

38

QUESTION PAPER
SERIES CODE
C

Registration No. :

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Centre of Exam. : _____

Name of Candidate : _____

Signature of Invigilator

ENTRANCE EXAMINATION, 2017
M.Sc. ENVIRONMENTAL SCIENCES
[Field of Study Code : SESM (223)]

Time Allowed : 3 hours

Maximum Marks : 100

INSTRUCTIONS FOR CANDIDATES

Candidates must read carefully the following instructions before attempting the Question Paper :

- (i) Write your Name and Registration Number in the space provided for the purpose on the top of this Question Paper and in the Answer Sheet.
- (ii) **Please darken the appropriate Circle of Question Paper Series Code on the Answer Sheet.**
- (iii) The Question Paper is divided into two parts : Part—A and Part—B. Both parts have multiple-choice questions. All answers are to be entered in the Answer Sheet provided with the Question Paper for the purpose. The answer to each question is to be indicated by darkening the appropriate choice [i.e., (a), (b), (c) or (d)] in the circles, against each question number on the Answer Sheet.
- (iv) Part—A consists of 45 questions. Answer any 30 questions. Each question carries 1 mark. **There will be negative marking and ¼ mark will be deducted for each wrong answer.**
- (v) Part—B consists of 95 questions. Answer any 70 questions. Each question carries 1 mark. **There will be negative marking and ¼ mark will be deducted for each wrong answer.**
- (vi) Calculators/Log Tables may be used.
- (vii) Answer written by the candidates inside the Question Paper will not be evaluated.
- (viii) Pages at the end have been provided for Rough Work.
- (ix) Return the Question Paper and Answer Sheet to the Invigilator at the end of the Entrance Examination. **DO NOT FOLD THE ANSWER SHEET.**

INSTRUCTIONS FOR MARKING ANSWERS

- 1. Use only Blue/Black Ballpoint Pen (do not use pencil) to darken the appropriate Circle.
- 2. Please darken the whole Circle.
- 3. Darken ONLY ONE CIRCLE for each question as shown in example below :

Wrong	Wrong	Wrong	Wrong	Correct
<input type="radio"/> a <input type="radio"/> b <input type="radio"/> c <input type="radio"/> d	<input checked="" type="radio"/> a <input type="radio"/> b <input type="radio"/> c <input type="radio"/> d	<input checked="" type="radio"/> a <input type="radio"/> b <input type="radio"/> c <input checked="" type="radio"/> d	<input checked="" type="radio"/> a <input type="radio"/> b <input type="radio"/> c <input type="radio"/> d	<input type="radio"/> a <input checked="" type="radio"/> b <input type="radio"/> c <input type="radio"/> d

- 4. Once marked, no change in the answer is allowed.
- 5. Please do not make any stray marks on the Answer Sheet.
- 6. Please do not do any rough work on the Answer Sheet.
- 7. Mark your answer only in the appropriate space against the number corresponding to the question.
- 8. **Ensure that you have darkened the appropriate Circle of Question Paper Series Code on the Answer Sheet.**

PART—A

Answer *any thirty* questions

1. Which of the following is a correct statement regarding the function $f(x) = \tan^{-1}(\cos x + \sin x)$?
 - (a) $f(x)$ is strictly increasing in the interval $\left(0, \frac{\pi}{4}\right)$
 - (b) $f(x)$ is strictly decreasing in the interval $\left(0, \frac{\pi}{4}\right)$
 - (c) $f(x)$ is strictly increasing in the interval $\left(0, \frac{\pi}{2}\right)$
 - (d) $f(x)$ is strictly decreasing in the interval $\left(0, \frac{\pi}{2}\right)$

2. Two cars start moving one after the other with an interval $\Delta t = 1$ min and move with an acceleration $a = 0.4 \text{ m/s}^2$ each. How long after the start of the first car is the distance between them equal to 4.2 km?
 - (a) 175 s
 - (b) 185 s
 - (c) 195 s
 - (d) 205 s

3. Two loads having a total mass $m_1 + m_2 = 30 \text{ kg}$ are suspended from the two ends of a rope around a pulley attached to a ceiling. The loads move with an acceleration of $0.3g$ (magnitude), where g is the acceleration due to gravity. If the load with mass m_2 moves downwards, what are the masses of the two loads?
 - (a) $m_1 = 8.5 \text{ kg}$ and $m_2 = 21.5 \text{ kg}$
 - (b) $m_1 = 9.5 \text{ kg}$ and $m_2 = 20.5 \text{ kg}$
 - (c) $m_1 = 10.5 \text{ kg}$ and $m_2 = 19.5 \text{ kg}$
 - (d) $m_1 = 11.5 \text{ kg}$ and $m_2 = 18.5 \text{ kg}$

4. A 100 kg load is uniformly moved over a horizontal plane by a force F applied at an angle $\alpha = 30^\circ$ to the horizontal. If the coefficient of friction between the load and the plane is $f = 0.3$, then the force applied F is
 - (a) ~ 150 N
 - (b) ~ 289 N
 - (c) ~ 398 N
 - (d) ~ 450 N

5. Given that the atmospheric pressure $p_0 = 1.013 \times 10^5$ Pa, what would be the pressure exerted by a lake of depth 4.5 m, if we assume the density of lake water to be equal to 1 g/cm^3 ?
- (a) 4.41×10^4 Pa
 - (b) 44.1 Pa
 - (c) 1.041×10^5 Pa
 - (d) 1.454×10^5 Pa
6. The unit of magnetic induction is
- (a) henry
 - (b) siemens
 - (c) weber
 - (d) tesla
7. If $f(x) = \sec^{-1} x$ and R is the set of real numbers, then the domain of this function is
- (a) $[-1, 1]$
 - (b) $[0, \pi]$
 - (c) R
 - (d) $R - [-1, 1]$
8. What is true about an ocean current that is moving toward the equator?
- (a) It is cold
 - (b) It is slow
 - (c) It is warm
 - (d) It is fast

9. The energy that drives surface ocean currents comes from
- (a) salinity variations
 - (b) wave action
 - (c) temperature differences
 - (d) wind
10. Because of the Coriolis effect, ocean currents in the Northern Hemisphere are deflected to the
- (a) left
 - (b) right
 - (c) south
 - (d) north
11. Which is the nearest star to the earth?
- (a) Venus
 - (b) Saturn
 - (c) Sun
 - (d) Jupiter
12. Which of the following is a blue planet?
- (a) Venus
 - (b) Saturn
 - (c) Earth
 - (d) Jupiter

13. Which of the following makes soil distinct from sediment?
- (a) Organic matter
 - (b) Water
 - (c) Grain size
 - (d) Humus
14. Which of the following is easily affected during pedogenesis?
- (a) Zircon
 - (b) Quartz
 - (c) Feldspar
 - (d) Rutile
15. Siderophile elements show affinity to
- (a) silicates
 - (b) sulfides
 - (c) iron
 - (d) gas
16. Which one of the following is the lightest transition element?
- (a) Hg
 - (b) Fe
 - (c) Sc
 - (d) Zn
17. According to which one of the following laws, the amount of a gas dissolved in a liquid is proportional to its partial pressure?
- (a) Raoult's law
 - (b) Boyle's law
 - (c) Dalton's law
 - (d) Henry's law

18. The number of moles of a solute present in 1 kg of solvent is called as
- (a) molarity
 - (b) molality
 - (c) normality
 - (d) None of the above
19. Which of the following tests is used to differentiate between aliphatic and aromatic compounds?
- (a) Tollens' reagent test
 - (b) Fehling solution test
 - (c) Benedict's solution test
 - (d) Sodium nitroprusside test
20. Which of the following **does not** undergo sublimation process?
- (a) Naphthalene
 - (b) Camphor
 - (c) Succinic acid
 - (d) Charcoal
21. Brown ring in the ring test for nitrate is due to the formation of
- (a) HNO_2
 - (b) $\text{FeSO}_4 \cdot \text{NO}$
 - (c) $\text{Fe}(\text{NO}_3)_3$
 - (d) $\text{Fe}(\text{NO}_2)_3$
22. What is the bond order in CO molecule?
- (a) 2
 - (b) 3
 - (c) 4
 - (d) 1.5

23. A local radio station transmits at approximately 95 MHz on its VHF (very high frequency) transmitter. What will be the wavelength of this transmission?
- (a) ~ 3.158 m
 - (b) ~ 315.8 m
 - (c) ~ 0.0315 m
 - (d) ~ 285 m
24. Calculate molar concentration of a sugar solution that has osmotic pressure of 2.465 at 27 °C. [Mol. wt. of sugar $C_{12}H_{22}O_{11} = 342$]
- (a) ~ 1 M
 - (b) ~ 0.1 M
 - (c) ~ 10 M
 - (d) ~ 5 M
25. Historically, the concept of pure cultures in microbiology was developed by
- (a) Louis Pasteur
 - (b) Antonie van Leeuwenhoek
 - (c) Robert Koch
 - (d) Joseph Lister
26. Which biofuel is widely used in many countries as a motor fuel?
- (a) Methane
 - (b) Ethanol
 - (c) Butanol
 - (d) Biodiesel
27. Where are the most microbial cells located on the earth?
- (a) Earth's surface
 - (b) Atmosphere
 - (c) Open oceans
 - (d) Oceanic and terrestrial subsurface

28. Which of the following is/are property/properties of cellular life?

- (a) Growth
- (b) Evolution
- (c) Motility
- (d) All of the above

29. The benefit people get from ecosystem is popularly known as

- (a) ecosystem process
- (b) ecosystem function
- (c) ecosystem products
- (d) ecosystem services

30. Which of the following is/are **not** related to genetic drift?

- (a) Small population
- (b) Short life cycle
- (c) Isolation
- (d) Random changes

31. Mule is an example of

- (a) cross-breeding
- (b) inbreeding
- (c) inbreeding as well as selection
- (d) interspecific hybridization

32. The human saliva helps in the digestion of

- (a) proteins
- (b) starch
- (c) fats
- (d) fibres

33. Which one of the following is likely to have the highest cation-exchange capacity?
- (a) Sand in soil
 - (b) Organic material in soil
 - (c) Clay in soil
 - (d) Loam
34. Which form of scattering in the atmosphere is **not** dependent on wavelength?
- (a) Mie
 - (b) Non-selective
 - (c) Rayleigh
 - (d) None of the above
35. During mitosis, ER and nucleolus begin to disappear at
- (a) early metaphase
 - (b) late metaphase
 - (c) early prophase
 - (d) late prophase
36. Organic evolution is defined as
- (a) formation of complex organisms
 - (b) evolution of land and its organisms
 - (c) formation of existing animals and plants from simpler ones by a gradual change over a period of time
 - (d) All of the above
37. Which of the following is directly associated with acid rain?
- (a) N_2O
 - (b) NO_2
 - (c) Urea
 - (d) Amines

38. The angle of elevation of the top of a tower at horizontal distance equal to the height of the tower from the base of the tower is
- (a) 30°
 - (b) 45°
 - (c) 60°
 - (d) None of the above
39. $\tan 3A \cdot \tan 2A - \tan A =$
- (a) $\tan 3A \tan 2A \tan A$
 - (b) $-\tan 3A \tan 2A \tan A$
 - (c) $\tan A \tan 2A - \tan 2A \tan 3A - \tan 3A \tan A$
 - (d) None of the above
40. The relation $PV = RT$ can describe the behaviour of real gas at
- (a) high temperature and high density
 - (b) high temperature and low density
 - (c) low temperature and low density
 - (d) low temperature and high density
41. The ionization potential of hydrogen atom is
- (a) 13.60 volts
 - (b) 8.24 volts
 - (c) 10.36 volts
 - (d) 14.24 volts

42. A moving-coil galvanometer works on the principle that
- (a) a magnetic field produces a mechanical force on a conductor
 - (b) a magnetic field produces a force on a current-carrying conductor
 - (c) a current-carrying conductor exerts a force on a magnet
 - (d) a conductor exerts a force on a magnet

43. If

$$\tan^{-1}(x+1) + \tan^{-1}(x-1) = \tan^{-1} \frac{8}{31}$$

then the value of x is

- (a) 8
- (b) $\frac{1}{2}$
- (c) $\frac{1}{4}$
- (d) $-\frac{1}{2}$

44. If

$$f(x) = \begin{cases} \frac{k \cos x}{\pi - 2x} & , \text{ when } x \neq \frac{\pi}{2} \\ 3 & , \text{ when } x = \frac{\pi}{2} \end{cases}$$

then the value of k for which the function is continuous at $x = \frac{\pi}{2}$ is

- (a) 6
 - (b) 4
 - (c) 3
 - (d) 1
45. Which of the following is a **false** statement?
- (a) If A and B are nonsingular matrices of the same order, then $(\text{adj } AB) = (\text{adj } B)(\text{adj } A)$
 - (b) For any square matrix A , $(\text{adj } A)' = \text{adj } A'$
 - (c) If A is a nonsingular square matrix of order n , then $|\text{adj } A| = |A|^n$
 - (d) If A is an invertible symmetric matrix, then A^{-1} is also symmetric

PART—B

Answer *any seventy* questions

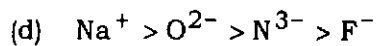
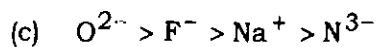
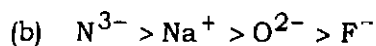
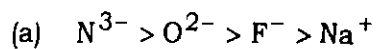
- 46.** Folds with two hinges are known as
- (a) chevron fold
 - (b) box fold
 - (c) isoclinal fold
 - (d) fan fold
- 47.** Pyroxenes belong to
- (a) single-chain structure
 - (b) double-chain structure
 - (c) nesosilicate
 - (d) sorosilicate
- 48.** During metamorphism, what happens to the size of crystals?
- (a) They get smaller
 - (b) They get larger
 - (c) No change in the size
 - (d) They break into pieces
- 49.** Colorless variety of tourmaline is
- (a) anchorite
 - (b) rubellite
 - (c) schorl
 - (d) tourmalone
- 50.** Sphene is a/an
- (a) magnesium silicate
 - (b) calcium iron silicate
 - (c) calcium titanosilicate
 - (d) iron titanosilicate

51. Garnets are characterized by their
- (a) rhombidodecahedron form
 - (b) trapezohedron form
 - (c) octahedron form
 - (d) Both (a) and (b)
52. In volcanic rocks, a calcium poor pyroxene is found which is known as
- (a) pigeonite
 - (b) diopside
 - (c) augite
 - (d) hedenbergite
53. Which is the most important indicator of ancient climate?
- (a) Radioactivity of the deposits
 - (b) Types of cementing material
 - (c) Order of superposition of beds
 - (d) Type and distribution of fossils
54. Hardness of quartz is more than
- (a) corundum
 - (b) topaz
 - (c) calcite
 - (d) diamond
55. Cherry red streak is unique identifier of
- (a) hematite
 - (b) magnetite
 - (c) azurite
 - (d) chrysocolla

56. Oddo-Harkins rule is all about
- (a) cerium anomaly
 - (b) elemental abundances
 - (c) redox reactions
 - (d) elemental substitution
57. Tsunamis never affect ships in deep ocean due to their
- (a) long wavelength
 - (b) high amplitude
 - (c) short wavelength
 - (d) high frequency
58. Which of the following rocks is exposed in Delhi?
- (a) Granite
 - (b) Quartzite
 - (c) Sandstone
 - (d) Limestone
59. Which planet in the solar system is known as 'Goldilocks' planet?
- (a) Mars
 - (b) Uranus
 - (c) Earth
 - (d) Venus
60. What is the ideal pH of a soil for healthy plant growth?
- (a) 4.5-5.5
 - (b) 5-6
 - (c) 6.5-7.5
 - (d) 7-8
61. Porosity and permeability of a soil is controlled by
- (a) grain size
 - (b) grain composition
 - (c) grain shape
 - (d) water temperature

62. Loamy soil consists dominantly of
- (a) sand (b) sand-silt-clay
- (c) clay (d) silt
63. Which of the following **does not** cause currents?
- (a) Wind
- (b) The earth's rotation
- (c) The moon's gravitational pull
- (d) Differences in water density within oceans
64. Geothermal gradient in the earth is
- (a) $\sim 5\text{ }^{\circ}\text{C}/40\text{ m}$ (b) $\sim 3\text{ }^{\circ}\text{C}/40\text{ m}$
- (c) $\sim 1\text{ }^{\circ}\text{C}/40\text{ m}$ (d) $\sim 2\text{ }^{\circ}\text{C}/40\text{ m}$
65. Generally, the temperature of magma varies from
- (a) $-1800\text{ }^{\circ}\text{C}$ to $2200\text{ }^{\circ}\text{C}$ (b) $1040\text{ }^{\circ}\text{C}$ to $1200\text{ }^{\circ}\text{C}$
- (c) $800\text{ }^{\circ}\text{C}$ to $1100\text{ }^{\circ}\text{C}$ (d) $900\text{ }^{\circ}\text{C}$ to $1000\text{ }^{\circ}\text{C}$
66. In metallurgy, obtaining a metal in fused state is called as
- (a) filtration (b) roasting
- (c) smelting (d) calcination

67. The correct order of ionic radii of N^{3-} , O^{2-} , F^{-} and Na^{+} is



68. Total number of electrons in NO_3^{-} is

(a) 24

(b) 7

(c) 32

(d) 38

69. Which one of the following is the most electropositive?

(a) Cs

(b) Na

(c) Ca

(d) K

70. Degree of dissociation **does not** depend on

(a) pressure

(b) temperature

(c) solvent nature

(d) solute nature

71. Hydronium ion is

(a) H^{+}

(b) HO^{-}

(c) H_2^{+}

(d) H_3O^{+}

72. Most abundant rare gas in the atmosphere is

(a) He

(b) Ne

(c) Ar

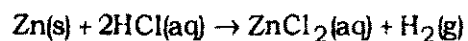
(d) Kr

73. Which one of the following has the highest percent ionic character?
- (a) HF (b) HCl
(c) HI (d) HBr
74. The correct order of penetration power of the α , β and γ rays is
- (a) $\beta > \alpha > \gamma$
(b) $\alpha > \beta > \gamma$
(c) $\gamma > \beta > \alpha$
(d) $\alpha > \gamma > \beta$
75. Which one of the following is isoelectronic with CO?
- (a) N_2^+
(b) O_2^+
(c) CN^-
(d) O_2^-
76. Which one of the following statements is correct about NO, O_2^- and N_2^- ?
- (a) Only NO is paramagnetic
(b) Only NO and O_2^- are paramagnetic
(c) Only N_2^- is paramagnetic
(d) All are paramagnetic

77. The oxidation state of Fe in $[\text{Fe}(\text{H}_2\text{O})_5(\text{NO})^+]\text{SO}_4$ complex is
- (a) 0
 - (b) +1
 - (c) +2
 - (d) +3
78. If e.m.f. value is positive in a redox reaction, then
- (a) the reaction will not take place
 - (b) the reaction will be spontaneous
 - (c) the reaction will be non-spontaneous
 - (d) it is difficult to predict the nature of the reaction
79. Lanthanide contraction leads to
- (a) increase in ionic size from La^{3+} to Lu^{3+} ions
 - (b) decrease in electronegativity from La^{3+} to Lu^{3+} ions
 - (c) decrease in basic strength from La^{3+} to Lu^{3+} ions
 - (d) decrease in standard electrode potential E° , for the reaction $\text{M}^{3+} + 3e^- \rightarrow \text{M}(\text{s})$ from La^{3+} to Lu^{3+} ions
80. What will be the pH of a 500 ml solution containing 5 g of acetic acid and 7.5 g of sodium acetate? [$K_{\text{CH}_3\text{COOH}} = 1.8 \times 10^{-5}$ at 25 °C]
- (a) ~ 4.78
 - (b) ~ 4
 - (c) ~ 7.4
 - (d) ~ 7

81. In any electrochemical cell, the cathode is always
- the positive electrode
 - the negative electrode
 - the electrode at which some species gains electrons
 - the electrode at which some species loses electrons
82. The formal charges on H, C and N respectively, in HCN are
- 0, -1 and -1
 - 1, -1 and 0
 - 0, -1 and +1
 - 0, 0 and 0
83. From left to right, give the hybridization of each carbon atom in the allene molecule
($\text{H}_2\text{C}=\text{C}=\text{CH}_2$)
- sp^2 , sp^2 , sp^2
 - sp^3 , sp^2 , sp^3
 - sp^2 , sp , sp^2
 - sp^3 , sp , sp^3
84. Which combination of formula, IUPAC name and common name below is **incorrect**?
- | | Formula / | IUPAC Name / | Common Name |
|-----|----------------------------------|----------------------|----------------------|
| (a) | CHCl_3 / | trichloromethane / | chloroform |
| (b) | CCl_4 / | tetrachloromethane / | carbon tetrachloride |
| (c) | $\text{C}_6\text{H}_5\text{I}$ / | iodobenzene / | phenyl iodide |
| (d) | CH_2Cl_2 / | dichloromethane / | methane chloride |

85. Which species is reduced in the following reaction?



- (a) Zn
- (b) Cl^\ominus
- (c) H_3O^+
- (d) H_2

86. Which one of the following has Ar 4S^2 electronic configuration?

- (a) Na
- (b) K
- (c) Ca
- (d) Cu

87. Name the yellowish pigment developed by the plants in the absence of light.

- (a) Carotenoids
- (b) Chlorophyll
- (c) Etiolin
- (d) Xanthalin

88. Spruce tree is found in

- (a) tropical rain forests
- (b) mountain forests
- (c) tidal forests
- (d) tropical deciduous forests

- 89.** Energy flow in an ecosystem is
- (a) bidirectional
 - (b) multi-directional
 - (c) unidirectional
 - (d) None of the above
- 90.** Phelloderm is a part of
- (a) epidermis
 - (b) phloem
 - (c) xylem
 - (d) periderm
- 91.** The function of coenzyme A is to
- (a) isomerize pyruvic acid
 - (b) isomerize NAD⁺
 - (c) activate the acetyl group
 - (d) facilitate oxidative phosphorylation
- 92.** Nitrogenous wastes are excreted as uric acid in birds to help in
- (a) conservation of water inside body
 - (b) reducing the chance of kidney stone formation
 - (c) conservation of body heat
 - (d) elimination of excess heat

- 93.** Methanogens are
- (a) obligate anaerobic bacteria
 - (b) aerobic fungi
 - (c) aerobic bacteria
 - (d) obligate anaerobic fungi
- 94.** Chlorosis of plants occurs due to the deficiency of
- (a) chlorine
 - (b) nitrogen
 - (c) calcium
 - (d) sulfur
- 95.** Which of the following is required for C1 activation of complement system of human immune system?
- (a) Ca
 - (b) Mg
 - (c) Mn
 - (d) Zn
- 96.** Chlorosomes are associated with which process in the bacteria?
- (a) Chlorination
 - (b) Photosynthesis
 - (c) Carbon fixation
 - (d) None of the above
- 97.** DNA gyrase is a
- (a) topoisomerase
 - (b) ligase
 - (c) restriction endonuclease
 - (d) protease

- 98.** Which of the following is **not** a phylogenetic class of phylum Proteobacteria?
- (a) Alpha
 - (b) Beta
 - (c) Gamma
 - (d) Theta
- 99.** Selective single-cell isolation can be effectively done by using
- (a) agar dilution tubes
 - (b) microarrays
 - (c) PCR
 - (d) laser tweezers
- 100.** An essential aspect of biofilms is
- (a) aggregation
 - (b) cell growth
 - (c) quorum sensing
 - (d) cell dispersal
- 101.** Bacteria that utilize H_2S as an electron donor for CO_2 reduction in photosynthesis are called
- (a) cyanobacteria
 - (b) hydrogen bacteria
 - (c) purple sulfur bacteria
 - (d) prochlorophytes

- 102.** What is the simplest explanation for why lunar sulfides are isotopically similar to those of the primordial earth?
- (a) The moon is the earth's satellite
 - (b) The moon lacks any form of life
 - (c) The moon shares its geological origin with the earth
 - (d) All of the above
- 103.** Which one of the following forest types covers the largest geographical area of India?
- (a) Tropical wet evergreen forest
 - (b) Subtropical dry evergreen forest
 - (c) Tropical dry deciduous forest
 - (d) Mountain wet temperate forest
- 104.** Forest fire
- (a) increases soil pH and soil organic matter
 - (b) decreases both soil pH and soil organic matter
 - (c) increases soil pH but decreases soil organic matter
 - (d) decreases soil pH but improves soil structure
- 105.** According to astronomical theory of climate change, which of the following is **not** responsible for climate change?
- (a) Variations in the earth's eccentricity
 - (b) Variations in the inclination of the axis of rotation
 - (c) Variations in the earth's gravitational field
 - (d) Precession of the earth's axis of rotation

- 106.** To separate viruses, one would need a membrane with pores of a diameter (in microns)
- (a) 10–100
 - (b) 1–10
 - (c) 0.1–1.0
 - (d) 0.01–0.1
- 107.** Which of the following surfaces exhibits maximum variation in albedo?
- (a) Snow
 - (b) Sand
 - (c) Water
 - (d) Grassland
- 108.** Haplotype means
- (a) haploid form of species
 - (b) an organism living in halophytic habitat
 - (c) the type specimen for a species, whose character defines the species description
 - (d) the type specimen for a species to describe its habitat and adaptation
- 109.** Association of suckerfish and shark can be described as
- (a) protocooperation
 - (b) commensalism
 - (c) predation
 - (d) competition
- 110.** The cells of the retina that are sensitive to color are
- (a) cones
 - (b) iodopsin
 - (c) macula lutea
 - (d) rods

111. The solution of the differential equation $x \cos x \frac{dy}{dx} + y(x \sin x + \cos x) = 1$ is

- (a) $xy = \sin x + c \cos x$
- (b) $xy \sec x = \tan x + c$
- (c) Both of the above
- (d) None of the above

112. $\sinh(x + y) \cosh(x - y) =$

- (a) $\sinh 2x + \sinh 2y$
- (b) $\frac{1}{2}(\sinh 2x + \sinh 2y)$
- (c) $\frac{1}{2}[\sinh 2x - \sinh 2y]$
- (d) None of the above

113. The curve represented by $x = 3(\cos t + \sin t)$, $y = 4(\cos t - \sin t)$ is

- (a) ellipse
- (b) parabola
- (c) hyperbola
- (d) circle

114. The pair of straight lines joining the origin to the common points of $x^2 + y^2 = 4$ and $y = 3x + c$ are perpendicular if $c^2 =$

- (a) 20
- (b) 13
- (c) $\frac{1}{5}$
- (d) 5

115. If $a = 4i + 2j - 5k$, $b = -12i - 6j + 15k$, then the vectors a , b are
- (a) orthogonal
 - (b) parallel
 - (c) non-coplanar
 - (d) None of the above
116. The velocity of sound is measured in hydrogen and oxygen gases at a given temperature. The ratio of two velocities (V_h / V_o) will be
- (a) 1 : 4
 - (b) 4 : 1
 - (c) 1 : 1
 - (d) 32 : 1
117. A lamp is hanging at a height 40 cm from the centre of a table. If its height is increased by 10 cm, the illuminance of the table will decrease by
- (a) 10%
 - (b) 20%
 - (c) 27%
 - (d) 36%
118. The sensitivity of a galvanometer **does not** depend upon
- (a) magnetic induction B of the permanent magnet
 - (b) number of turns N in the coil
 - (c) face area A of the coil
 - (d) the current that it measures

119. If the change in the value of g at a height h above the surface of the earth is the same as at a depth x below it, when both x and h are much smaller than the radius of the earth, then

- (a) $x = h$ (b) $x = 2h$
(c) $x = \frac{h}{2}$ (d) $x = h^2$

120. In the interference pattern, energy is

- (a) created at the position of maxima
(b) destroyed at the position of minima
(c) conserved but is redistributed
(d) None of the above

121. Which of the following statements is **not** correct?

- (a) If the supremum of a set does not belong to the set, then it is a limit point of the set
(b) If the infimum of a set does not belong to the set, then it is a limit point of the set
(c) The derived set of an infinite bounded set is not bounded
(d) The derived set of an infinite bounded set is bounded

122. Which of the following statements is **not** correct?

- (a) Every bounded sequence has a limit point
(b) Every bounded sequence with a unique limit point is convergent
(c) A bounded sequence which does not converge and has at least two limit points, oscillates infinitely
(d) A bounded sequence which does not converge and has at least two limit points, oscillates finitely

123. Which of the following is **not** a correct statement?

- (a) The intersection of any finite number of open sets is open
(b) The intersection of an arbitrary family of closed sets is closed
(c) A set is closed if and only if its complement is open
(d) A set is closed if and only if its complement is closed

124. $\lim_{x \rightarrow 0} \frac{xe^x - \log(1+x)}{x^2}$ is
- (a) $\frac{3}{2}$ (b) 1
(c) 0 (d) ∞
125. A perpendicular is drawn from the point $(-2, 3)$ to the line $y = 2x - 3$. The coordinates of the foot of the perpendicular are
- (a) $(1, -1)$ (b) $(2, 1)$
(c) $(-1, -5)$ (d) $(3, 3)$
126. The relative humidity of air in a closed vessel is 80% at temperature 10°C . What would be the relative humidity when the temperature is increased to 25°C ? Given that saturation vapor pressure is 1.21×10^3 Pa at 10°C and 3.13×10^3 Pa at 25°C .
- (a) 50% (b) 42%
(c) 36% (d) 31%
127. A flywheel of mass 500 kg and 2 m diameter makes 500 revolutions/min. Assuming its mass to be concentrated at the rim, what would be the kinetic energy of the flywheel?
- (a) 68.57×10^{11} ergs (b) 72.37×10^9 ergs
(c) 68.57×10^9 ergs (d) 72.37×10^{11} ergs
128. A steam engine takes steam from the boiler at 200°C and exhausts directly into the air at 100°C . What is its maximum possible efficiency?
- (a) 50% (b) 78.8%
(c) 21.1% (d) 36.2%
129. If the speed of sound at 273 K is 332 m/s in air, its speed in air at 300 K will be
- (a) 315 m/s (b) 332 m/s
(c) 348 m/s (d) 362 m/s

130. The temperature at which a ferromagnetic substance loses its ferromagnetism and becomes paramagnetic, is called

- (a) stagnation temperature
- (b) virtual temperature
- (c) Curie temperature
- (d) potential temperature

131. What is the condition when the line $y = mx + c$ will touch the parabola $y^2 = 4ax$?

- (a) $c = \frac{a}{m}$
- (b) $c = \frac{m}{a}$
- (c) $c = \frac{a^2}{m}$
- (d) $c = \frac{m^2}{a}$

132. What would be the eccentricity of the following ellipse?

$$\frac{x^2}{16} + \frac{y^2}{25} = 1$$

- (a) $\frac{4}{5}$
- (b) $\frac{3}{5}$
- (c) $\frac{2}{5}$
- (d) $\frac{1}{5}$

133. If $x^y = y^x$, then

- (a) $\frac{dy}{dx} = \frac{-y(x \log y + x)}{x(y \log x + y)}$
- (b) $\frac{dy}{dx} = \frac{y(x \log y + x)}{x(y \log x + y)}$
- (c) $\frac{dy}{dx} = \frac{y(x \log y - y)}{x(y \log x - x)}$
- (d) $\frac{dy}{dx} = \frac{-y(x \log y - y)}{x(y \log x - x)}$

134. $\int_0^{\pi/2} \log(\tan x) dx$ is equal to

- (a) 0
- (b) 1
- (c) $\frac{\pi}{4}$
- (d) $\frac{\pi}{2}$

135. What is the condition such that the roots of the equation $px^3 + qx^2 + rx + s = 0$ are in geometric progression?
- (a) $pr^3 = sq^3$ (b) $pr^3 = qs^3$
(c) $rp^3 = sq^3$ (d) $rp^3 = qs^3$
136. When the electron transition takes place from higher energy levels to $n = 3$, which of the following electromagnetic radiations is emitted?
- (a) Ultraviolet
(b) Infrared
(c) Visible
(d) Both ultraviolet and visible
137. The moon revolves around the earth, making a complete revolution in 27.3 days. Assuming that the orbit is circular and has a radius 3.85×10^8 meters, what would be the magnitude of the acceleration of the moon toward the earth?
- (a) 0.00273 m/s^2 (b) 0.102 m/s^2
(c) $2.78 \times 10^{-4} \text{ m/s}^2$ (d) 0.00102 m/s^2
138. A line joining any planet to the sun sweeps out equal areas in equal times. This statement is called
- (a) Halley's principle
(b) Kepler's first law of planetary motion
(c) Kepler's second law of planetary motion
(d) Kepler's third law of planetary motion
139. If the free-fall acceleration near the earth's surface is 9.8 m/s^2 and the radius of the earth is 6370 km, what would be the mass of the earth, given $G = 6.67 \times 10^{-11} \text{ Nm}^2/\text{kg}^2$?
- (a) $\approx 2 \times 10^{22} \text{ kg}$ (b) $\approx 6 \times 10^{22} \text{ kg}$
(c) $\approx 6 \times 10^{27} \text{ kg}$ (d) $\approx 6 \times 10^{24} \text{ kg}$
140. The dimensions of viscosity are
- (a) L^2MT^{-2} (b) LMT^{-1}
(c) $L^{-1}MT^{-1}$ (d) L^2MT^{-1}

SPACE FOR ROUGH WORK

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