PharmaRecall™

PHARMACODYNAMICS

MCQ Practice Pack • Volume 1

30 EXAM-FOCUSED MULTIPLE-CHOICE QUESTIONS

Answers with Explanations

Prepared by Dr Araromi Ebisola Jonathan Vincent

Pharmacology Tutor • Medical Content Writer

Designed for medical, pharmacy, nursing, physiology and other health-science students. Choose the single best answer for each question before checking the answer key and explanations.

Instructions

Each question has one best answer. Try completing all 30 questions before reviewing the answer key. The explanations reinforce core concepts and clarify common examination traps.

Section 1 — Core Concepts and Receptor Pharmacology

1. Which statement best defines pharmacodynamics?

A. The study of drug absorption and elimination

B. The study of what drugs do to the body and how they produce effects

C. The study of drug formulation and manufacture

D. The study of drug prices and availability

2. Which statement correctly distinguishes affinity from efficacy?

A. Affinity is maximal response; efficacy is receptor binding

B. Affinity is binding tendency; efficacy is the capacity to produce a response

C. Affinity and efficacy are interchangeable terms

D. Affinity measures toxicity; efficacy measures elimination

3. A partial agonist is added to a system containing a full agonist acting at the same receptor. What may occur?

A. The response must increase to the full agonist maximum

B. The partial agonist can reduce the overall response by competing for receptors

C. The partial agonist always has no receptor affinity

D. The full agonist becomes an inverse agonist

4. Which best describes an inverse agonist?

A. It binds only to inactive receptors and has no effect

B. It reduces constitutive receptor activity

C. It always produces the same response as a full agonist

D. It irreversibly destroys the receptor

5. A reversible competitive antagonist is added to an agonist. Which change is typically expected in a simple graded dose–response experiment?

A. Leftward shift with increased Emax

B. Rightward shift with preserved Emax if enough agonist is given

C. Immediate elimination of all receptor activity

D. Downward shift that cannot be overcome by more agonist

6. Which is most characteristic of noncompetitive antagonism?

A. It always increases agonist potency

B. It commonly reduces the agonist's achievable Emax

C. It has greater intrinsic activity than a full agonist

D. It necessarily binds the endogenous ligand site reversibly

7. Which statement about potency is correct?

A. It is the maximum effect a drug can produce

B. It is commonly compared using EC50 under comparable conditions

C. It is always directly proportional to toxicity

D. It is identical to therapeutic index

8. Two drugs have the same Emax, but Drug X has a lower EC50 than Drug Y. Which conclusion is most appropriate?

A. Drug X is more potent in the tested system

B. Drug X is necessarily safer

C. Drug Y is more efficacious

D. Drug X must be a partial agonist

9. What does Emax most directly represent in a graded dose–response curve?

A. The dose at which toxicity first appears

B. The maximal response achievable in the tested system

C. The fraction of a population responding

D. The time required for drug elimination

10. In a quantal dose–response curve, ED50 usually refers to the dose that:

A. Produces the maximum effect in every subject

B. Is effective in 50% of the population for a defined endpoint

C. Produces toxicity in all subjects

D. Is eliminated by 50% of the kidney

11. A tissue produces a maximal response when only a fraction of its receptors are occupied. This is evidence of:

A. Tachyphylaxis

B. Receptor reserve

C. Physiological antagonism

D. Zero efficacy

12. Which ratio is commonly used as a basic expression of therapeutic index?

A. ED50/TD50

B. TD50/ED50

C. EC50/Emax

D. Clearance/volume of distribution

Section 2 — Dose–Response and Signal Transduction

13. Activation of a Gs-coupled receptor most directly tends to:

A. Inhibit adenylyl cyclase and lower cAMP

B. Stimulate adenylyl cyclase and increase cAMP

C. Directly cleave DNA

D. Block all calcium movement

14. Activation of a Gi-coupled receptor commonly:

A. Inhibits adenylyl cyclase and reduces cAMP

B. Activates adenylyl cyclase in every tissue

C. Converts cAMP to DNA

D. Produces no signalling in any circumstance

15. Which sequence best represents the Gq–PLC pathway?

A. Gq → phospholipase C → IP3 and DAG

B. Gs → guanylyl cyclase → DNA replication

C. Gi → tyrosine hydroxylase → cGMP only

D. GPCR → direct steroid synthesis in every cell

16. Which of the following is a second messenger?

A. Albumin

B. cAMP

C. Haemoglobin

D. Collagen

17. Ligand binding to a receptor tyrosine kinase commonly leads to:

A. Receptor-associated phosphorylation and downstream signalling

B. Direct excretion of the ligand by the lungs

C. Immediate destruction of all cellular proteins

D. Exclusive activation of ligand-gated chloride channels

18. Steroid hormones often produce longer-term effects through intracellular receptors by:

A. Regulating gene transcription

B. Opening only extracellular sodium channels

C. Blocking all protein synthesis permanently

D. Acting exclusively through cAMP

19. What is receptor desensitisation?

A. An increase in receptor responsiveness after every exposure

B. A reduction in responsiveness after continued or repeated stimulation

C. The irreversible removal of all drug from plasma

D. The increase in drug absorption caused by food

20. Which statement best distinguishes receptor downregulation from desensitisation?

A. Downregulation means fewer receptors are available; desensitisation means reduced responsiveness

B. They always mean exactly the same thing

C. Desensitisation refers only to kidney clearance

D. Downregulation always increases receptor number

Section 3 — Applied Pharmacodynamics and Clinical Reasoning

21. A patient has a rapid decline in response after repeated doses over a short period. Which term best describes this phenomenon?

A. Tachyphylaxis

B. Bioavailability

C. First-pass metabolism

D. Receptor affinity

22. Which is an example of physiological antagonism?

A. Two drugs competing at the same receptor site

B. Adrenaline opposing histamine-induced bronchoconstriction through a different receptor pathway

C. A drug being displaced from albumin

D. A drug inhibiting its own metabolism

23. Pharmacodynamic tolerance is best described as:

A. Reduced response at a similar drug concentration due to target or system adaptation

B. Faster drug elimination in every case

C. Reduced drug absorption caused by food

D. Complete absence of drug-receptor binding from the first dose

24. Two drugs produce additive sedation despite neither changing the plasma concentration of the other. This is most consistent with:

A. A pharmacodynamic interaction

B. A pharmacokinetic interaction only

C. Reduced receptor affinity in all tissues

D. An increase in renal filtration caused by both drugs

25. Which statement about therapeutic index is most accurate?

A. A wide index guarantees no serious adverse effects

B. It captures every source of individual variability

C. It is a useful but incomplete measure of separation between effective and toxic doses

D. It is identical to drug potency

26. A drug's dose is increased, but a particular desired effect no longer rises appreciably. This is most consistent with:

A. A ceiling effect for that response

B. Increased potency at every dose

C. A leftward shift by definition

D. Absence of efficacy at all doses

27. Which factor can contribute to interindividual differences in pharmacodynamic response?

A. Receptor expression and genetic variation

B. Only tablet colour

C. The brand name alone in every case

D. The patient's height in isolation, regardless of context

28. A positive allosteric modulator typically:

A. Binds the orthosteric site and always activates the receptor maximally alone

B. Binds a different site and enhances the response to an orthosteric ligand

C. Destroys the receptor after binding

D. Prevents all endogenous ligands from binding in every circumstance

29. Different ligands acting at the same receptor preferentially activate different downstream pathways. This is called:

A. Biased agonism

B. First-pass metabolism

C. Quantal toxicity

D. Physiological antagonism

30. Why may abrupt withdrawal after long-term use of some receptor-active drugs cause rebound symptoms?

A. Compensatory adaptations may remain temporarily unopposed after the drug is removed

B. All drugs permanently destroy receptors

C. The therapeutic index always becomes zero

D. Receptor occupancy must remain at 100% after discontinuation

Answer Key and Explanations

Use this section after completing the questions. Review the explanation for each incorrect answer and return to the related recall cards in Pharmacodynamics Volumes 1 and 2.

1. Correct answer: B. The study of what drugs do to the body and how they produce effects

Pharmacodynamics concerns drug effects and mechanisms of action. Absorption, distribution, metabolism and excretion are pharmacokinetic processes.

2. Correct answer: B. Affinity is binding tendency; efficacy is the capacity to produce a response

Affinity describes how readily a drug binds to a receptor. Efficacy describes its ability, once bound, to activate the system and produce a response.

3. Correct answer: B. The partial agonist can reduce the overall response by competing for receptors

A partial agonist has lower efficacy than a full agonist in the same system. By occupying receptors, it can reduce the proportion activated by the full agonist.

4. Correct answer: B. It reduces constitutive receptor activity

Inverse agonists reduce baseline activity when a receptor has constitutive activity. A neutral antagonist blocks agonist binding without shifting basal activity.

5. Correct answer: B. Rightward shift with preserved Emax if enough agonist is given

A reversible competitive antagonist can usually be overcome by increasing agonist concentration, producing a rightward shift while preserving Emax.

6. Correct answer: B. It commonly reduces the agonist's achievable Emax

Noncompetitive antagonism reduces the system's ability to produce the maximal response and is not fully overcome by increasing agonist concentration.

7. Correct answer: B. It is commonly compared using EC50 under comparable conditions

Potency refers to the amount or concentration needed to produce a specified effect. A lower EC50 generally indicates greater potency in comparable systems.

8. Correct answer: A. Drug X is more potent in the tested system

With the same maximum response, a lower EC50 indicates that less Drug X is needed to produce half-maximal effect. This does not establish relative safety.

9. Correct answer: B. The maximal response achievable in the tested system

Emax is the maximal observed response under the experimental conditions and is commonly used as an indicator of efficacy.

10. Correct answer: B. Is effective in 50% of the population for a defined endpoint

In quantal population analysis, ED50 is the dose effective in 50% of the population. Some graded-response texts use ED50 differently, so context matters.

11. Correct answer: B. Receptor reserve

Receptor reserve means all receptors need not be occupied to produce a maximal response, often because signalling pathways amplify the initial receptor signal.

12. Correct answer: B. TD50/ED50

Therapeutic index is commonly expressed as TD50/ED50, or LD50/ED50 in suitable animal studies. It is a simplified measure and does not fully predict individual safety.

13. Correct answer: B. Stimulate adenylyl cyclase and increase cAMP

Gs commonly stimulates adenylyl cyclase, increasing cAMP and activating protein kinase A and other downstream targets.

14. Correct answer: A. Inhibits adenylyl cyclase and reduces cAMP

Gi commonly inhibits adenylyl cyclase, lowering cAMP. G-protein subunits may also regulate ion channels and other effectors.

15. Correct answer: A. Gq → phospholipase C → IP3 and DAG

Gq activates phospholipase C-β, which cleaves PIP2 to generate IP3 and DAG. IP3 promotes intracellular calcium release; DAG contributes to protein kinase C activation.

16. Correct answer: B. cAMP

cAMP is a second messenger. Other common examples include cGMP, IP3, DAG and intracellular Ca2+.

17. Correct answer: A. Receptor-associated phosphorylation and downstream signalling

Many receptor tyrosine kinases dimerise or rearrange and undergo autophosphorylation, recruiting signalling proteins that regulate pathways such as MAPK and PI3K–Akt.

18. Correct answer: A. Regulating gene transcription

Lipophilic steroid hormones can enter cells and bind intracellular receptors that regulate transcription. Effects often develop more slowly than ion-channel signalling.

19. Correct answer: B. A reduction in responsiveness after continued or repeated stimulation

Desensitisation may involve receptor phosphorylation, uncoupling, internalisation or other changes that reduce responsiveness.

20. Correct answer: A. Downregulation means fewer receptors are available; desensitisation means reduced responsiveness

Downregulation concerns receptor number or availability; desensitisation concerns responsiveness. They can occur together but are distinct concepts.

21. Correct answer: A. Tachyphylaxis

Tachyphylaxis is a rapid decrease in response after repeated dosing. Mechanisms may include mediator depletion or receptor/signalling adaptation.

22. Correct answer: B. Adrenaline opposing histamine-induced bronchoconstriction through a different receptor pathway

Physiological antagonists act through different mechanisms to produce opposing effects. This differs from pharmacological receptor antagonism.

23. Correct answer: A. Reduced response at a similar drug concentration due to target or system adaptation

Pharmacodynamic tolerance reflects changes in target sensitivity or physiological response. Pharmacokinetic tolerance occurs when exposure decreases, such as through increased metabolism.

24. Correct answer: A. A pharmacodynamic interaction

Pharmacodynamic interactions occur when effects add, enhance or oppose one another without necessarily changing drug concentrations.

25. Correct answer: C. It is a useful but incomplete measure of separation between effective and toxic doses

Therapeutic index is a simplified safety measure. It does not fully account for rare toxicity, interactions, patient variability, monitoring or clinical context.

26. Correct answer: A. A ceiling effect for that response

A ceiling effect occurs when further dose increases produce little or no additional effect for a particular endpoint. Other adverse effects may still increase.

27. Correct answer: A. Receptor expression and genetic variation

Response can vary with genetics, receptor expression, age, disease state, concurrent medicines, tolerance and physiological reserve, among other factors.

28. Correct answer: B. Binds a different site and enhances the response to an orthosteric ligand

Positive allosteric modulators bind a distinct site and enhance the response to an orthosteric ligand. Their effect depends on receptor and ligand context.

29. Correct answer: A. Biased agonism

Biased agonism describes ligand-dependent preference for particular downstream signalling pathways through the same receptor.

30. Correct answer: A. Compensatory adaptations may remain temporarily unopposed after the drug is removed

Chronic exposure can induce compensatory adaptations. When the drug is withdrawn, those adaptations may briefly produce rebound effects or withdrawal symptoms, depending on the drug.

Educational note: This pack is intended for learning and examination preparation. Question wording and explanations are simplified for revision and should be used alongside course materials and standard pharmacology texts.

PharmaRecall™ • Pharmacodynamics MCQ Practice Pack • Volume 1