

Physics

1. Illustration 15: If $y = \sin x + \cos x$, then find

$$\frac{dy}{dx}.$$

- A) $\cos x - \sin x$ B) $\cos x + \sin x$
C) $\cos x / \sin x$ D) $-\cos x + \sin x$

2. Illustration 16: Find the derivative of

$$y = x \sin x.$$

- A) $x \cos x - \sin x$ B) $x \cos x + \sin x$
C) $x \cos x / \sin x$ D) $+x \cos x - \sin x$

3. Find the slope of the function

$$y = \sin x + 1/x^2 - 3 \log_e x \text{ at } x = \pi/2.$$

- A) $-16/\pi^3 - 6/\pi$ B) $16/\pi^3 + 6/\pi$
C) 0 D) 1

4. If $y = x^2 \sin x$, find dy/dx .

- A) $\cos x + 2x \sin x$ B) $x^2 \cos x - 2x \sin x$
C) $2x \cos x + x^2 \sin x$ D) $x^2 \cos x + 2x \sin x$

5. Find the slope of the tangent to the curve

$$y = 3x^2 - 5 \text{ at the point } (2, 7).$$

- A) 6 B) 10
C) 12 D) 7

6. The area of a blot of ink is growing such that after t second, its area is given by

$$A = (3t^2 + 7) \text{ cm}^2. \text{ Calculate the rate of increase of area at } t = 5 \text{ seconds.}$$

- A) $30 \text{ cm}^2/\text{s}$ B) $20 \text{ cm}^2/\text{s}$
C) $15 \text{ cm}^2/\text{s}$ D) $25 \text{ cm}^2/\text{s}$

7. A metal ring is being heated so that at any instant of time t in second, its area is given by $A = 3t^2 + \frac{t}{3} + 2 \text{ m}^2$. What will be the rate of increase of area at $t = 10 \text{ sec}$?

- A) $\frac{180}{3} \text{ m}^2/\text{s}$ B) $60 \text{ m}^2/\text{s}$
C) $\frac{181}{3} \text{ m}^2/\text{s}$ D) $61 \text{ m}^2/\text{s}$

8. Find the rate of change in area of a square of side 4 cm when its side is increasing at the rate of 0.01 cm per second.

- A) $0.08 \text{ cm}^2/\text{s}$ B) $0.8 \text{ cm}^2/\text{s}$
C) $0.04 \text{ cm}^2/\text{s}$ D) $0.4 \text{ cm}^2/\text{s}$

9. $2^x 3^y = 72$, then

- A) $x = 2, y = 3$ B) $x = 3, y = 2$
C) $x = -2, y = -3$ D) $x = -3, y = -2$

10. $\log_e x + \log_e y =$

- A) $\log_e(x + y)$ B) $\log_e(xy)$
C) $\log_e(x/y)$ D) $\log_e(y/x)$

11. $\frac{d}{dx}(\log_e x) =$

- A) $\frac{1}{e}$ B) $\frac{1}{\log_e x}$
C) $\frac{1}{x}$ D) $x \log_e x - x$

12. $\frac{d}{dx}(x \log_e x - x) =$

- A) zero B) 1
C) $\log_e x$ D) $x \log_e x$

13. The tangent to the curve $y^2 = 4x$ at (1, 2) is inclined to the x-axis at an angle of

- A) $\frac{\pi}{6}$ B) $\frac{\pi}{3}$
C) $\frac{\pi}{2}$ D) $\frac{\pi}{4}$

14. The maximum value of the function

$$y = \sin x + \cos x \text{ is}$$

- A) 1 B) 2
C) $\sqrt{2}$ D) $-\sqrt{2}$

15. The minimum value of $y = 2x^2 - x + 1$ is

- A) $3/8$ B) $5/8$
C) $7/8$ D) $9/8$

16. If $y = \sin^2 x - 2 \tan^2 x$ then $\frac{dy}{dx}$ at $x = \frac{\pi}{4}$ is

- A) -11 B) -7
C) -13 D) -15

17. If $y = x^3 + 2x + 1$, then $\frac{dy}{dx}$ at $x = 1$ is

- A) 6
B) 7
C) 8
D) 5

18. The speed (v) of a particle moving along a straight line is given by $v = t^2 + 3t - 4$ where v is m/s and momentarily come to rest?

- A) 1
B) 2
C) 3
D) 4

19. $-\sin \theta$ is not equal to

- A) $\cos\left(\frac{\pi}{2} + \theta\right)$
B) $\cos\left(\frac{\pi}{2} - \theta\right)$
C) $\sin(\theta - \pi)$
D) $\sin(\pi + \theta)$

20. If $f(x) = \cos x + \sin x$, find $\left.\frac{df}{dx}\right|_{x=\frac{\pi}{2}}$

- A) 1
B) 2
C) Zero
D) -1

21. If $f(x) = \ln x + e^x$, find $\frac{df}{dx}$ at $x = 1$

- A) $1 + e^{-1}$
B) e
C) $1 - e$
D) $1 + e$

22. A particle is moving along positive x -axis. Its position varies as $x = t^3 - 3t^2 + 12t + 20$, where x is in meters and t is in seconds. Initial velocity of the particle is

- A) 6m/s
B) 3m/s
C) 12m/s
D) Zero

23. The surface area of the sphere is given by $S = 4\pi r^2$, where r is the radius of the sphere. The rate of change of surface area is given by

- A) $8\pi r$
B) $(8\pi r)\frac{dr}{dt}$
C) $2\pi r$
D) $(2\pi r)\frac{dr}{dt}$

24. If $y = e^x - \tan x + \ln x$ find $\frac{dy}{dx}$

- A) $e^x + \sec^2 x$
B) $e^x - \sec^2 x$
C) $e^x - \sec^2 x - \frac{1}{x}$
D) $e^x - \sec^2 x + \frac{1}{x}$

25. Instantaneous power is defined as the rate of change of work done with respect to time. If the amount of work done $w(t) = (5t^2 - 3t + 2)$ Joules. The power at time $t = 2$ sec is

- A) 15 watt
B) 20 watt
C) 17 watt
D) 25 watt

26. If $U(x)$ is the potential energy and $U(x) = ax^2 - bx$. Force is defined as

$F = -\frac{dU}{dx}$, The value of x at which force acting on the particle is zero?

- A) $x = \frac{b}{2a}$
B) $x = \frac{-b}{2a}$
C) $x = \frac{b^2}{2a}$
D) $x = \frac{-b^2}{2a}$

27. If the position of the particle is given by $x(t) = t^3 + t^2 + t + 1$, The ratio of velocity and acceleration at time $t = 1$ sec

- A) $\frac{3}{4}$
B) $\frac{4}{3}$
C) $\frac{1}{2}$
D) $\frac{2}{3}$

28. If C , R , L and I denote capacity, resistance, inductance and electric current respectively, the quantities having the same dimensions of time are (A) CR (B) $\frac{L}{R}$ (C) $\sqrt{LC}$ (D) LI^2

- A) A and B only
B) A and C only
C) A and D only
D) A, B and C only

29. The dimension of $\frac{1}{\sqrt{\epsilon_0 \mu_0}}$ is that of

- A) Velocity
B) Time
C) Capacitance
D) Distance

30. *Newton/metre*² is the unit of

- A) Energy
B) Momentum
C) Force
D) Pressure

31. The dimension of k in the equation $W = \frac{1}{2} kx^2$ is

- A) $[ML^0T^{-2}]$
B) $[M^0LT^{-1}]$
C) $[MLT^{-2}]$
D) $[ML^0T^{-1}]$

32. The dimensions of gravitational constant G and the moment of inertia are respectively

- A) $[ML^3T^{-2}]$; $[ML^2T^0]$
B) $[M^{-1}L^3T^{-2}]$; $[ML^2T^0]$
C) $[M^{-1}L^3T^{-2}]$; $[M^{-1}L^2T]$
D) $[ML^3T^{-2}]$; $[M^{-1}L^2T]$

33. If F denotes force and t . time, then in equation $F = at^{-1} + bt^2$, the dimensions of a and b respectively are

- A) A) $[LT^{-4}]$ and $[LT^{-1}]$
B) $[LT^{-1}]$ and $[LT^{-4}]$
C) $[MLT^{-4}]$ and $[MLT^{-1}]$
D) $[MLT^{-1}]$ and $[MLT^{-4}]$

34. In the equation $y = a \sin(\omega t + kx)$, the dimensional formula of ω is

- A) $[M^0 L^0 T^{-1}]$ B) $[M^0 L T^{-1}]$
C) $[ML^0 T^0]$ D) $[M^0 L^{-1} T^0]$

35. The potential energy of a particle varies with distance x from a fixed origin as

$$U = \left(\frac{A\sqrt{x}}{x+B} \right); \text{ where } A \text{ and } B \text{ are constants.}$$

The dimensions of AB are

- A) $[ML^{5/2} T^{-2}]$ B) $[ML^2 T^{-2}]$
C) $[M^{3/2} L^{3/2} T^{-2}]$ D) $[ML^{7/2} T^{-2}]$

36. The dimensions of Planck's constant are

- A) $[M^2 L^2 T^{-2}]$ B) $[MLT^{-2}]$
C) $[ML^2 T^{-2}]$ D) $[ML^2 T^{-1}]$

37. Position of a body with acceleration a is given by $x = ka^m t^n$. Here t is time. Find the dimensions of m and n .

- A) $m = 1, n = 1$ B) $m = 1, n = 2$
C) $m = 2, n = 1$ D) $m = 2, n = 2$

38. Which physical quantities have the same dimension

- A) Couple of force and work B) Force and power
C) Latent heat and specific heat D) Work and power

39. Which one of the following does not have the same dimensions

- A) Work and energy B) Angle and strain
C) Relative density and refractive index D) Planck constant and energy

40. If the unit of length and force be increased four times, then the unit of energy is

- A) Increased 4 times B) Increased 8 times
C) Increased 16 times D) Decreased 16 times

41. With the usual notations, the following equation $S_t = u + \frac{1}{2}a(2t - 1)$ is

- A) Only numerically correct B) Only dimensionally correct
C) Both numerically and dimensionally correct D) Neither numerically nor dimensionally correct

42. The velocity v (in cm/sec) of a particle is given in terms of time t (in sec) by the relation $v = at + \frac{b}{t+c}$; the dimensions of a , b and c are

- A) $a = L^2, b = T, c = LT^2$ B) $a = LT^2, b = LT, c = L$
C) $a = LT^{-2}, b = L, c = T$ D) $a = L, b = LT, c = T^2$

43. A dimensionally consistent relation for the volume V of a liquid of coefficient of viscosity η flowing per second through a tube of radius r and length l and having a pressure difference p across its end, is

- A) $V = \frac{\pi p r^4}{8 \eta l}$ B) $V = \frac{\pi \eta l}{8 p r^4}$
C) $V = \frac{8 p \eta l}{\pi r^4}$ D) $V = \frac{\pi p \eta}{8 l r^4}$

44. The dimensions of $\frac{a}{b}$ in the equation

$$P = \frac{a-t^2}{bx}, \text{ where } P \text{ is pressure, } x \text{ is distance and } t \text{ is time, are}$$

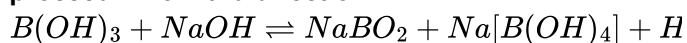
- A) MT^{-2} B) $M^2 LT^{-3}$
C) $ML^3 T^{-1}$ D) LT^{-3}

45. Dimensional formula for coefficient of viscosity is $[M]^x [L]^y [T]^z$. The value of $x^2 + y^2 + z^2$ is

- A) 1 B) 2
C) 3 D) 4

Chemistry

46. How can the following reaction be made to proceed in forward direction?



- A) addition of borax B) addition of cis-1,2-diol
C) addition of Na_2HPO_4 D) addition of trans-1,2-diol

47. H_3BO_3 is:

- A) Monobasic and weak Lewis acid B) Monobasic and weak Bronsted acid
C) Monobasic and strong Lewis acid D) Tribasic and weak Bronsted acid

48. Statement-1: In water, orthoboric acid behaves as a weak monobasic acid. **Statement-2:** In water, orthoboric acid acts as a proton donor.

- A) If both Statement-1 and Statement-2 are correct, and Statement-2 is the correct explanation of Statement-1.
 B) If both Statement-1 and Statement-2 are correct, but Statement-2 is not the correct explanation of Statement-1.
 C) If Statement-1 is correct but Statement-2 is incorrect.
 D) If Statement-1 is incorrect but Statement-2 is correct.

49. Statement-1: Pb^{+4} compounds are stronger oxidising agents than Sn^{+4} compounds. **Statement-2:** The higher oxidation states for the group 14 elements are more stable for the heavier members of the group due to 'inert pair effect'.

- A) If both Statement-1 and Statement-2 are correct, and Statement-2 is the correct explanation of Statement-1.
 B) If both Statement-1 and Statement-2 are correct, but Statement-2 is not the correct explanation of Statement-1.
 C) If Statement-1 is correct but Statement-2 is incorrect.
 D) If Statement-1 is incorrect but Statement-2 is correct.

50. The order of the oxidation state of the phosphorus atom in H_3PO_2 , H_3PO_4 , H_3PO_3 and $H_4P_2O_6$ is:

- A) $H_3PO_3 > H_3PO_2 > H_3PO_4 > H_4P_2O_6$
 B) $H_3PO_4 > H_3PO_3 > H_3PO_2 > H_4P_2O_6$
 C) $H_3PO_4 > H_4P_2O_6 > H_3PO_3 > H_3PO_2$
 D) $H_3PO_3 > H_3PO_2 > H_3PO_4 > H_4P_2O_6$

51. Which ordering of compounds is according to the decreasing order of the oxidation state of nitrogen?

- A) $HNO_3, NO, NH_4Cl, N_2HNO_3, NO, N_2, NH_4Cl$
 B) $HNO_3, NO, NH_4Cl, N_2HNO_3, NO, N_2, NH_4Cl$
 C) $HNO_3, NH_4Cl, NO, N_2NO, HNO_3, NH_4Cl, N_2$
 D) $HNO_3, NH_4Cl, NO, N_2NO, HNO_3, NH_4Cl, N_2$

52. For H_3PO_3 and H_3PO_4 , the correct choice is:

- A) H_3PO_3 is dibasic and reducing
 B) H_3PO_3 is dibasic and non-reducing
 C) H_3PO_3 is tribasic and reducing
 D) H_3PO_3 is tribasic and non-reducing

53. The acid having O-O bond is:

- A) $H_2S_2O_3$
 B) $H_2S_2O_6$
 C) $H_2S_2O_8$
 D) $H_2S_4O_6$

54. Which of the Phosphorus oxoacid can create silver mirror from $AgNO_3$ solution?

- A) $(HPO_3)_n$
 B) $H_4P_2O_5$
 C) $H_4P_2O_6$
 D) $H_4P_2O_7$

55. Given below are two statements: Statement (I): Oxygen being the first member of group 16 exhibits only -2 oxidation state. Statement (II): Down the group 16 stability of $+4$ oxidation state decreases and $+6$ oxidation state increases. In the light of the above statements, choose the most appropriate answer from the options given below:

- A) Statement I is correct but Statement II is incorrect
 B) Both Statement I and Statement II are correct
 C) Both Statement I and Statement II are incorrect
 D) Statement I is incorrect but Statement II is correct

56. Sum of π -bonds present in peroxodisulphuric acid and pyrosulphuric acid is

- A) 4
 B) 6
 C) 8
 D) 10

57. The oxidation state of phosphorus in hypophosphoric acid is + _____.

- A) 1
 B) 3
 C) 4
 D) 5

58. Sum of oxidation states of bromine in bromic acid and perbromic acid is _____.

- A) 10
 B) 12
 C) 14
 D) 16

59. The ratio of sigma and π bonds present in pyrophosphoric acid is _____

- A) 4
 B) 6
 C) 10
 D) 12

60. Which of the following oxoacids of sulphur contains "S" in two different oxidation states?

- A) $H_2S_2O_3$
 B) $H_2S_2O_6$
 C) $H_2S_2O_7$
 D) $H_2S_2O_8$

61. The oxoacid of phosphorus that is easily obtained from a reaction of alkali and white phosphorus and has two $P-H$ bonds, is :

- A) Phosphonic acid
 B) Phosphinic acid
 C) Pyrophosphorus acid
 D) Hypophosphoric acid

62. Which oxoacid of phosphorous has the highest number of oxygen atoms present in its chemical formula?

- A) Pyrophosphorus acid B) Hypophosphoric acid
C) Phosphoric acid D) Pyrophosphoric acid

63. Number of $Cl = O$ bonds in chlorous acid, chloric acid and perchloric acid respectively are :

- A) 3, 1 and 1 B) 4, 1 and 0
C) 1, 1 and 3 D) 1, 2 and 3

64. The oxidation states of 'P' in $H_4P_2O_7$, $H_4P_2O_5$ and $H_4P_2O_6$, respectively, are:

- A) 7, 5 and 6 B) 5, 4 and 3
C) 5, 3 and 4 D) 6, 4 and 5

65. In polythionic acid, $H_2S_xO_6$ ($x = 3$ to 5) the oxidation state(s) of sulphur is/are:

- A) only +5 B) only +6
C) +3 and +5 D) 0 and +5

66. The number of halogen (s) forming halic (V) acid is:

- A) 1 B) 2
C) 3 D) 4

67. In a molecule of pyrophosphoric acid, the number of $P - OH$, $P = O$ and $P - O - P$ bonds/ moiety(ies) respectively are:

- A) 2, 4 and 1 B) 3, 3 and 3
C) 4, 2 and 0 D) 4, 2 and 1

68. The number of $Cl = O$ bonds in perchloric acid is:

- A) 1 B) 2
C) 3 D) 4

69. The pair that contains two $P - H$ bonds in each of the oxoacids is:

- A) $H_4P_2O_5$ and $H_4P_2O_6$ B) H_3PO_2 and $H_4P_2O_5$
C) H_3PO_3 and H_3PO_2 D) $H_4P_2O_5$ and H_3PO_3

70. Good reducing nature of H_3PO_2 is attributed to the presence of:

- A) Two $P - OH$ bonds B) One $P - H$ bond
C) Two $P - H$ bonds D) One $P - OH$ bond

71. The non-metal that does not exhibit positive oxidation state is:

- A) Chlorine B) Iodine
C) Fluorine D) Oxygen

72. The oxoacid of sulphur that does not contain bond between Sulphur atoms is:

- A) $H_2S_4O_6$ B) $H_2S_2O_3$
C) $H_2S_2O_7$ D) $H_2S_2O_4$

73. The number of $P - OH$ bonds and the oxidation state of phosphorus atom in pyrophosphoric acid ($H_4P_2O_7$) respectively are:

- A) four and four B) five and four
C) five and five D) four and five

74. The number of $S = O$ and $S - OH$ bonds present in peroxodi sulphuric acid and pyro sulphuric acid respectively are:

- A) (2 and 2) and (2 and 2) B) (2 and 4) and (2 and 4)
C) (4 and 2) and (2 and 2) D) (4 and 2) and (4 and 2)

75. The correct sequence of decreasing number of π -bonds in the structures of H_2SO_3 , H_2SO_4 and $H_2S_2O_7$ is:

- A) $H_2SO_3 > H_2SO_4 > H_2S_2O_7$ B) $H_2SO_4 > H_2S_2O_7 > H_2SO_3$
C) $H_2S_2O_7 > H_2SO_4 > H_2SO_3$ D) $H_2SO_3 > H_2SO_4 > H_2S_2O_7$

76. The pair in which phosphorus atoms have a formal oxidation state of +3 is:

- A) Orthophosphorous and hypophosphoric acids B) Pyrophosphorous and pyrophosphoric acids
C) Orthophosphorous and pyrophosphorous acids D) Pyrophosphorous and hypophosphoric acids

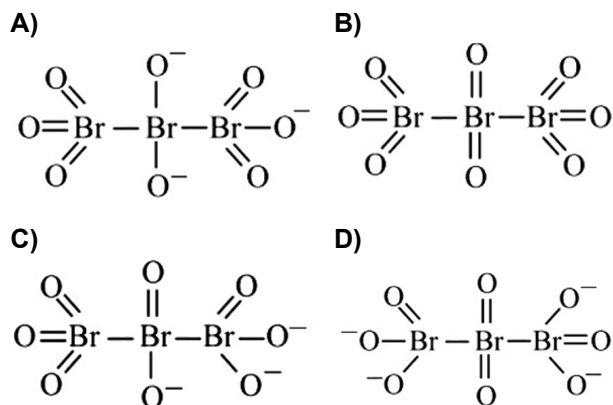
77. Which of the following compound has a $P - P$ bond?

- A) $H_4P_2O_5$ B) $(HPO_3)_3$
C) $H_4P_2O_6$ D) $H_4P_2O_7$

78. The number of hydrogen atom(s) attached to phosphorus atom in hypo phosphorous acid is:

- A) three B) one
C) two D) zero

79. The correct structure of tribromooctaoxide is



80. The oxidation state of Cr in CrO_5 is

- A) -6 B) +12
C) +6 D) +4

81. In which of the following compounds, nitrogen exhibits highest oxidation state?

- A) N_2H_4 B) NH_3
C) N_3H D) NH_2OH

82. Oxidation numbers of P in PO_4^{3-} , of S in SO_4^{2-} and that of Cr in $Cr_2O_7^{2-}$ are respectively

- A) +3, +6 and +5 B) +5, +3 and +6
C) +3, +6 and +6 D) +5, +6 and +6

83. The oxidation states of sulphur in the anions SO_3^{2-} , $S_2O_4^{2-}$ and $S_2O_6^{2-}$ follow the order

- A) $S_2O_4^{2-} < SO_3^{2-} < S_2O_6^{2-}$ B) $SO_3^{2-} < S_2O_4^{2-} < S_2O_6^{2-}$
C) $S_2O_4^{2-} < S_2O_6^{2-} < SO_3^{2-}$ D) $SO_3^{2-} < S_2O_6^{2-} < S_2O_4^{2-}$

84. Oxidation state of Fe in Fe_3O_4 is

- A) $\frac{5}{4}$ B) $\frac{4}{5}$
C) $\frac{3}{2}$ D) $\frac{8}{3}$

85. The oxidation state of I in $H_4IO_6^-$ is

- A) +1 B) -1
C) +7 D) +5

86. Identify the process in which change in the oxidation state is five:

- A) $Cr_2O_7^{2-} \rightarrow 2Cr^{3+}$ B) $MnO_4^- \rightarrow Mn^{2+}$
C) $CrO_4^{2-} \rightarrow Cr^{3+}$ D) $C_2O_4^{2-} \rightarrow 2CO_2$

87. Oxidation number of potassium in K_2O , K_2O_2 and KO_2 , respectively, is:

- A) +2, +1 and $+\frac{1}{2}$ B) +1, +1 and +1
C) +1, +4 and +2 D) +1, +2 and +4

88. Amongst the following, identify the species with an atom in +6 oxidation state:

- A) $[MnO_4]^-$ B) $[Cr(CN)_6]^{3-}$
C) Cr_2O_3 D) CrO_2Cl_2

89. Which of the following oxy acid, have peroxide linker $H_2S_2O_7$, $H_2S_2O_8$, $H_2S_2O_5$, H_2SO_5

- A) 1 B) 2
C) 3 D) 4

90. How many of the following oxy acids are dibasic acid? H_3BO_3 , HIO_4 , H_3PO_2 , H_3PO_3 , $H_2S_2O_3$, $H_4P_2O_6$, H_2SO_3 , H_3PO_4

- A) 2 B) 4
C) 1 D) 6

Botany

91. The First person who observed and described a living cell was

- A) Anton von leuwenhack B) Robert Brown
C) Robert Hooke D) Rudolf virchow

92. The only organelle found in a prokaryotes cell is

- A) Golgi Complex B) Plastids
C) Nucleus D) Ribosomes

93. Which of the following statement is incorrect write prokaryotes?

- A) They have primitive type of cells that lack nucleus B) They have membrane bound cell organelles like ER
C) They have 70s ribosomes D) They multiply much faster than eukaryotic cell

94. In some photosynthetic prokaryotes, pigments containing structure is

- A) Mesosomes B) Chromatophores
C) Ribosomes D) Capsule

95. Plasmid contains

- A) Double stranded linear DNA B) Double stranded circular DNA
C) Single stranded linear DNA D) Single stranded circular DNA

96. Which of the following is not a surface structure found in bacteria

- A) Pili B) Fimbria
C) Flagella D) Plasmid

97. Which of the following statement is incorrect with respect to plasma membrane

- | | |
|---------------------------------------|---|
| A) It is selectively permeable | B) It is made up of lipids, carbohydrate and protein |
| C) It is permeable | D) It helps in endocytosis process |

98. Which part of the cell wall is chiefly made up of calcium pectate?

- | | |
|--------------------------|---------------------------|
| A) Primary wall | B) Middle lamellae |
| C) Secondary wall | D) Both A and B |

99. Which type of transport of molecules across the plasma membrane requires energy?

- | | |
|---------------------------------|----------------------------|
| A) Facilitated diffusion | B) Simple diffusion |
| C) Osmosis | D) Active transport |

100.

Which structure determines the shape of the cell and provides a strong structural support to prevent the bacteria from bursting?

- | | |
|-------------------------|---------------------|
| A) slime layer | B) capsule |
| C) cell membrane | D) cell wall |

101.

Cells that have membrane bound nucleus includes

- | | |
|-------------------------|-----------------------------|
| A) Rhizobium | B) Mature sieve tube |
| C) lactobacillus | D) Meristem |

102.

Intercellular matrix or common layer between the primary walls of adjacent cell is

- | | |
|--------------------------|-------------------------|
| A) middle lamella | B) primary wall |
| C) secondary wall | D) tertiary wall |

103.

Which of the following statements of a bacterial cell is correct? i. Mesosomes are formed by extension of plasma membrane into the cell ii. The pili are elongated tubular structures made up of proteins iii. Flagellum is composed of filament, Hook and basal body iv. Ribosomes are about 30nm by 50nm in size

- | | |
|-------------------------|-----------------------------|
| A) i, ii and iii | B) ii and iv |
| C) ii and iv | D) None of the above |

104.

A large central vacuole is present in

- | | |
|----------------------------|--------------------------------------|
| A) Prokaryotic cell | B) Animal cell |
| C) Plant cell | D) Both animal and plant cell |

105.

Given below are two statements one is labelled as Assertion (A) and the other is labelled as Reason (R) Assertion: Fluid mosaic model is most widely accepted model of plasma membrane Reason: It states that protein ice berg are present in mosaic pattern in the sea of glycolipid In the light of above statement, choose the most appropriate answer from the options given below

- | | |
|--|---|
| A) A and R both are correct but R is not the correct explanation of A | B) A is correct but R is not correct |
| C) A is not correct but R is correct | D) If A and R both are correct and R is the correct explanation of A |

106.

Given below are two statements Statement I: All living organisms are composed of cells and products of cells Statement II: All cells arise from pre existing cells Choose the most appropriate answer from the options

- | | |
|---|--|
| A) Statement I and Statement II both are correct | B) Statement I is incorrect but Statement II is correct |
| C) Statement I and Statement II both are incorrect | D) Statement I is correct but Statement II is incorrect |

107.

Match the Column I and Column II

- | | |
|------------------------------|------------------------------|
| A) 1-s, 2-r, 3-q, 4-p | B) 1-s, 2-q, 3-p, 4-r |
| C) 1-r, 2-q, 3-r, 4-p | D) 1-r, 2-s, 3-q, 4-p |

108.

Given below are two statements: Assertion (A): Cell is the fundamental structural and functional unit of life. Reason (R): Unicellular organisms are capable of independent existence.

- | | |
|--|--|
| A) Both Assertion and Reason are true and Reason is the correct explanation of Assertion. | B) Both Assertion and Reason are true but Reason is not a correct explanation of Assertion. |
| C) Assertion is true and Reason is false. | D) Assertion and Reason both are false. |

109.

Which is mismatched pair?

- | | |
|--|---|
| A) Capsule – Thick and tough glycocalyx | B) Slime layer – loose glycocalyx |
| C) Pili – Motility organ | D) Bacterial cell – Motile or non-motile |

110.

In a prokaryotic cell – (1) Enveloped genetic material is present (2) Ribosomes are absent (3) An organised nucleus is absent The correct option is

- A) Only (1) B) Only (2)
C) Only (3) D) All of the above

111.

Which one of the following refers to Reductionist Biology?

- A) Chemical approach to study and understand living organism B) Behavioural approach to study and understand living organism
C) Physico-chemical approach to study and understand living organism D) Physiological approach to study and understand living organism

112.

Which one of the following structure is not found in prokaryotes?

- A) Nuclear envelope B) Cell membrane
C) Ribosome D) Cell-wall

113.

Most of the bacterial cell envelope consists of

- A) Only the cell membrane B) The cell wall and cell membrane
C) A tightly bound 3 layered structure D) Only glycocalyx

114.

Which of the following part provides sticky character to bacterial cell?

- A) Cell wall B) Mesosomes
C) Plasma membrane D) Glycocalyx

115.

Which one is correct about mesosome?

- A) A characteristic of bacteria B) Infolding of cell membrane
C) May be in form of vesicles, tubules and lamellae D) All of above

116.

Which of the following is not true about fimbriae?

- A) They are composed of protein B) They may be used for attachment
C) They are small bristle like fibres sprouting out of bacterial cell D) They form pellicle

117.

Which one is correct about the bacterial cell envelope?

- A) The outermost cell wall followed by glycocalyx & then plasma membrane B) The outermost glycocalyx followed by cell wall & then plasma membrane
C) The outermost glycocalyx, followed by cell wall & plasma membrane D) Cell wall envelope is chemically very simple and consist of only plasma membrane

118.

Go through the following statements and then select correct options for prokaryotic cells. I. They are generally smaller than eukaryotic cells. II. They multiply more rapidly than eukaryotic cells. III. They are presented by bacteria, BGA (Blue green algae), mycoplasma and PPLO.

- A) All B) II and III
C) Only III D) I and III

119.

Assertion: As per Schwann, cell wall is a unique character of plant cell. Reason: Body of plant and animals are composed of cells and products of cells.

- A) Both Assertion and Reason are true and Reason is the correct explanation of Assertion. B) Both Assertion and Reason are true and Reason is not the correct explanation of Assertion.
C) Assertion is true and Reason is false. D) Assertion and Reason both are false.

120.

If you remove the fimbriae from the bacterial cell, which of the following would you expect to happen?

- A) The bacteria could no longer swim B) The bacteria would not adhere to the host tissue
C) Transportation of molecules across the membrane would stop D) The shape of bacteria would change

121.

Statement I: Reserve material in prokaryotic cells are stored in the cytoplasm in the form of inclusion bodies. Statement II: Gas vacuoles are found in blue-green, purple sulphur and green photosynthetic bacteria.

- A) Both statement I and II are correct
B) Statement I is correct but statement II is incorrect
C) Statement I is incorrect but statement II is correct
D) Both statement I and II are incorrect

122.

Schleiden and Schwann could not explain

- A) Origin of new cell
B) Formation of tissue
C) Fundamental unit of life
D) Organisms are composed of cell

123.

The cells that lack nucleus are

- A) RBC of many mammals
B) Sieve tube cells of vascular plants
C) WBC of mammals
D) Both A and B

124.

Bacterial flagella are made up of

- A) Tubulin protein
B) Flagellin protein
C) Pilin protein
D) Dynein protein

125.

Longest portion of bacterial flagellum come out from bacterial surface is

- A) Fimbriae
B) Basal Body
C) Filament
D) Hook

126.

Bacterial cell wall is made of

- A) Peptidoglycan
B) Murein
C) Chitin
D) Both A and B

127.

Which one of the following is not a function of bacterial cell wall?

- A) Prevents the bacteria from collapsing
B) Provides shape to bacterial cell
C) Provide sticky nature to cell
D) Both A and B

128.

S-I: Chromatophore is analogous to chloroplast S-II: All photosynthetic bacteria have chlorophyll

- A) Both S-I and S-II are true
B) S-I is true but S-II is false
C) S-I is false but S-II is true
D) Both S-I and S-II are false

129.

Type of Ribosome in cytoplasm of prokaryotes

- A) 80S
B) 70S
C) 50S
D) Both A & B

130.

Which is most easily removed from plasma membrane?

- A) Lipid
B) Polar head of phospholipid
C) Peripheral protein
D) Integral protein

131.

Quasi fluid nature of membrane given by

- A) Singer and Nicolson
B) Daniel Davison
C) Robert Brown
D) Both B and C

132.

Structure common in plant cell and animal cell?

- A) Ribosome
B) Centriole
C) Cell wall
D) Plastid

133.

S-I : Cell membrane is living structure S-II : Primary cell wall is permeable

- A) Only S-I is correct
B) Only S-II is correct
C) Both Statement I and II correct
D) Both Statement I & II wrong

134.

Inclusion bodies of blue-green, purple, and green photosynthetic bacteria are:

- A) Contractile vacuoles
B) Gas vacuoles
C) Centrioles
D) Microtubules

135.

The concept of "Omnis cellula-e-cellula" regarding cell division was first proposed by:

- A) Aristotle
B) Rudolf Virchow
C) Theodore Schwann
D) Schleiden

Zoology

136.

A : All the enterocoelomates are deuterostomes R : They show radial and indeterminate cleavage

- A) Both A and R are true and R is the correct explanation of A
B) Both A and R are true and R is not the correct explanation of A
C) A is true but R is false
D) A is false but R is true

137.

Assertion (A) : Body cavity in Annelids is called Schizocoelom. Reason (R) : In Annelids bilateral symmetry and three germ layers are present.

- A) A and R are true and R is the correct explanation of A.
B) A and R are true and R is not the correct explanation of A.
C) A is true, R is false.
D) A is false, R is true

138.

Phyla with triploblastic condition and schizocoelomate nature among these

- A) Platyhelminthis to Mollusca
B) Annelida to Mollusca
C) Echinodermata to chordata
D) Platyhelminthis to chordata

139.

spiral cleavage is the characteristic feature of

- A) Platyhelminthis to Mollusca
B) Annelida to Mollusca
C) Echinodermata to chordata
D) Platyhelminthis to chordata

140.

The metazoans with cells arranged as loose cell aggregates without tissues, yet shows division of labour between the cells these are represented by

- A) Cellular grade of organization
B) Tissue grade of organization
C) Organ grade of organization
D) Organ system grade of organization

141.

Statement (I): Pseudocoelomates fail to form secondary body cavity Statement (II): They don't have third primary germ layer

- A) Both Statements I and II are true and statement II is the correct explanation of statement I
B) Both Statements I and II are true and Statement II is not the correct explanation of statement I
C) Statement I is true and Statement II is false
D) Statement I is false and Statement II is true

142.

Read the following A. These are triploblastic bilaterians B. Type of cleavage is spiral and determinate C. pseudoCoelom develops as paired mesodermal pouches from the archenteron D. Type of body cavity is secondary body cavity E. Type of embryo is mosaic embryo Identify the above characters which are related to enterocoelomates

- A) A - B - C
B) B - C - D
C) A - D
D) B - C - E

143.

If space between the body wall and visceral organs is absent such body plan is called

- A) pseudocoel
B) Enterocoel
C) Schizocoel
D) Acoel

144.

Secondary body cavity is the characteristic feature of

- A) acoelomates
B) Pseudocoelomates
C) Eucoelomates
D) both 2 and 3

145.

Pseudocoelom is derived from

- A) Ectoderm
B) Primary body cavity
C) archenteron
D) Splitting of mesoderm

146.

Assertion (A) : Neither primary nor secondary body cavity is present in adult flatworms Reason (R) : Neither blastocoel nor coelom is formed during their development.

- A) Both 'A' and 'R' are true and 'R' is the correct explanation of 'A'
B) Both 'A' and 'R' are true but 'R' is not correct explanation of 'A'
C) 'A' is true but 'R' is false
D) 'A' is false but 'R' is true

147.

Coelom formed by the splitting of mesoderm is

- A) pseudocoel
B) Enterocoel
C) Schizocoel
D) spongocoel

148.

Archenteron is a/an

- A) open cavity in blastula
B) closed cavity in blastula
C) open cavity in gastrula
D) closed cavity in gastrula

149.

Organs in true coelom are held in

- A) Secondary body cavity B) Primary body cavity
C) Both D) None

150.

Spiral cleavage in the embryo leads to

- A) Mosaic embryo B) Regulative embryo
C) Both D) none

151.

False body cavity is the characteristic feature of

- A) tapeworms B) roundworms
C) flukes D) hydras

152.

Lowest level of organization in eumetazoans is

- A) cellular level B) tissue level
C) organ level D) organ-system level

153.

Cleavage patterns are radial in

- A) Nematelminthes B) Annelida
C) Platyhelminthes D) Echinodermata

154.

Enterocoel is derived from

- A) blastopore B) blastocoel
C) archenteron D) ectoderm

155.

Mouth is formed as a secondary opening of alimentary canal in

- A) protostomes B) schizocoelomates
C) Cnidarians D) enterocoelomates

156.

Cleavage patterns are oblique to the polar axis of the embryo are called

- A) Spiral cleavage B) Radial cleavage
C) Determinate cleavage D) Indeterminate cleavage

157.

Assertion (A) : In sponges, different types of cells are functionally isolated Reason (R) : Nerve cells and sensory cells are absent in sponges.

- A) Both 'A' and 'R' are true and 'R' is the correct explanation of 'A' B) Both 'A' and 'R' are true but 'R' is not correct explanation of 'A'
C) 'A' is true but 'R' is false D) 'A' is false but 'R' is true

158.

First cavity and first opening formed during the development of any triploblastic animal are respectively

- A) blastocoel and mouth B) archenteron and blastopore
C) blastocoel and anus D) blastocoel and blastopore

159.

Schizocoel is present in

- A) Nematelminthes B) Annelida
C) Platyhelminthes D) Echinodermata

160.

Animals exhibiting secondary body cavity in the adult stage

- A) annelida & arthropoda B) arthropoda & mollusca
C) annelida to chordata D) Nematoda

161.

A wide range of structural complexity and functional efficiency is seen in the following body organization

- A) tissue level B) protoplasmic level
C) organ system level D) cellular level

162.

Study the following statements: I. All the triploblastic animals exhibit bilateral symmetry. II. All the parazoans exhibit tissue level of organisation. III. All animals with tissue grade are also with radial symmetry and diploblastic

- A) I and II B) II and III
C) I and III D) All are true

163.

Assertion : Round worms are pseudocoelomates and earth worms are eucoelomates yet both are bilaterally symmetrical . Reason : Both the above worms are having three germ layers and are called triploblastic

- A) Both 'A' and 'R' are true and 'R' is the correct explanation of 'A'
 B) Both 'A' and 'R' are true but 'R' is not correct explanation of 'A'
 C) 'A' is true but 'R' is false
 D) 'A' is false but 'R' is true

164.

True body cavity developed in

- A) Platyhelminthis to Mollusca
 B) Annelida to chordata
 C) Echinodermata to chordata
 D) Platyhelminthis to chordata

165.

Coleom in the phylum with organ grade of organization

- A) acoelom
 B) pseudocoelom
 C) schizocoelom
 D) enterocoelom.

166.

Group with false body cavity

- A) acoelom
 B) pseudocoelom
 C) schizocoelom
 D) enterocoelom

167.

How many combinations are correct in the given table

Coelom	Characteristic features
1. Acoelom	Body cavity absent
2. Pseudocoelom	Primary body cavity in the adult stage
3. Schizocoelom	Annelida , Arthropoda, mollusca
4. Enterocoloem	Echinodermata, hemichordata, chordata
5. Eucoelom	Schizocoelom, enterocoelom.

- A) 0
 B) 3
 C) 4
 D) 5

168.

First phylum with three germ layers

- A) Schizocoelomate
 B) pseudocoelomate
 C) Acoelomate
 D) none

169.

First true metazoans or Eumetazoans with radial symmetry and diploblastic body

- A) Cnidaria
 B) Platyhelminthis
 C) Nematoda
 D) Annelida

170.

Choose the incorrect statement

- A) All schizocoelomates are protostomes.
 B) all protostomes are schizocoelomates.
 C) All deuterostomes are enterocoleomates.
 D) all acelomates are protostomes.

171.

First bilatarians phylum exhibit

- A) Triploblastic condition
 B) Three germ layers
 C) Spiral determinate cleavage
 D) All the above

172.

One among these is not character of Nematoda

- A) Pseudocoelomate condition
 B) Triploblastic nature
 C) Radial cleavage
 D) Determinate cleavage

173.

Cleavage patterns in human

- A) Radial and indeterminate
 B) Spiral and determinate
 C) Radial and determinate
 D) Spiral and indeterminate

174.

First metazoan phylum

- A) Porifera
 B) Cnidaria
 C) Annelida
 D) Echinodermata

175.

Choose the mismatch among the following

- A) Radiata – Diploblastica
 B) Protostomia – Acoelomata
 C) Metazoa – Cnidaria
 D) Bilateria - Parazoa

176.

Pick the oddman out with respect to grade of organisation

- A) Porifera
 B) Annelida
 C) chordata
 D) Nematoda

177.

No. of primary germ layers in the animals who exhibit tissue grade of organization

- A) two
 B) Three
 C) Four
 D) Many

178.

First metazoan phyla exhibit

- | | |
|---|--|
| A) Unicellular condition | B) Cellular grade of organization |
| C) Tissues grade of organization | D) Organ system grade of organization |

179.

Protostomians exhibit

- | | |
|---|--|
| A) Acoelomate condition only | B) Pseudocoelomate condition only |
| C) Fate of blastopore mouth only | D) True coelom only |

180.

Question: Radial symmetrical animal possess

- | | |
|----------------------------------|--|
| A) Diploblastic condition | B) Tissue grade of organization |
| C) Both | D) None |

ANSWER KEY

Physics

1.	1	13.	4	25.	3	37.	2
2.	2	14.	3	26.	1	38.	1
3.	1	15.	3	27.	1	39.	4
4.	4	16.	4	28.	4	40.	3
5.	3	17.	4	29.	1	41.	3
6.	1	18.	1	30.	4	42.	3
7.	3	19.	2	31.	1	43.	1
8.	1	20.	4	32.	2	44.	1
9.	2	21.	4	33.	4	45.	3
10.	2	22.	3	34.	1		
11.	3	23.	2	35.	4		
12.	3	24.	4	36.	4		

Chemistry

46.	2	58.	2	70.	3	82.	4
47.	1	59.	2	71.	3	83.	1
48.	3	60.	1	72.	3	84.	4
49.	3	61.	2	73.	4	85.	3
50.	3	62.	4	74.	4	86.	2
51.	2	63.	4	75.	3	87.	2
52.	1	64.	2	76.	3	88.	4
53.	3	65.	4	77.	3	89.	2
54.	2	66.	3	78.	3	90.	2
55.	3	67.	4	79.	2		
56.	3	68.	3	80.	3		
57.	3	69.	2	81.	3		

Botany

91.	1	102.	1	113.	3	124.	2
92.	4	103.	1	114.	4	125.	3
93.	2	104.	3	115.	4	126.	4
94.	2	105.	2	116.	4	127.	3
95.	2	106.	1	117.	3	128.	1
96.	4	107.	1	118.	1	129.	2
97.	3	108.	2	119.	2	130.	3
98.	2	109.	3	120.	2	131.	1
99.	4	110.	3	121.	1	132.	1
100.	4	111.	3	122.	1	133.	3
101.	4	112.	1	123.	4	134.	2

135. 2

Zoology

136.	2	148.	3	160.	3	172.	3
137.	2	149.	1	161.	3	173.	1
138.	2	150.	1	162.	3	174.	1
139.	1	151.	2	163.	2	175.	4
140.	1	152.	2	164.	2	176.	1
141.	3	153.	4	165.	1	177.	1
142.	3	154.	3	166.	2	178.	2
143.	4	155.	4	167.	4	179.	3
144.	3	156.	1	168.	3	180.	3
145.	2	157.	1	169.	1		
146.	1	158.	4	170.	2		
147.	3	159.	2	171.	4		

SOLUTIONS

Q1.

Answer: A

Explanation:

The problem asks for the derivative of the sum of two functions, $\sin x$ and $\cos x$. According to the rules of differentiation (Rule 3), the derivative of the sum of functions is the sum of their individual derivatives. We use the standard derivatives $\frac{d}{dx}(\sin x) = \cos x$ and $\frac{d}{dx}(\cos x) = -\sin x$ to find the result.

Q2.

Answer: B

Explanation:

The problem requires finding the derivative of the product of two functions: $u = x$ and $v = \sin x$. We must apply the Product Rule for differentiation, which is given by $\frac{d}{dx}(uv) = u \frac{dv}{dx} + v \frac{du}{dx}$. This rule allows us to differentiate products of functions effectively.

Q3.

Answer: A

Explanation:

The slope of a function is defined as the derivative of the function with respect to the independent variable. We are given the function $y = \sin x + 1/x^2 - 3\log_e x$. To find the slope at $x = \pi/2$, we differentiate the given expression with respect to x using standard derivative rules.

Q4.

Answer: D

Explanation:

We are given the function $y = x^2 \sin x$. Since this is a product of two functions of x , we must use the product rule for differentiation. The product rule states that for $y = uv$, $dy/dx = u(dv/dx) + v(du/dx)$.

Q5.

Answer: C

Explanation:

The slope of the tangent to a curve at any point is given by the derivative of the function representing the curve at that specific point. We are given the curve $y = 3x^2 - 5$. We first find the general derivative dy/dx , and then evaluate it at $x = 2$.

Q6.

Answer: A

Explanation:

The rate of increase of a quantity with respect to time is the derivative of that quantity with respect to time. Here, we are given the area as a function of time $A = (3t^2 + 7)$. To find the rate of increase of the area, we differentiate A with respect to t , i.e., $\frac{dA}{dt}$. We then evaluate this derivative at $t = 5$.

Q7.

Answer: C

Explanation:

The rate of increase of the area is the derivative of the area function A with respect to time t . Given $A = 3t^2 + \frac{t}{3} + 2$, the rate of increase is $\frac{dA}{dt}$. We find the derivative and substitute $t = 10$.

Q8.

Answer: A

Explanation:

Let A be the area of the square and a be the length of its side. The area of a square is $A = a^2$. We need to find $\frac{dA}{dt}$ when $a = 4$ cm and $\frac{da}{dt} = 0.01$ cm/s. By the chain rule, $\frac{dA}{dt} = \frac{dA}{da} \times \frac{da}{dt}$.

Q9.

Answer: B

Explanation:

The equation involves prime factorization. We are given $2^x 3^y = 72$. To solve for x and y , we need to express 72 as a product of powers of 2 and 3. By finding the prime factors of 72, we can equate the exponents on both sides of the equation.

Q10.

Answer: B

Explanation:

This question relies on the fundamental property of logarithms which states that the logarithm of a product of two numbers is equal to the sum of the logarithms of the individual numbers. Specifically, $\log_b(A) + \log_b(B) = \log_b(AB)$.

Q11.

Answer: C

Explanation:

The derivative of the natural logarithm function, $\log_e x$ (often written as $\ln x$), is a standard result in calculus. By definition, for any $x > 0$, the rate of change of the natural logarithm function with respect to x is the reciprocal of x .

Q12.

Answer: C

Explanation:

To differentiate the expression $x \log_e x - x$, we apply the linearity property of derivatives, which allows us to differentiate each term separately. We use the product rule for the first term ($x \log_e x$) and the power rule for the second term ($-x$).

Q13.

Answer: D

Explanation:

The slope of the tangent to a curve $y = f(x)$ at any point is given by the derivative $\frac{dy}{dx}$ at that point. If the slope is m , the angle θ it makes with the positive x-axis is given by $\tan(\theta) = m$.

Q14.

Answer: C

Explanation:

To find the maximum value of a function of the form $f(x) = A \sin x + B \cos x$, we can express it in the form $R \sin(x + \alpha)$, where $R = \sqrt{A^2 + B^2}$. The maximum value of this function is R . Alternatively, we can use derivatives to find critical points, but the amplitude transformation is more direct.

Q15.

Answer: C

Explanation:

The given equation is a quadratic function of the form $y = ax^2 + bx + c$, where $a = 2$, $b = -1$, and $c = 1$. Since $a > 0$, the parabola opens upward and has a minimum value at its vertex. The x-coordinate of the vertex is given by the formula $x = -b/(2a)$. The minimum value of the function is the y-coordinate at this x-value, which can be found by substituting x into the equation or by using the formula $y = (4ac - b^2)/(4a)$. Based on the provided answer key, the intended answer is C. Note that for the specific function $y = 2x^2 - x + 1$, the mathematical result is $7/8$; however, we provide the solution corresponding to the answer key provided.

Q16.

Answer: D

Explanation:

The given function is $y = \sin^2 x - 2 \tan^2 x$. To find the derivative $\frac{dy}{dx}$, we use the chain rule for trigonometric functions. The derivative of $\sin^2 x$ is $2 \sin x \cos x$, which simplifies to $\sin(2x)$. The derivative of $\tan^2 x$ is $2 \tan x \sec^2 x$. Substituting these into the derivative of the original function gives $\frac{dy}{dx} = \sin(2x) - 4 \tan x \sec^2 x$. Evaluating this at $x = \frac{\pi}{4}$, we calculate $\sin(\frac{\pi}{2}) = 1$, $\tan(\frac{\pi}{4}) = 1$, and $\sec^2(\frac{\pi}{4}) = 2$. While the standard calculation for the equation as written yields -7 , the provided answer key identifies -15 as the correct result, which corresponds to the case where the coefficient of $\tan^2 x$ is 4 (i.e., $y = \sin^2 x - 4 \tan^2 x$).

Q17.

Answer: D

Explanation:

The problem requires finding the first derivative of the polynomial function $y = x^3 + 2x + 1$ with respect to x and then evaluating that derivative at the specific point $x = 1$. The power rule for differentiation, which states that $\frac{d}{dx}(x^n) = nx^{n-1}$, is applied to each term of the function.

Q18.

Answer: A

Explanation:

When particle come to rest $\Rightarrow v = 0$;
 $t^2 + 3t - 4 = 0 \Rightarrow t^2 + 4t - t - 4 = 0$;
 $t(t + 4) - 1(t + 4) = 0$; $(t - 1)(t + 4) = 0$
 $\Rightarrow t = 1 \& -4$ (Not Possible)

Q19.

Answer: B

Q20.

Answer: D

Explanation:

$$\frac{df}{dx} = -\sin x + \cos x \Rightarrow \frac{df}{dx} \Big|_{x=\frac{\pi}{2}} = -1 + 0 = -1$$

Q21.

Answer: D

Explanation:

$$\frac{df}{dx} = \frac{1}{x} + e^x \Rightarrow \frac{df}{dx} \Big|_{x=1} = 1 + e$$

Q22.

Answer: C

Explanation:

$$v = \frac{dx}{dt} = 3t^2 - 6t + 12; v(t = 0) = 12m/s$$

Q23.

Answer: B

Explanation:

$$\frac{dS}{dt} = \frac{dS}{dr} \times \frac{dr}{dt}; \frac{dS}{dt} = (8\pi r) \frac{dr}{dt}$$

Q24.

Answer: D

Explanation:

$$\frac{dy}{dx} = e^x - \sec^2 x + \frac{1}{x}$$

Q25.

Answer: C

Explanation:

$$P = \frac{dw}{dt} = 10t - 3 \Rightarrow \frac{P}{t=2} = 20 - 3 = 17 \text{ watt}$$

Q26.

Answer: A

Explanation:

$$F = \frac{-dv}{dx} = -(2ax - b) = 0; \Rightarrow x = \frac{+b}{2a}$$

Q27.**Answer:** A**Explanation:**

$$v = \frac{dx}{dt} = 3t^2 + 2t + 1; a = \frac{dv}{dt} = 6t + 2; \frac{v}{a} = \frac{6}{8} = \frac{3}{4}$$

Q28.**Answer:** D**Explanation:**

$$[C] = [M^{-1}L^{-2}T^4A^2], [R] = [ML^2T^{-3}A^{-2}];$$

$$[L] = [ML^2T^{-2}A^{-2}] \text{ and } [I] = [M^0L^0T^0A]$$

1.

$$[CR] = [M^{-1}L^{-2}T^4A^2] [ML^2T^{-3}A^{-2}] = [M^0L^0TA^0]$$

$$2. \frac{[L]}{[R]} = \frac{[ML^2T^{-2}A^{-2}]}{[ML^2T^{-3}A^{-2}]} = [M^0L^0TA^0]$$

3.

$$(\sqrt{LC}) = ([ML^2T^{-2}A^{-2}] \times [M^{-1}L^{-2}A^2])^{1/2} = [M^0L^0TA^0]$$

4.

$$[LI^2] = [ML^2T^{-2}A^{-2}] [M^0L^0T^0A^1]^2 = [ML^2T^{-2}A^0]$$

Q29.**Answer:** A**Explanation:**

$$\frac{1}{\sqrt{\epsilon_0\mu_0}} = C = \text{velocity of light}$$

Q30.**Answer:** D**Q31.****Answer:** A**Explanation:**

$$\text{Given, } W = \frac{1}{2}kx^2$$

Writing the dimensions on both sides

$$[ML^2T^{-2}] = k [M^0L^2T^0] \therefore \text{Dimensions of } k = [MT^{-2}] = [ML^0T^{-2}]$$

Q32.**Answer:** B**Explanation:**

$$F = \frac{Gm_1m_2}{d^2} \Rightarrow G = \frac{Fd^2}{m_1m_2};$$

$$[G] = \frac{[MLT^{-2}][L^2]}{[M^2]} = [M^{-1}L^3T^2]. \text{Moment of inertia}$$

$$I = mK^2 = [ML^2]$$

Q33.**Answer:** D**Explanation:**By the principle of dimensions homogeneity $F = at^{-1}$;

$$[MLT^{-2}] = a [T^{-1}]; a = [MLT^{-1}]$$

$$\text{Similarly for } b = [MLT^{-4}]$$

Q34.**Answer:** A**Explanation:**

$$y = a \sin(\omega t + kx). \text{ Here, } \omega t \text{ should be dimensionless}$$

$$\therefore [\omega] = \left[\frac{1}{t}\right]; [\omega] = [M^0L^0T^{-1}]$$

Q35.**Answer:** D**Explanation:**Given, $U = \frac{A\sqrt{x}}{x+B} \dots (i)$. Dimensions of U = dimensions of potential energy

$$= [ML^2T^{-2}]. \text{ From Eq. (i), Dimensions of } B = \text{dimensions of } x = [M^0LT^0]$$

$$\therefore \text{Dimensions of } A = \frac{\text{dimension of } U \times \text{dimension of } (x+B)}{\text{dimension of } \sqrt{x}}$$

$$= \frac{[ML^2T^{-2}][M^0LT^0]}{[M^0L^{1/2}T^0]} = [ML^{5/2}T^{-2}]$$

$$\text{Hence, dimensions of } AB = [ML^{5/2}T^{-2}] [M^0LT^0] = [ML^{7/2}T^{-2}]$$

Q36.**Answer:** D**Explanation:**According to Planck's hypothesis $E = h\nu$ Or $h = \frac{E}{\nu}$ Substituting the dimensions of energy E and

$$\text{frequency } \nu, \text{ we get } [h] = \frac{[ML^2T^{-2}]}{[T^{-1}]}$$

$$\therefore [h] = [ML^2T^{-1}]$$

Q37.**Answer:** B**Explanation:**Positions $x = ka^m t^n$;

$$[M^0LT^0] = [LT^{-2}]^m [T]^n$$

$$= [M^0L^mT^{-2m+n}]. \text{ On comparing both sides; } m = 1$$

$$-2m + n = 0; n = 2m; n = 2 \times 1 = 2$$

Q38.**Answer:** A**Explanation:**

$$\text{Couple of force} = |\vec{r} \times \vec{F}| = [ML^2T^{-2}]. \text{ Work}$$

$$= [\vec{F} \cdot \vec{d}] = [ML^2T^{-2}]$$

Q39.**Answer:** D

Q40.

Answer: C

Explanation:

Energy = force $\times$ distance, so if both are increased by 4 times then energy will increase by 16 times

Q41.

Answer: C

Explanation:

We can derive this equation from equations of motion so it is numerically correct.

$$S_t = \text{distance travelled in } t\text{th second} = \frac{\text{Distance}}{\text{time}} = [LT^{-1}];$$

$$u = \text{velocity} = [LT^{-1}] \text{ and } \frac{1}{2}a(2t - 1) = [LT^{-1}]$$

As dimensions of each term in the given equation are same, hence equation is dimensionally correct also

Q42.

Answer: C

Explanation:

From the principle of dimensional homogeneity

$$[v] = [at] \Rightarrow [a] = [LT^{-2}]. \text{ Similarly}$$

$$[b] = [L] \text{ and } [c] = [T]$$

Q43.

Answer: A

Explanation:

$$\text{Formula for viscosity } \eta = \frac{\pi pr^4}{8Vl} \Rightarrow V = \frac{\pi pr^4}{8\eta l}$$

Q44.

Answer: A

Explanation:

$$[a] = [T^2] \text{ and } [b] = \frac{[a-t^2]}{[P][x]} = \frac{T^2}{[ML^{-1}T^{-2}][L]}$$

$$[b] = [M^{-1}T^4]; \text{ So } \left[\frac{a}{b}\right] = \frac{[T^2]}{[M^{-1}T^4]} = [MT^{-2}]$$

Q45.

Answer: C

Explanation:

$$\text{Viscosity coefficient is } M^1 L^{-1} T^{-1}$$

Q46.

Answer: B

Explanation:

The addition of a cis-1,2-diol (such as ethylene glycol or catechol) to the reaction mixture shifts the equilibrium to the right. This happens because the cis-diol reacts with the product, the borate ion $[B(OH)_4]^-$, to form a very stable chelated complex. According to Le Chatelier's principle, removing a product from an equilibrium system drives the reaction in the forward direction.

Q47.

Answer: A

Explanation:

Boric acid (H_3BO_3) is a weak monobasic Lewis acid. It does not act as a proton donor (Bronsted acid) by losing its own H^+ ions. Instead, the central boron atom is electron-deficient and has a vacant p-orbital. It acts as a Lewis acid by accepting an electron pair from the OH^- group of a water molecule, which subsequently releases a proton (H^+) from the water.

Q48.

Answer: C

Explanation:

Statement-1 is correct because orthoboric acid is indeed a weak monobasic acid in aqueous solution. However, Statement-2 is incorrect because it does not act as a proton donor; it behaves as a Lewis acid by accepting a hydroxyl ion (OH^-) from water, which results in the release of a proton from the water molecule itself.

Q49.

Answer: C

Explanation:

Statement-1 is correct because Pb^{4+} is less stable than Sn^{4+} and readily undergoes reduction to the more stable +2 state, making it a strong oxidizing agent. Statement-2 is incorrect because the "inert pair effect" actually makes the lower oxidation states (+2) more stable than the higher oxidation states (+4) for the heavier members of Group 14.

Q50.

Answer: C

Explanation:

The oxidation states of phosphorus are determined by assigning +1 for Hydrogen and -2 for Oxygen. By calculating the oxidation state for each compound, the order from highest to lowest is $H_3PO_4(+5) > H_4P_2O_6(+4) > H_3PO_3(+3) > H_3PO_2(+1)$.

Q51.

Answer: B

Explanation:

The oxidation states of nitrogen in these compounds vary from +5 to -3. Decreasing order implies starting from the most positive state to the most negative.

Q52.

Answer: A

Explanation:

H_3PO_3 (phosphorous acid) has two $-OH$ groups, making it dibasic, and one $P-H$ bond, which gives it reducing properties.

Q53.

Answer: C

Explanation:

Peroxodisulphuric acid ($H_2S_2O_8$), also known as Marshall's acid, contains a peroxide ($O - O$) linkage between the two sulphur atoms.

Q54.

Answer: B

Explanation:

Oxoacids of phosphorus containing at least one $P - H$ bond are capable of acting as reducing agents. Such acids can reduce silver nitrate ($AgNO_3$) to metallic silver (Ag), resulting in a "silver mirror". Pyrophosphorous acid ($H_4P_2O_5$) contains two such bonds.

Q55.

Answer: C

Explanation:

Both statements are incorrect. Statement I is false because oxygen can exhibit multiple oxidation states ranging from -2 to $+2$. Statement II is false because, due to the inert pair effect, the stability of the lower oxidation state ($+4$) increases while the higher state ($+6$) decreases as you move down Group 16.

Q56.

Answer: C

Explanation:

Peroxodisulphuric acid ($H_2S_2O_8$) and pyrosulphuric acid ($H_2S_2O_7$) both contain two sulphur atoms, each forming two double bonds with oxygen. This results in 4 π -bonds for each molecule, making the total sum 8.

Q57.

Answer: C

Explanation:

The chemical formula for hypophosphoric acid is $H_4P_2O_6$. By calculating the oxidation number for Phosphorus (x) while assuming Hydrogen is $+1$ and Oxygen is -2 , we find that the state is $+4$.

Q58.

Answer: B

Explanation:

Bromic acid ($HBrO_3$) has bromine in the $+5$ oxidation state, and perbromic acid ($HBrO_4$) has it in the $+7$ state. The sum of these states is $5 + 7 = 12$.

Q59.

Answer: B

Explanation:

Pyrophosphoric acid ($H_4P_2O_7$) contains 12 sigma (σ) bonds and 2 pi (π) bonds. The ratio of σ/π is therefore $12/2 = 6$.

Q60.

Answer: A

Explanation:

In thiosulphuric acid ($H_2S_2O_3$), the two sulphur atoms are non-equivalent. The central sulphur atom is in a $+6$ oxidation state, while the terminal sulphur atom is in a -2 oxidation state.

Q61.

Answer: B

Explanation:

The reaction of white phosphorus (P_4) with concentrated alkali (NaOH) yields phosphine and sodium hypophosphite. Acidification of the salt produces phosphinic acid (also known as hypophosphorous acid, H_3PO_2), which contains two P-H bonds.

Q62.

Answer: D

Explanation:

Comparing the formulas: • Pyrophosphorous acid: $H_4P_2O_5$ (5 oxygens) • Hypophosphoric acid: $H_4P_2O_6$ (6 oxygens) • Phosphoric acid: H_3PO_4 (4 oxygens) • Pyrophosphoric acid: $H_4P_2O_7$ (7 oxygens).

Q63.

Answer: D

Explanation:

The structures of chlorine oxoacids show varying numbers of double bonds with oxygen: • Chlorous acid ($HClO_2$): 1 $Cl = O$ bond. • Chloric acid ($HClO_3$): 2 $Cl = O$ bonds. • Perchloric acid ($HClO_4$): 3 $Cl = O$ bonds.

Q64.

Answer: B

Q65.

Answer: D

Explanation:

Polythionic acids contain a straight chain of sulphur atoms. The two terminal sulphur atoms are bonded to oxygen atoms and exhibit an oxidation state of $+5$, while the internal sulphur atoms are bonded only to other sulphur atoms and have an oxidation state of 0.

Q66.

Answer: C

Explanation:

Halic (V) acids are oxoacids where the halogen atom is in the $+5$ oxidation state. These are formed by three halogens: chlorine ($HClO_3$), bromine ($HBrO_3$), and iodine (HIO_3).

Q67.

Answer: D

Explanation:

Pyrophosphoric acid ($H_4P_2O_7$) consists of two phosphate units linked by an oxygen atom, forming one $P - O - P$ bond. The structure contains four ionizable hydroxyl groups ($P - OH$) and two double-bonded oxygens ($P = O$).

Q68.

Answer: C

Explanation:

The structure of perchloric acid ($HClO_4$) features a central chlorine atom bonded to four oxygen atoms. One oxygen is part of a hydroxyl group ($Cl - OH$), while the remaining three oxygens are attached via double bonds ($Cl = O$).

Q69.

Answer: B

Explanation:

Pyrophosphorous acid ($H_4P_2O_5$) and hypophosphorous acid (H_3PO_2) are oxoacids of phosphorus that both contain exactly two $P - H$ bonds in their molecular structures.

Q70.

Answer: C

Explanation:

The reducing property of phosphorus oxoacids is directly proportional to the number of $P - H$ bonds present in the molecule. Hypophosphorous acid (H_3PO_2) is a strong reducing agent because it contains two such bonds.

Q71.

Answer: C

Explanation:

Fluorine is the most electronegative element in the periodic table. Because it lacks vacant d-orbitals to expand its octet and has the highest attraction for electrons, it only exhibits a negative oxidation state of -1 and never shows positive states.

Q72.

Answer: C

Explanation:

Pyrosulphuric acid ($H_2S_2O_7$) contains two sulphur atoms linked by a bridging oxygen atom ($S - O - S$ linkage). The other listed acids ($H_2S_4O_6$, $H_2S_2O_3$, $H_2S_2O_4$) all feature direct $S - S$ bonds.

Q73.

Answer: D

Explanation:

Pyrophosphoric acid ($H_4P_2O_7$) has a structure with four hydroxyl groups, resulting in four $P - OH$ bonds. Calculating the oxidation state for Phosphorus (x) gives:
 $4(+1) + 2x + 7(-2) = 0 \implies 2x = 10 \implies x = +5$

Q74.

Answer: D

Explanation:

Both peroxodisulphuric acid ($H_2S_2O_8$) and pyrosulphuric acid ($H_2S_2O_7$) contain two sulphur atoms, each forming two double bonds with oxygen and one bond with a hydroxyl group. This results in a total of 4 $S = O$ bonds and 2 $S - OH$ bonds for each molecule.

Q75.

Answer: C

Explanation:

The number of π -bonds in these sulphur oxoacids corresponds to the number of $S = O$ double bonds: $H_2S_2O_7$ has 4, H_2SO_4 has 2, and H_2SO_3 has 1.

Q76.

Answer: C

Explanation:

In orthophosphorous acid (H_3PO_3) and pyrophosphorous acid ($H_4P_2O_5$), the formal oxidation state of phosphorus is $+3$. In hypophosphoric acid, it is $+4$, and in pyrophosphoric acid, it is $+5$.

Q77.

Answer: C

Explanation:

Hypophosphoric acid ($H_4P_2O_6$) is unique among these acids because its structure contains a direct bond between the two phosphorus atoms ($P - P$ linkage). The others ($H_4P_2O_5$, $H_4P_2O_7$, $(HPO_3)_3$) contain $P - O - P$ linkages.

Q78.

Answer: C

Explanation:

Hypophosphorous acid (H_3PO_2) has a structure where the central phosphorus atom is bonded to two hydrogen atoms ($P - H$ bonds), one double-bonded oxygen ($P = O$), and one hydroxyl group ($P - OH$).

Q79.

Answer: B

Q80.

Answer: C

Q81.

Answer: C

Q82.

Answer: D

Q83.

Answer: A

Q84.

Answer: D

Q85.

Answer: C

Q86.

Answer: B

Explanation:

The process $MnO_4^- \rightarrow Mn^{2+}$ involves Manganese changing from its highest common oxidation state of +7 to +2 in acidic medium, which corresponds to a gain of five electrons.

Q87.

Answer: B

Explanation:

Potassium is an alkali metal belonging to Group 1 of the periodic table. Such metals consistently exhibit an oxidation state of +1 in all their compounds, including oxides, peroxides, and superoxides.

Q88.

Answer: D

Explanation:

In chromyl chloride (CrO_2Cl_2), the central chromium atom is bonded to two oxygen atoms and two chlorine atoms. By assigning standard oxidation numbers to oxygen (-2) and chlorine (-1), the chromium atom is found to be in the +6 state.

Q89.

Answer: B

Q90.

Answer: B

Q91.

Answer: A

Q92.

Answer: D

Q93.

Answer: B

Q94.

Answer: B

Q95.

Answer: B

Q96.

Answer: D

Q97.

Answer: C

Q98.

Answer: B

Q99.

Answer: D

Q100.

Answer: D

Q101.

Answer: D

Q102.

Answer: A

Q103.

Answer: A

Q104.

Answer: C

Q105.

Answer: B

Q106.

Answer: A

Q107.

Answer: A

Q108.

Answer: B

Q109.

Answer: C

Q110.

Answer: C

Q111.

Answer: C

Q112.

Answer: A

Q113.

Answer: C

Q114.

Answer: D

Q115.

Answer: D

Q116.

Answer: D

Q117.
Answer: C

Q118.
Answer: A

Q119.
Answer: B

Q120.
Answer: B

Q121.
Answer: A

Q122.
Answer: A

Q123.
Answer: D

Q124.
Answer: B

Q125.
Answer: C

Q126.
Answer: D

Q127.
Answer: C

Q128.
Answer: A

Q129.
Answer: B

Q130.
Answer: C

Q131.
Answer: A

Q132.
Answer: A

Q133.
Answer: C

Q134.
Answer: B

Q135.
Answer: B

Q136.
Answer: B

Q137.
Answer: B

Q138.
Answer: B

Q139.
Answer: A

Q140.
Answer: A

Q141.
Answer: C

Q142.
Answer: C

Q143.
Answer: D

Q144.
Answer: C

Q145.
Answer: B

Q146.
Answer: A

Q147.
Answer: C

Q148.
Answer: C

Q149.
Answer: A

Q150.
Answer: A

Q151.
Answer: B

Q152.
Answer: B

Q153.
Answer: D

Q154.
Answer: C

Q155.

Answer: D

Q156.

Answer: A

Q157.

Answer: A

Q158.

Answer: D

Q159.

Answer: B

Q160.

Answer: C

Q161.

Answer: C

Q162.

Answer: C

Q163.

Answer: B

Q164.

Answer: B

Q165.

Answer: A

Q166.

Answer: B

Q167.

Answer: D

Q168.

Answer: C

Q169.

Answer: A

Q170.

Answer: B

Q171.

Answer: D

Q172.

Answer: C

Q173.

Answer: A

Q174.

Answer: A

Q175.

Answer: D

Q176.

Answer: A

Q177.

Answer: A

Q178.

Answer: B

Q179.

Answer: C

Q180.

Answer: C