IMAT 2025
PROGRAM

# TEST DI MEDICINA 2019 EXAM

TRANSLATED BY :
**LOCOMOTIVE Group**

PREPARED FOR :
**IMAT Candidates**

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# TABLE OF CONTENTS

**The Italian Ministry of Education administers the TOLC-MED test twice a year. While these exams are generally easier than the IMAT tests, they share the same syllabus and number of questions. To prepare effectively for the IMAT exams, students should practice with the TOLC-MED tests. We recommend that students solve tests from at least the past five years.**


## 01 LOGIC

22 Questions
All types of question

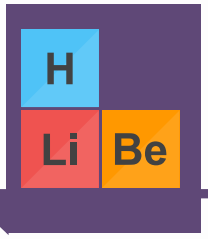
## 02 GK

22 Questions
All types of questions

## 03 BIOLOGY

18 Questions
All topics

## 04 CHEMISTRY

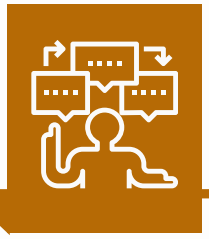



12 Questions
All topics

## 05 PHYSICS

8 Questions
All topics

## 06 MATH



8 Questions
All topics

1. Which famous English mathematician collaborated with the British army during the Second World War to decipher Nazi codes?

A) Alan M. Turing
B) Bertrand A. W. Russell
C) Godfrey H. Hardy
D) John E. Littlewood
E) Harold Jeffreys

2. Which of the following Italian doctors is also famous mainly for the educational method that bears their name?

A) Camillo Golgi
B) Maria Montessori
C) Ferdinando Aiuti
D) Rita Levi Montalcini
E) Umberto Veronesi

3. Which of the following events happened during the lifetime of Leonardo da Vinci?

A) Discovery of America
B) French Revolution
C) Richard the Lionheart takes part in the Third Crusade
D) Thirty Years' War
E) Death of Dante Alighieri

4. Which of the following is not a Parisian museum?

A) Louvre
B) Musée du quai Branly
C) Madame Tussauds
D) Musée Grévin
E) Musée D'Orsay

5. "Circumstance or set of circumstances from which it is feared that serious harm may result" is the definition associated with which of the following words?

A) Alarm
B) Unknown
C) Danger
D) Emergency
E) Incident

**6. For a wine tasting evening, Nicolò and Michele bring respectively 5 and 3 bottles of different wines, each costing €15. Tommaso, the third and last participant in the evening, does not bring any bottle but contributes to the wine expenses with €40. How should the €40 be divided between Nicolò and Michele so that each contributes equally to the cost?**

**A) €25 to Nicolò, €15 to Michele**
**B) €20 to Nicolò, €20 to Michele**
**C) €30 to Nicolò, €10 to Michele**
**D) €35 to Nicolò, €5 to Michele**
**E) It is not possible for each of the three to contribute the same amount to the expenses**

**7. For his aquarium, Michele bought 50 fish among neon, guppy, black angel, and clown loach. 46 are not guppy, 33 are not clown loach, and the number of neon is one more than the number of black angel. How many neon are there?**

**A) 11**
**B) 13**
**C) 15**
**D) 12**
**E) 14**

**8. In a toy shop, Alice finds plush toys of the character Gigio in two sizes: the large ones cost twice as much as the small ones. Alice decides to buy five small ones and three large ones. If, instead, she had bought five large ones and three small ones, she would have spent €24 more. What is the price Alice pays for one large Gigio plush toy?**

**A) €9**
**B) €6**
**C) €18**
**D) €24**
**E) €12**

**9. Which of the following series ABCDE is consistent with all three series 1, 2, and 3?**

1. **spring, summer, autumn, winter**
2. **morning, midday, afternoon, evening, night**
3. **Monday, Tuesday, Wednesday, Thursday, Friday, Saturday, Sunday**

**A) January, February, March, April, May, June, July, August, September, October, November, December**
**B) Thumb, index, middle, ring, little finger**
**C) 1, 2, 3, 4, 5, 6**
**D) George H.W. Bush, William J. Clinton, George W. Bush, Barack H. Obama, Donald J. Trump**
**E) Holly, begonia, chrysanthemum, dahlia, heather**

**10. Given an isosceles trapezoid with the larger base twice the length of the smaller base, add two right triangles to the trapezoid in such a way as to obtain a rectangle having the same height as the trapezoid and the base coinciding with the larger base of the trapezoid. If the sum of the areas of the two added triangles is 20 cm², what is the area of the trapezoid, in square centimeters?**

**A) 40**
**B) 100**
**C) 60**
**D) 80**
**E) 120**

**11. One of the criticisms of Darwinian theory is attributed to Thomas Huxley (1825–1895) with the famous paradox: "The amount of milk produced in England is directly proportional to the number of old maids in the country."**

**In fact, Huxley explains, milk, as is well known, is produced by cows, and they produce more the more clover they can eat. The insects that promote clover pollination are bumblebees, whose nests are often destroyed by mice. The fiercest enemies of mice are cats, which, as is well known, are often kept... by old maids!**

**So: more old maids → more cats, more cats → fewer mice, fewer mice → more bumblebees, more bumblebees → more clover for the cows, more cows → more milk.**

**Which type of logical reasoning does Huxley's paradox exemplify?**

**A) Deduction**
**B) Abduction**
**C) Induction**
**D) Modus ponens**
**E) Modus tollens**

**12. Truth tables are tables used in logic to determine whether a given proposition is true or false once truth values have been assigned to the propositions that compose it. The truth tables for disjunction (∨), biconditional (⇔), and negation (¬) are, respectively, as shown above.**

| A | B | A ∨ B |
|---|---|---|
| V | V | V |
| V | F | V |
| F | V | V |
| F | F | F |

| A | B | A ⇔ B |
|---|---|---|
| V | V | V |
| V | F | F |
| F | V | F |
| F | F | V |

| A | ¬A |
|---|---|
| V | F |
| F | V |

**Question: What is the truth table of the proposition P: (A ∨ (¬B)) ⇔ B?**
**Notes: In the tables, V = True and F = False.**

A)

| A | B | P |
|---|---|---|
| V | V | V |
| V | F | F |
| F | V | F |
| F | F | F |

B)

| A | B | P |
|---|---|---|
| V | V | F |
| V | F | F |
| F | V | F |
| F | F | V |

C)

| A | B | P |
|---|---|---|
| V | V | V |
| V | F | V |
| F | V | V |
| F | F | V |

D)

| A | B | P |
|---|---|---|
| V | V | V |
| V | F | F |
| F | V | V |
| F | F | F |

E)

| A | B | P |
|---|---|---|
| V | V | V |
| V | F | V |
| F | V | F |
| F | F | F |

13. Which of the following novelists was also a doctor?

A) George Eliot
B) Lewis Carroll
C) Mikhail Bulgakov
D) Gustave Flaubert
E) George Bernard Shaw

14. Of which artistic movement was Filippo Tommaso Marinetti a spokesperson?

A) Neorealism
B) Crepuscularism
C) Verismo
D) Futurism
E) Hermeticism

15. Which of the following countries is not a member of the European Union?

A) Turkey
B) Lithuania
C) France
D) Romania
E) Sweden

16. Who is the author of the famous mystery novel Murder on the Orient Express?

A) Jane Austen
B) Mary Shelley
C) Agatha Christie
D) Emily Dickinson
E) Virginia Woolf

17. Traveling from west to east, among the pairs of cities listed below, in which journey is the International Date Line crossed?

A) Buenos Aires – Madrid
B) Paris – Beijing
C) London – Tehran
D) Tokyo – Vancouver
E) San Francisco – Berlin

**18. Who was the President of the U.S.A. in 1962, the year of the Cuban Missile Crisis?**

**A) John F. Kennedy**
**B) Richard F. M. Nixon**
**C) Robert Kennedy**
**D) Lyndon B. Johnson**
**E) Dwight D. Eisenhower**

**19. In which country did Ayatollah Khomeini establish an Islamic Republic in 1979?**

**A) Iraq**
**B) Iran**
**C) Yemen**
**D) Qatar**
**E) Kuwait**

**20. Article 58 of the Constitution of the Italian Republic states:**

**"Senators are elected by universal and direct suffrage by voters who have passed their ... year of age. Voters who have reached their ... year of age are eligible to be elected senators."**

**Which of the following proposals correctly completes the article?**

**A) twenty-fifth, fortieth**
**B) eighteenth, twenty-fifth**
**C) twenty-first, fortieth**
**D) twenty-fifth, fiftieth**
**E) twenty-first, fiftieth**

Passage 1

Read the passage and answer this question based only on the information contained (explicitly or implicitly) in the passage and not based on what the candidate may already know about the topic.

REPAIRING NEURAL DAMAGE FROM DEMENTIA

Frontotemporal dementia is a chronic and irreversible deterioration of cognitive abilities: it is so called because it originates from an alteration of the neurons in the frontal and temporal lobes of the brain. Epidemiological studies indicate that it is a relatively rare pathology, as it accounts for about 10% of all dementia cases. It is also characterized by an earlier onset than other dementias such as Alzheimer's disease: the first signs of illness can manifest themselves between the ages of 55 and 65.

Thanks to a new study published in the journal Journal of Neuroscience, J. Terreros-Roncal and colleagues from the Universidad Autónoma de Madrid, Spain, identified the specific neuronal alterations associated with frontotemporal dementia in the brains of human beings and in a strain of genetically modified laboratory mice that represent an animal model for the disease. In rodents, moreover, the authors managed to block and reverse the degenerative process.

The study showed that the typical neuronal damage of frontotemporal dementia specifically affects the dentate granule cells, the main type of cell located in the hippocampal gyrus of the brain, within the hippocampus.

The authors demonstrated, for the first time, that in patients and animals affected by frontotemporal dementia, this population of hippocampal cells is disconnected from other brain regions, with a clear difference compared to normal subjects in the control groups. Furthermore, researchers observed that alterations in the newly formed granule cells were very similar to those in mice.

A fundamental finding from previous research is that the dentate gyrus produces dentate granule cells throughout life. Thus, the researchers tried to stimulate the regenerative and therapeutic potential of these cells. By chemically activating the cells and placing the animals in a stimulating environment, with wheels and toys in motion, they managed to compensate for morphological alterations in the dentate granule cells and partially restore the interrupted connectivity caused by dementia.

The success of this experimentation gives hope that, once transferred to humans, these results could be useful for better understanding dementias and opening new therapeutic prospects in a field where treatment options are currently very limited.

**21. From reading Passage 1, the following statements can be deduced:**

**$P_1$: Frontotemporal dementia is always due to neuronal damage of the dentate granule cells in the hippocampus.**
**$P_2$: The authors have managed to find a cure for frontotemporal dementia.**
**$P_3$: About 10% of elderly people suffer from frontotemporal dementia.**

**Which of the above deductions is/are correct?**

**A) $P_1$ and $P_2$**
**B) Only $P_2$**
**C) Only $P_3$**
**D) $P_1$ and $P_3$**
**E) None**

**22. From reading Passage 1, the following statements can be deduced:**

**$P_1$: In animal models, environmental stimulation is an important component to increase connectivity between hippocampal dentate cells and other brain regions.**
**$P_2$: Environmental stimulation improves the cognitive abilities of patients with frontotemporal dementia.**
**$P_3$: Chemical activation of hippocampal dentate cells reduces the symptoms of dementia in elderly patients.**

**Which of the above deductions is/are correct?**

**A) All**
**B) $P_1$ and $P_2$**
**C) $P_1$**
**D) $P_1$ and $P_3$**
**E) $P_2$ and $P_3$**

23. Which of the following statements about triglycerides is correct?

A) Those containing only saturated fatty acids, with equal carbon chain length, have a lower melting point than those containing only polyunsaturated fatty acids
B) They are formed by the hydrolysis of one molecule of glycerol and three molecules of fatty acid
C) Those containing only short-chain polyunsaturated fatty acids are generally solid at room temperature
D) They can contain both saturated and unsaturated fatty acids in the same molecule
E) The fatty acids in the same triglyceride always have carbon chains of the same length

24. Chromoplasts are cellular organelles characteristic of:

A) iris cells
B) Epidermal cells
C) Prokaryotic cells
D) plant cells
E) Retinal cells

25. Which of the following modes of transport across the plasma membrane normally requires ATP hydrolysis?

A) Ion pump
B) Diffusion of $O_2$
C) Facilitated diffusion via protein channels
D) Diffusion through ion channels
E) Osmosis

26. Macrophages are:

A) Phagocytic cells that develop by differentiation of monocytes
B) Epithelial cells of the small intestine
C) Bacteria with intense phagocytic activity
D) Organisms that feed on decomposing remains
E) Cells from which platelets are produced by fragmentation

27. Which of the following processes does NOT occur during mitosis?

A) DNA condensation
B) DNA duplication
C) Separation of sister chromatids
D) Removal of centromeric cohesins
E) Fragmentation of the nuclear envelope

28. Which of the following statements about the karyotype is correct?

A) The number of chromosomes in individuals of a given species is related to the complexity of the organisms
B) In humans, the normal male karyotype is 44,XY and the female karyotype is 44,XX
C) There are animal species with an odd number of chromosome pairs
D) Organisms with a polyploid chromosome set cannot exist
E) All plant organisms have fewer chromosomes than animal organisms

29. Which of the following terms does NOT correspond to a photosynthetic pigment?

A) Rhodopsin
B) Phycoerythrin
C) β-carotene
D) Phycocyanin
E) Xanthophyll

30. During glycolysis:

A) Two glucose molecules are needed to obtain one molecule of pyruvic acid
B) From each glucose molecule, two molecules of fructose-1,6-bisphosphate are produced
C) Phosphoenolpyruvate is converted to pyruvate by the enzyme isomerase
D) Four ADP molecules are phosphorylated to form ATP
E) From each glucose molecule, one molecule of glyceraldehyde-3-phosphate is produced

31. Pleiotropy refers to:

A) The control exerted by two or more genes on the same phenotypic trait
B) The presence, in a given population, of multiple allelic variants of the same phenotypic trait
C) The control exerted by a single gene over multiple phenotypic traits
D) The interaction between two genes in which one influences the phenotypic expression of the other
E) The phenotypic manifestation in both alleles of a heterozygous individual

32. To determine the causes of a malformation found in a newborn, cells from different tissues were analyzed; in the cells of the oral mucosa, a genetic mutation in chromosome 5 was found, absent in the peripheral blood cells. What could be the cause of this genetic mosaicism?

A) A mutation present at birth
B) A mutation in the germline that appeared in the early stages of embryonic development
C) A somatic mutation that appeared in the early stages of embryonic development
D) A mutation in the mitochondrial DNA of the oocyte before fertilization
E) A genetic mutation that appeared during paternal spermatogenesis

33. Eukaryotic genes are defined as discontinuous because:

A) Coding sequences are interspersed with non-coding sequences
B) The transcription and translation phases do not occur simultaneously
C) They are transcribed only in some phases of the cell cycle
D) Two contiguous genes are always separated by non-coding DNA sequences
E) RNA polymerase transcribes only coding portions

34. The mother of a girl with oculocutaneous albinism type 1 is expecting dizygotic twins. Knowing that neither the father nor the mother are albino and that the TYR gene associated with the condition is located on chromosome 11, what is the probability that both twins will be albino?

A) 9/16
B) 1/4
C) 1/16
D) 1/2
E) 1/8

35. In Drosophila, the gene for eye color is located on the X chromosome, and red eye color is dominant over white. Considering the cross between a heterozygous female for eye color and a red-eyed male, which of the following statements is correct?

A) 50% of the males will have white eyes
B) 50% of the offspring will have white eyes
C) 50% of the females will have white eyes
D) 25% of the males will have white eyes
E) 100% of the offspring will have red eyes

36. DNA sequencing by the Sanger method requires the preparation of a reaction mixture in which, in addition to DNA, other components must be present; which of the following listed is NOT a necessary component for the reaction?

A) DNA ligase
B) DNA polymerase
C) Primer
D) Deoxyribonucleotide triphosphates
E) Labeled dideoxyribonucleotide triphosphates

37. Which of the following statements about human ribs is NOT correct?

A) They insert into the diaphragm
B) They rise during inspiration
C) They insert into the abdominal muscles
D) They are long bones
E) They insert into the pectoral muscles

38. The spleen is:

A) An exocrine gland
B) An endocrine gland
C) A lymphoid organ
D) An organ of the digestive system
E) An organ of the urinary system

39. The pharynx in humans:

A) Allows only the passage of air
B) Is located between the larynx and the trachea
C) Is located in the middle part of the vocal cords
D) Receives the opening of the nasal cavities
E) Allows only the passage of food

40. Which of the following statements about epithelial cells is correct?

A) They are always arranged in a single layer
B) They are immersed in an abundant extracellular matrix
C) They form the superficial layer of the mucous membranes
D) They are always arranged to form multiple layers
E) They cover the axons of neurons by forming a myelin sheath

41. At a temperature of 27 °C, the volume of a balloon is 2.40 L. Assuming the pressure remains constant, what will be the volume of the same balloon at −23 °C?

A) 2.88 L
B) 2.00 L
C) −2.04 L
D) 1.20 L
E) 1.02 L

42. Which of the following statements about quantum numbers is NOT correct?

A) The number of possible orbitals for each value of n is $n^3$.
B) The angular momentum quantum number l can take all values from 0 to (n-1).
C) The magnetic quantum number m indicates the different possible orientations of orbitals in space.
D) The principal quantum number n can take all positive integer values from 1 to infinity.
E) The spin quantum number $m_s$ can take only two values.

43. Two elements have the following electron configurations:

$[Ar]3d^{10}, 4s^{2.}$ and $[Ar]3d^{10}, 4s^2 4p^4$

Which of the following statements is correct?

A) They are both transition metals.
B) They both belong to group 4.
C) They both belong to the fourth period.
D) They both have two valence electrons.
E) They both belong to the s block.

44. In a molecule of hydrocyanic acid (HCN), how many total bonds are present?

A) One π bond and three σ bonds
B) Two σ bonds and two π bonds
C) One σ bond and three π bonds
D) Three π bonds
E) Three σ bonds

45. Which of the following statements is NOT correct?

A) $HNO_3$ is the formula of a triatomic molecule.
B) $Mg(HSO_4)_2$ is the formula of a quaternary salt.
C) $S_8$ is the formula of a molecule of an elemental substance.
D) $NH_3$ is the formula of a tetra-atomic molecule.
E) $O_3$ is the formula of a triatomic molecule.

46. Which of the following combinations of stoichiometric coefficients — a, b, c, d, e — must be used to balance the reaction $aCu + bHNO_3 \rightarrow cCu(NO_3)_2 + dNO + eH_2O$?

A) a = 2; b = 8; c = 2; d = 4; e = 4
B) a = 3; b = 6; c = 3; d = 2; e = 4
C) a = 3; b = 8; c = 3; d = 2; e = 4
D) a = 1; b = 6; c = 1; d = 5; e = 2
E) a = 4; b = 6; c = 2; d = 2; e = 3

47. Tooth enamel consists mostly of hydroxyapatite, whose formula unit is $Ca_5(PO_4)_3(OH)$. In an acidic environment produced by sulfuric acid, it can be decomposed according to the following reaction:

$Ca_5(PO_4)_3(OH) + 4H^+ \rightarrow 5Ca^{2+} + 3HPO_4^{2-} + H_2O$.
How many moles of $H_2SO_4$ are needed to produce 0.3 moles of $HPO_4^{2-}$ ions?

A) 0.4
B) 0.2
C) 0.3
D) 0.1
E) 0.5

48. Which of the following actions produces an aqueous solution of $NaNO_3$ (M = 85 g/mol) with a concentration of 0.20 M?

A) Dilute 250 mL of a 0.8 M $NaNO_3$ solution up to 1.0 L
B) Dilute 50 mL of a 2 M $NaNO_3$ solution to 200 mL
C) Dissolve 17.0 g of $NaNO_3$ in 250 mL of $H_2O$
D) Add water to 8.5 g of $NaNO_3$ to obtain 250 mL of solution
E) Mix 150 mL of a 0.15 M $NaNO_3$ solution with 50 mL of a 0.05 M $NaNO_3$ solution

49. The equation $2A + B \rightarrow C + 2D$ represents a reaction that occurs in a single step. Which of the following expressions represents its rate law?

A) Rate = $k[C][D]^2 / ([A][B])$
B) Rate = $k[2A][B]$
C) Rate = $k[A]^2[B][C][D]^2$
D) Rate = $k[A]^2[B]$
E) Rate = $k[C][D]^2 / ([A]^2[B])$

50. In which of the following chemical species is manganese in the oxidation state (IV)?

A) $MnO_2$
B) $MnO_4^{2-}$
C) $MnO_4^-$
D) MnO
E) $Mn_2O_3$

**51. In an aqueous solution, the molar concentration of $OH^-$ ions is 5.8 \times 10^{-9}. What is the pH value of the solution?**

**A) 4.2**
**B) 8.2**
**C) 9.8**
**D) 5.8**
**E) 6.1**

**52. Which of the following statements about ketones and aldehydes is correct?**

**A) Aldehydes have one oxygen atom and one hydrogen atom bonded to the carbonyl carbon**
**B) Aldehydes have two oxygen atoms bonded to the carbonyl carbon**
**C) Aldehydes have two carbon atoms bonded to the carbonyl carbon**
**D) Ketones always have one hydrogen atom bonded to the carbonyl carbon**
**E) Ketones always contain double carbon–carbon bonds**

53. Michele has a total of 10 pairs of socks in his drawer, some striped, some polka-dotted, and some checkered. When randomly selecting a pair from the drawer, the probability of picking a striped pair is 0.4, and the probability of picking a polka-dotted pair is double the probability of picking a checkered pair. What is the probability that when drawing a pair of socks from the drawer, Michele picks a checkered pair?

A) 2/5
B) 1/5
C) 3/5
D) 4/5
E) 0

54. Which of the following expressions for K makes the identity true:

$\sin^4 \alpha - \cos^4 \alpha = K$?

A) $K = \cos 2\alpha$
B) $K = \cos 4\alpha$
C) $K = -\cos 2\alpha$
D) $K = \sin 4\alpha$
E) $K = -\cos 4\alpha$

55. What can be said about the perimeter of a square with an area less than 81 $m^2$?

A) It is equal to 36 m
B) It is greater than or equal to 36 m
C) It is less than or equal to 9 m
D) It is greater than 36 m
E) It is always less than 36 m

56. Given the two functions

$$f(x) = e^{(x^2)} \text{ e } g(x) = (e^x)^2$$

Which of the following statements is true?

A) They are never equal for any real value of x
B) They are equal for every real x
C) They have the same value if x = 0 or x = 2
D) They have the same value for $0 \le x \le 2$
E) They have the same value only for x = 1

57. What are the real solutions of the equation $9^x - 3^{x+1} = -2$?
A) There are no real solutions
B) x=0 and $x=\log^2{}_3$
C) x=0 and $x = \log_3\left(\frac{1}{2}\right)$
D) Only $x=\log^2{}_3$
E) Only x=0

58. Two objects of equal mass in thermal contact form an isolated system. The initial temperature of the two objects is t° C and 0° C respectively; assuming no phase changes occur, what is the equilibrium temperature if the specific heat of the hotter object is 9 times that of the colder object?

A) t° C
B) 0.9° C
C) 0.1° C
D) 0.5° C
E) 2t° C

59. Let $R_1$ be the equivalent resistance of a network of three equal resistors of value x, where one is in series with the other two connected in parallel; let $R_2$ be the equivalent resistance of a network of three equal resistors of value y, where one is in parallel with the other two connected in series.

What relation between x and y makes $R_1=R_2$?

A) x=4y/9
B) y=4x/9
C) y=x
D) y=3x/2
E) x=3y/2

60. Consider two isolated masses $M_1$ = m and $M_2$ = 2m. If F is the magnitude of the gravitational force acting on mass $M_1$, what is the magnitude of the gravitational force acting on mass $M_2$?

A) F
B) 2F
C) -F
D) -2F
E) 1.5F

# • Answer

Total Points: ...../90

Correct answer:...../60
Wrong answer:...../60
Unanswered:...../60

Correct answer: +1.5 points
Wrong answer: -0.4
Unanswered: 0 points

| | | |
|---|---|---|
| 1. A | 26. A | 51. D |
| 2. B | 27. B | 52. A |
| 3. A | 28. C | 53. B |
| 4. C | 29. A | 54. C |
| 5. C | 30. D | 55. E |
| 6. D | 31. C | 56. C |
| 7. C | 32. C | 57. B |
| 8. D | 33. A | 58. B |
| 9. A | 34. C | 59. A |
| 10. C | 35. A | 60. A |
| 11. A | 36. A | |
| 12. A | 37. D | |
| 13. C | 38. C | |
| 14. D | 39. D | |
| 15. A | 40. C | |
| 16. C | 41. B | |
| 17. D | 42. A | |
| 18. A | 43. C | |
| 19. B | 44. B | |
| 20. A | 45. A | |
| 21. E | 46. C | |
| 22. C | 47. B | |
| 23. D | 48. A | |
| 24. D | 49. D | |
| 25. A | 50. A | |