at $\ge 2$ points even if incorrectly evaluated $\Rightarrow$ MI 2 If B0 but no seen evidence to support $\ge 2$ points (correct or incorrect) marked on scatter diagram $\Rightarrow$ M0(iii)2 If B0 but seen correct attempt at $\ge 2$ points even if incorrectly evaluated $\Rightarrow$ MI 2 If B0 but no seen evidence to support $\ge 2$ points (correct or incorrect) marked on scatter diagram $\Rightarrow$ M0(iii)27 to 29B11(iii)At low temperatures more B (than A) dissolves At high temperatures more A (than B) dissolvesB12B12Either; OE (eg a comparison using lines and/or data at a specific temperature but not at 0°C)Amount increases more rapidly for A (than B) Amount increases more slowly for B (than A)B12Either; OE Any comments about b or $a \Rightarrow$ B0 Correct interve must relate to tempTotal1111	Notes	<ol> <li>Values of a and b interchanged and equation y = ax +</li> <li>Values of a and b interchanged and equation y = a +</li> <li>Values are not identified or simply a = # and b = #, th identification, [a = #, b = # with y = a + bx but not b = 2407/1060 CAO ⇒ B2, otherwise B1 if fraction a = 221/53 CAO ⇒ B2, otherwise B1 if fraction</li> <li>Some/all of marks can be scored in (b), and in c(ii) &amp; (iii), recouped by subsequent working in (b)</li> </ol>	b stated in bx stated in en 2.2 to 2 substitution equates to equates to even if som	(a) $\Rightarrow$ max (a) $\Rightarrow$ 0 for $a \approx b$ 1.3 $\Rightarrow$ B1 in for $a \ll b$ 2.2 to 2.3 3 to 7 re/all of mar	ax of 4 marks marks and 3 to 7 $\Rightarrow$ B1 but accept, for example, as b] <b>or</b> [intercept(a) = #, gradient(b) = #] (Notes 1, 2 & 3 also apply) (Notes 1, 2 & 3 also apply) ks are lost in (a) but marks lost in (a) <b>cannot</b> be	
Correct shortened and/or freehand line drawn on scatter diagram(B1)2(B1)2(B1)Correct (10, 25) (80, 180) Upper: (10, 30) (80, 190)Notes1 If B0 but seen correct attempt at $\geq 2$ points even if incorrectly evaluated $\Rightarrow$ M1M1Line must go from $x \leq 20$ to $x \geq 70$ and fall between the following 2 lines: Lower: (10, 25) (80, 180)(c)(i)Correct straight line drawn on scatter diagram Correct shortened and/or freehand line drawn on scatter diagramB2Line must go from $x \leq 20$ to $x \geq 70$ and fall between the following 2 lines: Lower: (10, 60) (80, 75) Upper: (10, 65) (80, 85)Notes1 If B0 but seen correct attempt at $\geq 2$ points even if incorrectly evaluated $\Rightarrow$ M1Line must go from $x \leq 20$ to $x \geq 70$ and fall between the following 2 lines: Lower: (10, 60) (80, 75) Upper: (10, 65) (80, 85)Notes1 If B0 but seen correct attempt at $\geq 2$ points even if incorrectly evaluated $\Rightarrow$ M12 If B0 but no seen evidence to support $\geq 2$ points (correct or incorrect) marked on scatter diagram $\Rightarrow$ M0(iii) $27$ to $29$ (iii)At low temperatures more B (than A) dissolves At high temperatures more A (than B) dissolvesB11B12B12B12B12B12B12B12B12B12B12B11B12B12B11B12B12B12B12B1 <t< th=""><th><b>(b</b>)</th><th>Correct straight line drawn on scatter diagram</th><th>B2</th><th></th><th>Line must go from <math>x \le 20</math> to <math>x \ge 70</math> and fall between the following 2 linear</th></t<>	<b>(b</b> )	Correct straight line drawn on scatter diagram	B2		Line must go from $x \le 20$ to $x \ge 70$ and fall between the following 2 linear	
scatter diagram(B1)2Upper: (10, 30) (80, 190)Notes1 If B0 but seen correct attempt at $\geq 2$ points even if incorrectly evaluated $\Rightarrow$ MI2 If B0 but no seen evidence to support $\geq 2$ points (correct or incorrect) marked on scatter diagram $\Rightarrow$ M0(c)(i)Correct straight line drawn on scatter diagram Correct shortened and/or freehand line drawn on scatter diagramB2 (B1)Line must go from $x \leq 20$ to $x \geq 70$ and fall between the following 2 lines: Lower: (10, 60) (80, 75) Upper: (10, 65) (80, 85)Notes1 If B0 but seen correct attempt at $\geq 2$ points (correct or incorrect) walked $\Rightarrow$ M12 If B0 but no seen evidence to support $\geq 2$ points (correct or incorrect) marked on scatter diagram $\Rightarrow$ M0(ii) $\frac{27 \text{ to } 29}{4}$ (iii)At low temperatures more B (than A) dissolves At high temperatures more A (than B) dissolvesB11B12B12B12B12B12B12B12B12B12B12B11B12B2		Correct shortened and/or freehand line drawn on			Lower: (10, 25) (80, 180)	
Notes1 If B0 but seen correct attempt at $\geq 2$ points even if incorrectly evaluated $\Rightarrow$ M12 If B0 but no seen evidence to support $\geq 2$ points (correct or incorrect) marked on scatter diagram $\Rightarrow$ M0(c)(i)Correct straight line drawn on scatter diagram Correct shortened and/or freehand line drawn on scatter diagramB2 (B1)Line must go from $x \leq 20$ to $x \geq 70$ and fall between the following 2 lines: Lower: (10, 60) (80, 75) Upper: (10, 65) (80, 85)Notes1 If B0 but seen correct attempt at $\geq 2$ points even if incorrectly evaluated $\Rightarrow$ M1Line must go from $x < 20$ to $x \geq 70$ and fall between the following 2 lines: Lower: (10, 60) (80, 75) Upper: (10, 65) (80, 85)Notes1 If B0 but seen correct attempt at $\geq 2$ points even if incorrectly evaluated $\Rightarrow$ M1(ii) $27$ to 29 At low temperatures more B (than A) dissolves At high temperatures more A (than B) dissolves Amount increases more rapidly for A (than B) Amount increases more slowly for B (than A)B12Either; OE (eg a comparison using lines and/or data at a specific temperature but not at 0°C)4Mount increases more slowly for B (than A)B12Either; OE Any comments about b or $a \Rightarrow$ B0 Comment about 'rate' must relate to temp		scatter diagram	(B1)	2	Upper: (10, 30) (80, 190)	
(c)(i)Correct straight line drawn on scatter diagram Correct shortened and/or freehand line drawn on scatter diagramB2 (B1)Line must go from $x \le 20$ to $x \ge 70$ and fall between the following 2 lines: Lower: (10, 60) (80, 75) Upper: (10, 65) (80, 85)Notes1 If B0 but seen correct attempt at $\ge 2$ points even if incorrectly evaluated $\Rightarrow$ M1 2 If B0 but no seen evidence to support $\ge 2$ points (correct or incorrect) marked on scatter diagram $\Rightarrow$ M0(ii) $27$ to $29$ B11AWFW Must clearly identify x-value Thus (27 to 29, y-value) $\Rightarrow$ B0(iii)At low temperatures more B (than A) dissolves At high temperatures more A (than B) dissolves At high temperatures more a point (than B) Amount increases more rapidly for A (than B) Amount increases more slowly for B (than A)B12B12Either; OE (eg a comparison using lines and/or data at a specific temperature but not at $0^{\circ}$ C)Total11	Notes	<ol> <li>If B0 but seen correct attempt at ≥2 points even if incorr</li> <li>If B0 but no seen evidence to support ≥2 points (correct</li> </ol>	 rectly evalua t or incorrec 	 ated ⇒ M et) marked o 	1 n scatter diagram $\Rightarrow$ M0	
Correct shortened and/or freehand line drawn on scatter diagramD2and fall between the following 2 lines: Lower: (10, 60) (80, 75) Upper: (10, 65) (80, 85)Notes1 If B0 but seen correct attempt at $\geq 2$ points even if incorrectly evaluated $\Rightarrow$ M1 2 If B0 but no seen evidence to support $\geq 2$ points (correct or incorrect) marked on scatter diagram $\Rightarrow$ M0(ii)27 to 29B11AWFW (calculation $\Rightarrow$ 27.75) Must clearly identify x-value Thus (27 to 29, y-value) $\Rightarrow$ B0(iii)At low temperatures more B (than A) dissolves At high temperatures more A (than B) dissolvesB12B12Either; OE (eg a comparison using lines and/or data at a specific temperature but not at 0°C)Amount increases more rapidly for A (than B) Amount increases more slowly for B (than A)B12Total11	(c)(i)	Correct <b>straight</b> line drawn on scatter diagram	B2		Line must go from $x \le 20$ to $x \ge 70$	
scatter diagram(B1)2Dower: (10, 60) (80, 73) Upper: (10, 65) (80, 85)Notes1 If B0 but seen correct attempt at $\geq 2$ points even if incorrectly evaluated $\Rightarrow$ M1 2 If B0 but no seen evidence to support $\geq 2$ points (correct or incorrect) marked on scatter diagram $\Rightarrow$ M0(ii)27 to 29B11AWFW (calculation $\Rightarrow$ 27.75) Must clearly identify x-value Thus (27 to 29, y-value) $\Rightarrow$ B0(iii)At low temperatures more B (than A) dissolves At high temperatures more A (than B) dissolvesB12Either; OE (eg a comparison using lines and/or data at a specific temperature but not at 0°C)Amount increases more rapidly for A (than B) Amount increases more slowly for B (than A)B12Either; OE Any comments about b or $a \Rightarrow$ B0 Comment about 'rate' must relate to temp		Correct shortened and/or freehand line drawn on			and fall between the following 2 lines:	
Notes1 If B0 but seen correct attempt at $\geq 2$ points even if incorrectly evaluated $\Rightarrow M1$ 2 If B0 but no seen evidence to support $\geq 2$ points (correct or incorrect) marked on scatter diagram $\Rightarrow M0$ (ii) $27 \text{ to } 29$ B11AWFW (calculation $\Rightarrow 27.75$ )Must clearly identify x-valueThus (27 to 29, y-value) $\Rightarrow B0$ (iii)At low temperatures more B (than A) dissolvesAt high temperatures more A (than B) dissolvesAt high temperatures more A (than B) dissolvesAmount increases more rapidly for A (than B)Amount increases more slowly for B (than A)B12Comment about 'rate' must relate to tempTotal11		scatter diagram	(B1)	2	Upper: (10, 65) (80, 75)	
Notes1 If B0 but seen correct attempt at $\geq 2$ points even if incorrectly evaluated $\Rightarrow$ M12 If B0 but no seen evidence to support $\geq 2$ points (correct or incorrect) marked on scatter diagram $\Rightarrow$ M0(ii) $27 \text{ to } 29$ B11AWFW (calculation $\Rightarrow 27.75$ )Must clearly identify x-valueThus (27 to 29, y-value) $\Rightarrow$ B0(iii)At low temperatures more B (than A) dissolvesAt high temperatures more A (than B) dissolvesAt high temperatures more A (than B) dissolvesAmount increases more rapidly for A (than B)Amount increases more slowly for B (than A)B12Either; OEAmount increases more slowly for B (than A)Total11						
(ii)27 to 29B11AWFW (calculation $\Rightarrow$ 27.75) Must clearly identify x-value Thus (27 to 29, y-value) $\Rightarrow$ B0(iii)At low temperatures more B (than A) dissolves At high temperatures more A (than B) dissolvesB11Either; OE (eg a comparison using lines and/or data at a specific temperature but not at 0°C)Amount increases more rapidly for A (than B) Amount increases more slowly for B (than A)B12Either; OE Any comments about b or $a \Rightarrow$ B0 Comment about 'rate' must relate to tempTotal1111	Notes	<ul> <li>1 If B0 but seen correct attempt at ≥2 points even if incorr</li> <li>2 If B0 but no seen evidence to support ≥2 points (correct</li> </ul>	rectly evalua or incorrect	ted $\Rightarrow$ M (ted) to marked or	1 a scatter diagram ⇒ M0	
(iii)At low temperatures more B (than A) dissolves At high temperatures more A (than B) dissolvesB1Either; OE (eg a comparison using lines and/or data at a specific temperature but <b>not</b> at 0°C)Amount increases more rapidly for A (than B) Amount increases more slowly for B (than A)B12Either; OE Any comments about b or $a \Rightarrow B0$ Comment about 'rate' must relate to tempTotal11	( <b>ii</b> )	<u>27 to 29</u>	B1	1	AWFW(calculation $\Rightarrow$ 27.75)Must clearly identify x-valueThus (27 to 29, y-value) $\Rightarrow$ B0	
Amount increases more rapidly for A (than B) Amount increases more slowly for B (than A)B12Either; OE Any comments about b or $a \Rightarrow B0$ Comment about 'rate' must relate to tempTotal11	(iii)	At low temperatures more B (than A) dissolves At high temperatures more A (than B) dissolves	B1		Either; OE (eg a comparison using lines and/or data at a specific temperature but <b>not</b> at 0°C)	
Total 11		Amount increases more rapidly for A (than B) Amount increases more slowly for B (than A)	B1	2	Either; OE Any comments about b or $a \Rightarrow B0$ Comment about 'rate' must relate to temp	
		Total		11		

PMT

PMT

MS/SS1E	(cont)	T = = = =		
Q	Solution	Marks	Total	Comments
4 (a)(i)	P(P-2) =			Ratios (eg 194:640) are only penalised by 1 accuracy mark at first correct answer
(a)(l)	P(B = 5) = 194/640  or  97/320  or  0.303  or  30.3%	B1	1	CAO or AWRT (0.303125)
(ii)	$P(T \ge 2) = \frac{172 + 256 + 135}{640} \text{ or } 1 - \frac{77}{640} \text{ or } \frac{563}{640} = \frac{563/640}{563/640}$	M1		САО
	or (0.879 to 0.88) or (87.9% to 88%)	A1	2	AWFW (0.879688)
(iii)	P(B = 3 & T ≥ 2) = $\frac{72 + 99 + 16}{640} \text{ or } \frac{194 - 7}{640} \text{ or } \frac{187}{640}$	M1		
	= <u>187/640 or 0.292 or 29.2%</u>	A1	2	CAO or AWRT (0.292188)
(iv)	$P(B \le 3   T = 2) = \frac{(14 + 67 + 72)}{172} \text{ or } \frac{172 - 19}{172} \text{ or } \frac{153}{172}$	M1 M1		Correct numerator (accept both ÷ 640) Correct denominator
	= <u>153/172</u> or (0.888 to 0.89) or (88.8% to 89%)	A1	3	CAO AWFW (0.889535)
(b)	$(a)(i) \times (a)(ii) \neq (a)(iii)$ since	M1		Answers as fractions, percentages or ratios lose accuracy (A & B) marks in (b) & (c) Attempted
	$0.303 \times 0.88 = 0.265 \text{ to } 0.27 \neq 0.292$	A1	2	AWFW & AWRT
SC	Any <b>correct fully-explained</b> reasoning, using other than any <b>numerically correct decimals</b> (to 3 dp) $\Rightarrow$ B1 (eg P(B = no/unclear/incomplete reasoning or no/incorrect/incomplete	 wers from pa = 3) = 0.303 numerical v 	 art (a), which 3 ≠ P(B = vork ⇒ B 	h results in an inequality ( $\neq$ ) with both sides as 3  T = 2) = 72/172 = 0.419) but 0
(c)	$P(2T \cap 3T \cap \ge 4T \mid B = 3) = \frac{72}{194} \times \frac{99}{193} \times \frac{16}{192}$	M1 M1		Correct 3 values multiplied in numerator Correct 3 values multiplied in denominator $0.371 \times 0.513 \times 0.083$ (all AWRT) $\Rightarrow$ M1 M1 (OE products)
	<i>abc</i> multiplied by 6 or 3	M1		0 < (a, b & c) < 1
	= 0.095 to $0.0952$	A1	4	AWFW (0.095187)

	- 0.095 to 0.0952	AI	4		(0.095187)
Notes	1 Incorrect answer with no working $\Rightarrow 0$ marks 2 The 3 correct fractions/decimals identified but not multiple 3 The 3 correct fractions/decimals identified together with 4 A denominator of ${}^{194}C_2 = 1198144 \Rightarrow M2 (2^{nd} \& 3^{nc})$	lied (eg add 0.016 (AW) <sup>1</sup> M1 marks		1 M0 M0 A0 1 M1 M0 A0	
	Total		14		

Q         Solution         Marks         Total         Comments           5         In (a) (b c), [anor the inclusion of a lower limit of 0; it has no effect on either answer limit of 0; it has no effect	MS/SS1B (cont)						
5       In (a)(i) & (c); ignore the inclusion of a lower limit of c; it has no effect on either answer         (a)       Weight, W = N(2.75, 0.15 <sup>2</sup> )       M1         (i) $P(W < 2.8) = P(Z < \frac{2.8 - 2.75}{0.15})$ M1 $= 0.629 \text{ to } 0.633$ A1       A1 $= 0.629 \text{ to } 0.633$ A1       AWRT/CAO; ignore inequality and sign May be implied by a correct answer         (ii) $P(W > 2.5) = P(Z > -1.67) = P(Z < +1.67)$ M1       AWFW       (0.63056)         (iii) $P(W > 2.5) = P(Z > -1.67) = P(Z < +1.67)$ M1       AWFW       (0.95221)         (b)       Weight, X - N(5.25, 0.20 <sup>2</sup> )       H1       5       AWFW       (0.95221)         (b)       Weight, X - N(5.25, 0.20 <sup>2</sup> )       B1       Accept 0.579       Accept 0.579 or 0.227         (ii)       P(5.1 < X < 5.3) = P(Z < 0.25) - P(Z < -0.75) = 0.59871       B1       Accept 0.773 or 0.227         MINUS [(1 - 0.77337) or 0.2263]       B1       2       Accept 0.773 or 0.227         AG; do not mark simply on answer       or       G       Accept 0.579       Accept 0.773 or 0.227         (c)       Weight, Y - N(10.75, 0.50 <sup>3</sup> )       B1       Accept 0.773 or 0.227       AG; do not mark simply on answer         (c)       Weight, Y - N(10.75, 0.50 <sup>3</sup> )       B1       Accept 1 - c	Q	Solution	Marks	Total	Comments		
(i) $P(W < 2.8) = P\left(Z < \frac{2.8 - 2.75}{0.15}\right)$ M1       Standardising 2.8 with 2.75 and 0.15; allow $(2.75 - 2.8)$ (ii) $P(W < 2.8) = P(Z < \frac{0.33 \text{ or } 1/3}{0.15})$ A1       A1       AWRT/CAO; ignore inequality and sign May be implied by a correct answer         (iii) $P(W > 2.5) = P(Z > -1.67) = P(Z < +1.67)$ M1       AWFW       (0.63056)         (iii) $P(W > 2.5) = P(Z > -1.67) = P(Z < +1.67)$ M1       AWFW       (0.63056)         (i) $P(W > 2.5) = P(Z > -1.67) = P(Z < +1.67)$ M1       Samawer b influe by a correct answer or an answer > 0.5         (b)       Weight, $X - N(5.25, 0.20^2)$ A1       5       AWFW       (0.95221)         (ii) $P(5.1 < X < 5.3) = P(Z < 0.25) - P(Z < -0.75)$ B1       B1       Accept 0.599       Accept 0.599         (iii) $P(0 \text{ in } 4) = [1 - 0.372]^d$ M1       Accept 0.599       Accept 0.599       Accept 0.599         (iii) $P(0 \text{ in } 4) = [1 - 0.372]^d$ M1       Accept 0.599       Accept 0.173 or 0.227         (c)       Weight, $Y - N(10.75, 0.50^2)$ B1       B1       CAO or AWFW       Standardising 10.5 with 10.75 and $\sqrt{0.0416}$ (c)       Weight, $Y - N(10.75, 0.50^2)$ B1       B1       Standardising 10.5 with 10.75 and $\sqrt{0.0416}$ Corre	5 (a)	Weight, $W \sim N(2.75, 0.15^2)$			In (a)(i) & (c), ignore the inclusion of a lower limit of 0; it has no effect on either answer		
$ \begin{array}{ c c c c c c c c c c c c c c c c c c c$	(i)	$P(W < 2.8) = P\left(Z < \frac{2.8 - 2.75}{0.15}\right)$	M1		Standardising 2.8 with 2.75 and 0.15; allow $(2.75 - 2.8)$		
$ \begin{array}{ c c c c c c c c c c c c c c c c c c c$		= P(Z < 0.33  or  1/3)	A1		AWRT/CAO; ignore inequality and sign May be implied by a <b>correct</b> answer		
(ii) $P(W > 2.5) = P(Z > -1.67) = P(Z < +1.67)$ M1       Correct area change May be implied by a correct answer or an answer > 0.5         (b)       Weight, $X \sim N(5.25, 0.20^{2})$ A1       5       AWFW       (0.95221)         (i) $P(5.1 < X < 5.3) = P(Z < 0.25) - P(Z < -0.75)$ = 0.59871       B1       S       AWFW       (0.95221)         (ii) $P(5.1 < X < 5.3) = P(Z < 0.25) - P(Z < -0.75)= 0.59871       B1       S       AWFW       (0.9529)         (iii)       P(0 \text{ in 4}) = [1 - 0.372]^4       M1       Accept 0.579       ACcept 0.773 or 0.227AG; do not mark simply on answer         (iii)       P(0 \text{ in 4}) = [1 - 0.372]^4       M1       Accept [1 - c^*s (b)(i)]^4         (c)       Weight, Y - N(10.75, 0.50^{2})       B1       Z       ACCPT (1 - c^*s (b)(i)]^4         Variance of \overline{Y_6} = 0.57/6 = 0.204       B1       CAO or AWFWStated or usedCAO or AWRT         Standardising 10.5 with 10.75 and\sqrt{0.0416}       M1       Standardising 10.5 with 10.75 and\sqrt{0.0416} OE; allow (10.75 - 10.5)         P(\overline{Y_6} < 10.5) = P\left(Z < \frac{10.5 - 10.75}{\sqrt{0.0416}}\right) =       M1       Standardising 10.5 with 10.75 and\sqrt{0.0416} OE; but do notaward for use of z = \pm 0.22 1 - (0.88877 \text{ to } 0.89065) = 0.109 \text{ to } 0.112       A1       4       AWFW       (0.11034)(1 - answer) \Rightarrow B1 M1 max$		= <u>0.629 to 0.633</u>	A1		AWFW (0.63056)		
$\begin{array}{ c c c c c c c c c c c c c c c c c c c$	(ii)	P(W > 2.5) = P(Z > -1.67) = P(Z < +1.67)	M1		Correct area change May be implied by a correct answer or an answer > 0.5		
(b)       Weight, $X \sim N(5.25, 0.20^2)$ Must have diff of 2 probs for each B1         (i)       P(5.1 < X < 5.3) = P(Z < 0.25) - P(Z < -0.75) = 0.59871       B1       B1       B1       B1       Cacept 0.599       Accept 0.773 or 0.227         (ii)       P(0 in 4) = [1 - 0.372]^4       M1       Accept 0.773 or 0.227       AG; do not mark simply on answer         (iii)       P(0 in 4) = [1 - 0.372]^4       M1       Accept 1 - c's (b)(i)]^4         (c)       Weight, $Y \sim N(10.75, 0.50^2)$ B1       B1       CAO or AWFW         Variance of $\overline{Y_6} = 0.5!/6 = 0.0416$ to 0.0417       B1       CAO or AWFW       Stated or used $CAO or AWFW$ Standardising 10.5 with 10.75 and $\sqrt{0.0416}$ OE; allow (10.75 - 10.5)       Correct area change $P(\overline{Y_6} < 10.5) = P(Z < \frac{10.5 - 10.75}{\sqrt{0.0416}}) =$ M1       Standardising 10.5 with 10.75 and $\sqrt{0.0416}$ OE; allow (10.75 - 10.5) $P(\overline{Y_6} < 10.5) = P(Z < \frac{10.5 - 10.75}{\sqrt{0.0416}}) =$ M1       Standardising 10.5 with 10.75 - 10.5) $P(Z < -1.22) = 1 - P(Z < 1.22) =$ m1       M1       M2       M2 $1 - (0.88877 to 0.89065) = 0.109 to 0.112$ A1       4       AWFW       (0.11034) $(1 - answer) \Rightarrow B1 M1 max$ M3       M3       M3       M3		= <u>0.951 to 0.953</u>	A1	5	AWFW (0.95221)		
(i) $P(5.1 < X < 5.3) = P(Z < 0.25) - P(Z < -0.75)$ $= 0.59871$ MINUS $[(1 - 0.77337)$ or $0.22663]$ $= 0.372(08)$ B1 B1 B1 B12Must have diff of 2 probs for each B1 Accept 0.599 Accept 0.773 or 0.227 AG; do not mark simply on answer(ii) $P(0 \text{ in } 4) = [1 - 0.372]^4$ $= 0.628^4 = 0.155 \text{ to } 0.156$ $= 0.628^4 = 0.155 \text{ to } 0.156$ A1A12AwFW Accept $[1 - c's (b)(i)]^4$ (c)Weight, $Y \sim N(10.75, 0.50^2)$ Variance of $\overline{Y_6} = 0.5^2/6 = 0.0416$ to $0.0417$ or Sd of $\overline{Y_6} = 0.57/6 = 0.204$ B1CAO or AWFW Stated or used CAO or AWFT $P(\overline{Y_6} < 10.5) = P\left(Z < \frac{10.5 - 10.75}{\sqrt{0.0416}}\right) =$ M1Standardising 10.5 with 10.75 and $\sqrt{0.0416}$ OE; allow (10.75 - 10.5) $P(\overline{Y_6} < 10.5) = P\left(Z < \frac{10.5 - 10.75}{\sqrt{0.0416}}\right) =$ M1At the arrow of a naswer $< 0.5$ ; but do not award for use of $z = \pm 0.22$ $1 - (0.88877 \text{ to } 0.89065) = 0.109 \text{ to } 0.112$ A14AWFW AWFW (0.11034) (1 - answer) $\Rightarrow$ B1 M1 max	(b)	<u>Weight, <math>X \sim N(5.25, 0.20^2)</math></u>					
(ii)       P(0 in 4) = $[1 - 0.372]^4$ M1       Accept $[1 - c's (b)(i)]^4$ $= 0.628^4 = 0.155 \text{ to } 0.156$ A1       2       AWFW $(0.15554)$ (c)       Weight, $Y \sim N(10.75, 0.50^2)$ A1       2       AWFW $(0.15554)$ Variance of $\overline{Y_6} = 0.5^2/6 = 0.0416$ to $0.0417$ or       B1       CAO or AWFW Stated or used CAO or AWRT       CAO or AWFW $P(\overline{Y_6} < 10.5) = P\left(Z < \frac{10.5 - 10.75}{\sqrt{0.0416}}\right) =$ M1       Standardising 10.5 with 10.75 and $\sqrt{0.0416}$ OE; allow (10.75 - 10.5) $P(\overline{Y_6} < 10.5) = P\left(Z < \frac{10.5 - 10.75}{\sqrt{0.0416}}\right) =$ m1       Correct area change May be implied by a correct answer or an answer < 0.5; but do not award for use of $z = \pm 0.22$ $1 - (0.88877$ to $0.89065) = 0.109$ to $0.112$ A1       4       AWFW (0.11034) (1 - answer) $\Rightarrow$ B1 M1 max	(i)	P(5.1 < X < 5.3) = P(Z < 0.25) - P(Z < -0.75) = 0.59871 MINUS [(1 - 0.77337) or 0.22663] = 0.372(08)	B1 B1	2	Must have diff of 2 probs for each B1 Accept 0.599 Accept 0.773 or 0.227 AG; do <b>not</b> mark simply on answer		
= $0.628^4 = 0.155 \text{ to } 0.156$ A1       2       AWFW       (0.15554)         (c)       Weight, $Y \sim N(10.75, 0.50^2)$ B1       CAO or AWFW       CAO or AWFW         or       Sd of $\overline{Y_6} = 0.5^2/6 = 0.0416$ to $0.0417$ B1       CAO or AWFW $P(\overline{Y_6} < 10.5) = P\left(Z < \frac{10.5 - 10.75}{\sqrt{0.0416}}\right) =$ M1       Standardising 10.5 with 10.75 and $\sqrt{0.0416}$ OE; allow (10.75 - 10.5) $P(\overline{Y_6} < 10.5) = P\left(Z < \frac{10.5 - 10.75}{\sqrt{0.0416}}\right) =$ m1       Correct area change May be implied by a correct answer or an answer < 0.5; but do not award for use of $z = \pm 0.22$ $1 - (0.88877 \text{ to } 0.89065) = 0.109 \text{ to } 0.112$ A1       4       AWFW (0.11034) (1 - answer) $\Rightarrow$ B1 M1 max	(ii)	$P(0 \text{ in } 4) = [1 - 0.372]^4$	M1		Accept $[1 - c's (b)(i)]^4$		
(c)       Weight, $Y \sim N(10.75, 0.50^2)$ B1       CAO or AWFW         Variance of $\overline{Y}_6 = 0.5^2/6 = 0.0416$ to $0.0417$ B1       CAO or AWFW         or       Sd of $\overline{Y}_6 = 0.5/\sqrt{6} = 0.204$ B1       CAO or AWFW $P(\overline{Y}_6 < 10.5) = P\left(Z < \frac{10.5 - 10.75}{\sqrt{0.0416}}\right) =$ M1       Standardising 10.5 with 10.75 and $\sqrt{0.0416}$ OE; allow (10.75 - 10.5) $P(\overline{Y}_6 < 10.5) = P\left(Z < \frac{10.5 - 10.75}{\sqrt{0.0416}}\right) =$ m1       Correct area change $P(Z < -1.22) = 1 - P(Z < 1.22) =$ m1       Correct area change $1 - (0.88877 \text{ to } 0.89065) = 0.109 \text{ to } 0.112$ A1       4         AWFW       (0.11034) (1 - answer) \Rightarrow B1 M1 max		$= 0.628^4 = 0.155 \text{ to } 0.156$	A1	2	AWFW (0.15554)		
Variance of $\overline{Y_6} = 0.5^2/6 = 0.0416$ to $0.0417$ or $Sd of \overline{Y_6} = 0.5/\sqrt{6} = 0.204$ B1       CAO or AWFW Stated or used CAO or AWRT $P(\overline{Y_6} < 10.5) = P\left(Z < \frac{10.5 - 10.75}{\sqrt{0.0416}}\right) =$ M1       Standardising 10.5 with 10.75 and $\sqrt{0.0416}$ OE; allow (10.75 - 10.5) $P(\overline{Y_6} < 10.5) = P\left(Z < -1.22\right) = 1 - P(Z < 1.22) =$ m1       Correct area change May be implied by a correct answer or an answer < 0.5; but do not award for use of $z = \pm 0.22$ $1 - (0.88877$ to $0.89065) = 0.109$ to $0.112$ A1       4       AWFW (0.11034) (1 - answer) $\Rightarrow$ B1 M1 max	(c)	<u>Weight, <math>Y \sim N(10.75, 0.50^2)</math></u>					
$P(\overline{Y_{6}} < 10.5) = P\left(Z < \frac{10.5 - 10.75}{\sqrt{0.0416}}\right) = M1$ $P(\overline{Y_{6}} < 10.5) = P\left(Z < \frac{10.5 - 10.75}{\sqrt{0.0416}}\right) = M1$ $P(Z < -1.22) = 1 - P(Z < 1.22) = M1$ $P(Z < -1.22) = 1 - P(Z < 1.22) = M1$ $P(Z < -1.22) = 1 - P(Z < 1.22) = M1$ $P(Z < -1.22) = 1 - P(Z < 1.22) = M1$ $P(Z < -1.22) = 1 - P(Z < 1.22) = M1$ $P(Z < -1.22) = 1 - P(Z < 1.22) = M1$ $P(Z < -1.22) = 1 - P(Z < 1.22) = M1$ $P(Z < -1.22) = 1 - P(Z < 1.22) = M1$ $P(Z < -1.22) = 1 - P(Z < 1.22) = M1$ $P(Z < -1.22) = 1 - P(Z < 1.22) = M1$ $P(Z < -1.22) = 1 - P(Z < 1.22) = M1$ $P(Z < -1.22) = 1 - P(Z < 1.22) = M1$ $P(Z < -1.22) = 1 - P(Z < 1.22) = M1$ $P(Z < -1.22) = 1 - P(Z < 1.22) = M1$ $P(Z < -1.22) = 1 - P(Z < 1.22) = M1$ $P(Z < -1.22) = 1 - P(Z < 1.22) = M1$ $P(Z < -1.22) = 1 - P(Z < 1.22) = M1$ $P(Z < -1.22) = 1 - P(Z < 1.22) = M1$ $P(Z < -1.22) = 1 - P(Z < 1.22) = M1$ $P(Z < -1.22) = 1 - P(Z < 1.22) = M1$ $P(Z < -1.22) = 1 - P(Z < 1.22) = M1$ $P(Z < -1.22) = 1 - P(Z < 1.22) = M1$ $P(Z < -1.22) = 1 - P(Z < 1.22) = M1$ $P(Z < -1.22) = 1 - P(Z < 1.22) = M1$ $P(Z < -1.22) = 1 - P(Z < 1.22) = M1$ $P(Z < -1.22) = 1 - P(Z < 1.22) = M1$ $P(Z < -1.22) = 1 - P(Z < 1.22) = M1$ $P(Z < -1.22) = 1 - P(Z < 1.22) = M1$ $P(Z < -1.22) = 1 - P(Z < 1.22) = M1$ $P(Z < -1.22) = 1 - P(Z < 1.22) = M1$ $P(Z < -1.22) = 1 - P(Z < 1.22) = M1$ $P(Z < -1.22) = 1 - P(Z < 1.22) = M1$ $P(Z < -1.22) = 1 - P(Z < 1.22) = M1$ $P(Z < -1.22) = 1 - P(Z < 1.22) = M1$ $P(Z < -1.22) = 1 - P(Z < 1.22) = M1$ $P(Z < -1.22) = 1 - P(Z < 1.22) = M1$ $P(Z < -1.22) = 1 - P(Z < 1.22) = M1$ $P(Z < -1.22) = 1 - P(Z < 1.22) = M1$ $P(Z < -1.22) = 1 - P(Z < 1.22) = M1$ $P(Z < -1.22) = 1 - P(Z < 1.22) = M1$ $P(Z < -1.22) = M$		Variance of $\overline{Y}_{6} = 0.5^{2}/6 = 0.0416$ to 0.0417 or Sd of $\overline{Y}_{6} = 0.5/\sqrt{6} = 0.204$	B1		CAO or AWFW Stated or used CAO or AWRT		
$P(Z < -1.22) = 1 - P(Z < 1.22) =$ m1Correct area change May be implied by a correct answer or an answer < 0.5; but do not award for use of $z = \pm 0.22$ $1 - (0.88877 \text{ to } 0.89065) = 0.109 \text{ to } 0.112$ A14AWFW (0.11034) (1 - answer) $\Rightarrow$ B1 M1 maxTotal		$P(\overline{Y}_{6} < 10.5) = P\left(Z < \frac{10.5 - 10.75}{\sqrt{0.0416}}\right) =$	M1		Standardising 10.5 with 10.75 and $\sqrt{0.0416}$ OE; allow (10.75 – 10.5)		
$\begin{array}{ c c c c c c c } \hline 1 & - & (0.88877 \text{ to } 0.89065) = \underline{0.109 \text{ to } 0.112} \\ \hline & & A1 \end{array}  A1 \qquad A \qquad \begin{array}{ c c c c c c c c c c c c c c c c c c c$		P(Z < -1.22) = 1 - P(Z < 1.22) =	m1		<b>Correct</b> area change May be implied by a correct answer or an answer < 0.5; but do not award for use of $z = \pm 0.22$		
Total 13		1 - (0.88877  to  0.89065) = 0.109  to  0.112	A1	4	AWFW(0.11034) $(1 - answer) \Rightarrow B1 M1 max$		
		Total		13			

MS/SS1B	(cont)	1	Г <u> </u>	
Q	Solution	Marks	Total	Comments
6 (a)(i)	<u><math>U \sim B(30, 0.13, 0.35 \text{ or } 0.20)</math></u>	M1		Used correctly anywhere in (a)
	$P(P=2) = {\binom{30}{2}} (0.13)^2 (0.87)^{28}$	A1		Can be implied by a <b>correct</b> answer
	= <u>0.148 to 0.15</u>	A1	3	AWFW (0.1489)
( <b>ii</b> )	p = 0.35	<b>B</b> 1		CAO
	$P(R \cup P > 10) = 1 - (0.5078 \text{ or } 0.3575)$	M1		Requires '1 –' Accept 3 dp rounding or truncation Can be implied by 0.49 to 0.493 but <b>not</b> by 0.642 to 0.643
	= <u>0.49 to 0.493</u>	A1	3	AWFW (0.4922)
(iii)	$P(5 \le G \le 10) = 0.9744 \text{ or } 0.9389$ $(p_1)$	M1		Accept 3 dp rounding or truncation
	<b>MINUS 0.2552 or 0.4275</b> ( <i>p</i> <sub>2</sub> )	M1		Accept 3 dp rounding or truncation
	$=$ <b><u>0.719 to 0.72</u></b> ( $p_3$ )	A1	3	AWFW (0.7192)
Notes	$\begin{array}{ccccc} 1 & p_3 \leq 0 & \text{or} & p_3 \geq 1 \implies & \text{M0 M0 A0} \\ 2 & p_2 - p_1 \implies & \text{M0 M0 A0} \\ 3 & (1 - p_2) - p_1 \implies & \text{M0 M0 A0} \end{array}$	1	4 5 6 (1	$p_1 - (1 - p_2) \implies M1 \text{ M0 A0}$ $p_1 \times p_2 \implies M1 \text{ M0 A0}$ $-p_2) - (1 - p_1) \implies M1 \text{ M1 (A1)}$
(b)(i)	Mean or $\mu = 100 \times 0.22$ = <u>22</u> Variance or $\sigma^2 = 100 \times 0.22 \times 0.78$	B1		CAO
	= <u>17.1 to 17.2</u>	B1	2	AWFW (ignore notation)(17.16)ISW all subsequent working
(ii)	22.1 $\approx/=$ 22 or means similar/equal or 0.221 $\approx/=$ 0.22 or proportions similar/equal so reject claim (that $p > 0.22$ ) or accept that $p = 0.22$	B1		Dependent on 22 seen in (b)(i) or (ii) Accept diff = 0.1 CAO <b>Correct</b> (numerical) comparison with <b>correct</b> conclusion (even if at end and stated as 'reject (both) claims')
	$\sqrt{17.1 \text{ to } 17.2} = 4.13 \text{ to } 4.15 \approx 4.17$	B1		Comparison using two values <b>or</b> one value + diff (0.02 to 0.04 AWFW)
	<u>17.1 to 17.2 ≈/= 17.3 to 17.4</u>			Comparison using two values <b>or</b> one value + diff (0.1 to 0.3 AWFW)
	so reject claim that not random samples			Dependent on previous B1
	or accept that are random samples	Bdep1	3	<b>Correct</b> conclusion regarding randomness of sample
	Total		14	

MS/SS1B	SS1B (cont)						
Q	Solution	Marks	Total	Comments			
7 (a)	$\overline{x} = \frac{181.8}{36} = $ <u>5.05 or 5050</u>	B1		CAO			
	98% (0.98) $\Rightarrow z = 2.32 \text{ to } 2.33$	B1		AWFW (2.3263)			
	CI for $\mu$ is $\overline{x} \pm z \times \frac{\sigma}{\sqrt{n}}$	M1		Used with $z$ (2.05 to 2.58), $\overline{x}$ (5.05, 5050 or 181.8), $\sigma$ (0.0075, 0.075, 0.75, 7.5 or 75) and $\div \sqrt{n}$ with $n > 1$			
	Thus $5.05 \pm 2.3263 \times \frac{0.075}{\sqrt{36}}$	A1		$z (2.05 \text{ to } 2.06 \text{ or } 2.32 \text{ to } 2.33 \\ \text{or } 2.57 \text{ to } 2.58), \\ \overline{x} (5.05) \& \sigma (0.075) \text{ or} \\ \overline{x} (5050) \& \sigma (75) \\ \text{and } \div \sqrt{36 \text{ or } 35} \end{cases}$			
	Hence $5.05 \pm 0.03$ or $5050 \pm 30$ OR (5.02, 5.08) or (5020, 5080)	Adep1	5	CAO/AWRT Dependent on previous A1 so can be scored with $z \neq 2.32$ to 2.33 Ignore (absence of) quoted units AWRT to 3sf accuracy			
Note	Use of $t(2.43 \text{ to } 2.72) \implies B1 B0 M1 A0 A0 \text{ max}$						
(b)	Clear correct comparison of 5 or 5000 with LCL or CI so agree with (first) claim (about mean)	Adep1		Dependent on Adep1 in (a) Must use consistent units			
	(8/36 or 0.22 or 22%) v (1/10 or 0.10 or 10%) or 8 v 3.6 (3 to 4)	B1		Mention of a value on LHS and a value on RHS			
	so 8/36 OE >/≠ 1/10 OE so <b>disagree</b> with (second) claim (about individuals)	Bdep1	3	Dependent on B1 Explicit comparison of values and correct conclusion			
Notes	<ol> <li>It/(claimed) mean/(claimed) value &lt; LCL/CI ⇒ Adep0</li> <li>98% have (mean) weights between CLs so ⇒ Adep0</li> <li>Any reference to CI for second claim ⇒ B0 Bdep0 C</li> </ol>	Must indicate 5 or 5000 0 laim refers to individual bottles					
(c)	Yes because volumes/bleach/litres/bottles/ (parent) population are not (stated as) normally distributed	B1	1	OE; but do <b>not</b> accept 'data' or 'sample' or 'it' Reference to sample size only $\Rightarrow$ B0 (eg $n > 25$ or $n > 30$ )			
	Total		9				
	TOTAL		75				