



**KENYATTA UNIVERSITY**

**EXAMINATION FOR THE DEGREE OF BACHELOR OF PHARMACY  
(BPHARM) LEVEL III**

**PPB 320: PHARMACOLOGY OF THE AUTONOMIC NERVOUS SYSTEM**

**1<sup>ST</sup> SEMESTER 2022/2023**

**TIME: 2 HOURS**

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**INSTRUCTIONS:**

- The paper consists of **THREE** sections; **SECTIONS: A, B, and C**
  - Answer each section on separate booklets. Label each booklet **CLEARLY**
  - Answer **ALL** questions
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**SECTION A**

**PPB 321: PHARMACOLOGY OF THE AUTONOMIC NERVOUS SYSTEM**

- Answer ALL questions
- The section comprises of 10 MCQS and 5 essay/short answer questions
- Total: 40 marks

**MULTIPLE CHOICE QUESTIONS:**

**Choose the best response**

1. .... is the rate-limiting step in acetylcholine biosynthesis.
  - A. Influx of sodium ions
  - B. Increase in intracellular calcium ion concentration
  - C. Recycling of choline
  - D. Activation of acetyltransferase enzyme
  - E. Regeneration of acetylcholinesterase enzyme

2. Which one of the following beta blockers is preferred for glaucoma due to its lack of local anaesthetic action?
  - A. Nadolol
  - B. Atenolol
  - C. Esmolol
  - D. Nebivolol
  - E. Timolol
3. Which one of the following drugs is most stable against acetylcholinesterase?
  - A. carbachol
  - B. methacholine
  - C. bethanechol
  - D. suxamethonium
  - E. acetylcholine
4. Which one of the following statements is TRUE of ganglion blockers? They....
  - A. are currently comprised of non-depolarizing agents
  - B. act mainly at the autonomic ganglion
  - C. cause diarrhoea
  - D. cause an increase in blood pressure
  - E. enhance ejaculation
5. ....is inhibited by bromocriptine.
  - A. catechol-O-methyl transferase
  - B. monoamine oxidase
  - C. D<sub>2</sub> receptor
  - D. reuptake-I inhibitor
  - E. DOPA decarboxylase
6. An alkaloid agonist acting at muscarinic receptors is.....
  - A. hemicholinium
  - B. pilocarpine
  - C. physostigmine
  - D. ipratropium
  - E. atropine

7. .... is effective in treating both organophosphate and muscarine poisoning.
- A. nicotine
  - B. echothiophate
  - C. atropine
  - D. pilocarpine
  - E. tubocurarine
8. Cholinergic activity on stomach acid secretion is .....
- A. increased during rest
  - B. increased during fight
  - C. not changed in flight
  - D. decreased in presence of food
  - E. decreased in sleep
9. Activation of the sympathetic nervous system will cause which change in the skeletal muscle and cutaneous vascular beds respectively?
- A. Vasoconstriction, vasoconstriction
  - B. Fasciculation, vasodilatation
  - C. Vasodilatation, vasoconstriction
  - D. Vasoconstriction, vasodilation
  - E. Fasciculation, vasoconstriction
10. Which of the following drugs has high surface activity and vasoconstrictor actions and is used to reduce bleeding in mucous membrane?
- A. Benzocaine
  - B. Bupivacaine
  - C. Cocaine
  - D. Lidocaine
  - E. Procaine
11. Using an appropriate example, outline the 'false transmitter' concept. (2 marks)
12. State TWO clinical uses of the following drugs; (6 marks)
- a) Physostigmine
  - b) Atropine
  - c) Yohimbine

- d) Clonidine
- e) Prazosin
- f) Pralidoxime

13. Read the following circumstances and answer the questions below.

- i) Several children at a scouts' camping trip were hospitalized after their first dinner which was mainly homemade canned food. They had difficulty swallowing, breathing, moving the eyes, muscle weakness and slurred speech.
- ii) Mrs. O, a librarian finds it increasingly difficult to organize the library shelves especially in the afternoons as she gets very fatigued and can hardly raise her arms.
- iii) Chris was in a party when he suddenly appeared euphoric, had an energetic high and was sweating, confused, agitated and his body temperature seemed to be rising.

- a) State the likely cause of each of the circumstances above. (3 marks; 1 mark each)
- b) Propose an approach and/or agent to counter the signs and symptoms in each case. (3 marks; 1 mark each)

14. For each of the agents listed below, explain the mechanism of action. (8 marks)

- a) Butoxamine
- b) Prazosin
- c) Echothiophate
- d) Atracurium

15. Describe the pharmacokinetic profiles of the following agents (8 marks)

- a) Acetylcholine
- b) Amphetamine
- c) Terbutaline
- d) Edrophonium

## **SECTION B**

### **PPB 322: CENTAL NERVOUS SYSTEM PHARMACOLOGY I**

- Answer ALL questions
- The section comprises of 10 MCQS and 7 essay/short answer questions
- Total: 40 marks

#### **MULTIPLE CHOICE QUESTIONS:**

**Choose the best response**

1. The following is TRUE regarding dopamine EXCEPT .....
  - A. it is a biogenic amine
  - B. it is found in adrenergic neurons
  - C. functions as a neuromodulator
  - D. stimulates prolactin release
  - E. elicits emesis
2. Which of the following statements is TRUE about serotonin receptors?
  - A. 5HT<sub>1</sub> - autoreceptors
  - B. 5HT<sub>2</sub> - blocked by LSD
  - C. 5HT<sub>3</sub> - localized in the cerebellum
  - D. 5HT<sub>4</sub> mediate cognitive function
  - E. 5HT<sub>7</sub> mediate gastrointestinal function
3. Tetanus toxin.....
  - A. is a viral toxin
  - B. prevents glycine release
  - C. selectively inhibits GlyT1 receptors
  - D. selectively inhibits GlyT2 receptors
  - E. acts on cortical neurons
4. The following are TRUE of GABA<sub>B</sub> receptors EXCEPT they .....
  - A. are heterodimeric
  - B. are G-protein coupled
  - C. inhibit calcium channel opening
  - D. inhibit potassium channel opening
  - E. are stimulated by baclofen

5. Activation of metabotropic receptors located pre-synaptically causes inhibition by decreasing the inward flux of
- A. Calcium
  - B. Chloride
  - C. Potassium
  - D. Sodium
  - E. Zinc
6. Which statement concerning the pharmacokinetics of antiseizure drugs is TRUE?
- A. Although ethosuximide has a half-life of 40 h, it is taken twice a day
  - B. At high doses, phenytoin elimination follows first-order kinetics
  - C. Valproic acid may increase the synthesis of porphyrins
  - D. Treatment with vigabatrin reduces the effectiveness of oral contraceptives
  - E. Phenobarbital is mainly bound to alpha-glycoproteins
7. Which statement concerning the barbiturates is ACCURATE?
- A. Abstinence syndromes are more severe during withdrawal from phenobarbital than from secobarbital
  - B. Alkalinization of the urine accelerates the elimination of phenobarbital
  - C. Barbiturates may increase the half-lives of drugs metabolized by the liver
  - D. Compared with barbiturates, buspirone exhibits a steeper dose-response relationship
  - E. Respiratory depression caused by barbiturate overdose can be reversed by flumazenil
8. Which drug is MOST likely to elevate the plasma concentration of other drugs administered concomitantly?
- A. Carbamazepine
  - B. Clonazepam
  - C. Gabapentin
  - D. Valproic acid
  - E. Vigabatrin

9. Which statement concerning nitrous oxide is TRUE?
- Lacks cardiovascular depression
  - Anemia is a common adverse effect
  - It is the most potent of the inhaled anesthetics
  - Causes malignant hyperthermia
  - Eliminated via hepatic metabolism
10. A 16-year-old patient visits his dentist for a routine checkup. He finds that his wisdom teeth are severely impacted and need to be removed. The oral surgeon to whom he is referred plans on using an agent that has good analgesic and sedative properties but does not cause skeletal muscle relaxation. Which agent has these ideal properties?
- Enflurane
  - Nitrous oxide
  - Thiopental
  - Halothane
  - Isoflurane
11. Describe the mechanism of action of the following: (3marks)
- Eszopiclone
  - Gabapentin
  - Lignocaine
12. The pKa of bupivacaine is 8.3. Calculate the percentage of the drug in the nonionized form that will be in infected tissue, of pH 6.3. (2 marks)
13. Identify THREE molecular targets and the respective second messenger for the actions of inhaled anesthetic drugs. (3 marks)
14. Account for the following:
- short duration of action of thiopental. (3 marks)
  - long duration action of diazepam. (3 marks)
15. Using a diagram, contrast dose-response relationship of phenobarbital, lorazepam and buspirone. (4 marks)
16. Regarding phenytoin pharmacokinetics, explain:
- absorption (2 marks)
  - metabolism (4marks)

17. A 20-year-old male patient scheduled for hernia surgery is administered with halothane, nitrous oxide and pancuronium. The patient rapidly developed tachycardia and became hypertensive. Generalized skeletal muscle rigidity was accompanied by marked hyperthermia. Laboratory values revealed hyperkalaemia and acidosis.

- i. Name the adverse reaction observed? (1 mark)
- ii. Which of the drugs administered MOST likely caused the patient's symptoms? (1 mark)
- iii. Describe the molecular mechanism of the adverse reaction observed. (2 marks)
- iv. List TWO genes that are possibly mutated making the patient susceptible to the drug reaction observed. (1 mark)
- v. Name and outline the mechanism of action of the appropriate drug to administer for the management of the reaction. (2 marks)

### **SECTION C**

#### **PPB 323: CENTAL NERVOUS SYSTEM PHARMACOLOGY II**

- Answer ALL questions
- The section comprises of 10 MCQS and 7 essay/short answer questions
- Total: 40 marks

### **MULTIPLE CHOICE QUESTIONS:**

#### **Choose the best response**

1. Entacapone may be of value in patients being treated with levodopa-carbidopa because it
  - A. Inhibits acetylcholine esterase
  - B. Decreases the formation of 3-*O*-methyldopa
  - C. Inhibits monoamine oxidase type B
  - D. Inhibits neuronal reuptake of dopamine
  - E. Releases dopamine from nerve endings
2. Which of the following drugs has a high affinity for 5-HT<sub>2</sub> receptors in the brain, does not cause extrapyramidal dysfunction or hematotoxicity, and is reported to increase the risk of significant QT prolongation?

- A. Clozapine
  - B. Haloperidol
  - C. Molindone
  - D. Olanzapine
  - E. Ziprasidone
3. Concerning the mechanisms of action of antidepressants, which statement is TRUE?
- A. Bupropion inhibits 5-HT reuptake into nerve endings in the CNS
  - B. Chronic treatment with tricyclic antidepressants leads to upregulation of adrenoceptors in the CNS
  - C. Decreased levels of NE and 5-HT in cerebrospinal fluid are characteristic of depressed patients before drug therapy
  - D. Nefazodone blocks 5-HT receptors in the CNS
  - E. Selegiline selectively decreases the metabolism of serotonin
4. Which sign or symptom is likely to occur with marijuana?
- A. Bradycardia
  - B. Conjunctival reddening
  - C. Hypertension
  - D. Increased psychomotor performance
  - E. Mydriasis
5. Which of the following statements best describes the main mechanism by which cocaine exerts its effects in the nervous system?
- A. Directly activates adrenergic receptors
  - B. Inhibits neuronal-norepinephrine reuptake
  - C. Inhibits catechol-O-methyltransferase
  - D. Blocks neuronal norepinephrine release
  - E. Increases neuronal norepinephrine release
6. Which of the following is a non-competitive NMDA receptor inhibitor that can be used to treat Alzheimer's disease?
- A. Memantine
  - B. Donepezil
  - C. Tacrine

- D. Galantamine
- E. Rivastigmine

7. Neuronal glutamate receptor modulation can result in neuronal damage by the following mechanisms **EXCEPT**.....

- A. altered intracellular calcium levels
- B. excessive free radical production.
- C. mitochondrial damage
- D. dendritic damage
- E. excitotoxicity

8. NMDA receptor antagonist that interacts with glycine binding site of channel to prevent excessive excitation while sparing normal functions

- A. Felbamate
- B. Tiagabine
- C. Pregabalin
- D. Vigabatrin
- E. Amantadine

9. Ethanol is used in methanol poisoning because it:

- A. antagonizes methanol cellular protein precipitation action
- B. stimulates the metabolism of methanol and reduces its blood level
- C. inhibits the metabolism of methanol and generation of toxic metabolite
- D. replenishes the folate stores depleted by methanol
- E. replenishes the enzymes responsible for methanol metabolism

10. The distinctive feature of methadone compared to morphine is:

- A. High oral bioavailability
- B. High plasma protein and tissue binding
- C. Delayed and milder withdrawal symptoms
- D. Fewer drug-drug interactions

E. Low volume of distribution

11. Describe TWO neurochemical abnormalities most closely associated with schizophrenia. (4 marks)

12. Match the neurogenerative disorder with appropriate causative protein aggregate. (2 marks)

- |                          |                       |
|--------------------------|-----------------------|
| i) Prion disease         | A. Lewy bodies        |
| ii) Alzheimer disease    | B. Nuclear inclusions |
| iii) Parkinson's disease | C. PrP amyloid        |
| iv) Huntington's disease | D. $\beta$ -amyloid   |

13. Identify TWO drugs that cause extrapyramidal symptoms. (2 marks)

14. Contrast bromocriptine and levodopa under the following titles; (4 marks)

- i) pharmacodynamics
- ii) pharmacokinetics

15. Regarding lithium, explain:

i) TWO distinct mechanisms of action (4 marks)

ii) pharmacokinetic properties (4 marks)

16. A 33-year-old woman patient treated with haloperidol is seen in casualty. Her husband describes complaints of rapidly worsening fever, muscle stiffness, and tremor. Her level of consciousness is diminishing. Her temperature is 40°C, and her serum creatine kinase (CK) level is elevated.

i) Name the reaction the patient is experiencing. (1 mark)

ii) Outline the molecular mechanism of the reaction. 2 marks)

17. Describe the relationship of receptor-blocking actions to the pharmacodynamics of both the typical and atypical antipsychotics. (3 marks)

18. M. K.O 73-year-old male is brought to hospital by a neighbor. History reveals that the man avoids company, lives by himself, and does not regularly visit a physician. The examination reveals that the man has difficulty walking, chorea and dystonia, and is suffering from dementia. It is believed that the man's father died from a similar disease.

i) What is the MOST likely diagnosis? (1 mark)

ii) Which drug would be prescribed for the patient's motor symptoms? (1 mark)

iii) Describe the mechanism of action of the drug in question (ii). (2 marks)