Part I. 80 Points (40 Questions; 2 Points Each)
Select the BEST answer for each of the following.

1. The drug illustrated below is:

\[
\text{Cl} \quad \overset{\text{N}}{\text{N}} \quad \overset{\text{N=CH}_2\text{CH}_2\text{O-CH}_2\text{CH}_2\text{OH}}{\text{H}}
\]

<table>
<thead>
<tr>
<th></th>
<th>I is known for its sedative effects.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>II is primarily used to prevent motion sickness with limited potential for sedation.</td>
</tr>
<tr>
<td></td>
<td>III is as close as one can get to a non-sedating antihistamine for the treatment of allergies.</td>
</tr>
</tbody>
</table>

A. I only  
B. III only  
C. I and II only  
D. II and III only  
E. I, II, and III  

Answer ___

2. Which of the comments are valid:

\[
\text{Alteplase} ....
\]

<table>
<thead>
<tr>
<th></th>
<th>I is tissue-type plasminogen activator that converts plasminogen to plasmin.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>II can cause ultimately the breakdown fibrin and dissolve clots.</td>
</tr>
<tr>
<td></td>
<td>III is a serine protease enzyme.</td>
</tr>
</tbody>
</table>

A. I only  
B. III only  
C. I and II only  
D. II and III only  
E. I, II, and III  

Answer ___

3. The drug illustrated below:

\[
\text{OCH}_2\text{CF}_3
\]

<table>
<thead>
<tr>
<th></th>
<th>I is activated to an electrophile at low pH.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>II Acts irreversibly.</td>
</tr>
<tr>
<td></td>
<td>III Inhibits platelet aggregation</td>
</tr>
</tbody>
</table>

A. I only  
B. III only  
C. I and II only  
D. II and III only  
E. I, II, and III  

Answer ___
4. The drug illustrated below:

<table>
<thead>
<tr>
<th>I</th>
<th>II</th>
<th>III</th>
</tr>
</thead>
<tbody>
<tr>
<td>£</td>
<td>£</td>
<td>Na+</td>
</tr>
<tr>
<td>CH3</td>
<td>CH3</td>
<td>CH3</td>
</tr>
<tr>
<td>OCH2CH2O</td>
<td>OCH2CH2O</td>
<td>OCH2CH2O</td>
</tr>
<tr>
<td>O</td>
<td>O</td>
<td>O</td>
</tr>
</tbody>
</table>

I is used to prevent or reduce the severity of asthma attacks.
II can be administered as an aerosol using a nebulizer.
III is an anticoagulant.

A. I only
B. III only
C. I and II only
D. II and III only
E. I, II, and III

Answer

5. The drug illustrated below:

<table>
<thead>
<tr>
<th>I</th>
<th>II</th>
<th>III</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cl</td>
<td>Cl</td>
<td>Cl</td>
</tr>
<tr>
<td>N</td>
<td>N</td>
<td>N</td>
</tr>
<tr>
<td>H3CH2CO</td>
<td>H3CH2CO</td>
<td>H3CH2CO</td>
</tr>
</tbody>
</table>

I has been shown to cause weight loss.
II is a non-sedating antihistamine.
III is selective for peripheral H1-receptors.

A. I only
B. III only
C. I and II only
D. II and III only
E. I, II, and III

Answer

6. The drug illustrated below:

<table>
<thead>
<tr>
<th>I</th>
<th>II</th>
<th>III</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cl</td>
<td>Cl</td>
<td>Cl</td>
</tr>
<tr>
<td>N</td>
<td>N</td>
<td>N</td>
</tr>
<tr>
<td>CH2CH2N</td>
<td>CH2CH2N</td>
<td>CH2CH2N</td>
</tr>
</tbody>
</table>

I can be used as an OTC nasal decongestant for individuals with high blood pressure.
II is less sedating than diphenhydramine.
III provides symptomatic relief from the common cold, flu, or allergies.

A. I only
B. III only
C. I and II only
D. II and III only
E. I, II, and III

Answer
7. Which of the comments are valid:

<table>
<thead>
<tr>
<th></th>
<th>1</th>
<th>2</th>
<th>3</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>inhibits or limits the production of platelets.</td>
<td>binds to PGI2 receptors on platelets.</td>
<td>acts at purinergic receptors.</td>
</tr>
</tbody>
</table>

A. I only  
B. III only  
C. I and II only  
D. II and III only  
E. I, II, and III  

Answer ___

8. The drug illustrated below:

<table>
<thead>
<tr>
<th></th>
<th>1</th>
<th>2</th>
<th>3</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Is a second generation antihistamine.</td>
<td>Has some anticholinergic activity.</td>
<td>Has antiemetic activity.</td>
</tr>
</tbody>
</table>

A. I only  
B. III only  
C. I and II only  
D. II and III only  
E. I, II, and III  

Answer ___

9. The drug illustrated below has been used to prevent alcohol flush because it......:

<table>
<thead>
<tr>
<th></th>
<th>1</th>
<th>2</th>
<th>3</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>accelerates the metabolism of acetaldehyde.</td>
<td>lowers blood alcohol levels.</td>
<td>inhibits the first-pass metabolism of ethanol to acetaldehyde</td>
</tr>
</tbody>
</table>

A. I only  
B. III only  
C. I and II only  
D. II and III only  
E. I, II, and III  

Answer ___

10. The drug illustrated below:

<table>
<thead>
<tr>
<th></th>
<th>1</th>
<th>2</th>
<th>3</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>is a H1-receptor antagonist.</td>
<td>can stimulate appetite and can cause weight gain.</td>
<td>is a serotonin agonist</td>
</tr>
</tbody>
</table>

A. I only  
B. III only  
C. I and II only  
D. II and III only  
E. I, II, and III  

Answer ___
11. The drug illustrated below:

<table>
<thead>
<tr>
<th></th>
<th>I</th>
<th>II</th>
<th>III</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image1" alt="Drug Structure" /></td>
<td>irreversibly inhibits cyclooxygenase (COX-1) in platelets.</td>
<td>inhibits the formation of thromboxane A₂.</td>
<td>has both a carboxylic acid and an ester in its structure.</td>
</tr>
</tbody>
</table>

A. I only  
B. III only  
C. I and II only  
D. II and III only  
E. I, II, and III  

Answer __________

12. The drug illustrated below:

<table>
<thead>
<tr>
<th></th>
<th>I</th>
<th>II</th>
<th>III</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image2" alt="Drug Structure" /></td>
<td>is frequently combined with OTC pain relievers as a sleep aid.</td>
<td>is used topically to relieve itch (pruritus).</td>
<td>can be used orally to treat hives (urticaria).</td>
</tr>
</tbody>
</table>

A. I only  
B. III only  
C. I and II only  
D. II and III only  
E. I, II, and III  

Answer __________

13. The drug illustrated below:

<table>
<thead>
<tr>
<th></th>
<th>I</th>
<th>II</th>
<th>III</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image3" alt="Drug Structure" /></td>
<td>is used to prevent motion sickness.</td>
<td>is available as an OTC pharmaceutical.</td>
<td>is used to treat allergic conjunctivitis.</td>
</tr>
</tbody>
</table>

A. I only  
B. III only  
C. I and II only  
D. II and III only  
E. I, II, and III  

Answer __________

14. The drug illustrated below is:

<table>
<thead>
<tr>
<th></th>
<th>I</th>
<th>II</th>
<th>III</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image4" alt="Drug Structure" /></td>
<td>blocks ADP receptors on platelets.</td>
<td>inhibits platelet aggregation.</td>
<td>is a phosphodiesterase type 3 inhibitor. increasing cAMP.</td>
</tr>
</tbody>
</table>

A. I only  
B. III only  
C. I and II only  
D. II and III only  
E. I, II, and III  

Answer __________
15. The drug illustrated below is:

![Chemical Structure]

I can inhibit hepatic enzymes.
II can elevate serum levels of several other drugs.
III is a H₂-receptor antagonist.

A. I only
B. III only
C. I and II only
D. II and III only
E. I, II, and III

Answer: E

16. The drug illustrated below is:

![Chemical Structure]

Abciximab....
I targets GPIIb/IIIa receptors on platelets.
II inhibits platelet aggregation.
III like heparin, it activates Antithrombin III.

A. I only
B. III only
C. I and II only
D. II and III only
E. I, II, and III

Answer: C

17. The drug illustrated below:

![Chemical Structure]

I is used to treat allergic conjunctivitis.
II is administered orally.
III irreversibly modifies the ADP receptor on platelets.

A. I only
B. III only
C. I and II only
D. II and III only
E. I, II, and III

Answer:

18. The drug illustrated below:

Heparin

I binds to antithrombin III.
II accelerates the inactivation of several clotting factors.
III activates prothrombin.

A. I only
B. III only
C. I and II only
D. II and III only
E. I, II, and III

Answer:
19. The drug illustrated below:

I inhibits the synthesis of platelets.
II is administered orally.
III binds to GPIIb/IIIa receptors blocking access by fibrinogen.

A. I only
B. III only
C. I and II only
D. II and III only
E. I, II, and III

Answer

20. The drug illustrated below:

I is administered orally.
II is an indirect-acting proton pump inhibitor.
III is used to treat allergic conjunctivitis.

A. I only
B. III only
C. I and II only
D. II and III only
E. I, II, and III

Answer

21. The drug illustrated below is:

I binds to cationic sites on serum albumin.
II inhibits vitamin K epoxide reductase.
III inhibits vitamin K reductase.

A. I only
B. III only
C. I and II only
D. II and III only
E. I, II, and III

Answer

22. The drug illustrated below is:

I is a direct thrombin inhibitor.
II used for the prophylaxis and treatment of heparin-induced thromocopenia
III blocks ADP receptors on platelets.

A. I only
B. III only
C. I and II only
D. II and III only
E. I, II, and III

Answer
23. The drug illustrated below:

<table>
<thead>
<tr>
<th></th>
<th>I</th>
<th>II</th>
<th>III</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>is classified as a non-sedating H₁-receptor antagonist.</td>
<td>does not inhibit h-ERG channels.</td>
<td>is used to prevent motion sickness.</td>
</tr>
</tbody>
</table>

A. I only  
B. III only  
C. I and II only  
D. II and III only  
E. I, II, and III  

Answer

24. The drug illustrated below:

<table>
<thead>
<tr>
<th></th>
<th>I</th>
<th>II</th>
<th>III</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>is a prodrug of theophylline.</td>
<td>is 1/10 the potency of theophylline with fewer side effects.</td>
<td>is weakly basic.</td>
</tr>
</tbody>
</table>

A. I only  
B. III only  
C. I and II only  
D. II and III only  
E. I, II, and III  

Answer

25. The drug illustrated below:

<table>
<thead>
<tr>
<th></th>
<th>I</th>
<th>II</th>
<th>III</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>is used to treat narcolepsy.</td>
<td>is used by people who must stay awake for an extended period of time.</td>
<td>is mostly excreted unchanged.</td>
</tr>
</tbody>
</table>

A. I only  
B. III only  
C. I and II only  
D. II and III only  
E. I, II, and III  

Answer

26. The drug illustrated below:

<table>
<thead>
<tr>
<th></th>
<th>I</th>
<th>II</th>
<th>III</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>is a CNS stimulant used to treat ADHD.</td>
<td>has a methyl at α-position to inhibit metabolism by MAO.</td>
<td>has an S-isomer that is more active than the R-enantiomer.</td>
</tr>
</tbody>
</table>

A. I only  
B. III only  
C. I and II only  
D. II and III only  
E. I, II, and III  

Answer
27. The drug illustrated below

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>I.</td>
<td>is used as an appetite suppressant.</td>
</tr>
<tr>
<td>II.</td>
<td>has two substituents on the nitrogen to decrease hallucinogenic effects.</td>
</tr>
<tr>
<td>III.</td>
<td>has two chiral centers and thus four stereoisomers.</td>
</tr>
</tbody>
</table>

A. I only  
B. III only  
C. I and II only  
D. II and III only  
E. I, II, and III

Answer

28. The drug illustrated below

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>I.</td>
<td>is an irreversible inhibitor of pancreatic lipase used to treat obesity.</td>
</tr>
<tr>
<td>II.</td>
<td>is synthetic analog of natural product called lipstatin.</td>
</tr>
<tr>
<td>III.</td>
<td>contains a β-lactam functional group.</td>
</tr>
</tbody>
</table>

A. I only  
B. III only  
C. I and II only  
D. II and III only  
E. I, II, and III

Answer

29. The two structures illustrated below

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>I.</td>
<td>are both erythro isomers.</td>
</tr>
<tr>
<td>II.</td>
<td>are enantiomers of each other.</td>
</tr>
<tr>
<td>III.</td>
<td>A is the more active isomer marketed as dexamethasonephendate for ADHD.</td>
</tr>
</tbody>
</table>

A. I only  
B. III only  
C. I and II only  
D. II and III only  
E. I, II, and III

Answer

30. The drug illustrated below

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>I.</td>
<td>is a selective serotonin reuptake inhibitor used as an antidepressant.</td>
</tr>
<tr>
<td>II.</td>
<td>is orally active.</td>
</tr>
<tr>
<td>III.</td>
<td>is mainly metabolized through oxidative pathways.</td>
</tr>
</tbody>
</table>

A. I only  
B. III only  
C. I and II only  
D. II and III only  
E. I, II, and III

Answer
31. The drug illustrated below

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
</table>
| I. is a mechanism-based inhibitor of monoamine oxidase used to treat depression. | A. I only  
B. III only  
C. I and II only  
D. II and III only  
E. I, II, and III |
| II. is a reversible inhibitor. |
| III. has one chiral center. thus two enantiomers. | Answer |

32. The drug illustrated below

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
</table>
| I. is an antidepressant with few anticholinergic side effects. | A. I only  
B. III only  
C. I and II only  
D. II and III only  
E. I, II, and III |
| II. is metabolized to secondary and primary amine metabolites that are active. |
| III. has one chiral center and is used as a racemic mixture. | Answer |

33. The drug illustrated below

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
</table>
| I. has E and Z isomers due to the presence of the double bond. | A. I only  
B. III only  
C. I and II only  
D. II and III only  
E. I, II, and III |
| II. is metabolized to a secondary amine that is known to be more active and has fewer side effects. |
| III. can be hydroxylated metabolically to give E and Z metabolites. | Answer |

34. The drug illustrated below

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
</table>
| I. is an antidepressant with some antipsychotic activity. | A. I only  
B. III only  
C. I and II only  
D. II and III only  
E. I, II, and III |
| II. is acidic due to the presence of H on the nitrogen of the piperazine ring. |
| III. Chlorine substitution makes the B-ring more electron rich and more susceptible to oxidative metabolism. | Answer |
35. The drug illustrated below

| | I. is a selective serotonin reuptake inhibitor used as an antidepressant. |
| | II. is extensively metabolized through demethylation resulting in an active metabolite. |
| | III. has a longer half life after long-term use. |

A. I only  
B. III only  
C. I and II only  
D. II and III only  
E. I, II, and III

Answer ___

36. The drug illustrated below

| | I. has two aromatic rings with electron-withdrawing substituents that inhibit oxidative metabolism of the rings. |
| | II. has the secondary amine as the major metabolite and the primary amine as the minor metabolite. |
| | III. Both the secondary amine and primary amine metabolites are inactive. |

A. I only  
B. III only  
C. I and II only  
D. II and III only  
E. I, II, and III

Answer ___

37. The drug illustrated below

| | I. has a metabolite with the t-butyl group removed through oxidative dealkylation. |
| | II. is metabolically reduced to a secondary alcohol. |
| | III. is an inhibitor of serotonin, norepinephrine, and dopamine reuptake. |

A. I only  
B. III only  
C. I and II only  
D. II and III only  
E. I, II, and III

Answer ___
38. The drug illustrated below

I. can be viewed as a conformationally restricted analog of sumatriptan.
II. has a shorter half life as compared to most other triptans.
III. is a 5HT₁B, 5HT₁D, 5HT₁F receptor antagonist used for migraine headache.

A. I only
B. III only
C. I and II only
D. II and III only
E. I, II, and III

Answer

39. The drug illustrated below

I. is a 5HT₃ receptor antagonist effective against vomiting and nausea.
II. has a pharmacophore consisted of one basic center, one aromatic ring and a carbonyl linker.
III. has three chiral centers.

A. I only
B. III only
C. I and II only
D. II and III only
E. I, II, and III

Answer

40. The drug illustrated below

I. is designed for oral administration.
II. is a prodrug of a substance P antagonist on NK1 receptor.
III. The F and CF₃ help deactivate the aromatic rings and increase metabolic stability.

A. I only
B. III only
C. I and II only
D. II and III only
E. I, II, and III

Answer
Part II * Points (4 Questions, 1 Point each)

51. and 52. Match a structure provided below to the generic name

51. Desipramine

52. Match a structure provided below to the generic name

52. Sertraline
53. Match a structure provided below to the generic name

53. Omeprazole

54. Match a structure provided below to the generic name

54. Azelastine
Part III.(16 Points) Complete the structures of the FOUR following compounds

Draw the correct chemical structure, including stereochemistry wherever indicated. Partial credit will be given but you will lose points for incorrect chemical symbols, hydrogens missing from heteroatoms, hydrogens missing from carbons labeled C, and for having too many bonds to an atom (see below for examples).

Examples:

Incorrect:
- Fluorobenzene
- Piperidine

Correct:
- Phenyl
- Piperidine
- Anthracene or Naphthalene

1. Methyl (+)-(S)-α-(2-methylphenyl)-6,7-dihydrothieno[3,2-c]pyridine-5(4H)-acetate

2. 5H-Benz[5,6]cyclohepta[1,2-b]pyridine, 6,11-dihydro-11-(1-methyl-4-piperidinylidene)-,(Z)-2-butenedioate (1:2)
3. $1H$-Benzimidazole. 6-methoxy-2-[[4-ethoxy-3,5-dimethyl-2-pyridinyl)methyl]sulfinyl]-

4. $1H$-Indole-6-methanesulfonamide, 3-[3-(dimethylamino)propyl]-N-methyl-. hydrochloride