Atmospheric Science 29th March 2025 Shift3

Time Allowed :1.5 Hours	**Maximum Marks :**300	**Total questions : 75**

General Instructions

General Instructions:

1. Question Paper contains 75 Questions .
2. Each correct answer will have +4 marks and wrong asnwer will lead to -1

1. If $A = \begin{bmatrix} 1 & 2 & -1 \\ 3 & 4 & 2 \\ 2 & 0 & 1 \end{bmatrix}$ **and** $B = \begin{bmatrix} 1 & 3 \\ -4 & 0 \\ 2 & 5 \end{bmatrix}$ **are two matrices, then which one of the following is incorrect:**

(A) AB is defined

(B) BA is not defined

(C) A + B is not defined

(D) A - B is defined

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2. If $f(t)$ **is the inverse Laplace transform of** $F(s) = \frac{s+1+s^{-2}}{s^2-1}$**, then** $f(t)$ **is**

(A) $e^t + \sinh t + t$

(B) $e^t + \sinh t - t$

(C) $e^t - \sinh t + t$

(D) $e^t + \cosh t - t$

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3. Which of the following statements are correct?

A. In a skew-symmetric matrix, all diagonal elements are zero.

B. A square matrix is called a diagonal matrix if all its non-diagonal elements are one.

C. If the determinant of the matrix is zero, then the matrix is known as non-singular matrix.

D. The product of a matrix A and its adjoint is equal to unit matrix multiplied by the determinant A.

(A) A and D only

(B) B and C only

(C) A, B and D only

(D) C and D only

---

4. Match LIST-I with LIST-II

LIST-I (Differential Equation)

(A) $\frac{dy}{dx} = 2x(y - x^2 + 1)$

(B) $x\frac{dy}{dx} + 2(x^2+1)y = 6$

(C) $(x^2+1)\frac{dy}{dx} + 2xy = x\sin x$

(D) $x^3\frac{dy}{dx} + 2xy = 2x^2e^{x^2}$

LIST-II (Integrating Factor)

(I) x^2

(II) e^{-x^2}

(III) x^2e^x

(IV) $1+x^2$

Choose the correct answer from the options given below:

(A) A - I, B - II, C - III, D - IV

(B) A - II, B - I, C - IV, D - III

(C) A - III, B - II, C - IV, D - I

(D) A - III, B - IV, C - I, D - II

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5. Let $y(t)$ be the solution of the differential equation $y'' + 4y = 0$, $y(0) = 1$, $y'(0) = -6$, then the Laplace transformation $Y(s)$ of the solution is equal to

(A) $\frac{s}{s^2+4} + \frac{2}{s^2+4}$

(B) $\frac{s-6}{s^2-4}$

(C) $\frac{s+6}{s^2+4}$

(D) $\frac{s-6}{s^2+4}$

---

6. Let $g(x) = x^2$, $-\pi \le x \le \pi$. The coefficient of $\cos(3x)$ in the Fourier series expansion of $g(x)$ is:

(A) $-4/9$

(B) $-1/4$

(C) $1/16$

(D) $9/16$

---

7. The imaginary part of the complex number $\log(1+i)$ is

(A) $\pi/4$

(B) $\pi/2$

(C) $3\pi/2$

(D) $3\pi/4$

---

8. In a sports event of football and basketball, 132 students registered to play football and 93 students registered in basketball. If the total number of students registered in the event is 200, then the number of students registered in both the games is:

(A) 20

(B) 25

(C) 32

(D) 27

---

9. Let (α, β) be the centre and γ be the radius of the circle $x^2 + y^2 - 6x - 2y - 15 = 0$, then the value of $(\alpha^2 + \beta^2 + \gamma^2)$ is:

(A) 9

(B) 35

(C) 21

(D) 42

---

10. The differential equation $(1 + 3x^2y^2 + \beta x^2y^4)dx + (2x^3y + 2x^3y^3)dy = 0$ will be exact differential equation if (assuming typos in original question are corrected as shown):

(A) $\beta = -1/2$

(B) $\beta = 3$

(C) $\beta = 2$

(D) $\beta = 3/2$

---

11. For two correlated data series X and Y, which formula for Var$(X - Y)$ is correct?

(A) Var(X) + Var(Y)

(B) Var(X) − Var(Y)

(C) Var(X) + Var(Y) − 2Cov(X, Y)

(D) $\text{Var}(X) - \text{Var}(Y) - 2\text{Cov}(X, Y)$

---

12. Identify the median class for the following grouped data:

Class interval	Frequency
5-10	**5**
10-15	**15**
15-20	**22**
20-25	**25**
25-30	**10**
30-35	**3**

(A) 20-25

(B) 25-30

(C) 5-10

(D) 15-20

---

13. The arithmetic mean of 10 items is 5. If 5 is added to each of the first seven items and 3 is subtracted from each of the last three items, then the mean of the new data series is:

(A) 5

(B) 7

(C) 7.6

(D) 6.7

---

14. The coefficient of correlation of the above two data series will be equal to _____

X	Y
-3	9
-2	4
-1	1
0	0
1	1
2	4
3	9

(A) +1

(B) -1

(C) 0

(D) -0.5

---

15. While writing a computer programming code, it was found that Team A incurred 250 errors in a code of 1000 lines while Team B incurred 300 errors in a code of 800 lines. In order to determine whether Team A has performed better than Team B, a statistical hypothesis was set and tested. Then the value of the test statistic is:

(A) -5.72

(B) -2.96

(C) 1.99

(D) 3.42

---

16. Process (in Operating System) is a:

(A) reusable resource

(B) variable timer

(C) program in execution

(D) allocation and de-allocation of memory

---

17. In an operating system, the ”deadlock” occurs when:

(A) Two or more processes are waiting for each other to release resources

(B) A process is executed beyond its allocated time slice

(C) System runs out of physical memory

(D) When a process entered into running state

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18. Which type of memory is used to store the BIOS (BASIC INPUT OUTPUT SYSTEM) in a computer?

(A) ROM

(B) DRAM

(C) Flash Memory

(D) SRAM

---

19. In the context of programming the term 'debugging' refers to:

(A) writing the code

(B) documenting the code

(C) finding and fixing errors in the code

(D) running the code

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20. Which one of the following is a machine-dependent language?

(A) Java

(B) C++

(C) Assembly language

(D) Python

---

21. What is the primary purpose of a function?

(A) creating reusable code blocks

(B) documenting the code

(C) testing the code

(D) coding of conditional statements

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22. Which of the following statements are true?

A. Address bus connects CPU to memory modules for data access.

B. System bus connects CPU to I/O devices, cache etc.

C. System bus is usually classified as data bus, address bus and control bus.

D. The width of data bus has no connection with the amount of the data that can be transferred simultaneously.

(A) A, B and D only

(B) A and C only

(C) A, B, C and D

(D) B, C and D only

---

23. In uni-processor operating system, the term ”multiprogramming” means?

(A) Multiple programs are executed with multiple processors

(B) Multiple programs are executed by a single processor by dividing CPU time between these programs

(C) In uni-processor operating system, multiprogramming is not possible

(D) Multiple processors are available in uni-processor operating system to support multiprogramming

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24. Match LIST-I with LIST-II

LIST-I

(A) Primary Key

(B) Alternate Key

(C) Super Key

(D) Composite Key

LIST-II

(I) Composed with at least two attributes

(II) Can contain extraneous attributes

(III) Only one such key is permitted in a relation

(IV) Used when the primary key is not working

(A) A - I, B - II, C - III, D - IV

(B) A - III, B - IV, C - I, D - II

(C) A - I, B - II, C - IV, D - III

(D) A - III, B - IV, C - II, D - I

---

25. Arrange the following capacities of storage units according to their sizes (smallest to largest)

A. 1 GB

B. 1 MB

C. 1 TB

D. 1 KB

(A) A, B, C, D

(B) D, B, A, C

(C) D, B, C, A

(D) A, B, D, C

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26. The brilliant colors in thin films of soap are due to _____.

(A) interference

(B) diffraction

(C) scattering

(D) dispersion

---

27. The mean free path of the molecules of a gas at 25°C is 2.63×10^{-5} **meter. If the radius of the molecule is** 2.56×10^{-10} **meter, find the pressure of the gas.**

[$k = 1.38 \times 10^{-23}$ **Joule/K]**

(A) 1 mm of mercury

(B) 10 mm of mercury

(C) 20 mm of mercury

(D) 50 mm of mercury

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28. The period of a satellite in a circular orbit of radius 12000 km around a planet is 3 hours. Obtain the period of a satellite in a circular orbit of radius 48000 km around the same planet.

(A) 6 hours

(B) 12 hours

(C) 24 hours

(D) 36 hours

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29. The first law of thermodynamics is the statement of

(A) conservation of heat

(B) conservation of work

(C) conservation of momentum

(D) conservation of energy

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30. A body P at 1000 K emits maximum energy at a wavelength of 3000 nm. If another body Q emits maximum energy at wavelength 550 nm, what will be the temperature of that body Q?

(A) 5454 K

(B) 6250 K

(C) 3125 K

(D) 4000 K

---

31. Choose the CORRECT statement about the behavior of product PV against pressure for real gas. [where P is pressure and V is volume]

(A) Below Boyle's temperature, the value of PV first increases with increase in pressure, reaches a maximum value at a particular temperature and then begins to decrease

(B) Above Boyle's temperature, the value of PV continuously decreases with increase in pressure.

(C) Below Boyle's temperature, the value of PV first decreases with increase in pressure, reaches a minimum value at a particular temperature and then begins to increase.

(D) Above Boyle's temperature, the value of PV is almost constant with increase in pressure.

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32. The appearance of the blue color of the sky and reddish color of the sun at sunrise and sunset is due to which phenomenon of light?

(A) Interference

(B) Reflection

(C) Refraction

(D) Scattering

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33. At what rate will energy be emitted from a black body whose filament has a temperature of 3600 K, if at 1800 K the energy is emitted at the rate of 16W?

(A) 32 W

(B) 64 W

(C) 128 W

(D) 256 W

---

34. Two satellites A and B go around a planet in circular orbits having radii of 4R and R, respectively. If the velocity of satellite A is 3v, the velocity of satellite B will be:

(A) 18v

(B) 12v

(C) 6v

(D) 3v

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35. The electric field at a point inside a charged hollow spherical conductor is:

(A) zero

(B) constant but not zero

(C) depends on the distance from centre

(D) depends on the charge on the conductor

---

36. Match LIST-I with LIST-II

LIST-I

(A) Lyman Series

(B) Balmer Series

(C) Paschen Series

(D) Pfund Series

LIST-II

(I) Microwave Range

(II) Ultraviolet Range

(III) Visible Range

(IV) Infrared Range

(A) A - I, B - II, C - III, D - IV

(B) A - II, B - III, C - I, D - IV

(C) A - I, B - II, C - IV, D - III

(D) A - II, B - III, C - IV, D - I

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37. A light beam traveling in the x-direction is described by the magnetic field $B_z = 2 \times 10^{-6} \sin \omega(t - x/c)$ **Tesla. The value of the maximum electric field is**

(A) 200 V/m

(B) 300 V/m

(C) 600 V/m

(D) 800 V/m

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38. Arrange the following minerals in decreasing order of their hardness as per Mohs scale.

A. Orthoclase

B. Calcite

C. Corundum

D. Fluorite

(A) A, B, C, D

(B) A, C, B, D

(C) C, A, D, B

(D) C, B, D, A

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39. In the Bowen's reaction series, which of the following mineral(s) is/are crystallized prior to amphibole?

A. Biotite

B. Clinopyroxene

C. K-feldspar

D. Forsterite

(A) A and B only

(B) A, B and D only

(C) B only

(D) B and D only

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40. The oldest crust on the earth is found at _____.

(A) mid oceanic ridge

(B) subduction zones

(C) sea floor spreading

(D) transform plate boundary

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41. The Tethys sea existed between _____ continents.

(A) Madagascar and Africa

(B) Africa and Eurasia

(C) Australia and Asia

(D) Antarctica and Australia

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42. Match LIST-I with LIST-II

LIST-I

(A) Epicenter

(B) Focus

(C) Mercalli scale

(D) Richter scale

LIST-II

(I) is the scale of measurement of degree of destructiveness of earthquakes

(II) is a point of the origin of the earthquake inside the earth

(III) is the scale to measure the magnitude of the energy released by an earthquake

(IV) is the place on the ground surface which is perpendicular to the hypocenter

(A) A-IV, B-II, C-I, D-III

(B) A-II, B-IV, C-I, D-III

(C) A-IV, B-I, C-III, D-II

(D) A-III, B-IV, C-I, D-II

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43. Arrange the following according to the depth of occurrence starting from deep to shallow.

A. Continental slope

B. Continental shelf

C. Abyssal plains

D. Continental rise

(A) A, C, B, D

(B) C, D, A, B

(C) D, C, B, A

(D) B, A, D, C

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44. Lithosphere is characterized by _____.

A. A thickness of about 100 km

B. Average density of 3.6 g/cc

C. Silicon and aluminum as dominant constituents

D. Basalt as the dominant rock

(A) A and C only

(B) B and D only

(C) A, B, and D only

(D) A and D only

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45. The amount of water vapor generally increases with increase in air temperature. The amount of water vapor in the air at a particular temperature is referred to as

(A) Super saturation

(B) Relative humidity

(C) Absolute humidity

(D) Saturation ratio

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46. Match LIST-I with LIST-II

LIST-I (Cloud related prefix)

(A) Cumulus

(B) Nimbus

(C) Cirrus

(D) Stratus

LIST-II (Characteristics)

(I) Rain bearing

(II) Stratified layer

(III) Puffy structure

(IV) Composed of ice crystals

(A) A-IV, B-II, C-III, D-I

(B) A-III, B-I, C-IV, D-II

(C) A-III, B-I, C-II, D-IV

(D) A-I, B-IV, C-III, D-II

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47. The effective average solar flux incident to a level surface at top of the atmosphere is _____.

(A) 124 W/m^2

(B) 242 W/m^2

(C) 89 W/m^2

(D) 342 W/m^2

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48. The most common mineral used in U-Pb radiometric dating is _____.

(A) Biotite

(B) Zircon

(C) Hornblende

(D) Quartz

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49. Arrange the following significant salts in decreasing order of their percentage in the oceans:

A. $MgCl_2$

B. $CaSO_4$ (assuming typo for $CuSO_4$)

C. $MgSO_4$

D. NaCl

(A) D, B, C, A

(B) D, A, C, B

(C) D, C, A, B

(D) D, B, A, C

---

50. Which of the following were constituents of the famous classical London smog?

A. Smoke

B. Fog

C. SO_2

D. Peroxyacetyl nitrate

E. Ozone

(A) A, B and E only

(B) A, B and C only

(C) A, B, C and D only

(D) A, B, C and E only

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51. Choose the correct statements about corals?

A. Corals are invertebrate animals a few millimeter in diameter.

B. Corals are sensitive to heat stress and ocean pH change.

C. Corals provide algae with stable environment, CO_2 and nutrients.

D. Corals bleach to get rid themselves of pathogens.

(A) C and D only

(B) A, B and C only

(C) A and B only

(D) A, B, C and D only

---

52. Choose the incorrect statement.

(A) Tornado is the smallest, most violent weather disturbance that occur on the earth.

(B) Tornadoes are defined as high pressure center where winds moves into high pressure and move upward.

(C) Tornadoes are of a dark color due to the dominance of dust, sand and condensed moisture.

(D) Tornadoes are funnel shaped storms.

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53. Arrange the following greenhouse gases in decreasing order of their contribution to total global warming.

A. Nitrous oxide

B. Carbon dioxide

C. Chlorofluoro carbon

D. Methane

(A) C, A, B, D

(B) A, C, B, D

(C) A, B, C, D

(D) B, D, A, C

54. Match LIST-I with LIST-II

LIST-I (Atmospheric component)

(A) Nitrogen

(B) Sulphur dioxide

(C) Aerosols

(D) Ozone

LIST-II (Role)

(I) Hypnoxyotic an(t)icle

(II) Photochemical interaction

(III) Retards re-radiation... (Greenhouse Effect)

(IV) Acid rain

(A) A-III, B-II, C-I, D-IV

(B) A-I, B-III, C-II, D-IV

(C) A-III, B-IV, C-I, D-II

(D) A-IV, B-II, C-I, D-II

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55. According to Koppen's climatic classification, _____ climate prevails in the Great Plains of India.

(A) Af

(B) Am

(C) BS

(D) Cwg

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56. Arrange the following in increasing order of their wavelength.

A. gamma radiations

B. X rays

C. UV radiations

D. microwave

E. Infrared radiations

(A) E, D, C, B, A

(B) B, A, C, D, E

(C) A, B, C, E, D

(D) A, B, C, D, E

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57. Half life of a radioactive material during radioactive decay is _____.

(A) directly proportional to the initial concentration

(B) inversely proportional to the initial concentration and directly proportional to decay constant

(C) directly proportional to the final concentration and inversely proportional to decay constant

(D) independent of the initial concentration and inversely proportional to decay constant

---

58. The amount of groundwater is estimated to be _____.

(A) nearly equal to the amount of surface water on the planet Earth

(B) less than the amount of surface water on the planet Earth

(C) twice the amount of surface water on the planet Earth

(D) twenty five times the amount of surface water on the planet Earth

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59. Match LIST-I with LIST-II

LIST-I (Disease)

(A) Blue baby syndrome

(B) Keshan disease

(C) Gas bubble disease

(D) Itai itai

LIST-II (Cause)

(I) Excess dissolved oxygen in drinking water

(II) Excess Cd in drinking water

(III) Excess nitrate ions in drinking water

(IV) Selenium deficiency

(A) A - I, B - II, C - III, D - IV

(B) A - I, B - III, C - IV, D - II

(C) A - III, B - IV, C - I, D - II

(D) A - III, B - IV, C - II, D - I

---

60. Choose the correct statements.

A. Dissolution of oxygen in surface water changes with change in temperature during extreme summer and winters.

B. Dissolved oxygen and BOD have inverse relationship in sewage water.

C. Chemical oxygen demand is always higher than BOD in sewage water.

D. More saline water will have less conductivity.

(A) A and B only

(B) A, B and D only

(C) A, B, C and D

(D) A, B and C only

---

61. Which of the following is dominantly responsible for buffering capacity of natural water?

(A) carbonate ions

(B) dissolved oxygen

(C) bicarbonate ions

(D) phosphate ions

---

62. Soil acidity can be introduced by _____.

A. Mine tailings rich in pyrites

B. Extraction of Al from its ore

C. Use of nitrogen-rich fertilizers

D. Use of limestone

(A) A, B and D only

(B) A and C only

(C) A, B and C only

(D) A, B, C and D

---

63. Match LIST I with LIST II

LIST I (Metal)

(A) Manganese

(B) Zinc

(C) Aluminium

(D) Lithium

LIST II (Ore)

(I) Sinsilfuoride (typo)

(II) Gibbsite

(III) Lepidolite

(IV) Psilomelane

(A) A-I, B-II, C-III, D-IV

(B) A-I, B-III, C-II, D-IV

(C) A-IV, B-I, C-II, D-III

(D) A-III, B-IV, C-I, D-II

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64. Arrange the following soil horizons as they occur from top to bottom in a typical soil profile.

A. A horizon

B. B horizon

C. R horizon

D. O horizon

E. C horizon

(A) A, B, C, D, E

(B) D, A, B, E, C

(C) C, E, B, D, A

(D) A, B, E, C, D

65. Choose the correct statement.

(A) Excessive nutrient inputs to lakes maintains the high dissolved oxygen of the lakes.

(B) Lakes with extensive algal blooms will have the good health of the lakes.

(C) Eutrophic lakes have high BOD.

(D) Oligotrophic lakes have high BOD compared to eutrophic lakes.

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66. Which one of the following statements is incorrect?

(A) Nitrogen is one of the top five elements found in plants and animals.

(B) Industrial and biological nitrogen fixation require the input of substantial amount of energy.

(C) Nitrogen in organisms is only found in nucleic acids, i.e. DNA and RNA.

(D) Nitrogen is plentiful in the earth's atmosphere in relatively inert forms.

---

67. Condensation of water vapors in atmosphere actually _____.

(A) cools the surrounding

(B) sometime cools and sometimes warms the surrounding

(C) warms the surrounding

(D) neither cools nor warms the surrounding

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68. The Prime Minister of India introduced mission LiFE in UN climate change conference of parties (COP) _____ held at _____ in the year _____.

(A) COP-26, Paris, 2021

(B) COP-26, Glasgow, 2020

(C) COP-29, Dubai, 2022

(D) COP-26, Glasgow, 2021

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69. Which of the following are criteria pollutants under national ambient air quality standards?

A. $PM_{2.5}$

B. NO_x

C. Lead

D. Methane

E. Sulphur dioxide

(A) A, B and D only

(B) A, B and C only

(C) A, C and E only

(D) A, B, C and E only

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70. Which one of the following states in India is known to have the highest Chromium pollution of water and soils due to tanning industry?

(A) Uttar Pradesh

(B) Andhra Pradesh

(C) Tamil Nadu

(D) Maharashtra

---

71. Arrange the following layers of atmosphere starting from earth's surface.

A. Troposphere

B. Stratosphere

C. Tropopause

D. Stratopause

E. Mesosphere

(A) A, B, C, D, E

(B) A, D, B, C, E

(C) A, C, B, D, E

(D) A, C, B, E, D

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72. Match LIST-I with LIST-II

LIST-I (Person)

(A) Anna Hazare

(B) Rajender Singh

(C) Chandi Prasad Bhatt

(D) Medha Patkar

LIST-II (Movement)

(I) Narmada Bachao Andolan

(II) Tarun Bharat Sangh

(III) Chipko movement

(IV) Ralegan Siddhi Watershed Development

(A) A-IV, B-II, C-III, D-I

(B) A-I, B-III, C-II, D-IV

(C) A-I, B-II, C-IV, D-III

(D) A-III, B-IV, C-I, D-II

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73. Match LIST-I with LIST-II

LIST-I (Type of Rock)

(A) Non-foliated metamorphic rock

(B) Foliated metamorphic rock

(C) Igneous rock

(D) Sedimentary rock

LIST-II (Characteristics/example)

(I) Dolomite

(II) Rhyolite

(III) Ornate Gneiss (Gneiss)

(IV) Quartzite

(A) A-II, B-IV, C-III, D-I

(B) A-I, B-III, C-IV, D-II

(C) A-IV, B-III, C-II, D-I

(D) A-IV, B-II, C-III, D-I

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74. Mohorovicic discontinuity is commonly defined as the depth at which _____.

(A) the p-wave velocity decreases to 5.6 km/sec

(B) the p-wave velocity exceeds 7.6 km/sec

(C) the s-wave velocity exceeds 3.57 km/sec

(D) the p and s waves exceed 5.6 km/sec and 3.57 km/sec respectively

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75. Ozone in the stratosphere captures _____ and protects us from harmful effects.

(A) UV A, UV B and UV C radiations completely

(B) UV A and UV B radiations completely

(C) UV B partially and UV C radiations completely

(D) UV A completely and UV B and UV C radiations partially
