

MCAT Biological and Biochemical Foundations of Living Systems

Practice Test 2

MCAT Biological and Biochemical Foundations of Living Systems • Form 2

Directions. This is an original independent practice form designed to mirror the current MCAT section structure. Select the best answer for each question. Do not use the answer fields or explanations until you have completed the form. **Timing.** 95 minutes. The practice form uses the AAMC section timing; it is not an official AAMC form and does not produce an official scaled score. **Blueprint note.** Approximate disciplines: introductory biology 65%, first-semester biochemistry 25%, general chemistry 5%, organic chemistry 5%; Foundational Concepts 1-3; Skills 1-4.

Passage 1: Evolution

In a follow-up study of selection, investigators compared two conditions that differed in the frequency of a heritable trait under an environmental pressure. They preregistered the expected direction and repeated the measurement with an independent batch of samples. The follow-up was designed to separate the proposed mechanism from a tempting alternative explanation. Data summary: The heritable phenotype became more common only in populations exposed to the stated selective pressure. The researchers also monitored the comparison variable described in the protocol. The result supports the interpretation that differential reproductive success shifts the distribution of heritable variants. A replication supports the mechanism only within the tested range and does not remove the need to identify possible confounders.

1. Which new result would most clearly distinguish the proposed explanation of selection from a competing mechanism?
 - A. Individuals acquire directed mutations because they need them.
 - B. Natural selection changes only an individual during its lifetime.
 - C. All genetic variation is harmful to a population.
 - D. The trait is heritable and correlated with offspring number.
2. The investigators repeat the study after the focal variable changes in the direction described by the passage. Which immediate outcome should be measured first?
 - A. All genetic variation is harmful to a population.
 - B. The advantageous phenotype increases in frequency when the pressure persists.
 - C. Individuals acquire directed mutations because they need them.
 - D. Natural selection changes only an individual during its lifetime.
3. Which protocol would best isolate the effect of the frequency of a heritable trait under an environmental pressure on selection?
 - A. Compare with a population lacking the selective pressure.
 - B. Individuals acquire directed mutations because they need them.
 - C. Natural selection changes only an individual during its lifetime.
 - D. The trait is heritable and correlated with offspring number.
4. Which prediction follows when the focal variable moves in the same direction described in the passage and the mechanism operates within the tested range?

- A. Natural selection changes only an individual during its lifetime.
 - B. Individuals acquire directed mutations because they need them.
 - C. Compare with a population lacking the selective pressure.
 - D. The advantageous phenotype increases in frequency when the pressure persists.
5. Which observation would be most inconsistent with the proposed explanation of selection?
- A. The trait is heritable and correlated with offspring number.
 - B. The advantageous phenotype increases in frequency when the pressure persists.
 - C. Natural selection changes population frequencies, not because individuals choose to adapt.
 - D. Individuals acquire directed mutations because they need them.

Passage 2: Cell cycle

In a follow-up study of checkpoint control, investigators compared two conditions that differed in DNA damage before division. They preregistered the expected direction and repeated the measurement with an independent batch of samples. The follow-up was designed to separate the proposed mechanism from a tempting alternative explanation. Data summary: A DNA-damage signal increased checkpoint-protein activity before cells entered the next division phase. The researchers also monitored the comparison variable described in the protocol. The result supports the interpretation that checkpoints protect genome integrity by delaying division or triggering repair or death. A replication supports the mechanism only within the tested range and does not remove the need to identify possible confounders.

6. Which new result would most clearly distinguish the proposed explanation of checkpoint control from a competing mechanism?
- A. The cell cycle has no checkpoints that can delay progression.
 - B. DNA damage changes only the cell membrane and not nuclear control.
 - C. A checkpoint protein becomes active before division is delayed.
 - D. DNA damage always accelerates cell division.
7. The investigators repeat the study after the focal variable changes in the direction described by the passage. Which immediate outcome should be measured first?
- A. DNA damage changes only the cell membrane and not nuclear control.
 - B. Cells with damage spend longer before entering the next phase.
 - C. DNA damage always accelerates cell division.
 - D. The cell cycle has no checkpoints that can delay progression.
8. Which protocol would best isolate the effect of DNA damage before division on checkpoint control?
- A. The cell cycle has no checkpoints that can delay progression.
 - B. A checkpoint protein becomes active before division is delayed.
 - C. Compare damaged and undamaged cells with the same growth factors.
 - D. DNA damage always accelerates cell division.

9. Which prediction follows when the focal variable moves in the same direction described in the passage and the mechanism operates within the tested range?
- A. Cells with damage spend longer before entering the next phase.
 - B. DNA damage always accelerates cell division.
 - C. Compare damaged and undamaged cells with the same growth factors.
 - D. The cell cycle has no checkpoints that can delay progression.
10. Which observation would be most inconsistent with the proposed explanation of checkpoint control?
- A. DNA damage always accelerates cell division.
 - B. A checkpoint protein becomes active before division is delayed.
 - C. Cells with damage spend longer before entering the next phase.
 - D. Loss of checkpoint function can increase mutation accumulation.

Passage 3: Immune response

In a follow-up study of clonal selection, investigators compared two conditions that differed in exposure to a specific antigen. They preregistered the expected direction and repeated the measurement with an independent batch of samples. The follow-up was designed to separate the proposed mechanism from a tempting alternative explanation. Data summary: The second antigen exposure produced a faster response and a larger concentration of antigen-specific antibody. The researchers also monitored the comparison variable described in the protocol. The result supports the interpretation that selection and proliferation amplify cells with matching receptors. A replication supports the mechanism only within the tested range and does not remove the need to identify possible confounders.

11. Which new result would most clearly distinguish the proposed explanation of clonal selection from a competing mechanism?
- A. Red blood cells are the primary source of antibodies.
 - B. Memory formation requires destruction of all antigen receptors.
 - C. A second exposure produces a faster and larger response.
 - D. Every lymphocyte responds identically to every antigen.
12. The investigators repeat the study after the focal variable changes in the direction described by the passage. Which immediate outcome should be measured first?
- A. Memory formation requires destruction of all antigen receptors.
 - B. The frequency of antigen-specific clones increases after exposure.
 - C. Every lymphocyte responds identically to every antigen.
 - D. Red blood cells are the primary source of antibodies.
13. Which protocol would best isolate the effect of exposure to a specific antigen on clonal selection?
- A. Red blood cells are the primary source of antibodies.
 - B. A second exposure produces a faster and larger response.
 - C. Compare antigen-specific and unrelated lymphocyte populations.
 - D. Every lymphocyte responds identically to every antigen.

14. Which prediction follows when the focal variable moves in the same direction described in the passage and the mechanism operates within the tested range?
- A. Compare antigen-specific and unrelated lymphocyte populations.
 - B. The frequency of antigen-specific clones increases after exposure.
 - C. Red blood cells are the primary source of antibodies.
 - D. Every lymphocyte responds identically to every antigen.
15. Which observation would be most inconsistent with the proposed explanation of clonal selection?
- A. Memory cells can support a faster response after later exposure.
 - B. Every lymphocyte responds identically to every antigen.
 - C. A second exposure produces a faster and larger response.
 - D. The frequency of antigen-specific clones increases after exposure.

Passage 4: Metabolism

In a follow-up study of oxidative phosphorylation, investigators compared two conditions that differed in the proton gradient across the inner mitochondrial membrane. They preregistered the expected direction and repeated the measurement with an independent batch of samples. The follow-up was designed to separate the proposed mechanism from a tempting alternative explanation. Data summary: Increasing the usable proton gradient increased ATP output until oxygen delivery became limiting. The researchers also monitored the comparison variable described in the protocol. The result supports the interpretation that the gradient stores electrochemical energy used by ATP synthase. A replication supports the mechanism only within the tested range and does not remove the need to identify possible confounders.

16. Which new result would most clearly distinguish the proposed explanation of oxidative phosphorylation from a competing mechanism?
- A. A protonophore lowers ATP output while oxygen consumption initially changes.
 - B. ATP synthase can produce ATP without the proton gradient in this model.
 - C. The inner mitochondrial membrane generates oxygen as its primary product.
 - D. The proton gradient exists only in the nucleus.
17. The investigators repeat the study after the focal variable changes in the direction described by the passage. Which immediate outcome should be measured first?
- A. ATP synthase can produce ATP without the proton gradient in this model.
 - B. The inner mitochondrial membrane generates oxygen as its primary product.
 - C. The proton gradient exists only in the nucleus.
 - D. Increasing the proton gradient increases ATP production until another component becomes limiting.
18. Which protocol would best isolate the effect of the proton gradient across the inner mitochondrial membrane on oxidative phosphorylation?
- A. The inner mitochondrial membrane generates oxygen as its primary product.
 - B. A protonophore lowers ATP output while oxygen consumption initially changes.

- C. Maintain oxygen and substrate while varying the gradient within the system's operating range.
 - D. ATP synthase can produce ATP without the proton gradient in this model.
19. Which prediction follows when the focal variable moves in the same direction described in the passage and the mechanism operates within the tested range?
- A. The inner mitochondrial membrane generates oxygen as its primary product.
 - B. Increasing the proton gradient increases ATP production until another component becomes limiting.
 - C. ATP synthase can produce ATP without the proton gradient in this model.
 - D. Maintain oxygen and substrate while varying the gradient within the system's operating range.
20. Which observation would be most inconsistent with the proposed explanation of oxidative phosphorylation?
- A. Electron transport and ATP synthesis are coupled through proton movement.
 - B. ATP synthase can produce ATP without the proton gradient in this model.
 - C. A protonophore lowers ATP output while oxygen consumption initially changes.
 - D. Increasing the proton gradient increases ATP production until another component becomes limiting.

Passage 5: Genetics

In a follow-up study of linkage, investigators compared two conditions that differed in the distance between loci. They preregistered the expected direction and repeated the measurement with an independent batch of samples. The follow-up was designed to separate the proposed mechanism from a tempting alternative explanation. Data summary: The recombinant fraction was larger for the more distant pair of loci in the three-point cross. The researchers also monitored the comparison variable described in the protocol. The result supports the interpretation that crossing over is more likely between loci that are farther apart. A replication supports the mechanism only within the tested range and does not remove the need to identify possible confounders.

21. Which new result would most clearly distinguish the proposed explanation of linkage from a competing mechanism?
- A. Recombination frequency is unrelated to the distance between loci.
 - B. Every offspring produced by a linked cross is recombinant.
 - C. A three-point cross places the loci in the predicted order.
 - D. Linked loci always segregate together without recombination.
22. The investigators repeat the study after the focal variable changes in the direction described by the passage. Which immediate outcome should be measured first?
- A. Every offspring produced by a linked cross is recombinant.
 - B. More distant loci produce a larger fraction of recombinant gametes.
 - C. Linked loci always segregate together without recombination.
 - D. Recombination frequency is unrelated to the distance between loci.

23. Which protocol would best isolate the effect of the distance between loci on linkage?
- A. Use the same heterozygous parent and score many offspring.
 - B. Linked loci always segregate together without recombination.
 - C. Recombination frequency is unrelated to the distance between loci.
 - D. A three-point cross places the loci in the predicted order.
24. Which prediction follows when the focal variable moves in the same direction described in the passage and the mechanism operates within the tested range?
- A. Linked loci always segregate together without recombination.
 - B. Use the same heterozygous parent and score many offspring.
 - C. Recombination frequency is unrelated to the distance between loci.
 - D. More distant loci produce a larger fraction of recombinant gametes.

Passage 6: Respiratory physiology

In a follow-up study of oxygen binding, investigators compared two conditions that differed in blood oxygen partial pressure. They preregistered the expected direction and repeated the measurement with an independent batch of samples. The follow-up was designed to separate the proposed mechanism from a tempting alternative explanation. Data summary: At matched temperature and pH, hemoglobin saturation increased with oxygen partial pressure, with the steepest change in the middle of the binding curve. The researchers also monitored the comparison variable described in the protocol. The result supports the interpretation that cooperative binding creates a curve with plateau and steep regions. A replication supports the mechanism only within the tested range and does not remove the need to identify possible confounders.

25. Which new result would most clearly distinguish the proposed explanation of oxygen binding from a competing mechanism?
- A. Hemoglobin binds oxygen irreversibly under physiological conditions.
 - B. pH cannot alter hemoglobin's oxygen affinity.
 - C. The curve shifts when pH changes at constant oxygen pressure.
 - D. Hemoglobin saturation changes linearly with oxygen pressure at every range.
26. The investigators repeat the study after the focal variable changes in the direction described by the passage. Which immediate outcome should be measured first?
- A. pH cannot alter hemoglobin's oxygen affinity.
 - B. At high partial pressure, a moderate increase produces a smaller saturation increase than it would in the steep region.
 - C. Hemoglobin saturation changes linearly with oxygen pressure at every range.
 - D. Hemoglobin binds oxygen irreversibly under physiological conditions.
27. Which protocol would best isolate the effect of blood oxygen partial pressure on oxygen binding?
- A. The curve shifts when pH changes at constant oxygen pressure.
 - B. Measure saturation with temperature and pH fixed.

- C. Hemoglobin saturation changes linearly with oxygen pressure at every range.
- D. Hemoglobin binds oxygen irreversibly under physiological conditions.

28. Which prediction follows when the focal variable moves in the same direction described in the passage and the mechanism operates within the tested range?
- A. Hemoglobin binds oxygen irreversibly under physiological conditions.
 - B. Hemoglobin saturation changes linearly with oxygen pressure at every range.
 - C. Measure saturation with temperature and pH fixed.
 - D. At high partial pressure, a moderate increase produces a smaller saturation increase than it would in the steep region.

Passage 7: Cardiovascular physiology

In a follow-up study of cardiac output, investigators compared two conditions that differed in heart rate at fixed stroke volume. They preregistered the expected direction and repeated the measurement with an independent batch of samples. The follow-up was designed to separate the proposed mechanism from a tempting alternative explanation. Data summary: Direct flow measurements matched the product of heart rate and stroke volume during the transient interval studied. The researchers also monitored the comparison variable described in the protocol. The result supports the interpretation that the product of rate and volume determines output. A replication supports the mechanism only within the tested range and does not remove the need to identify possible confounders.

29. Which new result would most clearly distinguish the proposed explanation of cardiac output from a competing mechanism?
- A. Cardiac output equals blood pressure divided by oxygen concentration.
 - B. Heart rate and stroke volume cannot influence the same output.
 - C. Cardiac output is independent of volume ejected per beat.
 - D. Direct flow measurement matches the predicted product.
30. The investigators repeat the study after the focal variable changes in the direction described by the passage. Which immediate outcome should be measured first?
- A. Cardiac output increases when heart rate rises if stroke volume is unchanged.
 - B. Cardiac output equals blood pressure divided by oxygen concentration.
 - C. Heart rate and stroke volume cannot influence the same output.
 - D. Cardiac output is independent of volume ejected per beat.
31. Which protocol would best isolate the effect of heart rate at fixed stroke volume on cardiac output?
- A. Cardiac output equals blood pressure divided by oxygen concentration.
 - B. Heart rate and stroke volume cannot influence the same output.
 - C. Direct flow measurement matches the predicted product.
 - D. Measure output while keeping stroke volume and venous return constant.
32. Which prediction follows when the focal variable moves in the same direction described in the passage and the mechanism operates within the tested range?

- A. Heart rate and stroke volume cannot influence the same output.
- B. Cardiac output equals blood pressure divided by oxygen concentration.
- C. Measure output while keeping stroke volume and venous return constant.
- D. Cardiac output increases when heart rate rises if stroke volume is unchanged.

Passage 8: Membrane transport

In a follow-up study of solute movement, investigators compared two conditions that differed in the concentration gradient. They preregistered the expected direction and repeated the measurement with an independent batch of samples. The follow-up was designed to separate the proposed mechanism from a tempting alternative explanation. Data summary: With voltage fixed, increasing the ion concentration ratio increased the initial current through the open channels. The researchers also monitored the comparison variable described in the protocol. The result supports the interpretation that net passive flux depends on the gradient, while a finite transporter population can become occupied. A replication supports the mechanism only within the tested range and does not remove the need to identify possible confounders.

33. Which new result would most clearly distinguish the proposed explanation of solute movement from a competing mechanism?
- A. Blocking the transporter reduces flux without changing the gradient.
 - B. Passive transport moves solute against its electrochemical gradient without energy input.
 - C. ATP is required for every form of membrane movement.
 - D. Membrane composition cannot affect solute flux.
34. The investigators repeat the study after the focal variable changes in the direction described by the passage. Which immediate outcome should be measured first?
- A. Net movement increases as the concentration gradient becomes larger, until another transport limit is reached.
 - B. Passive transport moves solute against its electrochemical gradient without energy input.
 - C. ATP is required for every form of membrane movement.
 - D. Membrane composition cannot affect solute flux.
35. Which protocol would best isolate the effect of the concentration gradient on solute movement?
- A. ATP is required for every form of membrane movement.
 - B. Blocking the transporter reduces flux without changing the gradient.
 - C. Use identical membranes and vary only the starting concentration difference.
 - D. Passive transport moves solute against its electrochemical gradient without energy input.
36. Which prediction follows when the focal variable moves in the same direction described in the passage and the mechanism operates within the tested range?
- A. ATP is required for every form of membrane movement.
 - B. Net movement increases as the concentration gradient becomes larger, until another transport limit is reached.
 - C. Passive transport moves solute against its electrochemical gradient without energy input.

- D. Use identical membranes and vary only the starting concentration difference.

Passage 9: Gene expression

In a follow-up study of transcription, investigators compared two conditions that differed in the availability of an activating transcription factor. They preregistered the expected direction and repeated the measurement with an independent batch of samples. The follow-up was designed to separate the proposed mechanism from a tempting alternative explanation. Data summary: Target-gene RNA increased in cells receiving the activating factor before the encoded protein increased. The researchers also monitored the comparison variable described in the protocol. The result supports the interpretation that regulatory proteins influence whether RNA polymerase initiates transcription efficiently. A replication supports the mechanism only within the tested range and does not remove the need to identify possible confounders.

37. Which new result would most clearly distinguish the proposed explanation of transcription from a competing mechanism?
- A. Target-gene RNA rises before the encoded protein increases.
 - B. Translation occurs before transcription in a eukaryotic cell.
 - C. Every change in gene expression requires a change in DNA sequence.
 - D. Ribosomes bind regulatory DNA to initiate transcription.
38. The investigators repeat the study after the focal variable changes in the direction described by the passage. Which immediate outcome should be measured first?
- A. Every change in gene expression requires a change in DNA sequence.
 - B. Ribosomes bind regulatory DNA to initiate transcription.
 - C. Messenger RNA for the target gene increases when an activating factor is available.
 - D. Translation occurs before transcription in a eukaryotic cell.
39. Which protocol would best isolate the effect of the availability of an activating transcription factor on transcription?
- A. Translation occurs before transcription in a eukaryotic cell.
 - B. Every change in gene expression requires a change in DNA sequence.
 - C. Target-gene RNA rises before the encoded protein increases.
 - D. Compare cells with and without the factor while keeping promoter sequence identical.
40. Which prediction follows when the focal variable moves in the same direction described in the passage and the mechanism operates within the tested range?
- A. Messenger RNA for the target gene increases when an activating factor is available.
 - B. Compare cells with and without the factor while keeping promoter sequence identical.
 - C. Translation occurs before transcription in a eukaryotic cell.
 - D. Every change in gene expression requires a change in DNA sequence.

Passage 10: Enzyme kinetics

In a follow-up study of enzyme activity, investigators compared two conditions that differed in substrate concentration. They preregistered the expected direction and repeated the measurement with an independent batch of samples. The follow-up was designed to separate the proposed mechanism from a tempting alternative explanation. Data summary: Velocity rose rapidly at low substrate concentration and approached a plateau at high concentration. The researchers also monitored the comparison variable described in the protocol. The result supports the interpretation that finite active-site availability produces saturation behavior. A replication supports the mechanism only within the tested range and does not remove the need to identify possible confounders.

41. Which new result would most clearly distinguish the proposed explanation of enzyme activity from a competing mechanism?
- A. Velocity continues to rise linearly without approaching a plateau.
 - B. A velocity-versus-substrate plot rises and approaches a plateau, while a double-reciprocal plot of $1/v$ against $1/[S]$ is linear.
 - C. Velocity decreases immediately as substrate rises for every enzyme.
 - D. Enzyme concentration alone determines velocity regardless of substrate concentration.
42. The investigators repeat the study after the focal variable changes in the direction described by the passage. Which immediate outcome should be measured first?
- A. Velocity rises at first and then approaches a plateau.
 - B. Velocity decreases immediately as substrate rises for every enzyme.
 - C. Enzyme concentration alone determines velocity regardless of substrate concentration.
 - D. Velocity continues to rise linearly without approaching a plateau.
43. Which protocol would best isolate the effect of substrate concentration on enzyme activity?
- A. Velocity decreases immediately as substrate rises for every enzyme.
 - B. Enzyme concentration alone determines velocity regardless of substrate concentration.
 - C. A velocity-versus-substrate plot rises and approaches a plateau, while a double-reciprocal plot of $1/v$ against $1/[S]$ is linear.
 - D. Measure the same enzyme with substrate varied and enzyme concentration fixed.
44. Which prediction follows when the focal variable moves in the same direction described in the passage and the mechanism operates within the tested range?
- A. Measure the same enzyme with substrate varied and enzyme concentration fixed.
 - B. Velocity decreases immediately as substrate rises for every enzyme.
 - C. Enzyme concentration alone determines velocity regardless of substrate concentration.
 - D. Velocity rises at first and then approaches a plateau.
45. In a simple model, a noncompetitive inhibitor most directly decreases:
- A. V_{max}
 - B. The amount of substrate
 - C. The genetic code

D. The number of chromosomes

46. Transcription in a eukaryotic cell occurs primarily in the:

A. Extracellular fluid

B. Nucleus

C. Ribosome

D. Lysosome

47. A ribosome uses which molecule as the immediate template for a polypeptide?

A. Antibody

B. mRNA

C. Lipid

D. Glycogen

48. A homozygous recessive individual for a trait represented by A/a has genotype:

A. AA

B. A

C. aa

D. Aa

49. Increased ADH most directly increases water reabsorption in the:

A. Renal artery wall only

B. Collecting duct

C. Glomerular basement membrane

D. Bowman capsule

50. A hormone that crosses the phospholipid bilayer and binds an intracellular receptor is most likely:

A. A membrane-impermeable ion

B. A ribosomal RNA

C. Lipid-soluble

D. A large polysaccharide

51. During repolarization of a typical neuron, which event contributes directly?

A. Permanent loss of all ion gradients

B. DNA replication

C. Ribosome dissociation

D. Potassium efflux

52. A deletion of two nucleotides from a coding sequence is most likely to cause:
- A. A silent change by definition
 - B. Whole-genome duplication
 - C. No possible protein effect
 - D. A frameshift
53. A receptor tyrosine kinase is activated most directly by:
- A. Dissolution of the phospholipid bilayer
 - B. Ligand binding that promotes receptor phosphorylation
 - C. mRNA degradation in the nucleus
 - D. Peptide-bond hydrolysis in a ribosome
54. During meiosis I, the structures that separate are primarily:
- A. Amino acids
 - B. Ribosomal subunits
 - C. Homologous chromosomes
 - D. Sister chromatids
55. Disulfide bonds most directly stabilize which level of protein organization?
- A. Tertiary structure
 - B. Primary sequence only
 - C. The genetic code
 - D. Chromosome number
56. A cell in a hypotonic solution will generally:
- A. Lose water and shrink
 - B. Remain unaffected under all conditions
 - C. Immediately divide
 - D. Gain water and swell
57. A study that measures naturally occurring variables without assigning treatment has limited ability to establish:
- A. A descriptive association
 - B. Causation
 - C. A sample mean
 - D. A measurement unit

58. The immune cells that secrete large amounts of antibody are:

- A.** Plasma cells
- B.** Platelets
- C.** Osteoclasts
- D.** Motor neurons

59. A founder effect can reduce variation because:

- A.** Every allele is copied equally into every new population
- B.** Mutation stops permanently
- C.** Natural selection becomes impossible
- D.** A small founding group carries only a subset of the source population's alleles

Answer Key and Explanations

1. **Answer: D.** The distinguishing result should change in the direction predicted by the mechanism while addressing the alternative: differential reproductive success shifts the distribution of heritable variants.
2. **Answer: B.** The immediate outcome should match the stated prediction and mechanism: differential reproductive success shifts the distribution of heritable variants.
3. **Answer: A.** A valid protocol holds the relevant competing variables steady while measuring selection.
4. **Answer: D.** The prediction is limited to the tested range and follows because differential reproductive success shifts the distribution of heritable variants.
5. **Answer: D.** The observation is inconsistent because it conflicts with the mechanism used to explain selection: differential reproductive success shifts the distribution of heritable variants.
6. **Answer: C.** The distinguishing result should change in the direction predicted by the mechanism while addressing the alternative: checkpoints protect genome integrity by delaying division or triggering repair or death.
7. **Answer: B.** The immediate outcome should match the stated prediction and mechanism: checkpoints protect genome integrity by delaying division or triggering repair or death.
8. **Answer: C.** A valid protocol holds the relevant competing variables steady while measuring checkpoint control.
9. **Answer: A.** The prediction is limited to the tested range and follows because checkpoints protect genome integrity by delaying division or triggering repair or death.
10. **Answer: A.** The observation is inconsistent because it conflicts with the mechanism used to explain checkpoint control: checkpoints protect genome integrity by delaying division or triggering repair or death.
11. **Answer: C.** The distinguishing result should change in the direction predicted by the mechanism while addressing the alternative: selection and proliferation amplify cells with matching receptors.
12. **Answer: B.** The immediate outcome should match the stated prediction and mechanism: selection and proliferation amplify cells with matching receptors.
13. **Answer: C.** A valid protocol holds the relevant competing variables steady while measuring clonal selection.
14. **Answer: B.** The prediction is limited to the tested range and follows because selection and proliferation amplify cells with matching receptors.
15. **Answer: B.** The observation is inconsistent because it conflicts with the mechanism used to explain clonal selection: selection and proliferation amplify cells with matching receptors.

16. **Answer: A.** The distinguishing result should change in the direction predicted by the mechanism while addressing the alternative: the gradient stores electrochemical energy used by ATP synthase.
17. **Answer: D.** The immediate outcome should match the stated prediction and mechanism: the gradient stores electrochemical energy used by ATP synthase.
18. **Answer: C.** A valid protocol holds the relevant competing variables steady while measuring oxidative phosphorylation.
19. **Answer: B.** The prediction is limited to the tested range and follows because the gradient stores electrochemical energy used by ATP synthase.
20. **Answer: B.** The observation is inconsistent because it conflicts with the mechanism used to explain oxidative phosphorylation: the gradient stores electrochemical energy used by ATP synthase.
21. **Answer: C.** The distinguishing result should change in the direction predicted by the mechanism while addressing the alternative: crossing over is more likely between loci that are farther apart.
22. **Answer: B.** The immediate outcome should match the stated prediction and mechanism: crossing over is more likely between loci that are farther apart.
23. **Answer: A.** A valid protocol holds the relevant competing variables steady while measuring linkage.
24. **Answer: D.** The prediction is limited to the tested range and follows because crossing over is more likely between loci that are farther apart.
25. **Answer: C.** The distinguishing result should change in the direction predicted by the mechanism while addressing the alternative: cooperative binding creates a curve with plateau and steep regions.
26. **Answer: B.** The immediate outcome should match the stated prediction and mechanism: cooperative binding creates a curve with plateau and steep regions.
27. **Answer: B.** A valid protocol holds the relevant competing variables steady while measuring oxygen binding.
28. **Answer: D.** The prediction is limited to the tested range and follows because cooperative binding creates a curve with plateau and steep regions.
29. **Answer: D.** The distinguishing result should change in the direction predicted by the mechanism while addressing the alternative: the product of rate and volume determines output.
30. **Answer: A.** The immediate outcome should match the stated prediction and mechanism: the product of rate and volume determines output.
31. **Answer: D.** A valid protocol holds the relevant competing variables steady while measuring cardiac output.

- 32. Answer: D.** The prediction is limited to the tested range and follows because the product of rate and volume determines output.
- 33. Answer: A.** The distinguishing result should change in the direction predicted by the mechanism while addressing the alternative: net passive flux depends on the gradient, while a finite transporter population can become occupied.
- 34. Answer: A.** The immediate outcome should match the stated prediction and mechanism: net passive flux depends on the gradient, while a finite transporter population can become occupied.
- 35. Answer: C.** A valid protocol holds the relevant competing variables steady while measuring solute movement.
- 36. Answer: B.** The prediction is limited to the tested range and follows because net passive flux depends on the gradient, while a finite transporter population can become occupied.
- 37. Answer: A.** The distinguishing result should change in the direction predicted by the mechanism while addressing the alternative: regulatory proteins influence whether RNA polymerase initiates transcription efficiently.
- 38. Answer: C.** The immediate outcome should match the stated prediction and mechanism: regulatory proteins influence whether RNA polymerase initiates transcription efficiently.
- 39. Answer: D.** A valid protocol holds the relevant competing variables steady while measuring transcription.
- 40. Answer: A.** The prediction is limited to the tested range and follows because regulatory proteins influence whether RNA polymerase initiates transcription efficiently.
- 41. Answer: B.** The distinguishing result should change in the direction predicted by the mechanism while addressing the alternative: finite active-site availability produces saturation behavior.
- 42. Answer: A.** The immediate outcome should match the stated prediction and mechanism: finite active-site availability produces saturation behavior.
- 43. Answer: D.** A valid protocol holds the relevant competing variables steady while measuring enzyme activity.
- 44. Answer: D.** The prediction is limited to the tested range and follows because finite active-site availability produces saturation behavior.
- 45. Answer: A.** Noncompetitive inhibition reduces the amount of functional enzyme, lowering $V_{\max}$ in the simple model.
- 46. Answer: B.** Nuclear DNA is transcribed into RNA before the RNA is exported for translation.
- 47. Answer: B.** The ribosome reads mRNA codons during translation.

48. **Answer: C.** Homozygous recessive means two copies of the recessive allele.
49. **Answer: B.** ADH increases collecting-duct water permeability, promoting water reabsorption.
50. **Answer: C.** Lipid-soluble hormones can diffuse through the bilayer and bind intracellular receptors.
51. **Answer: D.** Opening of potassium channels permits K^+ efflux and moves the membrane potential back toward negative values.
52. **Answer: D.** A deletion not divisible by three shifts the reading frame downstream.
53. **Answer: B.** Ligand binding can promote receptor dimerization and autophosphorylation, initiating signaling.
54. **Answer: C.** Homologous chromosomes separate in meiosis I; sister chromatids separate in meiosis II.
55. **Answer: A.** Covalent disulfide bonds between cysteine side chains can stabilize tertiary structure.
56. **Answer: D.** Water enters toward the cell's greater effective solute concentration.
57. **Answer: B.** Without experimental assignment, alternative explanations remain and causal inference is limited.
58. **Answer: A.** Activated B cells can differentiate into antibody-secreting plasma cells.
59. **Answer: D.** A small founding group can carry an unrepresentative sample of the source population's genetic variation.