2024 H1 Maths JC2 LCP1 Solutions

Qn	Solutions
1(a)	$A = \{2,4,6\}$ $B = \{3,6\}$ $C=\{1,2\}$ B and C are mutually exclusive since $B \cap C = \varnothing$
(b)	A and B are independent and A and C are independent **Method 1** $\text{P}(A) = \frac{3}{6} = \frac{1}{2}$ $\text{P}(B) = \frac{2}{6} = \frac{1}{3}$ $\text{P(C)} = \frac{2}{6} = \frac{1}{3}$ $A \cap B=\{6\}$ $A \cap C=\{1\}$ $\text{P}(A \cap B)=\frac{1}{6}$ $\text{P}(A \cap \text{C})=\frac{1}{6}$ $\text{P}(A)\times\text{P}(B)= \frac{1}{2}\times\frac{1}{3}=\frac{1}{6}=\text{P}(A\cap B)$ $\text{P}(A)\times\text{P(C)}= \frac{1}{2}\times\frac{1}{3}=\frac{1}{6}=\text{P}(A\cap C)$ Hence A and B are independent and A and C are independent events. **Method 2** For set B only "6" is even, hence $\text{P}(A\|B) = \frac{1}{2}$ $\text{P}(A) = \frac{3}{6} = \frac{1}{2}$ Hence $\text{P}(A\|B)=\text{P}(A)$. $\therefore A$ and B are independent. For set C only "2" is even, hence $\text{P}(A\|C) = \frac{1}{2}$ $\text{P}(A) = \frac{3}{6} = \frac{1}{2}$ Hence $\text{P}(A\|C)=\text{P}(A)$. $\therefore A$ and C are independent.

2(a)	P(faulty mug)$= 0.35\times 0.03+0.65\times 0.06=\dfrac{99}{2000}=0.0495$
b(i)	P(exactly one mug faulty) $=0.0495\times(1-0.0495)\times 2=0.0941$ (to 3 sig fig)
b(ii)	**Method 1** P(exactly one faulty, given that both made by A) $=0.03\times(1-0.03)\times 2=\dfrac{291}{5000}=0.0582$ **Method 2** P(exactly one faulty, given that both made by A) $=\dfrac{\text{P(exactly one mug is faulty } \cap \text{ both made by } A)}{\text{P(both made by } A)}$ $=\dfrac{0.35\times 0.03\times 0.35\times(1-0.03)\times 2}{0.35\times 0.35}$ $=0.03\times(1-0.03)\times 2=\dfrac{291}{5000}=0.0582$

3(a)	$\text{P(L}\vert\text{T)}=\dfrac{\text{P(L}\cap\text{T)}}{\text{P(T)}}=\dfrac{\frac{6}{25}}{\frac{2}{3}}=\dfrac{9}{25}$
(b)	$\text{P}(L\cup T)=\text{P}(L)+\text{P}(T)-\text{P}(L\cap T)=\dfrac{2}{5}+\dfrac{2}{3}-\dfrac{6}{25}=\dfrac{62}{75}$ $\text{P}(L'\cap T')=\text{P}((L\cup T)')=1-P(L\cup T)$ $=1-\dfrac{62}{75}=\dfrac{13}{75}=0.173$ (to 3 sf)
(c)	**Method 1** $[\text{P}(L)-\text{P}(L\cap T)]+[\text{P}(T)-\text{P}(L\cap T)]$ $=\left(\dfrac{2}{5}-\dfrac{6}{25}\right)+\left(\dfrac{2}{3}-\dfrac{6}{25}\right)=\dfrac{44}{75}=0.587$ (to 3 sf) **Method 2** $\text{P}(L\cup T)-\text{P}(L\cap T)=\dfrac{62}{75}-\dfrac{6}{25}=\dfrac{44}{75}=0.587$

4(a)	Consider the 2 Biology books as 1 unit Number of different arrangements = $9!\times 2! = 725760$
(b)	**Method 1** Consider the 3 Chemistry books as 1 unit Number of different arrangements such that the Chemistry books are together = $8!\times 3!$ Probability that the Chemistry books are not all next to one another = $1-\frac{8!\times 3!}{10!}=\frac{14}{15}=0.933$ (to 3 sig fig) **Method 2** P(Chemistry books are not all next to one another) = P(all separated) + P(2 together, 1 separated) n(all Chemistry books are separated) = $7!\times {}^{8}P_{3}$ n(1 Chemistry book is separated from 2 Chemistry books which are together) $=7!\times {}^{8}P_{2}\times {}^{3}C_{2}\times 2!$ Probability that the Chemistry books are not all next to one another = $\frac{7!\times {}^{8}P_{3}+7!\times {}^{8}P_{2}\times {}^{3}C_{2}\times 2!}{10!}$ $=\frac{14}{15}=0.933$ (to 3 sig fig)
(c)	Number of possible selections – Number of selections whereby none of the Chemistry is included = ${}^{10}C_{4}-{}^{7}C_{4}=175$
(d)	Probability that at most one Chemistry book is selected $=\frac{{}^{7}C_{4}+{}^{7}C_{3}\times {}^{3}C_{1}}{{}^{10}C_{4}}=\frac{2}{3}$