

38

QUESTION PAPER
SERIES CODE
A

Registration No. :

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Centre of Exam. :

Name of Candidate :

Signature of Invigilator

ENTRANCE EXAMINATION, 2013

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 ● (b) (c) ●	Wrong ⊗ (b) (c) (d)	Wrong ⊗ (b) (c) ⊗	Wrong ● (b) (c) ●	Correct ● (a) (b) (c) ●
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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. If

$$A = \begin{pmatrix} 2 & -1 & 1 \\ 0 & 1 & 2 \\ 1 & 0 & 1 \end{pmatrix}$$

then A^2 will be given by

(a) $\begin{pmatrix} 11 & -8 & 0 \\ 8 & -1 & 8 \\ 8 & -4 & 3 \end{pmatrix}$

(b) $\begin{pmatrix} 5 & -3 & 1 \\ 2 & 1 & 4 \\ 3 & -1 & 2 \end{pmatrix}$

(c) $\begin{pmatrix} 5 & 2 & 3 \\ -3 & 1 & -1 \\ 1 & 4 & 2 \end{pmatrix}$

(d) $\begin{pmatrix} 11 & 8 & 8 \\ -8 & -1 & -4 \\ 0 & 8 & 3 \end{pmatrix}$

2. A line drawn from the sun to the planet sweeps out equal areas in equal time intervals. The above statement is known as

- (a) Kepler's first law
- (b) Kepler's second law
- (c) Kepler's third law
- (d) Newton's law

3. The equation of the straight line which passes through the intersection of the straight lines $3x - 4y + 1 = 0$ and $5x + y - 1 = 0$ and cuts off equal intercepts on the axes, is

- (a) $3x - 2y + 1 = 0$
- (b) $3x + 5y + 6 = 0$
- (c) $23x + 23y - 11 = 0$
- (d) $3x + 4y + 7 = 0$

4. If

$$y = \tan^{-1}\left(\frac{x}{1 + \sqrt{1 - x^2}}\right)$$

then $\frac{dy}{dx}$ is

(a) $\frac{1}{2\sqrt{1-x^2}}$

(b) $\frac{1}{x\sqrt{1-x^2}}$

(c) $\frac{2}{x\sqrt{1-x^2}}$

(d) $\frac{-2x}{\sqrt{1-x^2}}$

5. $\int (\log x)^2 dx$ is equal to

(a) $(\log x)^2 - \log x + x + C$

(b) $x(\log x)^2 - \log x + 2x + C$

(c) $(\log x)^2 - x \log x + 2x + C$

(d) $x(\log x)^2 - 2x \log x + 2x + C$

6. A helicopter ascends with a velocity $v_0 = 10$ m/s. At a height $H = 50$ m, a heavy body is dropped from it. The velocity with which this body reaches the ground is

(a) 11 m/s

(b) 22 m/s

(c) 33 m/s

(d) 44 m/s

7. Lissajous figures are useful in the study of
- (a) wave motion
 - (b) viscosity
 - (c) semiconductors
 - (d) thermodynamics
8. Velocity of sound is measured in hydrogen and oxygen gases at a given temperature. The ratio of the two velocities $\left(\frac{v_H}{v_O}\right)$ will be
- (a) 4 : 1
 - (b) 1 : 4
 - (c) 1 : 1
 - (d) 32 : 1
9. An air bubble in water behaves like a
- (a) convergent lens
 - (b) divergent lens
 - (c) cylindrical lens
 - (d) bifocal lens
10. Obliquity of the earth is currently
- (a) $24^\circ 3'$
 - (b) $20^\circ 0'$
 - (c) $28^\circ 5'$
 - (d) $23^\circ 27'$
11. Which of the following is the weakest acid?
- (a) Ethyl alcohol
 - (b) Methyl alcohol
 - (c) Phenol
 - (d) *t*-butyl alcohol

12. Which of the following is considered as metal as well as nonmetal?
- (a) Iodine
 - (b) Hydrogen
 - (c) Helium
 - (d) Mercury
13. An atom having more electrons than its protons is known as
- (a) an isotope
 - (b) an anion
 - (c) a cation
 - (d) a molecule
14. Which of the following metals floats on water?
- (a) Beryllium
 - (b) Titanium
 - (c) Magnesium
 - (d) Potassium
15. Which one of the following is condensation polymer?
- (a) PVC
 - (b) Polythene
 - (c) Protein
 - (d) Rubber
16. Which of the following is used as a standard for octane rating of fuels?
- (a) Iso-octane
 - (b) *n*-octane
 - (c) 2,2,4-trimethylpentane
 - (d) *n*-heptane

17. Which of the following has bond order equal to $1/2$?
- (a) He_2
 - (b) He_2^+
 - (c) He_2^-
 - (d) NO
18. Which of the following statements for ionic compounds is false?
- (a) They generally consist of ions
 - (b) They generally have high m.p. and b.p.
 - (c) They are good conductor at room temperature
 - (d) They are generally soluble in polar solvents
19. Which of the following elements is the most electronegative?
- (a) Potassium
 - (b) Oxygen
 - (c) Fluorine
 - (d) Bromine
20. The mass of 1 mole of calcium carbonate (CaCO_3) is
- (a) 50 g
 - (b) 100 g
 - (c) 200 g
 - (d) 400 g

21. A determinant

$$\Delta = \begin{vmatrix} 1 & -3 & 2 \\ 4 & -1 & 2 \\ 0 & 5 & 1 \end{vmatrix}$$

is given. Its cofactor C_{23} of the third element in the second row is equal to

- (a) 5
- (b) 11
- (c) 20
- (d) -5

22. Dimensions of angular momentum are
- (a) $L^2 M$
 - (b) $L M T^{-2}$
 - (c) $L^2 M T^{-1}$
 - (d) $L^2 M T^{-2}$
23. The induced current is always in such a direction as to oppose the change producing it. The above statement is known as
- (a) Faraday's law
 - (b) Henry's law
 - (c) Maxwell's law
 - (d) Lenz's law
24. Fusion reaction takes place at about
- (a) 3×10^2 K
 - (b) 3×10^3 K
 - (c) 3×10^4 K
 - (d) 3×10^6 K
25. Which of the following **does not** support the wave nature of light?
- (a) Interference
 - (b) Diffraction
 - (c) Photoelectric effect
 - (d) Polarization
26. Molten rock inside the earth is known as
- (a) lava
 - (b) magma
 - (c) volcano
 - (d) basalt

- 27.** The slow imperceptible gravity movement is known as
- (a) creep
 - (b) landslide
 - (c) avalanche
 - (d) land subsidence
- 28.** Jasper is a
- (a) variety of iron ore
 - (b) variety of quartz
 - (c) variety of manganese mineral
 - (d) variety of zinc ore
- 29.** Phytolith is a
- (a) fossilized plant
 - (b) plant-shaped rock
 - (c) solar weathering of rocks
 - (d) silicate mineral
- 30.** Ice melt out cycle, which is an indicator of climate change, is known as
- (a) uniformitarianism
 - (b) Heinrich cycle
 - (c) water cycle
 - (d) rejuvenation
- 31.** Angular fragment of volcanic glass is known as
- (a) tektite
 - (b) shard
 - (c) phenocryst
 - (d) oolite

32. The ring of fire surrounds
- (a) the Pacific Ocean
 - (b) the Atlantic Ocean
 - (c) the Indian Ocean
 - (d) the Arabian Sea
33. The intensity of earthquake is measured by
- (a) Richter scale
 - (b) Mercalli scale
 - (c) Mohs scale
 - (d) Millennium scale
34. Which of the following is **not** a metamorphic rock?
- (a) Phyllite
 - (b) Marble
 - (c) Schist
 - (d) Limestone
35. Extinction of dinosaurs took place on account of
- (a) seafloor spreading
 - (b) continental drift
 - (c) volcanic eruptions
 - (d) earthquake

36. Majority of soil fungi are bound in
- (a) basic soils
 - (b) acidic soils
 - (c) neutral soils
 - (d) None of the above
37. The light reactions of photosynthesis take place in the
- (a) cytosol
 - (b) endoplasmic reticulum
 - (c) leucoplasts
 - (d) chloroplasts
38. The lower limit of water availability in soil is known as
- (a) wilting point
 - (b) wilting capacity
 - (c) field capacity
 - (d) water holding capacity
39. Which one of the following processes helps in nutrient conservation?
- (a) Mineralization
 - (b) Leaching
 - (c) Nitrification
 - (d) Immobilization
40. The group of organisms which converts light into food is called
- (a) autotroph
 - (b) oligotroph
 - (c) heterotroph
 - (d) decomposer

41. Members of which of the following groups cannot generate their own ATP?
- (a) Lichens
 - (b) Viruses
 - (c) Diatoms
 - (d) Protozoa
42. The association between rhizobium and leguminous plant is
- (a) parasitism
 - (b) commensalism
 - (c) symbiosis
 - (d) predation
43. In which of the following phases of cell cycle, DNA synthesis takes place?
- (a) G₁-phase
 - (b) S-phase
 - (c) G₂-phase
 - (d) M-phase
44. Which of the following is **not** a greenhouse gas?
- (a) CO₂
 - (b) SO₂
 - (c) CH₄
 - (d) N₂O
45. The death of a river by environmental pollutants ultimately results from
- (a) the depletion of oxygen
 - (b) the overpopulation of algae
 - (c) the overabundance of toxic materials
 - (d) the buildup of sediment on the river bottom

PART—B

Answer any **seventy** questions

46. $\begin{vmatrix} x & y & z \\ x^2 & y^2 & z^2 \\ yz & zx & xy \end{vmatrix}$ is equal to

- (a) $(x - y)(y - z)(z - x)$
- (b) $(x - y)(y - z)(z - x)(x + y + z)$
- (c) $(x - y)(y - z)(z - x)(xy + yz + zx)$
- (d) 0

47. The length of the latus rectum of the ellipse $3x^2 + 4y^2 = 48$ is equal to

- (a) 8
- (b) $4\sqrt{3}$
- (c) 6
- (d) $\frac{1}{2}$

48. If $y = \tan^{-1} \left[\frac{\sqrt{1+x^2} + \sqrt{1-x^2}}{\sqrt{1+x^2} - \sqrt{1-x^2}} \right]$, then $\frac{dy}{dx}$ is equal to

- (a) $\frac{-x}{\sqrt{1-x^4}}$
- (b) $\frac{x}{\sqrt{1-x^4}}$
- (c) $\frac{1}{\sqrt{1-x^4}}$
- (d) $\frac{-1}{\sqrt{1-x^4}}$

49. $\lim_{x \rightarrow 0} \left[\tan \left(\frac{\pi}{4} + x \right) \right]^{\frac{1}{x}}$ is equal to

- (a) e
- (b) e^2
- (c) $\frac{1}{e}$
- (d) $\frac{1}{e^2}$

50. A and B throw a coin alternately till one of them gets a head and wins the game. Assuming the coin to be unbiased, the probability that A wins the game is equal to
- (a) $\frac{2}{3}$
 - (b) $\frac{1}{3}$
 - (c) 0
 - (d) Cannot be determined

51. The equation of a plane passing through the point (1, -1, -1) and perpendicular to each of the planes $x - 2y - 8z = 0$ and $2x + 5y - z = 0$ is
- (a) $5x - 3y + 7z - 16 = 0$
 - (b) $3x + 7y - 9z + 16 = 0$
 - (c) $14x - 5y + 3z - 16 = 0$
 - (d) $7x - 5y + 9z + 16 = 0$

52. $(\sqrt{3} + i)^6$ is equal to —, if it is given that $i^2 = -1$.
- (a) 64
 - (b) -64
 - (c) $64i$
 - (d) $-64i$

53. The series

$$f(x) = 1 - \frac{x^2}{2!} + \frac{x^4}{4!} - \frac{x^6}{6!} + \dots$$

represents

- (a) $\sec x$
 - (b) $\cos x$
 - (c) $\sin x$
 - (d) $\tan x$
54. In 50 sec, 300 c.c. of oxygen diffuses through a porous plate. How long will it take 300 c.c. of chlorine to diffuse through the same plate? [Take molecular weight of oxygen and chlorine as 32 and 72 respectively]
- (a) 50 sec
 - (b) 75 sec
 - (c) 60 sec
 - (d) 85 sec

55. The unit of magnetic induction is
- (a) weber
 - (b) henry per meter
 - (c) tesla
 - (d) farad per meter
56. What will be the terminal velocity in air of an oil drop of radius 10^{-5} m? [Given, $g = 9.8 \text{ m/sec}^2$, viscosity of air = $1.8 \times 10^{-5} \text{ kg m}^{-1} \text{ sec}^{-1}$ and density of oil = 900 kg/m^3 ; the upthrust of air may be neglected]
- (a) 3.59 cm/sec
 - (b) 1.08 cm/sec
 - (c) 0.63 cm/sec
 - (d) 2.48 cm/sec
57. Water flows through a horizontal pipe of varying cross-section at the rate of 10 cubic meter/min. What is the velocity of water at a point where the radius of the pipe is 10 cm?
- (a) 7.5 m/sec
 - (b) 6.3 m/sec
 - (c) 5.3 m/sec
 - (d) 4.5 m/sec
58. A wire, 50 cm long and 1 mm^2 in cross-section, has Young's modulus $1.24 \times 10^{12} \text{ dyne/cm}^2$. How much work is done in stretching it through 1 mm?
- (a) 0.124 joule
 - (b) $0.248 \times 10^5 \text{ erg}$
 - (c) $0.124 \times 10^5 \text{ erg}$
 - (d) 0.248 joule
59. How far from the earth does acceleration due to gravity become one percent of its value at the earth's surface? [Assume the earth to be a sphere of radius $6.38 \times 10^8 \text{ cm}$]
- (a) $6.75 \times 10^{10} \text{ cm}$
 - (b) $6.75 \times 10^9 \text{ m}$
 - (c) $5.74 \times 10^9 \text{ m}$
 - (d) $5.74 \times 10^9 \text{ cm}$

60. A body weighs 900 gm on the surface of the earth. How much will it weigh on the surface of the Mars whose mass is one-ninth and radius one-half that of the earth?
- (a) 200 gm
 - (b) 300 gm
 - (c) 400 gm
 - (d) 500 gm
61. Molar internal energy of a monoatomic ideal gas as a function of absolute temperature is
- (a) $\frac{\sqrt{3}}{2} RT$
 - (b) $\frac{3}{2} RT^2$
 - (c) $\frac{3}{2} RT$
 - (d) $\frac{3}{\sqrt{2}} RT$
62. Which of the following types of cloud occurs at the highest altitude?
- (a) Cumulus
 - (b) Stratus
 - (c) Cirrus
 - (d) Cumulonimbus
63. A closed bottle containing water at 30 °C is carried to the moon in a spaceship. It is placed on the surface of the moon. What will happen to the water as soon as the lid is opened?
- (a) Water will freeze
 - (b) Water will boil
 - (c) Water will decompose into H₂ and O₂
 - (d) Nothing will happen
64. Which of the following surfaces shows the maximum variation in albedo during the daytime?
- (a) Vegetation
 - (b) Sand
 - (c) Snow
 - (d) Water

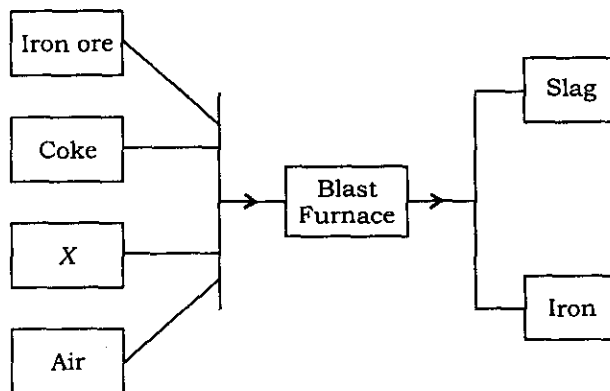
65. Which of the following is a correct statement?
- (a) $\frac{dT}{dZ} = 0$ in the stratosphere
 - (b) $\frac{dT}{dZ} > 0$ in the troposphere
 - (c) $\frac{dT}{dZ} < 0$ in the thermosphere
 - (d) $\frac{dT}{dZ} < 0$ in the mesosphere
66. pH of 0.15 M $\text{NH}_4\text{Cl}(\text{aq})$ solution is [Given, $K_a = 5.6 \times 10^{-10}$]
- (a) 1.5
 - (b) 5.04
 - (c) 9.44
 - (d) >10
67. A certain system absorbs 3×10^{18} quanta of light per second. On irradiation for 20 minutes, 0.003 mole of reactant was found to have reacted. The quantum yield (ϕ) for the process is [Avogadro's number = 6.023×10^{23}]
- (a) >1
 - (b) 0.5
 - (c) 1.0
 - (d) <0.5
68. Which of the following statements is true about a pure substance above its critical point?
- (a) One fluid phase is present
 - (b) Solid, liquid and gas are in equilibrium
 - (c) Only liquid and gas are in equilibrium
 - (d) A liquid forms
69. The enthalpy change during the formation of 1.00 mole $\text{NH}_3(\text{g})$ from its elements at 298 K is -46.1 kJ. The change in internal energy during this process is equal to [Given, $RT = 2.48$ kJ mol $^{-1}$ at 298 K]
- (a) -48.58 kJ
 - (b) -43.6 kJ
 - (c) -46.1 kJ
 - (d) 48.58 kJ

70. Which of the following electrolytes will have maximum flocculation value for $\text{Fe}(\text{OH})_3$ sol?
- (a) NaCl
 - (b) K_2SO_4
 - (c) Na_2S
 - (d) $(\text{NH}_4)_3\text{PO}_4$
71. Which of the following compounds will develop a blue colour on successive treatment with aqueous KI containing KIO_3 and starch solution?
- (a) Ethanol
 - (b) Phenol
 - (c) Benzoic acid
 - (d) Ethyl acetate
72. Which of the following organic compounds have more than one NMR signal?
- | | | |
|-------------------------------------|--------------------------------------|--|
| (i) $(\text{CH}_3)_4\text{C}$ | (ii) C_3H_6 | (iii) $\text{C}_3\text{H}_6\text{O}_2$ |
| (iv) $\text{C}_2\text{H}_6\text{O}$ | (v) $\text{C}_3\text{H}_8\text{O}_2$ | |
- (a) (i) and (ii)
 - (b) (iii) and (v)
 - (c) (iii), (iv) and (v)
 - (d) (ii) and (iv)
73. The number of d electrons in Fe^{+2} ($Z = 26$) is **not** equal to that of
- (a) p electrons in Ne ($Z = 10$)
 - (b) s electrons in Mg ($Z = 12$)
 - (c) d electrons in Fe ($Z = 26$)
 - (d) p electrons in Cl ($Z = 17$)
74. Which of the following is true for hexagonal crystal system?
- (a) $\alpha = \beta = \gamma = 90^\circ$
 - (b) $\alpha = \beta = 90^\circ$ $\gamma \neq 90^\circ$
 - (c) $\alpha = \beta = 90^\circ$ $\gamma = 120^\circ$
 - (d) $\alpha = \beta = \gamma \neq 90^\circ$

75. Na_2SO_3 and Na_2SO_4 can be distinguished from each other by using
- BaCl and HCl
 - AgNO_3 and NH_3
 - Na_2CO_3 and NaOH
 - NH_3
76. The following carbocations in order of increasing stability (least \rightarrow most) is
- $$\begin{array}{ccc} \text{CH}_3\overset{+}{\text{C}}\text{HCH}_3 & \text{CH}_3\overset{+}{\text{C}}\text{HCH}=\text{CHCH}_3 & (\text{CH}_3)_3\overset{+}{\text{C}}\text{CH}_2 \\ (1) & (2) & (3) \end{array}$$
- $1 < 2 < 3$
 - $3 < 1 < 2$
 - $2 < 3 < 1$
 - $2 < 1 < 3$
77. Phytane is a naturally occurring alkane produced by the alga *Spirogyra* and is a constituent of petroleum. The IUPAC name for phytane is
- 2,4,6,10-tetramethylhexadecane
 - 2,6,10,14-tetramethylhexadecane
 - 2,6,10,12-tetramethylhexadecane
 - 2,4,6,8-tetramethylhexadecane
78. How many gram of sulphuric acid are contained in 3.00 litre of 0.500 *N* solution? [M. W. of $\text{H}_2\text{SO}_4 = 98.1$]
- 73.6 g
 - 98.1 g
 - 196.2 g
 - 496.3 g
79. A 25.0 mL sample of a basic solution of unknown concentration is titrated with 0.100 mole/L hydrochloric acid. A total of 20.0 mL of acid is required to neutralize the base. The concentration of the base will be
- 0.040 mole/L
 - 0.080 mole/L
 - 0.120 mole/L
 - 0.160 mole/L
80. The condensation of a gas to a liquid would most likely have
- positive ΔH and positive ΔS
 - negative ΔH and positive ΔS
 - positive ΔH and negative ΔS
 - negative ΔH and negative ΔS

81. How many millilitres of a 50.0% (by mass) HNO_3 solution with a density of 2.00 gram per millilitre are required to make 500 mL of a 2.00 M HNO_3 solution?
- (a) 50.0 mL
 (b) 63.0 mL
 (c) 100 mL
 (d) 200 mL

82. The diagram below represents the manufacture of iron :



What is X?

- (a) Bauxite
 (b) Limestone
 (c) Mild steel
 (d) Sand
83. Climate change assessment is derived from the analysis of global average temperature records. Meaningful climate change estimates require the analysis of data record over time span
- (a) ≥ 24 hours
 (b) ≥ 30 years
 (c) ≥ 10 years
 (d) ≥ 1 year
84. The average thickness of glass lens used in spectacles will stop
- (a) solar UV-B
 (b) visible radiation
 (c) IR radiation
 (d) radio waves
85. Which of the following is **not** a criterion for air pollution?
- (a) Pb
 (b) O_3
 (c) CO_2
 (d) NO_x

86. If a cricket ball is dropped in a tunnel made along the diameter of the earth, then the ball will
- not enter the tunnel
 - stop at the centre
 - escape into space from other side
 - oscillate in simple harmonic motion
87. Molecule having zero polarizability will manifest
- strong Rayleigh scattering
 - strong dynamic light scattering
 - absorption plus light scattering
 - no light scattering
88. The area of the segment enclosed by the curve $y = x(2 - x)$ and the line $y = \frac{x}{2}$ is equal to
- 0
 - 1
 - 7
 - $\frac{9}{16}$
89. Which of the following is true for an isothermal expansion process?
- $\Delta E = 0, \Delta H = 0$
 - $\Delta E \neq 0, \Delta H = 0$
 - $\Delta E = 0, \Delta H \neq 0$
 - $\Delta E \neq 0, \Delta H \neq 0$
90. The total energy radiated per unit surface area of a blackbody across all wavelengths per unit time is directly proportional to the fourth power of the blackbody's thermodynamic temperature. This statement is known as
- Kirchhoff's law
 - Joule's law
 - Stefan's law
 - Newton's law

91. The following data is given :

x	2	6	4	7	5
y	8	8	5	6	2

A line of best fit is drawn considering y as the dependent variable. Its slope and intercept are

- 0.129 and 6.83
- 0.216 and 5.54
- 0.129 and 6.83
- 0.216 and 6.83

92. Which of the following statements is **not** correct?
- The union of two closed sets is a closed set
 - The union of any finite collection of closed sets is a closed set
 - The union of an infinite number of closed sets need not be a closed set
 - The intersection of two closed sets need not be a closed set
93. Which of the following is a correct statement?
- A sequence $\{a_n\}$ is said to be strictly monotonically increasing, if $a_{n+1} \geq a_n \forall n \in N$
 - A sequence $\{a_n\}$ is said to be strictly monotonically increasing, if $a_{n+1} > a_n \forall n \in N$
 - A sequence $\{a_n\}$ is said to be strictly monotonically decreasing, if $a_{n+1} \leq a_n \forall n \in N$
 - A sequence $\{a_n\}$ is said to be monotonically decreasing, if $a_{n+1} > a_n \forall n \in N$

94. If $f(x)$ be a function such that—

- it is continuous in the closed interval $[a, b]$;
- it is derivable in the open interval (a, b) ;

then there exists at least one point $c \in (a, b)$ such that $\frac{f(b) - f(a)}{b - a} = f'(c)$.

The above statement is called as

- Rolle's theorem
- Lagrange's mean value theorem
- Cauchy's mean value theorem
- intermediate mean value theorem

95. $\lim_{x \rightarrow 0} \left(\frac{3^{2x} - 1}{2^{3x} - 1} \right)$ is equal to

- $\frac{\log 9}{\log 8}$
- $\frac{\log 8}{\log 9}$
- $\frac{2}{3}$
- $\frac{3}{2}$

96. If $y = \left(1 + x + \frac{x^2}{2!} + \frac{x^3}{3!} + \dots \infty \right)$, then $\frac{dy}{dx}$ is equal to

- ∞
- Cannot be determined
- y
- $\log y$

97. Consider the earth to be a blackbody with an average temperature of 15.0°C and surface area equal to $5.1 \times 10^{14} \text{ m}^2$. What is the rate at which energy is radiated by the earth? [Given, Stefan-Boltzmann constant = $5.67 \times 10^{-8} \text{ W/m}^2 \cdot \text{K}^4$]
- $4.0 \times 10^6 \text{ W}$ approximately
 - $4.0 \times 10^{17} \text{ W}$ approximately
 - $2.0 \times 10^{17} \text{ W}$ approximately
 - $2.0 \times 10^6 \text{ W}$ approximately
98. Excess pressure inside a drop of mercury of diameter 4 mm at 20°C will be
- 5 N m^{-2}
 - 50 N m^{-2}
 - 465 N m^{-2}
 - 46.5 N m^{-2}
99. The atmospheric pressure on a day when the height of mercury in barometer is 76 cm will be
- 101300 N m^{-2}
 - 101.300 N m^{-2}
 - $1.013 \times 10^5 \text{ N m}^{-2}$
 - $1.013 \times 10^3 \text{ N m}^{-2}$
100. In the first second of its flight, a rocket ejects $\frac{1}{60}$ of its mass with relative velocity of 2400 ms^{-1} . The acceleration of the rocket will be
- 9.8 ms^{-2}
 - 31.2 ms^{-2}
 - 19.6 ms^{-2}
 - 62.4 ms^{-2}
101. Geological formation in sedimentary rocks is shaped by soluble
- magnesite or siderite
 - limestone or dolomite
 - siderophile or magnesite
 - glauconite or siderite
102. — leads to lengthening or stretching of the crest.
- Confining stress
 - Tensional stress
 - Compressional stress
 - Shear stress

103. A — is a circular upwardly displaced fold.
- (a) plunging basin
 - (b) dome
 - (c) converging basin
 - (d) depression
104. Which of the following minerals are silicates?
- | | |
|--|---|
| <ul style="list-style-type: none"> (i) Calcite (iii) Malachite | <ul style="list-style-type: none"> (ii) Hornblende (iv) Biotite |
|--|---|
- (a) (i) and (ii)
 - (b) (ii) and (iii)
 - (c) (ii) and (iv)
 - (d) (i) and (iv)
105. Glaciers move by — where the entire glacier slides over bedrock.
- (a) plastic flow
 - (b) subduction slip
 - (c) saltation flow
 - (d) basal slip
106. — runs down the centre of many parts of the ridge and valley, and both are offset by numerous —.
- (a) Midoceanic ridge, island arcs
 - (b) Rift valley, transform faults
 - (c) Oceanic ridge, transform faults
 - (d) Rift valley, oceanic trenches
107. — pattern is developed when bedrock exerts strong control over stream flow because of the structure of the underlined geology.
- (a) Dendritic
 - (b) Radial
 - (c) Rectangular
 - (d) Trellis
108. — dunes are shaped like a crescent moon except that horns point upward and regular, occur in more sand supply region with sufficient vegetation.
- (a) Longitudinal
 - (b) Star
 - (c) Parabolic
 - (d) Barchan

109. A bowl-shaped depression carved by the glacier on the side of mountain is
- (a) cinder
 - (b) chert
 - (c) clast
 - (d) cirque
110. Removal of ice at the toe of the glacier by melting and sublimation is
- (a) snout
 - (b) calving
 - (c) ablation
 - (d) moraine
111. Breccia is produced in
- (a) fault zone
 - (b) folded rocks
 - (c) unconformity
 - (d) fractured rocks
112. Kimberlites are the source rocks for
- (a) gold
 - (b) diamond
 - (c) petroleum
 - (d) silver
113. QAPF system is **not** suitable for classification of
- (a) granite
 - (b) dolerite
 - (c) quartzite
 - (d) carbonatite
114. A cumulative effect of impacts of hypervelocity particles from outer space is known as
- (a) cosmic erosion
 - (b) wind erosion
 - (c) stellar erosion
 - (d) outer spacial erosion

115. A — is a broad depositional surface found by merging alluvial fans.
- (a) bajada
 - (b) pediment
 - (c) playa
 - (d) mesa
116. The isotopic composition of — in — and — are used to estimate the time of ore deposition and information about the crustal history.
- (a) zinc, corundum, pyrite
 - (b) lead, cuprite, galena
 - (c) lead, pyrite, galena
 - (d) lead, zincovite, corundum
117. The evidence of the oldest life existence in the earth is
- (a) 2.5 billion years
 - (b) 3.2 billion years
 - (c) 3.8 billion years
 - (d) 2.8 billion years
118. Monazite is commonly found in the — of India.
- (a) beach placers
 - (b) fluvial placers
 - (c) colluvial placers
 - (d) lacustrine placers
119. Hardness of gypsum is more than
- (a) fluorite
 - (b) apatite
 - (c) talc
 - (d) calcite
120. Algal bloom is a sudden growth on the surface of a lake, pond or stream, and occurs due to enrichment of
- (a) phosphorus
 - (b) calcium
 - (c) iron
 - (d) magnesium

121. Which of the following types of bonds or interactions are least likely to be involved in stabilizing the three-dimensional folding of most proteins?
- (a) Hydrogen bonds
 - (b) Hydrophobic interactions
 - (c) Disulphide bonds
 - (d) Ester bonds
122. In reversed-phase HPLC
- (a) a hydrophobic stationary phase is combined with a nonpolar mobile phase
 - (b) a hydrophilic stationary phase is combined with a polar mobile phase
 - (c) a hydrophilic stationary phase is combined with a nonpolar mobile phase
 - (d) a hydrophobic stationary phase is combined with a polar mobile phase
123. In primary succession, plant's demand for nutrients is high during
- (a) pioneer stage
 - (b) early successional stage
 - (c) climax stage
 - (d) None of the above
124. Cellular proteins destined for secretion are sorted and packaged in
- (a) lysosomes
 - (b) endoplasmic reticulum
 - (c) trans-Golgi network
 - (d) endosomes
125. The amount of living matter present at any point of time in an ecosystem is called
- (a) net productivity
 - (b) gross productivity
 - (c) standing crop biomass
 - (d) food chain
126. According to classical model of transcription, given by Jacob and Monad, a repressor protein binds to
- (a) an operator
 - (b) an AUG sequence
 - (c) an enhancer
 - (d) TATA binding site
127. Virus-mediated transfer of cellular genetic material from one bacterial cell to another by means of virus particles is called
- (a) induction
 - (b) transfection
 - (c) transformation
 - (d) transduction

128. Artificial immunity can be acquired from
- (a) serious illness
 - (b) vaccination
 - (c) repeated exposure to the same microbe
 - (d) treatment with antibiotic
129. Which of the following regulates the cell division in shoot and root of plants?
- (a) Gibberellin
 - (b) Auxin
 - (c) Abscisic acid
 - (d) Cytokinin
130. Which of the following is secreted by exocrine cell of pancreas?
- (a) Carboxypeptidase
 - (b) Gastrin
 - (c) Enteropeptidase
 - (d) Aminopeptidase
131. Which of the following is a polar amino acid?
- (a) Isoleucine
 - (b) Proline
 - (c) Glycine
 - (d) Serine
132. Which of the following is unsaturated fatty acid?
- (a) Palmitic acid
 - (b) Stearic acid
 - (c) Lauric acid
 - (d) Oleic acid
133. A biome is distinguished by its
- (a) unique soil type
 - (b) unique ecosystem processes
 - (c) unique climate and vegetation
 - (d) unique soil type and unique ecosystem processes
134. The process of methanogenesis is carried out by
- (a) bacteria
 - (b) fungi
 - (c) archaea
 - (d) protozoa

135. Which of the following can act as an electron donor in photosynthesis?
- (a) H_2
 - (b) H_2O
 - (c) H_2S
 - (d) All of the above
136. The site of origin of life is
- (a) the ocean's edge
 - (b) under frozen oceans
 - (c) near deep-sea vents
 - (d) the desert area
137. Rainfall in Mediterranean region occurs
- (a) throughout the year
 - (b) in summer
 - (c) in winter
 - (d) never
138. Which one of the following statements is *not* correct?
- (a) Rhizobium is an example of mutualism
 - (b) Epiphytes like many orchids growing on trees illustrate an example of commensalism
 - (c) Lichens offer an example of mutualism
 - (d) Commensalism is a positive interaction found only in terrestrial ecosystem
139. — is the greatest nitrogen reservoir in the biosphere.
- (a) Atmosphere
 - (b) Ocean
 - (c) Organism
 - (d) Rock
140. An ecological pyramid of energy flow is often an inverted pyramid in
- (a) desert ecosystem
 - (b) rainforest ecosystem
 - (c) tundra ecosystem
 - (d) ocean ecosystem

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