BSc Degree Examinations 2018-9

Department:
BIOLOGY

Title of Exam:
Pharmacology

Time Allowed:
1.5 hours

Marking Scheme:
Total marks available for this paper: 60
Section A contains interpretation and data handling questions (40 marks). Section B contains an essay question (one from 2 choices) 20 marks

Instructions:
Section A: Answer all questions in the spaces provided on the examination paper
Section B: Answer either question A or B. Write your answer in the green answer booklet provided and attach it to the back of the question paper using the cable tie provided.

Materials Supplied:
CALCULATOR, Graph Paper, Green Answer Booklet

For marker use only:

<table>
<thead>
<tr>
<th></th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>A</th>
<th>B</th>
<th>Total as %</th>
</tr>
</thead>
</table>

DO NOT WRITE ON THIS BOOKLET BEFORE THE EXAM BEGINS

DO NOT TURN OVER THIS PAGE UNTIL INSTRUCTED TO DO SO BY AN INVIGILATOR
SECTION A:

Answer all questions in the spaces provided.

Mark total for this section: 40

1.

a) Describe how the route of drug administration may be tailored to the specific needs of the patient giving examples of relevant clinical situations in each case.  

(3 marks)

b) If a patient inadvertently overdoses on a drug what clinical interventions are available to minimise resulting harm?  

(2 marks)

2.

a) Once a drug is present in the target tissue what factors determine the time course of the drug’s action?  

(3 marks)

b) Explain why this may be important for achieving the desired therapeutic effect.
3. For drugs acting at G protein-coupled receptors:

a) Give an example of a drug-receptor-effector pathway for a drug acting via Gas (G protein subunit alpha-S) (3 marks)

b) Give an example of drug-receptor-effector pathway for a drug acting via Gaq (G protein subunit alpha-q) (3 marks)

4. If a receptor changes calcium ion concentration inside a cell ([Ca^{2+}]):

a) Briefly explain three possible consequences in terms of change in cell function. (3 marks)

b) Calcium ion concentration can increase in the cytoplasm owing to influx through L-type calcium channels or by release from intracellular stores. Which drugs affect these systems and what may they be useful for clinically? (2 marks)
5. Below is the change in plasma concentration ($C_p$) of two newly developed chemotherapeutic drugs immediately following an intravenous bolus dose.

![Diagram showing plasma concentration over time for Drug A and Drug B](image)

a) Which compartment model best describes the pharmacokinetic profiles of these drugs and why? (2 marks)

b) What is the value of $C_0$ for each drug? (1 mark)
c) What is the elimination rate constant \( (K_{\text{el}}) \) for each drug? Show how you arrived at your answer. \( \text{(4 marks)} \)

6. In a study examining the effects of a potential new treatment for anxiety, the drug (X) is tested in an assay quantifying the effects of the stress hormone cortisol on plasma noradrenaline (NA) levels. The following values were obtained:

<table>
<thead>
<tr>
<th>Cortisol conc’n (mM)</th>
<th>[NA] (nM) (cortisol alone)</th>
<th>[NA] (nM) (cortisol + Drug X)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.001</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>0.002</td>
<td>12</td>
<td>0</td>
</tr>
<tr>
<td>0.005</td>
<td>89</td>
<td>76</td>
</tr>
<tr>
<td>0.010</td>
<td>200</td>
<td>167</td>
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<td>0.020</td>
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<td>430</td>
<td>250</td>
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<tr>
<td>0.100</td>
<td>456</td>
<td>255</td>
</tr>
</tbody>
</table>

a) Plot a concentration-response curve (semilog) of the effects of cortisol alone and cortisol plus drug x. Label axes appropriately. \( \text{(3 marks)} \)
b) What are the approximate binding affinities \((K_d)\) for cortisol alone and in the presence of drug X. \((2 \text{ marks})\)

c) What type of agonist or antagonist best describes drug X for this effect of cortisol. Explain your answer. \((1 \text{ mark})\)

7. Consider the following 2 brief case studies:

a) A 60 year old woman who has previously been prescribed codeine for pain relief for her headaches visits her GP to complain that she is feeling no better. Provide a pharmacological explanation for why this may be the case. \((3 \text{ marks})\)

b) A 24 year old student from Thailand starts to develop nausea, as well as a red flush and eventually suffers from vomiting after drinking champagne at their graduation ceremony. Provide a pharmacological explanation for their symptoms. \((3 \text{ marks})\)
The space above the line is sufficient for your answer.
SECTION B: Essay question

Answer one question in the green answer booklet provided.

Remember to write your candidate number on the front of the answer booklet and indicate whether you have answered question A or B at the top of the page.

Mark total for this section: 20

A. Describe the main types of adverse drug reaction (ADR) seen in the clinic. Briefly explain the cause(s) of each.

Or

B. Compare and contrast the four main receptor-effector systems used by drugs to alter biological processes.