Select the best answer for each of the following (60 Points, 2 Points each):

1. The drug illustrated below is:

   ![Chemical Structure](image)

   I An α₁-antagonist.
   II A potent peripheral vasodilator.
   III Used as a nasal decongestant.

   a. I only
   b. III only
   c. I and II only
   d. II and III only
   e. I, II, and III

   **Answer**

2. The drug illustrated below is:

   ![Chemical Structure](image)

   I A calcium channel blocker.
   II Can be used as an antiarrhythmic agent.
   III Can be used to treat angina.

   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:

   ![Chemical Structure](image)

   I Can cross the blood brain barrier.
   II Is used as an adjunct in the treatment of Parkinson's disease.
   III Can cause miosis.

   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:

- I is a depolarizing agent at neuromuscular nerve terminals.
- II Causes a decrease in cGMP.
- III Is a phosphodiesterase type 5 (PDE5) inhibitor.

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:

- I is a β₁-selective antagonist.
- II Is used to treat hypertension.
- III Is a non-selective β-antagonist.

(CH₃)₂CHNHCH₂CHOHCH₂

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 is:

- I A β₁-selective antagonist.
- II Is a direct agonist.
- III Used to treat peripheral vascular disease.

a) I only
b) III only
c) I and II only
d) II and III only
e) I, II, and III

Answer ______

7. The drug illustrated below:

- I Is a depolarizing neuromuscular blocking agent.
- II Is available as a transdermal patch to produce a very localized effect.
- III Acts by inhibiting acetylcholinesterase.

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>Structure</th>
<th>I</th>
<th>II</th>
<th>III</th>
</tr>
</thead>
<tbody>
<tr>
<td>[Image]</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>a</td>
<td>I only</td>
<td></td>
<td></td>
</tr>
<tr>
<td>b</td>
<td>III only</td>
<td></td>
<td></td>
</tr>
<tr>
<td>c</td>
<td>I and II only</td>
<td></td>
<td></td>
</tr>
<tr>
<td>d</td>
<td>II and III only</td>
<td></td>
<td></td>
</tr>
<tr>
<td>e</td>
<td>I, II, and III</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Answer ______

9. The drug illustrated below is:

<table>
<thead>
<tr>
<th>Structure</th>
<th>I</th>
<th>II</th>
<th>III</th>
</tr>
</thead>
<tbody>
<tr>
<td>[Image]</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>a</td>
<td>I only</td>
<td></td>
<td></td>
</tr>
<tr>
<td>b</td>
<td>III only</td>
<td></td>
<td></td>
</tr>
<tr>
<td>c</td>
<td>I and II only</td>
<td></td>
<td></td>
</tr>
<tr>
<td>d</td>
<td>II and III only</td>
<td></td>
<td></td>
</tr>
<tr>
<td>e</td>
<td>I, II, and III</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Answer ______

10. The drug illustrated below is:

<table>
<thead>
<tr>
<th>Structure</th>
<th>I</th>
<th>II</th>
<th>III</th>
</tr>
</thead>
<tbody>
<tr>
<td>[Image]</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>a</td>
<td>I only</td>
<td></td>
<td></td>
</tr>
<tr>
<td>b</td>
<td>III only</td>
<td></td>
<td></td>
</tr>
<tr>
<td>c</td>
<td>I and II only</td>
<td></td>
<td></td>
</tr>
<tr>
<td>d</td>
<td>II and III only</td>
<td></td>
<td></td>
</tr>
<tr>
<td>e</td>
<td>I, II, and III</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Answer ______

11. The drug illustrated below:

<table>
<thead>
<tr>
<th>Structure</th>
<th>I</th>
<th>II</th>
<th>III</th>
</tr>
</thead>
<tbody>
<tr>
<td>[Image]</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>a</td>
<td>I only</td>
<td></td>
<td></td>
</tr>
<tr>
<td>b</td>
<td>III only</td>
<td></td>
<td></td>
</tr>
<tr>
<td>c</td>
<td>I and II only</td>
<td></td>
<td></td>
</tr>
<tr>
<td>d</td>
<td>II and III only</td>
<td></td>
<td></td>
</tr>
<tr>
<td>e</td>
<td>I, II, and III</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Answer ______
12. The drug illustrated below:

<p>| | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>a</td>
<td>I only</td>
<td></td>
</tr>
<tr>
<td>b</td>
<td>III only</td>
<td></td>
</tr>
<tr>
<td>c</td>
<td>I and II only</td>
<td></td>
</tr>
<tr>
<td>d</td>
<td>II and III only</td>
<td></td>
</tr>
<tr>
<td>e</td>
<td>I, II, and III</td>
<td></td>
</tr>
</tbody>
</table>

Is used as a GI antispasmodic.
Can cause miosis.
Is a cholinergic agonist.

Answer: ___

13. The drug illustrated below:

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>a</td>
<td>I only</td>
</tr>
<tr>
<td>b</td>
<td>III only</td>
</tr>
<tr>
<td>c</td>
<td>I and II only</td>
</tr>
<tr>
<td>d</td>
<td>II and III only</td>
</tr>
<tr>
<td>e</td>
<td>I, II, and III</td>
</tr>
</tbody>
</table>

Is a selective monoamine oxidase inhibitor (MAO-B).
Frequently causes sleeplessness (insomnia).
Cannot cross the Blood Brain Barrier.

Answer: ___

14. The drug illustrated below is:

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>a</td>
<td>I only</td>
</tr>
<tr>
<td>b</td>
<td>III only</td>
</tr>
<tr>
<td>c</td>
<td>I and II only</td>
</tr>
<tr>
<td>d</td>
<td>II and III only</td>
</tr>
<tr>
<td>e</td>
<td>I, II, and III</td>
</tr>
</tbody>
</table>

Used to prevent exercise-induced bronchospasm (EIB)
Prescribed for the treatment of hypertension.
Used to treat symptoms of benign prostatic hyperplasia (BPH).

Answer: ___

15. The drug illustrated below is:

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>a</td>
<td>I only</td>
</tr>
<tr>
<td>b</td>
<td>III only</td>
</tr>
<tr>
<td>c</td>
<td>I and II only</td>
</tr>
<tr>
<td>d</td>
<td>II and III only</td>
</tr>
<tr>
<td>e</td>
<td>I, II, and III</td>
</tr>
</tbody>
</table>

A MAO type B inhibitor.
Used to treat urinary frequency and incontinence.
A cholinergic antagonist.

Answer: ___
16. The drug illustrated below is:

<table>
<thead>
<tr>
<th></th>
<th>I</th>
<th>II</th>
<th>III</th>
</tr>
</thead>
<tbody>
<tr>
<td>O₂NO</td>
<td>A vasodilator.</td>
<td>Is used to treat angina.</td>
<td>Lowers heart rate.</td>
</tr>
<tr>
<td>H</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>H</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>OONO₂</td>
<td></td>
<td></td>
<td></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

17. The drug illustrated below:

<table>
<thead>
<tr>
<th></th>
<th>I</th>
<th>II</th>
<th>III</th>
</tr>
</thead>
<tbody>
<tr>
<td>NH₂</td>
<td>Is a β₁,β₂ antagonist with ISA.</td>
<td>Is a substrate for MAO A.</td>
<td>Is an endogenous neurotransmitter.</td>
</tr>
<tr>
<td>HO</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CH₃CH₂</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>H</td>
<td></td>
<td></td>
<td></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

18. The drug illustrated below:

<table>
<thead>
<tr>
<th></th>
<th>I</th>
<th>II</th>
<th>III</th>
</tr>
</thead>
<tbody>
<tr>
<td>H₂NCH₂CH₂COH₂C-N</td>
<td>Is used to treat angina and hypertension.</td>
<td>Has a short duration of action.</td>
<td>Has a very rapid onset.</td>
</tr>
<tr>
<td>H₃CH₂COCl</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>H₃CH₂COOCH₃</td>
<td></td>
<td></td>
<td></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

19. The pesticide illustrated below:

<table>
<thead>
<tr>
<th></th>
<th>I</th>
<th>II</th>
<th>III</th>
</tr>
</thead>
<tbody>
<tr>
<td>CH₃</td>
<td></td>
<td></td>
<td></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
20. The drug illustrated below:

\[
\begin{array}{c}
\begin{array}{c}
\begin{array}{c}
\text{Cl} \\
\text{N}
\end{array} \\
\begin{array}{c}
\text{N} \\
\text{N}
\end{array}
\end{array}
\end{array}
\]

<table>
<thead>
<tr>
<th></th>
<th>I: Inhibits the release of norepinephrine.</th>
<th>II: Is an (\alpha_2)-agonist that acts centrally.</th>
<th>III: Is used to treat hypotension.</th>
</tr>
</thead>
<tbody>
<tr>
<td>a</td>
<td>I only</td>
<td>II only</td>
<td>III only</td>
</tr>
<tr>
<td>b</td>
<td>I and II only</td>
<td>II and III only</td>
<td>I, II, and III</td>
</tr>
<tr>
<td>c</td>
<td>II and III only</td>
<td>I only</td>
<td>III only</td>
</tr>
<tr>
<td>d</td>
<td>I only</td>
<td>II only</td>
<td>I and II only</td>
</tr>
<tr>
<td>e</td>
<td>II and III only</td>
<td>I, II, and III</td>
<td>I only</td>
</tr>
</tbody>
</table>

Answer: ___

21. The drug illustrated below:

\[
\begin{array}{c}
\begin{array}{c}
\text{CH}_3 \\
\text{N}
\end{array} \\
\begin{array}{c}
\text{H} \\
\text{O-CHC}
\end{array}
\]

<table>
<thead>
<tr>
<th></th>
<th>I: Inhibits acetylcholinesterase.</th>
<th>II: Is used to treat myasthenia gravis.</th>
<th>III: Is used to treat bradyarrhythmias.</th>
</tr>
</thead>
<tbody>
<tr>
<td>a</td>
<td>I only</td>
<td>II only</td>
<td>III only</td>
</tr>
<tr>
<td>b</td>
<td>I and II only</td>
<td>II and III only</td>
<td>I, II, and III</td>
</tr>
<tr>
<td>c</td>
<td>II and III only</td>
<td>I only</td>
<td>III only</td>
</tr>
<tr>
<td>d</td>
<td>I only</td>
<td>II only</td>
<td>I and II only</td>
</tr>
<tr>
<td>e</td>
<td>II and III only</td>
<td>I, II, and III</td>
<td>I only</td>
</tr>
</tbody>
</table>

Answer: ___

22. The drug illustrated below:

\[
\begin{array}{c}
\begin{array}{c}
\text{HO} \\
\text{NHCH}_3
\end{array} \\
\begin{array}{c}
\text{HO}
\end{array}
\]

<table>
<thead>
<tr>
<th></th>
<th>I: Is pseudoephedrine.</th>
<th>II: Has replaced pseudoephedrine in some OTC products.</th>
<th>III: Is a direct adrenergic agonist.</th>
</tr>
</thead>
<tbody>
<tr>
<td>a</td>
<td>I only</td>
<td>II only</td>
<td>I only</td>
</tr>
<tr>
<td>b</td>
<td>III only</td>
<td>II and III only</td>
<td>I and II only</td>
</tr>
<tr>
<td>c</td>
<td>I only</td>
<td>II only</td>
<td>II and III only</td>
</tr>
<tr>
<td>d</td>
<td>II and III only</td>
<td>I, II, and III</td>
<td>III only</td>
</tr>
<tr>
<td>e</td>
<td>I only</td>
<td>III only</td>
<td>I only</td>
</tr>
</tbody>
</table>

Answer: ___

23. The drug illustrated below:

\[
\begin{array}{c}
\begin{array}{c}
\text{H}_3\text{CO} \\
\text{N}
\end{array} \\
\begin{array}{c}
\text{N} \\
\text{O}
\end{array}
\]

<table>
<thead>
<tr>
<th></th>
<th>I: Can provide symptomatic relief for patients with benign prostatic hyperplasia.</th>
<th>II: Can lower blood pressure.</th>
<th>III: Is an (\alpha_1)-antagonist.</th>
</tr>
</thead>
<tbody>
<tr>
<td>a</td>
<td>I only</td>
<td>II only</td>
<td>III only</td>
</tr>
<tr>
<td>b</td>
<td>III only</td>
<td>I and II only</td>
<td>I only</td>
</tr>
<tr>
<td>c</td>
<td>I and II only</td>
<td>II and III only</td>
<td>I, II, and III</td>
</tr>
<tr>
<td>d</td>
<td>II and III only</td>
<td>I only</td>
<td>III only</td>
</tr>
<tr>
<td>e</td>
<td>I, II, and III</td>
<td>I only</td>
<td>III only</td>
</tr>
</tbody>
</table>

Answer: ___
24. The drug illustrated below is:

\[
\begin{array}{c}
\text{CH}_3 \\
\text{CH}_2\text{NH-CCH}_2\text{CH}_2 \\
\text{H-C-OH} \\
\text{OH} \\
\text{NH}_2 \\
\text{CO} \\
\text{C}_6\text{H}_4 \\
\end{array}
\]

<table>
<thead>
<tr>
<th></th>
<th>I</th>
<th>II</th>
<th>III</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>An (\alpha_1)-agonist.</td>
<td>A (\beta_1) antagonist.</td>
<td>A (\beta_2) 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

25. The drug illustrated below:

\[
\begin{array}{c}
\text{OCCH}_3 \\
\text{O} \\
\text{H} \\
\text{H}_3\text{C} \\
\text{H}_3\text{C} \\
\text{H}_2\text{C} \\
\text{H}_3\text{C} \\
\text{H}_3\text{C} \\
\text{N} \\
\text{H}_3\text{C} \\
\text{H}_3\text{C} \\
\text{H}_3\text{C} \\
\text{H}_3\text{C} \\
\text{H}_3\text{C} \\
\text{H}_3\text{C} \\
\text{H}_3\text{C} \\
\text{H}_3\text{C} \\
\text{H}_3\text{C} \\
\text{H}_3\text{C} \\
\text{H}_3\text{C} \\
\end{array}
\]

<table>
<thead>
<tr>
<th></th>
<th>I</th>
<th>II</th>
<th>III</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Is a depolarizing neuromuscular blocking agent.</td>
<td>Inhibits acetylcholinesterase.</td>
<td>Is a non-depolarizing neuromuscular blocking agent.</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 has:

\[
\begin{array}{c}
\text{H}_3\text{C} \\
\text{O} \\
\text{H} \\
\text{H} \\
\text{H} \\
\text{H} \\
\text{H} \\
\text{H} \\
\text{H} \\
\text{H} \\
\text{H} \\
\text{H} \\
\text{H} \\
\text{H} \\
\text{H} \\
\text{H} \\
\text{H} \\
\text{H} \\
\end{array}
\]

<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 arrhythmias.</td>
<td>Is a potent vasodilator.</td>
<td>Is a calcium channel blocker.</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:

| CH₂CH₃ | H⁻C⁻NHCH(CH₃)₂ | \( \text{I} \) is used to treat asthma. \\
|--------|----------------|----------------------------------|
| H-O-C-H | OH             | \( \text{II} \) is a substrate for catechol-O-methyl transferase. \\
|        | OH             | \( \text{III} \) is used as an inhalant. \\

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:

| CH₂CH₂N⁺S⁻CH₂⁻O⁻ | \( \text{I} \) is a 5-HT₁ agonist. \\
|------------------|----------------------------------|
| CH₂CH₂N⁺CH₃⁻     | \( \text{II} \) is used to treat migraine headache. \\
|                  | \( \text{III} \) is used an antiemetic. \\

a. I only  
b. III only  
c. I and II only  
d. II and III only  
e. I, II, and III

Answer ______

29. The drug illustrated below:

| CH₂N⁺H⁻C⁻CH₃⁻ | \( \text{I} \) is a \( \beta \)-selective antagonist with ISA. \\
|----------------|----------------------------------|
| H⁻C⁻OH         | \( \text{II} \) can reduce blood pressure. \\
| CH₂CH₃         | \( \text{III} \) is \( \beta_1, \beta_2 \)-antagonist with ISA. \\

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:

| CH₃⁴⁺N⁻O⁻CH₂CH₃⁻ | \( \text{I} \) is used to treat Alzheimer’s disease. \\
|------------------|----------------------------------|
| N⁻CH₃⁻          | \( \text{II} \) is an enzyme inhibitor. \\
| CH₂CH₃⁻          | \( \text{III} \) is a reversible indirect-acting cholinergic agent. \\

a. I only  
b. III only  
c. I and II only  
d. II and III only  
e. I, II, and III

Answer ______
Part II (12 Points)

1. Indicate BRIEFLY and SPECIFICALLY the difference, if any, in the MECHANISM OF ACTION between the following two drugs. When requested, provide the generic name.

   Generic Name: __________________________

2. Indicate BRIEFLY and SPECIFICALLY the difference, if any, in the MECHANISM OF ACTION between the following two drugs. When requested, provide the generic name.

   Generic Name: __________________________

3. Indicate BRIEFLY and SPECIFICALLY the difference, if any, in the MECHANISM OF ACTION between the following two drugs. When requested, provide the generic name.

   Generic Name: __________________________

4. Indicate BRIEFLY and SPECIFICALLY the Differences, if any, in the MECHANISM Associated with the Extended Duration of Action of the following two asthmatic agents, which are administered by inhalation. When requested, provide the generic name.

   Generic Name: __________________________
Part III (12 Points)

1. Indicate BRIEFLY and SPECIFICALLY the difference, if any, in the principal MEDICINAL USE between the following two drugs. When requested, provide the generic name of the drug.

Generic Name: _______________________

2. Indicate BRIEFLY and SPECIFICALLY the difference, if any, in the principal MEDICINAL USE between the following two drugs. When requested, provide the generic name of the drug.

Generic Name: _______________________

3. Indicate BRIEFLY and SPECIFICALLY the difference, if any, in the principal MEDICINAL USE between the following two drugs. When requested, provide the generic name of the drug.

Generic Name: _______________________

4. Indicate BRIEFLY and SPECIFICALLY the Chemical Basis for the Differences in the principal MEDICINAL USE of the following two Anticholinergic Agents. When requested, provide the generic name of the drug.

Generic Name: _______________________

5. Indicate BRIEFLY and SPECIFICALLY the Chemical Basis for the Differences in the principal MEDICINAL USE of the following two Anticholinergic Agents. When requested, provide the generic name of the drug.
Part IV. Nomenclature (16 Points)
Complete the structures of all FOUR of the compounds listed.

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).

Note: For all salts, designate the conjugate acid or conjugate base with the cation and anion as they would preferentially exist.

Examples:

Incorrect:
- Incorrect chemical symbol (-1 point each)
- Hydrogen missing from nitrogen (-1 point)
- 5 bonds to carbon (-2 points)
- Hydrogens missing from carbon chain (-1 point)

Correct:
- 5,8-Dimethyl-3-hydroxy-1-azabicyclo[3.2.1]oct-6-ene (endo,syn)
- 4-Isoquinolinebutanol, 1,8-dimethyl-8-[(1-methylamino)ethyl]

1. 5,8-Dimethyl-3-hydroxy-1-azabicyclo[3.2.1]oct-6-ene (endo,syn)

2. 4-Isoquinolinebutanol, 1,8-dimethyl-8-[(1-methylamino)ethyl]
3. 2-Oxo-1,11-diazadispiro[4.2.5.2]pentadec-6-ene, monohydrochloride

4. Phenylethylamine. β-hydroxy-α-ethyl-3-acetyloxy-4-fluoro-, [S (R* S*)]-

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<tr>
<th>Part</th>
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<td>Part I</td>
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