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

Booklet Serial No. 000617 **Test Booklet Series**

TEST BOOKLET - 2022
SCIENTIFIC OFFICER PHYSICS
(05)

A

Time Allowed: Two Hours ***Maximum Marks: 120***

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 Response Sheet. Any omission/discrepany 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 **120** items (questions). Each item comprises of four responses (answers). You will select the response which you want to mark on the 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 Response Sheet provided. See directions in the Response Sheet.
6. All items carry equal marks.
7. Before you proceed to mark in the Response sheet the response to various items in the Test Booklet you have to fill in some particulars in the 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 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. **Penalty for wrong answers:**
    THERE WILL BE PENALTY FOR WRONG ANSWERS MARKED BY THE CANDIDATE.
    (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) It 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. India's first central forensic science laboratory was established in Calcutta in year :

A) 1954 B) 1957

C) 1968 D) 1970

2. What is the velocity of light in diamond, if the refractive index of diamond with respeect to vacuum is 2.5?

A) 1.2×10^8 B) 1.2×10^{10}

C) 2.5×10^8 D) 3.5×10^8

3. Which of the following process is used to do maximum work done on the ideal gas if the gas is compressed to half of its initial volume?

A) Isothermal B) Isobaric

C) Thermal D) Adiabatic

4. Which among the following is considered as best measure for central tendency?

A) Geometric mean B) Arithmetic mean

C) Mode D) Harmonic mean

5. Which of the following increases the likelihood of a Type II error when conducting a t-test?

A) High random error B) Low Random error

C) Large sample size D) Difference in means

6. Testimony of government scientific expert is accepted under :

A) Section - 46 Indian Evidence Act

B) Section - 293 Indian Penal Code

C) Section - 293 CrPC

D) Section - 292 Indian Evidence Act

7. In order to reduce the temperature of boiling water in a flask, one should :

A) Connect the mouth of flask with compressor

B) Connect the mount of the flask with evacuating system

C) Supply heat from less intense source

D) Reduce the surrounding temperature

8. If the ball is thrown up vertically and return to the ground, its potential energy is maximum

A) During the upward journey B) During the downward journey

C) At maximum height D) At the bottom

9. Which of the following equation represents a straight line?

A) $y = ax$ B) $y = b*a$

C) $y = b+mx$ D) $y = b^2+c^2$

10. A batsman hits a cricket ball, it rolls over the ground and after covering some distance it comes to a rest. The reason for stopping of ball is :

A) There is an opposing force towards the motion of ball

B) Velocity of the ball depends upon the force exerted on it

C) The ball was not hit hard enough

D) None of the above

11. The drugs and cosmetic act was enacted in:

A) 2000 B) 1950

C) 1985 D) 1940

12. A body is said to move in simple harmonic motion if its acceleration is :

A) Proportional to square of the distance from the point of reference

B) Always directed away from the centre, at the point of reference

C) Proportional to the distance from the point of reference and directed towards it

D) Opposite to the distance from the point of reference

13. Motion of sound waves in air is :

A) Longitudinal B) Transverse

C) Polarized D) Electromagnetic

14. The process of joining two small ice pieces by pressing them against each other can be explained by phenomena of :

A) Refrigeration B) Annealing

C) Radiation D) Regelation

15. If the angular speed of the rotor increases, its power :

A) Decreases B) Increases

C) Remains constant. D) First increase and then increases

16. Which method is used to determine the purity of metal?

A) Archimedes Principle B) Pascal's law

C) Hooke's law D) Boyle's law

17. Red colour of sun at sunrise and sunset is due to :

A) Dispersion of light B) Reflection of light

C) Scattering of light D) Diffraction of light

18. In the case $v<<c$, Lorentz transformation is the same as _____

A) Galilean transformation B) Einstein's transformation

C) Maxwell's transformation D) Planck's transformation

19. The instrument used to study the laws of vibrating string is :

A) Hydrometer B) Sonometer

C) Hygrometer D) Electrometer

20. Police inquest is conducted under section :

A) 174 IPC
B) 176 IPC
C) 176 CrPC
D) 174 CrPC

21. Michelson Stellar Interferometer is used to measure :

A) Refractive index
B) Density
C) Angular diameter of star
D) Wavelength

22. Hollow Cathode Lamp (HCL) is used in the following :

A) Atomic Absorption Spectrometer
B) Atomic Emission Spectrometer
C) X-ray Fluorescence Spectrometer
D) Inductively Coupled Plasma.

23. For a freely falling body, which among the following does not change :

A) Velocity
B) Total Mechanical energy
C) Total Potential energy
D) Total Kinetic energy

24. Two ends of a tube are closed by corks so that the tube becomes airtight. The pressure of air inside the tube is :

A) Very small
B) Dependent on the tube length
C) Slightly less than atmospheric pressure
D) Equal to the atmospheric pressure

25. Going through a loop on a roller coaster is an example of :

A) Centrifugal force
B) Centripetal force
C) Buoyant force
D) Mechanical force

26. Which among the following is not a real time Operating system?

A) Vx Works

B) QNX

C) Palm OS

D) RTLinux

27. '.INI' extension refers usually to what kind of file?

A) Image file

B) Hyperlink file

C) Audio file

D) System file

28. Vibration in tuning fork induced by playing some tune on the speaker, can be explained by:

A) Doppler's effect

B) Refraction of sound

C) Resonance

D) Damping

29. The building collapse during the earthquake because :

A) Building's natural frequency is equal to frequency of earthquake

B) Building's natural frequency is smaller than the frequency of earthquake

C) Building's natural frequency is higher than the frequency of earthquake

D) Building's natural frequency mismatches with the frequency of earthquake

30. If a man's face is 25 cm in front of concave shaving mirror producing erect image 1.5 times the size of face, focal length of the mirror would be :

A) 25 cm B) 75 cm

C) 15 cm D) 35 cm

31. An unpolarised light beam of intensity E_0 falls on the Polaroid, producing an emergent beam of intensity :

A) $2E_0$ B) E_0^2

C) $E_0/2$ D) Zero

32. Dielectric constant for pure water is :

A) Infinite B) 81

C) 1 D) 0

33. If the density of air is 1.30g/lit, what will be the volume occupied by 6.5 g of air?

A) 7.5 lit B) 6 lit

C) 6.5 lit D) 5 lit

34. Einstein was awarded with Nobel prize for :

A) General theory of relativity B) Special theory of relativity

C) Photoelectric emission D) Explanation for Brownian motion

35. For an ideal gas, the value of C_v/C_p is :

A) <1 B) >1

C) $=1$ D) Zero

36. Calculate the mass of ice required to lower the temperature of 200 g of water at 40°C to water at 0°C. (Specific latent heat of ice = 336 J/g, Specific heat capacity of water = 4.2 J/g°C).

A) 200 g B) 150 g

C) 100 g D) 50 g

37. A ball resting on the top of book is an example of :

A) Unstable equilibrium B) Stable Equilibrium

C) Neutral Equilibrium D) Perfect Equilibrium

38. The difference between the expected value of a statistic and the value of the parameter being estimated is called a :

A) Standard deviation
B) Standard error
C) Bias
D) Sampling error

39. Equal volumes of all gases under similar conditions of temperature and pressure contain equal numbers of molecules. This statement was given by :

A) Gay - Iussae
B) Avogadro
C) Maxwell
D) Richard Towneley

40. The law that studies the blackbody light emission phenomena at different temperature is called as :

A) Hook's law
B) Planck's law
C) Maxwell law
D) Wien's law

41. The phenomena in which bending of light rays are actually refracted to form the false image at the observer's location is called :

A) Mirage
B) Birefringence
C) Diffraction
D) Scattering

42. Ideal packaging material for collection and preservation of mobile phone evidence is :

A) Paper bag
B) Faraday bag
C) Cardboard box
D) Molded fiber

43. Which method is used for particle size analysis of sample?

A) Floatation method
B) Becke line method
C) Density gradient method
D) Birefringence

44. If an electron and proton have same de - broglie wavelength, the kinetic energy of proton is :

A) Less than electron
B) More than electron
C) Same as electron
D) Double that of electron

45. Which of the following rules is used to identify the direction of the current induced in a wire moving in a magnetic field?

A) Faraday's law

B) Lenz's law

C) Ampere's law

D) Fleming's left hand rule

46. A digital device processes information in which form?

A) Continuous

B) Discrete

C) Quasiperiodic

D) Semi discrete

47. A coil induces 350 mV when the current changes at the rate of 1 A/s. The value of inductance is :

A) 3500 mH

B) 250 mH

C) 350 mH

D) 35 mH

48. Calculate the value of mean, when mode is 10 and the value of (mean - median) is 15.

A) 44

B) 55

C) 45

D) 50

49. Which among the following is first super computer developed India?

A) Pratyush (Cray XC40)

B) PARAM YUVA II

C) PARAM 8000

D) Mihir (Cray XC 40)

50. Specialised processes such as graphical and numerical methods are utilised in which of the following of statistics?

A) Descriptive
B) Business
C) Educational
D) Social

51. The electric field due to an infinitely long straight uniformly charged wire at a distance r is directly proportional to :

A) r
B) $1/r^2$
C) $1/r$
D) r^2

52. Unit to measure sound is :

A) Hertz
B) Angstorm
C) Joule
D) Decibel

53. Which of the following factors is the self inductance associated with a coil is independent of?

A) Coil resistance
B) Induced voltage
C) Current
D) Time

54. How eddy current can be produced in a bulk piece of conducting material?

A) By placing it under changing electric field
B) By placing it under uniform magnetic field
C) By rotating the conducting material
D) By changing magnetic field in the conductor

55. Spectroscopic technique ideally used to conduct elemental analysis of paint sample:

A) ICP
B) AAS
C) AES
D) NAA

56. The frequency variation of a sound produced by siren of an ambulance passing in front of you can be explained by :

A) Resonance effect

B) Doppler's effect

C) Psychoacoustic effect

D) Reverberation effect

57. Which among the following is an example of standalone application in computers?

A) Spreadsheets

B) Word processors

C) Google docs

D) Google chrome

58. Foot impression on snow surface can be best preserved using :

A) Sulphure casting

B) Plaster of Paris casting

C) Tracing

D) Wax casting

59. Momentum of a particle of radiating energy with wavelength of $2\mathring{A}$ is :

A) 4.4×10^{-14} kg-m/s

B) 2.5×10^{-14} kg-m/s

C) 1.4×10^{-14} kg-m/s

D) 3.3×10^{-14} kg-m/s

60. In sketching a scene of air crash, which among the following would be most appropriate method?

A) Strip method

B) Zonal method

C) Wheel method

D) Spiral method

61. Which among the following has highest penetration power?

A) X-rays
B) Gamma rays
C) Radio waves
D) UV rays

62. Epoxy resins are widely used in paint compositions as :

A) Pigments
B) Vehicle
C) Binders
D) Colorants

63. The secondary electrons radiated back in scanning microscope is collected by :

A) Specimen
B) Anode
C) Vacuum chamber
D) Cathode

64. A type I superconductor is :

i. A conductor with infintie conductivity at all temperatures
ii. A conductor with a very large conductivity below a critical temperature
iii. A material showing susceptibility - 1 below the critical temperature
iv. A pert conductor having conductivity drastically reduced by a critical current.

A) i, ii, iii
B) i, ii, iii, iv
C) ii, iii, iv
D) iii, iv

65. Radiation used for treatment of muscle pain is :

A) X-rays
B) Gamma rays
C) Infrared rays
D) Microwaves

66. Which of the following falls under the class characteristics of footwear impression?

A) Dimensions of the impression
B) Foreign material/inclusions
C) Wear and Tear patterns
D) Repair marks

67. The blue smoke seen coming out of 2 stroke or 4 stroke engines of motorcycle can be an result of :

A) Wien's law
B) Hooke's law
C) Charles' law
D) Tyndall effect

68. The effect that explains the expulsion of magnetic fields from the interior of normal material during its transition to the superconducting state is called

A) Meissner effect
B) Lenz's law
C) Compton effect
D) Zeeman's effect

69. Degree of scattering in transmission electron microscope is a function of _____

A) Wavelength of electron beam
B) Number of atoms that lie in the electron path
C) Mass of atoms that lie in the electron path
D) Number and mass of atoms that lie in the electron path

70. Reactions which can normally be observed on conducting micro - chemical test of paint samples may include :

i. Change in colour
ii. Dissolution of paint sample
iii. Effervescence of gases
iv. Scaling out of layers

A) i, ii, iii and iv
B) ii, iii and iv
C) i, ii and iii
D) ii and iii

71. A PMR spectrometer operates at 300 MHz. Find the value of magnetic field.

Given : $g_N = 5.585$ and $B_N = 5.05 \times 10^{-27}\ JT^{-1}$.

A) 8.08T
B) 7.05T
C) 7.25T
D) 6.55T

72. Optical components of UV Visible spectrophotometer are made up of :

A) Glass
B) PVC
C) Sodium halide bromide
D) Quartz

73. The law that allows scientists to figure out how hot the sun is based on how much power strikes the Earth in a square metre is :

A) Boyles' law
B) Planck's law
C) Stefan's law
D) Bohr's law

74. What type of scale is used to take close up shots of bite mark injuries :

A) ABFO
B) Steel Ruler
C) Seamstress Tape
D) Meted Stick

75. Reason for high applicability of superconductors in wide areas is :

A) They can manufacture bubble memories
B) They can generate very strong magnetic field
C) They can generate regions free from magnetic field
D) They can generate high electric field

76. The lower energy levels contain more atoms than upper level under the condition of :

A) Isothermal packaging
B) Pumping
C) Thermal equilibrium
D) Population inversion

77. The scientist who worked on the theory and application of the maser :

A) Enrico Fermi
B) Nikolay Basov
C) T.H. Maiman
D) C.H. Townes

78. Steps for crime scene investigation in proper format is :

A) Protection of scene, collection and disposal of evidence, interview of witness, photography
B) Photography, interview of witness, protection of scene, collection and disposal of evidence
C) Protection of scene, photography, collection and disposal of evidence, interview of witness
D) Photography, Protection of scene, collecetion and disposal of evidence, interview of witness

79. Which camera is best used for recording a crime scene?

A) Polaroid

B) 35 mm DSLR

C) 35 mm DTLR

D) Box camera

80. Who proposed the concept of the first gas laser?

A) Ali Javan

B) Michael Stephen Feld

C) J J Thomson

D) Homi Jehangir Bhabha

81. Which among the following fibers contains scales?

A) Cotton

B) Jute

C) Linen

D) Wool

82. Suitable material for casting of tool marks :

A) Plasticine

B) Acrylic sand

C) Faxfilm

D) Both A and B

83. Optical fibers are used in :

A) CAT scans

B) Endoscopy

C) MRI scans

D) PET scans

84. The perception of pitch, how high or low a tone is, is dependent on this property of sound waves.

A) Intensity
B) Intonation pattern
C) Frequency
D) Amplitude

85. Types of lenses used to take the close up shot at the crime site

A) Zoom lens
B) Wide angle lens
C) Fisheye lens
D) Micro lens

86. Which radiation source has electrode in its construction?

A) Tungsten lamp
B) Xenon Discharge Lamp
C) Mercury lamp
D) Hydrogen discharge lamp

87. An instrument has a sensitivity of 1000 ohm/volt. On the 100 volt scale, it will have internal resistance of :

A) 10 ohms
B) 10,000 ohms
C) 100,000 ohms
D) 100 ohms

88. Find the mean of tossing 4 coins :

A) 1
B) 2
C) 3
D) 4

89. Which among the following is a secondary memory device?

A) HDD
B) Flash memory
C) RAM
D) Cache memory

90. Torque/weight ratio of an instrument indicates :

A) Selectivity
B) Performance
C) Sensitivity
D) Accuracy

91. Percentage of loss on ignition of humus soil is nearly :

A) 20% B) 25%

C) 40% D) 50%

92. MCT detector is commonly used in which type of spectroscopy?

A) GC B) AES

C) FTIR D) NAA

93. In 1835, Henry Goddard was asked to investigate a burglary in Southampton, England. The butler said a shot had been fired as he struggled with the burglars. Goddard retrieved the bullet and disproved the butler's version of events by using which technique?

A) Studying the broken glass B) Comparison of bullet

C) Determining bullet trajectory D) Blood spatter analysis

94. In Scanning electron microscope, the incident beam is focused using :

A) Electromagnets B) Prism

C) Mirror D) Slits

95. Visible radiations in X - ray diffraction method is detected by :

A) Geiger counter B) Scintillation counter

C) Silicon diode D) Ionization detector

96. Linseed, poppy seed, walnut, Safflower are examples of :

A) Paint pigments B) Paint binders

C) Paint oils D) Paint solvents

97. Circumstantial evidence are used for :

A) Analyzing a crime scene for the presence of direct evidence

B) Implying a fact and to incriminate a person

C) Accepting eye witness testimony

D) Analyzing crime scene for extremely small items

98. Cadence is defined as :

A) Number of steps per unit time
B) Number of steps per unit distance
C) Angle of steps
D) Alignment of foot while walking

99. The material used for sealing or to impart stability to the POP cast of sunken footprint:

A) Shellac
B) Epoxy resin
C) Dental stone
D) Acrylate

100. In the X - ray diffraction of a set of crystal planes having d = 0.28 nm, first order reflection is found to be at an angle of 22°. The wavelength of X - rays is : (where sin22° = 0.374, Cos22° = 0.927)

A) 0.14561
B) 0.13464
C) 0.07151
D) 0.20944

101. Peening means :

A) Hammering the surface with round punch
B) Erasing the tool markers with chemical
C) Drilling the wooden surface
D) Inducing the new characteristics on the metal surface

102. Which soil horizon is best developed in forest soil?

A) A
B) B
C) E
D) F

103. On shutdown window, to start the computer type :

A) S
B) W
C) N
D) R

104. The fast moving car applies sudden brakes, it continue to skid on the road surface due to:

A) Torque
B) Momentum
C) Energy
D) Power

105. Crime Scene sketches provide detail which is/are not provided by photography and videography :

A) Condition of evidence

B) Distance and dimensions

C) Position of evidence

D) Details of the evidence

106. Which among the following is not a material used for laser source in fiber optics?

A) Phosphorous

B) He-Ne

C) Argon

D) Nd-YAG

107. Silt soil is found near :

A) Lakes

B) Mountains

C) Forest

D) Farms

108. Forensic Podiatry is the study of :

A) Poultry study

B) Pollen grain study

C) Footprints measurement

D) Study of microorganisms

109. Which among the following has highest accuracy?

A) Standard resistance

B) Standard capacitance

C) Standard inductance

D) Standard mutual inductance

110. The number of photons emitted for a 2.5 mW He-Ne laser is _____

A) 6.9×10^{15}

B) 7.9×10^{15}

C) 8.9×10^{15}

D) 9.9×10^{15}

111. Computer based human assisted gait analysis study involves :

A) Silhouette sequences

B) Model based approach

C) Behavioral patterns

D) Both A and B

112. The diameter of clay particle is :

A) 0.05-0.002 mm

B) 1-0.5mm

C) 0.5 - 0.05 mm

D) Below 0.002 mm

113. Green color on addition of few drops of potassium ferrocyanide in soil sample indicates the presence of :

A) Copper

B) Iodine

C) Iron

D) Aluminum

114. The minimum number of wattmeter(s) required to measure 3 - phase, 3 - wire balanced or unbalanced power :

A) 1

B) 2

C) 3

D) 4

115. Which of the following can be used for the generation of laser pulse?

A) Ruby laser
B) CO_2 laser
C) He-Ne laser
D) Nd - YAG laser

116. The size of the crime scene depends upon the type of crime, the location of the evidence and _____.

A) Environmental conditions
B) Location of suspect
C) Type of evidence
D) Lighting conditions

117. Total paints thickness on new vehicle is :

A) 120 microns
B) 80 microns
C) 50 microns
D) 200 microns

118. Transistors belong to which generation of comptuers?

A) First
B) Second
C) Third
D) Fourth

119. The wavelengths of visible light, x - rays and microwaves are represented by λ_v, λ_x and λ_m respectively, then :

A) $\lambda_v > \lambda_x > \lambda_m$
B) $\lambda_m > \lambda_x > \lambda_v$
C) $\lambda_v > \lambda_m > \lambda_x$
D) $\lambda_m > \lambda_v > \lambda_x$

120. Stance phase consist of _____ % of gait cycle :

A) 60
B) 40
C) 20
D) 50

ROUGH WORK

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