Roll No. .....

Question Booklet Number

O. M. R. Serial No. | | | | | | | |

M. Sc. (Fourth Semester)

(NEP) EXAMINATION, 2025-26

PHYSICS

(Elements of Atmospheric and Space Science) (Elective)

Paper Code							
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Questions Booklet Series
D

Time : 1:30 Hours] [*Maximum Marks : 75*

Instructions to the Examinee :

1. Do not open the booklet unless you are asked to do so.

2. The booklet contains 100 questions. Examinee is required to answer 75 questions in the OMR Answer-Sheet provided and not in the question booklet. All questions carry equal marks.

3. Examine the Booklet and the OMR Answer-Sheet very carefully before you proceed. Faulty question booklet due to missing or duplicate pages/questions or having any other discrepancy should be got immediately replaced.

परीक्षार्थियों के लिए निर्देश :

1. प्रश्न-पुस्तिका को तब तक न खोलें जब तक आपसे कहा न जाए।

2. प्रश्न-पुस्तिका में 100 प्रश्न हैं। परीक्षार्थी को 75 प्रश्नों को केवल दी गई OMR आन्सर-शीट पर ही हल करना है, प्रश्न-पुस्तिका पर नहीं। सभी प्रश्नों के अंक समान हैं।

3. प्रश्नों के उत्तर अंकित करने से पूर्व प्रश्न-पुस्तिका तथा OMR आन्सर-शीट को सावधानीपूर्वक देख लें। दोषपूर्ण प्रश्न-पुस्तिका जिसमें कुछ भाग छपने से छूट गए हों या प्रश्न एक से अधिक बार छप गए हों या उसमें किसी अन्य प्रकार की कमी हो, तो उसे तुरन्त बदल लें।

(Remaining instructions on the last page) **(शेष निर्देश अन्तिम पृष्ठ पर)**

(Only for Rough Work)

1. The South Atlantic Anomaly (SAA) is associated with :

   (A) Weakening of the Earth's magnetic field

   (B) Formation of auroras

   (C) Intense solar radiation

   (D) Increased ozone concentration

2. The ring current during magnetic storms is mainly carried by :

   (A) Protons

   (B) Neutrons

   (C) Electrons

   (D) Photons

3. During a geomagnetic storm, charged particles are mostly trapped in :

   (A) Stratosphere

   (B) Mesosphere

   (C) Ozone layer

   (D) Van Allen radiation belts

4. Which satellite observation is critical in studying storm phenomena ?

   (A) GOES

   (B) GPS

   (C) Copernicus

   (D) Hubble

5. What is the main feature of the recovery phase of a magnetic storm ?

   (A) Strengthening of Earth's magnetic field

   (B) Weakening of solar wind pressure

   (C) Increased auroral activity

   (D) Magnetospheric collapse

6. Auroras are most visible during which phase of a substorm ?

   (A) Growth phase

   (B) Expansion phase

   (C) Recovery phase

   (D) Substorm cessation

7. Which instrument is primarily used to monitor magnetic storms ?

   (A) Magnetometer

   (B) Thermometer

   (C) Anemometer

   (D) Barometer

8. The growth phase of a substorm is characterized by :

   (A) Sudden onset of auroras

   (B) Buildup of energy in the magnetotail

   (C) Compression of the ionosphere

   (D) Fluctuations in tropospheric pressure

9. The primary energy source for substorms is :
   (A) Solar wind energy stored in the magnetotail
   (B) Earth's core heat
   (C) Atmospheric pressure gradients
   (D) Coriolis force

10. During a magnetic storm, the magnetosphere is compressed due to :
   (A) Increased gravitational pull
   (B) Solar wind pressure
   (C) Earth's rotation
   (D) Lunar effects

11. Which index is commonly used to quantify geomagnetic storms ?
   (A) Solar Constant
   (B) UV Index
   (C) Dst Index
   (D) Schumann Resonance

12. The primary cause of auroral substorms is :
   (A) Geothermal activity
   (B) Magnetic reconnection in the magnetotail
   (C) Cosmic ray collisions
   (D) Solar flares

13. Magnetic storms are typically triggered by :
   (A) Volcanic eruptions
   (B) Atmospheric heating
   (C) Earth's rotational anomalies
   (D) Coronal mass ejections (CMEs)

14. What is the primary factor influencing atmospheric density in the thermosphere ?
   (A) Gravity
   (B) Earth's magnetic field
   (C) Solar radiation
   (D) Convection

15. Which gas becomes dominant at altitudes beyond 500 km ?
   (A) Oxygen
   (B) Hydrogen
   (C) Nitrogen
   (D) Helium

16. Neutral density in the upper atmosphere decreases exponentially with :
   (A) Altitude
   (B) Latitude
   (C) Temperature
   (D) Magnetic field strength

17. Which equation is used to model the density profile of the upper atmosphere ?
   (A) Ideal gas law
   (B) Hydrostatic equilibrium
   (C) Continuity equation
   (D) Barometric equation

18. At what height does the ion density peak in the F2 layer ?

(A) ~90 km

(B) ~250-400 km

(C) ~400-500 km

(D) ~600 km

19. The ion density in the ionosphere increases significantly due to :

(A) Photoionization

(B) Thermal conduction

(C) Gravity waves

(D) Geothermal effects

20. Which layer marks the transition between the ionosphere and the magnetosphere ?

(A) Thermosphere

(B) Exosphere

(C) Troposphere

(D) Mesosphere

21. The magnetosphere's bow shock forms as a result of :

(A) Earth's rotation

(B) Solar wind pressure

(C) Lunar gravitational pull

(D) Geothermal activity

22. Which region of the ionosphere is absent at night ?

(A) D layer

(B) E layer

(C) F1 layer

(D) F2 layer

23. The height range of the E-layer in the ionosphere is approximately :

(A) 50-90 km

(B) 90-150 km

(C) 150-220 km

(D) 220-500 km

24. The magnetosphere is primarily formed due to the interaction of the Earth's magnetic field with :

(A) Cosmic rays

(B) Van Allen belts

(C) Solar wind

(D) Atmospheric circulation

25. Which ionospheric layer has the highest electron density during daytime ?

(A) D layer

(B) F2 layer

(C) E layer

(D) F1 layer

26. Relative humidity is highest during :

(A) Afternoon

(B) Evening

(C) Noon

(D) Night near sunrise

27. The Montreal Protocol was signed in :

(A) 1972

(B) 1987

(C) 1992

(D) 2000

28. Diurnal temperature maximum typically occurs at :

(A) Sunrise

(B) Noon

(C) 14 : 00-15 : 00

(D) Midnight

29. Relative humidity is expressed in :

(A) g/m^3

(B) g/kg

(C) %

(D) atm

30. Which instrument is used to measure atmospheric pressure ?

(A) Thermometer

(B) Barometer

(C) Anemometer

(D) Hygrometer

31. Atmospheric pressure decreases with height in an :

(A) Linear relationship

(B) Exponential relationship

(C) Logarithmic relationship

(D) Constant rate

32. The exosphere begins at approximately :

(A) 50 km

(B) 85 km

(C) 600 km

(D) 1000 km

33. Which atmospheric layer burns up most meteors ?

(A) Troposphere

(B) Stratosphere

(C) Mesosphere

(D) Thermosphere

34. Increased UV radiation due to ozone depletion contributes to higher risks of :

(A) Respiratory diseases

(B) Skin cancer

(C) Malaria

(D) Diabetes

35. Which phenomenon is responsible for the formation of monsoon systems ?

(A) Ozone depletion

(B) Differential heating of land and water

(C) Earth's magnetic field

(D) Solar flares

36. In the stratosphere, temperature increases with altitude primarily due to :

(A) Greenhouse gases

(B) Conduction from the troposphere

(C) Solar wind interaction

(D) Ozone absorption of UV radiation

37. The boundary between the troposphere and stratosphere is called :

(A) Mesopause

(B) Tropopause

(C) Stratopause

(D) Exopause

38. The troposphere contains approximately what percentage of the atmosphere's total mass ?

(A) 50%

(B) 75%

(C) 90%

(D) 99%

39. Ozone depletion leads to an increase in :

(A) Ultraviolet radiation

(B) Infrared radiation

(C) Visible light

(D) Cosmic rays

40. The ozone layer is found in which atmospheric layer ?

(A) Troposphere

(B) Stratosphere

(C) Mesosphere

(D) Thermosphere

41. The primary cause of ozone depletion is :

(A) Increased carbon dioxide

(B) Chlorofluorocarbons (CFCs)

(C) Methane emissions

(D) Deforestation

42. The ozone hole is most prominent over which region ?

(A) Arctic

(B) Tropics

(C) Equator

(D) Antarctic

43. The phenomenon of temperature inversion is commonly associated with :

(A) Daytime heating

(B) Nighttime cooling

(C) Seasonal change

(D) Cloud formation

44. Humidity is generally higher at :

(A) High altitudes

(B) Coastal regions

(C) Desert areas

(D) Polar regions

45. Seasonal pressure variations are mostly caused by :

(A) Earth's axial tilt

(B) Ocean circulation patterns

(C) Solar flares

(D) Moon's gravitational pull

46. Which factor primarily affects diurnal temperature variations ?

(A) Atmospheric pressure

(B) Earth rotation

(C) Ocean currents

(D) Latitude

47. Which trace gas plays a crucial role in Earth's radiative balance ?

(A) Water paper

(B) Carbon dioxide

(C) Methane and Nitrous Oxide

(D) All the above

48. The gas responsible for the majority of greenhouse effects is :

(A) Nitrogen

(B) Oxygen

(C) Carbon dioxide

(D) Neon

49. Which layer of the atmosphere contains most of the weather phenomena ?

(A) Stratosphere

(B) Thermosphere

(C) Troposphere

(D) Mesosphere

50. What percentage (approx) of the Earth's atmosphere is composed of nitrogen ?

(A) 28%

(B) 78%

(C) 21%

(D) 1%

51. CMEs are eruptions of :

(A) Neutrons only

(B) Plasma and magnetic fields

(C) Gamma rays

(D) Dust particles

52. X-class solar flares typically cause :

(A) No effect

(B) Minor disturbances

(C) Short radio blackouts

(D) Major radio blackouts and geomagnetic storms

53. Fast solar wind originates mainly from :

(A) Active regions

(B) Sunspots

(C) Coronal holes

(D) Chromosphere

54. Slow solar wind velocity is typically :

(A) 100-200 km/s

(B) 300-400 km/s

(C) 500-600 km/s

(D) 900-1000 km/s

55. Magnetic substorms can disrupt :

(A) Convective processes in the photosphere

(B) GPS signals and navigation systems

(C) Solar neutrino emissions

(D) Differential rotation

56. The Sun's active regions are associated with :

(A) Sunspots

(B) Solar wind tails

(C) Quiet chromospheric activity

(D) Heliospheric currents

57. Magnetic storms are classified based on :

(A) Sunspot number

(B) Dst index thresholds

(C) Alfvén wave activity

(D) Heliopause density

58. The solar magnetic cycle lasts about :

(A) 5 years

(B) 11 years

(C) 22 years

(D) 50 years

59. Which particle type dominates the solar wind composition ?

(A) Electrons

(B) Neutrons

(C) Protons

(D) Helium nuclei

60. The solar magnetic field is generated by :

(A) Nuclear fusion directly

(B) Solar dynamo action

(C) Gravitational collapse

(D) Cosmic rays

61. Radiation storms caused by space weather are most harmful to :

(A) Surface-dwelling organisms

(B) Marine ecosystems

(C) Tropospheric aircraft

(D) Astronauts in space

62. Space weather can cause disruptions in power grids by :

(A) Generating electric currents in transmission lines

(B) Affecting Earth's core temperatures

(C) Weakening atmospheric density

(D) Reducing solar wind intensity

63. During a geomagnetic storm, low Earth orbit satellites experience :

(A) Reduced drag

(B) Increased atmospheric drag

(C) Increased orbital altitude

(D) Sudden propulsion

64. The Sun is classified as a :

(A) White dwarf

(B) Red giant

(C) Main sequence star

(D) Neutron star

65. The interplanetary magnetic field (IMF) is carried by :

(A) Coronal loops

(B) Solar wind

(C) Sunspot eruptions

(D) Radio waves

66. CME occurrence rate during solar maximum is :

(A) 0.5 per day

(B) 1 per day

(C) 5-6 per day

(D) 10 per day

67. The outer boundary of the heliosphere is :

(A) Termination shock

(B) Heliosheath

(C) Heliopause

(D) Magnetopause

68. Space weather disturbances are mainly driven by :

(A) Solar flares, CMEs, solar wind streams

(B) Sunspot cooling

(C) Neutrino flux

(D) Photospheric density

69. The heliotail is defined as :

(A) A coronal hole

(B) The leading edge of the heliopause

(C) The interaction region between Earth's magnetosphere and solar wind

(D) The region of the heliosphere trailing behind the Sun due to solar wind

70. The primary factor differentiating the fast and slow solar wind is :

(A) The temperature of the coronal

(B) The density of the photosphere

(C) The frequency of CMEs

(D) The intensity of sunspots

71. Solar prominences are :

(A) Bright arcs of plasma anchored in the photosphere

(B) High-speed solar wind streams

(C) Radiation from sunspots

(D) Intense bursts of gamma rays

72. CMEs are more likely to occur during :

(A) Solar minimum

(B) Solar maximum

(C) Equinoxes

(D) Solstices

73. The energy released during a typical solar flare is approximately equivalent to :

(A) A small nuclear bomb

(B) Earth's yearly energy usage

(C) Billions of nuclear bombs

(D) A volcanic eruption

74. What is the typical timescale for a solar flare to occur ?

(A) Milliseconds

(B) Minutes to hours

(C) Days

(D) Years

75. The speed of the slow solar wind is typically around :

(A) 100 km/s

(B) 400 km/s

(C) 1,000 km/s

(D) 2,000 km/s

76. Magnetic reconnection in the Sun's atmosphere is responsible for :

(A) Coronal heating and flares

(B) Solar wind generation

(C) Photospheric granules

(D) Density variations in the core

77. Which phenomenon occurs more frequently during solar maximum ?

(A) Coronal holes

(B) Solar flares

(C) Radiative cooling

(D) Differential rotation

78. The helioseismology of the Sun provides insights into :

(A) Coronal heating mechanisms

(B) Internal solar oscillations

(C) Sunspot polarity

(D) Solar wind speed

79. Maunder Minimum refers to a period of :

(A) Low sunspot activity

(B) High sunspot activity

(C) Increased solar flares

(D) Corona expansion

80. The Sun's differential rotation causes its equator to rotate :

(A) Faster than the poles

(B) Slower than the poles

(C) At the same speed as the poles

(D) Independently of the core

81. The solar constant refers to :

(A) Solar magnetic field strength

(B) Energy received per unit area at Earth's orbit

(C) Total solar energy output

(D) Frequency of solar flares

82. The solar wind originates from :

(A) Photosphere

(B) Corona

(C) Chromosphere

(D) Convective zone

83. Coronal mass ejections (CMEs) are often associated with :

(A) Sunspots

(B) Granules

(C) Solar neutrinos

(D) Radiative transfer

84. Which region is responsible for the Sun's magnetic field ?

(A) Convective zone

(B) Radiative zone

(C) Chromosphere

(D) Core

85. What process stretches the Sun's magnetic field lines, leading to sunspots ?

(A) Coronal mass ejections

(B) Differential rotation

(C) Nuclear fusion

(D) Convection

86. The Sun's magnetic field flips polarity approximately every :

(A) 5 years

(B) 11 years

(C) 22 years

(D) 50 years

87. The Babcock model explains :

(A) Stellar formation

(B) Solar neutrinos

(C) Sunspot cycles

(D) Coronal heating

88. Solar rotation is faster :

(A) Near the poles

(B) At the equator

(C) At mid-latitudes

(D) In the corona

89. Sunspots tend to form in :

(A) High latitudes

(B) Mid-latitudes

(C) Near the poles

(D) Uniformly across the surface

90. The average temperature of a sunspot is :

(A) 3,000-4,500 K

(B) 6,000-7,000 K

(C) 10,000 K

(D) 1-2 million K

91. Sunspots are caused by :

(A) Temperature anomalies

(B) Nuclear fusion

(C) Convection currents

(D) Magnetic field disruptions

92. The primary heating mechanism of the corona is :

(A) Radiative transfer

(B) Magnetic reconnection

(C) Convective heating

(D) Thermal conduction

93. Spicules are observed in which solar layer ?

(A) Photosphere

(B) Chromosphere

(C) Radiative zone

(D) Convective zone

94. Which element's spectral lines dominate the chromosphere ?

(A) Helium

(B) Oxygen

(C) Hydrogen

(D) Carbon

95. The temperature in the Sun's corona is approximately :

(A) 5,000 K

(B) 10,000 K

(C) 1-2 million K

(D) 5 million K

96. Granulation on the Sun's surface is caused by :

(A) Convective currents

(B) Magnetic fields

(C) Solar flares

(D) Differential rotation

97. The density of the Sun decreases :

(A) From the core to the photosphere

(B) From the photosphere to the core

(C) Uniformly throughout

(D) From the corona to the core

98. Which layer of the Sun is responsible for its visible light ?

(A) Chromosphere

(B) Corona

(C) Photosphere

(D) Convective zone

99. The radiative zone of the Sun is responsible for :

(A) Convection of energy

(B) Transporting energy through photons

(C) Fusion of hydrogen

(D) Generating magnetic fields

100. What is the primary energy-generation mechanism in the Sun's core ?

(A) Gravitational contraction

(B) Proton-proton chain reaction

(C) CNO cycle

(D) Nuclear fission

(Only for Rough Work)

4. Four alternative answers are mentioned for each question as—A, B, C & D in the booklet. The candidate has to choose the correct answer and mark the same in the OMR Answer-Sheet as per the direction :

Example :

Question :

Q. 1 (A) ● (C) (D)
Q. 2 (A) (B) ● (D)
Q. 3 (A) ● (C) (D)

Illegible answers with cutting and over-writing or half filled circle will be cancelled.

5. Each question carries equal marks. Marks will be awarded according to the number of correct answers you have.

6. All answers are to be given on OMR Answer Sheet only. Answers given anywhere other than the place specified in the answer sheet will not be considered valid.

7. Before writing anything on the OMR Answer Sheet, all the instructions given in it should be read carefully.

8. After the completion of the examination candidates should leave the examination hall only after providing their OMR Answer Sheet to the invigilator. Candidate can carry their Question Booklet.

9. There will be no negative marking.

10. Rough work, if any, should be done on the blank pages provided for the purpose in the booklet.

11. To bring and use of log-book, calculator, pager and cellular phone in examination hall is prohibited.

12. In case of any difference found in English and Hindi version of the question, the English version of the question will be held authentic.

Impt. : On opening the question booklet, first check that all the pages of the question booklet are printed properly. If there is any discrepancy in the question Booklet, then after showing it to the invigilator, get another question Booklet of the same series.

4. प्रश्न-पुस्तिका में प्रत्येक प्रश्न के चार सम्भावित उत्तर—A, B, C एवं D हैं। परीक्षार्थी को उन चारों विकल्पों में से सही उत्तर छाँटना है। उत्तर को OMR आन्सर-शीट में सम्बन्धित प्रश्न संख्या में निम्न प्रकार भरना है :

उदाहरण :

प्रश्न :

प्रश्न 1 (A) ● (C) (D)
प्रश्न 2 (A) (B) ● (D)
प्रश्न 3 (A) ● (C) (D)

अपठनीय उत्तर या ऐसे उत्तर जिन्हें काटा या बदला गया है, या गोले में आधा भरकर दिया गया, उन्हें निरस्त कर दिया जाएगा।

5. प्रत्येक प्रश्न के अंक समान हैं। आपके जितने उत्तर सही होंगे, उन्हीं के अनुसार अंक प्रदान किये जायेंगे।

6. सभी उत्तर केवल ओ. एम. आर. उत्तर-पत्रक (OMR Answer Sheet) पर ही दिये जाने हैं। उत्तर-पत्रक में निर्धारित स्थान के अलावा अन्यत्र कहीं पर दिया गया उत्तर मान्य नहीं होगा।

7. ओ. एम. आर. उत्तर-पत्रक (OMR Answer Sheet) पर कुछ भी लिखने से पूर्व उसमें दिये गये सभी अनुदेशों को सावधानीपूर्वक पढ़ लिया जाये।

8. परीक्षा समाप्ति के उपरान्त परीक्षार्थी कक्ष निरीक्षक को अपनी OMR Answer Sheet उपलब्ध कराने के बाद ही परीक्षा कक्ष से प्रस्थान करें। परीक्षार्थी अपने साथ प्रश्न-पुस्तिका ले जा सकते हैं।

9. निगेटिव मार्किंग नहीं है।

10. कोई भी रफ कार्य, प्रश्न-पुस्तिका के अन्त में, रफ-कार्य के लिए दिए खाली पेज पर ही किया जाना चाहिए।

11. परीक्षा-कक्ष में लॉग-बुक, कैलकुलेटर, पेजर तथा सेल्युलर फोन ले जाना तथा उसका उपयोग करना वर्जित है।

12. प्रश्न के हिन्दी एवं अंग्रेजी रूपान्तरण में भिन्नता होने की दशा में प्रश्न का अंग्रेजी रूपान्तरण ही मान्य होगा।

महत्वपूर्ण : प्रश्नपुस्तिका खोलने पर प्रथमतः जाँच कर देख लें कि प्रश्न-पुस्तिका के सभी पृष्ठ भलीभाँति छपे हुए हैं। यदि प्रश्नपुस्तिका में कोई कमी हो, तो कक्षनिरीक्षक को दिखाकर उसी सिरीज की दूसरी प्रश्न-पुस्तिका प्राप्त कर लें।