

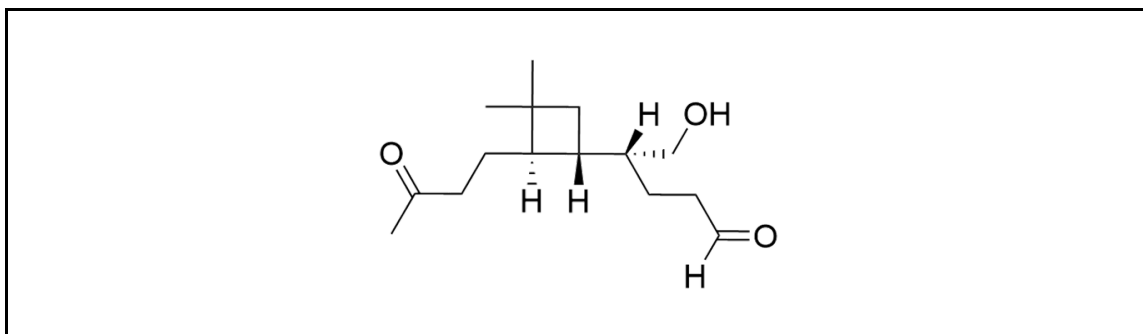


1. Isocaryophyllene, clovene, and humulene (34 pt total)

1.1 (7 pt)

A	B
Isocaryophyllene (<i>i</i> -Cy)	

1.2 (3 pt)





1.3 (6 pt)

E	F
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1.4 (2 pt)

- ☐ PCC
- ☐ $\text{K}_2\text{Cr}_2\text{O}_7$, H_2SO_4 , H_2O
- ☐ MnO_2
- ☐ (i) OsO_4 , (ii) KHSO_3

1.5 (2 pt)

- ☐ PCC
- ☐ $\text{K}_2\text{Cr}_2\text{O}_7$, H_2SO_4 , H_2O
- ☐ MnO_2
- ☐ (i) OsO_4 , (ii) KHSO_3

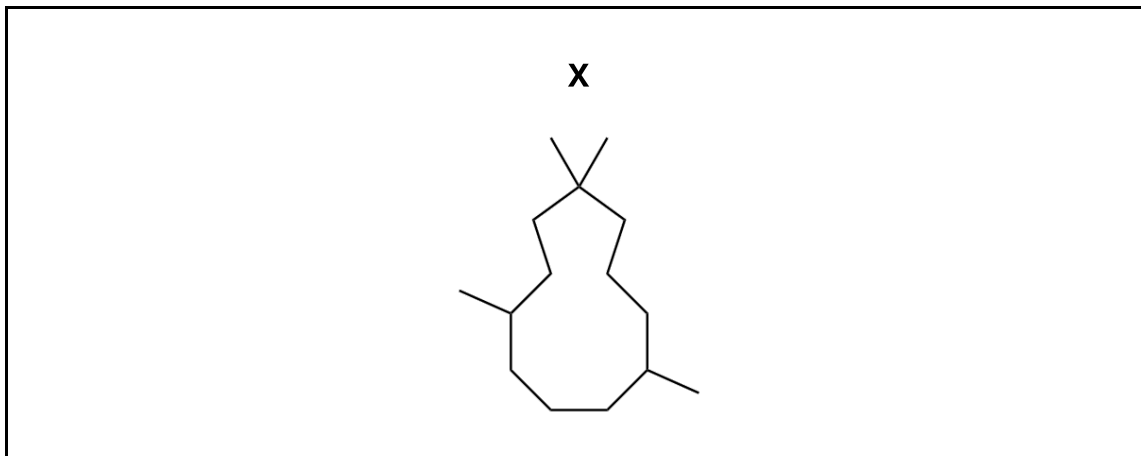


1.6 (8 pt)

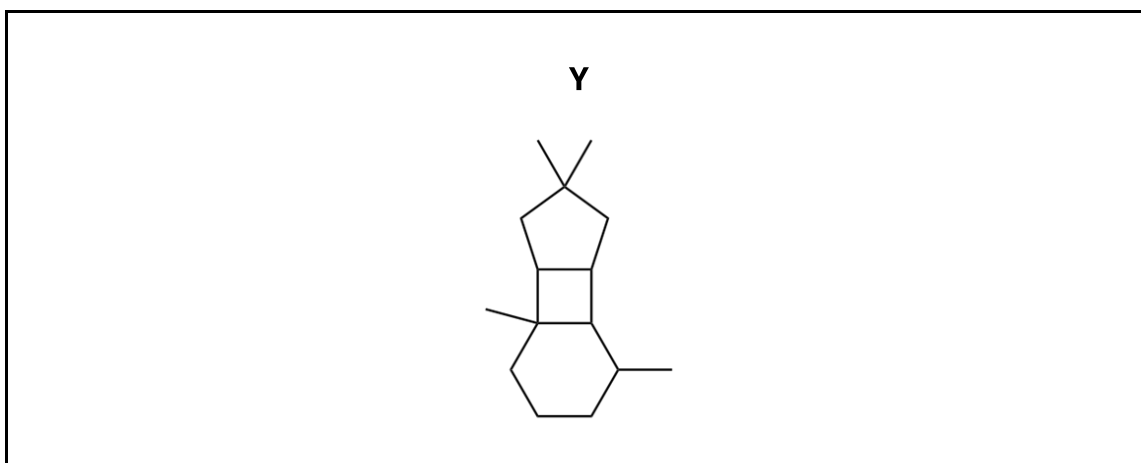
I	J
K	



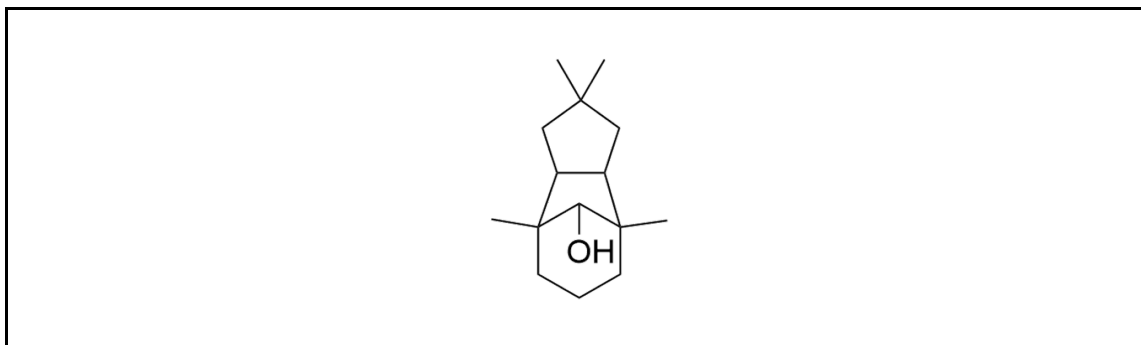
1.7 (2 pt)



1.8 (2 pt)



1.9 (2 pt)





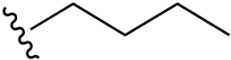
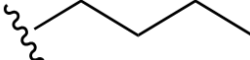
2. Rapamycin – A molecular glue (67 pt total)

2.1 (12 pt)

a	
b	c



2.2 (19 pt)

a	1		2	
	3		4	
	5		6	
	7		8	
b	F			



2.3a, 2.3b, 2.3c (18 pt)

Diagram illustrating the synthesis of a complex molecule (4) from a starting material (1) through three intermediate steps (2, 3, 4). The reaction sequence is shown in a vertical flow, with each step labeled 1., 2., 3., and 4. The starting material (1) is a cyclohexene ring substituted with a sulfonamide group (SO₂NH₂) and a hydroxyl group (OH). The final product (4) is a complex molecule featuring a cyclohexane ring, a sulfonamide group, a ketone, an alkene, and a hydroxyl group.

Reaction scheme details:

- Starting material (1): OS(=O)(=O)C1=CCCCC1O
- Intermediate 2: OS(=O)(=O)C1=CCCCC1
- Intermediate 3: OS(=O)(=O)C1=CCCCC1
- Final product (4): OS(=O)(=O)C1=CCCCC1C(=O)C=C(C)C(O)C1

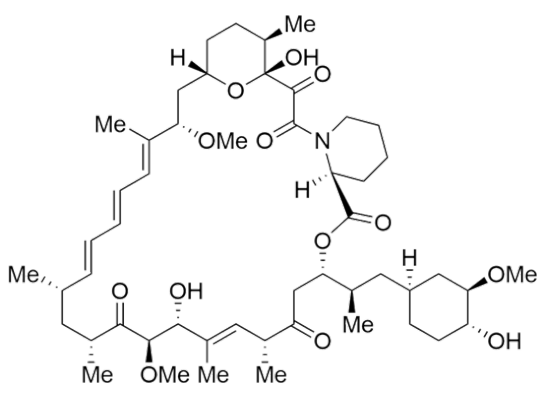
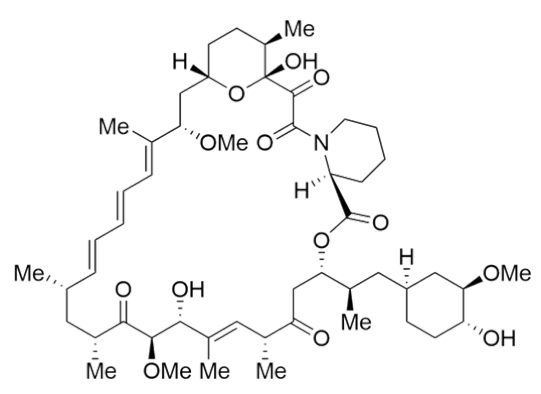
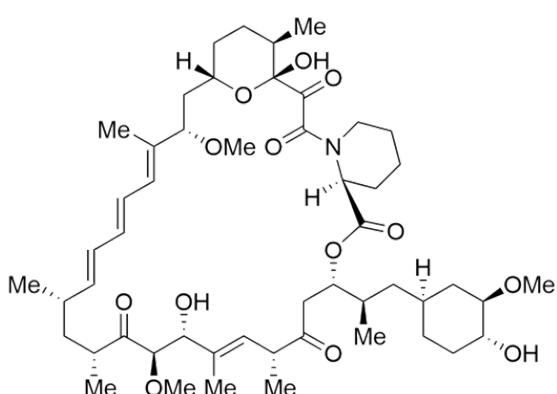
Reaction conditions and reagents for each step are indicated in boxes:

- Step 1: CoL, ER, KS, AT
- Step 2: ACP, KS, AT
- Step 3: ACP, KS, AT
- Step 4: ACP

A vertical arrow on the right indicates the progression of the synthesis.



2.4 (18 pt)

a	
b	
c	



3. Lanterns and the Burj Khalifa (111 pt total)

3.1 (6 pt)

Angle	A	B	C
0°			
30°			
45°			
60°			
90°			
120°			
135°			
180°			

3.2 (4 pt)

	<		<	
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3.3 (4 pt)

Q	1	2
(h, k)	(0, 1)	(1, 1)
V	6	
E	12	
F	8	
F_3	8	8
F_4	0	

3.4 (5 pt)

Q	4
(h, k)	
V	
E	
F	
F_3	8
F_4	

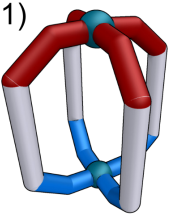
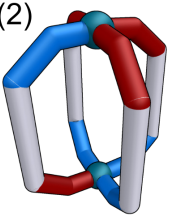
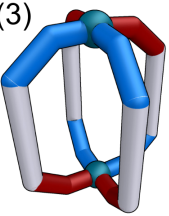
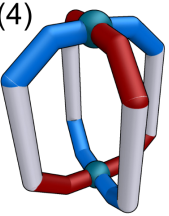
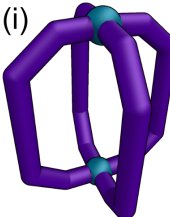
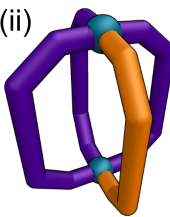
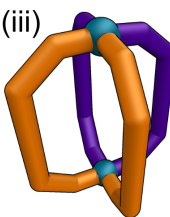
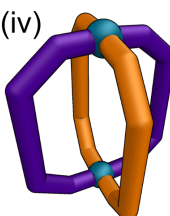


3.5 (40 pt)

H	I
J	K
L	

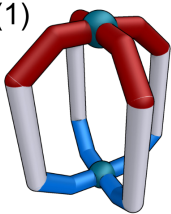
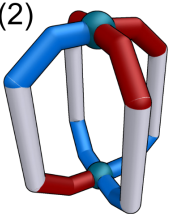
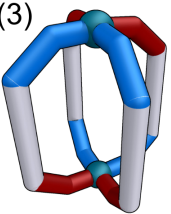
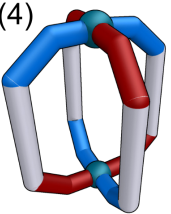


3.6 (20 pt)

	(1)	(2)	(3)	(4)
				
(i)				
(ii)				
(iii)				
(iv)				



3.7 (32 pt)

	(1)	(2)	(3)	(4)
				
(i)		2		
(ii)			4	
(iii)				
(iv)				



4. The life of tennis balls (40 pt total)

4.1 (3 pt)

$m = \rule{1.5cm}{0.4pt} \text{ g}$



4.2 (16 pt)



أولمبياد الكيمياء الدولي السابع والخمسون
الإمارات العربية المتحدة
57th ICHO - United Arab Emirates - 2025

A:	B:	C:	D:



4.3 (5 pt)

Reaction 1	
Reaction 2	
Reaction 3	
Reaction 4	
Reaction 5	



4.4a (4 pt)

$k_{\text{N}_2} = \underline{\hspace{2cm}}$



4.4b (5 pt)

$k_{\text{O}_2} = \underline{\hspace{2cm}}$



4.4c (7 pt)

$p_{\text{start}} = \rule{1.5cm}{0.4pt} \text{ atm}$



5. Solar-powered multi-stage flash desalination (16 pt total)

5.1 (2 pt)

$T = \underline{\hspace{2cm}} \text{ } ^\circ\text{C}$

5.2 (2 pt)

$w_{\text{NaCl}} = \underline{\hspace{2cm}} \%$



5.3 (3 pt)

$T = \underline{\hspace{2cm}} \text{ } ^\circ\text{C}$

5.4 (2 pt)

$n = \underline{\hspace{2cm}} \text{ mol}$



5.5 (2 pt)

$p_f = \text{_____ atm}$

5.6 (2 pt)

$E = \text{_____ kWh}$



5.7 (1 pt)

$m = \rule{1.5cm}{0.4pt} \text{ kg}$



5.8 (2 pt)

$N =$ _____



6.1 (5 pt)

$$T = \text{_____ K}$$



6.2 (2 pt)

Reaction 1	
Reaction 2	

6.3 (3 pt)

$x =$ _____



$p(\text{O}_2) = \underline{\hspace{2cm}} \text{ bar}$

+3	+2 (anion)	+2 (neutral molecule)	0	-2	-4



6.6 (2 pt)

☐ CdS	☐ Ge	☐ Si	☐ SiC	☐ WO ₃	☐ ZrO ₂
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6.7 (4 pt)

$\eta =$ _____
 $\phi =$ _____



7. Dubai crude oil (22 pt total)

7.1 (8 pt)

1	1'
2	2'
3	3'
4	4'



7.2 (2 pt)

5	6
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7.3 (3 pt)

$w(\text{S}) = \text{_____ wt\%}$

7.4 (1 pt)

☐ 270 nm	☐ 300 nm	☐ 350 nm	☐ 510 nm
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7.5 (8 pt)

$$c_0(\text{SeO}_3^{2-}) = \text{_____ } \mu\text{M}$$

$$c_0(\text{SeO}_4^{2-}) = \text{_____ } \mu\text{M}$$



8. Carbon monoxide: deadly poison or promising therapeutic agent? (35 pt total)

8.1 (4 pt)

		Ox	Red	Same
(a)				
(b)				
(c)				

8.2 (1 pt)

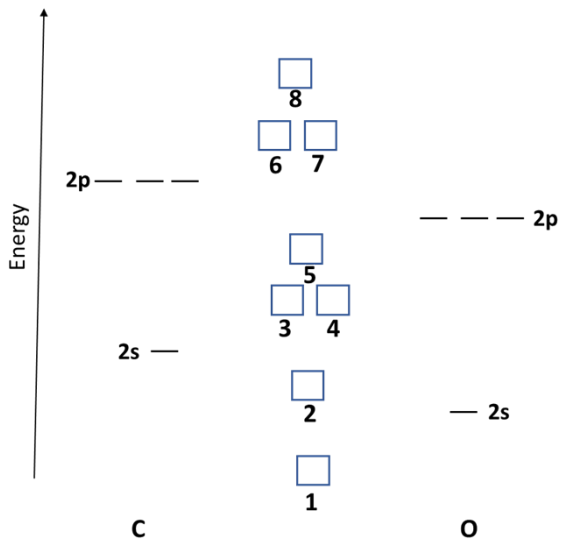
$$v = \text{_____ mL min}^{-1}$$

8.3 (6 pt)

$$N = \text{_____}$$



8.4 (3 pt)



MO	1	2	3	4	5	6	7	8
Type of overlap								

8.5 (2 pt)

	in	dec	nc
Ru-CO			
C-O			



8.6 (2 pt)

	1850 cm ⁻¹	1930 cm ⁻¹	2100 cm ⁻¹	2143 cm ⁻¹
A				
B				
C				
CO				

8.7 (4 pt)

$$\%_{\text{Ni}} = \underline{\hspace{2cm}} \%$$



8.8 (8 pt)

A	B
C	D



8.9 (5 pt)

E

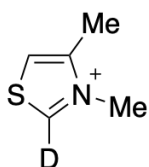
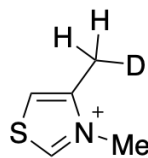
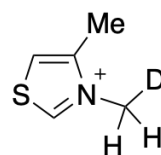
F

G



9. Enzymes and cofactors (36 pt total)

9.1 (2 pt)

☐☐☐☐

9.2 (6 pt)

3	6
8	



9.3 (2 pt)

13

9.4 (6 pt)

15

16

17



9.5 (10 pt)

21	22
23	24
25	



9.6 (10 pt)