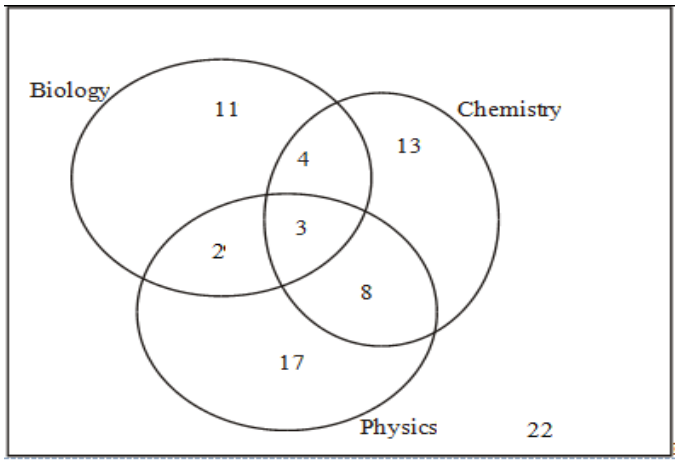
A level Mathematics Practice Paper – Probability – Mark scheme

Question	Scheme	Marks
1(a)	*(R* and *S* are mutually) exclusive.	B1
		(1)
1(b)	$\frac{2}{3} = \frac{1}{4} + \mathrm{P}(B) - \mathrm{P}(A \cap B)$ use of Addition Rule	M1
	$\frac{2}{3} = \frac{1}{4} + \mathrm{P}(B) - \frac{1}{4} \times \mathrm{P}(B)$ use of independence	M1 A1
	$\frac{5}{12} = \frac{3}{4}\ \mathrm{P}(B)$	
	$\mathrm{P}(B) = \frac{5}{9}$	A1
		(4)
1(c)	$\mathrm{P}(A' \cap B) = \frac{3}{4} \times \frac{5}{9} = \frac{15}{36} = \frac{5}{12}$	M1A1ft
		(2)
1(d)	$\mathrm{P}(B' \mid A) = \frac{(1 - (\mathrm{b})) \times 0.25}{0.25}$ or $\mathrm{P}(B')$ or $\frac{\frac{1}{9}}{\frac{1}{4}}$	M1
	$= \frac{4}{9}$	A1
		(2)
		(9 marks)

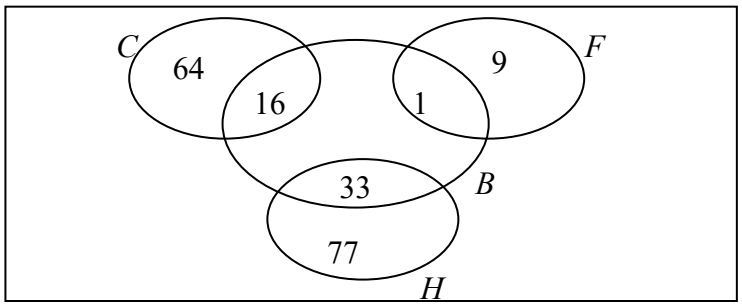
A level Mathematics Practice Paper – Probability – Mark scheme

Question	Scheme	Marks
2(a)		B1 M1 A1 A1 B1
		(5)
2(b)	$\frac{\text{'13'}}{80}$ or 0.1625	B1ft
		(1)
2(c)	$\frac{28+30-11}{80}$ or $\frac{2+3+4+8+13+17}{80}$ or $1-\frac{(11+22)}{80}=\frac{47}{80}$ or 0.5875	M1 A1
		(2)
2(d)	$\frac{\text{"17+8+13"}}{\text{"47"}}$ or $\frac{\frac{\text{"38"}}{80}}{\frac{\text{"47"}}{80}}$ or $1-\frac{\text{"2+3+4"}}{\text{"47"}}=\frac{38}{47}$ (condone awrt 0.809)	M1 A1cao
		(2)
2(e)	$P(B\|C)=\frac{7}{28}$, $P(B)=\frac{20}{80}$ $P(C\|B)=\frac{7}{20}$, $P(C)=\frac{28}{80}$ $P(B\cap C)=\frac{7}{80}$, $P(B)\ =\ \frac{20}{80}P(C)=\frac{28}{80}$ $P(B\|C)=P(B)$, $P(C\|B)=P(C)$ these may be implied by correct conclusion $P(B\cap C)=P(B)\times P(C)$ this approach requires the product to be seen So, they are independent.	M1 M1 A1
		(3)
		(13 marks)

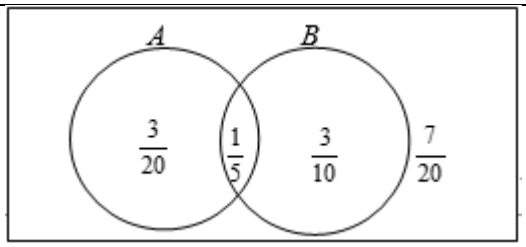
A level Mathematics Practice Paper – Probability – Mark scheme

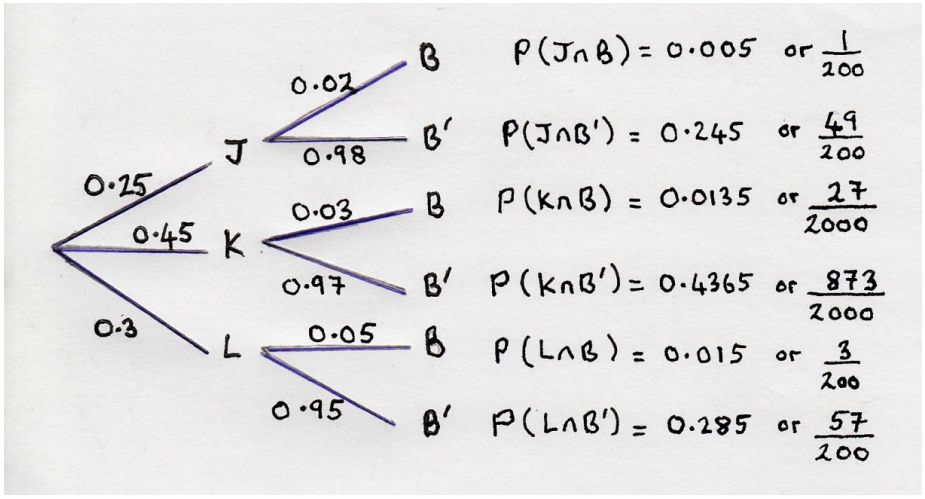
Question	Scheme	Marks
3(a)	$p = \mathrm{P}(B \cap C) = \quad \mathrm{P}(B) \times \mathrm{P}(C) = 0.6 \times 0.25 \;\; = \mathbf{\underline{0.15}}$	M1
	$q = [\mathrm{P}(C) - p\,] = \mathbf{\underline{0.10}}$	A1
		(2)
3(b)	$r = 1 - 0.08 - [\mathrm{P}(B) + q] = 1 - 0.08 - 0.6 - 0.1$ (o.e.) or $1 - 0.08 - (0.6+0.25 - p)$	M1
	$= \mathbf{\underline{0.22}}$	A1cao
		(2)
3(c)	$s \;= [\mathrm{P}(A) - r\,] = \mathbf{\underline{0.28}}$	B1ft
	$t = [\,\mathrm{P}(B) - p - s$ or use $\mathrm{P}(B \cap C') - s = 0.6 \times 0.75 - "0.28"\;] = \mathbf{\underline{0.17}}$	B1ft
		(2)
3(d)	$\mathrm{P}(A) \times \mathrm{P}(B) = 0.5 \times 0.6 = 0.3$ which is not equal to s (= 0.28)	M1
	So A and B are not independent	A1
		(2)
3(e)	$\dfrac{(s+p) \text{ or } (0.6-t)}{\mathrm{P}(A \cup C) \text{ or } [\mathrm{P}(A) + \mathrm{P}(C)] \text{or } (r+s+p+q)}$, = $\dfrac{("0.28"+"0.15") \text{ or } (0.6-"0.17")}{0.5+0.25}$	M1 A1ft
	$= \underline{\frac{43}{75}}$	A1
		(3)
		(11 marks)

A level Mathematics Practice Paper – Probability – Mark scheme

Question	Scheme	Marks
4(a)	$\frac{35+75}{200}=0.55$	M1 A1
		(2)
4(b)	$\frac{200-2}{200}=0.99$	M1 A1
		(2)
4(c)	$\left[\mathrm{P}\left(W \mid C\right)\right]=\frac{\mathrm{P}(W \cap C)}{\mathrm{P}(C)}=\frac{30/200}{80/200}=\frac{30}{80}=0.375$	M1 A1
		(2)
4(d)		M1 B1 for 9, 1 B1 for 77,33 B1 for 64,16
	Allow diagrams with intersections between *F, C* and *H* provided these are marked with 0. If their diagram indicates extra empty regions do not treat a blank as 0.	
		(4)
4(e)	$\frac{1+16+33}{200}=0.25$	M1 A1
		(2)
		(12 marks)

A level Mathematics Practice Paper – Probability – Mark scheme

Question	Scheme		Marks
5(a)	$P(A \cap B) = P(A \mid B) \times P(B)$		
	$P(A \cap B) = \frac{2}{5} \times \frac{1}{2} = \frac{1}{5}$		M1 A1
			(2)
5(b)		2 intersecting circles and 'P($A \cap B$)'	B1ft
		$\frac{3}{20}$ and $\frac{3}{10}$	B1
		Box and $\frac{7}{20}$	B1
			(3)
5(c)	$\left[P(A) = \frac{3}{20} + \frac{1}{5} \right] = \frac{7}{20}$ or 0.35		B1ft
			(1)
5(d)	$P(B \mid A) = \frac{P(A \cap B)}{P(A)} = \frac{\frac{1}{5}}{\frac{7}{20}}$		M1
	$= \frac{4}{7}$		A1 cao
			(2)
5(e)	0.3		B1ft
			(1)
			(9 marks)

Question	Scheme	Marks
6(a)		M1 A1
		(2)
6(b)	0.25×0.98, $= \mathbf{0.245}$ (or exact equiv. e.g. $\frac{49}{200}$)	M1A1
		(2)
6(c)	$0.25\times0.02+0.45\times0.03+0.3\times0.05$, $= \mathbf{0.0335}$ (or exact equiv. e.g. $\frac{67}{2000}$)	M1A1
		(2)
6(d)	$[\mathrm{P}(J\cup L\mid B)] = \dfrac{0.25\times0.02+0.3\times0.05}{0.0335}$ or $\dfrac{0.0335-0.45\times0.03}{0.0335}$	M1A1ft
	$= 0.5970...$ awrt **0.597** (or $\frac{40}{67}$ or exact equiv.)	A1
		(3)
		(9 marks)

A level Mathematics Practice Paper – Probability – Mark scheme

Question	Scheme	Marks
7(a)	B, W or T, W [accept $B \cup T, W$ or $B \cap T, W$] [Condone P(B), P(W) etc]	B1
	Since there is no overlap between the events or cannot happen together (o.e.)	B1
	(Accept comment in context e.g. "no one walks and takes the train")	
		(2)
7(b)	e.g. $\mathrm{P}(B) = \frac{9}{25}$, $\mathrm{P}(T) = \frac{8}{25}$, $\mathrm{P}(B \cap T) = \frac{5}{25}$	M1
	$\mathrm{P}(B \cap T) \neq \mathrm{P}(B) \times \mathrm{P}(T)$ [$0.2 \neq 0.36 \times 0.32 = 0.1152$ o.e.]	M1
	So B and T are not independent	A1cso
		(3)
7(c)	[P(W) =] $\frac{7}{25}$ or 0.28	B1
		(1)
7(d)	[P($B \cap T$) =] $\frac{5}{25}$ or $\frac{1}{5}$ or 0.2	B1
		(1)
7(e)	[P($T \mid B$) =] $\frac{\mathrm{P}(T \cap B)}{\mathrm{P}(B)} = \frac{\text{"(d)"}}{(5+4)/25}$	M1
	$= \frac{5}{9}$ or $0.\dot{5}$	A1
		(2)
		(9 marks)

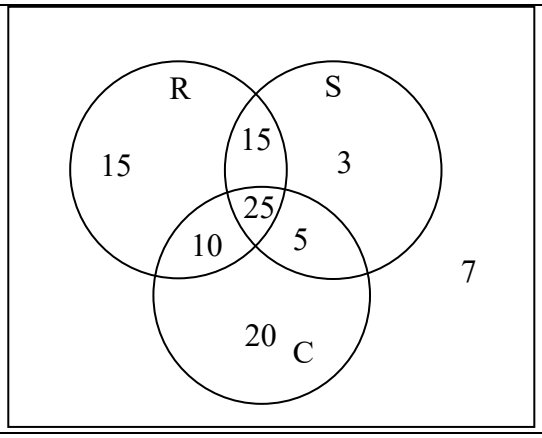
A level Mathematics Practice Paper – Probability – Mark scheme

Question	Scheme	Marks
8(a)	[P(B) = 0.4, P(A) = p + 0.1 so] $0.4\times(p+0.1)=0.1$ or $0.4\times\text{P}(A)=0.1$	M1
	$p=\frac{1}{4}-0.1$ **$\underline{p = 0.15}$**	M1A1
		(3)
8(b)	$\frac{5}{11}=\left[\frac{\text{P}(B\cap C)}{\text{P}(C)}=\right]\frac{0.2}{0.2+q}$ or $\frac{5}{11}=\frac{0.2}{\text{P}(C)}$	M1
	$11\times0.2=5\times(0.2+q)$	dM1
	$\underline{q = 0.24}$	A1
	$r = 0.6 – (p + q)$ i.e. **$\underline{r = 0.21}$**	A1ft
		(4)
8(c)	$\left[\frac{\text{P}((A\cup C)\cap B)}{\text{P}(B)}\right]=\frac{0.3}{0.4}$	M1
	= **$\underline{0.75}$**	A1
		(2)
		(9 marks)

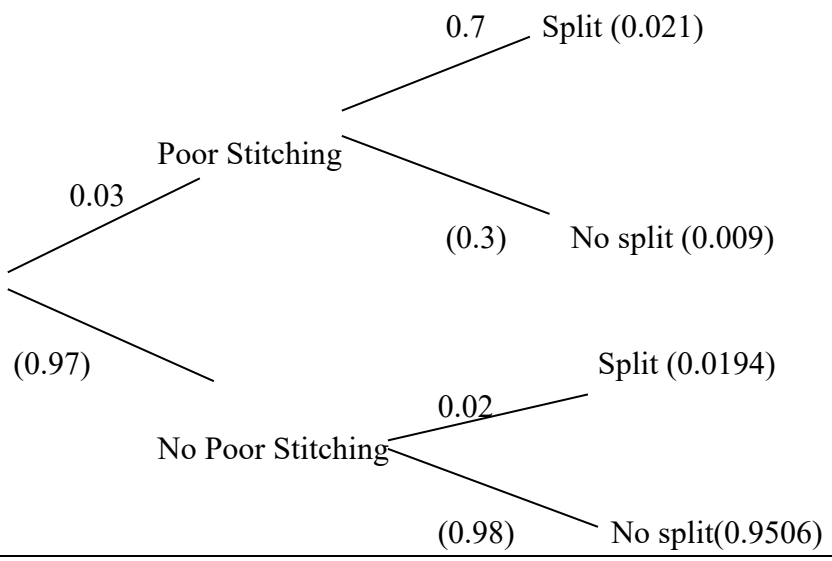
A level Mathematics Practice Paper – Probability – Mark scheme

Question	Scheme	Marks
9(a)	$P(J \cup K) = 1 - 0.7$ or $0.1 + 0.15 + 0.05 =$ $\underline{0.3}$	B1
		(1)
9(b)	$P(K) = 0.05 + 0.15$ or "0.3" – 0.25 + 0.15 or "0.3" = 0.25 + $P(K)$ – 0.15	M1
	May be seen on Venn diagram	
	$= \underline{0.2}$	A1
		(2)
9(c)	$\left[P(K \mid J)\right] = \dfrac{P(K \cap J)}{P(J)}$	M1
	$= \dfrac{0.15}{0.25}$	A1
	$= \underline{\dfrac{3}{5}}$ $\underline{\text{or } 0.6}$	A1
		(3)
9(d)	$P(J) \times P(K) = 0.25 \times 0.2 (= 0.05)$, $P(J \cap K) = 0.15$ $\underline{\text{or}}$ $P(K \mid J) = 0.6$, $P(K) = 0.2$ $\underline{\text{or}}$ may see $P(J \mid K) = 0.75$ and $P(J) = 0.25$	M1
	not equal therefore not independent	A1ft
		(2)
9(e)	Not independent so confirms the teacher's suspicion $\underline{\text{or}}$ they are linked	B1ft
	(This requires a statement about independence in (d) or in (e))	
		(1)
		(9 marks)

A level Mathematics Practice Paper – Probability – Mark scheme

Question	Scheme		Marks
10(a)		3 closed curves and 25 in correct place	M1
		15,10,5	A1
		15,3,20	A1
		Labels R, S, C and box	B1
	All values/100 or equivalent fractions award accuracy marks.		
			(4)
10(b)	7/100 or 0.07 or here)/100 M1 for ('their 7'in diagram		M1 A1
			(2)
10(c)	(3+5)/100 = 2/25 or 0.08		M1A1
			(2)
10(d)	(25+15+10+5)/100 = 11/20 or 0.55		M1 A1
			(2)
10(e)	$\mathrm{P}\left(S \cap C' \middle\| R\right) = \dfrac{P\left(S \cap C' \cap R\right)}{P(R)}$ Require denominator to be 'their 65' or 'their $\dfrac{65}{100}$',		M1
	$= \dfrac{15}{65}$ require 'their 15' and correct denominator of 65		A1
	$= \dfrac{3}{13}$ or exact equivalents.		A1
			(3)
			(13 marks)

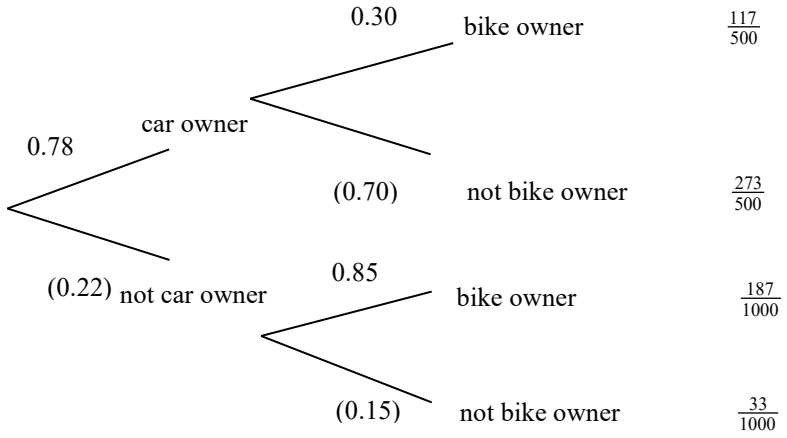
A level Mathematics Practice Paper – Probability – Mark scheme

Question	Scheme	Marks
11(a)		
	Shape	B1
	Labels & 0.03	B1
	Labels & 0.7,0.02	B1
		(3)
11(b)	P(Exactly one defect) = $0.03\times0.3+0.97\times0.02$ or $P(PS\cup Split)-2P(PS\cap Split)$	M1A1ft
	= [0.009 + 0.0194 =] **<u>0.0284</u>**	A1 cao
		(3)
11(c)	P(No defects) = $(1-0.03)\times(1-0.02)\times(1-0.05)$ (or better)	M1
	= 0.90307 **awrt <u>0.903</u>**	A1 cao
		(2)
11(d)	P(Exactly one defect) = (b)$\times(1-0.05)$ + $(1-0.03)\times(1-0.02)\times0.05$	M1 M1
	= "0.0284"$\times0.95+0.97\times0.98\times0.05$	A1ft
	= [0.02698 + 0.04753] = 0.07451 **awrt <u>0.0745</u>**	A1 cao
		(4)
		(12 marks)

A level Mathematics Practice Paper – Probability – Mark scheme

Question	Scheme		Marks
12(a)		both $\frac{2}{3},\frac{1}{3}$	B1
		$\frac{4}{9}$	B1
		both $\frac{3}{5},\frac{2}{5}$	B1
		all three of $\frac{4}{9},\frac{4}{9},\frac{5}{9}$	B1
			(4)
12(b)	$\mathrm{P}(A)=\mathrm{P}(RR)+\mathrm{P}(YY)=\frac{1}{2}\times\frac{2}{5}+\frac{1}{2}\times"\frac{2}{5}"=\frac{2}{5}$	B1 for $\frac{1}{2}\times\frac{2}{5}$ (oe) seen at least once	B1 M1 A1
			(3)
12(c)	$\mathrm{P}(B)=\mathrm{P}(RRR)+\mathrm{P}(RYR)+\mathrm{P}(YRR)+\mathrm{P}(YYR)$	M1 for at least 1 case of 3 balls identified. (Implied by 2nd M1)	M1
	$\left(\frac{1}{2}\times\frac{2}{5}\times"\frac{2}{3}"\right)+\left(\frac{1}{2}\times\frac{3}{5}\times\frac{5}{9}\right)+\left(\frac{1}{2}\times"\frac{3}{5}"\times\frac{5}{9}\right)+\left(\frac{1}{2}\times"\frac{2}{5}"\times"\frac{4}{9}"\right)\quad=\frac{5}{9}$ **(*)**		M1 A1cso
			(3)
12(d)	$\mathrm{P}(A\cap B)=\mathrm{P}(RRR)+\mathrm{P}(YYR)$	M1 for identifying both cases and + probs. may be implied by correct expressions	M1
	$=\left(\frac{1}{2}\times\frac{2}{5}\times\frac{2}{3}\right)+\left(\frac{1}{2}\times\frac{2}{5}\times\frac{4}{9}\right)\qquad=\frac{2}{9}$ **(*)**		A1cso
			(2)
12(e)	$\mathrm{P}(A\cup B)=\mathrm{P}(\mathrm{A})+\mathrm{P}(\mathrm{B})-\mathrm{P}(A\cap B)$ Must have some attempt to use		M1
	$="\frac{2}{5}"+\frac{5}{9}-\frac{2}{9}\quad=\frac{11}{15}$		A1cao
			(2)
12(f)	$\frac{\mathrm{P}(RRR)}{\mathrm{P}(RRR)+\mathrm{P}(YYY)}=\frac{\frac{1}{2}\times\frac{2}{5}\times\frac{2}{3}}{\left(\frac{1}{2}\times\frac{2}{5}\times\frac{2}{3}\right)+\left(\frac{1}{2}\times\frac{2}{5}\times\frac{5}{9}\right)}=\frac{6}{11}$	Probabilities must come from the product of 3 probs. from their tree diagram.	M1 A1ft A1 cao
			(3)
			(17 marks)

A level Mathematics Practice Paper – Probability – Mark scheme

Question	Scheme	Marks
13(a)		B1 B1 B1
		(3)
13(b)	P(car or bike but not both)$= 0.78\times 0.70 + 0.22\times 0.85 = 0.733$	M1 A1
		(2)
13(c)	$[\text{P(car}\mid\text{bike)}] = \dfrac{\text{P(car}\cap\text{bike)}}{\text{P(bike)}} = \dfrac{0.78\times 0.30}{0.78\times 0.30 + 0.22\times 0.85}, = 0.555819....$ **awrt** 0.556	M1A1 A1
		(3)
13(d)	$\text{P(bike)} = 0.78\times 0.30 + 0.22\times 0.85 = 0.421$, P(not bike) = 1 – 0.421 $0.421\times 0.579 + 0.579\times 0.421$ = 0.487518 **awrt** 0.488	M1 dM1 A1
		(3)
		(11 marks)

A level Mathematics Practice Paper – Probability – Mark scheme

<table>
<tr><th>Question</th><th colspan="3">Scheme</th><th>Marks</th></tr>
<tr><td>14(a)</td><td colspan="3">$[\,\mathrm{P}(A)=1-0.18-0.22\,]$ = 0.6 (or exact equivalent)</td><td>B1</td></tr>
<tr><td></td><td colspan="3"></td><td>(1)</td></tr>
<tr><td>14(b)</td><td colspan="3">$\mathrm{P}(A\cup B)="0.6"+0.22$ = 0.82 (or exact equivalent)</td><td>B1ft</td></tr>
<tr><td></td><td colspan="3"></td><td>(1)</td></tr>
<tr><td rowspan="5">14(c)</td><td>$x=\mathrm{P}(A\cap B)$</td><td>Use
$\mathrm{P}(B)\mathrm{P}(A'\mid B)=\mathrm{P}(A'\cap B)$</td><td>Establish
independence before or after 1st M1and score marks for (d) (RH ver)</td><td>M1</td></tr>
<tr><td>$\dfrac{x}{x+0.22}=0.6$</td><td>$\mathrm{P}(B)\times[1-0.6]=0.22$</td><td>Find $\mathrm{P}(B)$</td><td></td></tr>
<tr><td>$x=0.6x+0.132$</td><td>Use $\mathrm{P}(A\cap B)=\mathrm{P}(A\mid B)\mathrm{P}(B)$</td><td>Use
$\mathrm{P}(B)\mathrm{P}(A)=\mathrm{P}(A\cap B)$</td><td>dM1</td></tr>
<tr><td>$0.4x=0.132$</td><td>$\mathrm{P}(A\cap B)=0.6\times0.55$</td><td>$\mathrm{P}(A\cap B)=0.6\times0.55$</td><td></td></tr>
<tr><td colspan="3">$x=$ 0.33 (or exact equivalent)</td><td>A1cso</td></tr>
<tr><td></td><td colspan="3"></td><td>(3)</td></tr>
<tr><td rowspan="5">14(d)</td><td colspan="3">$\mathrm{P}(B)=0.55$</td><td></td></tr>
<tr><td colspan="2">$\mathrm{P}(B)\times\mathrm{P}(A)=0.55\times0.6$</td><td>or stating $\mathrm{P}(A)=\mathrm{P}(A|B)$ [= 0.6]</td><td>M1</td></tr>
<tr><td colspan="2">$=0.33$</td><td></td><td></td></tr>
<tr><td colspan="2">$\mathrm{P}(B)\times\mathrm{P}(A)=\mathrm{P}(A\cap B)$
therefore (statistically) independent</td><td>or $\mathrm{P}(A)=\mathrm{P}(A|B)$
therefore (statistically) independent</td><td>A1cso</td></tr>
<tr><td></td><td colspan="3"></td><td>(2)</td></tr>
<tr><td></td><td colspan="3"></td><td>(7 marks)</td></tr>
</table>

A level Mathematics Practice Paper – Probability – Mark scheme

	Source paper	Question number	New spec references	Question description	New AOs
1	S1 Jan 2012	2	A 3.1, 3.2	Probability	1.1b, 1.2, 3.1a
2	S1 2015	3	A 3.1, 3.2	Probability	1.1b, 2.1, 2.4, 3.1b, 3.4
3	S1 2017	3	A 3.1, 3.2	Probability	1.1b, 1.2, 2.4, 3.1a
4	S1 2013	3	A 3.1, 3.2	Probability	1.1b, 3.1a, 3.1b, 3.4
5	S1 2014R	4	A 3.1, 3.2	Probability	1.1b, 3.1a, 3.4
6	S1 2014	4	A 3.1, 3.2	Probability	1.1a, 1.1b, 3.4
7	S1 2012	4	A 3.1, 3.2	Probability	1.1b, 1.2, 2.4, 3.4
8	S1 2013R	6	A 3.1, 3.2	Probability and Venn diagram	1.1b, 1.2, 3.1a, 3.4
9	S1 2011	6	A 3.1, 3.2, 3.3	Probability	1.1b, 1.2, 2.1, 2.4, 3.1b
10	S1 Jan 2012	6	A 3.1, 3.2	Probability	1.1b , 3.1b, 3.4
11	S1 2012	7	A 3.1, 3.2	Probability	1.1b, 3.1b, 3.3, 3.4
12	S1 Jan 2011	7	A 3.1, 3.2	Probability	1.1b, 2.1, 3.1a, 3.1b
13	S1 2014R	7	A 3.1, 3.2	Probability, Tree diagram	1.1b, 3.1b, 3.4
14	S1 2014	8	A 3.1, 3.2	Probability	1.1b, 1.2, 2.1, 2.4