RESEARCH METHODOLOGY

1. What is a research hypothesis ?

(a) A statement of fact

(b) A testable prediction

(c) A conclusion drawn from data

(d) A research tool

2. Which of the following is *not* a type of research design ?

(a) Exploratory (b) Descriptive

(c) Conclusive (d) Narrative

3. What is the primary goal of exploratory research ?

(a) To gain insights and explore ideas

(b) To test hypotheses

(c) To confirm existing theories

(d) To collect quantitative data

4. Which of the following is a characteristic of qualitative research ?

(a) Seeks to understand meanings and experiences

(b) Focuses on numerical data

(c) Uses random sampling exclusively

(d) Involves statistical analysis

5. In research, what does 'sampling' refer to ?

(a) Choosing a research question

(b) Selecting a subset of a population

(c) Analyzing data

(d) Formulating a hypothesis

6. What is the main purpose of a literature review in research ?

(a) To gather data

(b) To summarize findings

(c) To identify gaps and justify research

(d) To formulate hypotheses

7. Which of the following is a potential source of error in research designs ?

(a) Bias (b) Control groups

(c) Random sampling (d) Variable manipulation

8. What role do variables play in research ?

(a) They are fixed elements

(b) They represent measurable traits or characteristics

(c) They are irrelevant to research

(d) They only exist in qualitative studies

9. Which of the following research designs focuses on establishing cause-and-effect relationships ?

(a) Descriptive (b) Exploratory

(c) Causal (d) Historical

10. Which term describes the ethical obligation to report findings truthfully ?

(a) Scientific misconduct (b) Research integrity

(c) Intellectual honesty (d) Conflicts of interest

11. What is the role of propositions in theory building ?

(a) They serve as standalone theories

(b) They are relationships that can be tested

(c) They are irrelevant to research

(d) They only exist in qualitative studies

12. What distinguishes conclusive research from exploratory research ?

(a) It uses qualitative methods

(b) It aims to provide final answers

(c) It is less structured

(d) It only involves surveys

13. Which of the following is a key principle of research ethics ?

(a) Fabrication of data

(b) Plagiarism

(c) Informed consent

(d) Ignoring conflicts of interest

14. In which of the following is the 'impact factor' primarily used ?

(a) Qualitative Research (b) Descriptive Research

(c) Experimental Research (d) Academic Publishing

15. Which of the following describes 'falsification' in research misconduct ?

(a) Copying someone else's work

(b) Misrepresenting research data

(c) Making false claims about authorship

(d) Not citing sources

16. What is the primary focus of descriptive research ?

(a) To find cause-and-effect relationships

(b) To provide a detailed account of a phenomenon

(c) To explore new areas of study

(d) To test hypotheses

17. Which research method is typically used for gathering qualitative data ?

(a) Surveys (b) Experiments

(c) Interviews (d) Case studies

18. Which of the following is a criterion for evaluating research sources ?

(a) Popularity (b) Author's age

(c) Length (d) Relevance

19. What does ICT stand for in the context of research ?

(a) Information and Communication Technology

(b) Information Collection Techniques

(c) Integrated Communication Tools

(d) International Collaborative Teams

20. In which stage of the research process are objectives formulated ?

(a) Data collection (b) Literature review

(c) Research design (d) Analysis

21. What is the significance of referencing in research ?

(a) To embellish the paper

(b) To acknowledge sources and avoid plagiarism

(c) To make the paper longer

(d) To confuse readers

22. What type of error occurs when a researcher fails to control for extraneous variables ?

(a) Systematic error (b) Random error

(c) Measurement error (d) Sampling error

23. Which type of sampling involves selecting participants based on specific characteristics ?

(a) Random sampling (b) Convenience sampling

(c) Stratified sampling (d) Purposive sampling

24. What is the primary aim of causal research ?

(a) To explore relationships

(b) To describe phenomena

(c) To establish a cause-effect relationship

(d) To gather qualitative data

25. Which of the following describes the term 'plagiarism' ?

(a) Collaborating without acknowledgement

(b) Falsifying data

(c) Using someone else's work without credit

(d) Misrepresenting findings

26. What is one of the main objectives of conclusive research ?

(a) To provide conclusive evidence

(b) To explore ideas

(c) To generate new theories

(d) To gather exploratory data

27. What type of research focuses on events that have already occurred ?

(a) Historical (b) Experimental

(c) Descriptive (d) Exploratory

28. Which of the following best describes 'scientific misconduct' ?

(a) Ethical research practices

(b) Ignoring conflicts of interest

(c) Any violation of ethical standards in research

(d) Thorough data analysis

29. What does qualitative data typically consist of ?

(a) Numbers and statistics (b) Experimental results

(c) Graphs and charts (d) Text, interviews, and observations

30. Which of the following is an example of a secondary data source ?

(a) A survey conducted by the researcher

(b) A laboratory experiment

(c) Interviews conducted by the researcher

(d) Government statistics

31. In research, what is a 'theory' ?

(a) A guess

(b) A proven fact

(c) A systematic explanation of phenomena

(d) An anecdotal observation

32. Which of the following is an essential aspect of research integrity ?

(a) Avoiding all criticism

(b) Ignoring dissenting opinions

(c) Acknowledging contributions of others

(d) Overstating the significance of findings

33. Which referencing style is most commonly used in social sciences ?

(a) APA (b) MLA

(c) Chicago (d) Harvard

34. What is an impact factor ?

(a) A measure of a journal's quality

(b) A tool for qualitative research

(c) A statistical method for data analysis

(d) A type of sampling technique

35. What is the rationale for using qualitative research ?

(a) To quantify results

(b) To understand complex behaviors and social phenomena

(c) To conduct experiments

(d) To gather numerical data only

36. Which of the following terms refers to an error that occurs due to chance ?

(a) Systematic error (b) Sampling error

(c) Measurement error (d) Random error

37. What is the role of indexing and citation databases in research ?

(a) To limit access to research

(b) To promote unethical research

(c) To track and evaluate research outputs

(d) To confuse researchers

38. In qualitative research, what is a common method of data collection ?

(a) Randomized controlled trials

(b) Surveys with closed questions

(c) Focus groups

(d) Statistical analysis

39. What does the term 'conflicts of interest' refer to in research ?

(a) When researchers are unbiased

(b) When personal interests affect research integrity

(c) When researchers work collaboratively

(d) When data is misinterpreted

40. Which of the following is a key component of ethical research conduct ?

(a) Ignoring ethical guidelines

(b) Transparency in data reporting

(c) Misrepresenting authorship

(d) Fabricating data

41. What is the focus of historical research ?

(a) Present data analysis (b) Future predictions

(c) Understanding past events (d) Causal relationships

42. In research, what does 'data interpretation' involve ?

(a) Collecting new data

(b) Analyzing and making sense of data

(c) Conducting interviews

(d) Writing the research proposal

43. Which of the following best describes 'data triangulation' ?

(a) Using multiple methods or data sources to enhance credibility

(b) Collecting data from a single source

(c) Focusing solely on quantitative data

(d) Analyzing data without context

44. What is one of the main functions of a research design ?

(a) To gather irrelevant data

(b) To outline the research approach

(c) To ignore ethical considerations

(d) To present data without analysis

45. What does it mean to 'fabricate' data in research ?

(a) To collect data ethically

(b) To summarize findings accurately

(c) To analyze data thoroughly

(d) To create false data or results

46. What is a common tool used for qualitative data analysis ?

(a) SPSS (b) NVivo

(c) Excel (d) R

47. Which of the following research methods is most suitable for studying small, specific groups ?

(a) Surveys (b) Experiments

(c) Case studies (d) Longitudinal studies

48. What is the purpose of publication ethics ?

(a) To ensure fair and honest reporting in research

(b) To promote unethical practices

(c) To prioritize personal gain

(d) To limit research collaboration

49. Which of the following represents a qualitative data analysis method ?

(a) Correlation analysis (b) ANOVA

(c) Regression analysis (d) Thematic analysis

50. What role does ICT play in modern research ?

(a) It complicates the research process

(b) It has no impact on research

(c) It limits access to research findings

(d) It facilitates data collection and analysis

PHYSICS

51. The direction of grad ϕ is :

(a) tangent to level surface

(b) normal to level surface

(c) inclined at 45° to level surface

(d) arbitrary

52. The residue of $\frac{z}{(z-a)(z-b)}$ at infinity is :

(a) a/b (b) $-b/a$

(c) 1 (d) -1

53. If $A = \begin{bmatrix} 1 & 2 & 3 \\ 2 & 4 & 6 \\ 3 & 6 & 9 \end{bmatrix}$, then rank of A is :

(a) 1 (b) 2

(c) 3 (d) 0

54. The dimensional representation of Planck's constant is identical to that of :

(a) torque (b) work

(c) stress (d) angular momentum

55. The magnitude of the sum of the two vectors is equal to the difference of their magnitudes. What is the angle between the vectors ?

(a) 0° (b) 45°

(c) 90° (d) 180°

56. If $P_n(x)$ = is the Legendre polynomial of order n, then $3x^2 + 3x + 1$ can be expressed as :

(a) $2P_2 + 3P_1$ (b) $4P_2 + 2P_1 + P_0$

(c) $3P_2 + 3P_1 + P_0$ (d) $2P_2 + 3P_1 + 2P_0$

57. If a co-ordinate is cyclic, Hamiltonian would reduce the number of variables in new formulation by :

(a) 1 (b) 2

(c) 3 (d) 4

58. The number of degrees of freedom of the bob of simple pendulum oscillating in a plane is :

(a) 5 (b) 3

(c) 2 (d) 1

59. The constraint on a bead on a circular wire is :

(a) holonomic

(b) non-holonomic

(c) rheonomic

(d) both holonomic and rheonomic

60. The mass of an electron is double its rest mass then the velocity of the electron is :

(a) $c/2$ (b) $2c$

(c) $\sqrt{3}\,c/2$ (d) $\sqrt{2}\,c$

61. For a one-dimensional harmonic oscillator, the representative point in two-dimensional phase space traces :

(a) an ellipse (b) a parabola

(c) a hyperbola (d) always a straight line

62. Jacobi identity for Poisson Bracket is :

(a) [X, [Y, H]] + [Y, [H, X]] + [H, [X, Y]]

(b) [X, [Y, H]] – [Y, [H, X]] + [H, [X, Y]]

(c) [X, [Y, H]] + [Y, [H, X]] – [H, [X, Y]]

(d) [X, [Y, H]] – [Y, [H, X]] – [H, [X, Y]]

63. A cylinder of radius R and length L is placed in uniform electric field E parallel to the cylinder axis. The total electric flux from the surface of the cylinder is :

(a) $2\pi R^2 E$ (b) $\pi R^2 E$

(c) $2\pi R^2/E$ (d) zero

64. Two parallel metal plates having charges + Q and –Q face each other at a certain distance between them. If the plates are now dipped in kerosene oil tank, the electric field between the plates will :

(a) become zero (b) increase

(c) decrease (d) remain same

65. The Laplace's equation in CGS Gaussian system is :

(a) $\nabla^2 V = -\rho/\varepsilon_0$ (b) $\nabla^2 V = -4\pi\rho$

(c) $\nabla^2 V == -4\pi\sigma$ (d) $\nabla^2 V = 0$

66. Two wires of same length are shaped into a square and a circle. If they carry same current then ratio of their magnetic moments is :

(a) 2 : π (b) π : 2

(c) π : 4 (d) 4 : π

67. A solenoid 1.5 m long and 0.4 cm in diameter possesses 10 turns per cm length. A current of 5A flows through it. The magnetic field at the axis inside the solenoid is :

(a) $2\pi \times 10^{-3}$T (b) $2\pi \times 10^{-5}$T

(c) $4\pi \times 10^{-2}$T (d) $4\pi \times 10^{-5}$T

68. Two solenoids of equal number of turns have their lengths and radii in the same ratio 1 : 2. The ratio of their self inductances will be :

(a) 1 : 2 (b) 2 : 1

(c) 1 : 1 (d) 1 : 4

69. The electric field of an electromagnetic wave travelling through vacuum is given by the equation $E = E_0 \sin(kx - \omega t)$. The quantity that is independent of wavelength is :

(a) k/ω (b) $k\omega$

(c) k (d) ω

70. The commutation relation for the operator x and d/dx gives :

(a) zero (b) 1

(c) -1 (d) x

71. The lowest energy possible for a particle in a potential box is 2 eV. The next higher energy the particle can have is :

(a) 4 eV (b) 8 eV

(c) 16 eV (d) 32 eV

72. The eigen value associated with an Hermitian operator is :

(a) imaginary (b) complex

(c) real (d) None of these

73. Which of the following is an eigen function of L_z ?

(a) $e^{i\phi}$ (b) $\sin\phi$

(c) $\cos\phi$ (d) $\cos^2\phi$

74. The Born approximation is applicable for :

(a) high energy, low atomic number for scatterer

(b) low energy, low atomic number for scatterer

(c) high energy, high atomic number for scatterer

(d) low energy, high atomic number for scatterer

75. The time independent Schrödinger equation of a system represent the conservation of the :

(a) total binding energy of the system

(b) total potential energy of the system

(c) total kinetic energy of the system

(d) total energy of the system

76. For a thermo dynamical system P, V, T, U, Q and S represent pressure, volume, temperature, internal energy, heat and entropy respectively. Then the combined form of first and second law of thermodynamics is :

(a) $TdS = dU + PdV$

(b) $dQ = TdS + PdV$

(c) $dU = TdS + dQ$

(d) $TdS = dU - PQ$

77. On a temperature-entropy diagram, the isothermals are :

(a) straight lines parallel to the temperature axis

(b) straight lines parallel to the entropy axis

(c) straight lines inclined at any angle

(d) rectangular parabola

78. A Carnot engine operates between 327°C and 27°C. How much heat does it take from the 327°C reservoir for every 100 J of work done ?

(a) 100 J (b) 200 J

(c) 300 J (d) 400 J

79. In a canonical ensemble, a system X of fixed volume is in contact with a large reservoir Y. Then :

(a) X can exchange only energy with Y

(b) X can exchange only particles with Y

(c) X can exchange neither energy nor particles with Y

(d) X can exchange both energy and particles with Y

80. Number of co-ordinates in the phase space of a single particle is :

(a) 2 (b) 3

(c) 5 (d) 6

81. For a black body radiation in cavity, photons are created and annihilated freely as a result of emission and absorption by the walls of the cavity. This is because :

(a) the chemical potential of photons is zero

(b) photons obey Pauli exclusion principle

(c) photons are spin-1 particles

(d) the entropy of photons is very large

82. The doublets observed in alkali spectra are due to :

(a) screening of the K electrons

(b) spin-orbit interaction of the electrons

(c) pressure of isotope

(d) compton effect

83. The exciting line in an experiment is 5660 Å and Stoke's line is 5520 Å. The wavelength of anti-Stoke's line is :

(a) 5210 Å (b) 4310 Å

(c) 5401 Å (d) 5308 Å

84. In the first order Stark effect in hydrogen atom, the ground state :

(a) splits in two levels

(b) splits in three levels

(c) splits in four levels

(d) does not split

85. Russel-Saunder's coupling is also called as :

(a) LS coupling (b) LJ coupling

(c) JJ coupling (d) SJ coupling

86. The number of Zeeman components for $^2D_{3/2} \rightarrow {}^3P_{3/2}$ transition in one electron atom will be :

(a) 6 (b) 8

(c) 10 (d) 12

87. The Lande g factor for an energy state with L = 1 and J = 3/2 is :

(a) 1/3 (b) 1/2

(c) 3/2 (d) 4/3

88. In a Ruby laser, Ruby crystal is made of :

(a) chromium oxide with small percentage of aluminium oxide

(b) aluminium oxide with small percentage of chromium oxide

(c) aluminium oxide with small percentage of manganese oxide

(d) manganese oxide with small percentage of chromium oxide

89. If 0.28 nm is the interionic distance in NaCl crystal, the lattice parameter is :

(a) 0.14 nm (b) 0.56 nm

(c) 0.08 nm (d) 0.07 nm

90. A plane intercepts at a, $b/2$, $3c$ in a simple cubic unit cell. The Miller indices of the plane are :

(a) (1 3 2)

(b) (2 6 1)

(c) (3 6 1)

(d) (1 2 3)

91. Transition temperature (T_c) and critical field (H_c) for a superconductor are related as :

(a) $H_c = H_0 (T_c - 1)$

(b) $H_c = H_0 (T_c + 1)$

(c) $T_c = T_0 [1 - (H_0/H_c)^2]$

(d) $H_c = H_0 [1 - (T/T_c)^2]$

92. In superconductor state :

(a) entropy increases and thermal conductivity decreases

(b) entropy and thermal conductivity decrease

(c) entropy and thermal conductivity increase

(d) entropy decreases and thermal conductivity increases

93. The unit of Hall coefficient is :

(a) $Vm^3A^{-1}Wb^{-1}$

(b) Vm^2AWb^{-1}

(c) Vm^3AWb

(d) $Vm^2A^{-2}Wb$

94. .Which of the following can never be the cause of Point defects in crystals ?

(a) irradiation with X-rays

(b) elastic deformation

(c) plastic deformation

(d) quenching from high temperatures

95. The density (d) of nuclear matter varies with nucleon number A as :

(a) $d \propto A^3$ (b) $d \propto A^2$

(c) $d \propto A$ (d) $d \propto A^0$

96. If the binding energy of deuterium is 2.23 MeV, the mass defect given in amu is :

(a) 0.0036 (b) 0.0048

(c) 0.0012 (d) 0.0024

97. Nuclear fission was explained by Meitner and Frisch on the basis of :

(a) independent particle model of nucleus

(b) shell model of nucleus

(c) liquid drop model of the nucleus

(d) meson theory of the nuclear forces

98. Enriched uranium is used in nuclear reactors because, it contain greater proportion of :

(a) U^{238} (b) U^{235}

(c) U^{239} (d) U^{234}

99. The half life of radium is 1600 years. The fraction of a sample of radium that would remain after 6400 years is :

(a) 2/4 (b) 1/2

(c) 1/8 (d) 1/16

100. The mother and daughter elements, with the emission of gamma rays are called :

(a) isotopes (b) isobars

(c) isomers (d) isodiaphers