JAMMU AND KASHMIR PUBLIC SERVICE COMMISSION

RESHAM GHAR COLONY, BAKSHI NAGAR, JAMMU - 180016

Website: http://jkpsc.nic.in

Jammu: 0191-2566533

Subject: Written Examination for the posts of Lecturer(s) [Zoology, Physics, Botany and Chemistry] in the School Education Department - Provisional Answer Key(s) thereof.

Notification No. PSC/Exam/S/2025/43
Dated: 12.10.2025

In pursuance of Rule 10(c) of the Jammu & Kashmir Public Service Commission (Conduct of Examination) Rules, 2022, as amended upto date, the Provisional Answer Keys of Question Papers pertaining to the written examinations for the posts of **Lecturer(s) [Zoology, Physics, Botany and Chemistry] in School Education Department,** held on **12.10.2025,** are hereby notified for seeking the objections from candidates.

Provisional Answer Key

(Zoology)

Test Booklet Question No. (Series A)	
Q1	D
Q2	A
Q3	D
Q4	B
Q5	A
Q6	C
Q7	A
Q8	C
Q9	B
Q10	C
Q11	D

Test Booklet Question No. (Series A)	
Q12	C
Q13	C
Q14	B
Q15	A
Q16	B
Q17	C
Q18	B
Q19	A
Q20	C
Q21	A
Q22	D

Test Booklet Question No. (Series A)	
Q23	D
Q24	A
Q25	D
Q26	D
Q27	B
Q28	D
Q29	A
Q30	D
Q31	B
Q32	C
Q33	A

Test Booklet Question No. (Series A)	
Q34	D
Q35	A
Q36	C
Q37	C
Q38	D
Q39	C
Q40	C
Q41	B
Q42	C
Q43	C
Q44	A
Q45	D
Q46	B
Q47	D
Q48	C
Q49	A
Q50	C
Q51	A
Q52	D
Q53	B
Q54	D
Q55	C
Q56	D

Test Booklet Question No. (Series A)	
Q57	C
Q58	D
Q59	B
Q60	B
Q61	A
Q62	B
Q63	C
Q64	B
Q65	D
Q66	A
Q67	C
Q68	D
Q69	D
Q70	C
Q71	B
Q72	C
Q73	D
Q74	A
Q75	C
Q76	A
Q77	D
Q78	D
Q79	C

Test Booklet Question No. (Series A)	
Q80	A
Q81	C
Q82	D
Q83	C
Q84	B
Q85	A
Q86	A
Q87	D
Q88	B
Q89	A
Q90	B
Q91	C
Q92	B
Q93	D
Q94	A
Q95	A
Q96	C
Q97	A
Q98	D
Q99	A
Q100	B

Provisional Answer Key

(Physics)

Test Booklet Question No. (Series A)	
Q1	C
Q2	B
Q3	C
Q4	B
Q5	D
Q6	B
Q7	A
Q8	C
Q9	A
Q10	B
Q11	C
Q12	B
Q13	B
Q14	C
Q15	B
Q16	C
Q17	D
Q18	B
Q19	A
Q20	B
Q21	D
Q22	C
Q23	A
Q24	D
Q25	A
Q26	C
Q27	B
Q28	D
Q29	D
Q30	B
Q31	B
Q32	D
Q33	D
Q34	A

Test Booklet Question No. (Series A)	
Q35	A
Q36	B
Q37	A
Q38	A
Q39	B
Q40	A
Q41	B
Q42	A
Q43	C
Q44	A
Q45	A
Q46	A
Q47	A
Q48	D
Q49	C
Q50	B
Q51	A
Q52	B
Q53	B
Q54	C
Q55	B
Q56	C
Q57	C
Q58	D
Q59	D
Q60	A
Q61	D
Q62	A
Q63	B
Q64	C
Q65	D
Q66	A
Q67	C
Q68	C

Test Booklet Question No. (Series A)	
Q69	C
Q70	B
Q71	B
Q72	A
Q73	B
Q74	A
Q75	C
Q76	A
Q77	B
Q78	B
Q79	A
Q80	B
Q81	C
Q82	C
Q83	D
Q84	A
Q85	C
Q86	A
Q87	C
Q88	C
Q89	D
Q90	C
Q91	D
Q92	B
Q93	A
Q94	C
Q95	A
Q96	A
Q97	D
Q98	A
Q99	B
Q100	D

Provisional Answer Key

(Botany)

Test Booklet Question No. (Series A)	
Q1	B
Q2	A
Q3	B
Q4	D
Q5	C
Q6	A
Q7	C
Q8	A
Q9	D
Q10	C
Q11	B
Q12	A
Q13	B
Q14	D
Q15	D
Q16	D
Q17	B
Q18	B
Q19	D
Q20	C
Q21	B
Q22	D
Q23	A
Q24	C
Q25	C
Q26	D
Q27	A
Q28	D
Q29	B
Q30	C
Q31	B
Q32	A
Q33	C
Q34	B

Test Booklet Question No. (Series A)	
Q35	D
Q36	A
Q37	B
Q38	D
Q39	A
Q40	B
Q41	B
Q42	A
Q43	D
Q44	C
Q45	A
Q46	D
Q47	C
Q48	A
Q49	D
Q50	B
Q51	C
Q52	A
Q53	B
Q54	A
Q55	C
Q56	B
Q57	A
Q58	B
Q59	D
Q60	A
Q61	C
Q62	A
Q63	D
Q64	B
Q65	C
Q66	A
Q67	C
Q68	C

Test Booklet Question No. (Series A)	
Q69	D
Q70	B
Q71	A
Q72	D
Q73	B
Q74	B
Q75	A
Q76	D
Q77	D
Q78	D
Q79	A
Q80	C
Q81	D
Q82	A
Q83	A
Q84	A
Q85	B
Q86	C
Q87	D
Q88	C
Q89	D
Q90	B
Q91	A
Q92	A
Q93	B
Q94	D
Q95	B
Q96	C
Q97	D
Q98	A
Q99	A
Q100	C

Provisional Answer Key

(Chemistry)

Test Booklet Question No. (Series A)	
Q1	B
Q2	C
Q3	B
Q4	D
Q5	B
Q6	B
Q7	B
Q8	C
Q9	A
Q10	D
Q11	C
Q12	C
Q13	B
Q14	A
Q15	B
Q16	B
Q17	B
Q18	C
Q19	C
Q20	A
Q21	C
Q22	B
Q23	B
Q24	C
Q25	A
Q26	B
Q27	B
Q28	B
Q29	A
Q30	B
Q31	B
Q32	B
Q33	C
Q34	B

Test Booklet Question No. (Series A)	
Q35	D
Q36	B
Q37	A
Q38	A
Q39	B
Q40	B
Q41	B
Q42	A
Q43	B
Q44	B
Q45	A
Q46	B
Q47	B
Q48	B
Q49	C
Q50	B
Q51	C
Q52	A
Q53	B
Q54	A
Q55	B
Q56	B
Q57	A
Q58	A
Q59	B
Q60	B
Q61	C
Q62	C
Q63	C
Q64	B
Q65	B
Q66	B
Q67	B
Q68	A

Test Booklet Question No. (Series A)	
Q69	A
Q70	B
Q71	C
Q72	B
Q73	C
Q74	B
Q75	C
Q76	B
Q77	B
Q78	B
Q79	B
Q80	A
Q81	B
Q82	A
Q83	C
Q84	B
Q85	A
Q86	A
Q87	B
Q88	A
Q89	C
Q90	C
Q91	D
Q92	A
Q93	B
Q94	C
Q95	A
Q96	A
Q97	A
Q98	A
Q99	A
Q100	A

The candidates are advised to refer to **Question Booklet (Series A)** to match the corresponding question(s) in their respective Question Booklet Series and if any candidate feels that the key to any of the question(s) is/are wrong, he/she may represent on prescribed format/proforma annexed as **Annexure-A** along with the documentary proof/evidence **(hard copies only)** and fee of Rs.500/- per question in the form of Demand Draft drawn in favour of **COE, J&K PSC** (refundable in case of genuine/correct representation) to the Controller of Examinations, Jammu & Kashmir Public Service Commission, from Monday i.e. 13.10.2025 to 15.10.2025. **The candidates are further advised to clearly mention the question(s) objected to with reference to its serial number as it appears in the Question Booklet of Series A of the provisional answer key(s).**

Any objection/application not accompanied by the requisite Demand Draft of Rs.500/- as prescribed, shall not be considered/entertained under any circumstances. Candidates are, in their own interest, advised to adhere to these instructions and not submit any objection unaccompanied by the Demand Draft as required under extant rules. The Commission shall not entertain any such representation(s) after the expiry of the stipulated period i.e. after 15.10.2025 (Wednesday), 05.00 pm.

Further, objection(s) submitted in any other mode will not be entertained.

The provisional answer key(s) are also available on the website of the Commission http://www.jkpsc.nic.in.

12/X/25

(Sachin Jamwal) JKAS
Controller of Examinations
J&K Public Service Commission

No. PSC/Ex-Secy/2025/28 Dated: 12.10.2025

Copy to the: -

1. Director, Information and Public Relations, J&K for publication of the notice in all leading newspapers published from Jammu/Srinagar.
2. P.S. to Hon'ble Chairman, J&K Public Service Commission for information of the Hon'ble Chairman.
3. P.S. to Hon'ble Member, Shri _____ for information of the Hon'ble Member.
4. P. A. to Secretary, J&K Public Service Commission for information of the Secretary.
5. Main file/Stock file/Notice Board.

Annexure-A

Representation regarding objection(s) to any Question/Answer pertaining to the Written Examination conducted for the posts of Lecturer(s) [Zoology, Physics, Botany and Chemistry] in School Education Department held on 12.10.2025

(NOTE: USE SEPARATE FORMS FOR SEPARATE QUESTIONS)

Discipline: _____

Name of the Applicant: _____

Roll No. : _____

Correspondence Address : _____

Contact/Mobile No. : _____

Date of Application: _____.10.2025

Demand Draft Details: No._____Date_____ Amount_____

Candidates Account No.(16 digit) & IFSC Code :_____

_____

Question No. in Series A	Details of the Objection	Resource Material (copy to be enclosed)	Details of the Website (if any)
Correct Answer/Option as per candidate :			

Signature of the Candidate

Note : Application for each question/answer shall be made on separate page in the given format, otherwise the first question entered in the format shall only be considered.

DO NOT OPEN THIS TEST BOOKLET UNTIL YOU ARE TOLD TO DO SO

Booklet Serial No. 346305

Test Booklet Series

TEST BOOKLET
LECTURER - (10+2)
ZOOLOGY
WRITTEN TEST - 2025

A

(74)

Time Allowed: Two Hours ***Maximum Marks: 100***

INSTRUCTIONS

1. IMMEDIATELY AFTER THE COMMENCEMENT OF THE EXAMINATION, YOU SHOULD CHECK THAT THIS TEST BOOKLET ***DOES NOT*** HAVE ANY UNPRINTED OR TORN OR MISSING PAGES OR ITEMS, ETC. IF SO, GET IT REPLACED BY A COMPLETE TEST BOOKLET.
2. **Please note that it is the candidate's responsibility to encode and fill in the Roll Number and Test Booklet Series Code A, B, C or D carefully and without any omission or discrepancy at the appropriate places in the OMR Answer /Response Sheet. Any omission/discrepancy will render the Response Sheet liable for rejection.**
3. You have to enter your Roll Number on the Test Booklet in the Box provided alongside. ***DO NOT*** **write** ***anything else*** on the Test Booklet.
4. This Test booklet contains **100** items (questions). Each item comprises of four responses (answers). You will select the response which you want to mark on the Answer Sheet/Response Sheet. In case you feel that there is more than one correct response, mark the response which you consider the best. In any case, choose ***ONLY ONE*** response for each item.
5. You have to mark all your responses ***ONLY*** on the separate Answer /Response Sheet provided. *See directions in the Response Sheet.*
6. ***All*** items carry equal marks.
7. Before you proceed to mark in the Answer /Response Sheet, the response to various items in the Test Booklet, you have to fill in some particulars in the Answer /Response Sheet as per instructions sent to you with your Admission Certificate.
8. After you have completed filling in all your responses on the Response Sheet and the examination has concluded, you should hand over to the Invigilator ***only the Answer /Response Sheet***. You are permitted to take away with you the Test Booklet and ***Candidate's Copy of the Response Sheet .***
9. Sheets for rough work are appended in the Test Booklet at the end.
10. While writing Centre, Subject and Roll No. on the top of the Answer Sheet/Response Sheet in appropriate boxes use **"ONLY BALL POINT PEN".**
11. **Penalty for wrong answers:**

    THERE WILL BE PENALTY FOR WRONG ANSWERS MARKED BY THE CANDIDATE IN THE WRITTEN TEST (OBJECTIVE TYPE QUESTIONS PAPERS).

    (i) There are four alternatives for the answer to every question. For each question for which a wrong answer has been given by the candidate, **(0.25)** of the marks assigned to that question will be deducted as penalty.

    (ii) If a candidate gives more than one answer, it will be treated as a **wrong answer** even if one of the given answers happens to be correct and there will be same penalty as above for that question.

    (iii) If a question is left blank, i.e., no answer is given by the candidate, there will be **no penalty** for that question.

DO NOT OPEN THIS TEST BOOKLET UNTIL YOU ARE TOLD TO DO SO

1. An inverted biomass pyramid is expected in:
   A) Grasslands
   B) Forest
   C) Deserts
   D) Open ocean

2. Tree frogs near a forest trail stop calling when people pass. After repeated harmless visits, they no longer react. What behavioural phenomenon explains this?
   A) Habituation
   B) Sensitization
   C) Classical conditioning
   D) Operant conditioning

3. The interaction that is least likely to contribute to antigen-antibody binding under physiological conditions?
   A) Hydrogen bonds
   B) Van der Waals forces
   C) Hydrophobic bonds
   D) Covalent bonds

4. Which of the following supports the endosymbiotic origin of mitochondria?
   A) Presence of lysosomal enzymes
   B) Presence of circular DNA
   C) High cholesterol in membranes
   D) Continuous connection with ER

5. Which of the following medusoid polymorphic forms in colonial hydrozoans is specialized for locomotion?
   A) Nectophore
   B) Gonozooid
   C) Gastrozooid
   D) Phyllozooid

6. Which of the following features is essential for an effective hemodialysis membrane?
   A) It should allow passage of plasma proteins but not ions
   B) It must actively pump metabolic wastes across the membrane
   C) It must permit passive diffusion of solutes while retaining blood cells
   D) All of the above

7. Identify the correct combination of statements that accurately represent established or targeted applications of Genetically Modified (GM) livestock Statements:

I. Increased disease resistance

II. Production of pharmaceuticals in milk

III. Creation of sterile hybrids for ecological release

IV. Enhanced wool quality

V. Complete elimination of need for breeding programs

Options:

A) I, II, and IV only

B) I and III only

C) II, III, and V only

D) I, II, III, and IV only

8. Match the following:

i. Porifera	1. Pseudocoelom, longitudinal muscles
ii. Platyhelminthes	2. Radial symmetry, cnidocytes
iii. Nematoda	3. Totipotent archaeocyte cells, no true tissues
iv. Cnidaria	4. Flame cells, syncytial tegument

Options:

A) i-4, ii-1, iii-3, iv-2

B) i-1, ii-2, iii-4, iv-3

C) i-3, ii-4, iii-1, iv-2

D) i-2, ii-3, iii-1, iv-4

9. Which of the following correctly distinguishes classical from operant conditioning?

A) Classical conditioning involves voluntary responses; operant is involuntary

B) Operant conditioning depends on consequences of actions; classical does not

C) Classical conditioning always leads to extinction; operant does not

D) In classical conditioning, the stimulus precedes the response; in operant conditioning, the response precedes the stimulus

10. Which of the following are true for beta DNA?

I. Right-handed helix

II. 10.5 base pairs per turn

III. Bases are perpendicular to the helix axis

IV. Major and minor grooves are identical in width

Options:

A) Only I and IV

B) II and IV only

C) I, II, and III

D) All are correct

11. Arrange the following events in chick heart development in correct sequence:
I. Fusion of endocardial tubes
II. Heart looping
III. Cardiac crescent formation
IV. Blood island formation
Options:
A) III → I → IV → II
B) III → IV → I → II
C) IV → I → III → II
D) IV → III → I → II

12. A patient with blood group B receives blood from a group A donor. Which of the following best explains the immediate hemolytic reaction?
A) Delayed antibody formation against Rh antigen on donor cells
B) Recipient's lack of A antigens leading to antibody formation against donor cells
C) Presence of anti-A antibodies in recipient plasma causing complement-mediated lysis
D) Immune tolerance due to minor antigen mismatch

13. Choose the most appropriate option based on the given assertion and reasoning:
Assertion (A): In radial cleavage, each cell retains the potential to develop into a complete embryo.
Reason (R): Radial cleavage is characteristic of protostomes.
Options:
A) Both A and R are true, and R is the correct explanation of A
B) Both A and R are true, but R is not the correct explanation of A
C) A is true but R is false
D) A is false but R is true

14. A pedigree shows that a trait skips generations and affects males and females equally. What is the most likely mode of inheritance?
A) Autosomal dominant
B) Autosomal recessive
C) X-linked dominant
D) X-linked recessive

15. Which of the following are considered in-situ conservation methods?
I. Biosphere reserves
II. Seed banks
III. Sacred groves
IV. Cryopreservation
Options:
A) I and III only
B) I and II only
C) II and IV only
D) I, III and IV

16. Which of the following is true regarding DNA replication?

A) Leading strand is synthesized discontinuously

B) Okazaki fragments are found on lagging strand

C) Helicase unwinds RNA primers

D) DNA ligase initiates replication at the origin

17. A life table for a moth population shows the following:

- High early mortality
- Survivors reproduce massively
- Very few reach old age

Which survivorship curve and life-history strategy best describe this population?

Options:

A) Type I; K-selected

B) Type II; K-selected

C) Type III; r-selected

D) Type I; r-selected

18. Match the mouthparts with the insects:

i. Piercing and sucking	1. beetles
ii. Sponging	2. moths
iii. Siphoning	3. aphids
iv. Chewing	4. houseflies

Options:

A) i-4, ii-3, iii-1, iv-2

B) i-3, ii-4, iii-2, iv-1

C) i-1, ii-2, iii-3, iv-4

D) i-2, ii-4, iii-1, iv-3

19. A mutant cell line fails to arrest at the G1 checkpoint despite DNA damage. Which protein is most likely defective?

A) p53

B) APC

C) CDK1

D) Cyclin D

20. Which of the following is not a characteristic feature of parasitoids?

A) They develop on or inside a single host.

B) They eventually kill the host.

C) They consume multiple hosts in their lifetime.

D) They are often hymenopteran or dipteran insects.

21. Which of the following are not recognized types of pseudopodia in protozoa?

I. Lobopodia
II. Myopodia
III. Axonopodia
IV. Reticulopodia

Options:

A) II and III
B) I and IV
C) II only
D) I, II, and III

22. The nucleolus is primarily involved in:

A) DNA replication
B) Chromatin remodeling
C) tRNA splicing
D) Ribosomal RNA synthesis

23. Arrange the steps involved in converting sound waves into nerve impulses:

I. Vibration of tympanic membrane
II. Movement of ossicles in middle ear
III. Displacement of basilar membrane in cochlea
IV. Deflection of hair cell stereocilia
V. Generation of receptor potential and neurotransmitter release

Options:

A) II → I → III → IV → V
B) I → III → II → V → IV
C) III → I → II → IV → V
D) I → II → IV → III → V

24. How many of the following syndrome-karyotype associations are correct?

I. Turner syndrome - 45, X
II. Klinefelter syndrome - 47, XXY
III. Patau syndrome - Trisomy 15
IV. Edwards syndrome - Trisomy 21
V. Down syndrome - Trisomy 18

Options:

A) Only two are correct
B) Exactly three are correct
C) Exactly four are correct
D) All five are correct

25. Choose the most appropriate option based on the following Assertion and Reasoning:
Assertion (A): Gross primary productivity is always less than net primary productivity.
Reason (R): A portion of gross primary productivity is used in plant respiration.
Options:
A) Both A and R are true, and R is the correct explanation
B) A is true, R is true, but R is not the correct explanation
C) A is true, R is false
D) A is false, R is true

26. A dichotomous key that leads to a final identification based on mutually exclusive character states is called:
A) Artificial key
B) Diagnostic key
C) Polyclave key
D) Indented key

27. ABO blood group shows:
A) Incomplete dominance
B) Multiple alleles and co-dominance
C) Epistasis
D) X-linked inheritance

28. Which of the following correctly lists the Linnaean taxonomic ranks in ascending order?
A) Genus → Species → Family → Order → Class → Phylum → Kingdom
B) Species → Family → Genus → Order → Class → Kingdom → Phylum
C) Species → Genus → Order → Family → Class → Phylum → Kingdom
D) Species → Genus → Family → Order → Class → Phylum → Kingdom

29. Match the following:

i.	Factor I	1.	Activates prothromb in to thrombin
ii.	Factor II	2.	Converts fibrinogen to fibrin
iii.	Factor X	3.	Precursor of thrombin
iv.	Thrombin	4.	Final protein forming blood clot

Options:
A) i-4, ii-3, iii-1, iv-2
B) i-3, ii-2, iii-4, iv-1
C) i-2, ii-1, iii-3, iv-4
D) i-1, ii-4, iii-2, iv-3

30. Imprinting differs from other forms of learning because:
A) It is reversible with new exposure
B) It requires repeated reinforcement
C) It occurs only in adulthood
D) It occurs during a critical period of life and is often irreversible

31. Which statement about plasma membrane composition is incorrect?
A) Cholesterol increases fluidity at low temperatures
B) Glycolipids are mostly found on the cytosolic leaflet
C) Integral proteins span the bilayer
D) Membrane asymmetry is functionally important

32. Which of the following occur during human spermatogenesis?
I. Meiotic arrest in prophase I until fertilization
II. Transformation of spermatids into spermatozoa
III. Formation of the acrosome from the Golgi apparatus
IV. Production of progesterone by Sertoli cells

Options:
A) I and II only
B) II and IV only
C) II and III only
D) I, III, IV only

33. Which is an essential component of integrated fish farming?
A) Incorporation of livestock or crop enterprises to enhance nutrient cycling
B) Reliance solely on synthetic fertilizers for pond productivity
C) Strict monoculture without ancillary agricultural inputs
D) Prohibition of organic waste utilization in the production system

34. Choose the option that is appropriate about the given Assertion and Reasoning.
Assertion (A): Ramsar sites are declared based on criteria that emphasize fish population density and tourism value.
Reason (R): Ramsar Convention primarily focuses on sustainable fisheries and wetland dependent human livelihoods.

Options:
A) Both A and R are true and R explains A
B) A is true but R is false
C) A is false but R is true
D) Both A and R are false

35. Which cell lineages are normal in number in SCID patients?
A) Myeloid and erythroid
B) Myeloid and lymphoid
C) Lymphoid and erythroid
D) Only lymphoid

36. The blastopore forms the anus in:
A) Protostomes
B) Acoelomates
C) Deuterostomes
D) Radiata

37. Which of the options is correct based on the Assertion and Reasoning below?
Assertion (A): Bile salts are essential for fat digestion.
Reason (R): They enzymatically hydrolyze triglycerides into fatty acids and monoglycerides.
Options:
A) A and R are true, and R is the correct explanation of A
B) A and R are true, but R is not the correct explanation of A
C) A is true, R is false
D) A is false, R is true

38. Identify the correct statements about respiratory disorders:
I. Emphysema increases total lung compliance.
II. Pulmonary fibrosis leads to restrictive lung disease.
III. Asthma is primarily an obstructive disorder.
IV. Chronic bronchitis affects alveolar surface area.
Options:
A) I and II only
B) II and III only
C) I, II, and IV only
D) All of the above

39. The founder effect is most commonly associated with which speciation model?
A) Sympatric
B) Parapatric
C) Peripatric
D) Hybrid speciation

40. How many of the following statements are correct about polysaccharides?

I. Glycogen is more branched than amylopectin

II. Cellulose has β-1,4 linkages

III. Starch is composed of glucose and galactose

IV. Chitin contains N-acetylglucosamine

Options:

A) Only one statement is correct

B) Two statements are correct

C) Three statements are correct

D) All Four statements are correct

41. Which statement about innate behaviour is incorrect?

A) It is performed correctly the first time without practice

B) It varies greatly between individuals of the same species

C) It is genetically programmed

D) Fixed action pattern is an innate behaviour

42. In a test cross of a plant heterozygous for two genes A and B, the following progeny frequencies were observed:

AB = 40%, Ab = 10%, aB = 10%, ab = 40%.

Which of the following inferences is most accurate?

A) Genes A and B are unlinked and assort independently

B) The genes are tightly linked in repulsion phase with 20% recombination frequency

C) The genes are linked in coupling phase with 20% recombination frequency

D) The genes exhibit complete linkage with no crossing over

43. Under the Wildlife Protection (Amendment) Act 2022, which of the following is/are new provisions introduced?

I. Rationalisation of Schedules from six to four

II. Legalisation of elephant ownership for temple use

III. Inclusion of CITES obligations directly in Indian law

IV. Declaration of Tiger Reserves by Central Government only

Options:

A) I and IV only

B) II and III only

C) I, II and III only

D) All four

44. What is the common immunological feature shared by nude mice and humans with DiGeorge's syndrome?
A) Absence of mature T cells due to thymic defects
B) Absence of functional B cells
C) Defective complement activation
D) Hyper-IgM immunodeficiency

45. Match Poriferan with their canal systems:

i.	Leucosolenia	1.	Syconoid
ii.	Scypha	2.	Asconoid
iii.	Euspongia	3.	Leuconoid

Options:
A) i-2, ii -3, iii-1
B) i-1, ii-2, iii-3
C) i-3, ii-2, iii-1
D) i-2, ii-1, iii-3

46. Which of the following nutrients, when added to freshwater ecosystems, are primary contributors to eutrophication?
I. Nitrate
II. Phosphate
III. Potassium
IV. Sulphate
Options:
A) I and III only
B) I and II only
C) II and IV only
D) All four

47. Female elephants have a long gestation period and extended maternal care. Males compete with each other for access to fertile females. Which aspect of parental investment theory is best illustrated in this example?
A) Female-biased sex ratio leads to monogamy
B) Male care increases inclusive fitness
C) Equal parental investment supports long-term pairing
D) High female investment leads to male-male competition

48. Which feature differentiates menstrual from estrous cycles in humans?
A) Progesterone surge during luteal phase
B) LH surge triggers ovulation
C) Endometrial lining is shed in absence of fertilization
D) Fertilization occurs in fallopian tube

49. Identify the correct statements about taxonomic hierarchy:

I. Superclass ranks above Class.

II. Genus is a broader rank than Family.

III. Suborder is nested within Order.

IV. Species lies outside the formal hierarchical ranks.

Options:

A) I and III

B) I, II, and IV

C) II, III, and IV

D) I, III, and IV

50. What percentage of carbon dioxide is transported as carbaminohemoglobin in human blood?

A) ~5%

B) ~10%

C) ~20-25%

D) ~50%

51. Which of the following are *correctly paired larval forms* with phyla?

I. Trochophore - Mollusca

II. Bipinnaria - Echinodermata

III. Glochidium- Nematoda

IV. Nauplius - Arthropoda

Options:

A) I, II, IV

B) II and IV

C) I and II

D) All are correct

52. Female African lions consistently prefer males with darker, fuller manes, a trait associated with higher testosterone levels and greater mating success. Which evolutionary explanation best accounts for this preference?

A) Kin selection to ensure inclusive fitness

B) Direct benefits hypothesis

C) Intrasexual selection

D) Sexy son hypothesis

53. The mechanism that maintains a constant Glomerular Filtration Rate (GFR) despite fluctuations in blood pressure is:
A) Passive diffusion
B) Renal autoregulation via tubuloglomerular feedback
C) Active transport of urea
D) Stimulation of osmoreceptors in the hypothalamus

54. Consider the following Statements:
Assertion (A): The histone H1 is part of the nucleosome core particle.
Reason (R): H1 stabilizes the 30-nm chromatin fiber by linking adjacent nucleosomes.
Which of the following options is true for the given Assertion and Reasoning:
A) Both A and R are true, and R is the correct explanation
B) Both A and R are true, but R is not the correct explanation
C) A is true, R is false
D) A is false, R is true

55. Match the National parks with their prominent inhabitant species:

i. Sundarbans National Park	1. Hangul
ii. Hemis National park	2. Bengal Tiger
iii. Dachigam National Park	3. Great Indian Bustard
iv. Desert National Park	4. Nilgiri Tahr
v. Eravikulam National Park	5. Snow leopard

Options:
A) i- 2, ii- 3, iii- 1, iv- 5, v- 4
B) i- 3, ii- 5, iii- 1, iv- 2, v- 4
C) i- 2, ii- 5, iii- 1, iv- 3, v- 4
D) i- 5, ii- 4, iii- 1, iv- 2, v- 3

56. Which of the following insects undergoes complete metamorphosis (holometabolous development)?
A) Grasshopper
B) Cockroach
C) Termite
D) Butterfly

57. Which of the following disrupt Hardy-Weinberg equilibrium?
I. Assortative mating
II. Gene flow
III. Random mating
IV. Small population size
Options:
A) I, II, III
B) I, III, IV
C) I, II, IV
D) II, III, IV

58. A female is heterozygous for sickle cell anemia (AS genotype). She marries a man who is also a carrier (AS). What is the probability that their third child specifically will be affected by sickle cell anemia?

A) 0 - two carriers cannot have an affected child
B) 1/2
C) 3/4
D) 1/4 - each child has an independent 25% chance of being affected

59. Composite fish culture typically includes:

A) Only catfish species
B) Multiple compatible species occupying different trophic levels
C) Fish monoculture for uniform growth
D) Only ornamental species

60. Which of the following structural features of mammalian hair are correctly matched with their description or function?

I. Cuticle - Single layer of overlapping flattened cells that protect inner hair layers
II. Cortex - Contains keratin fibers and pigment granules, providing strength and color
III. Medulla - Central hollow shaft always present in guard hairs and vibrissae
IV. Hair matrix - Mitotically active zone responsible for growth of the hair shaft

Options:

A) I and III only
B) I, II, and IV only
C) II, III and IV only
D) All of the above

61. The likely cause of Type 1 Diabetes Mellitus is:

A) Autoimmune destruction of pancreatic beta cells
B) Insulin resistance in peripheral tissues
C) Overproduction of glucagon by alpha cells
D) Excessive insulin secretion

62. Which of the options is valid for the following Assertion-Reasoning:

Assertion (A): Pericentric inversions include the centromere.
Reason (R): They occur only in telomeric regions.

Options:

A) Both A and R are true; R explains A
B) A is true, R is false
C) A is false, R is true
D) Both A and R are false

63. Which of the following delays ecological succession?

I. Frequent fires
II. Rich seed bank
III. Nutrient-poor soil
IV. Herbivore overgrazing

Options:

A) I and II only
B) I, II, and III only
C) I, III, and IV only
D) All are correct

64. A 28-year-old male presents with infertility. Semen analysis shows low sperm count and absence of motile sperm. Testicular biopsy shows absence of seminiferous tubules. Which structure is most likely defective?

A) Sertoli cells
B) Germinal epithelium
C) Leydig cells
D) Epididymis

65. Which complement activation pathway is initiated by Mannose-Binding Lectin (MBL) binding to microbial surfaces?

A) Classical pathway
B) Membrane attack pathway
C) Alternative pathway
D) Lectin pathway

66. Cysticercosis in humans is caused by infection with which of the following stages of *Taenia solium?*

A) Hexacanth embryo from ingested eggs
B) Gravid proglottid
C) Bladder worm (cysticercus) acquired from undercooked pork
D) Adult tapeworm scolex attaching to intestinal mucosa

67. Match ECG components with corresponding cardiac electrical events:

i. P wave	1. Ventricular repolarization
ii. QRS complex	2. Atrial depolarization
iii. T wave	3. Ventricular depolarization
iv. PR interval	4. AV nodal conduction time

Options:

A) i-2, ii-1, iii-3, iv-4
B) i-3, ii-2, iii-1, iv-4
C) i-2, ii-3, iii-1, iv-4
D) i-4, ii-1, iii-3, iv-2

68. Which breeding method is preferred for rapid improvement of milk yield in cattle?

A) Random mating

B) Backcrossing

C) Crossbreeding with sheep

D) Artificial insemination using selected sires

69. The largest carbon sink over geological timescales is:

A) Forests

B) Atmosphere

C) Permafrost

D) Marine sediments

70. A mutation prevents eIF2 from binding GTP. What will be the result?

A) No transcription

B) No peptide bond formation

C) Failure of translation initiation

D) mRNA degradation

71. Which one of the following statements is correct?

I. All modern reptiles have a four-chambered heart with complete separation of oxygenated and deoxygenated blood.

II. Reptilian scales are derived from dermis and regularly shed.

III. The Jacobson's organ in reptile functions as a thermoreceptor.

IV. Fertilization in most reptiles is internal and eggs are typically covered with a leathery shell.

Options:

A) Only statement III is correct

B) Only statement IV is correct

C) Statements II, III and IV are correct

D) Statements I, III, and IV are correct

72. Which brain structure is primarily responsible for regulating circadian rhythms in mammals?

A) Pineal gland

B) Optic tectum

C) Suprachiasmatic nucleus

D) Cerebellum

73. The characteristic that distinguishes polytene chromosomes from lampbrush chromosomes?

A) Presence of chromomeres
B) Transcriptionally active chromosomal loops
C) Visualization only during meiosis
D) Multiple rounds of DNA replication without division

74. Which statements about noise pollution are true?

I. It is measured in decibels (dB)
II. It causes permanent hearing loss only above 45 dB
III. It leads to cardiovascular stress
IV. It is always a point source pollutant

Options:

A) I and III only
B) II and III only
C) I, II and III only
D) All are true

75. How many of the following methods are passive sampling techniques in wildlife studies?

I. Camera traps
II. Pitfall traps
III. Line transects
IV. Acoustic recording units

Options:

A) One
B) Two
C) Three
D) All Four

76. Which of the following statements are true about the classification of animals?

I. Protostomes include annelids and arthropods.
II. Deuterostomes show radial and indeterminate cleavage.
III. Radial symmetry is a derived trait in echinoderms.
IV. All pseudocoelomates have a coelom entirely lined with mesoderm

Options:

A) I, II and III
B) Only I and IV
C) Only II and IV
D) All of the above

77. Which of the following events occurs in the loop of Henle?
A) Filtration of plasma
B) Reabsorption of glucose
C) Acid-base regulation
D) Establishment of osmotic gradient

78. Choose the best option that explains the following Assertion and Reasoning:
Assertion (A): In co-dominance, heterozygotes express a phenotype that is intermediate between the two homozygotes.
Reason (R): Co-dominance results in blending of traits.
Options:
A) Both A and R are true, and R is the correct explanation of A
B) Both A and R are true, but R is not the correct explanation of A
C) A is false, but R is true
D) Both A and R are false

79. Match each evolutionary thinker with the idea they are best known for:

i. Lamarck	1. Natural selection and genetics
ii. Darwin	2. Sudden mutations
iii. De Vries	3. Use and disuse of organs
iv. Haldane	4. Mathematical population genetics

Options:
A) i-3, ii-1, iii-4, iv-2
B) i-2, ii-3, iii-4, iv-1
C) i-3, ii-1, iii-2, iv-4
D) i-4, ii-3, iii-1, iv-2

80. In pearl culture, insertion of a mantle tissue piece into the oyster is primarily to:
A) Stimulate nacre secretion around a nucleus
B) Trigger immune defense
C) Induce shell growth
D) Prevent parasite infection

81. How many of the following adult structures arise from the endoderm?
I. Alveolar epithelium
II. Liver parenchyma
III. Adrenal cortex
IV. Pancreatic ducts
Options:
A) One
B) Two
C) Three
D) All Four

82. In a simplified aquatic food web, phytoplankton → zooplankton → small fish → large fish → birds. What happens if a persistent pollutant is introduced at the phytoplankton level?

A) Biomagnification will occur, affecting only birds
B) Pollutant will be diluted across trophic levels
C) Small fish will be unaffected due to trophic filtering
D) Trophic levels above phytoplankton will show biomagnification

83. Which of the following statements about Hemichordata are correct?

I. The body is divided into proboscis, collar, and trunk.
II. The coelom is enterocoelous and divided into three compartments.
III. Bodywall is single layered, with syncytial epidermis.
IV. They possess paired gill slits that open to the exterior.

Options:

A) Only statements I and II are correct
B) Only statements II and III are correct
C) Only statements I, II and IV are correct
D) All of the above are correct

84. A 50-year-old woman presents with upper torso weight gain, moon face, and hirsutism. She also reports hypertension. Which hormone is most likely in excess?

A) Insulin
B) Cortisol
C) Thyroxine
D) Growth hormone

85. Arrange these human ancestors in correct evolutionary order:

I. *Australopithecus afarensis*
II. *Homo habilis*
III. *Homo erectus*
IV. *Homo neanderthalensis*

Options:

A) I → II → III → IV
B) II → I → III → IV
C) I → III → II → IV
D) III → I → II → IV

86. In many mammalian species, natal dispersal is more commonly observed in males. The evolutionary reason for this is to:

A) Reduce kin competition and inbreeding
B) Avoid mother-infant bonding
C) Increase foraging opportunities
D) Maintain genetic similarity in a population

87. Match the following orders with their characters:

i.	Cetacea	1.	Flight and echolocation
ii.	Chiroptera	2.	Evergrowing incisors
iii.	Carnivora	3.	Large brain size, Complex social behaviour
iv.	Rodentia	4.	Aquatic, streamlined body
v.	Primates	5.	Shearing teeth and predatory adaptations

Options:

A) i-4, ii-2, iii-5, iv-1, v-3
B) i-3, ii-1, iii-4, iv-2, v-5
C) i-2, ii-4, iii-1, iv-3, v-5
D) i-4, ii-1, iii-5, iv-2, v-3

88. Which of the following animals is diploblastic?

A) Taenia
B) Hydra
C) Ascaris
D) Pheretima

89. Protein glycosylation, an essential post-translational modification, occurs primarily in which of the following organelles?

A) Golgi apparatus
B) Mitochondria
C) Lysosomes
D) Smooth endoplasmic reticulum

90. Which of the following chromosomal aberrations can cause altered gene expression?

I. Duplication
II. Inversion
III. Translocation
IV. Deletion of non-coding region lacking regulatory elements

Options:

A) I and II only
B) II and III only
C) I, II and III only
D) All aberrations can cause altered gene expression

91. Which of the options is valid for the following Assertion-Reasoning:
Assertion (A): Some tumors escape CTL attack by reducing class I MHC expression.
Reason (R): Reduced MHC I expression decreases antigen presentation to NK cells.
Options:
A) Both A and R true; R explains A
B) Both A and R true; R does not explain A
C) A true, R false
D) A false, R true

92. Which of the following organisms is correctly matched with its feeding mechanism?
A) Earthworm - Fluid feeder
B) Hydra - Extracellular digestion in gastrovascular cavity
C) Mosquito - Bulk feeder
D) Paramecium - Absorptive feeder via villi

93. Which niche type is most directly shaped by biotic interactions such as competition and predation?
A) Trophic niche
B) Grinnellian niche
C) Fundamental niche
D) Realized niche

94. Vermicomposting primarily relies on:
A) Earthworms such as *Eisenia fetida*
B) Crustaceans such as prawns
C) Termites such as *Odontotermes obesus*
D) Silkworm larvae

95. Match the feather types in birds with their primary functions:

i. Down feathers	1. Sensory perception
ii. Contour feathers	2. Insulation
iii. Filoplumes	3. Protection of nostrils and eyes
iv. Bristles	4. Streamlining and flight

Options:
A) i-2, ii-4, iii-1, iv-3
B) i-1, ii-3, iii-4, iv-2
C) i-2, ii-4, iii-3, iv-1
D) i-3, ii-2, iii-1, iv-4

96. Which of the options is correct based on the Assertion and Reasoning below?
Assertion (A): Oxygen diffuses from alveoli into the pulmonary capillary blood.
Reason (R): The partial pressure of oxygen is higher in pulmonary capillaries than in alveoli.
Options:
A) Both A and R are true, and R is the correct explanation
B) Both A and R are true, but R is not the correct explanation
C) A is true, R is false
D) A is false, R is true

97. Which of the following statements are correct about molecular evidences for evolution?
I. Orthologous genes show common ancestry between species.
II. Molecular clocks can be calibrated using fossil data.
III. All synonymous mutations are subject to natural selection.
IV. Mitochondrial DNA is often used to trace maternal ancestry.
Options:
A) I, II, IV
B) I, III, IV
C) II, III, IV
D) I, II, III

98. Which of the following is the correct order of events during human fertilization?
A) Sperm binds zona pellucida → Acrosome reaction → Cortical reaction → Sperm-egg fusion
B) Acrosome reaction → Sperm binds zona pellucida → Cortical reaction → Sperm-egg fusion
C) Cortical reaction → Acrosome reaction → Sperm-egg fusion → Zona binding
D) Sperm binds zona pellucida → Acrosome reaction → Sperm-egg fusion → Cortical reaction

99. Two weeks after an allogeneic bone marrow transplant, a patient develops rash, diarrhea, and liver enzyme elevation. What could be the cause for it?
A) Donor T cells attacking host MHC
B) Host T cells attacking graft
C) Donor NK cells killing host RBCs
D) Host macrophages attacking graft stroma

100. Which of the following nutritional modes in protozoa involves ingestion of solid food particles via cytoplasmic extensions?
A) Osmotrophy
B) Phagocytosis
C) Autotrophy
D) Pinocytosis

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Booklet Serial No. 349897

Test Booklet Series

TEST BOOKLET
LECTURER - (10+2)
PHYSICS
WRITTEN TEST - 2025
(67)

A

Time Allowed: Two Hours ***Maximum Marks: 100***

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2. **Please note that it is the candidate's responsibility to encode and fill in the Roll Number and Test Booklet Series Code A, B, C or D carefully and without any omission or discrepancy at the appropriate places in the OMR Answer /Response Sheet. Any omission/discrepancy will render the Response Sheet liable for rejection.**
3. You have to enter your Roll Number on the Test Booklet in the Box provided alongside. ***DO NOT*** **write** ***anything else*** on the Test Booklet.
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7. Before you proceed to mark in the Answer /Response Sheet, the response to various items in the Test Booklet, you have to fill in some particulars in the Answer /Response Sheet as per instructions sent to you with your Admission Certificate.
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9. Sheets for rough work are appended in the Test Booklet at the end.
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11. **Penalty for wrong answers:**

    THERE WILL BE PENALTY FOR WRONG ANSWERS MARKED BY THE CANDIDATE IN THE WRITTEN TEST (OBJECTIVE TYPE QUESTIONS PAPERS).

    (i) There are four alternatives for the answer to every question. For each question for which a wrong answer has been given by the candidate, **(0.25)** of the marks assigned to that question will be deducted as penalty.

    (ii) If a candidate gives more than one answer, it will be treated as a **wrong answer** even if one of the given answers happens to be correct and there will be same penalty as above for that question.

    (iii) If a question is left blank, i.e., no answer is given by the candidate, there will be **no penalty** for that question.

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1. Pair of nuclei in which the number of protons in one equals the number of neutrons in the other are called
   A) Isomers
   B) Isotones
   C) Mirror nuclei
   D) None of the above

2. The Liquid drop model is based on the following assumption
   A) Nucleons do not interact with each other.
   B) Nucleons interact with each other at short range.
   C) Nucleons interact each other at long range.
   D) None of the above

3. Match the following:

List - I	**List - II**
i) $_{20}Ca^{40}, _{19}K^{39}$	1) Isomers
ii) $_{6}C^{14}, _{7}N^{14}$	2) Isotopes
iii) $_{27}Co^{50}m, _{27}Co^{50}$	3) Isobars
iv) $_{92}U^{235}, _{92}U^{238}$	4) Isotones

Choose the correct match:
   A) i-1, ii-2, iii-3, iv-4
   B) i-2, ii-3, iii-4, iv-1
   C) i-4, ii-3, iii-1, iv-2
   D) i-4, ii-3, iii-2, iv-1

4. Match the following:

List - I	**List - II**
i) Geiger Muller Counter	1) Sodium Iodide
ii) Scintillation Detector	2) Particle accelerator
iii) Solid State Detector	3) Argon Gas
iv) Cyclotron	4) P N Junction diode

Choose the correct match:
   A) i-2, ii-4, iii-1, iv-3
   B) i-3, ii-1, iii-4, iv-2
   C) i-3, ii-4, iii-1, iv-2
   D) i-2, ii-1, iii-4, iv-3

5. What is not true about β-decay?
   A) It obeys all the three conservation laws (energy, momentum, and angular momentum).
   B) It led to the discovery of Neutrinos.
   C) Electron or positron is emitted along with a neutrino
   D) Parity is not violated.

6. The reaction

$\pi^- + p \rightarrow \Lambda^0 + K^0$ is an example of

A) Weak interaction
B) Strong interaction
C) Gravitational interaction
D) Electromagnetic interaction

7. Given the reaction :

$e^+ + e^- \rightarrow \mu^+ + \pi^-$

Assertion (A) = The reaction cannot occur.
Reason (R) = Muon Lepton number is not conserved.
Choose the correct option:

A) Both A and R are true and R is the correct explanation of A.
B) Both A and R are true but R is not the correct explanation of A.
C) A is true but R is false.
D) Both A and R are false.

8. Quark composition of a neutron and a proton respectively is given by

A) sss, udd
B) sss, uud
C) udd, uud
D) None of the above

9. As per nuclear shell model, the following numbers of nucleons result in extra stable nuclei

A) 2, 8, 20, 28
B) 2, 8, 10, 40
C) 4, 6, 20, 50
D) 6, 14, 28, 40

10. For the two isotopes of Oxygen, ${}_8O^{16}$ and ${}_8O^{18}$ having nuclear masses 15.990523 amu and 17.994768 amu respectively, which statement or statements will be true? Given mass of proton and neutron as 1.007276 amu and 1.008665 amu respectively.

A) ${}_8O^{18}$ will be more abundant.
B) ${}_8O^{16}$ will be more abundant.
C) Binding energy per nucleon of ${}_8O^{18}$ is less than that of ${}_8O^{16}$.
D) None of the above

11. Which term/terms were added as an improvement to the semi-empirical binding energy formula?

A) Surface energy
B) Volume energy
C) Asymmetry energy
D) Pairing energy

12. Regarding the parity of deuteron:

Assertion (A): Parity of deuteron is positive.

Reason (R): Spin of deuteron is 1

Choose the correct option :

A) Both A and R are true and R is correct reason for A.

B) Both A and R are true but R is not the correct reason for A.

C) Both A and R are false.

D) A is true but R is false.

13. Which of the following is not true for a face centred cubic structure?

A) The reciprocal lattice will be body centred cubic structure.

B) Atoms are located only at the corners of the cube.

C) Total number of atoms in the unit cell will be 4.

D) Each atom is in contact with its 12 nearest neighbours.

14. Given the two statements:

I: All the crystalline substances are solids.

II: A solid need not be a crystal.

Which of the above statement(s) is/are true?

A) I is true but II is false.

B) II is true but I is false.

C) Both I and II are true.

D) Both I and II are false.

15. The Miller Indices of a plane making an intercept of 2Å, 4Å and 6Å on the coordinate axes of an orthorhombic crystal with a:b:c =1:2:6 is given as

A) (236)

B) (112)

C) (211)

D) (111)

16. The density of points in (100) plane of a bcc lattice with lattice parameter, a, equal to 2Å will be :

A) 3.2×10^{19} atoms/m^2

B) 5.0×10^{19} atoms/m^2

C) 2.5×10^{19} atoms/m^2

D) 1.5×10^{19} atoms/m^2

17. In three dimensions, the number of crystal systems and Bravais lattice respectively is

A) 6,12

B) 4,8

C) 3,9

D) 7,14

18. The atomic bonding arising due to the sharing of electrons between two atoms is called
A) Ionic Bonding
B) Covalent Bonding
C) Metallic Bonding
D) Vander Waals Bonding

19. The minimum wavelength of the X-ray produced if the potential difference across X-ray tube is 30kV, will be
A) $0.41\,\overset{o}{A}$
B) $0.31\,\overset{o}{A}$
C) $0.52\,\overset{o}{A}$
D) $0.12\,\overset{o}{A}$

20. The fundamental law that shows the dependence of frequency of characteristic X-ray emitted by an element on its atomic number is
A) Bragg's law
B) Moseley's law
C) Einstein's Photoelectric Effect
D) Compton effect

21. Which of the following statement is false regarding the properties of a reciprocal lattice vector?
A) Volume of the unit cell of the reciprocal lattice is inversely proportional to that of the corresponding direct lattice.
B) The reciprocal of the reciprocal lattice is a direct lattice.
C) Every reciprocal lattice vector is normal to the plane of the crystal lattice.
D) None of the above.

22. Which of the following conditions are correct representation of the Laue diffraction conditions with **G** as the reciprocal lattice vector?
A) $\mathbf{k}-\mathbf{k}_0=\mathbf{G}$, $\mathbf{k}$ is the incident wave vector and $\mathbf{k}_0$ scattered wave vector.
B) $|\mathbf{k}|=|\mathbf{k}_0|$
C) Both (A) and (B)
D) Neither (A) or (B)

23. **Regarding the thermal property of crystals:**
Assertion (A): Einstein's model of specific heat fails at low temperature
Reason (R): It assumes that all the atomic oscillators vibrate independently at a constant frequency.
Choose the correct option :
A) Both A and R are true and R is correct explanation of A
B) Both A and R are true but R is not the correct explanation of A
C) A is true but R is false.
D) A is false but R is true.

24. In Debye theory for specific heat, at very high temperatures $(T>\theta_D)$, the specific heat approaches

A) 0
B) Infinity
C) ½ R
D) 3R (Dulong Petit's law)

25. Para-magnetism arises due to

A) presence of unpaired electrons in atoms, ions or molecules.
B) orbital motion of paired electrons in atoms, ions or molecules
C) parallel alignment of unpaired electron spin that is permanent magnetic moments.
D) None of the above.

26. The sign of Hall Coefficient will determine the

A) Density of charge carriers.
B) Mobility of charge carriers.
C) Nature of charge carriers.
D) All of the above.

27. What is the most common physical significance of the Hamiltonian in conservative systems?

A) It always represents the total angular momentum of the system.
B) It is equal to the total energy (kinetic + potential) of the system.
C) It is always equal to the kinetic energy of the system.
D) It gives the instantaneous power supplied to the system.

28. Which of the following properties of Poisson brackets is true for the dynamical variables f and g

A) $\{f,g\}=-\{g,f\}$
B) $\{af+bg,h\}=a\{f,h\}+b\{g,h\}$
C) $\{f,\{g,h\}\}+\{g,\{h,f\}\}+\{h,\{f,g\}\}=0$
D) All of the above.

29. What is the physical significance of solving the Hamilton-Jacobi equation

A) It directly gives the trajectory q(t) without requiring moments p.
B) It provides a complete solution of the dynamics of the principal function S is known.
C) It connects classical mechanics with quantum mechanics, since S plays a role similar to the phase of the wave function
D) All of the above

30. Hamilton's principal can be applied in the generalized coordinates q_i. The action is $\int_{t_1}^{t_2} L(q_i, \dot{q}_i, t)dt$. if the variation $\delta q_i(t)$ vanish at the endpoints t_1 and t_2 which of the following condition leads to the Euler - Lagrange equations?

A) $\delta q_i \neq 0$ everywhere

B) $\delta S = 0$ for arbitrary variation $\delta q_i(t)$

C) $\delta \dot{q}_I = 0$ always

D) $\delta L = 0$ identicaly

31. In Hamiltonian mechanics, a canonical transformation is a change of variables from (q_i, p_i) to new variables (Q_i, P_i) such that Hamilton's equations preserve their form. Which of the following conditions ensures that a transformation is canonical?

A) The transformation must keep the Hamiltonian H unchanged

B) The transformation must preserve the form of Hamilton's equations, which is equivalent to preserving the fundamental Poisson brackets :

i. $\{Q_i, Q_j\} = 0, \{P_i, P_j\} = 0, \{Q_i, P_j\} = \delta_{ij}$

C) The transformation must be linear in coordinates and momenta.

D) The transformation must leave the Lagrangian L unchanged.

32. The Hamilton - Jacobi equation for a system with Hamiltonian $H(q_i, p_i, t)$ and principal function $S(q_i, t)$ is given by :

$$\frac{\partial S}{\partial t} + H\left(q_i, \frac{\partial S}{\partial q_i}, t\right) = 0$$

What is the physical significance of the function S ?

A) It is the generating function of a canonical transformation that reduces the Hamiltonian to zero.

B) It represents the action of the system as a function of coordinates and time.

C) It directly gives the momentum through $P_i = \frac{\partial S}{\partial q_i}$

D) All of the above

33. Let $f(q_i, p_i, t)$ and $g(q_i, p_i, t)$ be two dynamical variables. Their Poisson bracket is defined as :

$$\{f,g\} = \sum_i \left(\frac{\partial f}{\partial q_i}\frac{\partial g}{\partial p_i} - \frac{\partial f}{\partial p_i}\frac{\partial g}{\partial q_i} \right)$$

Which of the following properties is not true for Poisson brackets?

A) $\{f,g\} = -\{g,f\}$

B) $\{af+bg,h\} = a\{f,h\} + b\{g,h\}$

C) $\{f,\{g,h\}\} + \{g,\{h,f\}\} + \{h,\{f,g\}\} = 0$

D) $\{f,f\} = f$

34. Consider a one - dimensional harmonic oscillator with Hamiltonian:

$$H = \frac{p^2}{2m} + \frac{1}{2}m\omega^2 q^2$$

Using Hamilton's equations, which of the following is its equations of motion

A) $\dot{q} = \frac{p}{m}, \dot{p} = -m\omega^2 q$

B) $\dot{q} = mp, \dot{p} = -\frac{q}{m}$

C) $\dot{q} = \omega^2 p, \dot{p} = -q$

D) $\dot{q} = \frac{q}{m}, \dot{p} = -mp$

35. Consider the transformation in one degree of freedom :

$Q = aq$, $P = \frac{p}{a}$, with numerical value $(a = 2)$. For canonical variables (q, p) with fundamental Poisson bracket $\{q, p\} = 1$, evaluate $\{Q, P\}$. Is the transformation canonical?

A) $\{Q,P\} = 1$, (canonical)

B) $\{Q,P\} = 2$, (not canonical)

C) $\{Q,P\} = \frac{1}{2}$, (not canonical)

D) $\{Q,P\} = 0$, (not canonical)

36. For a particle in central potential *V(r)*, which of the following is a constant of motion?

A) Radial momentum (p_r)

B) Angular momentum (p_θ)

C) Total momentum $(\vec{p})$

D) None of the above

37. A system has three spin states s_1, s_2 and s_3. The system is prepared in the state $|\psi\rangle = c\left[1|s_1\rangle + 2|s_2\rangle + 3|s_3\rangle\right]$. What is the probability that when spin of the system is measured it will be in s_2 state

A) $\frac{2}{7}$

B) $\frac{1}{7}$

C) $4c^2$

D) $2c$

38. What is the de Broglie wavelength of an electron who have a kinetic energy of 1 KeV

A) 38.7 pm

B) 38.7 nm

C) 0

D) ∞

39. Which of the following statements best describes the physical significance of the Ehrenfest theorem?

A) It shows that expectation values of quantum operators exactly follow Newton's laws of motion for all states.

B) It shows that expectation values of quantum operators approximately follow classical mechanics when the wave packet is localized.

C) It shows that quantum operators commute with the Hamiltonian in all cases.

D) It shows that the uncertainty principle is not valid for position and momentum.

40. Spherical harmonics $Y_1^m(\theta,\phi)$ are eigenfunctions of certain operators in quantum mechanics. Which of the following statements is correct?

A) $Y_1^m(\theta,\phi)$ are eigenfunctions of $\widehat{L^2}$ with eigenvalue $\hbar^2 l(l+1)$, and eigenfunctions of $\widehat{L_z}$ with eigenvalue $\hbar m$.

B) $Y_l^m(\theta,\phi)$ are eigenfunctions of $\widehat{L_x}$ with eigenvalue $\hbar m$.

C) $Y_l^m(\theta,\phi)$ depend only on the radial coordinate r.

D) For all l,m can only take the values 0 and 1.

41. For the hydrogen atom, consider the state with principal quantum number $n = 3$ and orbital angular momentum quantum number $l = 1$.

The radial wave function is denoted by $R_{31}(r)$.

Which of the following correctly represents $R_{31}(r)$?

A) $R_{31}(r) = \dfrac{4}{81\sqrt{6}\, a_0^{3/2}} \dfrac{r}{a_0} e^{-r/(3a_0)} \left(6 - \dfrac{r}{a_0}\right)$

B) $R_{31}(r) = \dfrac{8}{27\sqrt{6}\, a_0^{3/2}} \dfrac{r}{a_0} e^{-r/(3a_0)} \left(1 - \dfrac{r}{6a_0}\right)$

C) $R_{31}(r) = \dfrac{4}{81\sqrt{6}\, a_0^{3/2}} e^{-r/(3a_0)}$

D) $R_{31}(r) = \dfrac{1}{\sqrt{\pi a_0^3}} e^{-r/a_0}$

42. For a free particle of mass m, the position operator in the Heisenberg picture at time t is denoted by $\widehat{x_H}(t)$. If $\widehat{x_H}(0) = \widehat{x_0}$ and momentum operator $\widehat{p_H}$ is constant in time, which of the following correctly represents $\widehat{x_H}(t)$?

A) $\widehat{x_H}(t) = \widehat{x_0} + \dfrac{\widehat{pH}}{m} t$

B) $\widehat{x_H}(t) = \widehat{x_0} e^{-\frac{i}{\hbar}\widehat{H}t}$

C) $\widehat{x_H}(t) = \dfrac{\widehat{pH}}{m} t$

D) $\widehat{x_H}(t) = \widehat{x_0}$

43. The total angular momentum operator is defined as $\widehat{L^2} = \widehat{L_x^2} + \widehat{L_y^2} + \widehat{L_z^2}$. Evaluate the commutator $\left[\widehat{L^2}, \widehat{L_x}\right]$.

A) $\iota\hbar\widehat{L_x}$

B) $\iota\hbar\widehat{L_y}$

C) 0

D) $-\iota\hbar\widehat{L_x}$

44. The ladder operators are defined as $\widehat{L_{\pm}} = \widehat{L_x} \pm i\widehat{L_y}$. For an eigenstate $|l,m\rangle$ of $\widehat{L^2}$ and $\widehat{L_z}$, which of the following expressions for $\widehat{L_{\pm}}|l,m\rangle$ is correct?

A) $\widehat{L_{\pm}}|l,m\rangle = \hbar\sqrt{l(l+1)-m(m\pm1)}|1\rangle$

B) $\widehat{L_{\pm}}|l,m\rangle = \hbar\sqrt{l(l+1)-m^2}\,|l,m\pm1\rangle$

C) $\widehat{L_{\pm}}|l,m\rangle = \hbar\sqrt{m(m\pm1)}|l,m\pm1\rangle$

D) $\widehat{L_{\pm}}|l,m\rangle = \hbar\sqrt{l^2-m^2}\,|l,m\pm1\rangle$

45. A particle with $\frac{1}{2}$ combines with a particle of spin -1. What are the possible values of the total spin quantum number S?

A) $S = \frac{1}{2}, \frac{3}{2}$

B) $S = \frac{1}{2}$ only

C) $S = 1, \frac{3}{2}$

D) $S = 0, 1, 2$

46. A particle is in a one - dimensional infinite potential well of width a. The unperturbed normalized ground state wave function is

$$\psi_1(x) = \sqrt{\frac{2}{a}}\sin\left(\frac{\pi x}{a}\right), 0 < x < a.$$

If the perturbation is $H'(x) = V_0\frac{x}{a}$, what is the first - order correction to the ground state energy?

A) $E_1^{(1)} = \frac{V_0}{2}$

B) $E_1^{(1)} = \frac{V_0}{3}$

C) $E_1^{(1)} = \frac{V_0}{4}$

D) $E_1^{(1)} = 0$

47. Consider a quantum harmonic oscillator with unperturbed Hamiltonian

$\widehat{H_0} = \frac{p^2}{2m} + \frac{1}{2} m\omega^2 x^2$.

Suppose a perturbation $H'(x) = \lambda x^4$ is added. What is the first - order correction to the ground state energy?

A) $E_0^{(1)} = \frac{3\lambda\hbar^2}{4m^2\omega^2}$

B) $E_0^{(1)} = \frac{3\lambda\hbar}{2m\omega}$

C) $E_0^{(1)} = \frac{\lambda\hbar}{2m\omega}$

D) $E_0^{(1)} = 0$

48. If a quantum system can be in two normalized states ψ_1 and ψ_2, then according to the superposition principle the general state of the system can be written as :

A) $\psi = \psi_1 + \psi_2$, always normalized

B) $\psi = c_1\psi_1 - c_2\psi_2$, with c_1, c_2 real only

C) $\psi = c_1\psi_1 + c_2\psi_2$, with $c_1, c_2 \in R$

D) $\psi = c_1\psi_1 + c_2\psi_2$, with $|c_1|^2 + |c_2|^2 = 1$

49. A particle has an average lifetime of 1.0×10^{-10} s. What is the minimum uncertainty in its energy?

A) $\Delta E \approx 6.6\times10^{-5} eV$

B) $\Delta E \approx 3.3\times10^{-4} eV$

C) $\Delta E \approx 3.3\times10^{-5} eV$

D) $\Delta E \approx 6.6\times10^{-4} eV$

50. As per Bohr's Theory, which spectral line series of Hydrogen spectrum lies in the visible region?

A) Lyman series

B) Balmer series

C) Brackett series

D) Paschen series

51. Which coupling scheme is used to obtain the resultant orbital and spin momentum for lighter atoms?

A) LS Coupling

B) JJ Coupling

C) Both

D) None of the above

52. Splitting up of spectral lines in the presence of weak magnetic field is called
A) Paschen-Back Effect
B) Zeeman Effect
C) Linear Stark Effect
D) None of the above

53. The wavelength of the photon ionizing a hydrogen atom in the ground state, giving out the ejected electron of kinetic energy 11.5 eV will be
A) 515.5 $\mathring{A}$
B) 495.2 $\mathring{A}$
C) 90 $\mathring{A}$
D) 500 $\mathring{A}$

54. If the first spectral line of the Lyman series of Hydrogen has a wavelength of 1200 $\mathring{A}$, then the wavelength of the second spectral line will be
A) 1000 $\mathring{A}$
B) 1200 $\mathring{A}$
C) 1012.5 $\mathring{A}$
D) 1014.5 $\mathring{A}$

55. For He-Ne and Ruby lasers:
Assertion(A): He-Ne Laser is preferred over Ruby Laser
Reason (R): He-Ne Laser has a continuous output
Choose the Correct Option:
A) Both A and R are true but R is not the correct explanation for A
B) Both A and R are true and R is the correct explanation for A
C) Both A and R are false.
D) A is true but R is false.

56. What is true about rotational spectra of a diatomic molecule?
A) the energy levels are not equally spaced.
B) the frequencies are equally spaced.
C) Both (A) and (B)
D) None of the above

57. The vibrational spectra of a diatomic molecule lie in
A) Microwave region
B) Visible region
C) Infrared region
D) Ultraviolet region

58. The necessary conditions for Laser action to take place are:
A) Population Inversion
B) Presence of a metastable state
C) Stimulate emission
D) All the above

59. The fine structure in the electronic spectra of diatomic molecules is due to:
A) Only vibration motion
B) Nuclear spin
C) Only electronic transitions
D) Rotational motion being superimposed on electronic transitions

60. In which type of semiconductor, the number of electrons is equal to the number of holes?
A) Intrinsic semiconductor
B) P type semiconductor
C) N type semiconductor
D) None of the above

61. Which of the diodes is used as a voltage regulator?
A) p-n junction diode
B) Photo diode
C) Light emitting diode
D) Zener diode

62. The wavelength of radiation emitted by a light emitting diode having a band gap of 1.9 eV is:
A) 6533 $\mathring{A}$
B) 6000 $\mathring{A}$
C) 6200 $\mathring{A}$
D) 7000 $\mathring{A}$

63. The static resistance of a p-n Germanium diode at a temperature of 300 K and reverse saturation current of 1 μA , when a forward bias of 0.2 Volts is applied will be
A) 100 Ω
B) 88 Ω
C) 94 Ω
D) 150 Ω

64. In common base configuration of a pnp transistor, what will be the power gain if the current gain magnitude of the amplifier is 0.96, the dynamic resistance is 50 Ω and the load resistance in collector circuit is 5k Ω ?
A) 90
B) 100
C) 92
D) 104

65. What do you mean by Subthreshold conduction in MOSFET?
A) Avalanche breakdown
B) Zener breakdown
C) Current flow due to thermionic emission
D) Leakage current when $V_{GS} < V_{th}$, V_{GS} is the control voltage and V_{th} is threshold voltage

66. For an Op-Amp in a closed loop configuration, the bandwidth will be:
A) Inversely proportional to the closed-loop gain.
B) Independent of the closed-loop gain.
C) Inversely proportional to the open-loop bandwidth
D) None of the above.

67. An ideal comparator has an output which is:
A) always zero.
B) independent of differential input.
C) dependent on differential input.
D) an analog signal.

68. In a 8085 micro-processor, the logical instruction CMP R refers to:
A) compare immediate with accumulator
B) AND register with accumulator
C) compare register with accumulator
D) None of the above

69. If the frequency of 8051 microcontroller is 20 MHz, then how much time each machine cycle will take?
A) 1 μs
B) 2 μs
C) 0.6 μs
D) 0.8 μs

70. Liouville's theorem states that
A) The total energy of the system is conserved
B) The phase space volume occupied by an ensemble of systems is conserved in time
C) The entropy of the system always increases.
D) The probability of each microstate is equal.

71. Which of the following describes the partition function of a canonical ensemble

A) $Z = \sum_i E_i$

B) $Z = \sum_i e^{-\beta E_i}$

C) $Z = \int d\Gamma\, E$

D) $Z = e^{-\beta F}$

72. For a system with single-particle energy levels $\in_n = nE$, the canonical partition function is $Z = \frac{1}{1-e^{-\beta E}}$

Which of the following is the correct expression for heat capacity at constant volume C_V

A) $\langle E \rangle = \frac{E}{e^{\beta E} - 1}$

B) $\langle E \rangle = E e^{-\beta E}$

C) $\langle E \rangle = \frac{E}{1-e^{-\beta E}}$

D) $\langle E \rangle = \frac{1}{\beta}$

73. A quantum system has three non-degenerate energy levels: $E_0 = 0, E_1 = \in, E_2 = 2\in$. At temperature T, what is the average energy $\langle E \rangle$ of the system?

A) $\langle E \rangle = \frac{\in}{e^{\beta \in} - 1}$

B) $\langle E \rangle = \frac{\in e^{-\beta \in} + 2 \in e^{-2\beta \in}}{1 + e^{-\beta \in} + e^{-2\beta \in}}$

C) $\langle E \rangle = \frac{2 \in}{1 + e^{-\beta \in}}$

D) $\langle E \rangle = \in e^{-\beta \in}$

74. A non-interacting gas of N non-relativistic spin $-\frac{1}{2}$ fermions is confined inside a two-dimensional box of area A. The system is at absolute zero temperature. What is the total energy of the system

A) $\frac{N\varepsilon_F}{2}$

B) $2N\varepsilon_F$

C) $N\varepsilon_F$

D) $\frac{N\varepsilon_F}{4}$

75. A collection of N classical particles is evolving in phase space. Consider the following two systems:

I. A free particle moving without any external force.

II. A particle in a one-dimensional harmonic oscillator potential.

According to Liouville's theorem, how does the phase space volume occupied by an ensemble of such systems evolve with time?

A) Expands in case (I), shrinks in case (II).

B) Shrinks in both cases.

C) Remains constant in both cases.

D) Expands in case (II), remains constant in case (I).

76. A spin $-\frac{1}{2}$ particle is in a completely mixed state described by the density operator $\hat{\rho} = \frac{1}{2} I$, where I is the identity operator. What is the expected value of σ_x in this state?

A) 0

B) $+\frac{1}{2}$

C) +1

D) −1

77. A single quantum harmonic oscillator of frequency ω is in thermal equilibrium at temperature T. Using statistical mechanics, what is the average internal energy $U(T)$ of the oscillator? Where $\beta = 1/k_B T$.

A) $U = \dfrac{\hbar\omega}{1 - e^{-\beta\hbar\omega}}$

B) $U = \dfrac{\hbar\omega}{e^{\beta\hbar\omega} - 1}$

C) $U = k_B T$

D) $U = \dfrac{1}{2}\hbar\omega$

78. In the classical limit, both Bose--Einstein and Fermi--Dirac distributions reduce to which of the following forms?

A) $f(E) = \dfrac{1}{e^{\beta(E-\mu)} \pm 1}$

B) $f(E) \approx e^{-\beta(E-\mu)}$

C) $f(E) = \dfrac{1}{e^{\beta(E-\mu)}}$

D) $f(E) \approx k_B T$

79. According to Planck's law of blackbody radiation, the spectral energy density peaks at a wavelength λ_{max} given by Wien's displacement law: $\lambda_{max} T = b$, where $b = 2.9 \times 10^{-3}$ m.K. For a blackbody at temperature $T = 5800\ K$, what is λ_{max} ?

A) 5.0×10^{-7}m

B) 5.0×10^{-6}m

C) 5.0×10^{-5}m

D) 5.0×10^{-8}m

80. Consider a system of non-interacting fermions that can occupy a single energy level $\in$. The system is in contact with a reservoir at temperature T and chemical potential μ. Using the grand canonical ensemble, the average number of particles in this energy level is given by which of the following?

A) $\langle N \rangle = \frac{1}{e^{\beta(\in-\mu)}-1}$

B) $\langle N \rangle = \frac{1}{e^{\beta(\in-\mu)}+1}$

C) $\langle N \rangle = e^{-\beta(\in-\mu)}$

D) $\langle N \rangle = \frac{1}{\beta(\in-\mu)}$

81. Out of the following four Maxwell's equations, which equation represents that magnetic monopoles do not exist:

A) $\nabla.E = \rho/\varepsilon_0$

B) $\nabla \times E = -\partial B/\partial t$

C) $\nabla.B = 0$

D) $\nabla \times B = \mu_0 J + \mu_0 \varepsilon_0 \partial E/\partial t$

82. What is the reason to introduce displacement current in Maxwell's equations?

A) to explain the motion of charges in vacuum.

B) to explain conduction in metals.

C) to make sure that there is continuity of current in time varying fields.

D) All of the above.

83. Which of the statements is not true for a skin depth?

A) It is inversely proportional to the square root of the permeability of the medium.

B) It is inversely proportional to the square root of conductivity of the medium.

C) It is inversely proportional to the square root of frequency of the electromagnetic wave.

D) It is directly proportional to the square root of the frequency of the electromagnetic wave.

84. What will be the difference in the phase of electric and magnetic fields for an electromagnetic wave travelling through a lossless dielectric medium:

A) They are in phase.

B) They are 90 degrees out of phase.

C) They are 180 degrees out of phase.

D) They are 45 degrees out of phase.

85. The value of the reflection co-efficient of energy of the normally incident electromagnetic wave on the surface of a medium with $\varepsilon_r = 64$ will be

A) 0.64
B) 0.36
C) 0.604
D) 0.306

86. Brewster's angle is formed when

A) reflected wave gets completely polarized.
B) reflected and refracted waves are parallel to each other.
C) refracted ray gets completely polarized.
D) incidence and refracted rays are perpendicular to each other.

87. Electric force per unit length on one wire as a result of the other for two parallel thin wires having uniform charge densities λ_1 and λ_2 separated by a distance x will be:

A) λ_1 / λ_2
B) λ_2 / λ_1
C) $(1/2\varepsilon_0)\lambda_1\lambda_2 / x$
D) $\lambda_1\lambda_2$

88. What will be the energy gained by an α particle, if it is accelerated through a potential difference of 2000 Volts?

A) 3.2×10^{-16} J
B) 2.2×10^{-16} J
C) 6.4×10^{-16} J
D) 3.6×10^{-16} J

89. Which of the statements will be true when a conductor is placed inside a magnetic field?

A) The electric field inside the conductor will be zero.
B) There will be no volume charge density.
C) The electric potential will be constant throughout the body of the conductor and on the surface.
D) All the above statements will be true.

90. The magnitude of the magnetic field due to a long thin wire carrying current of 15 Amp at a distance of 1 cm from the wire will be

A) 4 Tesla
B) 3 Tesla
C) 3×10^{-4} Tesla
D) 4×10^{-4} Tesla

91. For a given function f(x) to be expanded in Fourier series, then as per Dirichlet's conditions which of the following is **not true**:

A) f(x) should be periodic, single valued and finite.

B) f(x) should be piece wise continuous.

C) f(x) has only finite number of maxima and minima.

D) f(x) has got infinite number of maxima and minima.

92. For a cosine function:

Assertion (A): Cos (x) is an even function.

Reason (R): cos(-x) = cos (x) for all values of x in its domain.

Choose the correct option:

A) Both A and R are true, but R is not the correct reason for A.

B) Both A and R are true and R is the correct reason for A.

C) A is true but R is false.

D) Both A and R are false.

93. The Fourier series $F(x) = h/2 + 2h/\pi$ (sin x/1 +sin3x/3....) represents which type of waveform?

A) Square wave

B) Rectangular wave

C) Triangular

D) None of the above

94. The most important condition for analyticity is:

A) function, f(z) should be finite and real.

B) f(z) should be bounded.

C) Cauchy-Riemann equations should be satisfied.

D) None of the above.

95. The equation representing Euler's formula will be:

A) $e^{ix} = \cos x + i \sin x$

B) $e^{ix} = \cos x - i \sin x$

C) $e^{ix} = \sin x + i \cos x$

D) $e^{ix} = -\sin x + i \cos x$

96. Cauchy's Integral Theorem is said to be applicable only if:

A) the function is analytic everywhere inside and on a given closed contour.

B) the function is continuous but not analytical.

C) the function has a simple pole inside the given contour.

D) All of the above.

97. Out of the given functions, which cannot be represented by a Taylor series around z=0?

A) e^z

B) cos z

C) sin z

D) 1/z

98. The difference between Laurent series and Taylor series is that Laurent series

A) includes negative powers of $(z - z_0)$

B) converges everywhere

C) cannot represent analytical functions

D) is same as Taylor series.

99. The recurrence relations for Bessel functions connect a Bessel function of order n with:

A) Trigonometric function sin x

B) Bessel function of order n+1 and n–1

C) Trigonometric function cos x

D) Bessel function of second kind $Y_n(x)$ with trigonometric functions.

100. Which of the following properties hold for Laguerre polynomials?

A) Orthogonality over $[0,\infty)$

B) Recurrence relations

C) None from (A) and (B)

D) Both (A) and (B)

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    THERE WILL BE PENALTY FOR WRONG ANSWERS MARKED BY THE CANDIDATE IN THE WRITTEN TEST (OBJECTIVE TYPE QUESTIONS PAPERS).

    (i) There are four alternatives for the answer to every question. For each question for which a wrong answer has been given by the candidate, **(0.25)** of the marks assigned to that question will be deducted as penalty.

    (ii) If a candidate gives more than one answer, it will be treated as a **wrong answer** even if one of the given answers happens to be correct and there will be same penalty as above for that question.

    (iii) If a question is left blank, i.e., no answer is given by the candidate, there will be **no penalty** for that question.

SEAL

DO NOT OPEN THIS TEST BOOKLET UNTIL YOU ARE TOLD TO DO SO

1. Which of the following symbols represent bilabiate corolla and diadelphous stamens?

A) $C_{(5)}A_{2+4}$

B) $C_{(2/3)}A_{1+(9)}$

C) $C_{(5)}A_{1+(9)}$

D) $C_{(2/3)}A_{2+4}$

2. Match the following:

(I)	(II)
i. Versatile anthers	1. *Delphinium*
ii. Spur	2. *Foeniculum*
iii. Aril	3. *Triticum*
iv. Umbel	4. *Litchi*

Choose the Correct Option:

A) i - 3, ii - 1, iii - 4, iv - 2

B) i - 1, ii - 4, iii - 3, iv - 2

C) i - 3, ii - 2, iii - 4, iv - 1

D) i - 2, ii - 1, iii - 4, iv - 3

3. Read the statement and answer:

Statement - I: Alkaloids are organic nitrogen - containing bases, usually with heterocyclic rings.

Statement - II: Alkaloids are present only in angiosperms and are therefore used in chemotaxonomy.

Choose the Correct Option:

A) Statement I and Statement II are correct and II justifies I.

B) Statement I is correct but II is incorrect

C) Statement I is incorrect but II is correct

D) Statement I and II are correct, but II doesn't justify I.

4. Which of the following statement define the Principle of Parsimony?

A) The most likely evolutionary route is the longest hypothetical pathway of changes.

B) Taxonomy in a truly phylogenetic system should be paraphyletic

C) Taxonomy in a truly phylogenetic system should be polyphyletic

D) The most likely evolutionary route is the shortest hypothetical pathway of changes.

5. The phenomenon of persistence of juvenile features in a mature organism is known as:
   A) Heterobathmy
   B) Apomorphy
   C) Neoteny
   D) Plesiomorphy

6. The rhizome of ginger and corm of *Colocasia* are examples of:
   A) Homologous organs
   B) Analogous organs
   C) Monopoly
   D) Polyphyly

7. Read the statements given below and choose the correct options:
   Statement - I : The stem of angiophytes separated from the sister groups in Triassic period.
   Statement - II : The crown angiophytes split into the extant group in late Jurassic period.
   Choose the Correct Option:
   A) I is correct and II is incorrect
   B) Both I and II are correct and represent paraphyletic origin of angiosperms.
   C) Both I and II are correct and together represent the origin of angiosperms.
   D) I is incorrect and II is correct.

8. Which of the following Indian scholars compiled the 'Vrikshayurveda'?
   A) Parasara
   B) Charaka
   C) Agnivesh
   D) Gargi

9. Match the following:

(I)	(II)
i. Caspar Bauhin	1. Father of taxonomy
ii. J. P. de Tournefort	2. Binomial nomenclature
iii. Andrea Cesalpino	3. Genus concept
iv. Carlous Linnaeus	4. First plant taxonomist

   Choose the Correct Option:
   A) i - 3, ii - 4, iii - 2, iv - 1
   B) i - 1, ii - 4, iii - 3, iv - 2
   C) i - 3, ii -1, iii - 4, iv - 2
   D) i - 2, ii - 3, iii - 4, iv - 1

10. The Shine - Dolgarno sequence facilitates which of the following processes:

A) Translation in eukaryotes

B) Transcription in eukaryotes

C) Translation in prokaryotes

D) Transcription in prokaryotes

11. Which of the following is essential for translation in prokaryotes?

A) Na^{+}

B) Mg^{2+}

C) Ca^{2+}

D) K^{+}

12. Consider the following Statements:

Assertion: The signal sequence is a short amino acid sequence found in proteins at the N-terminal

Reason: It is involved in directing proteins to their specific location in eukaryotic cells

Choose the Correct Option:

A) Assertion and reason both are correct

B) Assertion is correct but reason is incorrect

C) Assertion is incorrect but reason is correct

D) Both assertion and reason are incorrect

13. Which of the following is an amphibolic pathway?

A) C-3 cycle

B) Citric acid cycle

C) C-4 cycle

D) CAM cycle

14. Which of the following is a key intermediary in the metabolism of amino acids, fats and carbohydrates?

A) ATP

B) $FADH_2$

C) NADH

D) Acetyl Co-A

15. Match the following:

(I)	(II)
i. Split genes	1. Chech and Altman
ii. Ribozymes	2. Jacob and Monad
iii. Woble Hypothesis	3. Sharp and Roberts
iv. Operon	4. FHC Crick

Choose the Correct Option:

A) i-3, ii-2, iii-4, iv-1

B) i-2, ii-1, iii-3, iv-4

C) i-2, ii-3, iii-1, iv-4

D) i-3, ii-1, iii-4, iv-2

16. Which of the following is the only achiral amino acid and why?

A) Serine as it has single H

B) Threonine as it is the largest amino acid

C) Leucine as it is the most polar amino acid

D) Glycine as it has a single H as a R-group

17. Consider the following Statements:

Assertion: The zone A in soil profile is known as eluvial zone and is light coloured

Reason: Zone A is light coloured as mineral elements accumulate in this zone.

Choose the Correct Option:

A) The assertion is incorrect but reason is correct

B) The assertion is correct but reason is incorrect

C) Both are incorrect

D) Both are correct

18. Consider the following Statements:

Assertion: Alluvial and Eolian are types of Residual soils

Reason: Residual soils are those in which the process of soil formation is completed in different places.

Choose the Correct Option:

A) Both Assertion and Reason are correct

B) Both Assertion and Reason are incorrect

C) Assertion is correct and the reason explains the assertion

D) Assertion is correct but the reason is not the correct explanation

19. Consider the following Statements:

Assertion: Sunken stomata are found in sciophytes.

Reason: Sunken stomata prevent excess loss of water due to transpiration

Choose the Correct Option:

A) The Assertion is correct but Reason is incorrect

B) Both Assertion and Reason are correct

C) Both Assertion and Reason are incorrect

D) Assertion is incorrect but Reason is correct

20. Velamen is a layer of specialised cells found in the roots of:

A) Halophytes

B) Heliophytes

C) Epiphytes

D) Sciophytes

21. *Euphorbia hirta* is found in two morphological variants which belong to the same genetic stock, and the variations are reversible. Such variants are known as:

A) Ecotypes

B) Ecads

C) Sibling species

D) Compilospecies

22. Match the following:

(I)	(II)
i. Nudation	1. Successful establishment
ii. Ecesis	2. Movement of propagules into new area
iii. Migration	3. Interaction between new populations
iv. Stabilization	4. Development of bare area

Choose the Correct Option:

A) i-3, ii-4, iii-1, iv-2

B) i-1, ii-2, iii-3, iv-4

C) i-2, ii-3, iii-4, iv-1

D) i-4, ii-1, iii-2, iv-3

23. The maximum growth rate of a population under favourable conditions and unlimited resources is known as:

A) Biotic potential

B) Fecundity

C) Clutch size

D) Natality

24. Which of the following community characters is an analytical as well as synthetic character?

A) Frequency

B) Density

C) Dominance

D) Abundance

25. Consider the following Statements:

Assertion: The universal model of flow of energy in an ecosystem is Y-shaped

Reason: The Y-shaped energy flow model shows the linkage between grazing and detritus food chains.

Choose the Correct Option:

A) The Assertion is true but Reason is incorrect

B) The Assertion is incorrect but Reason is correct

C) Both Assertion and Reason are true and reason justifies the assertion

D) Both Assertion and Reason are true but the Reason does not justify the Assertion

26. Match the following:

(I)	(II)
i. C. Raunkier	1. Monoclimax Theory
ii. F.E. Clements	2. Life Forms
iii. A.G. Tansley	3. Y shaped energy flow model
iv. E.P. Odum	4. Polyclimax Theory

Choose the Correct Option:

A) i-1, ii-2, iii-3, iv-4

B) i-1, ii-3, iii-4, iv-2

C) i-2, ii-4, iii-3, iv-1

D) i-2, ii-1, iii-4, iv-3

27. A species with high abundance value and low frequency indicates that:

A) It is localised and restricted in distribution

B) It is uniformly distributed

C) It is absent from the area

D) It is randomly distributed

28. Who among the following were awarded nobel prize for discovering the α -helix structure of proteins?

A) Maurice Wilkins and Rosalind Franklin

B) Frederick Sanger

C) Hargobind Khurana

D) Linus and Pauling and Robert Carey

29. The thickening present in the pit membrane of bordered pit is known as:

A) Desmotubule

B) Torus

C) Phargmoplast

D) Mesoplasm

30. Fungal cell wall is primarily made up of:

A) Hemicellulose and Lignin

B) Lignin and β -glucans

C) Chitin and β -glucans

D) Cellulose and hemicellulose

31. Which of the following is the best technique to study arrangement of membrane proteins?

A) Electron microscopy

B) Freeze-fracture

C) Confocal microscopy

D) X-ray crystallography

32. Which of the following statements about the particles of Fernandez-Moran is not true?

A) They are found on the outer mitochondrial membrane
B) They are involved in the process of ATP synthesis
C) They are also known as oxysomes
D) Their round headpiece faces forwards the matrix

33. Which of the following histone acts as a linker protein?

A) H_2A
B) H3
C) H1
D) H4

34. Which of the following statements is not true about the axoneme?

A) It has a 9+2 arrangements of tubules
B) It is the basal part of flagella
C) It is surrounded by the plasma membrane
D) It has tubulins and dyenins

35. The chemiosmotic of ATP synthesis can be experimentally demonstrated by using which of the following combinations?

A) Isolated cell wall and Na^+ - K^+ gradient
B) Isolated cell wall and pH gradient
C) Isolated thylakoids and Na^+ - K^+ gradient
D) Isolated thylakoids and pH gradient

36. According to the Vant Hoff's equation for osmotic pressure, which of the following is not true:

A) It is directly proportional to volume of solvent
B) It is directly proportional to number of moles of solvent
C) It is directly proportional to the temperature
D) It is directly proportional to the gas constant

37. Which of the following plant material is most appropriate for studying membrane permeability in classroom?

A) Sweet potato
B) Beet root
C) Carrot
D) Radish

38. Which of the following is not the criteria for essentiality of elements?

A) Its absence should lead to a symptom / illness in plant
B) It is essential for the plant to complete its life cycle
C) It cannot be substituted by any other element.
D) It should be present in large quantity in soil as well as plant

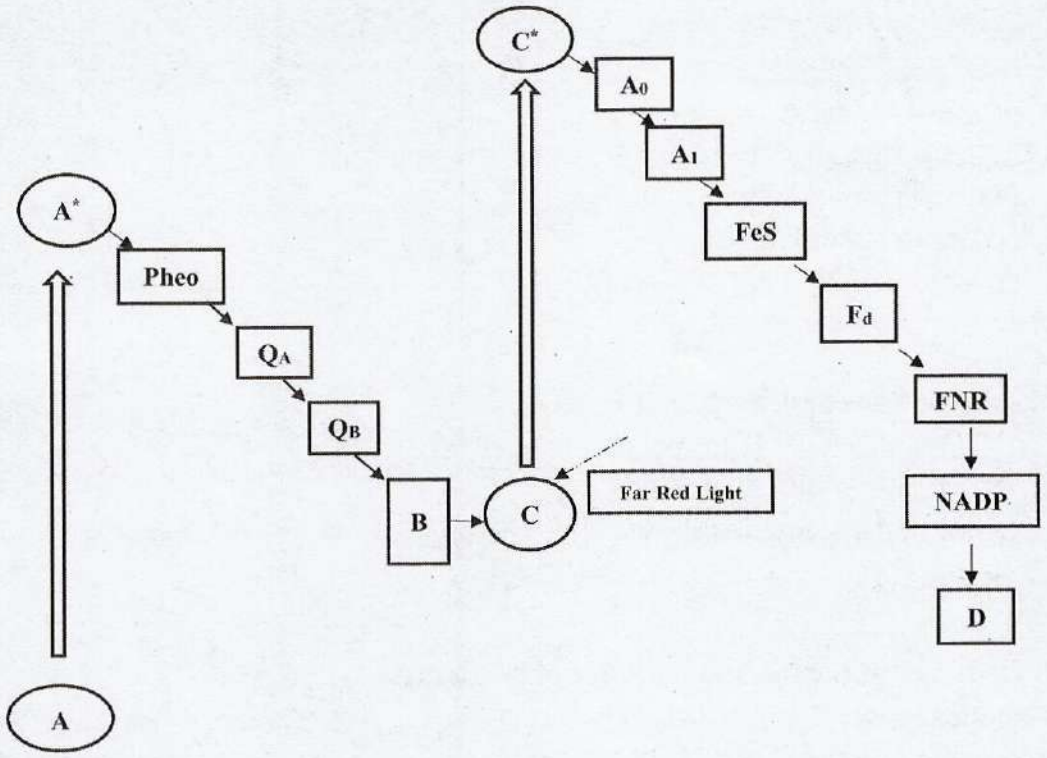
39. Match the following:

(I)	(II)
i. F.F. Blackman	1. Red drop
ii. Robert Emerson	2. Z-scheme
iii. Robert Hill	3. Dark phase in photosynthesis
iv. Govindjee	4. O_2 production by isolated chloroplasts

Choose the Correct Option:

A) i-3, ii-1, iii-4, iv-2
B) i-1, ii-2, iii-3, iv-4
C) i-3, ii-2, iii-4, iv-1
D) i-1, ii-4, iii-3, iv-2

40.



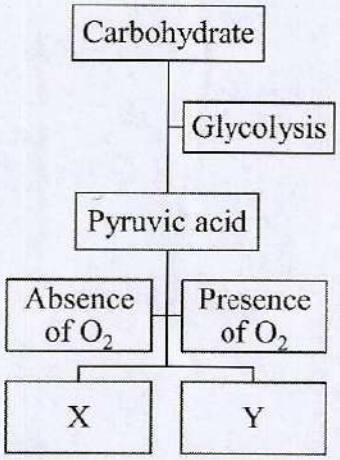
In the above scheme which of the following represent A, B, C and D?

A) A - P_{680}; B - Plastocyanin; C - P_{700}; D - FADH
B) A - P_{680}; B - cyt b_6f; C - P_{700}; D - NADH
C) A - P_{700}; B - cyt b_6f; C - P_{680}; D - NADH
D) A - P_{700}; B - Plastocyanin; C - P_{680}; D - NADH

41. Which of the following is the significant advantage of Kranz anatomy in C4 plants?
A) It helps in decreasing the concentration of CO_2
B) It helps in increasing the concentration of CO_2
C) It helps in increasing the concentration of O_2
D) It helps in decreasing the concentration of O_2

42. Which of the following is the correct sequence of organelles in which the reactions of C2 cycle takes place?
A) Chloroplast → peroxisome → mitochondria → peroxisome → chloroplast
B) Mitochondria → chloroplast → peroxisome → mitochondria
C) Chloroplast → mitochondria → peroxisome → chloroplast
D) Mitochondria → peroxisome → chloroplast → mitochondria

43.



In the above flowchart, the X and Y are:
A) X = Lactic acid + H_2O; Y = CO_2 + H_2O
B) X = Lactic acid + O_2; Y = CO_2 + H_2O
C) X = Ethyl alcohol + H_2O; Y = CO_2 + H_2O
D) X = Ethyl alcohol + CO_2; Y = CO_2 + H_2O

44. Which of the following is an inhibitor of hexokinase?
A) Iodoacetate
B) Acetyl coA
C) Glucose-6-phosphate
D) Citrate

45. Arrange the following substrates in the increasing order of R.Q.
A) Fats < Proteins < Carbohydrates < Organic acids
B) Proteins < Carbohydrates < Fats < Organic acids
C) Carbohydrates < Proteins < Organic acids < Fats
D) Organic acids < Fats < Proteins < Carbohydrates

46. Consider the following Statements:
Assertion: In photostationary state Phytochrome P_R is 97% and P_{FR} is 3%
Reason: The physiological responses seen in plants is due to P_{FR} as it is the active form
Choose the Correct Option:
A) Assertion is correct and Reason is incorrect
B) Assertion is incorrect and Reason is correct
C) Both Assertion and Reason are incorrect
D) Both Assertion and Reason are correct

47. Match the following:

(I)	(II)
i. *Volvox*	1. Palmella
ii. *Chlamydomonas*	2. Plakea
iii. *Chara*	3. Akinetes
iv. *Nostoc*	4. Amylum stars

Choose the Correct Option:
A) i-4, ii-3, iii-2, iv-1
B) i-3, ii-4, iii-1, iv-2
C) i-2, ii-1, iii-4, iv-3
D) i-1, ii-4, iii-3, iv-2

48. Which of the following is the source of Ergot alkaloids?
A) *Claviceps purpurea*
B) *Rhizopus oryzae*
C) *Ustilago maydis*
D) *Aspergillus fumigatus*

49. Consider the following Statements:
Assertion: Species of *Trichoderma* are used as bio-control agents.
Reason: Biocontrol agents are hyperparasites and kill other fungi in soil
Choose the Correct Option:
A) Both Assertion and Reason are incorrect
B) Both Assertion and Reason are correct
C) Assertion is incorrect, Reason is correct
D) Assertion is correct, Reason is incorrect

50. Which of the following is not true for lichens?
A) They are a source of litmus
B) They are climax species in succession
C) They have been used as a source of food
D) They are a source of essential oils

51. Which of the following facilitate attachment of the bacteriophage to the host?

A) Phage lysozymes

B) Tail fibre

C) Collar

D) Ghosts

52. T.O. Diener is credited with the discovery of:

A) Viroids

B) Prions

C) Ribozymes

D) PPLO's

53. The simplest and earliest group of Embryophytes are:

A) Pteridophytes

B) Bryophytes

C) Gymnosperms

D) Progymnosperms

54. Which of the following term is used when sporophyte develops from gametophyte without gametic union?

A) Apogamy

B) Apospory

C) Diplospory

D) Amphimixis

55. Which of the following characters is common between algae and bryophytes?

A) Zygote forms the embryo

B) Amphibious habitat

C) Starch is reserve food

D) Presence of water conduction system

56. Which of the following are not liverworts?

A) *Marchantia*

B) *Parmelia*

C) *Riccia*

D) *Plagiochasma*

57. Consider the following Statements:

Assertion: Elaters are present in the sporophyte of some Bryophytes

Reason: They facilitate dispersal of spores

Choose the Correct Option:

A) Both Assertion and Reason are correct

B) Both Assertion and Reason are incorrect

C) Assertion is correct but Reason is incorrect

D) Assertion is incorrect but Reason is correct

58. Gymnosperms and pteridophytes do not have which character in common?

A) Circinate vernation

B) Tap root system

C) Dominant sporophytic phase

D) Sporophylls bearing sporangia

59. The vascular bundle which has both centripetal and centrifugal xylem is known as?

A) Paracyclic

B) Diarch

C) Mesarch

D) Diploxylic

60. Ovules in *Cycas* are:

A) Orthotropous and unitegmic

B) Anatropus and unitegmic

C) Orthotropous and bitegmic

D) Anatropus and bitegmic

61. Consider the following Statements:

Assertion: Haplostele is found in *Rhynia*

Reason: Haplostele is the simplest form of stele where solid xylem core is surrounded by phloem

Choose the Correct Option:

A) Both Assertion and Reason are incorrect

B) Assertion is correct, Reason is incorrect

C) Both Assertion and Reason are correct

D) Assertion is incorrect, Reason is correct

62. Which of the following characters are not common between gymnosperms and angiosperms?

A) Free nuclear division in zygote

B) Siphonogamous fertilization

C) Presence of vessels

D) Presence of Embryo suspensor

63. Consider the following Statements:

Assertion: Kink in protein is a sharp bend in the α-helix

Reason: Presence of proline is often responsible for Kink

Choose the Correct Option:

A) Assertion is incorrect, Reason is correct

B) Assertion is correct, Reason is incorrect

C) Both Assertion and Reason are incorrect

D) Both Assertion and Reason are correct, Reason explains Assertion

64. Which of the following is not a primary metabolite?

A) ATP

B) Carotenoids

C) Enzymes

D) Sugars

65. Which of the following is not true for facilitated transport?

A) Requires special membrane proteins

B) Highly selective

C) Uphill transport

D) Transport saturates

66. Which of the following plant is best suitable for observing plasmolysis under classroom conditions?

A) *Rhoeo* sp.

B) *Crinium* sp.

C) *Vinca rosea*

D) *Hibiscus* sp

67. Which of the following is not a part of symplast?

A) Casparian strip

B) Protoplast

C) Cell wall

D) Pericycle

68. Which of the following defines imbibition?

A) It is type of diffusion where water moves through a semi-permeable membrane

B) It is a type of osmosis through a semi-permeable membrane

C) It is a type of diffusion where water is absorbed by solid

D) It is a type of osmosis where water is absorbed by solids

69. Which of the following is essential part of nitrogenase enzyme?

A) Mg

B) Cl

C) Ca

D) Mo

70. Members of which of the following are good model systems for intra-ovarian pollination?

A) Asteraceae

B) Papaveraceae

C) Poaceae

D) Solanaceae

71. Among the following types of embryogeny in angiosperms, which does not have first division in zygote horizontal?

A) Piperad

B) Chenopodiad

C) Caryophyllad

D) Asterad

72. Consider the following Statements:

Assertion: Polyembryony is an abnormal feature in *Citrus*

Reason: Polyembryony is the occurrence of more than two embryos in an ovule

Choose the Correct Option:

A) Both Assertion and Reason are correct

B) Both Assertion and Reason are incorrect

C) Assertion is correct, Reason is incorrect

D) Assertion is incorrect, Reason is correct

73. Myrmechory is defined as:

A) Dispersal of seeds by fresh water

B) Dispersal of seeds by ants

C) Dispersal of seeds by ruminants

D) Dispersal of seed by salt water

74. Who among the following was the first to observe triple fusion in angiosperms?

A) Camerarius

B) Nawaschin

C) Strasburger

D) Amici

75. Which of the following is also known as dwarf male in *Oedogonium*?

A) Nannandrous

B) Macrandous

C) Gyandrosporous

D) Akinetes

76. Which of the following structures help fungi in adhering to the surface of host?

A) Sclerotium

B) Stromata

C) Prosenchyma

D) Appresorium

77. In the equation for population growth curve

$$\frac{dN}{dt} = rN \times \left(\frac{k-N}{k} \right)$$

k denotes:

A) Fecundity

B) Clutch size

C) Population density

D) Carrying capacity

78. Phenylketonuria results due to which of the following:

A) Degradation of phenylpyruvic acid

B) Accumulation of phenylpropanoic acid

C) Accumulation of phenylalanine

D) Accumulation of phenylpyruvic acid

79. Which of the following is not a property of genetic code?

A) Overlapping

B) Triplet

C) Universal

D) Degenerate

80. Economically important part of *Crocus sativus* is

A) Versatile anthers

B) Bifid stigma

C) Tripartite funnel shaped stigma

D) Tripartite feathery stigma

81. Which of the following fruits were not cultivated for at least 4000 years?

A) Apple

B) Apricot

C) Almond

D) Avocado

82. Consider the following Statements:

Assertion: The fruit in *Malus pumita* is a Pome

Reason: The Pome is enlarged and fleshy receptacle

Choose the Correct Option:

A) Both Assertion and Reason are correct

B) Both Assertion and Reason are incorrect

C) Assertion is correct, but Reason is incorrect

D) Assertion is incorrect, but Reason is correct

83. The source of buckwheat flour is:

A) *Fagopyrum esculentum*

B) *Chenopodium quinoa*

C) *Amaranthus* sp.

D) *Ceralia munera*

84. Which of the following describes gynoecium of wheat?

A) Monocarpellary, syncarpous, unilocular ovary

B) Bicarpellary, syncarpous, unilocular ovary,

C) Monocarpellay, polycarpous, unilocular ovary

D) Bicarpellary, polycarpous, unilocular ovary

85. The presence of D genome in hexaploid wheat is believed to have come from:

A) *Triticum boeticum*

B) *Triticum tauschii*

C) *Triticum dicoccoides*

D) *Triticum aestivum*

86. The term sustainability was used by the Brundtland commission in its report titled:

A) Climate Change: A Global Threat Requiring Immediate Action

B) Urban Planning For Sustainable Cities

C) Our Common Future

D) The Circular Economy: A Path Towards Sustainable Resource Management

87. The pattern in which one group of plant species gradually replaces another in succession is described as:

A) Phytosociological model

B) Climax concept

C) Ecesis

D) Relay floristics model

88. Match the plant disease with their correct causal organism

(I)	(II)
i. Apple scab	1. *Monilina* sp.
ii. Brown rot	2. *Erwinia amylovora*
iii. Fire blight	3. *Phytophthora* sp.
iv. Root rot of apple	4. *Venturia inaequalis*

Choose the Correct Option:

A) i-1, ii-2, iii-3, iv-4

B) i-2, ii-1, iii-4, iv-3

C) i-4, ii-1, iii-2, iv-3

D) i-4, ii-3, iii-2, iv-1

89. The AABBDD genome of hexaploidy wheat is an example of:

A) Autopolyploidy

B) Nullisomy

C) Aneuploidy

D) Allopolyploidy

90. The chromosome formulae $2n = x = 7$ represents which of the following?

A) Nullisomic

B) Monoploid

C) Haploid

D) Polyhaploid

91. Which of the following is the correct sequence followed in gram staining:
A) Crystal violet → gram iodine → ethanol → safranine
B) Gram iodine → ethanol → safranine → crystal violet
C) Crystal violet → safranine → ethanol → gram iodine
D) Gram iodine → crystal violet → ethanol → safranine

92. Which group among the following received Nobel prize for their work on CRISPR / Cas9?
A) Jenifer Daoudna and Emmanuelle Charpentier
B) Benjamin List and David Mac Millan
C) David Julius and Ardem Patapoutiar
D) Harvey J. Alter, Michael Houghton and Charles M. Rice

93. Which of the following depicts the Michaelis - Menten equation?
A) $V_{max} = \frac{V_o[S]}{k_m + [S]}$
B) $V_0 = \frac{V_{max}[S]}{K_m + [S]}$
C) $E + S \rightleftharpoons ES + P$
D) $E + S \rightleftharpoons E + P$

94. The Lambert - Beer's law is the principle behind which of the following:
A) High Performance Liquid Chromatography
B) Scanning electron microscopy
C) Atomic Absorption Spectrophotometer
D) Spectrophotometer

95. Match the amino acid group with the correct R group:

(I)	(II)
i. Non-polar, aliphatic R	1. Methionine
ii. Aromatic R	2. Aspartate
iii. Sulphur containing	3. Glycine
iv. Negatively charged R group	4. Tyrosine

Choose the Correct Option:
A) i-1, ii-2, iii-4, iv-3
B) i-3, ii-4, iii-1, iv-2
C) i-3, ii-1, iii-4, iv-2
D) i-1, ii-2, iii-3, iv-4

96. Introns were discovered by

A) Thomas Cech

B) Jacob and Monod

C) Philip Sharp and Richard Roberts

D) Messelson and Stahl

97. Synaptonemal complex is observed in which of the following stages in meiosis?

A) Leptotene

B) Pachytene

C) Diplotene

D) Zygotene

98. Which of the following is an exception to the central dogma?

A) Prion hypothesis

B) Wobble hypothesis

C) Signal hypothesis

D) Null hypothesis

99. Which of the following are important for protein folding?

A) Chaperons

B) Signal sequences

C) Translocation motors

D) Clathrin

100. Consider the following Statements:

Assertion: Ca^{2+} is an important secondary messenger used in cell signaling

Reason: The concentration of Ca^{2+} remains constant in a cell, thereby helping it in signaling

Choose the Correct Option:

A) Both Assertion and Reason are correct

B) Both Assertion and Reason are incorrect

C) Assertion is correct but Reason is incorrect

D) Assertion is incorrect but Reason is correct

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Booklet Serial No. 358657

Test Booklet Series

TEST BOOKLET
LECTURER - (10+2)
CHEMISTRY
WRITTEN TEST - 2025
(53)

A

Time Allowed: Two Hours ***Maximum Marks: 100***

INSTRUCTIONS

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2. **Please note that it is the candidate's responsibility to encode and fill in the Roll Number and Test Booklet Series Code A, B, C or D carefully and without any omission or discrepancy at the appropriate places in the OMR Answer /Response Sheet. Any omission/discrepancy will render the Response Sheet liable for rejection.**
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4. This Test booklet contains **100** items (questions). Each item comprises of four responses (answers). You will select the response which you want to mark on the Answer Sheet/Response Sheet. In case you feel that there is more than one correct response, mark the response which you consider the best. In any case, choose ***ONLY ONE*** response for each item.
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11. **Penalty for wrong answers:**

    THERE WILL BE PENALTY FOR WRONG ANSWERS MARKED BY THE CANDIDATE IN THE WRITTEN TEST (OBJECTIVE TYPE QUESTIONS PAPERS).

    (i) There are four alternatives for the answer to every question. For each question for which a wrong answer has been given by the candidate, **(0.25)** of the marks assigned to that question will be deducted as penalty.

    (ii) If a candidate gives more than one answer, it will be treated as a **wrong answer** even if one of the given answers happens to be correct and there will be same penalty as above for that question.

    (iii) If a question is left blank, i.e., no answer is given by the candidate, there will be **no penalty** for that question.

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1. What happens to the mass of the zinc electrode in a Daniel cell as the reaction proceeds?
   A) Increases
   B) Decreases
   C) Remains constant
   D) First increases, then decreases

2. The Nernst equation can be applied to:
   A) Only galvanic cells
   B) Only concentration cells
   C) Both galvanic and electrolytic cells
   D) Only cells at equilibrium

3. The standard electrode potential of a half-cell is determined using:
   A) A voltmeter alone
   B) A galvanic cell with SHE as one electrode
   C) A concentration cell
   D) A pH meter

4. In a Wheatstone bridge, if $R1 = 10\,\Omega$, $R2 = 20\,\Omega$ and $R3 = 30\,\Omega$, what should R4 be for balance?
   A) $5\,\Omega$
   B) $15\,\Omega$
   C) $40\,\Omega$
   D) $60\,\Omega$

5. The electrolyte in a lead-acid battery is:
   A) Potassium hydroxide
   B) Sulfuric acid
   C) Sodium chloride
   D) Lithium hexafluorophosphate

6. The units of molar absorptivity (ϵ) are :
   A) $mol.L^{-1}.cm^{-1}$
   B) $L.mol^{-1}.cm^{-1}$
   C) $cm.mol^{-1}$
   D) Unitless

7. In rotational spectroscopy, the bond length of a diatomic molecule can be determined using:

A) The vibrational frequency

B) The moment of inertia

C) The electronic transition energy

D) The nuclear spin coupling constant

8. For a non-linear molecule with N atoms, how many vibrational degrees of freedom does it possess?

A) N

B) 2N

C) 3N-6

D) 3N-5

9. Degenerate vibrational modes occur when:

A) Two vibrations have the same frequency

B) A vibration is IR-inactive

C) The molecule is linear

D) The temperature is very low

10. The "fingerprint region" in IR spectroscopy (400-1500 cm^{-1}) is useful because :

A) It contains stretching frequencies of C-H, N-H, and O-H bonds

B) It is unaffected by isotopic substitution

C) It corresponds to rotational transitions

D) It provides unique patterns for molecule identification

11. The Huckel rule for aromaticity states that a monocyclic conjugated system is aromatic if it has :

A) $2n\ \pi$ - electrons

B) $4n\ \pi$ - electrons

C) $4n + 2\ \pi$-electrons

D) $8n\ \pi$ - electrons

12. The bond order in MO theory is calculated as :

A) (Number of bonding electrons) - (Number of antibonding electrons)

B) (Number of bonding electrons + Number of antibonding electrons)/2

C) (Number of bonding electrons - Number of antibonding electrons)/2

D) Number of electrons in bonding orbitals only

13. For a wave function to be physically acceptable, it must be:

A) An eigen function of all quantum mechanical operators

B) Single-valued, continuous, and square-integrable

C) Always real-valued

D) Symmetric with respect to particle exchange

14. The eigen values of an operator in quantum mechanics represent:

A) Possible experimental outcomes of a physical measurement

B) Probability amplitudes of a wavefunction

C) Normalization constants for wavefunctions

D) Spatial coordinates of particles

15. The energy levels of the hydrogen atom are given by :

A) $E_n = -\frac{13.6eV}{n}$

B) $E_n = -\frac{13.6eV}{n^2}$

C) $E_n = n^2 h\omega$

D) $E_n = \frac{h^2 n^2}{2m}$

16. The order of a reaction can be determined by:

A) Balancing the chemical equation

B) Measuring the rate at different concentrations of reactants

C) Determining the molecularity of the reaction

D) Calculating the equilibrium constant

17. In competitive inhibition, the apparent Michaelis Menten constant (Km) :
    A) Decreases
    B) Increases
    C) Remains unchanged
    D) Becomes zero

18. A key difference between fluorescence and phosphorescence is:
    A) Fluorescence requires a triplet state
    B) Phosphorescence ceases immediately after excitation stops
    C) Phosphorescence persists after excitation ceases
    D) Fluorescence has a longer lifetime

19. The photodecomposition of HI is an example of a:
    A) Unimolecular reaction
    B) Bimolecular reaction
    C) Chain reaction
    D) Catalytic reaction

20. A quantum yield $\Phi > 1$ implies :
    A) A chain reaction mechanism
    B) Incomplete light absorption
    C) Energy transfer to a catalyst
    D) Non - radiative decay dominates

21. The temperature at which a real gas behaves ideally over a wide range of pressures is called:
    A) Critical temperature
    B) Inversion temperature
    C) Boyle's temperature
    D) Absolute zero

22. The Joule-Thomson effect in states of matter describes:
    A) Heating of a gas under adiabatic expansion
    B) Temperature change of a fluid during throttling
    C) Work done in isothermal expansion
    D) Entropy change under adiabatic expansion

23. Which technique combines X-ray diffraction with fluorescence to study material composition?

A) Ultra-violet spectroscopy

B) Energy-Dispersive X-ray Spectroscopy

C) X-ray Photoelectron Spectroscopy

D) Transmission electron microscopy

24. In the supercritical fluid region:

A) Distinct liquid and gas phases exist

B) Surface tension is high

C) Density can be continuously varied

D) Diffusion coefficients are zero

25. The heat capacity at constant pressure (Cp) is related to Cv by :

A) $Cp = Cv + R$

B) $Cp = Cv - R$

C) $Cp = Cv$

D) $Cp = Cv + nRT$

26. Entropy change for an isolated system undergoing spontaneous process is:

A) Zero

B) Positive

C) Negative

D) Constant

27. For a diatomic ideal gas at room temperature, the molar heat capacity Cv is :

A) $\frac{3}{2}R$

B) $\frac{5}{2}R$

C) $\frac{7}{2}R$

D) $4R$

28. Abnormal colligative properties arise when:

A) The solute is non-volatile

B) The solute dissociates or associates in solution

C) The solvent is water

D) The temperature is very high

29. For an ideal solution, which of the following is true?

A) Both components obey Raoult's law

B) Both components obey Henry's law

C) Solvent obeys Raoult's law, solute obeys Henry's law

D) Solute obeys Raoult's law, solvent obeys Henry's law

30. The Born-Haber cycle is used to determine:

A) Solubility of ionic compounds

B) Lattice energy experimentally

C) Covalent character in ionic solids

D) Thermal expansion coefficient

31. Which molecule exhibits sp hybridization?

A) H_2O

B) C_2H_2

C) NH_3

D) CH_4

32. Valence bond theory fails to explain:

A) Bond angles in H_2O

B) Paramagnetism in O_2

C) Tetrahedral geometry of CH_4

D) Determining geometrical shapes

33. Intramolecular hydrogen bonding is observed in:

A) HF

B) H_2O

C) o-Nitrophenol

D) NH_3

34. The geometry of XeF_4 is:

A) Linear

B) Square planar

C) Tetrahedral

D) Octahedral

35. The oxidation state of xenon in XeO_6^{4-} is:

A) +2

B) +4

C) +6

D) +8

36. The reaction of B_2H_6 with NH_3 forms:

A) Hydrazine (N_2H_4)

B) Borazine ($B_3N_3H_6$)

C) Ammonia borane (NH_3BH_3)

D) Boric acid (H_3BO_3)

37. The bond angle in ClF_3 is approximately :

A) 90°

B) 109.5°

C) 120°

D) 180°

38. The geometry of I_3^- (tri - iodide ion) is :

A) Linear

B) Bent

C) Trigonal planar

D) Tetrahedral

39. The catalytic activity of transition metals is primarily due to:

A) Low ionization energy

B) Variable oxidation states

C) High electronegativity

D) Small atomic size

40. Higher oxidation states of transition metals generally exhibit:

A) Basic character

B) Acidic character

C) Neutral character

D) Amphoteric character

41. The geometry of $[Ni(CN)_5]^{3-}$ is :

A) Trigonal planar

B) Trigonal bipyramidal

C) Tetrahedral

D) Octahedral

42. A "forbidden" transition occurs when :

A) $\Delta S \neq 0$ and $\Delta l = 0$

B) $\Delta S = 0$ and $\Delta l = \pm 1$

C) $\Delta n = 0$

D) $\Delta m_l = \pm 1$

43. The green color of $[Ni(H_2O)_6]^{2+}$ arises from :

A) A Laporte - allowed transition

B) A spin - forbidden $d \rightarrow d$ transition

C) A charge - transfer transition

D) An $f \rightarrow f$ transition

44. The Jahn-Teller theorem states that:

A) Linear molecules are always stable

B) Nonlinear molecules in degenerate electronic states are unstable

C) Octahedral complexes cannot distort

D) Only spin-paired complexes show distortion

45. The product of hydroboration - oxidation of 1 - butyne ($HC \equiv C\text{-}CH_2CH_3$) is :

A) Butanal

B) Butanone

C) 1 - Butanol

D) 2 - Butanol

46. Which reaction is used to prepare terminal alkynes from vicinal dihalides?

A) Hydroboration- oxidation

B) Double dehydrohalogenation

C) Catalytic hydrogenation

D) Ozonolysis

47. The $C=C$ bond length in alkenes is shorter than C-C single bonds because :

A) sp^2 hybridization increases bond strength

B) π - electrons add electron density between nuclei

C) σ - bonds are weaker

D) Alkene carbons are smaller

48. Which polymerization mechanism involves the insertion of monomers into a metal - carbon bond?

A) Free - radical polymerization

B) Ziegler - Natta polymerization

C) Anionic polymerization

D) Cationic polymerization

49. Which property of the arene affects the stability of its metal complex the most?

A) Molecular weight

B) Boiling point

C) Electron density of the aromatic ring.

D) Degree of substitution

50. Deprotonation of cyclopentadiene (C_5H_6) requires a strong base because:

A) The resulting $C_5H_5^-$ anion is antiaromatic

B) C_5H_6 is a weak acid

C) The $C_5H_5^-$ anion is unstable

D) C_5H_6 is highly sterically hindered

51. The linear form of glucose converts to a cyclic structure via:

A) Oxidation at C-1

B) Formation of a glycosidic bond

C) Intramolecular hemiacetal formation

D) Esterification

52. The reducing end of a polysaccharide has:

A) A free anomeric carbon

B) A glycosidic bond

C) No hydroxyl groups

D) A ketose sugar

53. Which amino acid is critical for disulfide bond formation in proteins?

A) Serine

B) Cysteine

C) Alanine

D) Aspartate

54. Maple syrup urine disease is associated with defective metabolism of:

A) Branched-chain amino acids (Leu, Ile, Val)

B) Aromatic amino acids (Phe, Tyr, Trp)

C) Sulfur-containing amino acids (Met, Cys)

D) Acidic amino acids (Asp, Glu)

55. A nucleoside consists of:

A) Nitrogenous base + phosphate

B) Nitrogenous base + sugar

C) Sugar + phosphate

D) Nitrogenous base + sugar + phosphate

56. Which RNA molecule has an anticodon loop?

A) mRNA

B) tRNA

C) rRNA

D) miRNA

57. The N-H bending vibration for primary amines is observed near:

A) 1600 cm^{-1}

B) 1700 cm^{-1}

C) 2200 cm^{-1}

D) 2900 cm^{-1}

58. The O – H stretch for alcohols appears as a broad peak near:

A) 3600 – 3200 cm^{-1}

B) 3000 cm^{-1}

C) 1700 cm^{-1}

D) 1200 cm^{-1}

59. The characteristic C=O stretching frequency for most carbonyl compounds appears in the range:

A) 1500 – 1400 cm^{-1}

B) 1700 – 1750 cm^{-1}

C) 2200 – 2300 cm^{-1}

D) 3000 – 3100 cm^{-1}

60. Aldehydes show an additional small peak near 2720 cm^{-1} due to:

A) C=O overtone

B) Fermi resonance of aldehyde C – H stretch

C) N – H bending

D) C – C stretching

61. Primary amines ($R-NH_2$) show two N – H stretches near 3400-3300 cm^{-1}. H-bonding in solids or concentrated solutions causes these peaks to:

A) Merge into one sharp peak

B) Disappear

C) Broaden and shift below 3300 cm^{-1}

D) Split into four peaks

62. Increasing solvent dielectric constant generally _____ the intensity of IR peaks.

A) Increases

B) Decreases

C) Does not affect

D) Splits

63. The splitting pattern of a proton adjacent to two equivalent protons (e.g., $-CH_2-$) is a:

A) Singlet

B) Doublet

C) Triplet

D) Quartet

64. The chemical shift (δ) in NMR is measured in:

A) Hertz (Hz)

B) Parts per million (ppm)

C) Tesla (T)

D) Watts (W)

65. Which compound is commonly used as an internal standard in 1H NMR?

A) Sodium chloride

B) Tetramethylsilane

C) Deuterated chloroform

D) Deuterium

66. NOESY (Nuclear Overhauser Effect Spectroscopy) is used to determine:

A) Molecular weight

B) Through-space proton proximities

C) Heteronuclear couplings

D) Chemical exchange rates

67. Long-range coupling (^4J) is typically observed in:

A) Saturated hydrocarbons

B) Aromatic systems

C) Ionic compounds

D) Metals

68. The chemical shift of a proton in NMR is observed to be more downfield when:

A) It is attached to a carbon adjacent to an electronegative atom

B) It is in the shielding cone of a nearby aromatic ring

C) It is part of an aliphatic hydrocarbon chain

D) It is in a highly symmetrical environment

69. The chemical shift of an alkene proton (e.g., in ethylene) appears downfield (~5-6 ppm) compared to an alkane proton because:

A) The π-electrons create a deshielding magnetic anisotropy

B) The sp^2 carbon is less electronegative than sp^3 carbon

C) There is no hybridization effect

D) Alkene protons are always involved in hydrogen bonding

70. Which of the following proton pairs would exhibit the largest coupling constant (J)?

A) Geminal protons (^2J, same carbon)

B) Vicinal protons in a trans-alkene (^3J)

C) Vicinal protons in a gauche conformation (^3J)

D) Long-range coupled protons (^4J or higher)

71. What is the expected splitting pattern for a proton adjacent to a CH_2 group (where the CH_2 protons are coupled to another CH_3 group)?

A) Triplet (if CH_3 is far away)

B) Quartet (due to CH_2 splitting)

C) Doublet of triplets (if CH_2 is further split by CH_3)

D) Singlet (if no coupling exists)

72. The [4+2] cycloaddition (Diels-Alder reaction) is an example of :

A) A photochemically allowed reaction under thermal conditions.

B) A thermally allowed reaction involving 4π (diene) + 2π (dienophile) electrons.

C) A [2+2] cycloaddition with inverse electron demand.

D) A sigmatropic rearrangement.

73. Which of the following reactions is an example of an electrocyclic process?

A) Diels-Alder reaction.

B) Cope rearrangement.

C) Ring opening of cyclobutene to butadiene.

D) [2+2] cycloaddition of two alkenes.

74. The Claisen rearrangement is a:

A) [2,3]-sigmatropic shift of an allyl vinyl ether.

B) [3,3]-sigmatropic shift of an allyl aryl ether.

C) [1,5]-sigmatropic hydrogen shift.

D) Electrocyclic ring closure.

75. Which of the following is a characteristic feature of an SN2 reaction?

A) It proceeds via a carbocation intermediate.

B) It shows first-order kinetics.

C) It involves a single-step, bimolecular nucleophilic attack with inversion of configuration.

D) It is favoured by sterically hindered substrates.

76. In an SN1 reaction, the rate-determining step is:

A) Nucleophilic attack on the substrate.

B) Formation of a carbocation intermediate.

C) Deprotonation of the product.

D) Simultaneous bond-breaking and bond-forming.

77. The Wolff rearrangement involves the conversion of:

A) A carboxylic acid to an ester

B) An α-diazoketone to a ketene

C) An alkene to an epoxide

D) An aldehyde to a primary alcohol

78. What type of reaction follows the Wolff rearrangement when the ketene reacts with an amine?

A) Electrophilic aromatic substitution

B) Nucleophilic acyl substitution

C) Diels-Alder cycloaddition

D) Free-radical polymerization

79. What is the key intermediate in the Wolff rearrangement?

A) A carbocation

B) A carbene

C) A nitrene

D) A free radical

80. Which factor determines the major product in an unsymmetrical Pinacol rearrangement?

A) The stability of the resulting carbocation

B) The polarity of the solvent

C) The temperature of the reaction

D) The concentration of the diol

81. Which substrate undergoes E1 reactions most readily?

A) Methyl bromide (CH_3Br)

B) Isopropyl bromide ($(CH_3)_2CHBr$)

C) Neopentyl bromide ($(CH_3)_3CCH_2Br$)

D) Ethyl bromide (CH_3CH_2Br)

82. The Hoffmann product in elimination reactions refers to:

A) The least substituted alkene.

B) The most substituted alkene.

C) The alkene with the highest polarity.

D) The alkene formed via E1 mechanism.

83. Which of the following is a characteristic feature of an E2 reaction?

A) It proceeds via a carbocation intermediate.

B) It is a first-order reaction.

C) It involves a concerted proton abstraction and leaving group departure.

D) It is favored by weak bases.

84. Hofmann elimination involves the cleavage of quaternary ammonium hydroxides to yield:

A) Alcohols and amines

B) Alkenes, tertiary amines, and water

C) Carboxylic acids and ammonia

D) Nitriles and water

85. The final step in Hofmann elimination is:

A) Deprotonation to form the alkene

B) Loss of N_2 gas

C) Nucleophilic attack on the nitrogen

D) Oxidation of the amine

86. Arrange the following carbocations in order of increasing stability from least stable to most stable:

A) $1^\circ < 2^\circ < 3^\circ$

B) $3^\circ < 2^\circ < 1^\circ$

C) $2^\circ < 1^\circ < 3^\circ$

D) $1^\circ < 3^\circ < 2^\circ$

87. The inductive effect of alkyl groups in carbocations is:

A) Electron-withdrawing

B) Electron-donating

C) Neutral

D) Electronegativity -dependent

88. Hyperconjugation involves:

A) Overlap of σ -bonds with empty p-orbitals

B) Delocalization of π -electrons

C) Hydrogen bonding

D) Ionic interactions

89. Which carbene is most stabilized by resonance?

A) CH_2

B) CCl_2

C) $C(Ph)_2$

D) CF_2

90. Compared to typical alkynes, arynes are:

A) More stable but less reactive

B) Less stable but more nucleophilic

C) More electrophilic due to ring strain

D) Identical in reactivity

91. How many stereoisomers exist for a molecule with 3 chiral centers?

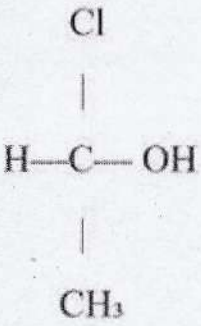
A) 2

B) 4

C) 6

D) 8

92. What is the R/S configuration of this molecule?



A) R

B) S

C) Both

D) Neither

93. A compound with the *R* configuration at one chiral center is converted to its *S* enantiomer via a single chemical step. Which process could achieve this?

A) SN1 reaction

B) SN2 reaction

C) Free radical halogenation

D) Electrophilic addition

94. Which spectroscopic method best distinguishes *E/Z* isomers?

A) IR spectroscopy

B) UV-Vis spectroscopy

C) ^{1}H NMR (coupling constants)

D) Mass spectrometry

95. In the chair conformation of cyclohexane, the number of axial hydrogens is:

A) 6

B) 3

C) 2

D) 0

96. The Pechmann reaction is used to synthesize:

A) Coumarins

B) Flavonoids

C) Alkaloids

D) Steroids

97. The key intermediate in the Fries rearrangement is:

A) Acylium ion ($R-C\equiv O^{+}$)

B) Carbanion

C) Benzyne

D) Radical

98. The active electrophile generated in the Reimer-Tiemann reaction is:

A) Dichlorocarbene

B) Carbocation

C) Chloromethyl radical

D) Formyl cation

99. The first step in Aldol condensation is:

A) Formation of an enolate ion

B) Protonation of the carbonyl

C) Nucleophilic substitution

D) Elimination of water

100. In the Cannizzaro reaction of benzaldehyde, the products are:

A) Benzyl alcohol + Sodium benzoate

B) Benzoic acid + Toluene

C) Phenylmethanol + Benzophenone

D) No reaction
