

Total No. of Printed Pages: 06

No. of Questions : 50

Dr. Babasaheb Ambedkar Marathwada University, Chhatrapati Sambhajinagar
PET 2024 (9018) Doctor of Philosophy (Physics)

(To be filled by the Candidate)

Candidate Seat Number
(As per Admit card)

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OMR Sheet Number

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Invigilator's signature with Date

Candidate's Seat No. in Words : _____

Name of the Center : _____

Paper Code & Name of Examination : **9018- Doctor of Philosophy (Physics)**Date: **03/10/2024****PET 2024 - EXAMINATION**Time: **One Hours**Total Marks: **100****Important Instructions for the candidate**

- Write your seat number and OMR Sheet number on the question paper in the earmarked space
- This question paper carries Fifty (50) Multiple-choice type questions and each question carries 2 Marks
- At the commencement of examination, the question paper will be given to the student.
- Each question has four alternative responses marked (A) (B) (C) and (D). You have to darken the circle as indicated below on the correct response against each question
Example: where (C) is correct answer

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- Your responses to the answer are to be indicated in the OMR Sheet. If you mark at any place other than in the circle in the OMR Sheet it will not be evaluated.
- Rough work is to be done at the end of this question paper.
- You have to return OMR answer sheet and question paper to the invigilator at the end of examination compulsorily and must not carry with you outside the examination hall.
- Use only Black / Blue ball point pen
- Use of any type of calculator or log table etc. is prohibited.
- There is no negative marking for incorrect answers

विद्यार्थ्यांसाठी महत्त्वाच्या सूचना

- परीक्षार्थींनी आपला आसन क्रमांक या पृष्ठावरील वरच्या कोपऱ्यात तसेच आपणास दिलेल्या उत्तर पत्रिकेचा क्रमांक त्याखाली लिहावा.
- या प्रश्नपत्रिकेतील सर्व प्रश्न सोडवणे अनिवार्य आहे.
- परीक्षा सुरू झाल्यावर विद्यार्थ्यांला प्रश्नपत्रिका दिली जाईल.
- प्रत्येक प्रश्नासाठी (A) (B) (C) (D) अशी चार विकल्प उत्तरे दिली आहेत, त्यातील योग्य उत्तराचा रकाना खाली दर्शविल्याप्रमाणे ठळकपणे काळा निळा करावा.
उदा: जर (C) हे उत्तर योग्य असेल तर

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- या प्रश्नपत्रिकेतील प्रश्नांची उत्तरे ओएमआर उत्तर पत्रिकेतच दर्शवावीत इतर ठिकाणी लिहिलेली उत्तरे तपासली जाणार नाहीत.
- प्रश्नपत्रिकाच्या शेवटी कोऱ्या जागेवरच कच्चे काम करावे
- परीक्षा संपल्यानंतर विद्यार्थ्यांनी मूळ ओ. एम. आर उत्तरपत्रिका पर्यवेक्षकाकडे परत करणे आवश्यक आहे तथापि प्रश्नपत्रिका व ओ. एम. आर. उत्तरपत्रिका आपल्याबरोबर नेण्यास विद्यार्थ्यांला परवानगी नाही.
- फक्त काळ्या किंवा निळ्या बॉलपेनचाच वापर करावा
- कॅल्क्युलेटर किंवा लॉग टेबल वापरण्यास परवानगी नाही
- चुकीच्या उत्तरासाठी गुण कपात केली जाणार नाही

- | Q. No. | Question |
|--------|---|
| 1. | <p>Research is a — — — —.</p> <p>(A) Searching again and again
 (B) Searching solution to a problem
 (C) Working in a scientific manner to solve problem
 (D) Random collection of data</p> |
| 2. | <p>Much priorities in research demands — — — —.</p> <p>(A) Novelty
 (B) Social Relevance
 (C) Reliability
 (D) All of these</p> |
| 3. | <p>Which is the prior step in starting the research?</p> <p>(A) Literature Survey
 (B) Identification of a problem
 (C) Finding solution to a problem
 (D) Both (A) and (B)</p> |
| 4. | <p>Objectives of the research includes enhancement of — — — —.</p> <p>(A) Learning Capabilities
 (B) Thinking capabilities
 (C) Analytical capabilities
 (D) All of these</p> |
| 5. | <p>Which of the following is not the characteristics of the research?</p> <p>(A) Writing Reports
 (B) Logical
 (C) Analytical
 (D) Empirical</p> |
| 6. | <p>Which is not the prerequisite for research?</p> <p>(A) Socio-economic status
 (B) Fertile imaginative capacity
 (C) Proper selection of research topic
 (D) Availability of necessary facilities</p> |
| 7. | <p>What are the essential things in research?</p> <p>(A) Patience
 (B) Proper guidance
 (C) Resources
 (D) All of these</p> |
| 8. | <p>The essential qualities of the researcher are — — — —.</p> <p>(A) Spirit of free enquiry
 (B) Reliance on observation
 (C) Theorizing of knowledge
 (D) All of these</p> |
| 9. | <p>Formulation of hypothesis is followed by — — — —.</p> <p>(A) Objectives
 (B) Analysis of data
 (C) Selection of research tools
 (D) Collection of data</p> |
| 10. | <p>Validation of hypothesis requires — — — —.</p> <p>(A) Objectives
 (B) Results and discussions
 (C) Methodology
 (D) Both (A) and (C)</p> |
| 11. | <p>What make people to undertake research?</p> <p>(A) To get a research degree
 (B) Service to society
 (C) Challenge in solving unsolved problems
 (D) All of these</p> |
| 12. | <p>Which of the following is not a data collection method?</p> <p>(A) Research questions
 (B) Unstructured interviewing
 (C) Postal survey questionnaires
 (D) Participant observations</p> |

13. Which of the following processes is not needed in experimental research?
 (A) Reference collection (B) Controlling
 (C) Observations (D) Manipulation and replication
14. Research is based upon — — — —.
 (A) Rating scale (B) Experiments
 (C) General principles (D) Scientific methods
15. Reliability is the fundamental quality of the research which also reflects — — — —.
 (A) Superiority (B) Purity of data
 (C) Validity (D) Verifiability
16. Data of the research is — — — —.
 (A) Qualitative only (B) Quantitative only
 (C) Both a and b (D) Either a or b
17. The research is always — — — —.
 (A) Exploring new knowledge (B) Verifying old knowledge
 (C) Including both of these (D) Filling gap between the knowledge
18. The following are the features of good research students except — — — —.
 (A) Replicability (B) Systematic
 (C) Ethical and unbiased (D) Unethical and biased
19. Which are the sources of primary data in research?
 (A) Survey (B) Experiments
 (C) Analysis (D) Both (A) and (B)
20. A systematic step by step procedure following logical process of reasoning is called — — — —.
 (A) Experiments (B) Observation
 (C) Scientific methods (D) Analysis
21. An essential criterion of scientific study is — — — —.
 (A) Belief (B) Objectives
 (C) Values (D) Subjective
22. The determination of the need for research lies on — — — —.
 (A) Time constraints (B) Availability of data
 (C) Nature of the decision (D) All of these
23. Research method is a part of — — — —.
 (A) Research methodology (B) Experiments
 (C) Research Techniques (D) Problems
24. In the formulation of the problem, we need to give a — — — —.
 (A) Title (B) Index
 (C) Bibliography (D) Concepts
25. Last step in problem formulation is — — — —.
 (A) Survey (B) Discussion
 (C) Rephrasing the research problems (D) Literature survey

26. The probability density function ($|\Psi(x, t)|^2$) represents — — — —.
- (A) The probability of finding the particle at position (x) and time (t)
 (B) The phase of the wave function
 (C) The energy of the particle
 (D) The momentum of the particle
27. The commutation relation between the position operator [x] and momentum operator [p] in quantum mechanics is given by — — — —.
- (A) $[yp_y - p_y y] = [y, p_y] = -i\hbar$
 (B) $[zp_y - p_y z] = [z, p_y] = -i\hbar$
 (C) $[yp_z - p_z y] = [y, p_z] = -i\hbar$
 (D) $[xp_x - p_x x] = [x, p_x] = i\hbar$
28. The time independent Schrodinger equation is applicable for — — — —.
- (A) Non stationary quantum systems (B) Time dependent potentials
 (C) Stationary quantum states (D) Relativistic quantum states
29. Which of the following conditions is necessary for Bose-Einstein condensation to occur in an ideal gas of bosons?
- (A) The temperature must be below the critical temperature (T_c)
 (B) The particle must obey Fermi-Dirac statistics
 (C) The gas must be in a strong magnetic field
 (D) The temperature must be higher than the critical temperature (T_c)
30. The critical temperature (T_c) for Bose-Einstein condensation in an ideal gas is dependent on which of the following factors?
- (A) Only the mass of the boson (B) Only the density of the boson
 (C) Both mass and density of bosons (D) Only the volume of the gas
31. The Bragg Williams approximations is used in which of the following field?
- (A) Quantum Mechanics (B) Statistical Mechanics
 (C) Classical Mechanics (D) Electrodynamics
32. A rigid body moving freely in space has — — — — degrees of freedom.
- (A) 3 (B) 4
 (C) 6 (D) 5
33. The first integral of motion is — — — —.
- (A) linear integral (B) Jacobi's integral
 (C) Both (A) and (B) (D) none of the above
34. When “e” is eccentricity and “E” is energy, then condition for elliptical orbit is — — — —.
- (A) $E > 0, e = 1$ (B) $E < 0, e = 1$
 (C) $E > 0, e = 0$ (D) $E < 0, e < 1$
35. The Eigen values of matrix $\begin{bmatrix} \cos \theta & \sin \theta \\ \sin \theta & \cos \theta \end{bmatrix}$ are — — — —.
- (A) $\pm \cos \theta$ (B) $\pm e^{i\theta}$
 (C) $\pm \sin \theta$ (D) $\cos \theta \pm \sin \theta$

36. The sum of Eigen values of $\begin{bmatrix} 1 & 3 \\ 3 & 0 \end{bmatrix}$ is — — — —.
- (A) 1 (B) 3
(C) 6 (D) $\sqrt{37}$
37. Using De Moivre's theorem $\frac{(\cos 3\theta + i \sin 3\theta)}{(\sin 4\theta + i \cos 4\theta)} =$ — — — —.
- (A) $(\cos 7\theta - i \sin 7\theta)$ (B) $(\cos \theta + i \sin \theta)$
(C) $(\cos 12\theta + i \sin 12\theta)$ (D) $(\cos 7\theta + i \sin 7\theta)$
38. For an ideal op-amp the value of open loop gain is — — — —.
- (A) Zero (B) 0.5
(C) 1 (D) Infinite
39. Slew rate of op-amp is measured in — — — —.
- (A) m/s (B) V/s
(C) V/Hz (D) None of the above
40. The output of a particular op-amp increases 4V in 8 μ s. The slew rate is — — — —.
- (A) 32 V μ s (B) μ s/V
(C) 0.5 V / μ s (D) 2.0 V / μ s
41. While propagating Electromagnetic wave, field vectors can be propagated as — — — —.
- (A) Field (B) Vector
(C) Independent (D) Wave
42. If the refractive index of the first medium is 1.5 times that of second medium, then for normal incidence, the reflection coefficient is — — — —.
- (A) 0.02 (B) 0.04
(C) 0.4 (D) 4.4
43. If the velocity of an electromagnetic wave is 3×10^8 m/s and the wavelength of wave is 30 cm, the frequency of the wave is — — — —.
- (A) 0.5 GHz (B) 1.33 GHz
(C) 1 GHz (D) 1.5 GHz
44. Repeatable entity of a crystal structure is known as — — — —.
- (A) Crystal (B) Lattice
(C) Unit cell (D) Miller indices
45. Atomic packing factor is — — — —.
- (A) Distance between two adjacent atoms (B) Projected area fraction of atoms
(C) Distance between two line (D) Volume fraction of atoms in cell
46. On the basis of length and interfacial angles of a unit cell, the crystal have been divided into — — — —.
- (A) Fourteen structures (B) Thirty two structures
(C) Five structures (D) Seven structures
47. Radioactivity is the characteristic of which of the following?
- (A) Electron (B) Proton
(C) Neutron (D) Nucleus

48. Thorium ($^{90}\text{Th}_{232}$) has a half-life of — — — —.
- (A) 13.9×10^9 years (B) 4.5×10^9 years
(C) 1.5×10^9 years (D) 2.2×10^6 years
49. The wave function for identical fermions is anti-symmetric under particle interchange. Which of the following is a consequence of this property?
- (A) Pauli exclusion principle (B) Bohr correspondence principle
(C) Heisenberg uncertainty principle (D) Bose-Einstein condensation
50. Consider the following statements: Stern and Gerlach experiment gives a direct and convincing confirmation of:
1. Space quantization.
 2. Wave nature of electron.
 3. Spin of electron.
 4. Quantized atomic magnetic moment.
- Which of the above statements are correct?
- (A) 3 and 4 (B) 1, 2 and 4
(C) 1, 3 and 4 (D) 1 and 2
