

38

QUESTION PAPER  
SERIES CODE  
**A**

Registration No. :

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 ○ (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. 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)  $30^\circ$
  - (b)  $45^\circ$
  - (c)  $60^\circ$
  - (d) None of the above
  
2.  $\tan 3A - \tan 2A - \tan A =$ 
  - (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
  
3. 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
  
4. The ionization potential of hydrogen atom is
  - (a) 13.60 volts
  - (b) 8.24 volts
  - (c) 10.36 volts
  - (d) 14.24 volts

5. A moving-coil galvanometer works on the principle that
- a magnetic field produces a mechanical force on a conductor
  - a magnetic field produces a force on a current-carrying conductor
  - a current-carrying conductor exerts a force on a magnet
  - a conductor exerts a force on a magnet

6. If

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

then the value of  $x$  is

- 8
- $\frac{1}{2}$
- $\frac{1}{4}$
- $-\frac{1}{2}$

7. 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

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

9. 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  $\left(0, \frac{\pi}{2}\right)$

10. 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

11. Two loads having a total mass  $m_1 + m_2 = 30$  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)  $m_1 = 8.5$  kg and  $m_2 = 21.5$  kg

(b)  $m_1 = 9.5$  kg and  $m_2 = 20.5$  kg

(c)  $m_1 = 10.5$  kg and  $m_2 = 19.5$  kg

(d)  $m_1 = 11.5$  kg and  $m_2 = 18.5$  kg

12. 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)  $\sim 150$  N

(b)  $\sim 289$  N

(c)  $\sim 398$  N

(d)  $\sim 450$  N

13. 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  $1 \text{ g/cm}^3$ ?
- (a)  $4.41 \times 10^4$  Pa
  - (b) 44.1 Pa
  - (c)  $1.041 \times 10^5$  Pa
  - (d)  $1.454 \times 10^5$  Pa
14. The unit of magnetic induction is
- (a) henry
  - (b) siemens
  - (c) weber
  - (d) tesla
15. 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)  $R - [-1, 1]$
16. 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

17. The energy that drives surface ocean currents comes from

- (a) salinity variations
- (b) wave action
- (c) temperature differences
- (d) wind

18. Because of the Coriolis effect, ocean currents in the Northern Hemisphere are deflected to the

- (a) left
- (b) right
- (c) south
- (d) north

19. Which is the nearest star to the earth?

- (a) Venus
- (b) Saturn
- (c) Sun
- (d) Jupiter

20. Which of the following is a blue planet?

- (a) Venus
- (b) Saturn
- (c) Earth
- (d) Jupiter

21. Which of the following makes soil distinct from sediment?
- (a) Organic matter
  - (b) Water
  - (c) Grain size
  - (d) Humus
22. Which of the following is easily affected during pedogenesis?
- (a) Zircon
  - (b) Quartz
  - (c) Feldspar
  - (d) Rutile
23. Siderophile elements show affinity to
- (a) silicates
  - (b) sulfides
  - (c) iron
  - (d) gas
24. Which one of the following is the lightest transition element?
- (a) Hg
  - (b) Fe
  - (c) Sc
  - (d) Zn
25. 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



26. 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
27. 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
28. Which of the following **does not** undergo sublimation process?
- (a) Naphthalene
  - (b) Camphor
  - (c) Succinic acid
  - (d) Charcoal
29. Brown ring in the ring test for nitrate is due to the formation of
- (a)  $\text{HNO}_2$
  - (b)  $\text{FeSO}_4 \cdot \text{NO}$
  - (c)  $\text{Fe}(\text{NO}_3)_3$
  - (d)  $\text{Fe}(\text{NO}_2)_3$
30. What is the bond order in CO molecule?
- (a) 2
  - (b) 3
  - (c) 4
  - (d) 1.5

31. 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
32. 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
33. Historically, the concept of pure cultures in microbiology was developed by
- (a) Louis Pasteur
  - (b) Antonie van Leeuwenhoek
  - (c) Robert Koch
  - (d) Joseph Lister
34. Which biofuel is widely used in many countries as a motor fuel?
- (a) Methane
  - (b) Ethanol
  - (c) Butanol
  - (d) Biodiesel
35. Where are the most microbial cells located on the earth?
- (a) Earth's surface
  - (b) Atmosphere
  - (c) Open oceans
  - (d) Oceanic and terrestrial subsurface

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

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

**37.** The benefit people get from ecosystem is popularly known as

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

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

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

**39.** Mule is an example of

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

**40.** The human saliva helps in the digestion of

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

41. 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
42. Which form of scattering in the atmosphere is **not** dependent on wavelength?
- (a) Mie
  - (b) Non-selective
  - (c) Rayleigh
  - (d) None of the above
43. During mitosis, ER and nucleolus begin to disappear at
- (a) early metaphase
  - (b) late metaphase
  - (c) early prophase
  - (d) late prophase
44. 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
45. Which of the following is directly associated with acid rain?
- (a)  $N_2O$
  - (b)  $NO_2$
  - (c) Urea
  - (d) Amines

**PART—B**

Answer *any seventy* questions

46. 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
47.  $\sinh(x + y) \cosh(x - y) =$
- (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
48. 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
49. 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

50. 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
51. 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
52. 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%
53. 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

54. 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)  $x = h^2$
55. 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
56. 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
57. 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
58. 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

59.  $\lim_{x \rightarrow 0} \frac{xe^x - \log(1+x)}{x^2}$  is
- (a)  $\frac{3}{2}$  (b) 1  
(c) 0 (d)  $\infty$
60. 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)  $(3, 3)$
61. The relative humidity of air in a closed vessel is 80% at temperature  $10^\circ\text{C}$ . What would be the relative humidity when the temperature is increased to  $25^\circ\text{C}$ ? Given that saturation vapor pressure is  $1.21 \times 10^3$  Pa at  $10^\circ\text{C}$  and  $3.13 \times 10^3$  Pa at  $25^\circ\text{C}$ .
- (a) 50% (b) 42%  
(c) 36% (d) 31%
62. 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)  $68.57 \times 10^{11}$  ergs (b)  $72.37 \times 10^9$  ergs  
(c)  $68.57 \times 10^9$  ergs (d)  $72.37 \times 10^{11}$  ergs
63. A steam engine takes steam from the boiler at  $200^\circ\text{C}$  and exhausts directly into the air at  $100^\circ\text{C}$ . What is its maximum possible efficiency?
- (a) 50% (b) 78.8%  
(c) 21.1% (d) 36.2%
64. 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



65. The temperature at which a ferromagnetic substance loses its ferromagnetism and becomes paramagnetic, is called
- stagnation temperature
  - virtual temperature
  - Curie temperature
  - potential temperature

66. 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) $c = \frac{m^2}{a}$ |

67. 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) $\frac{1}{5}$ |
68. If  $x^y = y^x$ , then

- $\frac{dy}{dx} = \frac{-y(x \log y + x)}{x(y \log x + y)}$
- $\frac{dy}{dx} = \frac{y(x \log y + x)}{x(y \log x + y)}$
- $\frac{dy}{dx} = \frac{y(x \log y - y)}{x(y \log x - x)}$
- $\frac{dy}{dx} = \frac{-y(x \log y - y)}{x(y \log x - x)}$

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

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

70. 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)  $rp^3 = qs^3$
71. 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
72. The moon revolves around the earth, making a complete revolution in 27.3 days. Assuming that the orbit is circular and has a radius  $3.85 \times 10^8$  meters, what would be the magnitude of the acceleration of the moon toward the earth?
- (a)  $0.00273 \text{ m/s}^2$  (b)  $0.102 \text{ m/s}^2$   
(c)  $2.78 \times 10^{-4} \text{ m/s}^2$  (d)  $0.00102 \text{ m/s}^2$
73. 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
74. If the free-fall acceleration near the earth's surface is  $9.8 \text{ m/s}^2$  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)  $\approx 6 \times 10^{24} \text{ kg}$
75. The dimensions of viscosity are
- (a)  $L^2 MT^{-2}$  (b)  $LMT^{-1}$   
(c)  $L^{-1} MT^{-1}$  (d)  $L^2 MT^{-1}$

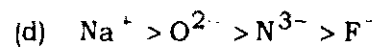
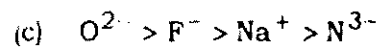
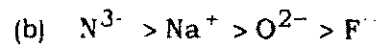
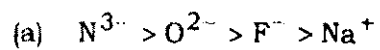
76. Folds with two hinges are known as
- (a) chevron fold
  - (b) box fold
  - (c) isoclinal fold
  - (d) fan fold
77. Pyroxenes belong to
- (a) single-chain structure
  - (b) double-chain structure
  - (c) nesosilicate
  - (d) sorosilicate
78. During metamorphism, what happens to the size of crystals?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

- 81.** Garnets are characterized by their
- (a) rhombidodecahedron form
  - (b) trapezohedron form
  - (c) octahedron form
  - (d) Both (a) and (b)
- 82.** In volcanic rocks, a calcium poor pyroxene is found which is known as
- (a) pigeonite
  - (b) diopside
  - (c) augite
  - (d) hedenbergite
- 83.** 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
- 84.** Hardness of quartz is more than
- (a) corundum
  - (b) topaz
  - (c) calcite
  - (d) diamond
- 85.** Cherry red streak is unique identifier of
- (a) hematite
  - (b) magnetite
  - (c) azurite
  - (d) chrysocolla

86. Oddo-Harkins rule is all about
- (a) cerium anomaly
  - (b) elemental abundances
  - (c) redox reactions
  - (d) elemental substitution
87. Tsunamis never affect ships in deep ocean due to their
- (a) long wavelength
  - (b) high amplitude
  - (c) short wavelength
  - (d) high frequency
88. Which of the following rocks is exposed in Delhi?
- (a) Granite
  - (b) Quartzite
  - (c) Sandstone
  - (d) Limestone
89. Which planet in the solar system is known as 'Goldilocks' planet?
- (a) Mars
  - (b) Uranus
  - (c) Earth
  - (d) Venus
90. 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
91. Porosity and permeability of a soil is controlled by
- (a) grain size
  - (b) grain composition
  - (c) grain shape
  - (d) water temperature

92. Loamy soil consists dominantly of
- (a) sand (b) sand-silt-clay  
(c) clay (d) silt
93. 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
94. Geothermal gradient in the earth is
- (a) ~ 5 °C/40 m (b) ~ 3 °C/40 m  
(c) ~ 1 °C/40 m (d) ~ 2 °C/40 m
95. Generally, the temperature of magma varies from
- (a) - 1800 °C to 2200 °C (b) 1040 °C to 1200 °C  
(c) 800 °C to 1100 °C (d) 900 °C to 1000 °C
96. In metallurgy, obtaining a metal in fused state is called as
- (a) filtration (b) roasting  
(c) smelting (d) calcination

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



98. Total number of electrons in  $NO_3^-$  is

(a) 24

(b) 7

(c) 32

(d) 38

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

(a) Cs

(b) Na

(c) Ca

(d) K

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

(a) pressure

(b) temperature

(c) solvent nature

(d) solute nature

101. Hydronium ion is

(a)  $H^+$

(b)  $HO^+$

(c)  $H_2^+$

(d)  $H_3O^+$

102. Most abundant rare gas in the atmosphere is

(a) He

(b) Ne

(c) Ar

(d) Kr

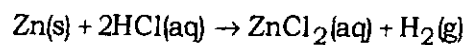
103. Which one of the following has the highest percent ionic character?
- (a) HF (b) HCl  
(c) HI (d) HBr
104. The correct order of penetration power of the  $\alpha$ ,  $\beta$  and  $\gamma$  rays is
- (a)  $\beta > \alpha > \gamma$   
(b)  $\alpha > \beta > \gamma$   
(c)  $\gamma > \beta > \alpha$   
(d)  $\alpha > \gamma > \beta$
105. Which one of the following is isoelectronic with CO?
- (a)  $N_2^+$   
(b)  $O_2^+$   
(c)  $CN^-$   
(d)  $O_2^-$
106. 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



107. 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
108. 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
109. Lanthanide contraction leads to
- (a) increase in ionic size from  $\text{La}^{3+}$  to  $\text{Lu}^{3+}$  ions
  - (b) decrease in electronegativity from  $\text{La}^{3+}$  to  $\text{Lu}^{3+}$  ions
  - (c) decrease in basic strength from  $\text{La}^{3+}$  to  $\text{Lu}^{3+}$  ions
  - (d) decrease in standard electrode potential  $E^\circ$ , for the reaction  $\text{M}^{3+} + 3\text{e}^- \rightarrow \text{M}(\text{s})$  from  $\text{La}^{3+}$  to  $\text{Lu}^{3+}$  ions
110. 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  $25^\circ\text{C}$ ]
- (a) ~ 4.78
  - (b) ~ 4
  - (c) ~ 7.4
  - (d) ~ 7

111. In any electrochemical cell, the cathode is always
- (a) the positive electrode
  - (b) the negative electrode
  - (c) the electrode at which some species gains electrons
  - (d) the electrode at which some species loses electrons
112. The formal charges on H, C and N respectively, in HCN are
- (a) 0, -1 and -1
  - (b) -1, -1 and 0
  - (c) 0, -1 and +1
  - (d) 0, 0 and 0
113. From left to right, give the hybridization of each carbon atom in the allene molecule  
( $\text{H}_2\text{C}=\text{C}=\text{CH}_2$ )
- (a)  $sp^2$ ,  $sp^2$ ,  $sp^2$
  - (b)  $sp^3$ ,  $sp^2$ ,  $sp^3$
  - (c)  $sp^2$ ,  $sp$ ,  $sp^2$
  - (d)  $sp^3$ ,  $sp$ ,  $sp^3$
114. Which combination of formula, IUPAC name and common name below is **incorrect**?
- |     | Formula /                        | IUPAC Name /         | Common Name          |
|-----|----------------------------------|----------------------|----------------------|
| (a) | $\text{CHCl}_3$ /                | trichloromethane /   | chloroform           |
| (b) | $\text{CCl}_4$ /                 | tetrachloromethane / | carbon tetrachloride |
| (c) | $\text{C}_6\text{H}_5\text{I}$ / | iodobenzene /        | phenyl iodide        |
| (d) | $\text{CH}_2\text{Cl}_2$ /       | dichloromethane /    | methane chloride     |

115. Which species is reduced in the following reaction?



- (a) Zn
- (b)  $\text{Cl}^\ominus$
- (c)  $\text{H}_3\text{O}^+$
- (d)  $\text{H}_2$

116. Which one of the following has Ar  $4s^2$  electronic configuration?

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

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

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

118. Spruce tree is found in

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

- 119.** Energy flow in an ecosystem is
- (a) bidirectional
  - (b) multi-directional
  - (c) unidirectional
  - (d) None of the above
- 120.** Phelloderm is a part of
- (a) epidermis
  - (b) phloem
  - (c) xylem
  - (d) periderm
- 121.** The function of coenzyme A is to
- (a) isomerize pyruvic acid
  - (b) isomerize NAD<sup>+</sup>
  - (c) activate the acetyl group
  - (d) facilitate oxidative phosphorylation
- 122.** 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

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

- 128.** Which of the following is **not** a phylogenetic class of phylum Proteobacteria?
- (a) Alpha
  - (b) Beta
  - (c) Gamma
  - (d) Theta
- 129.** Selective single-cell isolation can be effectively done by using
- (a) agar dilution tubes
  - (b) microarrays
  - (c) PCR
  - (d) laser tweezers
- 130.** An essential aspect of biofilms is
- (a) aggregation
  - (b) cell growth
  - (c) quorum sensing
  - (d) cell dispersal
- 131.** 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

132. 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
133. 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
134. 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
135. 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

- 136.** 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
- 137.** Which of the following surfaces exhibits maximum variation in albedo?
- (a) Snow
  - (b) Sand
  - (c) Water
  - (d) Grassland
- 138.** 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
- 139.** Association of suckerfish and shark can be described as
- (a) protocooperation
  - (b) commensalism
  - (c) predation
  - (d) competition
- 140.** The cells of the retina that are sensitive to color are
- (a) cones
  - (b) iodopsin
  - (c) macula lutea
  - (d) rods



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