Question	Answer	Marks	Guidance
(a)	$\left[\dfrac{9!}{2!2!}=\right]$ 90 720	B1	
		1	
(b)	**Method 1** Arrangements Cs at ends – Arrangements Cs at ends and Os together		
	[Os not together =] $\dfrac{7!}{2!}-6!$ [$=2520-720$]	M1	$\dfrac{w!}{2!}-y$, $w=6, 7$ y an integer. Condone $2\times\left(\dfrac{w!}{2!}\right)-y$.
		M1	$a-6!$ or $a-720$, a an integer resulting in a positive answer.
	1800	A1	
	Method 2 identified scenarios R ^ ^ ^ R		
	[Os not together =] $5!\times\dfrac{6\times5}{2!}=$	M1	$5!\times b$, b integer >1.
		M1	$c\times\left(\dfrac{6\times5}{2!}\text{ or }{}^6C_2\text{ or }\dfrac{{}^6P_2}{2!}\text{ or }15\right)$, c integer >1.
	1800	A1	
		3	

Question	Answer	Marks	Guidance
(c)	CCO _ $^5C_1 = 5$ CC _ _ $^5C_2 = 10$ OOC _ $^5C_1 = 5$ OO _ _ $^5C_2 = 10$ C _ _ _ $^5C_3 = 10$ O _ _ _ $^5C_3 = 10$	B1	Correct outcome/value for 1 identified scenario. Accept unsimplified. WWW
		M1	Add 5 or 6 values of appropriate scenarios only, no additional incorrect scenarios, no repeated scenarios. Accept unsimplified. Condone use of permutations.
	[Total =] 50	A1	
		3	
(d)	Both Os in group with a C $^5C_2$ $= 10$ Both Os in group without a C $^5C_2 \times {}^3C_2 = 30$ One O in a C group, one not $^5C_1 \times {}^4C_2 = 30$ One O with each C $({}^5C_1 \times {}^4C_1) \div 2! = 10$	B1	A correct scenario calculated accurately. Accept unsimplified.
		M1	Add 3 or 4 correct scenario values, no incorrect scenarios, accept repeated scenarios. Accept unsimplified.
	[Total =] 80	A1	
	Alternative method for question (d)		
	CCO O^^ ^^^ = $^5C_2 = 10$ CC^ O^^ O^^ = $^5C_1 \times {}^4C_2 = 30$ CC^ OO^ ^^^ = $^5C_1 \times {}^4C_1 = 20$	B1	A correct scenario calculated accurately. Accept unsimplified.
	Total ways of making three groups $\dfrac{{}^9C_6 \times {}^6C_3}{2 \times 2 \times 3} = 140$ 140 – (*their* 10+ *their* 30+ *their* 20)	M1	Total subtract 2 or 3 correct scenario values, no incorrect scenarios. Accept unsimplified.
	80	A1	
		3	