Max Marks: 720 | **JR_WEEK-4 (06-07-2026)** | **Time: 180 mins**

Physics

1. The speed of light (c), gravitational constant (G) and Planck's constant (h) are taken as the fundamental units in a system. The dimension of time in this new system should be

A) $G^{1/2}h^{1/2}c^{-5/2}$ **B)** $G^{-1/2}h^{1/2}c^{1/2}$
C) $G^{1/2}h^{1/2}c^{-3/2}$ **D)** $G^{1/2}h^{1/2}c^{1/2}$

2. In the relation $P=\frac{\alpha}{\beta}e^{-\frac{\alpha Z}{k\theta}}$ P is pressure, Z is the distance, k is Boltzmann constant and □ is the temperature. The dimensional formula of □ will be

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

3. The frequency of vibration of string is given by $\nu=\frac{p}{2l}\left[\frac{F}{m}\right]^{1/2}$. Here p is number of segments in the string and l is the length. The dimensional formula for m will be

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

4. E, m, l and G denote energy, mass, angular momentum and gravitational constant respectively, then the dimension of $\frac{El^2}{m^5G^2}$ are

A) Angle **B)** Length
C) Mass **D)** Time

5. In an electron gun, emission current from the cathode is given by the equation, $I=AT^2\,e^{-(B/(KT))}$ [K = Boltzmann constant, A = constant] The dimensional formula for AB^2 is same as

A) KT **B)** IT^2
C) IK^2 **D)** $\frac{IK^2}{T}$

6. If the acceleration due to gravity is $10\,ms^{-2}$ and the units of length and time are changed in kilometer and hour respectively, the numerical value of the acceleration is

A) 360000 **B)** 72,000
C) 36,000 **D)** 129600

7. From the equation $\tan\theta=\frac{rg}{v^2}$, one can obtain the angle of banking θ for a cyclist taking a curve (the symbols have their usual meanings). Then say, it is

A) Both dimensionally and numerically correct **B)** Neither numerically nor dimensionally correct
C) Dimensionally correct only **D)** Numerically correct only

8. 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)** $a=L,\ b=LT,\ c=T^2$

9. From the dimensional consideration, which of the following equation is correct

A) $T=2\pi\sqrt{\frac{R^3}{GM}}$ **B)** $T=2\pi\sqrt{\frac{GM}{R^3}}$
C) $T=2\pi\sqrt{\frac{GM}{R^2}}$ **D)** $T=2\pi\sqrt{\frac{R^2}{GM}}$

10. The position of a particle at time t is given by the relation $x(t)=\left(\frac{v_0}{\alpha}\right)(1-c^{-\alpha t})$, where v_0 is a constant and $\alpha>0$. The dimensions of v_0 and α are respectively

A) $M^0L^1T^{-1}$ and T^{-1} **B)** $M^0L^1T^0$ and T^{-1}
C) $M^0L^1T^{-1}$ and LT^{-2} **D)** $M^0L^1T^{-1}$ and T

11. The equation of state of some gases can be expressed as $\left(P+\frac{a}{V^2}\right)=\frac{R\theta}{V}$ Where P is the pressure, V the volume, θ the absolute temperature and a and b are constants. The dimensional formula of a is

A) $[ML^5T^{-2}]$ **B)** $[M^{-1}L^5T^{-2}]$
C) $[ML^{-1}T^{-2}]$ **D)** $[ML^{-5}T^{-2}]$

12. The dimensions of $\frac{a}{b}$ in the equation $P=\frac{a-t^2}{bx}$, where P is pressure, x is distance and t is time, are

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

13. The frequency of vibration f of a mass m suspended from a spring of spring constant $K$is given by a relation of this type $f = C\,m^x K^y$; where C is a dimensionless quantity. The value of x and y are

A) $x = \frac{1}{2},\ y = \frac{1}{2}$ **B)** $x = -\frac{1}{2},\ y = -\frac{1}{2}$
C) $x = \frac{1}{2},\ y = -\frac{1}{2}$ **D)** $x = -\frac{1}{2},\ y = \frac{1}{2}$

14. The velocity of water waves v may depend upon their wavelength λ, the density of water ρ and the acceleration due to gravity g. The method of dimensions gives the relation between these quantities as

A) $v^2 rg$ **B)** $v^2 \propto g\lambda\rho$
C) $v^2 \propto g\lambda$ **D)** $v^2 \propto g^{-1}\lambda^{-3}$

15. The equation of a wave is given by $Y = A\sin\omega\left(\frac{x}{v} - k\right)$where ω is the angular velocity and v is the linear velocity. The dimension of k is

A) LT **B)** T
C) T^{-1} **D)** T^2

16. The period of a body under SHM i.e. presented by $T = P^a D^b S^c$; where P is pressure, D is density and S is surface tension. The value of $a,\ b$ and c are

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

17. The velocity of a freely falling body changes as $g^p h^q$ where g is acceleration due to gravity and h is the height. The values of p and q are

A) $1,\ \frac{1}{2}$ **B)** $M^0L^2T^{-2}$
C) $\frac{1}{2},\ 1$ **D)** $1,\ 1$

18. The Martians use force (F), acceleration (A) and time (T) as their fundamental physical quantities. The dimensions of length on Martians system are

A) FT^2 **B)** $F^{-1}T^2$
C) $F^{-1}A^2T^{-1}$ **D)** AT^2

19. If P represents radiation pressure, c represents speed of light and Q represents radiation energy striking a unit area per second, then non-zero integers $x,\ y$ and z such that $P^xQ^yc^z$ is dimensionless, are

A) $x = 1,\ y = 1,\ z = -1$ **B)** $x = 1,\ y = -1,\ z = 1$
C) $x = -1,\ y = 1,\ z = 1$ **D)** $x = 1,\ y = 1,\ z = 1$

20. Dimensions of the following three quantities are the same

A) Work, energy, force **B)** Velocity, momentum, impulse
C) Potential energy, kinetic energy, momentum **D)** Pressure, stress, coefficient of elasticity

21. A force F is given by $F = at + bt^2$, where t is time. What are the dimensions of a and b

A) MLT^{-3} and ML^2T^{-4} **B)** MLT^{-3} and MLT^{-4}
C) C)MLT^{-1} and MLT^0 **D)** D)MLT^{-4} and MLT^1

22. If the speed of light (c), acceleration due to gravity (g) and pressure (p) are taken as the fundamental quantities, then the dimension of gravitational constant is

A) $c^2g^0p^{-2}$ **B)** $c^0g^2p^{-1}$
C) cg^3p^{-2} **D)** $c^{-1}g^0p^{-1}$

23. A physcial quantity x depends on quantities y and z as follows: $x = Ay + B\tan Cz$, where $A,\ B$ and C are constants. Which of the following do not have the same dimensions

A) x and B **B)** C and z^{-1}
C) y and B/A **D)** x and A

24. The dimensions of K in the equation $W = \frac{1}{2}Kx^2$ is

A) $M^1L^0T^{-2}$ **B)** $M^0L^1T^{-1}$
C) $M^1L^1T^{-2}$ **D)** $M^1L^0T^{-1}$

25. The velocity of a body is given by the equation $v = \frac{b}{t} + ct^2 + dt^3$. The dimensional formula of b is

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

26. The force F is given in terms of time t and displacement x by the equation $F = A\cos Bx + C\sin Dt$. The dimensional formula of D/B is

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

27. If P represents radiation pressure, c represents speed of light and Q represents radiation striking unit area per second, then non-zero integers x, y, and z such that $P^xQ^yc^z$ is dimensionless are

A) $x = 1, y = 1, z = -1$ **B)** $x = 1, y = -1, z = 1$
C) $x = -1, y = 1, z = 1$ **D)** $x = 1, y = 1, z = 1$

28. A physical quantity is represented by $X = M^aL^bT^{-c}$. If percentage errors in the measurement of M, L and T are α, β and γ, respectively, then total percentage error is

A) $(\alpha a + \beta b - \gamma c)$ **B)** $(\alpha a + \beta b + \gamma c)$
C) $(\alpha a - \beta b - \gamma c)$ **D)** zero

29. If force, velocity and time are taken as fundamental quantities, find the dimensions of work.

A) FVT **B)** FVT^2
C) F^0VT^{-1} **D)** FV^2T^{-1}

30. Given that: $y = A\sin\left[\left(\frac{2\pi}{\lambda}\right)(ct - x)\right]$, where y and x are measured in the unit of length. Which of the following statements is true?

A) The unit of λ is same as that of x and A.
B) The unit of λ is same as that of x but not of A.
C) The unit of c is same as that of $2\pi/\lambda$.
D) The unit of $(ct - x)$ is same as that of $2\pi/\lambda$.

31. Suppose refractive index μ is given as $\mu = A + \frac{B}{\lambda^2}$ where A and B are constants and λ is wavelength, then dimensions of B are same as that of.

A) wavelength
B) volume
C) pressure
D) area

32. A physical quantity x depends on quantities y and z as follows: $x = Ay + B\tan(Cz)$, where A, B and C are constants. Which of the following do not have the same dimensions?

A) x and B
B) C and z^{-1}
C) y and B/A
D) x and A

33. Force F is given in terms of time t and distance x by $F = A\sin Ct + B\cos Dx$. Then, dimensions of A/B and C/D are.

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

34. The frequency (n) of vibration of a string is given as $n = \frac{1}{2l}\sqrt{\frac{T}{m}}$, where T is tension and l is the length of vibrating string. Then, the dimensional formula for m is.

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

35. The position x of a particle at time t is given by $x = \frac{V_0}{a}(1 - e^{-at})$, where V_0 is constant and $a > 0$. The dimensions of V_0 and a are.

A) M^0LT^{-1} and T^{-1}
B) M^0LT^0 and T^{-1}
C) M^0LT^{-1} and LT^{-2}
D) M^0LT^{-1} and T

36. Write the dimensions of a/b in the relation $P = \frac{a - t^2}{bx}$, where P is the pressure, x is the distance and t is the time.

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

37. Write the dimensions of $a \times b$ in the relation $E = \frac{b - x^2}{at}$, where E is the energy, x is the displacement and t is time.

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

38. In the formula $X = 3YZ^2$, X and Z have the dimensions of capacitance and magnetic induction, respectively. The dimensions of Y in M.K.S. system are.

A) $M^{-3}L^{-2}T^{-2}A^{-4}$
B) $ML^{-2}A^o$
C) $M^{-3}L^{-2}T^8A^4$
D) $M^{-3}L^{-2}T^4A^4$

39. Match List - I with List - II. Choose the correct answer from the options given below :

List – I	List – II
A. Coefficient of viscosity	I. $[ML^{-1}T^{-2}]$
B. Surface tension	II. $[ML^2T^{-2}]$
C. Pressure	III. $[ML^0T^{-2}]$
D. Surface energy	IV. $[ML^{-1}T^{-1}]$

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

40. Consider a modified Bernoulli equation. $\left(P + \frac{A}{Bt^2}\right) + \rho g(h + Bt) + \frac{1}{2}\rho V^2 = \text{constant}$ If t has the dimension of time then the dimensions of A and B are ____ , ____ respectively.

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

41. The potential energy of a particle changes with distance x from a fixed origin as $V = \frac{A\sqrt{x}}{x+B}$, where A and B are constant with appropriate dimensions. The dimensions of A B are _____

A) $\left[M^1\ L^{5/2}\ T^{-2}\right]$
B) $\left[M^{3/2}\ L^{5/2}\ T^{-2}\right]$
C) $\left[M^1\ L^2\ T^{-2}\right]$
D) $\left[M^1\ L^{7/2}\ T^{-2}\right]$

42. Dimensions of universal gravitational constant (G) in terms of Planck's constant (h), distance (L), mass (M) and time (T) are _____.

A) $[hTLM^{-2}]$
B) $[hT^{-1}LM^{-2}]$
C) $[hTL^2M^{-2}]$
D) $[h^{-1}T^{-1}LM^{-2}]$

43. If μ_0 and ϵ_0 are the permeability and permittivity of free space, respectively, then the dimension of $\left(\frac{1}{\mu_0\epsilon_0}\right)$ is :

A) $\frac{T^2}{L}$
B) L^2/T^2
C) $\frac{T^2}{L^2}$
D) $\frac{L}{T^2}$

44. The pair of physical quantities not having the same dimensions is :

A) Angular momentum and Planck's constant
B) Torque and energy
C) Surface tension and impulse
D) Pressure and Young's modulus

45. The position of a particle moving on x-axis is given by $x(t) = A\sin t + B\cos^2 t + Ct^2 + D$, where t is time. The dimension of $\frac{ABC}{D}$ is

A) L
B) $\mathrm{L}^3\ \mathrm{T}^{-2}$
C) $\mathrm{L}^2\ \mathrm{T}^{-2}$
D) L^2

Chemistry

46. Match List - I (compound) with list - II (Oxidation state of N) and select the correct answer using the codes given below the list: List - I:

List - I	List-II
(A) KNO_3	(a) – 1/3
(B) HNO_2	(b) – 3
(C) NH_4Cl	(c) 0
(D) NaN_3	(d) + 3
	(e) + 5

A) A-e, B-d, C-b, D-a
B) A-e, B-b, C-d, D-a
C) A-d, B-e, C-a, D-c
D) A- b, B-c, C-d, D-e

47. Which one of the following is a redox reaction?

A) $H_2 + Br_2 \rightarrow 2HBr$
B) $2NaCl + H_2SO_4 \rightarrow Na_2SO_4 + 2HCl$
C) $HCl + AgNO_3 \rightarrow AgCl + HNO_3$
D) $NaOH + HCl \rightarrow NaCl + H_2O$

48. Which of the following is not a redox change?

A) $2H_2S + SO_2 \rightarrow 2H_2O + 3S$
B) $2BaO + O_2 \rightarrow 2BaO_2$
C) $BaO_2 + H_2SO_4 \rightarrow BaSO_4 + H_2O_2$
D) $2KClO_3 \rightarrow 2KCl + 3O_2$

49. In the reaction, $Cl_2 + OH^- \rightarrow Cl^- + ClO_4^- + H_2O$, chlorine is:

A) Oxidised
B) Reduced
C) Oxidised as well as reduced
D) Neither oxidised nor reduced

50. Which is a redox reaction:

A) $2CuI_2 \rightarrow 2CuI + I_2$
B) $NaCl + AgNO_3 \rightarrow AgCl + NaNO_3$
C) $NH_4Cl + NaOH \rightarrow NH_3 + NaCl + H_2O$
D) $2Cr(OH)_3 + 3KOH \rightarrow 2Cr(OH)_3 + 3K_2SO_4$

51. Which of the following example does not represent disproportionation -

A) $MnO_2 + 4HCl \rightarrow MnCl_2 + Cl_2 + 2H_2O$
B) $2H_2O_2 \rightarrow 2H_2O + O_2$
C) $4KClO_3 \rightarrow 3KClO_4 + KCl$
D) $3Cl_2 + 6NaOH \rightarrow 5NaCl + Na$

52. The decomposition of $KClO_3$ to KCl and O_2 on heating is an example of:

A) Intermolecular redox change
B) Intramolecular redox change
C) Disproportionation or auto redox change
D) Comproportionation

53. Which of the following change represents a disproportionation reaction (s):

A) $Cl_2 + 2OH^- \rightarrow ClO^- + Cl^- + H_2O$
B) $Cu_2^+ + 2H^+ \rightarrow Cu + Cu^{2+} +$
C) $2HCuCl_2 \xrightarrow[Water]{dilution\ with} Cu + Cu^{2+} + 4Cl^- + 2H^+$
D) All of the above

54. How many electrons should X_2H_4 liberate so that in the new compound X shows oxidation number of $-1/2$ (E.N. $X > H$)

A) 10
B) 4
C) 3
D) 2

55. Which one of the following is not a redox reaction :-

A) $CaCO_3 \rightarrow CaO + CO_2$
B) $2H_2 + O_2 \rightarrow 2H_2O$
C) $Na + H_2O \rightarrow NaOH + \frac{1}{2}H_2$
D) $MnCl_3 \rightarrow MnCl_2 + \frac{1}{2}Cl_2$

56. In the reaction:

$$MnO_4^- + SO_3^{2-} + H^+ \rightarrow SO_4^{2-} + Mn^{2+} + H_2O$$

A) MnO_4^- and H^+ both are reduced
B) MnO_4^- is reduced and H^+ is oxidised
C) MnO_4^- is reduced and SO_3^{2-} is oxidised
D) MnO_4^- is oxidised and SO_3^{2-} is reduced

57. $I_2 + KI \rightarrow KI_3$. In the above reaction:-

A) Only oxidation taken place
B) Only reduction takes place
C) Both the above
D) Neither oxidation nor reduction

58. Which of the following reaction represents the oxidising behaviour of H_2SO_4 :-

A) $2PCl_3 + H_2SO_4 \rightarrow 2POCl_3 + 2HCl + H_2SO_4$
B) $2NaCl + H_2SO_4 \rightarrow Na_2SO_4 +$
C) NaCl +
D) $2HI + H_2SO_4 \rightarrow I_2 + SO_2 + 2$

59. Select the example of disproportionation reaction

A) $BaCl_2 + H_2SO_4 \rightarrow BaSO_4 + HCl$

B) $4NH_3 + 4NO \rightarrow N_2O + 2H_2O$

C) $4H_3PO_3 \rightarrow PH_3 + 3H_3PO_4$

D) $AgCl + 2NH_3 \rightarrow Ag(NH_3)_2Cl$

60. Which of the following reaction involves oxidation & reduction :-

A) $NaBr + HCl \rightarrow NaCl + HBr$

B) $HBr + AgNO_3 \rightarrow AgBr + HNO_3$

C) $2NaOH + H_2SO_4 \rightarrow Na_2SO_4 + 2H_2O$

D) $H_2 + Br_2 \rightarrow 2HBr$

61. The reaction $2K_2MnO_4 + Cl_2 \rightarrow 2KMnO_4 + 2KCl$ is an example of

A) Redox

B) Reduction only

C) Neutralization

D) Disproportionation

62. Which of the following reaction involves neither oxidation nor reduction :–

A) $CrO_4^{2-} \rightarrow Cr_2O_7^{2-}$

B) $Cr \rightarrow CrCl_3$

C) $Na \rightarrow Na^+$

D) $2S_2O_3^{2-} \rightarrow S_4O_6^{2-}$

63. $Zn + H_2SO_4 \rightarrow ZnSO_4 + H_2$**. Znundergoes –**

A) Reduction

B) Oxidation

C) Both oxidation and reduction

D) Neither oxidation nor reduction

64. Balance the following given half reaction for the unbalanced whole reaction: $CrO_4^{2-} \rightarrow CrO_2^- + OH^-$ is :

A) $CrO_4^{2-} + 2H_2O + 3e^- \rightarrow CrO_2^- + 4OH^-$

B) $CrO_4^{2-} + 4OH^- \rightarrow CrO_2^- + 4H_2O + 4e^-$

C) $CrO_4^{2-} + H_2O \rightarrow CrO_2^- + 3OH^- + 3e^-$

D) $2CrO_4^{2-} + 4H_2O + 6e^- \rightarrow 2CrO_2^- + 8OH^-$

65. Choose the set of coefficients that correctly balances the following equation : $xCr_2O_7^{2-} + yH^+ + ze^- \rightarrow aCr^{3+} + bH_2O$

A) x-2, y-14, z-6, a-2, b-7

B) x-1, y-14, z-6, a-2, b-7

C) x-2, y-7, z-6, a-2, b-7

D) x-2, y-7, z-6, a-1, b-7

66. In the reaction: $MnO_4^- + xH^+ + ne^- \rightarrow Mn^{2+} + yH_2O$. What is the value of n :

A) 5

B) 8

C) 6

D) 3

67. The number of electrons required to balance charge in the following equation – $MnO_4^- + 2H_2O \rightarrow MnO_2 + 4OH^-$ is

A) 5

B) 4

C) 3

D) 2

68. $2KMnO_4 + 5H_2S + 6H^+ \rightarrow 2Mn^{2+} + 2K^+ + 5S + 8$**. In the above reaction, how many electrons would be involved in the oxidation of 1 mole of reductant?**

A) Two

B) Five

C) Ten

D) One

69. The value of n in : $4MnO^- + 8H^+ + ne^- \rightarrow Mn^{2+} + 4H_2O$ is

A) 5

B) 4

C) 3

D) 2

70. For the redox reaction $Zn + NO_3^- \rightarrow Zn^{2+} + NH_4^+$ in basic medium, coefficients of Zn, NO_3^- and OH^- in the balanced equation respectively are :

A) 4, 1, 7

B) 7, 4, 1

C) 4, 1, 10

D) 1, 4, 10

71. In the balanced equation- $[Zn + H^+ + NO_3^- \rightarrow NH_4^+ + Zn^{+2} + H_2O]$ coefficient of NH_4^+ is:-

A) 4

B) 3

C) 2

D) 1

72. In the balanced equation $4MnO^- + H^+ + C_2O_4^{2-} \rightarrow Mn^{2+} + CO_2 + H_2O$, the moles of CO_2 formed are :-

A) 2

B) 4

C) 5

D) 10

73. In the following reaction the value of 'X' is $H_2O + SO_3^{2-} \rightarrow SO_4^{2-} + 2H^+ + X$

A) $4e^-$

B) $3e^-$

C) $2e^-$

D) $1e^-$

74. The number of electrons required to balance the following equation are: $NO_3^- + 4H^+ \rightarrow 2H_2O + NO$

A) 2 on right side

B) 3 on left side

C) 3 on right side

D) 5 on left side

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

A) N_3H

B) NH_2OH

C) N_2H_4

D) NH_3

76. The reaction of aqueous $KMnO_4$ with H_2O_2 in acidic conditions gives:

A) Mn^{4+} and O_2

B) Mn^{2+} and O_2

C) Mn^{2+} and O_3

D) Mn^{4+} and MnO_2

77. Assuming complete ionization, same moles of which of the following compounds will require the least amount of acidified $KMnO_4$ for complete oxidation?

A) FeC_2O_4 **B)** $Fe(NO_2)2$
C) $FeSO_4$ **D)** $FeSO_3$

78. In the reaction $CH_3OH \rightarrow HCOOH$, the number of electrons that must be added to the right is:

A) 4 **B)** 3
C) 2 **D)** 14

79. Which statement is wrong:

A) Oxidation number of oxygen is $+1$ in peroxides **B)** Oxidation number of oxygen is $+2$ in oxygen difluoride
C) Oxidation number of oxygen is $-1/2$ in superoxides **D)** Oxidation number of oxygen is -2 in most of its compound

80. In the reaction $8Al + 3Fe_3O_4 \rightarrow 4Al_2O_3 + 9Fe$, the number of electrons transferred from reductant to oxidant is:

A) 8 **B)** 4
C) 16 **D)** 24

81. In which of the following reaction hydrogen is acting as an oxidising agent:

A) With iodine to give hydrogen iodide **B)** With lithium to give lithium hydride
C) With nitrogen to give ammonia **D)** With sulphur to give hydrogen sulphide

82. Oxidation number of Xe in XeF_5^- is:

A) $+1$ **B)** $+2$
C) $+3$ **D)** $+4$

83. Which is the best description of the behaviour of bromine in the reaction given below:
$H_2O + Br_2 \rightarrow HOBr + HBr$

A) Both oxidized and reduced **B)** Oxidized only
C) Reduced only **D)** Proton acceptor only

84. Consider the following reaction:
$xMnO_4^- + yC_2O_4^{2-} + zH^+ \rightarrow xMn^{2+} + 2yCO_2 + \frac{z}{2}H_2O$
The values of x, y and z in the reaction are respectively:

A) $5, 2$ and 16 **B)** $2, 5$ and 8
C) $2, 5$ and 16 **D)** $5, 2$ and 8

85. In which of the following reaction H_2O_2 acts as a reducing agent? (a) $H_2O_2 + 2H^+ + 2e^- \rightarrow 2H_2O$ **(b)** $H_2O_2 - 2e^- \rightarrow O_2 + 2H^+$ **(c)** $H_2O_2 + 2e^- \rightarrow 2OH^-$ **(d)** $H_2O_2 + 2OH^- - 2e^- \rightarrow O_2 + 2H_2O$

A) (a), (c) **B)** (b), (d)
C) (a), (b) **D)** (c), (d)

86. In the following reaction:
$2FeCl_3 + H_2S \rightarrow 2FeCl_2 + 2HCl + S$

A) $FeCl_3$ is oxidant **B)** $FeCl_3$& H_2S are oxidised
C) $FeCl_3$ is oxidised & H_2S is reduced **D)** H_2S is oxidant

87. In oxidation reduction reaction
$Cr_2O_7^{2-} + SO_3^{2-} + H^+ \rightarrow Cr^{+3} + SO_4^{2-} + H_2O$
the balance equation coefficient for $Cr_2O_7^{2-}, SO_3^{2-}, H^+$ are:

A) 1, 3, 8 **B)** 16, 5, 2
C) 2, 16, 5 **D)** 5, 2, 16

88. Which of the following act both as oxidant & reductant:

A) H_2S **B)** SO_3
C) H_2O_2 **D)** F_2

89. $KMnO_4$ is titrated with ferrous ammonium sulphate hexahydrate in presence of dilute H_2SO_4 . Number of water molecules produced for 2 molecules of $KMnO_4$ is _____.

A) 68 **B)** 34
C) 36 **D)** 72

90. Identify the reducing agent in the reaction:
$3Fe_3O_4 + 8Al(s) \rightarrow 9Fe + 4Al_2O_3(s)$

A) Fe_3O_4 **B)** Al
C) Fe **D)** Al_2O_3

Botany

91. Which of the following is a saturated fatty acid?

A) Oleic acid **B)** Linoleic acid
C) Arachidonic acid **D)** Palmitic acid

92. When grinding living tissue in trichloroacetic acid, which of the following biomolecules is found in the acid-insoluble fraction despite having a molecular weight less than 800 Daltons?

A) Amino acids **B)** Lipids
C) Polysaccharides **D)** Nucleotides

93. Which of the following sets contains the four most abundant elements forming the foundational framework of organic biomolecules?

A) $P, S, K,$ and H **B)** $Mg, Ca, Fe,$ and Na
C) $C, H, O,$ and N **D)** $Zn, Mo, Mn,$ and Cu

94. The elemental analysis of a dried plant sample that is subsequently completely burnt (combusted) leaves behind "ash". This ash contains:

A) Gaseous carbon dioxide and nitrogen oxides
B) Only organic compounds like carbohydrates and lipids
C) Inorganic minerals like calcium, magnesium, and phosphate
D) Water vapor and volatile organic compounds

95. Arrange the following elements in the CORRECT descending order of their percent weight abundance in the human body:

A) $\text{Carbon} > \text{Oxygen} > \text{Nitrogen} > \text{Hydrogen}$
B) $\text{Oxygen} > \text{Carbon} > \text{Nitrogen} > \text{Hydrogen}$
C) $\text{Oxygen} > \text{Carbon} > \text{Hydrogen} > \text{Nitrogen}$
D) $\text{Carbon} > \text{Nitrogen} > \text{Hydrogen} > \text{Nitrogen}$

96. Which element is present in a "negligible" amount in the human body despite being the second most abundant element in the Earth's crust?

A) Carbon
B) Silicon
C) Magnesium
D) Sodium

97. Match List-I (Fraction/Process) with List-II (Biomolecule/Property) and select the correct option:

List-I	List-II
(a) Acid-soluble pool	(i) Molecular weight > 10,000 Da
(b) Acid-insoluble pool	(ii) Water-insoluble vesicular aggregates
(c) Ash analysis	(iii) Monomers with molecular weight 18–800 Da
(d) Lipids	(iv) Left behind after escaping of CO2 and H2O

A) (a)-(iii), (b)-(i), (c)-(iv), (d)-(ii)
B) (a)-(i), (b)-(iii), (c)-(iv), (d)-(ii)
C) (a)-(iii), (b)-(i), (c)-(ii), (d)-(iv)
D) (a)-(iv), (b)-(ii), (c)-(i), (d)-(iii)

98. Read the following statements regarding the elemental analysis of organisms: Statement I: A comparison of elements in the Earth's crust and living tissue reveals that the relative abundance of Carbon and Hydrogen is higher in any living organism than in the Earth's crust. Statement II: Trichloroacetic acid (Cl3CCOOH) is used to precipitate the macromolecular fraction during chemical analysis.

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

99. Which of the following amino acids is optically inactive due to the absence of a chiral carbon atom?

A) Alanine
B) Glycine
C) Valine
D) Serine

100.
Match the amino acids in List-I with their specific chemical nature or functional group in List-II:

List-I (Amino Acid)	List-II (Chemical Nature)
(a) Glutamic acid	(i) Neutral
(b) Lysine	(ii) Hydroxy-methyl group
(c) Valine	(iii) Acidic
(d) Serine	(iv) Basic

A) (a)-(iii), (b)-(iv), (c)-(i), (d)-(ii)
B) (a)-(iv), (b)-(iii), (c)-(i), (d)-(ii)
C) (a)-(iii), (b)-(iv), (c)-(ii), (d)-(i)
D) (a)-(i), (b)-(iv), (c)-(iii), (d)-(ii)

101.
Which specific chemical group determines the physical and chemical properties of a particular amino acid?

A) Amino group ($-NH_2$)
B) Carboxyl group ($-COOH$)
C) Hydrogen atom ($-H$)
D) Variable R-group

102.
Read the following statements regarding amino acid structures: Statement I: In Alanine, the variable R-group is represented by a methyl group ($-CH_3$). Statement II: Amino acids are substituted methanes where the four substituent groups occupy the four valency positions. Choose the correct option:

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

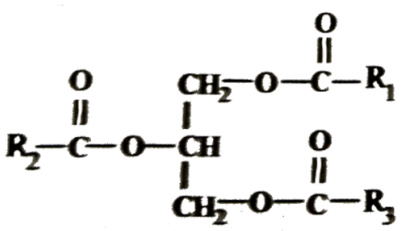
103.
Which of the following is a saturated fatty acid?

A) Oleic acid
B) Linoleic acid
C) Arachidonic acid
D) Palmitic acid

104.
Saturated fatty acids possess _____ bonds between carbon atoms and are _____ at room temperature.

A) single, solids
B) double, solids
C) single, liquids
D) double, liquids

105.
Given molecular formula belongs to which of the following groups of biomolecules?



A) Carbohydrates
B) Proteins
C) Nucleic acids
D) Triglycerides

106.
Lecithin is a:

A) sterol
B) glycolipid
C) phospholipid
D) sphingolipid

107.
Match the column I with column II and choose the correct combination from the given options.

Column I (Component)		Column II (% of the total cellular mass)
A. Ions	(i)	1
B. Lipids	(ii)	2
C. Carbohydrates	(iii)	3
D. Nucleic acids	(iv)	5–7
E. Proteins	(v)	10–15

A) A-(i), B-(ii), C-(iii), D-(iv), E-(v)
B) A-(ii), B-(iii), C-(i), D-(v), E-(iv)
C) A-(iii), B-(i), C-(ii), D-(iv), E-(v)
D) A-(iv), B-(ii), C-(iii), D-(v), E-(i)

108.
Which of the following organic compounds is/are found in the acid-insoluble fraction? (i) Proteins (ii) Nucleic acids (iii) Polysaccharides (iv) Lipids

A) (i), (ii) and (iii) only
B) (ii), (iii) and (iv) only
C) (i) and (iii) only
D) (i), (ii), (iii) and (iv)

109.
Living tissue $\rightarrow$ Grinding in Cl3CCOOH $\rightarrow$ Thick slurry $\rightarrow$ Strained through cheese cloth $\rightarrow$ 2 fractions are obtained: [A] Filtrate / Acid-soluble pool [B] Retentate / Acid-insoluble fraction or pellet. Match the following characteristics to fractions [A] and [B]: (i) Molecular weight ranging from 18 to 800daltons (Da) approximately (ii) Proteins, nucleic acids, polysaccharides and lipids (iii) Contain chemicals that have molecular weight more than (iv) Has monomers (v) Generally has polymers

A) A: (i), (ii), (iii) ;B: (iv), (v)
B) A: (ii), (iv); B: (i), (iii), (v)
C) A: (i), (iv) ; B: (ii), (iii), (v)
D) A: (i), (iii), (v) ; B: (ii), (iv)

110.
What structural feature differs among the 20 common amino acids?

A) Carboxyl groups
B) R-groups
C) Peptide bonds
D) Amino groups

111.
Which of the following is classified as a basic amino acid?

A) Alanine
B) Serine
C) Lysine
D) Tyrosine

112.
Which of the following is an aromatic amino acid?

A) Tyrosine
B) Lysine
C) Glutamic Acid
D) Valine

113.
Chemically, glycerol is defined as which of the following compounds?

A) Trihydroxy methane
B) Trihydroxy propane
C) Dihydroxy ethane
D) Monohydroxy propane

114.
Palmitic acid and arachidonic acid contain how many carbon atoms respectively (including the carboxyl carbon)?

A) 16 and 18
B) 15 and 19
C) 16 and 20
D) 18 and 20

115.
Read the following statements and choose the correct option: Statement I: Lipids are generally water-insoluble biomolecules. Statement II: Lipids are strictly macromolecules because they have molecular weights exceeding ten thousand Daltons.

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

116.
Identify the type of lipid that does not contain any fatty acids or ester bonds, yet is grouped with lipids due to its hydrophobic nature:

A) Triglycerides
B) Monoglycerides
C) Cholesterol
D) Phospholipids

117.
Concanavalin A is a widely studied secondary metabolite. What type of molecule is it?

A) Alkaloid
B) Essential oil
C) Terpenoid
D) Lectin

118.
Assertion (A): In solutions of different pH, the chemical structure of amino acids remains completely unchanged. Reason (R): The amino group ($-NH_2$) and carboxyl group ($-COOH$) of amino acids are easily ionizable.

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 the correct explanation of (A)
C) (A) is true but (R) is false
D) (A) is false but (R) is true.

119.

Which pair of secondary metabolites contains compounds that are actively used as anti-cancer drugs and remedies?

A) Rubber and Gums

B) Vinblastine and Curcumin

C) Lemon grass oil and Menthol

D) Monoterpenes and Diterpenes

120.

If you analyze a plant tissue sample using trichloroacetic acid, where would you expect to find the majority of small-molecule secondary metabolites like alkaloids and flavonoids?

A) In the acid-insoluble fraction (retentate)

B) Caught on the cheesecloth matrix

C) In the acid-soluble pool (filtrate)

D) Completely destroyed by the acid solution

121.

Which of the following statements is INCORRECT regarding secondary metabolites?

A) They are produced by plants, fungi, and microbes.

B) They have identifiable functions and play known roles in normal physiological processes of the host organism.

C) Many of them are useful to human welfare (e.g., rubber, drugs, spices).

D) Some secondary metabolites have ecological importance.

122.

Assertion (A): Amino acids, glucose, and ribose sugar are classified as primary metabolites.
Reason (R): They are directly involved in the fundamental growth, development, and reproduction of an organism.

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 the correct explanation of (A)

C) (A) is true but (R) is false

D) (A) is false but (R) is true.

123.

Read the following statements regarding elemental composition analysis: Statement I: If we examine the abundance of elements relative to other elements, the abundance of Carbon and Hydrogen is higher in any living organism than in the earth's crust. Statement II: Nitrogen is one of the major elements in the earth's crust, standing right behind oxygen in its abundance percentage.

A) Both Statement I and Statement II are correct

B) Both Statement I and Statement II are incorrect

C) Statement I is correct but Statement II is incorrect

D) Statement I is incorrect but Statement II is correct.

124.

Assertion (A): If living tissue is dried completely before burning it, its weight reduces significantly.
Reason (R): The drying process evaporates all the water content from the tissue, leaving behind what is known as the 'dry weight'.

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 the correct explanation of (A)

C) (A) is true but (R) is false

D) (A) is false but (R) is true.

125.

Which of the following element combinations shows the highest percentage of weight in the human body compared to all other elements?

A) Carbon and Hydrogen

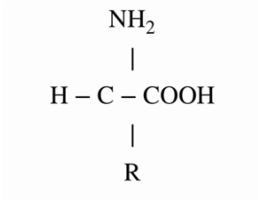
B) Oxygen and Carbon

C) Nitrogen and Oxygen

D) Silicon and Calcium

126.

Examine the general chemical structure of an amino acid given below. If three different variations of this molecule are present in a cell, identify the correct matching of the variable 'R' group with its designated name ?



A) If $R = -CH_3$, the amino acid is Glycine.

B) If $R = -H$, the amino acid is Alanine.

C) If $R = -CH_2OH$, the amino acid is Serine.

D) If $R = -H$, the amino acid is Glutamic acid.

127.

In the structural diagram of Lecithin what unique feature distinguishes its visual structure from a simple triglyceride?

A) It has three fatty acid chains instead of two.

B) One of the fatty acid chains is replaced by a phosphorylated, nitrogen-containing choline head group.

C) It is entirely linear and contains no glycerol backbone.

D) It features a steroid ring structure fused directly to a carboxyl group.

128.

Some tissues have lipids with highly complex structures. This is especially true for:

A) Neural tissues

B) Connective tissues

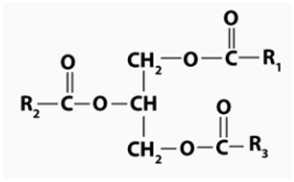
C) Muscular tissues

D) Epithelial tissues

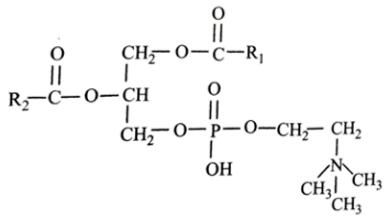
129.

Consider two organic structures

A)



B)



Which one of the following structural formulae of two organic compounds is correctly identified along with its related function?

A) A : Lecithin - a component of cell membrane

B) B : choline - N containing phospholipid

C) A : Triglyceride - major source of energy

D) B : palmitic acid - saturated fatty acid

130.

Select the correct sequence of cellular components arranged in the descending order of their percentage of total cellular mass.

A) Water > Nucleic Acids > Proteins > Carbohydrates > Lipids > Ions

B) Water > Proteins > Carbohydrates > Nucleic Acids > Lipids > Ions

C) Water > Proteins > Nucleic Acids > Carbohydrates > Lipids > Ions

D) Proteins > Water > Nucleic Acids > Lipids > Carbohydrates > Ions

131.

If the R-group in a proteinaceous amino acid is a hydroxy-methyl group ($-CH_2OH$), the amino acid is identified as:

A) Glycine

B) Alanine

C) Serine

D) Tyrosine

132.

The amino acid structure changes its charge configuration at different pH levels. Select the correct representation of a Zwitterion form.

A) $R - \mathrm{CH}(\mathrm{NH_2}) - \mathrm{COOH}$

B) $R - \mathrm{CH}(\mathrm{NH_3^+}) - \mathrm{COO^-}$

C) $R - \mathrm{CH}(\mathrm{NH_3^+}) - \mathrm{COOH}$

D) $R - \mathrm{CH}(\mathrm{NH_2}) - \mathrm{COO^-}$

133.

When an amino acid is placed in a highly acidic solution (low pH, e.g., pH = 1), it exists predominantly as a:

A) Cation (Positively charged ion)

B) Anion (Negatively charged ion)

C) Zwitterion (Net neutral dipolar ion)

D) Completely uncharged molecule

134.

Statement I: Palmitic acid is a saturated fatty acid containing 16 carbons including the carboxyl carbon. Statement II: Arachidonic acid is an unsaturated fatty acid containing 20 carbons excluding the carboxyl carbon.

A) Both Statement I and Statement II are correct.

B) Both Statement I and Statement II are incorrect.

C) Statement I is correct but Statement II is incorrect.

D) Statement I is incorrect but Statement II is correct.

135.

Oils have lower melting points than fats (e.g., gingelly oil) and hence remain as liquids in winter. This lower melting point is primarily due to:

A) The absence of glycerol molecules

B) A high proportion of unsaturated fatty acids with double bonds

C) A high proportion of long-chain saturated fatty acids

D) The presence of phosphate groups attached to the tail.

Zoology

136.

Which of the following is not found in the phylum–Chordata?

A) A dorsal hollow nerve cord

B) Lateral paired gill slits during development

C) A notochord at some stage of development

D) An external skeleton

137.

All chordates have the following characteristics.

A) Bilaterally symmetrical, presence of coelom, triploblastic, open circulatory system

B) Bilaterally symmetrical, presence of coelom, diploblastic or triploblastic

C) Open circulatory system, diploblastic or triploblastic, coelom and bilaterally symmetrical

D) Bilaterally symmetrical, coelom present, triploblastic with closed circulatory system

138.

Phylum–Chordata is divided into subphyla namely

A) Vertebrata, Protochordata and Urochordata

B) Urochordata, Gnathochordata and Vertebrata

C) Urochordata, Tunicata and Vertebrata

D) Tunicata, Cephalochordata and Vertebrata

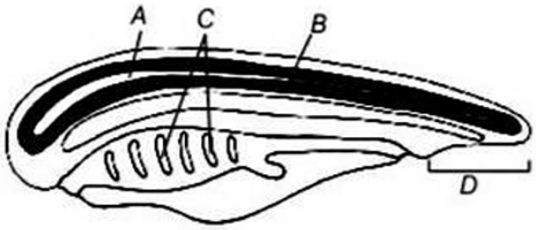
139.
The members of which of the following are often referred as protochordates?

A) Urochordata
B) Cephalochordata
C) Both (a) and (b)
D) None of these

140.
Which animals belong to subphylum–Urochordata?

A) Branchiostoma and Lancelet
B) Salpa and Lancelet
C) Ascidia and Doliolum
D) Salpa and Amphioxus

141.
Animals belonging to phylum–Chordata are fundamentally characterised by the presence of structure noted as A, B, C and D. Identify A, B, C and D.



A) A–Notochord, B–Nerve cord, C–Gill slits, D–Post-anal part
B) A–Nerve cord, B–Notochord, C–Gill slits, D–Post-anal part
C) A–Nerve cord, B–Notochord, C–Post-anal part, D–Gill slits
D) A–Nerve cord, B–Gill slits, C–Notochord, D–Post-anal part

142.
Select the correct difference between the notochord in the following.

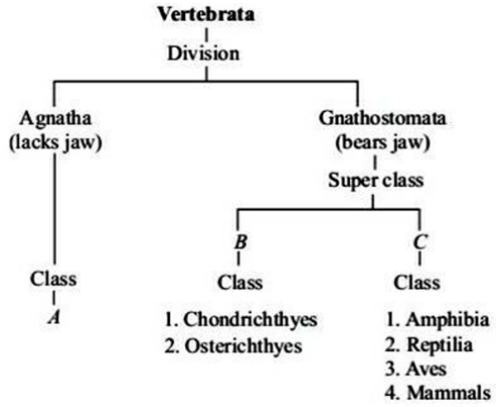
	Urochordata		Cephalochordata
(a)	Present only in larval tail	–	Extend from head to tail throughout life
(b)	Present only in adult	–	Present only in larval tail
(c)	Persistent throughout their life	–	Present only in adult
(d)	Extend from head to tail throughout life	–	Present only in larval tail

A) a
B) b
C) c
D) d

143.
Choose the incorrect vertebrate character.

A) Ventral muscular heart
B) Kidneys for excretion and osmoregulation
C) Paired appendages which may be fins or limbs
D) None of the above

144.
The following is the flow chart depicting the divisions of the subphylum–Vertebrata. Fill in the parts A, B, C and D and choose the correct option.



A) A–Ostracodermi, B–Pisces, C–Tetrapoda
B) A–Cyclostomata, B–Pisces, C–Tetrapoda
C) A–Ostracodermi, B–Cyclostomata, C–Pisces
D) A–Pisces, B–Tetrapoda, C–Cyclostomata

145.
Which of the following options about the class–Cyclostomata is incorrect?

A) Cranium and vertebral column are cartilaginous
B) Elongated body bearing scales and paired fins
C) Gill slits for respiration
D) Sucking and circular mouth

146.
Myxine (Hagfish) has

A) 6–15 pairs of gill slits
B) Closed type circulation
C) Jaws
D) Both (a) and (b)

147.
Match the name of the animal (Column I) with one characteristic (Column II) and the phylum/class (Column III) to which it belongs.

	Column I	Column II	Column III
(a)	Petromyzon	Ectoparasite	Cyclostomata
(b)	Ichthyophis	Terrestrial	Reptilia
(c)	Limulus	Body covered by chitinous exoskeleton	Pisces
(d)	Adamsia	Radially symmetrical	Porifera

A) a
B) b
C) c
D) d

148.
Chondrichthyes is characterised by tooth shaped

A) Placoid scale with dorsal mouth
B) Ctenoid scale with dorsal mouth
C) Ctenoid scale with ventral mouth
D) Placoid scale with ventral mouth

149.
Which one is not cartilaginous fish?

A) Carcharodon (Great white shark), Trygon (sting ray)
B) Exocoetus (flying fish), Catla (katla), Clarias (magur)
C) Scoliodon (dog fish)
D) Pristis (saw fish)

150.
Which of the following is not a characteristic feature of class–Chondrichthyes?

A) Gill slits are separate and without operculum
B) Predaceous with powerful jaws
C) Notochord is persistent throughout life
D) Air bladder present

151.
Choose the incorrect option for the given figure.

A) Operculum present
B) Bony fish
C) Poisonous sting at tail
D) Sexes separate

152.
Bony fishes

A) have external fertilisation
B) are mostly oviparous
C) show direct development
D) All of the above

153.
The number of gills present in Osteichthyes is

A) 2 pairs
B) 6 pairs
C) 5 pairs
D) 4 pairs

154.
Air bladder occurs in

A) Torpedo
B) Clarias
C) Scoliodon
D) Elasmobranch

155.
Which of the following statements is true?

A) All chordates are vertebrates
B) all vertebrates are chordates
C) all chordates are urochordates
D) all chordates are cephalochordates

156.
Which statement is incorrect about Ascidia?

A) They are Triploblastic
B) They have Organ system level organisation
C) They have notochord in larval tail
D) They have notochord throughout the life .

157.
Which one of the following statements about certain given animals is correct?

A) In Chondrichthyes fertilization is internal
B) In osteichthyes mouth is ventral
C) In cyclostomata teeth are modified placoid scales
D) In vertebrates notochord persistant throught the life.

158.
Mark the false statement for the phylum–Cyclostomata .

A) They are ectoparasites
B) They have circular mouth with sucker
C) 6 - 15 pairs of gills for respiration
D) claspers are present for internal fertilization

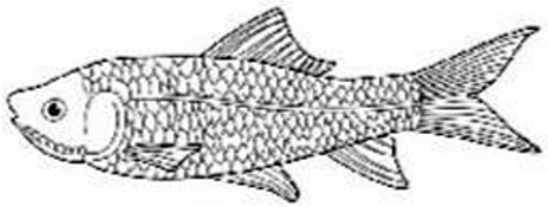
159.
Which statement is incorrect for animals belonging to the class–Osteichthyes?

A) The presence of cycloid/ctenoid scales
B) Both marine and freshwater forms with bony endoskeleton
C) Mouth terminal and gills covered by operculum
D) Notochord is persistent only at larval stage, after that it disappears

160.
Choose the correct statement.

A) Both cartilaginous and bony fishes are dioecious
B) Cartilaginous fishes show sexual dimorphism
C) Male cartilaginous fish have claspers
D) Female cartilaginous fish have claspers

161.
Choose the correct statement for the animals given in the figure below.



A) Its skin is tough, containing minute placoid scales
B) It has four pairs of gills which are covered by air bladder
C) Fertilisation is external and is oviparous
D) Mouth is located ventrally and jaws are very powerful

162.

Which of the following statements are true/false? I. Cell aggregate body plan is found in phylum–Platyhelminthes. II. Radial symmetry is the most common symmetry found in animals. III. Pseudocoelom is found only in phylum–Aschelminthes. IV. All triploblastic animals have a true coelom. V. Haemocoel is sometimes observed in animals belong to phylum-Platyhelminthes

A) I and V are true and II, III and IV are false

B) II, III and V are true and I and IV are false

C) I, II and III are true and IV and V are false

D) I, II, IV and V are false, Only III is true

163.

Consider the following statements. I. Lancelets are jawless, primitive fish-like vertebrates. II. In lancelets, notochord, tubular nerve cord and pharyngeal gill slits are present throughout their life.

A) I is true, but II is false

B) I is false, but II is true

C) Both I and II are true

D) Both I and II are false

164.

Choose the correct option for the following statements. I. All vertebrates are chordates. II. Vertebrates possess notochord during embryonic period.

A) I is true, but II is false

B) II is true, but I is false

C) Both I and II are true

D) Both I and II are false

165.

Match the following columns.

Column I (Scientific names)	Column II (Common names)
A. Branchiostoma	1. Hagfish
B. Petromyzon	2. Lamprey
C. Trygon	3. Sting ray
D. Myxine	4. Ascidia
	5. Amphioxus

A) A-1, B-5, C-2, D-4

B) A-3, B-1, C-2, D-5

C) A-5, B-4, C-1, D-2

D) A-5, B-2, C-3, D-1

166.

Match the following columns.

Column I (Features)	Column II (Animals)
A. These possess electric organs	1. Trygon
B. Animals of this class are poikilothermous	2. Cyclostomata
C. These possess poison sting	3. Torpedo
D. These migrate for spawning to freshwater	4. Chondrichthyes
	5. Lamprey
	6. Exocoetus

A) A-6, B-1, C-3, D-2

B) A-1, B-4, C-6, D-5

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

D) A-3, B-4, C-6, D-2

167.

Match the following columns.

Column I (Animals)	Column II (Common names)
A. Chelone	1. Wall lizard
B. Bungarus	2. Viper
C. Calotes	3. Krait
D. Hemidactylus	4. Garden lizard
	5. Turtle
	6. Tortoise

A) A-3, B-2, C-1, D-6

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

C) A-5, B-4, C-1, D-6

D) A-2, B-5, C-1, D-6

168.

Match the following columns.

Column I (Animals)	Column II (Common names)
A. Hippocampus	1. Fighting fish
B. Betta	2. Great white shark
C. Clarias	3. Sea horse
D. Labeo	4. Angelfish
	5. Rohu
	6. Magur

A) A-3, B-1, C-6, D-5

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

C) A-3, B-2, C-6, D-4

D) A-4, B-1, C-6, D-5

169.

Match the following columns.

Column I (Characteristics)	Column II (Animals)
A. Diploblastic, radial symmetry and tissue level organisation	1. Wuchereria
B. Triploblastic, pseudocoelomates and complete digestive system	2. Dugesia
C. Bilateral symmetry, incomplete digestive system, organ and organ system level of organisation	3. Cucumaria
D. Triploblastic, coelomate, radial symmetry	4. Balanoglossus
	5. Hydra

A) A-2, B-1, C-4, D-5

B) A-3, B-2, C-1, D-5

C) A-4, B-3, C-2, D-5

D) A-5, B-1, C-2, D-3

170.

Match the following columns.

Column I (Parts)	Column II (Description)
A. Hypostome or manubrium	1. The oral tip surrounded by tentacles in Hydra
B. Muscular pharynx	2. Present in Aschelminthes to ingest food.
C. Radula	3. Rasping organ for feeding in Pinctada
D. Malpighian tubules	4. Excretory organ in cockroach

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

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

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

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

171.

Match the Scientific Name in Column I with its Common Name in Column II:

Column I (Scientific Name)	Column II (Common Name)
a. Aptenodytes	1. Toad
b. Betta	2. Blue whale
c. Balaenoptera	3. Penguin
d. Bufo	4. Fighting fish

A) a-3, b-4, c-2, d-1

B) a-4, b-3, c-1, d-2

C) a-3, b-2, c-4, d-1

D) a-2, b-4, c-3, d-1

172.
Match the Reptiles and Fishes in Column I with their correct names in Column II:

Column I	Column II
a. Bungarus	1. Great white shark
b. Carcharodon	2. Marine turtle
c. Calotes	3. Krait
d. Chelone	4. Garden lizard

A) a-3, b-2, c-4, d-1 **B)** a-4, b-1, c-3, d-2
C) a-3, b-1, c-4, d-2 **D)** a-1, b-3, c-2, d-4

173.
Match the Mammalian Examples in Column I with their Common Names in Column II:

Column I	Column II
a. Macropus	1. Common dolphin
b. Ornithorhynchus	2. Flying fox
c. Pteropus	3. Kangaroo
d. Delphinus	4. Platypus

A) a-3, b-4, c-2, d-1 **B)** a-4, b-3, c-1, d-2
C) a-3, b-2, c-4, d-1 **D)** a-2, b-4, c-1, d-3

174.
Match the Fishes in Column I with their Common Names/Features in Column II:

Column I	Column II
a. Exocoetus	1. Sea horse
b. Hippocampus	2. Flying fish
c. Pristis	3. Indian dog fish
d. Scoliodon	4. Saw fish

A) a-2, b-1, c-4, d-3 **B)** a-1, b-2, c-3, d-4
C) a-2, b-4, c-1, d-3 **D)** a-4, b-1, c-2, d-3

175.
Match the Aves (Birds) in Column I with their Common Names in Column II:

Column I	Column II
a. Neophron	1. Parrot
b. Psittacula	2. African ostrich
c. Pavo	3. Vulture
d. Struthio	4. Peacock

A) a-1, b-3, c-4, d-2 **B)** a-3, b-1, c-4, d-2
C) a-3, b-4, c-1, d-2 **D)** a-2, b-1, c-3, d-4

176.
Match the Lower Chordates in Column I with their Common Names in Column II:

Column I	Column II
a. Ascidia	1. Amphioxus / Lancelet
b. Branchiostoma	2. Sea squirt / Tunicate
c. Myxine	3. Lamprey
d. Petromyzon	4. Hag fish

A) a-2, b-1, c-4, d-3 **B)** a-1, b-2, c-3, d-4
C) a-2, b-4, c-1, d-3 **D)** a-4, b-3, c-2, d-1

177.
Match the Amphibians in Column I with their Common Names in Column II:

Column I	Column II
a. Hyla	1. Frog
b. Ichthyophis	2. Tree frog
c. Rana	3. Salamander
d. Salamandra	4. Limbless amphibian

A) a-2, b-4, c-3, d-1 **B)** a-4, b-2, c-1, d-3
C) a-2, b-4, c-1, d-3 **D)** a-1, b-3, c-4, d-2

178.
Match the Cartilaginous Fishes (Chondrichthyes) in Column I with their Special Features/Names in Column II:

Column I	Column II
a. Trygon	1. Electric ray (dorsal muscles modified into electric organs)
b. Torpedo	2. Great white shark
c. Carcharodon	3. Sting ray (sting is poisonous)
d. Pristis	4. Saw fish

A) a-1, b-3, c-2, d-4 **B)** a-3, b-1, c-4, d-2
C) a-3, b-1, c-2, d-4 **D)** a-4, b-2, c-1, d-3

179.

Match the Reptiles in Column I with their Common Names in Column II:

Column I	Column II
a. Chameleon	1. Wall lizard
b. Hemidactylus	2. Tree lizard
c. Naza	3. Russel's viper
d. Vipera	4. Cobra

A) a-2, b-1, c-4, d-3 **B)** a-1, b-2, c-3, d-4

C) a-2, b-4, c-1, d-3 **D)** a-4, b-3, c-2, d-1

180.

Match the Scientific Name in Column I with its appropriate Taxon (Class/Subphylum) in Column II:

Column I	Column II
a. Doliolum	1. Mammalia
b. Clarias	2. Urochordata
c. Testudo	3. Osteichthyes
d. Panthera tigris	4. Reptilia

A) a-2, b-3, c-4, d-1 **B)** a-3, b-2, c-1, d-4

C) a-4, b-1, c-3, d-2 **D)** a-2, b-4, c-3, d-1

ANSWER KEY

Physics

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

Chemistry

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

Botany

91.	**4**	103.	**4**	115.	**3**	127.	**2**
92.	**2**	104.	**1**	116.	**3**	128.	**1**
93.	**3**	105.	**4**	117.	**4**	129.	**3**
94.	**3**	106.	**3**	118.	**4**	130.	**3**
95.	**2**	107.	**1**	119.	**2**	131.	**3**
96.	**2**	108.	**4**	120.	**3**	132.	**2**
97.	**1**	109.	**3**	121.	**2**	133.	**1**
98.	**3**	110.	**2**	122.	**1**	134.	**3**
99.	**2**	111.	**3**	123.	**3**	135.	**2**
100.	**1**	112.	**1**	124.	**1**		
101.	**4**	113.	**2**	125.	**2**		
102.	**3**	114.	**3**	126.	**3**		

Zoology

136.	**4**	137.	**4**	138.	**4**	139.	**3**

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

SOLUTIONS

Q1.

Answer: A

Explanation:
Time$\propto c^x G^y h^z \Rightarrow T = kc^x G^y h^z$ Putting the dimensions in the above relation $\Rightarrow$
$[M^0L^0T^1] = [LT^{-1}]^x [M^{-1}L^3T^{-2}]^y [ML^2T^{-1}]^z \Rightarrow$
$[M^0L^0T^1] = [M^{-y+z}L^{x+3y+2z}T^{-x-2y-z}]$ Comparing the powers of M, L and T $-y + z = 0$...(i) $x + 3y + 2z = 0$...(ii) $-x - 2y - z = 1$...(iii) On solving equations (i) and (ii) and (iii) $x = \frac{-5}{2}$, $y = z = \frac{1}{2}$ Hence dimension of time are $[G^{1/2}h^{1/2}c^{-5/2}]$

Q2.

Answer: D

Explanation:
In given equation, $\frac{\alpha z}{k\theta}$ should be dimensionless $\therefore$
$\alpha = \frac{k\theta}{z} \Rightarrow [\alpha] = \frac{[ML^2T^{-2}K^{-1} \times K]}{[L]} = [MLT^{-2}]$ and
$P = \frac{\alpha}{\beta} \Rightarrow [\beta] = \left[\frac{\alpha}{p}\right] = \frac{[MLT^{-2}]}{[ML^{-1}T^{-2}]} = [M^0L^2T^0]$.

Q3.

Answer: C

Explanation:
$\nu = \frac{P}{2l}\left[\frac{F}{m}\right]^{1/2} \Rightarrow \nu^2 = \frac{P^2}{4l^2}\left[\frac{F}{m}\right] \therefore m \propto \frac{F}{l^2\nu^2}$
$\Rightarrow [m] = \left[\frac{MLT^{-2}}{L^2T^{-2}}\right] = [ML^{-1}T^0]$

Q4.

Answer: A

Explanation:
$[E] = [ML^2T^{-2}]$, $[m] = [M]$, $[l] = [ML^2T^{-1}]$and $[G] = [M^{-1}L^3T^{-2}]$ Substituting the dimension of above quantities in the given formula : $\frac{El^2}{m^5G^2}$
$\frac{[ML^2T^{-2}]\,[ML^2T^{-1}]^2}{[M^5]\,[M^{-1}L^3T^{-2}]^2} = \frac{M^3L^6T^{-4}}{M^3L^6T^{-4}} = [M^0L^0T^0]$

Q5.

Answer: C

Explanation:
$\frac{B}{kT}$ is dimensionless [B] = [kT] Also [I] = [AT2] [A] = [IT–2] [AB2] = [IK2]

Q6.

Answer: D

Explanation:
$n_2 = n_1\left[\frac{L_1}{L_2}\right]^1\left[\frac{T_1}{T_2}\right]^{-2} = 10\left[\frac{meter}{km}\right]^1\left[\frac{\sec}{hr}\right]^{-2}$
$n_2 = 10\left[\frac{m}{10^3 m}\right]^1\left[\frac{\sec}{3600\,\sec}\right]^{-2} = 129600$

Q7.

Answer: C

Explanation:

Given equation is dimensionally correct because both sides are dimensionless but numerically wrong because the correct equation is $\tan\theta = \frac{v^2}{rg}$.

Q8.

Answer: C

Explanation:
From the principle of dimensional homogenity
$[v] = [at] \Rightarrow [a] = [LT^{-2}]$. Similarly $[b] = [L]$ and $[c] = [T]$

Q9.

Answer: A

Explanation:

By substituting the dimensions in $T = 2\pi\sqrt{\frac{R^3}{GM}}$ we get
$\sqrt{\frac{L^3}{M^{-1}L^3T^{-2} \times M}} = T$

Q10.

Answer: A

Explanation:

Dimension of αt= $[M^0L^0T^0]$ [a] = $[T^{-1}]$ Again $\left[\frac{v_0}{\alpha}\right] = [L]$so $[v_0] = [LT^{-1}]$

Q11.

Answer: A

Explanation:
By the principle of dimensional homogenity
$[P] = \left[\frac{a}{V^2}\right] \Rightarrow [a] = [P] \times [V^2] = [ML^{-1}T^{-2}]\,[L^6]$= $[ML^5T^{-2}]$

Q12.

Answer: B

Explanation:
$[a] = [T^2]$ and $[b] = \frac{[a-t^2]}{[P]\,[x]} = \frac{T^2}{[ML^{-1}T^{-2}]\,[L]}$ Þ $[b] = [M^{-1}T^4]$
So $\left[\frac{a}{b}\right] = \frac{[T^2]}{[M^{-1}T^4]} = [MT^{-2}]$

Q13.

Answer: D

Explanation:
By putting the dimensions of each quantity both the sides we get $[T^{-1}] = [M]^x[MT^{-2}]^y$ Now comparing the dimensions of quantities in both sides we get $x + y = 0$ and $2y = 1$ $\therefore$ $x = -\frac{1}{2}$, $y = \frac{1}{2}$

Q14.

Answer: C

Explanation:
Let $v^x = kg^y\lambda^z\rho^\delta$.Now by substituting the dimensions of each quantities and equating the powers of M, L and T we get $\delta = 0$ and $x = 2$, $y = 1$, $z = 1$.

Q15.

Answer: B

Explanation:
From the principle of homogenity $\left(\frac{x}{v}\right)$ has dimensions of T.

Q16.

Answer: A

Explanation:
By substituting the dimension of each quantity we get $T = [ML^{-1}T^{-2}]^a[L^{-3}M]^b[MT^{-2}]^c$ By solving we get a = – 3/2, b = 1/2 and c = 1

Q17.

Answer: B

Explanation:
$v \propto g^p h^q$ (given) By substituting the dimension of each quantity and comparing the powers in both sides we get
$[LT^{-1}] = [LT^{-2}]^p[L]^q \Rightarrow$
$p + q = 1,\ -2p = -1, \therefore\ p = \frac{1}{2},\ q = \frac{1}{2}$

Q18.

Answer: D

Explanation:
Acceleration = $\frac{\text{distance}}{\text{time}^2} \square A = LT^{-2} \Rightarrow L = AT^2$

Q19.

Answer: B

Explanation:
By substituting the dimension of given quantities $[ML^{-1}T^{-2}]^x[MT^{-3}]^y[LT^{-1}]^z = [MLT]^0$ By comparing the power of M, L, T in both sides $x + y = 0$....(i), $-x + z = 0$..... (ii), $-2x - 3y - z = 0$....(iii) The only values of $x,\ y,\ z$ satisfying (i), (ii) and (iii) corresponds to (b).

Q20.

Answer: D

Explanation:
[Pressure] = [Stress] = [coefficient of elasticity] = $[ML^{-1}T^{-2}]$

Q21.

Answer: B

Explanation:
From the principle of dimensional homogenity
$[a] = \left[\frac{F}{t}\right] = [MLT^{-3}]$ and $[b] = \left[\frac{F}{t^2}\right] = [MLT^{-4}]$

Q22.

Answer: B

Explanation:
Let $[G] \propto c^x g^y p^z$ by substituting the following dimensions :
$[G] = [M^{-1}L^3T^{-2}],\ [c] = [LT^{-1}], [g] = [LT^{-2}]$
$[p] = [ML^{-1}T^{-2}]$ and by comparing the powers of both sides we can get $x = 0,\ y = 2,\ z = -1 \therefore [G] \propto c^0 g^2 p^{-1}$

Q23.

Answer: D

Explanation:
$x = Ay + B\ \tan Cz$ From the dimensional homogenity
$[x] = [Ay] = [B] \Rightarrow \left[\frac{x}{A}\right] = [y] = \left[\frac{B}{A}\right]$
$[Cz] = [M^0L^0T^0] =$Dimension less x and B; C and Z^{-1}; y and $\frac{B}{A}$ have the same dimension but x and A have the different dimensions.

Q24.

Answer: A

Explanation:
$W = \frac{1}{2}kx^2 \Rightarrow [k] = \frac{[W]}{[x^2]} = \left[\frac{ML^2T^{-2}}{L^2}\right] = [MT^{-2}]$

Q25.

Answer: A

Explanation:
In the equation, left hand side has the dimension of velocity. Thus, from the principle of homogeneity each term in the right hand side should have the dimensions of velocity. $\left[\frac{b}{t}\right] = [v]$ or $[b] = [vt] = [L]$.

Q26.

Answer: D

Explanation:
In the given equation $Bx \& Dt$ should be dimensionless.
$[B] = [x^{-1}]$ and $[D] = [T^{-1}] \Rightarrow \left[\frac{D}{B}\right] = \left[\frac{x}{T}\right] = [\text{velocity}]$.

Q27.

Answer: B

Explanation:
Dimensions of $P^xQ^yc^z = [ML^{-1}T^{-2}]^x[MT^{-3}]^y[LT^{-1}]^z$. As it is dimensionless, s
$[ML^{-1}T^{-2}]^x[MT^{-3}]^y[LT^{-1}]^z = [M^0L^0T^0]$ or
$[M^{x+y}L^{-x+z}T^{-2x-3y-z}] = [M^0L^0T^0]$ Comparing powers of M, L and T, we get
$x + y = 0, -x + z = 0, -2x - 3y - z = 0$. Solving,
$x = 1, y = -1, z = 1$.

Q28.

Answer: B

Explanation:
$\frac{\Delta x}{x} \times 100 = a\frac{\Delta M}{M} \times 100 + b\frac{\Delta L}{L} \times 100 + c\frac{\Delta T}{T} \times 100 = a\alpha + b\beta$
.

Q29.

Answer: A

Explanation:
$W = ML^2T^{-2} = [F]^a[V]^b[T]^c \Rightarrow ML^2T^{-2} = [MLT^{-2}]^a[LT^{-1}]$ and $c - 2a - b = -2 \Rightarrow c = 1$. So, $[W] = FVT$.

Q30.

Answer: B

Explanation:
Here, unit of $(y)$and A will be same and that of $(x)\ and\ \lambda$will be same. $(\frac{2\pi}{\lambda}(ct - x))$ is dimensionless. Here, $(\frac{ct}{\lambda})$ and $(\frac{x}{\lambda})$ are dimensionless. Unit of (ct) is same as that of (λ) or (x).

Q31.

Answer: D

Explanation:
As
$(\mu = \text{ velocity of light in vacuum}\text{velocity of light in medium})$
, hence, (μ) is dimensionless. Thus, each term on th R.H.S. of given equation should be dimensionless, i.e., $(\frac{B}{\lambda^2})$ is dimensionless, i.e., (B) should have dimension of (λ^2), i.e., (cm^2), i.e., area.

Q32.

Answer: D

Explanation:

$[x] = [Ay] = [B] \Rightarrow [y] = [B/A]$Also, $([x] \neq [A])$ and $([Cz] =)$ dimensionless$\Rightarrow [C] = [z^{-1}]$.

Q33.

Answer: C

Explanation:

$\frac{A}{B} = \frac{\text{Force}}{\text{Force}} = [M^0L^0T^0]$

$Ct = \text{angle} \Rightarrow C = \frac{\text{angle}}{\text{time}} = \frac{1}{T} = T^{-1},$

$Dx = \text{angle} \Rightarrow D = \frac{\text{angle}}{\text{distance}} = \frac{1}{L} = L^{-1}$

$\therefore \ \frac{C}{D} = \frac{T^{-1}}{L^{-1}} = [M^0LT^{-1}]$

Q34.

Answer: C

Explanation:

$n = \frac{1}{2l}\sqrt{\frac{T}{m}}; \Rightarrow; n^2 = \frac{1}{4l^2} \cdot \frac{T}{m},$

$m = \frac{T}{4l^2n^2} = \left[\frac{MLT^{-2}}{L^2 \times T^{-2}}\right] = [ML^{-1}]$

Q35.

Answer: A

Explanation:

Here, (at) is dimensionless$\Rightarrow; a = \frac{1}{t} = \left[\frac{1}{T}\right] = [T^{-1}] x = \frac{V_0}{a}$ and$V_0 = xa = [LT^{-1}] = [M^0LT^{-1}]$.

Q36.

Answer: B

Explanation:

Here, (a) has the same dimensions as (t^2)

$a = [T^2], b = \frac{T^2}{Px} = \frac{T^2}{ML^{-1}T^{-2}L} = \frac{T^4}{M} = [M^{-1}T^4]$ Now, $\frac{a}{b} = \frac{T^2}{M^{-1}T^4} = ML^0T^{-2}$

Q37.

Answer: B

Explanation:

Here, $(b)$and $(x^2 = L^2)$ have same dimensions. Also, $a = \frac{x^2}{E \times t} = \frac{L^2}{(ML^2T^{-2})T} = M^{-1}T^1 a \times b = [M^{-1}L^2T^1]$

Hence, correct answer is (b).

Q38.

Answer: C

Explanation:

Here,$X = \frac{Q}{V}$.But,$V = \frac{W}{Q}$.$\therefore; X = \frac{Q^2}{W}$.Now,$Z = B = \frac{F}{IL}$

$\therefore; Y = \frac{X}{3Z^2} = \frac{1}{3} \cdot \frac{Q^2}{W} \times \frac{I^2L^2}{F^2}$

$= \frac{A^2T^2, A^2L^2}{[ML^2T^{-2}][M^2L^2T^{-4}]} = [M^{-3}L^{-2}T^8A^4].$

Q39.

Answer: B

Explanation:

From Newton's law of viscosity, the force is $\mathrm{F} = \eta \mathrm{A}\left(\frac{\Delta \mathrm{v}}{\Delta \mathrm{x}}\right)$, where A is area and $\frac{\Delta \mathrm{v}}{\Delta \mathrm{x}}$ is the velocity gradient. $\eta = \frac{\mathrm{F}}{\mathrm{A} \cdot \left(\frac{\Delta \mathrm{v}}{\Delta \mathrm{x}}\right)}$

$\Rightarrow [\eta] = \frac{\left[\mathrm{MLT}^{-2}\right]}{[\mathrm{L}^2] \cdot \left(\frac{\left[\mathrm{LT}^{-1}\right]}{[\mathrm{L}]}\right)} = \frac{\left[\mathrm{MLT}^{-2}\right]}{[\mathrm{L}^2] \cdot [\mathrm{T}^{-1}]} = \left[\mathrm{ML}^{-1}\ \mathrm{T}^{-1}\right]\ \mathrm{A} \rightarrow \mathrm{IV}$

Surface tension is defined as the force acting per unit length.

$\mathrm{T} = \frac{\text{Force}}{\text{Length}}\ [\mathrm{T}] = \frac{\left[\mathrm{MLT}^{-2}\right]}{[\mathrm{L}]} = \left[\mathrm{ML}^0\ \mathrm{T}^{-2}\right]\ \mathrm{B} \rightarrow$ III Pressure is defined as force acting per unit area. $\mathrm{P} = \frac{\text{Force}}{\text{Area}}$

$[\mathrm{P}] = \frac{\left[\mathrm{MLT}^{-2}\right]}{[\mathrm{L}^2]} = \left[\mathrm{ML}^{-1}\ \mathrm{T}^{-2}\right]\ C \rightarrow I$ Surface energy $(\mathrm{U_s})$ is defined as the work done by surface tension in changing the surface area $\mathrm{U_s} = \mathrm{T} \cdot (\Delta\ \mathrm{A}) \Rightarrow [\mathrm{U_S}] = [\text{ Surface Tension }] \cdot [\text{ Area }] \Rightarrow$

$[\mathrm{U_S}] = \left[\mathrm{ML}^0\ \mathrm{T}^{-2}\right] \cdot \left[\left[\mathrm{M}^0\ \mathrm{L}^2\ \mathrm{T}^0\right]\right] = \left[\left[\mathrm{ML}^2\ \mathrm{T}^{-2}\right]\right]$

$\mathrm{D} \rightarrow \mathrm{II}$

List - I	List - II
A. Coefficient of viscosity	IV. $\left[\mathrm{ML}^{-1}\ \mathrm{T}^{-1}\right]$
B. Surface tension	III. $\left[\mathrm{ML}^0\ \mathrm{T}^{-2}\right]$
C. Pressure	I. $\left[\mathrm{ML}^{-1}\ \mathrm{T}^{-2}\right]$
D. Surface energy	II. $\left[\mathrm{ML}^2\ \mathrm{T}^{-2}\right]$

Hence the correct answer is B

Q40.

Answer: D

Explanation:

In the term $(h + Bt)$, Bt is added to h, where h is the height or length which has the dimension: $[h] = [L]$. Therefore, using principle of homogeneity the product Bt must also have the dimension of length: $[\mathrm{L}]$. Given that t is time whose dimension is $[\mathrm{T}] : [\mathrm{B}][\mathrm{t}] = [\mathrm{L}] \Rightarrow [\mathrm{B}][\mathrm{T}] = [\mathrm{L}] \Rightarrow [\mathrm{B}] = \frac{[\mathrm{L}]}{[\mathrm{T}]} = \left[\mathrm{LT}^{-1}\right]$

Therefore, the dimensions of B is $\left[\mathrm{M}^0\mathrm{LT}^{-1}\right]$. In the term $\left(\mathrm{P} + \frac{\mathrm{A}}{\mathrm{Bt}^2}\right)$, $\frac{\mathrm{A}}{\mathrm{Bt}^2}$ is added to P (Pressure). The dimension of pressure is $\mathrm{P} = \frac{\text{Force}}{\text{Area}} : [\mathrm{P}] = \frac{\left[\mathrm{MLT}^{-2}\right]}{[\mathrm{L}^2]} = \left[\mathrm{ML}^{-1}\ \mathrm{T}^{-2}\right]$

According to the principle of homogeneity, the dimension of $\frac{\mathrm{A}}{\mathrm{Bt}^2}$ must equal the dimension of P : $\left[\frac{\mathrm{A}}{\mathrm{Bt}^2}\right] = \left[\mathrm{ML}^{-1}\ \mathrm{T}^{-2}\right] \Rightarrow \frac{[\mathrm{A}]}{[\mathrm{LT}^{-1}][\mathrm{T}^2]} = \left[\mathrm{ML}^{-1}\ \mathrm{T}^{-2}\right] \Rightarrow [\mathrm{A}] = \left[\mathrm{ML}^{-1}\ \mathrm{T}^{-2}\right] \times [\mathrm{LT}] \Rightarrow [\mathrm{A}] = [\mathrm{M}]\left[\mathrm{L}^{-1+1}\right]\left[\mathrm{T}^{-2+1}\right] \Rightarrow [\mathrm{A}] = \left[\mathrm{ML}^0\ \mathrm{T}^{-1}\right]$ Therefore, dimensions of A is $\left[\mathrm{ML}^0\ \mathrm{T}^{-1}\right]$ and the dimensions of B is $\left[\mathrm{M}^0\mathrm{LT}^{-1}\right]$. Hence, the correct option is (D).

Q41.

Answer: D

Explanation:

According to the principle of homogeneity, dimensions of each term on both sides of a equation must be the same. Also, only physical quantities of the same dimensions can be added or subtracted. The potential energy of the particle is given as $V = \frac{A\sqrt{x}}{x+B}$, where A and B are constant. In the denominator of the expression $\mathrm{x} + \mathrm{B}$, the constant B is added to distance x . Therefore, the dimensions of B must be the same as the dimensions of x. $[\mathrm{B}] = [\mathrm{x}] = \left[\mathrm{L}^1\right]$ The potential energy V has the same dimensions as work or energy.
$[\mathrm{V}] = [\mathrm{F} \times \mathrm{x}] = \left[\mathrm{M}^1\ \mathrm{L}^1\ \mathrm{T}^{-2} \times \mathrm{L}^1\right] = \left[\mathrm{M}^1\ \mathrm{L}^2\ \mathrm{T}^{-2}\right]$ On rearranging the formula of potential energy for A : $A = \frac{V(x+B)}{\sqrt{x}}$
Substituting the dimensions: $[\mathrm{A}] = \frac{\left[\mathrm{M}^1\ \mathrm{L}^2\ \mathrm{T}^{-2}\right]\left[\mathrm{L}^1\right]}{\left[\mathrm{L}^{1/2}\right]} \Rightarrow$
$[\mathrm{A}] = \frac{\left[\mathrm{M}^1\ \mathrm{L}^3\ \mathrm{T}^{-2}\right]}{\left[\mathrm{L}^{1/2}\right]} \Rightarrow$
$[\mathrm{A}] = \left[\mathrm{M}^1\ \mathrm{L}^{3-\frac{1}{2}}\ \mathrm{T}^{-2}\right] = \left[\mathrm{M}^1\ \mathrm{L}^{5/2}\ \mathrm{T}^{-2}\right]$ To find the dimensions of the product AB : $[\mathrm{AB}] = [\mathrm{A}] \times [\mathrm{B}] \Rightarrow$
$[\mathrm{AB}] = \left[\mathrm{M}^1\ \mathrm{L}^{5/2}\ \mathrm{T}^{-2}\right] \times \left[\mathrm{L}^1\right] \Rightarrow$
$[\mathrm{AB}] = \left[\mathrm{M}^1\ \mathrm{L}^{5/2+1}\ \mathrm{T}^{-2}\right] \Rightarrow [\mathrm{AB}] = \left[\mathrm{M}^1\ \mathrm{L}^{7/2}\ \mathrm{T}^{-2}\right]$
Therefore, the dimensions of A B is $\left[M^1 L^{7/2} T^{-2}\right]$. Thus, the correct option is (D).

Q42.

Answer: B

Explanation:

Using the dimensional formula of gravitational constant:
$[G] = \frac{[F]\,[r^2]}{[m_1][m_2]}$ Since, $[F] = [MLT^{-2}]$ So,
$[G] = \frac{[MLT^{-2}][L^2]}{[M][M]} = [M^{-1}L^3T^{-2}]$ Now, we need to express this in terms of h, L, M, and T. We know Planck's constant has dimensions: $[h] = [ML^2T^{-1}]$ Assume $[G] = [h^aL^bM^cT^d]$
Then,
$[h^aL^bM^cT^d] = [M^aL^{2a}T^{-a}][L^b][M^c][T^d] = [M^{a+c}L^{2a+b}T^{-a+d}]$
Compare with $[G] = [M^{-1}L^3T^{-2}]$ So, $a + c = -1$
$2a + b = 3$ $-a + d = -2$ Now check options. Option A: $[hTLM^{-2}]$ Dimensions:
$[h][T][L][M^{-2}] = [ML^2T^{-1}][T][L][M^{-2}] = [M^{-1}L^3T^0]$
Not correct. Option B: $[hT^{-1}LM^{-2}]$ Dimensions:
$[h][T^{-1}][L][M^{-2}] = [ML^2T^{-1}][T^{-1}][L][M^{-2}] = [M^{-1}L^3T^{-2}]$
This matches [G]. So, the correct answer is: $[hT^{-1}LM^{-2}]$
Hence, Option B is correct.

Q43.

Answer: B

Explanation:

The expression $\frac{1}{\mu_0\epsilon_0}$ is related to the speed of light c , given by the equation: $c = \frac{1}{\sqrt{\mu_0\epsilon_0}}$ Therefore, we have: $\frac{1}{\mu_0\epsilon_0} = c^2$ The speed of light c has the dimensions of $\mathrm{L}\ \mathrm{T}^{-1}$, where L is the dimension of length and T is the dimension of time. Thus, when squared, the dimensions become: $c^2 = (\mathrm{L}\ \mathrm{T}^{-1})^2 = \mathrm{L}^2\mathrm{T}^{-2}$
Hence, the dimensions of $\frac{1}{\mu_0\epsilon_0}$ are $\mathrm{L}^2\mathrm{T}^{-2}$.

Q44.

Answer: C

Explanation:

$[\tau] = [\mathrm{E}]\ [\sigma] \neq [\mathrm{I}]\ [\mathrm{L}] = [\mathrm{h}]\ [\mathrm{P}] = [\mathrm{Y}]$

Q45.

Answer: C

Explanation:

Let's analyze the position function step by step. The particle's position is given by: $x(t) = A\sin t + B\cos^2 t + Ct^2 + D$, where t represents time, which has the dimension T . Since the overall dimensions of position $x(t)$ must be length (L), each term in the expression must also have dimensions of length. Term $A\sin t$: The sine function, $\sin t$, is dimensionless (its argument must be dimensionless, and by convention, if t is in an appropriate unit where the argument is dimensionless, the function itself is dimensionless). Therefore, A must carry the dimension of length: $[A] = L$. Term $B\cos^2 t$: Similarly, the cosine function is dimensionless, and so is its square. Thus, B must have the dimension of length: $[B] = L$. Term Ct^2: Here, t^2 has the dimension T^2. To have the overall term with the dimension L , we require: $[C] \times [T^2] = L$. So, the dimension of C must be: $[C] = LT^{-2}$. Term D : This is a constant term added to position, so it must also have the dimension of length: $[D] = L$. Now, we are asked to find the dimension of: $\frac{ABC}{D}$.
The dimensions of A , B , and C are:
$[A] = L, \quad [B] = L, \quad [C] = LT^{-2}$. Multiplying them together: $[ABC] = L \times L \times (LT^{-2}) = L^3T^{-2}$. Since $[D] = L$, dividing by D gives: $\frac{[ABC]}{[D]} = \frac{L^3T^{-2}}{L} = L^2T^{-2}$.
Thus, the dimension of $\frac{ABC}{D}$ is: L^2T^{-2}. The correct answer is Option C.

Q46.

Answer: A

Explanation:

The oxidation state of nitrogen is calculated by setting the sum of the oxidation numbers of all atoms in the neutral compound to zero. Hydrogen is typically $+1$, Oxygen is -2, and Alkali metals (like K and Na)are+1.

Q47.

Answer: A

Explanation:

A redox reaction involves a simultaneous increase and decrease in the oxidation numbers of different atoms. In option A , the oxidation states of H_2 and Br_2 change from 0 to $+1$ and -1 respectively.

Q48.

Answer: C

Explanation:

A reaction is not redox if there is no change in the oxidation numbers of any of the participating atoms. In option C , the oxidation states of Ba, O, H, and S remain identical on both sides.

Q49.

Answer: C

Explanation:

This is a disproportionation reaction where the same element (Cl) undergoes both oxidation and reduction.

Q50.

Answer: A

Explanation:

In a redox reaction, there must be a change in oxidation states. In option A, Cu is reduced and I is oxidized.

Q51.

Answer: A

Explanation:
A disproportionation reaction involves one element in a single compound undergoing both oxidation and reduction. Option A is an intermolecular redox reaction.

Q52.

Answer: B

Explanation:
In an intramolecular redox reaction, oxidation and reduction take place in a single compound involving different elements.

Q53.

Answer: D

Explanation:
A disproportionation reaction occurs when an element in an intermediate oxidation state is converted into both higher and lower oxidation states.

Q54.

Answer: C

Explanation:
The number of electrons liberated corresponds to the total increase in the oxidation number of the atoms.

Q55.

Answer: A

Explanation:
A reaction is not redox if the oxidation states of all atoms remain unchanged. Thermal decomposition of carbonates is a non-redox process.

Q56.

Answer: C

Explanation:
Oxidation involves an increase in OS, while reduction involves a decrease in OS.

Q57.

Answer: C

Explanation:
KI_3 contains the I_3^- ion where the average oxidation state of Iodine is $-1/3$. This reaction involves both oxidation and reduction of different iodine species.

Q58.

Answer: D

Explanation:
H_2SO_4 acts as an oxidizing agent when its sulfur atom $(+6)$ is reduced to a lower oxidation state (like $+4$ in SO_2).

Q59.

Answer: C

Explanation:
Disproportionation involves a single element in a compound changing into products with higher and lower OS.

Q60.

Answer: D

Explanation:
A redox reaction requires changes in the oxidation numbers of atoms.

Q61.

Answer: A

Explanation:
The reaction involves Mn being oxidized and Cl being reduced, which characterizes a redox reaction.

Q62.

Answer: A

Explanation:
In the conversion of chromate to dichromate, the oxidation state of Chromium remains $+6$.

Q63.

Answer: B

Explanation:
Oxidation is defined as the loss of electrons or an increase in oxidation number.

Q64.

Answer: A

Explanation:
The balancing follows the ion-electron method where atoms are balanced first, then oxygen with H_2O, then hydrogen, and finally charges with electrons.

Q65.

Answer: B

Explanation:
Balancing atoms (except H, O)$first, then$O, then H, and then charge.

Q66.

Answer: A

Explanation:
The number of electrons n equals the change in the oxidation number of Manganese in an acidic medium.

Q67.

Answer: C

Explanation:
In a neutral or weak alkaline medium, Manganese is reduced from $+7$ to $+4$, requiring 3 electrons.

Q68.

Answer: A

Explanation:
The reductant is H_2S because Sulfur is oxidized from -2 to 0.

Q69.

Answer: A

Explanation:
In an acidic medium, the MnO_4^- ion is reduced to Mn^{2+} by gaining 5 electrons.

Q70.

Answer: C

Explanation:
Balancing involves equating the total increase in OS with the total decrease in OS.

Q71.

Answer: D

Explanation:
From the balanced redox equation $4Zn + NO_3^- + 10H^+ \rightarrow 4Zn^{2+} + NH_4^+ + 3H_2O$, the coefficient is determined.

Q72.

Answer: D

Explanation:
In the standard balanced equation between permanganate and oxalate, 5 moles of oxalate produce 10 moles of carbon dioxide.

Q73.

Answer: C

Explanation:
'X' represents the electrons lost in the oxidation of sulfite to sulfate.

Q74.

Answer: B

Explanation:
Charge balancing requires adding electrons to the more positive side of the half-reaction.

Q75.

Answer: A

Explanation:
The oxidation state is calculated by assigning standard values ($H = +1, O = -2$). Among the options, all nitrogen atoms have negative oxidation states. The "highest" state refers to the value closest to zero (the least negative).

Q76.

Answer: B

Explanation:
In acidic medium, $KMnO_4$ acts as a strong oxidizing agent and is reduced from Mn^{+7} to Mn^{2+}. Simultaneously, H_2O_2 acts as a reducing agent and is oxidized to O_2.

Q77.

Answer: C

Explanation:
The amount of $KMnO_4$ required is proportional to the total number of electrons lost by one mole of the reductant. The compound that loses the fewest electrons per mole requires the least oxidant.

Q78.

Answer: A

Explanation:

The number of electrons added to the right side of an oxidation half-reaction corresponds to the total increase in the oxidation number of the atoms being oxidized.

Q79.

Answer: A

Explanation:
Standard rules for oxidation numbers state that Oxygen is typically -2, but has specific values in peroxides, superoxides, and fluorides.

Q80.

Answer: D

Explanation:

The number of electrons transferred is the total change in oxidation number for either the total amount of reductant or oxidant in the balanced equation.

Q81.

Answer: B

Explanation:
An oxidizing agent is a substance that gains electrons (is reduced). Hydrogen acts as an oxidant when it reacts with highly electropositive metals, changing from OS 0 to -1.

Q82.

Answer: D

Explanation:
The sum of oxidation states in a polyatomic ion equals the net charge on the ion. Fluorine always has an oxidation state of -1.

Q83.

Answer: A

Explanation:
A reaction where the same element undergoes both oxidation and reduction is called a disproportionation reaction.

Q84.

Answer: C

Explanation:
Balancing a redox reaction requires the total loss of electrons from the reductant to equal the total gain of electrons by the oxidant.

Q85.

Answer: B

Explanation:

A reducing agent is a substance that loses electrons (undergoes oxidation). In these half-reactions, loss of electrons is indicated by electrons on the product side or a minus sign on the reactant side.

Q86.

Answer: A

Explanation:
An oxidant is a substance that causes oxidation of another substance and is itself reduced.

Q87.

Answer: A

Explanation:
Balancing by the ion-electron method ensures that mass and charge are conserved by equalizing the electrons transferred.

Q88.

Answer: C

Explanation:
A compound can act as both an oxidant and a reductant if its central element is in an intermediate oxidation state, allowing it to either increase or decrease its state.

Q89.

Answer: A

Explanation:

In acidic medium, potassium permanganate oxidizes ferrous ions present in ferrous ammonium sulphate (Mohr's salt) to ferric ions, while permanganate is reduced to manganese(II) ions. Balancing the complete molecular equation shows that for every 2 molecules of $KMnO_4$, a total of 68 molecules of water are produced.

Q90.

Answer: B

Explanation:

The reducing agent is the substance that is oxidized (donates electrons/increases in oxidation number).

Q91.

Answer: D

Q92.

Answer: B

Q93.

Answer: C

Q94.

Answer: C

Q95.

Answer: B

Q96.

Answer: B

Q97.

Answer: A

Q98.

Answer: C

Q99.

Answer: B

Q100.

Answer: A

Q101.

Answer: D

Q102.

Answer: C

Q103.

Answer: D

Q104.

Answer: A

Q105.

Answer: D

Q106.

Answer: C

Q107.

Answer: A

Q108.

Answer: D

Q109.

Answer: C

Q110.

Answer: B

Q111.

Answer: C

Q112.

Answer: A

Q113.

Answer: B

Q114.

Answer: C

Q115.

Answer: C

Q116.

Answer: C

Q117.

Answer: D

Q118.

Answer: D

Q119.

Answer: B

Q120.

Answer: C

Q121.

Answer: B

Q122.

Answer: A

Q123.
Answer: C

Q124.
Answer: A

Q125.
Answer: B

Q126.
Answer: C

Q127.
Answer: B

Q128.
Answer: A

Q129.
Answer: C

Q130.
Answer: C

Q131.
Answer: C

Q132.
Answer: B

Q133.
Answer: A

Q134.
Answer: C

Q135.
Answer: B

Q136.
Answer: D

Q137.
Answer: D

Q138.
Answer: D

Q139.
Answer: C

Q140.
Answer: C

Q141.
Answer: B

Q142.
Answer: A

Q143.
Answer: D

Q144.
Answer: B

Q145.
Answer: B

Q146.
Answer: D

Q147.
Answer: A

Q148.
Answer: D

Q149.
Answer: B

Q150.
Answer: D

Q151.
Answer: C

Q152.
Answer: D

Q153.
Answer: D

Q154.
Answer: B

Q155.
Answer: B

Q156.
Answer: D

Q157.
Answer: A

Q158.
Answer: D

Q159.
Answer: D

Q160.
Answer: D

Q161.
Answer: C

Q162.
Answer: D

Q163.
Answer: C

Q164.
Answer: C

Q165.
Answer: D

Q166.
Answer: C

Q167.
Answer: B

Q168.
Answer: A

Q169.
Answer: D

Q170.
Answer: A

Q171.
Answer: A

Q172.
Answer: C

Q173.
Answer: A

Q174.
Answer: A

Q175.
Answer: B

Q176.
Answer: A

Q177.
Answer: C

Q178.
Answer: C

Q179.
Answer: A

Q180.
Answer: A