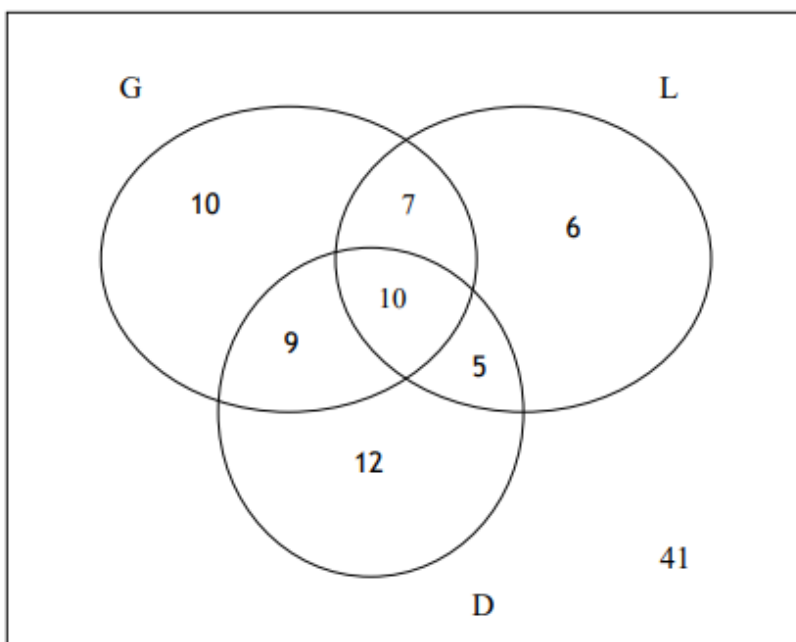


Conditional Probability and Venn Diagrams (From Edexcel 6683)

Q1, (Jun 2006, Q6)

(a)



3 closed curves that intersect
 Subtract at either stage
 9,7,5
 10,6,12
 41 & box

M1
 M1
 A1
 A1
 A1
 (6)

(b) $P(\overline{G}, \overline{LH}, \overline{D}) = \frac{10}{100} = \frac{1}{10}$

B1 ∫
 (1)

(c) $P(\overline{G}, \overline{LH}, \overline{D}) = \frac{41}{100}$

B1 ∫
 (1)

(d) $P(\text{Only two attributes}) = \frac{9+7+5}{100} = \frac{21}{100}$

M1A1 ∫
 (2)

(e) $P(G|LH \& DH) = \frac{P(G \& LH \& DH)}{P(LH \& DH)} = \frac{\frac{10}{100}}{\frac{15}{100}} = \frac{10}{15} = \frac{2}{3}$ awrt 0.667

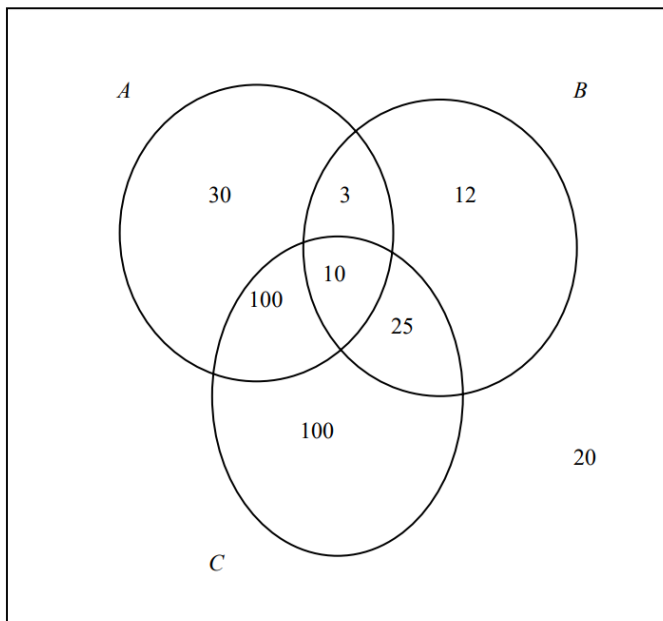
M1A1 ∫ A1

N.B. Assumption of independence M0

(3)
Total 13

Q2, (Jun 2008, Q5)

(a)



3 closed intersecting curves
with labels
100 100,30
12,10,3,25
Box

M1
A1
A1
B1

[4]

(b)

$$P(\text{Substance } C) = \frac{100+100+10+25}{300} = \frac{235}{300} = \frac{47}{60} \text{ or exact equivalent}$$

M1A1ft
[2]

(c)

$$P(\text{All 3} | A) = \frac{10}{30+3+10+100} = \frac{10}{143} \text{ or exact equivalent}$$

M1A1ft
[2]

(d)

$$P(\text{Universal donor}) = \frac{20}{300} = \frac{1}{15} \text{ or exact equivalent}$$

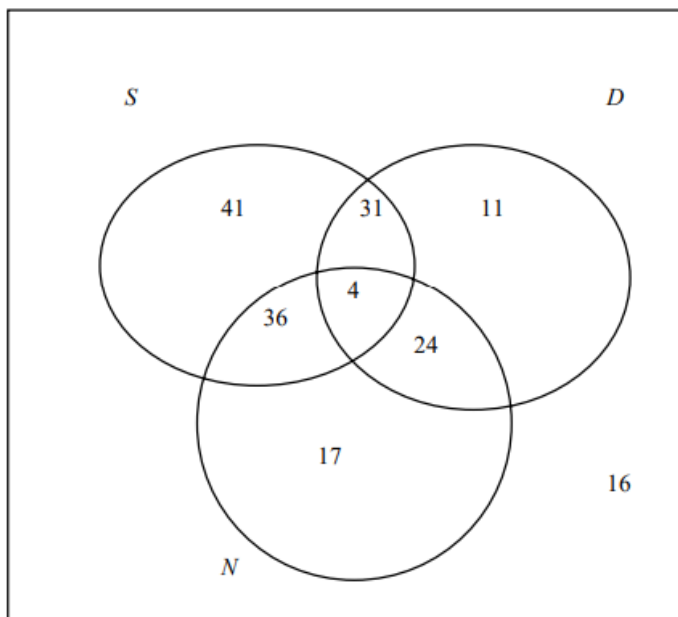
M1A1 cao
[2]
Total 10

Notes:

- (a) 20 not required. Fractions and exact equivalent decimals or percentages.
- (b) M1 For adding their positive values in C and finding a probability
A1ft for correct answer or answer from their working
- (c) M1 their 10 divided by their sum of values in A
A1ft for correct answer or answer from their working
- (d) M1 for 'their 20' divided by 300
A1 correct answer only

Q3, (Jan 2010, Q4)

(a)



3 closed curves and 4 in centre M1
 Evidence of subtraction M1
 31,36,24 A1
 41,17,11 A1
 Labels on loops, 16 and box B1

(b)

$$P(\text{None of the 3 options}) = \frac{16}{180} = \frac{4}{45}$$

(5)

(c)

$$P(\text{Networking only}) = \frac{17}{180}$$

B1ft

(1)

(d)

$$P(\text{All 3 options/technician}) = \frac{4}{40} = \frac{1}{10}$$

B1ft

(1)

M1 A1

(2)

Total [9]

Q4, (Jun 2010, Q4)

(a) $\frac{2+3}{\text{their total}} = \frac{5}{\text{their total}} = \frac{1}{6}$ (** given answer**)

M1 A1cso (2)

(b) $\frac{4+2+5+3}{\text{total}}, = \frac{14}{30}$ or $\frac{7}{15}$ or 0.46

M1 A1 (2)

(c) $P(A \cap C) = 0$

B1 (1)

(d) $P(C | \text{reads at least one magazine}) = \frac{6+3}{20} = \frac{9}{20}$

M1 A1 (2)

(e) $P(B) = \frac{10}{30} = \frac{1}{3}$, $P(C) = \frac{9}{30} = \frac{3}{10}$, $P(B \cap C) = \frac{3}{30} = \frac{1}{10}$ or $P(B|C) = \frac{3}{9}$

M1

$P(B) \times P(C) = \frac{1}{3} \times \frac{3}{10} = \frac{1}{10} = P(B \cap C)$ or $P(B|C) = \frac{3}{9} = \frac{1}{3} = P(B)$

M1

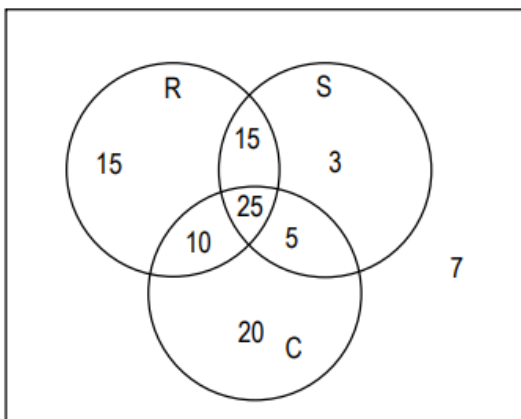
So yes they are statistically independent

A1cso (3)

Total 10

Q5, (Jan 2012, Q6)

(a)



3 closed curves and 25 in correct place

15,10,5

15,3,20

Labels *R, S, C* and box

M1

A1

A1

B1

All values/100 or equivalent fractions award accuracy marks.

(b) 7/100 or 0.07

M1 for ('their 7' in diagram or here)/100

(4)

M1 A1

(2)

(c) $(3+5)/100 = 2/25$ or 0.08

M1A1

(2)

(d) $(25+15+10+5)/100 = 11/20$ or 0.55

M1 A1

(2)

(e) $P(S \cap C' | R) = \frac{P(S \cap C' \cap R)}{P(R)}$

Require denominator to be 'their 65' or 'their $\frac{65}{100}$ '

M1

$$= \frac{15}{65}$$

require 'their 15' and correct denominator of 65

A1

$$= \frac{3}{13}$$

or exact equivalents.

A1

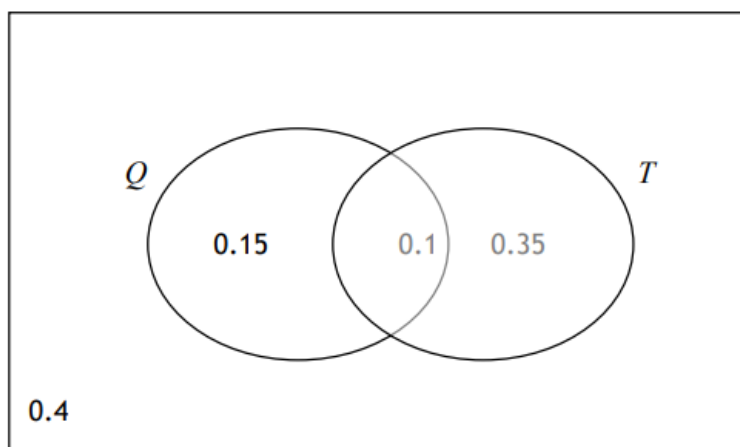
(3)

Total 13

Q6, (Jun 2007, Q4)

- (a) $P(Q \cup T) = 0.6$
 $P(Q) + P(T) - P(Q \cap T) = 0.6$
 $P(Q \cap T) = 0.1$
- (b)

B1
M1
A1
(3)



Venn
 0.15, 0.35
 0.4 and box

M1
A1
B1
(3)

(c) $P(Q \cap T' | Q \cup T) = \frac{0.15}{0.60} = \frac{1}{4}$ or 0.25 or 25%

M1A1
A1
(3)
Total 9 marks

Q7, (Jan 2013, Q7)

(a) $P(A \cup B) = 0.35 + 0.45 - 0.13$ or $0.22 + 0.13 + 0.32$
 $= \underline{\underline{0.67}}$

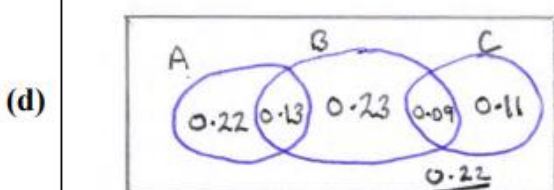
M1
A1
(2)

(b) $P(A' | B') = \frac{P(A' \cap B')}{P(B')}$ or $\frac{0.33}{0.55}$
 $= \frac{3}{5}$ or 0.6

M1
A1
(2)

(c) $P(B \cap C) = 0.45 \times 0.2$
 $= \underline{\underline{0.09}}$

M1
A1
(2)



Allow 1st B1 for 3 intersecting circles in a box with zeros in the regions for $A \cap C$
 Do not accept "blank" for zero

B1
B1ft
B1
B1
(4)

(e) $P(B \cup C)' = 0.22 + \underline{\underline{0.22}}$ or $1 - [0.56]$ or $1 - [0.13 + 0.23 + 0.09 + 0.11]$ o.e.
 $= \underline{\underline{0.44}}$

M1
A1
(2)
12

Q8, (Jun 2014, Q8)

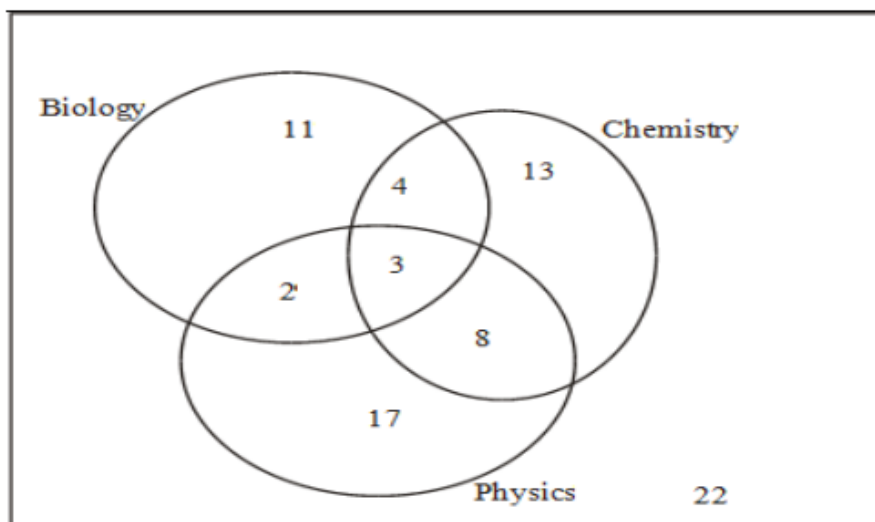
(a)	$[P(A) = 1 - 0.18 - 0.22] = 0.6$	(or exact equivalent)	B1	(1)	
(b)	$P(A \cup B) = 0.6 + 0.22 = 0.82$	(or exact equivalent)	B1ft	(1)	
(c)	$x = P(A \cap B)$ $\frac{x}{x + 0.22} = 0.6$ $x = 0.6x + 0.132$ $0.4x = 0.132$	Use $P(B)P(A' B) = P(A' \cap B)$ $P(B) \times [1 - 0.6] = 0.22$ Use $P(A \cap B) = P(A B)P(B)$ $P(A \cap B) = 0.6 \times 0.55$ $x = 0.33$ (or exact equivalent)	Establish independence before or after 1 st M1 and score marks for (d) (RH ver) Find $P(B)$ Use $P(B)P(A) = P(A \cap B)$ $P(A \cap B) = 0.6 \times 0.55$	M1	
(d)	$P(B) = 0.55$				
	$P(B) \times P(A) = 0.55 \times 0.6 = 0.33$	or stating $P(A) = P(A B) [= 0.6]$	M1		
	$P(B) \times P(A) = P(A \cap B)$ therefore (statistically) independent	or $P(A) = P(A B)$ therefore (statistically) independent	A1cso	(2)	
			Total 7		

Q9, (Jun 2013(R), Q6)

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

Q10, (Jun 2015, Q3)

(a)



B1
M1
A1
A1
B1

(b) $\frac{13}{80}$ or 0.1625

(5)

B1ft

(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

(1)

M1 A1

(d) $\frac{17+8+13}{47}$ or $\frac{38}{47}$ or $1 - \frac{2+3+4}{47} = \frac{38}{47}$ (condone awrt 0.809)

(2)

M1 A1cao

(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.

(2)

M1

M1

A1 (3)

(13 marks)

Q11, (Jun 2016, Q4)

(a)	$[P(B \cap R') =]$ <u>0</u>	B1	(1)
(b)	$P(B) = 0.27 + 0.33 = 0.6$, $P(D) = 0.27 + 0.15 + t$, $P(B \cap D) = 0.27$	M1	
	$[P(B) \times P(D) = P(B \cap D) \text{ gives}]$ $0.6 \times (0.42 + t) = 0.27$	M1	
	$0.42 + t = \frac{0.27}{0.6}$ <u>or</u> $0.6t = 0.018$	A1	
	$t = \underline{0.03}$	A1	
(c)	$[u =]$ $1 - (0.6 + 0.15 + t)$	M1	(4)
	$u = \underline{0.22}$	A1ft	
(d)(i)	$\left[\frac{P(D \cap R \cap B)}{P(R \cap B)} = \right] = \frac{0.27}{0.27 + 0.33}$ <u>or</u> $P(D R \cap B) = P(D B) = P(D)$ $= \underline{0.45}$	M1	
		A1	
(ii)	$\left[\frac{P(D \cap [R \cap B'])}{P(R \cap B')} = \right] = \frac{0.15}{0.15 + u}$	M1	
	$= \frac{15}{37}$	A1	
			(4)
(e)	$40 \times "0.45"$ and $37 \times \frac{15}{37}$	M1	
	$= \underline{33}$	A1	
			(2)
[13 marks]			