 Examination Candidate Number: _____________

 Desk Number: _____________

 UNIVERSITY OF YORK
 BSc Stage 2 Degree Examinations 2017-18

 Department:
 BIOLOGY

 Title of Exam:
 Pharmacology

 Time allowed: 1 hour and 30 minutes
 Total marks available for this paper: 80

 This paper has three parts:

 Section A: Short answer questions (30 marks)
   - Answer all questions in the spaces provided on the examination paper

 Section B: Problem questions (20 marks)
   - Answer all questions in the spaces provided on the examination paper

 Section C: Long answer question (marked out of 100, weighted 30 marks)
   - Answer either question A or question B
   - Write your answer on the separate paper provided and attach it to the back of the question paper using the treasury tag provided

   - The marks available for each question are indicated on the paper
   - A calculator will be provided

 For marker use only:

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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: Short answer questions

Answer all questions in the spaces provided

Mark total for this section: 30

1. 
   a) Which organ is involved in the "first pass" metabolism?  
   (1 mark)

   b) Name two common systemic drug administration routes aimed at avoiding 
      the "first pass" metabolism.  
   (2 marks)

   c) Name two phase 2 chemical reactions involved in first pass drug metabolism.  
   (2 marks)
2. Describe the two main types and features of adverse drug reactions to medicinal products and briefly explain the differences. (6 marks)

3. 
   a) Give an example of drug-enzyme interactions which first led clinicians into the field of pharmacogenetics. Name both the enzyme and drug involved. (2 marks)

   b) Give an example in childhood leukaemia where pharmacogenetics is important. Name the pathway/enzyme and drug involved. (2 marks)

   c) Give two examples of the potential benefits of considering pharmacogenetic or pharmacogenomic data. (2 marks)
4.

a) Give 3 reasons why drug effects mediated by GPCRs are so diverse.  
(3 marks)

b) Give an example of a drug-receptor-effector-enzyme target combination for a 
G-protein-coupled receptor system targeted by mood stabilising drugs such as 
lithium.  
(3 marks)

5.

a) Describe three adverse consequences of using drugs with strong bonds (e.g. 
Ionic, hydrophobic, covalent) to their receptor targets.  
(3 marks)
6.

a) What is the difference between mutagenesis and oncogenesis? (2 marks)

b) Name two human oncoviruses. (2 marks)
SECTION B: Problem questions

Answer all questions in the spaces provided

Mark total for this section: 20

7. Below is the change in plasma concentration ($C_p$) of a new anticonvulsant immediately following a bolus dose.

![Graph showing plasma concentration over time](image)

a) By what route was this drug most likely administered? Explain your answer. (2 marks)

b) What is the value of $C_{\text{max}}$? (1 mark)

c) What is the value of $T_{\text{max}}$? (1 mark)
d) Why might this administration route not be recommended in cases of clinical urgency? (2 marks)

8. The graph below shows the concentration-response curves for 4 drugs (named A-D) in a laboratory assay for smooth muscle function.

a) Within the ‘drug effect spectrum’ describe the drugs A,B,C,D in terms of their behaviour at their receptor. (4 marks)
b) What is the approximate $K_d$ of drug A? (1 mark)

c) What does the behaviour of drug D tell you about the baseline activity of its receptor? (1 mark)

d) Give the equation that relates maximal binding ($B_{\text{max}}$) to dissociation constant ($K_d$). (2 marks)

9. Consider the following case study: A 45 year old male suffers from occasional spastic paralysis of the lower limbs. He is prescribed an experimental anti-spastic drug which, in the laboratory, has been shown to act by reducing calcium ion binding to troponin. The drug significantly alleviates his muscle spasms but he reports multiple side effects including shortness of breath, oedema in his lower legs and inability to perform his usual exercise routines.

a) What is the likely cause of his side-effects? (1 mark)

b) What are the similarities and differences in the mechanisms underlying contraction in different muscle types? (3 marks)

c) Why does he report no side effects related to gut function? (2 marks)
SECTION C: Long answer question

Answer one question on the separate paper provided

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

Mark total for this section: 30

EITHER

A) Why is liver and kidney function vitally important when considering drug dosing regimens? Discuss the role of these organs in drug metabolism and excretion (and the pharmacokinetic consequences), how they influence drug interactions and the role they play in drug toxicity.

OR

B) Compound X is a potential novel nootropic (memory enhancing) drug acting to enhance calcium entry in neurons. Discuss, including mechanisms, the main consequences for synaptic transmission and suggest potential adverse effects of its administration.