Booklet Serial No. 10077

DO NOT BREAK THE SEAL OF THE BOOKLET UNTIL YOU ARE TOLD TO DO SO

QUESTION BOOKLET

SERIES : I

Subjects : General English, General Knowledge & Aptitude, and Chemistry/Forensic Science

Full Marks : 300 **Time Allowed : 2½ Hours**

Read the following instructions carefully before you begin to answer the questions.

INSTRUCTIONS TO CANDIDATES

1. This Booklet contains 150 questions to be answered in a separate OMR Answer Sheet using Black Ballpoint Pen in the following three Parts :

Part—A : General English	:	**50 questions**
Part—B : General Knowledge & Aptitude	:	**50 questions**
Part—C : [Choose any ONE subject from the following]		
Chemistry/Forensic Science	:	**50 questions**

2. **All** questions are compulsory.
3. You will be supplied the Answer Sheet separately by the Invigilator. You must complete the details of particulars asked for.
4. Answer must be shown by completely blackening the corresponding circle in the Answer Sheet against the relevant question number by Black Ballpoint Pen. OMR Answer Sheet without marking Series shall not be evaluated.

   Example :

   Suppose the following question is asked :

   The Capital of Meghalaya is

   (A) Guwahati
   (B) Kohima
   (C) Shillong
   (D) Delhi

   You will have four alternatives in the Answer Sheet for your response corresponding to each question of the Question Booklet as below :

   Ⓐ Ⓑ Ⓒ Ⓓ

   In the above illustration, if your chosen response is alternative (C), i.e., Shillong, then the same should be marked on the Answer Sheet by blackening the relevant circle with a Black Ballpoint Pen only as below :

   Ⓐ Ⓑ ● Ⓓ

   The example shown above is the only correct method of answering.
5. Answer the questions as quickly and as carefully as you can. Some questions may be difficult and others easy. Do not spend too much time on any one question.
6. There will NOT be any negative marking for wrong answers.
7. The Answer Sheet must be handed over to the Invigilator before you leave the Examination Hall.
8. No Rough Work is to be done on the Answer Sheet. Space for Rough Work has been provided in the Question Booklet.

SEAL

PART—A : GENERAL ENGLISH

(*Marks* : 100)

Each question carries **2** marks

***Direction* (Q. Nos. 1–35) : Choose the correct option from the given alternatives.**

1. What is the meaning of 'Ephemeral'?

(A) Lasting for a very short time

(B) Permanent

(C) Powerful

(D) Mysterious

2. What does 'Obfuscate' mean?

(A) To simplify

(B) To clarify

(C) To make something unclear or confusing

(D) To organize

3. The word 'Ubiquitous' means

(A) rare

(B) present everywhere

(C) dangerous

(D) invisible

4. What is the meaning of 'Magnanimous'?

(A) Selfish

(B) Cruel

(C) Generous and forgiving

(D) Fearful

5. 'Esoteric' refers to

(A) easily understood by everyone

(B) intended for or understood by a small group with specialized knowledge

(C) popular and common

(D) scientific and proven

6. What does 'Perfunctory' mean?

(A) Done with great care

(B) Done enthusiastically

(C) Done routinely with little interest or effort

(D) Done secretly

7. The committee was divided _____ the issue of academic autonomy.

(A) on

(B) over

(C) at

(D) by

8. The Professor insisted _____ revising the manuscript before publication.

(A) on

(B) at

(C) in

(D) for

9. She is proficient _____ statistical data analysis.

(A) at

(B) on

(C) in

(D) with

10. The report is based _____ extensive fieldwork.

(A) in

(B) on

(C) at

(D) from

11. The students were exempted _____ the attendance requirement.

(A) from

(B) of

(C) with

(D) by

12. What is the meaning of 'Burn one's bridges'?

(A) To destroy future opportunities through one's actions

(B) To build new relationships

(C) To solve a problem permanently

(D) To travel abroad

13. What is the meaning of 'Feather one's nest'?

(A) To decorate a house

(B) To enrich oneself, often unfairly

(C) To work hard

(D) To help others financially

14. What does 'In the doldrums' mean?

(A) Feeling bored, depressed, or inactive

(B) Being highly energetic

(C) Working efficiently

(D) Living luxuriously

15. The idiom 'Leave no stone unturned' means

(A) ignore all possibilities

(B) explore every possible option

(C) make a quick decision

(D) travel extensively

16. What does 'On the horns of a dilemma' mean?

(A) Being in a difficult situation with two choices

(B) Winning a competition

(C) Feeling confident

(D) Being angry

17. The idiom 'Read between the lines' means

(A) read quickly

(B) understand the hidden meaning

(C) read aloud

(D) skip unimportant details

18. The idiom 'A red-letter day' refers to

(A) a dangerous day

(B) a day of great significance or happiness

(C) a public holiday only

(D) a busy working day

19. What is the meaning of the phrase 'At arm's length'?

(A) Very closely

(B) At a distance; avoiding intimacy or involvement

(C) Within reach

(D) Under supervision

20. What does 'In black and white' mean?

(A) In writing or print

(B) In colourless form

(C) In a newspaper only

(D) In a simple manner

21. The phrase 'By virtue of' means

(A) in spite of

(B) because of; due to

(C) instead of

(D) apart from

22. What is the meaning of 'At cross purposes'?

(A) Working together effectively

(B) Misunderstanding each other

(C) Competing for the same goal

(D) Reaching an agreement

23. The phrase 'On the verge of' means

(A) far from

(B) about to happen

(C) uncertain about

(D) finished with

24. What is the meaning of 'At one's disposal'?

(A) Ready to be used as one wishes

(B) To be discarded

(C) Under someone's control

(D) Out of reach

25. The phrase 'At stake' means

(A) safe and secure

(B) being risked or in danger

(C) guaranteed

(D) completed successfully

26. The phrase 'In tandem with' means

(A) separately from

(B) in conflict with

(C) together with; in cooperation with

(D) instead of

27. _____ research conducted by the department has received international recognition.

(A) A

(B) An

(C) The

(D) *No article required*

28. She was appointed as _____ Chairperson of the Committee.

(A) a

(B) an

(C) the

(D) *No article required*

29. He delivered _____ unique lecture on contemporary literary theory.

(A) a

(B) an

(C) the

(D) *No article required*

30. _____ knowledge gained through experience is often invaluable.

(A) A

(B) An

(C) The

(D) *No article required*

31. She has _____ M.Phil. degree in Linguistics.

(A) a

(B) an

(C) the

(D) *No article required*

32. _____ United Nations plays an important role in global affairs.

(A) A

(B) An

(C) The

(D) *No article required*

33. We discussed _____ impact of artificial intelligence on education.

(A) a

(B) an

(C) the

(D) *No article required*

34. He is _____ honest researcher with a strong publication record.

(A) a

(B) an

(C) the

(D) *No article required*

35. _____ Nile is one of the longest rivers in the world.

(A) A

(B) An

(C) The

(D) *No article required*

***Direction* (Q. Nos. 36–40) : Choose the word which is similar (synonym) of the given word.**

36. HOSTILE

(A) Friendly

(B) Helpful

(C) Aggressive

(D) Polite

37. RAPID

(A) Slow

(B) Fast

(C) Delayed

(D) Gradual

38. METICULOUS

(A) Careless

(B) Thorough

(C) Hasty

(D) Negligent

39. ALLEVIATE

(A) Intensify

(B) Aggravate

(C) Relieve

(D) Increase

40. CONCUR

(A) Disagree

(B) Debate

(C) Approve

(D) Agree

***Direction* (Q. Nos. 41–45) : Choose the word which is the opposite of the given word.**

41. RELUCTANT

(A) Unwilling

(B) Hesitant

(C) Eager

(D) Doubtful

42. FRAGILE

(A) Delicate

(B) Brittle

(C) Sturdy

(D) Weak

43. RESILIENT

(A) Adaptable

(B) Flexible

(C) Vulnerable

(D) Hardy

44. AMBIGUOUS

(A) Vague

(B) Uncertain

(C) Obscure

(D) Explicit

45. PRUDENT

(A) Wise

(B) Cautious

(C) Sensible

(D) Reckless

Direction **(Q. Nos. 46–50) : Read the passage given below and answer the following questions by choosing the correct alternative.**

In recent years, many cities around the world have introduced bicycle-sharing programmes to reduce traffic congestion and air pollution. These systems allow people to rent bicycles from one location and return them to another, making short-distance travel more convenient. Supporters argue that bicycle-sharing encourages physical activity, reduces dependence on cars, and helps create a cleaner environment.

However, bicycle-sharing programmes also face several challenges. Some cities struggle with vandalism, theft, and the high costs of maintenance. In addition, bicycles are not always available when and where users need them, which can reduce public confidence in the system. Weather conditions can also affect usage, as people are less likely to cycle during heavy rain or extreme temperatures.

Despite these difficulties, many experts believe that bicycle-sharing programmes can be successful if they are carefully planned and supported by good infrastructure, such as dedicated bike lanes and secure parking areas. When combined with other forms of public transportation, bicycle-sharing can become an important part of a city's efforts to create a more sustainable and efficient transport network.

46. What is the main purpose of bicycle-sharing programmes?

(A) To increase the number of cars in cities

(B) To make long-distance travel easier

(C) To reduce traffic congestion and pollution

(D) To replace all forms of public transportation

47. Which of the following is mentioned as a challenge for bicycle-sharing programmes?

(A) Lack of bicycles being manufactured

(B) Vandalism and theft

(C) Excessive government support

(D) Too many dedicated bike lanes

48. Why might people use bicycle-sharing less often?

(A) Bicycles are too fast for city travel

(B) Public transportation is unavailable

(C) Weather conditions may discourage cycling

(D) Cities do not allow bicycles on roads

49. According to the passage, what can help bicycle-sharing programmes succeed?

(A) Higher parking fees

(B) More private cars

(C) Dedicated bike lanes and secure parking

(D) Fewer transportation options

50. What is the author's overall view of bicycle-sharing programmes?

(A) They are ineffective and should be discontinued

(B) They can be beneficial if properly managed

(C) They are only useful in small towns

(D) They are more harmful than helpful

PART—B : GENERAL KNOWLEDGE & APTITUDE

(*Marks* : 100)

Each question carries **2** marks

51. Which Article of the Indian Constitution provides for the appointment of a Finance Commission?

(A) Article 280

(B) Article 324

(C) Article 370

(D) Article 148

52. Which of the following is the largest biosphere reserve in India?

(A) Nilgiri

(B) Sundarbans

(C) Gulf of Mannar

(D) Great Rann of Kutch

53. The term 'helium flash' is associated with which of the following?

(A) Supernova explosion

(B) Formation of a black hole

(C) Nuclear fusion in stars

(D) Creation of planetary nebulae

54. Which Indian city is known as the 'Silicon Valley of India'?

(A) Pune

(B) Hyderabad

(C) Bengaluru

(D) Chennai

55. In which year did India conduct its first nuclear test?

(A) 1965

(B) 1971

(C) 1974

(D) 1998

56. Which is the highest civilian award of India?

(A) Padma Vibhushan

(B) Padma Bhushan

(C) Padma Shri

(D) Bharat Ratna

57. Which one of the following movements was led by women in large numbers?

(A) The Non-Cooperation Movement

(B) The Salt Satyagraha

(C) The Swadeshi Movement

(D) The Quit India Movement

58. The term 'genome sequencing' is associated with

(A) mapping of stars

(B) mapping of genetic material

(C) measuring earthquake vibrations

(D) classifying exoplanets

59. Which of the following countries was officially invited to join the BRICS during the 2023 Johannesburg Summit, but did not join?

(A) Argentina

(B) Egypt

(C) Iran

(D) The UAE

60. Who is the author of the book, *Why Bharat Matters* published in 2024?

(A) Amit Shah

(B) S. Jaishankar

(C) Narendra Modi

(D) Dr. Shashi Tharoor

61. Which one of the following gases is released mostly from landfills in urban areas?

(A) Nitrogen

(B) Hydrogen

(C) Methane

(D) Oxygen

62. The HIV virus weakens the immunity of a person because it destroys

(A) mast cells

(B) platelets

(C) erythrocytes

(D) lymphocytes

63. Which of the following is **not** a tributary of the river Ganga?

(A) Son

(B) Mahananda

(C) Teesta

(D) Sharda

64. "If you feel you are trapped in a black hole, don't give up. There is a way out." Who among the following made the above statement?

(A) Albert Einstein

(B) Stephen Hawking

(C) C. V. Raman

(D) Abdus Salam

65. Which of the following countries does **not** share a border with the Black Sea?

(A) Bulgaria

(B) Romania

(C) Armenia

(D) Moldova

66. Which one of the following is the largest lake in the world?

(A) Lake Superior

(B) Caspian Lake

(C) Michigan Lake

(D) Huron Lake

67. Which of the following languages was **not** added to the Eighth Schedule of the Constitution of India through the 92nd Constitutional Amendment Act, 2003?

(A) Konkani

(B) Maithili

(C) Dogri

(D) Santhali

68. Extraordinary powers granted under Article 142 can be exercised by the

1. Supreme Court of India

2. High Courts

Which of the following options is correct?

(A) 1 only

(B) 2 only

(C) Both 1 and 2

(D) Neither 1 nor 2

69. Which of the following writs is issued by an appropriate judicial body to free a person who has been illegally detained?

(A) Quo warranto

(B) Mandamus

(C) Certiorari

(D) Habeas Corpus

70. The Chairman of the Rajya Sabha is elected by

(A) the elected members of the Rajya Sabha

(B) all the members of the Rajya Sabha

(C) the elected members of the Lok Sabha and the Rajya Sabha

(D) all the members of the Lok Sabha and the Rajya Sabha

71. Which of the following liquefied gases has the lowest boiling point?

(A) Nitrogen

(B) Argon

(C) Oxygen

(D) Hydrogen

72. The Human Development Report for each year at the global level is published by the

(A) WTO

(B) World Bank

(C) UNDP

(D) IMF

73. Which of the following is **not** a 'public good'?

(A) Electricity

(B) National defence

(C) Lighthouse

(D) Public parks

74. The Right to Education was added to the Fundamental Rights in the Constitution of India through the

(A) 86th Amendment

(B) 93rd Amendment

(C) 87th Amendment

(D) 97th Amendment

75. Among the currently operational Indian satellites, there is no

(A) Communication satellite

(B) Navigation satellite

(C) Earth observation satellite

(D) Jupiter orbiter satellite

76. According to B. R. Ambedkar, which one among the following Articles is the 'heart and soul' of the Constitution of India?

(A) Article 21

(B) Article 15

(C) Article 14

(D) Article 32

77. The 7th Edition of the 'Indian Ocean Conference' was held at

(A) Dhaka

(B) New Delhi

(C) Male

(D) Perth

78. Which one of the following is an 'end-to-end secure mobile ecosystem' developed recently by the Indian Army?

(A) SANCHAR

(B) VAIBHAV

(C) SAMPARK

(D) SAMBHAV

79. Which country is the birthplace of the Olympic Games?

(A) Denmark

(B) Italy

(C) Greece

(D) Germany

80. The headquarters of the International Cricket Council (ICC) is in which country?

(A) The United Kingdom

(B) Australia

(C) The United Arab Emirates

(D) South Africa

81. In a market, you can buy a mango for ₹ 10, a lemon for ₹ 1 and 8 chillies for ₹ 1. How many of these items do you need to buy to get a mix of 100 items for exactly ₹ 100?

(A) 6 mangoes, 22 lemons, 72 chillies

(B) 7 mangoes, 21 lemons, 72 chillies

(C) 1 mango, 19 lemons, 80 chillies

(D) 8 mangoes, 12 lemons, 80 chillies

82. For every 5 chocolates that Ramesh gets, Suresh gets 3 chocolates. Geeta gets 3 chocolates for every 2 chocolates that Suresh gets. If Geeta has 18 chocolates, then the sum of chocolates with Ramesh and Suresh is

(A) 16

(B) 30

(C) 32

(D) 38

83. In 1979, Ramesh's age was the sum of the digits of his year of birth. In 2017, on his birthday, what was his age?

(A) 49

(B) 57

(C) 60

(D) 64

84. A device needs 4 batteries to run. Each battery runs for 2 days. If there is a total of 6 batteries available, what is the maximum number of days for which the device can be run by strategically replacing the batteries till all the batteries are completely drained of power?

(A) 2

(B) 3

(C) 4

(D) 5

85. A person takes a loan of ₹ 1,50,000 at a compound interest rate of 10% per annum. If the loan is repaid at the end of the 3rd year, what is the total interest paid?

(A) ₹ 1,45,000

(B) ₹ 82,600

(C) ₹ 94,600

(D) ₹ 49,650

86. The ratio of the ages of a mother and her daughter is 14 : 1 at present. After four years, the ratio of their ages will be 16 : 3. What was the age of the mother when the daughter was born?

(A) 26 years

(B) 28 years

(C) 30 years

(D) 32 years

87. The son was born when his mother was 28 years old. The father is older to the mother by 4 years. If the current ages of the father and the mother are in the ratio 9 : 8, what is the current age (in years) of the son?

(A) 2

(B) 3

(C) 4

(D) 5

88. Rajesh went to Sunil's house situated 1 km North-East of his house. From there, he went to Arjun's house, which is situated 707 m South of Sunil's house. What is the distance between Rajesh's current location and his house (to the nearest metre)?

(A) 800 m

(B) 600 m

(C) 707 m

(D) 1000 m

89. If 6 students occupy a bench, one bench will be left completely unoccupied. If 5 students occupy each bench, instead, one student will not find a seat. The number of students is

(A) 30

(B) 31

(C) 36

(D) 42

90. The cost of 2 mangoes, 1 coconut and 2 bananas is ₹71, while the cost of 5 mangoes, 3 coconuts and 4 bananas is ₹182. What is the cost of 1 mango and 1 coconut?

(A) It cannot be calculated

(B) ₹40

(C) ₹47

(D) ₹53

91. The price of an item is increased by 20% of its cost price and is then sold at 10% discount for ₹2,160. What is its cost price?

(A) ₹1,680

(B) ₹1,700

(C) ₹1,980

(D) ₹2,000

92. Find the number that will come in the place of the question mark in the given series

11, 12, 15, 20, 27, ?

(A) 36

(B) 35

(C) 38

(D) 41

93. Fill in the blank :

DFH, HJL, LNP, _____, TVX

(A) DTV

(B) NRT

(C) PRT

(D) RQS

94. BOTANY is to PLANTS as PHILOSOPHY is to

(A) REGULATIONS

(B) RELIGIONS

(C) IDEAS

(D) POLITICS

95. The ratios of girls to boys in two sections in a class are 3 : 4 and 3 : 7 respectively. Their ratio in the entire class (when the two sections are combined) is 4 : 7. Which of the following can be the strength of the girls in the entire class?

(A) 36

(B) 42

(C) 45

(D) 48

96. In the following finite sequence of integers, how many 9's are divisible by their immediate next terms?

8, 3, 4, 9, 3, 5, 9, 5, 9, 9, 9, 4, 5, 9, 5, 6, 3, 3, 5, 7, 2, 3, 9, 9, 8, 9, 3, 9, 1, 9, 4

(A) 3

(B) 4

(C) 5

(D) 6

97. Shyam buys a watch at a 10% discount on its maximum retail price (MRP). He sells it to Mohan for ₹ 3,960 making a profit of 10%. What is the MRP of the watch?

(A) ₹ 4,040

(B) ₹ 4,000

(C) ₹ 3,960

(D) ₹ 4,356

98. The average weight of 8 persons increases by 2·5 kg when a new person comes in place of one of them weighing 65 kg. What might be the weight of the new person?

(A) 76 kg

(B) 76·5 kg

(C) 85 kg

(D) 95·5 kg

99. In a 100-m race, *A* covers the distance in 36 seconds and *B* in 45 seconds. In this race, *A* beats *B* by

(A) 20 m

(B) 25 m

(C) 22·5 m

(D) 9 m

100. Three numbers are in the ratio of 3 : 4 : 5 and their LCM is 2400. Their HCF is

(A) 40

(B) 80

(C) 120

(D) 200

PART—C : [Choose any ONE subject from the following]

CHEMISTRY

(*Marks* : 100)

Each question carries **2** marks

101. The maximum number of electrons that can be accommodated in a sub-shell with the value of azimuthal quantum number, $l = 1$, is

(A) 6 (B) 8

(C) 2 (D) 4

102. The orbital represented by the quantum numbers $n = 2$, $l = 1$, where n = principal quantum number and l = azimuthal quantum number, is

(A) $2p$ (B) $3p$

(C) $3s$ (D) $2s$

103. The Schrodinger's wave equation in Cartesian coordinates can be written as

(A) $\frac{\delta^2\psi}{\delta x^2}+\frac{\delta^2\psi}{\delta y^2}+\frac{\delta^2\psi}{\delta z^2}+\frac{8\pi^2 m}{h^2}(E+V)\psi = 0$

(B) $\frac{\delta^2\psi}{\delta x^2}+\frac{\delta^2\psi}{\delta y^2}+\frac{\delta^2\psi}{\delta z^2}+\frac{8\pi^2 m}{2h^2}(E+V)\psi = 0$

(C) $\frac{\delta^2\psi}{\delta x^2}+\frac{\delta^2\psi}{\delta y^2}+\frac{\delta^2\psi}{\delta z^2}+\frac{8\pi^2 m}{h}(E-V)\psi = 0$

(D) $\frac{\delta^2\psi}{\delta x^2}+\frac{\delta^2\psi}{\delta y^2}+\frac{\delta^2\psi}{\delta z^2}+\frac{8\pi^2 m}{h^2}(E-V)\psi = 0$

104. de Broglie equation is given as

(A) $\lambda = -\frac{h}{p}$

(B) $\lambda = \frac{h}{p}$

(C) $\lambda = -\frac{h}{m}$

(D) $\lambda = \frac{h}{\nu}$

105. Which of the following molecules has the highest C—H bond energy?

(A) Ethyne

(B) Benzene

(C) Ethene

(D) Methane

106. The number of sp^2-hybridized carbon atoms present in 1,3-butadiene is

(A) 4

(B) 3

(C) 2

(D) 0

107. The decreasing order of acid strength of FCH_2COOH, $ClCH_2COOH$, $BrCH_2COOH$ and ICH_2COOH is

(A) $ICH_2COOH > ClCH_2COOH > FCH_2COOH > BrCH_2COOH$

(B) $ClCH_2COOH > FCH_2COOH > ICH_2COOH > BrCH_2COOH$

(C) $FCH_2COOH > ClCH_2COOH > BrCH_2COOH > ICH_2COOH$

(D) $BrCH_2COOH > ClCH_2COOH > ICH_2COOH > FCH_2COOH$

108. Hyperconjugation is

(i) delocalization of σ and π bonds

(ii) no bond resonance

(iii) σ-π conjugation

Select the correct answer.

(A) (i) and (ii)

(B) (ii) and (iii)

(C) (i) and (iii)

(D) (i), (ii) and (iii)

109. Mathematically, Boyle's law can be represented as

(A) $V \propto T$

(B) $V \propto \frac{1}{P}$

(C) $V \propto \frac{1}{T}$

(D) $V \propto P$

110. The average kinetic energy of the gas molecules is

(A) directly proportional to the square root of its absolute temperature

(B) equal to the square of its absolute temperature

(C) directly proportional to its absolute temperature

(D) inversely proportional to its absolute temperature

111. Compressibility factor is unity for

(A) liquids

(B) solids

(C) real gases

(D) ideal gases

112. The mathematical expression for Boltzmann constant, k, is given by

(A) $k = R \cdot N_A$

(B) $k = \frac{T}{N_A}$

(C) $k = \frac{R}{N_A}$

(D) $k = \frac{1}{N_A}$

113. In the reaction $BrF_3 + F^- \rightarrow [BrF_4]^-$

(A) Lewis acid is F^-, Lewis base is BrF_3

(B) Lewis acid is BrF_3, Lewis base is F^-

(C) Lewis acid is $[BrF_4]^-$, Lewis base is BrF_3

(D) Lewis acid is BrF_3, Lewis base is $[BrF_4]^-$

114. The masses of proton and neutron are 1·007277 amu and 1·008665 amu respectively. If the mass of ^2_1H = 2·01473 amu, then its binding energy per nucleon is

(A) 0·664 MeV

(B) 1·692 MeV

(C) 0·564 MeV

(D) 1·128 MeV

115. A radioactive source has a half-life of 80 s. How long will it take for $\frac{7}{8}$ of the source to decay?

(A) 70 s

(B) 540 s

(C) 240 s

(D) 110 s

116. Which of the following nuclear reactions is possible?

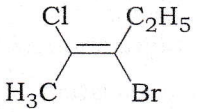
(A) $^1_1H + {}^1_1H \rightarrow {}^4_2He$

(B) $^{14}_7N + {}^1_0n \rightarrow {}^{16}_7N + {}^1_1H$

(C) $^{16}_8O + {}^1_0n \rightarrow {}^{14}_7N + 3^1_1H + 2\beta$

(D) $^{32}_{16}S + {}^1_1H \rightarrow {}^{35}_{17}Cl + {}^4_2He$

117. The correct IUPAC name of



is

(A) (*Z*)-3-bromo-2-chloropent-2-ene

(B) (*E*)-2-bromo-3-chloropent-2-ene

(C) (*E*)-3-bromo-2-chloropent-2-ene

(D) (*Z*)-2-bromo-3-chloropent-2-ene

118. The rate of S_N1 reaction is favoured by

(A) a polar aprotic solvent and a weak nucleophile

(B) a polar protic solvent and a strong nucleophile

(C) a polar aprotic solvent and a strong nucleophile

(D) a polar protic solvent and a weak nucleophile

119. In an S_N2 condition for the reaction of (*R*)-2-bromobutane with aq. KOH, the product(s) obtained is/are

(i) (*S*)-butan-2-ol

(ii) (*R*)-butan-2-ol

Select the correct answer.

(A) Both (i) and (ii)

(B) Only (i)

(C) Only (ii)

(D) 70% (i) and 30% (ii)

120. When (3*R*, 4*S*)-3-bromo-3,4-dimethylhexane undergoes *E*2 reaction in alc. KOH, the product(s) obtained is/are

(i) (3*Z*)-3,4-dimethylhex-3-ene

(ii) (3*E*)-3,4-dimethylhex-3-ene

Select the correct answer.

(A) Both (i) and (ii)

(B) Only (ii)

(C) Only (i)

(D) 40% (i) and 60% (ii)

121. Which of the following variables is an inexact differential?

(A) Heat

(B) Pressure

(C) Temperature

(D) Volume

122. The equation that represents a closed system is

(A) $dE = TdS$

(B) $dE = 0$

(C) $dE = TdS - PdV$

(D) $dE = -PdV$

123. According to the Freundlich isotherm, the amount of gas adsorbed increases with pressure. Which of the following statements are true?

(i) The adsorption process is very favourable ($n > 1$).

(ii) The amount of gas adsorbed increases linearly with increasing pressure.

(iii) The adsorption sites are becoming saturated as pressure increases.

(iv) The Freundlich isotherm cannot be used to determine favourability.

Select the correct answer.

(A) (i) and (iii)

(B) (i) and (ii)

(C) (iii) and (iv)

(D) (i), (ii) and (iii)

124. The heat of the reaction

$$N_2 + 3H_2 \rightarrow 2NH_3$$

at 27 °C was found to be –21·976 kcal. What will be the heat of the reaction at 50 °C? Given that the molar heat capacities at constant pressure and 27 °C for nitrogen, hydrogen and ammonia are 6·8 cal mol^{-1} $degree^{-1}$, 6·77 cal mol^{-1} $degree^{-1}$ and 8·86 cal mol^{-1} $degree^{-1}$ respectively.

(A) –21·760 kcal

(B) –24·135 kcal

(C) –22·192 kcal

(D) –21·976 kcal

125. How much work is required to compress a gas from a volume of 5·0 L to a volume of 2·5 L by exerting a constant pressure of 1·5 atm?

(A) 380 J

(B) 475 J

(C) 286 J

(D) 125 J

126. BrF_5 has

(A) 5 bond pairs, 1 lone pair with a square pyramidal geometry

(B) 3 bond pairs, 2 lone pairs with a T-shape geometry

(C) 3 bond pairs, 2 lone pairs with a trigonal planar geometry

(D) 4 bond pairs, 2 lone pairs with tetrahedral geometry

127. Which of the following is **not** an essential amino acid?

(A) Leucine

(B) Lysine

(C) Alanine

(D) Valine

128. Which of the following metal electrodes will liberate hydrogen gas with dilute acids?

(A) Zn and Cu

(B) Mg and Ag

(C) Cu and Ag

(D) Zn and Mg

129. An aqueous solution of NaCl is

(A) bivariant

(B) univariant

(C) trivariant

(D) invariant

130. Which of the following systems shows incongruent melting point?

(A) Phenol-Aniline

(B) Phenol-Water

(C) NaCl-H_2O

(D) KI-H_2O

131. D-glucose can be converted into D-arabinose by

(A) Wohl degradation

(B) epimerization

(C) mutarotation

(D) Kiliani-Fischer synthesis

132. _____ is not a disaccharide.

(A) Maltose

(B) Sucrose

(C) Raffinose

(D) Lactose

133. Martius yellow is

(A) a nitro dye

(B) an azo dye

(C) a phthalein dye

(D) an anthraquinone dye

134. An increase in equivalent conductance of a strong electrolyte with dilution is mainly due to

(A) increase in both, i.e., number of ions and ionic mobility of ions

(B) increase in ionic mobility of ions

(C) increase in number of ions

(D) complete ionization of electrolyte at normal dilution

135. The equivalent conductance of Ba^{2+} and Cl^- are 127 $ohm^{-1} cm^2 eq^{-1}$ and 76 $ohm^{-1} cm^2 eq^{-1}$ respectively at infinite dilution. The equivalent conductance of $BaCl_2$ at infinite dilution will be

(A) 203 $ohm^{-1} cm^2 eq^{-1}$

(B) 139·5 $ohm^{-1} cm^2 eq^{-1}$

(C) 101·5 $ohm^{-1} cm^2 eq^{-1}$

(D) 279 $ohm^{-1} cm^2 eq^{-1}$

136. The amount of free water-soluble, volatile fatty acids present in a fat or oil is expressed in terms of its

(A) iodine number

(B) saponification number

(C) acid number

(D) Reichert-Meissl number

137. The aromatic character of furan, pyrrole and thiophene is in the order of

(A) furan > pyrrole > thiophene

(B) pyrrole > furan > thiophene

(C) thiophene > furan > pyrrole

(D) thiophene > pyrrole > furan

138. The pH of a 0·10 *M* solution of barium hydroxide, $Ba(OH)_2$, is

(A) 11·31

(B) 13·30

(C) 11·70

(D) 10·50

139. The coordination number and oxidation state of Cr in $K_3[Cr(C_2O_4)_3]$ are

(A) 6 and +3 respectively

(B) 6 and +2 respectively

(C) 3 and +2 respectively

(D) 3 and +3 respectively

140. A mixture of ice, water and water vapour in equilibrium has phases (*P*), components (*C*) and degrees of freedom (*F*) of

(A) $P = 1;\ C = 2;\ F = 3$

(B) $P = 3;\ C = 1;\ F = 0$

(C) $P = 2;\ C = 1;\ F = 1$

(D) $P = 1;\ C = 3;\ F = 5$

141. D-erythrose is a/an

(A) ketohexose

(B) ketotriose

(C) aldohexose

(D) aldotetrose

142. The isoelectric point of glycine is

(A) 5·97

(B) 9·60

(C) 2·34

(D) 5·70

143. _____ is an example of a basic amino acid.

(A) Aspartic acid

(B) Lysine

(C) Proline

(D) Isoleucine

144. The number of moles of phenyl-hydrazone required to react with 1 mole of glucose/fructose to form osazone is

(A) 1

(B) 2

(C) 3

(D) 4

145. Conversion of glyceryl trioleate to glyceryl tristearate is an example of

(A) saponification

(B) drying of oils

(C) halogenation

(D) hardening of oils

146. In organometallic compounds, the number of carbon atoms bound to the metal is indicated by

(A) σ

(B) κ

(C) δ

(D) η

147. The π-bonded organometallic compound which has ethene as one of its components is

(A) ferrocene

(B) Zeise's salt

(C) dibenzene chromium

(D) tetraethyl tin

148. Which of the following statements best characterize Ostwald's dilution law?

(i) It is valid for weak electrolyte dissociation.

(ii) It is useful in calculating the ionization constant of acids or bases.

(iii) It is not valid for strong electrolytes.

Select the correct answer.

(A) (i) and (ii)

(B) (ii) and (iii)

(C) (i) and (iii)

(D) (i), (ii) and (iii)

149. Which of the following statements is **false** for an electrochemical cell?

(A) Oxidation and reduction half-reactions occur at electrodes in electrochemical cells.

(B) Reduction occurs at the cathode while oxidation occurs at the anode.

(C) All electrochemical cells involve the use of electricity to initiate non-spontaneous chemical reactions.

(D) All electrochemical reactions involve the transfer of electrons.

150. From the following, identify the complex that can exhibit linkage isomerism.

(A) $[Co(NH_3)_5H_2O]Cl_3$

(B) $[Co(NH_3)_5Cl]Cl_2$

(C) $[Co(NH_3)_5Cl]SO_4$

(D) $[Co(NH_3)_5(NO_2)]Cl_2$

FORENSIC SCIENCE

(*Marks* : 100)

Each question carries **2** marks

101. In a Berdan primer, the anvil is

(A) in primer cup

(B) in cartridge case

(C) in propellant

(D) in firing pin

102. Which statement does correctly distinguish a toxin from a toxicant?

(A) Toxins are always synthetic.

(B) Toxicants are always biological.

(C) Toxins are produced by living organisms.

(D) Toxicants are necessarily more potent.

103. The sweat glands most important to latent print development are the

(A) apocrine glands

(B) sebaceous glands

(C) eccrine glands

(D) meibomian glands

104. During cyanoacrylate fuming, development should generally be terminated

(A) after complete chamber saturation

(B) when the background becomes fluorescent

(C) shortly after the first signs of fingerprints appear

(D) after all residues have polymerized

105. Teeth can remain useful for DNA analysis in severely decomposed remains primarily because

(A) enamel contains large amounts of nuclear DNA

(B) the mineralized tooth structure protects DNA from degradation

(C) dental pulp contains only mitochondrial DNA

(D) dentin is composed entirely of nucleic acids

106. Raman spectroscopy is based primarily on

(A) inelastic scattering of light

(B) absorption of IR radiation

(C) elastic scattering of light

(D) emission of thermal radiation

107. In a disguised specimen, which observation would be most useful in assessing authorship?

(A) Changed pictorial appearance

(B) Retained habitual features beneath the disguise

(C) Altered letter size alone

(D) Increased writing pressure alone

108. Tetrameric STRs are commonly preferred for forensic profiling because they generally produce

(A) more frequent stutter peaks than dinucleotide repeats

(B) no allelic variation

(C) longer amplification products than VNTRs

(D) fewer stutter peaks than dimeric and trimeric repeats

109. Chamber sealing during firing is termed

(A) engraving

(B) obturation

(C) swaging

(D) recoil

110. Which of the following pairs is most appropriate for chemical characterization of a paint?

(A) Pigment and binder

(B) Solvent and pigment

(C) Resin and surface texture

(D) Layer thickness and color

111. Which cranial feature is commonly considered in skeletal ancestry assessment?

(A) Nasal aperture

(B) Patellar height

(C) Femoral neck angle

(D) Radial tuberosity

112. At an intersection of two writings, pigment from one stroke has been dragged by the other. This observation primarily assists in determining

(A) ink formulation

(B) relative sequence

(C) writer identity

(D) absolute age of ink

113. Retrograde extrapolation of alcohol concentration involves

(A) estimating alcohol intake from urine concentration

(B) converting blood alcohol concentration to breath alcohol concentration

(C) determining the rate of alcohol absorption from breath

(D) estimating a prior alcohol concentration from a later measurement

114. Toxicity may vary significantly with the route of administration because

(A) metabolism is always identical

(B) toxicant disposition may differ

(C) LD_{50} is route-independent

(D) excretion is always increased

115. Which search method is **not** an acceptable systematic search pattern?

(A) Grid

(B) Spiral

(C) Quadrant

(D) Mill-around

116. The most important consideration in comparing handwriting is

(A) letter size

(B) general appearance

(C) combination of characteristics

(D) writing instrument

117. Inconsistency in letter form, change in slope, tremors, use of alternate letter form normally **not** used by the writer are the characteristics commonly associated with which of the following?

(A) Spurious signatures

(B) Simulated forgery

(C) Guided signatures

(D) Disguise

118. Which combination is most characteristic of a traced signature?

(A) Smooth movement, variable pressure and natural rhythm

(B) Rapid movement, natural shading and fluent connections

(C) Regular rhythm, spontaneous strokes and natural variation

(D) Slow movement, hesitation, retouching and pen lifts

119. A silver physical developer develops primarily the

(A) water-insoluble components of residue

(B) water-soluble components of residue

(C) amino acids in sweat

(D) chloride ions in sweat

120. Compared with anagen hairs, naturally shed telogen hairs generally contain

(A) more nuclear DNA

(B) more intact nuclei

(C) less nuclear DNA

(D) no mitochondrial DNA

121. Which one of the following is **not** one of the six original Gustafson's criteria?

(A) Root transparency

(B) Pulp calcification

(C) Root resorption

(D) Cementum apposition

122. Which feature is associated with the cuticle rather than the cortex?

(A) Pigment granules

(B) Medullary index

(C) Pigment distribution

(D) Overlapping scales

123. In handwriting comparison, which finding carries the greatest weight for establishing non-identity?

(A) Difference in slant

(B) Difference in letter size

(C) Fundamental difference in individual features

(D) Variation in baseline position

124. Which one of the following sequences is most appropriate after forensic acquisition?

(A) Verification → Working copy → Examination → Archive

(B) Analysis → Verification → Archive → Working copy

(C) Working copy → Acquisition → Verification → Examination

(D) Archive → Analysis → Verification → Working copy

125. The principal cellular source of nuclear DNA in compact bones is the

(A) osteocyte

(B) osteoclast

(C) osteoblast

(D) chondrocyte

126. The characteristic effect of many drugs used in drug-facilitated sexual assault that is particularly important in forensic investigation is

(A) hyperactivity

(B) anterograde amnesia

(C) increased blood pressure

(D) enhanced muscle control

127. An antihuman antiserum used for species identification reacts strongly with human serum primarily because of antibodies directed against

(A) albumin

(B) fibrinogen

(C) hemoglobin

(D) immunoglobulin G

128. The rib phase method of age estimation primarily examines the

(A) first rib

(B) second rib

(C) fourth rib

(D) eighth rib

129. During DNA extraction from bones EDTA is used primarily to

(A) digest proteins

(B) bind calcium ions during decalcification

(C) hydrolyse DNA

(D) precipitate nucleic acids

130. Lead inhibits ALAD primarily by

(A) binding to DNA

(B) displacing zinc

(C) blocking calcium channels

(D) depleting metallothionein

131. Which technique provides a rapid and reliable method for determining the generic class of a manufactured fiber?

(A) Visible-light microspectrophotometry

(B) Polarizing microscopy

(C) Comparison microscopy

(D) Infrared spectrophotometry

132. The refractive index of fragments from a single sheet of plate glass may vary by approximately

(A) 0·00002

(B) 0·0002

(C) 0·002

(D) 0·02

133. In the immersion method for determining refractive index, the match point is indicated by

(A) minimum visual contrast

(B) maximum Becke line intensity

(C) complete disappearance of the liquid

(D) maximum particle visibility

134. Which technique can distinguish prostatic acid phosphatase from vaginal acid phosphatase on the basis of electrophoretic mobility?

(A) Agarose gel electrophoresis

(B) Paper chromatography

(C) Thin-layer chromatography

(D) Gas chromatography

135. A hair root showing a club-shaped appearance is most consistent with the

(A) anagen phase

(B) catagen phase

(C) telogen phase

(D) early anagen phase

136. The most fleeting evidence should generally be

(A) photographed last

(B) packaged separately

(C) examined in the laboratory

(D) collected first

137. Prostate-specific antigen (PSA), commonly used in forensic semen identification, is also known as

(A) PGM1

(B) P10

(C) P20

(D) P30

138. In a car-bombing investigation, samples should be collected from

(A) metallic surfaces only

(B) porous surfaces only

(C) the engine compartment only

(D) both porous and non-porous surfaces

139. The individual characteristics of a tool are principally associated with

(A) size and shape of the tool

(B) random nicks and breaks

(C) general dimensions of the mark

(D) width and depth of the impression

140. Which of the following is most commonly associated with the term 'date-rape drug' in the text?

(A) Flunitrazepam

(B) Morphine

(C) Cocaine

(D) Methadone

141. Which is **not** one of the five major problems in automated fingerprint processing?

(A) Pattern individualization

(B) Image enhancement

(C) Feature extraction

(D) Matching

142. For most explosive evidence, the preferred material for small sample packaging is

(A) nylon

(B) paper

(C) cotton

(D) glass wool

143. Which factor has a major influence on ridge count and pattern formation?

(A) Sweat gland density

(B) Volar pad size

(C) Epidermal thickness

(D) Dermal papillae size

144. On a porous surface, the recommended sequence for latent fingerprint development is

(A) ninhydrin → DFO → physical developer

(B) DFO → ninhydrin → physical developer

(C) physical developer → DFO → ninhydrin

(D) DFO → physical developer → ninhydrin

145. Shed cells from worn clothing are considered a source of

(A) extracellular DNA only

(B) touched DNA evidence

(C) mitochondrial DNA only

(D) non-biological trace evidence

146. In an electron microscope, resolution is primarily improved by decreasing the

(A) electron wavelength

(B) accelerating voltage

(C) beam current

(D) detector sensitivity

147. A bloodstain has a length of 8 mm and a width of 4 mm. The approximate angle of impact is

(A) 30°

(B) 45°

(C) 60°

(D) 75°

148. Which is a limitation of microcrystal tests for blood?

(A) They cannot detect heme

(B) They are more sensitive than presumptive tests

(C) They cannot distinguish human blood from animal blood

(D) They require intact erythrocytes

149. Wet biological evidence should generally be

(A) air-dried without heat before packaging

(B) frozen immediately in a sealed plastic bag

(C) dried using direct heat

(D) preserved in formalin

150. Which component of cannabis is the principal psychoactive compound?

(A) Cannabinol

(B) Cannabidiol

(C) Δ^9-tetrahydrocannabinol

(D) Cannabigerol