National Forensic Sciences University
Knowledge | Wisdom | Fulfilment
An Institution of National Importance
(Ministry of Home Affairs, Government of India)

Answer Key
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JSO - NSTS - Examination

1. Which of the following is a characteristic of unsaturated fats?

A Solid at room temperature
B Mainly found in animal products
✓ C Liquid at room temperature
D Not beneficial for health

2. Which of these is a fat-soluble vitamin?

A Vitamin B12
B Vitamin C
✓ C Vitamin K
D Vitamin B6

3. Which of the following is considered a micronutrient?

A Carbohydrate
B Protein
✓ C Vitamin C
D Fiber

4. The variable gene insertion location in Genetically Modified crops can lead to:

A Guaranteed single-copy insertion.
B Predictable expression
C Consistent stability
✓ D Pleiotropic effects

5. Which of the following is considered a Nutraceuticals?

A A prescription drug
✓ B A dietary supplement that has a health benefit
C A fast-food meal
D A natural food flavoring

6. The structure of a triglyceride consists of three fatty acids linked to a glycerol backbone. What type of bond forms between the fatty acid and the glycerol molecule?

A Hydrogen bond

B Peptide bond

✓ C Ester bond

D Ionic bond

7. What is the role of the coenzyme NAD+ (nicotinamide adenine dinucleotide) in cellular metabolism?

A It assists in protein synthesis

✓ B It acts as a carrier of electrons during redox reactions

C It stores energy in the form of glucose

D It binds to fatty acids for transport across cell membranes

8. What is the key difference between essential and non-essential amino acids?

A Essential amino acids are synthesized by the body, while non-essential amino acids must be obtained through diet

B Essential amino acids are only found in plant-based foods, while non-essential amino acids are found in animal-based foods

✓ C Essential amino acids must be obtained through diet, while non-essential amino acids can be synthesized by the body

D There is no difference, both must be obtained through diet

9. According to the FSSAI (Food Safety and Standards Authority of India) Regulations 2011, which of the following is a major requirement for ensuring food safety?

A All food products must be labeled with nutritional content

✓ B Food products must be free from contaminants such as pesticide residues

C Only organic foods must be allowed in the market

D Food products must be imported only from approved countries

10. Under FSSAI Regulation 2011, which of the following food contaminants must be monitored for safety in milk, honey, and poultry?

A Heavy metals

✓ B Antibiotic residues

C Pesticide residues

D Artificial food colors

11. Which principle of food preservation involves reducing the water activity in food to prevent microbial growth?

A Pasteurization

B Freezing

✓ C Dehydration

D Canning

12. Which of the following is a primary reason for the inclusion of food labeling requirements in the FSSAI Regulations 2011?

A To ensure food products are marketable

✓ B To provide consumers with information regarding the nutritional content and ingredients

C To ensure that food manufacturers can advertise their products effectively

D All of the mentioned

13. The term “Shelf life” of a food product is most associated with which principle of food preservation?

A Control of temperature

B Use of preservatives

C Packaging and sealing

✓ D All of the mentioned

14. What is the main purpose of food safety audits under the FSSAI Regulations 2011?

A To verify compliance with food safety standards and regulations

B To monitor the financial health of food companies

C To approve marketing strategies for food products

D To check the profitability of food products

15. The FSSAI’s food safety standards include specific limits for heavy metals such as lead and mercury in food. What is the primary health concern associated with high levels of these heavy metals in food products?

A They are used as preservatives in processed foods

✓ B They can accumulate in the body over time and cause long-term toxicity, particularly in children

C They enhance the flavor of food products

D They serve as a natural coloring agent in food

16. In the FSSAI Regulations 2011, which of the following technologies is recognized for its role in food preservation, particularly for preventing spoilage and extending shelf life?

✓ **A** UV radiation for food sterilization

B Chemical additives like artificial sweeteners

C Hot water washing to remove dirt

D Low-temperature pasteurization

17. What happens to the boiling point of a liquid when pressure increase?

✓ **A** Increases

B Decreases

C Remains the same

D First decrease then increases

18. High sugar concentrations preserve food by?

A Increasing pH

✓ **B** Lowering water activity

C Adding antioxidants

D Increasing oxygen

19. Which of the following statements concerning the structure of a triacylglycerol is correct?

A It consists of a glycerol backbone linked to three phosphate groups.

B It is composed of a sphingosine backbone and fatty acids.

✓ **C** It contains a glycerol backbone linked to three fatty acids by ester linkages.

D It is formed by the polymerization of monosaccharides.

20. Which The quaternary structure of a protein refers to?

A The linear sequence of amino acids.

B The local folding patterns of the polypeptide backbone.

C The overall three-dimensional shape of a single polypeptide chain.

✓ **D** The arrangement of multiple polypeptide subunits into a functional protein complex.

21. Which of the following substances is classified as a cannabinoid that is prohibited in sports due to its performance-enhancing effects?

- ✓ **A** THC (Tetrahydrocannabinol)
- **B** CBD (Cannabidiol)
- **C** Morphine
- **D** Caffeine

22. What is the key function of growth hormones in doping, and how does it affect athletic performance?

- **A** Growth hormones increase the production of red blood cells, improving endurance performance
- ✓ **B** Growth hormones enhance muscle repair and recovery, enabling faster recovery between training sessions
- **C** Growth hormones reduce the risk of injuries by strengthening bones and ligaments
- **D** Growth hormones increase fat oxidation, making them ideal for weight loss during training

23. What is one of the most common methods by which athletes misuse diuretics in doping practices?

- **A** To enhance cardiovascular endurance during events
- **B** To reduce body fat content rapidly
- ✓ **C** To mask the presence of other banned substances in urine samples
- **D** All of the mentioned

24. In terms of anti-doping regulations, which of the following would be considered a violation of Therapeutic Use Exemption (TUE) policies?

- **A** An athlete using a banned substance only after receiving a medical prescription from a licensed physician
- ✓ **B** An athlete using a banned substance without medical justification and failing to apply for a TUE
- **C** An athlete applying for a TUE after using a prohibited substance for a long period of time
- **D** An athlete using a banned substance that is prescribed for personal medical use

25. What does pharmacodynamics study?

- **A** The absorption, distribution, metabolism, and excretion of drugs
- ✓ **B** The effects of drugs on the body and how they exert their actions
- **C** The chemical structure of drugs
- **D** The regulatory approval process for drugs

26. In terms of pharmacokinetics, what happens to a dope drug like a stimulant (e.g., amphetamines) after ingestion in an athlete's body?

✓ **A** It is absorbed into the bloodstream and quickly metabolized by the liver, leading to a rapid increase in heart rate and alertness

B It is stored in the fat cells and only slowly metabolized over time, providing sustained energy

C It is absorbed in the gastrointestinal tract but does not enter the bloodstream

D It directly enters the brain without being metabolized, immediately increasing energy levels

27. Which of the following most accurately describes the mechanism of action of anabolic steroids in promoting muscle growth?

✓ **A** Anabolic steroids directly increase muscle fiber size by stimulating cellular hypertrophy

B Anabolic steroids increase protein breakdown, resulting in muscle atrophy

C Anabolic steroids inhibit the action of testosterone, preventing muscle growth

D Anabolic steroids reduce oxygen delivery to muscle tissue

28. The "Athlete Biological Passport" is used to:

A Track an athlete's travel history.

✓ **B** Monitor an athlete's biological variables over time to detect potential doping.

C Record an athlete's performance statistics.

D Document an athlete's medical history.

29. The "whereabouts" rule in anti-doping requires athletes to:

A Disclose their medical history.

B Provide their financial records.

✓ **C** Inform anti-doping agencies of their location for out-of-competition testing.

D Submit their training schedules.

30. The "half-life" of a drug refers to:

A The time it takes for the drug to reach its maximum concentration in the body.

✓ **B** The time it takes for half of the drug to be eliminated from the body.

C The time it takes for the drug to1 bind to its target receptors.

D The time it takes for the drug to be completely metabolized.

31. In anti-doping analysis, The MRPL is:

A The maximum allowable concentration of a prohibited substance in a sample.

✓ B The minimum concentration of a prohibited substance that an analytical method must reliably detect.

C The therapeutic dose of a prohibited substance.

D The concentration of a prohibited substance that causes adverse effects.

32. Threshold substances" in anti-doping refer to:

A Substances that are always prohibited, regardless of concentration.

✓ B Substances that are prohibited only when their concentration exceeds a specified limit.

C Substances that are permitted within a specific therapeutic range.

D Substances that have no performance-enhancing effects.

33. The pKa value of an acid is defined as the pH at which:

A The acid is fully dissociated into its ions

✓ B The concentration of the acid equals the concentration of its conjugate base

C The acid has zero dissociation

D The pKa value is not related to pH

34. Which of the following is true about the pKa of a weak acid?

A The higher the pKa, the stronger the acid

✓ B The lower the pKa, the stronger the acid

C pKa values are only relevant for strong acids

D pKa values are independent of concentration

35. Which of the following analytical methods is most commonly used for determining the mass of an unknown sample?

A Volumetric method

B Titrimetric method

✓ C Gravimetric method

D Chromatographic method

36. The distribution ratio in extraction is defined as the ratio of the concentration of the solute in:

- A The solvent to the solute in the original phase
- ✓ B The original phase to the solvent phase
- C The gas phase to the liquid phase
- D The solute to the solvent in the original phase

37. Which of the following extraction methods is most likely to be used when a higher temperature is applied to accelerate the process?

- A Solid phase extraction
- ✓ B Heat reflux extraction
- C Ultrasonic extraction
- D Liquid-liquid extraction

38. In the periodic table, elements in the same group typically have:

- A Similar atomic masses
- ✓ B Similar chemical properties due to the same number of valence electrons
- C The same number of protons
- D The same number of neutrons

39. In an aqueous solution, a weak acid (HA) has a pKa value of 4.0. What is the pH at which the concentration of HA is equal to its conjugate base (A-)?

- A 1
- ✓ B 4
- C 7
- D 10

40. In titrimetric analysis, which of the following statements about the choice of indicator is correct?

- ✓ A The indicator should have a pKa value very similar to the pH at the equivalence point of the titration
- B The indicator should have a large dissociation constant (Ka) compared to the titrant
- C The indicator should be used in concentrations much higher than the titrant for accuracy
- D The indicator should react with the analyte to form a colored complex, regardless of pH changes

41. Which of the following techniques is most effective when extracting a solute from a mixture where the solute has a very low boiling point and cannot withstand high temperatures?

- A Heat reflux extraction
- B Solid-phase extraction
- ✓ C Accelerated solvent extraction
- D Ultrasonic extraction

42. In the context of the periodic table, elements in the same period exhibit similar trends in:

- ✓ A Electronegativity and ionization energy
- B Atomic radius and metallic character
- C Reactivity with acids and bases
- D Electron affinity and atomic mass

43. Which of the following elements has the smallest atomic radius in its respective period?

- A Sodium (Na)
- B Magnesium (Mg)
- C Chlorine (Cl)
- ✓ D Argon (Ar)

44. Which of the following is the trend for electronegativity across a period in the periodic table?

- ✓ A Electronegativity increases as you move from left to right across a period
- B Electronegativity decreases as you move from left to right across a period
- C Electronegativity increases as you move down a group
- D Electronegativity remains constant across a period

45. Which of the following is true regarding the ionization energy of elements in a group?

- A Ionization energy increases as you move down a group
- B Ionization energy does not change as you move down a group
- C Ionization energy decreases as you move across a period
- ✓ D Ionization energy decreases as you move down a group

46. Which of the following reagents is commonly used for the reduction of alkenes in organic synthesis?

- A Potassium permanganate ($KMnO_4$)
- ✓ B Hydrogen gas (H_2) with a palladium catalyst
- C Sodium hydroxide (NaOH)
- D Acetone

47. In regression analysis, what is the primary goal?

- A To determine the correlation between two variables
- ✓ B To predict the value of one variable based on another
- C To compare the means of two or more groups
- D To calculate the probability of an event occurring

48. Which of the following statements is true about the null hypothesis in hypothesis testing?

- A The null hypothesis suggests that there is a significant effect or relationship in the data
- B The null hypothesis is always true
- ✓ C The null hypothesis assumes there is no significant effect or relationship in the data
- D The null hypothesis is always rejected in hypothesis testing

49. Which statistical test is typically used to compare the means of two independent groups?

- A Chi-square test
- ✓ B T-test
- C Analysis of Variance (ANOVA)
- D Pearson correlation

50. Which of the following trends in the periodic table best explains why fluorine is the most electronegative element?

- ✓ A Fluorine has the smallest atomic radius in its period, which leads to a stronger attraction for bonding electrons.
- B Fluorine has the largest atomic radius in its period, which leads to a stronger attraction for bonding electrons.
- C Fluorine has the highest ionization energy, making it more likely to accept electrons in bonds.
- D Fluorine has the highest electron affinity, making it more likely to accept electrons in bonds.

51. Which of the following reagents is most commonly used for the selective oxidation of primary alcohols to aldehydes?

✓ **A** Potassium dichromate ($K_2Cr_2O_7$) in acidic conditions

B Sodium borohydride ($NaBH_4$)

C Lithium aluminum hydride ($LiAlH_4$)

D Hydrogen peroxide (H_2O_2) with a palladium catalyst

52. In the context of hypothesis testing, if a researcher conducts a t-test and obtains a p-value of 0.03, what can be concluded?

A The null hypothesis is definitively true.

✓ **B** There is strong evidence against the null hypothesis, suggesting the alternative hypothesis may be true.

C The null hypothesis should always be rejected if the p-value is below 0.05.

D The sample size is too small to draw any conclusions.

53. What is the principle of Gas Chromatography (GC)?

A Separation based on molecular size

✓ **B** Separation based on boiling point differences

C Separation based on solubility

D Separation based on charge

54. Which of the following is a limitation of Raman spectroscopy compared to IR spectroscopy?

A Raman spectroscopy cannot analyze aqueous samples.

B Raman spectroscopy requires more specialized sample preparation.

✓ **C** Raman spectroscopy has weaker signal strength in comparison to IR spectroscopy.

D Raman spectroscopy is less sensitive to molecular vibrations.

55. In UV-Visible spectroscopy, the absorption of light by a molecule is primarily due to:

A Changes in nuclear spin

✓ **B** Electron transitions between molecular orbitals

C Vibrational modes of the molecule

D Rotational transitions of the molecule

56. Which of the following factors affects the frequency of an IR absorption band?

✓ **A** The bond strength (force constant) and the reduced mass of the atoms involved in the bond

B The molecular weight of the compound

C The color of the compound

D The temperature of the sample

57. In Raman spectroscopy, which of the following statements is true?

A Raman spectroscopy detects the absorption of light by molecular bonds.

✓ **B** Raman spectroscopy involves the scattering of light, typically using visible or near-infrared light.

C Raman spectroscopy is sensitive only to changes in molecular mass.

D Raman spectroscopy can only be used to study liquids.

58. Which detector is commonly used in GC to detect organic compounds that produce ions when combusted?Which detector is commonly used in GC to detect organic compounds that produce ions when combusted?

A UV detector

B Refractive index detector

✓ **C** Flame ionization detector (FID)

D Mass spectrometer

59. In UV-Visible spectroscopy, the Beer-Lambert law relates absorbance to:

A Wavelength and frequency.

✓ **B** Concentration and path length.

C Molecular weight and density.

D Polarity and solubility.

60. In capillary electrophoresis (CE), what is the primary factor that influences the electrophoretic mobility of an analyte?

A Hydrophobicity.

B Boiling point.

✓ **C** Charge-to-size ratio.

D Molecular weight.

61. In mass spectrometry, what does the term "tandem mass spectrometry (MS/MS)" refer to?

A Simultaneous detection of multiple ions.

✓ B Fragmentation of selected ions for structural analysis.

C Measurement of isotopic ratios.

D Ionization using multiple techniques.

62. What is the purpose of using a "reflector" in a Time of flight mass spectrometer (TOF-MS)?

A To increase ion acceleration.

✓ B To improve mass resolution.

C To ionize the sample.

D To decrease ion velocity.

63. In reversed-phase HPLC, what is the primary interaction responsible for analyte retention?

A Ionic interactions.

✓ B Hydrophobic interactions.

C Hydrogen bonding.

D Size exclusion.

64. What is the significance of the "plate height" in chromatography?

A It represents the length of the column.

✓ B It indicates the efficiency of the separation.

C It determines the flow rate of the mobile phase.

D It measures the detector response.

65. In mass spectrometry, what is the purpose of a collision-induced dissociation (CID) cell?

A To accelerate ions.

✓ B To fragment selected ions.

C To measure isotopic ratios.

D To ionize the sample.

66. For accurate quantification using stable isotope dilution in LC-MS, the labeled internal standard should ideally:

- A Have a significantly different retention time from the analyte.
- B Undergo different fragmentation patterns compared to the analyte.
- ✓ C Co-elute and have similar ionization properties to the analyte.
- D Have a much lower molecular weight than the analyte.

67. A shift in an absorption spectrum to a shorter wavelength is known as:

- A Red shift
- B Bathochromic shift
- ✓ C Blue shift
- D None of the mentioned

68. Which of the following would cause a bathochromic shift in a UV-Vis absorption spectrum?

- A Decreasing the polarity of the solvent.
- ✓ B Introducing a chromophore that extends the conjugated system.
- C Removing a chromophore that extends the conjugated system.
- D Decreasing the concentration of the analyte.

69. A "bathochromic shift" refers to:

- A A shift to higher energy and shorter wavelength.
- ✓ B A shift to lower energy and longer wavelength.
- C A decrease in the intensity of absorption.
- D An increase in the intensity of absorption.

70. Which of the following is a key difference between quality control (QC) and quality assurance (QA)?

- ✓ A QA focuses on preventing defects, while QC focuses on detecting defects
- B QA is more reactive than QC
- C QC is an ongoing process, while QA is a one-time effort
- D QA and QC have no significant difference

71. What is proficiency testing in the context of an ISO/IC 17025 accredited laboratory?

- A A method for training laboratory personnel
- ✓ B A comparison of the laboratory's performance against known standards or other laboratories
- C A routine internal audit of laboratory operations
- D A technique for reducing laboratory testing times

72. What does a "Management Review Meeting" typically focus on in an ISO/IEC 17025 accredited laboratory?

- A Ensuring the laboratory meets ISO/IEC 9001 requirements
- B Reviewing laboratory finances
- ✓ C Assessing the performance of the quality management system, including areas for improvement
- D Discussing new forensic cases

73. According to ISO/IEC 17025:2017, which of the following is a mandatory requirement for a laboratory to demonstrate its competence?

- A The laboratory must have a documented process for continuous improvement.
- B The laboratory must be accredited by a global certification body.
- C The laboratory must only perform tests that are specified by the government.
- ✓ D The laboratory must have procedures for validating new methods and verifying existing ones.

74. Which of the following best describes the concept of measurement uncertainty in the context of testing under ISO/IEC 17025?

- A The range within which test results can fluctuate due to human error
- B The systematic error in a laboratory instrument
- C The difference in results when testing the same sample multiple times
- ✓ D The quantifiable estimation of the error associated with the measurement results

75. Certified Reference Materials (CRMs) are used for:

- ✓ A Validating analytical methods and ensuring traceability.
- B Calibrating instruments only.
- C Performing proficiency testing.
- D Documenting quality audits.

76. If A = 1, B = 2, C = 3, what is the sum of the positions of the letters in "DOG"?

- A 24
- ✓ B 26
- C 30
- D 23
- E 27

77. Find the odd one out: Apple, Orange, Grapes, Mango, Potato.

- A Apple
- B Orange
- C Grapes
- D Mango
- ✓ E Potato

78. If 3 cats can catch 3 mice in 3 minutes, how many cats are needed to catch 100 mice in 100 minutes?

- ✓ A 3
- B 30
- C 10
- D 100
- E 9

79. If 9 = 81, 8 = 64, 7 = 49, then 6 = ?

- ✓ A 36
- B 49
- C 25
- D 42
- E 30

80. Arrange the following words in dictionary order: (1) Elephant, (2) Eagle, (3) Earth, (4) Envelope.

- A 1-2-3-4
- B 3-2-4-1
- C 3-2-1-4
- ✓ D 2-3-4-1
- E 4-3-2-1

81. "Some men are teachers. All teachers are educated." What conclusion follows?

- ✓ A Some men are educated
- B All men are educated
- C Some teachers are men
- D No men are teachers
- E None of the mentioned

82. What is the value of 25% of 200?

- A 25
- ✓ B 50
- C 100
- D 150
- E 200

83. If 4 workers can build a wall in 10 days, how many days will 2 workers take?

- A 10
- ✓ B 20
- C 30
- D 5
- E 15

84. A train travels 60 km in 1 hour. How far will it travel in 3.5 hours?

- A 200 km
- B 150 km
- ✓ C 180 km
- D 210 km
- E 170 km

85. If x + y = 12 and x - y = 4, what is the value of x?

A 3

B 5

✓ C 8

D 10

E 6

86. The LCM of 12 and 18 is:

A 6

✓ B 36

C 12

D 18

E 24

87. The compound interest on ₹5000 at 10% per annum for 2 years is:

A 1000

B 1100

C 1050

✓ D 1210

E 1200

88. A and B together can complete a task in 12 days. B alone takes 30 days. How many days will A take alone?

A 10

✓ B 15

C 18

D 20

E 22

89. Choose the correct synonym for "Abundant":

A Scarce

✓ B Plenty

C Rare

D Tiny

E Insufficient

90. What is the plural form of "Analysis"?

- A Analysis
- B Analysises
- ✓ C Analyses
- D Analyze
- E None of the mentioned

91. Identify the correctly spelled word:

- A Tommorrow
- B Tomorow
- C Tommoro
- ✓ D Tomorrow
- E Tomorro

92. Find the antonym of "Expand":

- A Enlarge
- ✓ B Contract
- C Spread
- D Grow
- E Widen

93. Choose the correct sentence:

- A He has went to market
- B He have gone to market
- ✓ C He has gone to market
- D He was go to market
- E He will gone to market

94. "The sun rises in the east" is an example of which type of sentence?

- A Interrogative
- B Imperative
- ✓ C Assertive
- D Exclamatory
- E Negative

95. What is the chemical formula of water?

- A H_2O_2
- ✓ B H_2O
- C O_2H
- D HO_2
- E H_3O

96. What is the hardest natural substance on Earth?

- A Iron
- B Graphite
- ✓ C Diamond
- D Quartz
- E Gold

97. Which vitamin is known as the "Sunshine Vitamin"?

- A Vitamin A
- B Vitamin B
- C Vitamin C
- ✓ D Vitamin D
- E Vitamin K

98. Which gas is most abundant in Earth's atmosphere?

- A Oxygen
- B Carbon Dioxide
- ✓ C Nitrogen
- D Hydrogen
- E Helium

99. The phenomenon of "Ozone depletion" is mainly caused by:

- A Carbon Dioxide
- B Sulfur Dioxide
- ✓ C CFCs
- D Oxygen
- E Hydrogen

100. The process of plants making their food using sunlight is called:

- **A** Respiration
- **B** Digestion
- ✓ **C** Photosynthesis
- **D** Evaporation
- **E** Transpiration