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1. \( (\vec{a} \times \vec{b}) = (\vec{b} \times \vec{a}) \)
   \[ \Rightarrow \quad A B \cos(\vec{n}) = A B \cos(-\vec{n}) \]
   \[ \Rightarrow \quad \sin \theta = -\sin \theta \quad \Rightarrow \quad 2 \sin \theta = 0 \]
   \[ \Rightarrow \quad \sin \theta = 0 \quad \Rightarrow \quad \theta = 0 \text{ or } \pi \]

2. \( d \)

3. \( c \)
   \[ q_3 = \frac{C_2}{C_2 + C_3} \cdot a \]
   \[ q_3 = \frac{2}{3+2} \times 80 = \frac{2}{5} \times 80 = 48 \text{ MC} \]

4. For the circular part \( A B C \), the angle subtended at the centre is \( \frac{3\pi}{2} \).
   
   Due to \( A B C \), \( \theta_1 = \frac{110 \cdot \frac{1}{2}}{4\pi \times 1} \)
   
   Due to \( A D \), \( A \) is at the end of the well, therefore at \( O \), \( \theta_2 = \frac{110 \times 1}{4\pi \times 2} = \frac{110}{4\pi} \)
   
   \[ \therefore \quad \text{Total Induction} = \frac{110}{4\pi} \left( \frac{3\pi+1}{2} \right) \]
\( \frac{d}{dt} v = -\frac{1}{L} \frac{di}{dt} \)

Here \( \frac{di}{dt} +ue \) for \( \frac{T}{2} \) time and 
\( \frac{di}{dt} -ue \) for next \( \frac{T}{2} \) time.

- Loss of KE: \( KE = \frac{m_1 m_2}{2(m_1 + m_2)} (u_1 - u_2)^2 \)

- As \( x \) increases so \( \frac{dB}{dt} \) increases i.e. induced emf \( (e) \) is negative. \( \frac{dt}{dt} \) when loop completely enters in the magnetic field, emf = 0 when it exits. \( x \) increases but \( \frac{dB}{dt} \)
decreases i.e. \( e \) is positive.

- According to Einstein's equation
  \( K_{\max} = h\nu - h\nu_0 \)

- Correct graph is d.

- Tension at lowest point \( T_{\max} = \frac{gm v^2 + mg}{h} \)
- Tension at highest point \( T_{\min} = \frac{mv^2 - mg}{h} \)
  \( \frac{T_{\max}}{T_{\min}} = \frac{\frac{gm v^2 + mg}{h}}{\frac{mv^2 - mg}{h}} = \frac{6}{3} \)

- Solving, \( v = \sqrt{2gh} = \sqrt{980} \text{ m/s} \).
11. Correct option is (4)

Solution:

Answer (4)

\[ C_{\text{net}} = \frac{5C}{3} \]

\[ a = \frac{h}{P} \]
14 a. By superposition principle
\[-\frac{2N}{4} dR + \frac{R}{4} = 0\]
\[\Rightarrow \alpha = \frac{1}{B}\]

15 a. Mayer's formula.

16 b.\[
F_{\text{net}} = F_A + F_B \cos \frac{\pi}{4} + F_C \cos \frac{\pi}{4}
\]
\[= Ky + 2Ky \cos 46^\circ\]
\[\Rightarrow K'y = 2Ky\]
\[\Rightarrow K' = 2K\]
\[T = 2\sqrt{\frac{mg}{2K}}\]

17 c.

18 b. Area in which bullet will spread
\[A = \pi r^2\]
For maximum area, \(r = R_{\text{max}} = \frac{v^2}{g}\) (0 = 45°)

Maximum area:
\[A_{\text{max}} = \pi R_{\text{max}}^2\]
\[= \pi \left(\frac{v^2}{g}\right)^2 = \frac{\pi v^4}{g^2}\]
19. Correct option is (2)

2 \Omega \text{ net resistance.}
\( b \)  

\[ Y = \overline{A + B} = \overline{A \cdot B} = A \cdot B \]

AND gate.

\( b \)

\[
\begin{array}{c}
\lambda_1 \\
\lambda_2 \\
\lambda_3 \\
C \\
\end{array}
\begin{array}{c}
B \\
A \\
\end{array}
\]

\[(E_C - E_B) + (E_B - E_A) = E_C - E_A\]

\[\Rightarrow \frac{h}{\lambda_1} + \frac{h}{\lambda_2} = \frac{h}{\lambda_3} \Rightarrow \lambda_3 = \frac{\lambda_1 \lambda_2}{\lambda_1 + \lambda_2}\]

\( d \)

\[V = \frac{x^4}{4} - \frac{x^2}{2}\]

for minimum \( V \), \( \frac{dV}{dx} = 0 \) & \( \frac{d^2V}{dx^2} > 0 \)

\[F = -\frac{dV}{dx} = \frac{4x^3}{4} - \frac{2x}{2} = 0\]

\[\Rightarrow x = 0, \quad x = \pm 1\]

Now, \( \frac{d^2V}{dx^2} = 3x^2 - 1\)

for \( x = \pm 1 \), \( \frac{d^2V}{dx^2} > 0 \)
Substituting these values in \(V(x)\),

\[ V_{\text{min}} = \left[ \frac{1}{4} - \frac{1}{2} \right] = -\frac{1}{4} \]

\[ (KE)_{\text{max}} = TE - (PE)_{\text{min}} \]

\[ = 2 - (-\frac{1}{4}) = \frac{9}{4} \]

\[ \frac{1}{2} mV_{\text{max}}^2 = \frac{9}{4} \quad \Rightarrow \quad V_{\text{max}} = \frac{3}{\sqrt{2}} \text{ m/s}. \]

23 a

24 b 
Fundamental freq of closed organ pipe: \(= \frac{V_1}{4l_1} \)

Second harmonic frequency of string: \(= \frac{2V_2}{2l_2} \)

\[ \Rightarrow \frac{V_1}{4l_1} = \frac{V_2}{l_2} \]

\[ \Rightarrow \frac{320}{4 \times 0.8} = \frac{1}{0.5} \sqrt{50} \text{ m} \]

\[ = m = 10 \text{ gm}. \]

25 C

26 C

\[ mg - B = ma - 1 \]
27. Correct option is (3)
**Solution:**
Answer (3)

\[ m = \frac{f}{f + u} \]

For real image

\[-m = \frac{f}{f - u_i}, \]

\[- \frac{f}{f - u_2} = \frac{f}{f - u_1} \Rightarrow f = \frac{u_1 + u_2}{2} \]

\[ C \]

\[ \frac{1}{2} m v^2 = \frac{1}{2} \frac{V A}{L} l^2 \]

\[ v = \sqrt{\frac{\text{VAR}}{m L}} = 260 \text{ m/s} \]

29. Correct option is (2)
**Solution:**

Water should be poured such that shift in depth of image is 1 cm

\[ \left( d - \frac{d}{4} \right) = 1 \]

\[ d \left( 1 - \frac{3}{4} \right) = 1 \]

\[ d = 4 \text{ cm} \]
If the voltmeter is ideal, then the given circuit is an open circuit so the reading of voltmeter is equal to the emf of cell i.e. 6V.

\[ 30 \]

\[ a \frac{dt}{dx} = 2ax + \beta \implies v = \frac{1}{2ax + \beta} \]

\[ a = \frac{dv}{dt} - \frac{dv}{dx} \cdot \frac{dx}{dt} = \frac{V_0 dv}{dx} \]

\[ a = -\frac{V_0 \cdot 2a}{(2ax + \beta)^2} = -2aV_0 \cdot V^2 = -2ax^3. \]
32) \( b' \) (Doppler's effect of light).

33) \( a \) If \( \dot{x} = \text{constant} \), then \( \dot{x} = 0 \)

\[ \Rightarrow \dot{x} x \dot{y} = 0 \]

\( \dot{y} \) should be parallel to \( \dot{x} \), so the coefficient should be in same ratio.

\[ \Rightarrow \frac{\dot{y}}{\dot{x}} = \frac{\dot{y}}{\dot{x}} = \frac{-1}{2} \quad \dot{x} = 1. \]

34) \( a \)

\[ \frac{d\dot{k}}{dt} = \frac{d}{dt} \left( \frac{1}{2} MV^2 \right) = \frac{V^2}{2} \frac{dM}{dt} \]

\[ \Rightarrow \frac{d\dot{k}}{dt} = \frac{V^2}{2} \left( \frac{dM}{dt} x \frac{d\dot{l}}{dt} \right) \]

\[ \Rightarrow \frac{d\dot{k}}{dt} = \frac{1}{2} mV^2 x \frac{d\dot{l}}{dt} = \frac{1}{2} mV^3 \]

35) \( a \)

\[ f = \mu \dot{R} \Rightarrow F \cos 60^\circ = \mu (W + F \sin 60^\circ) \]

Substituting \( \mu = \frac{1}{2V} \) and \( W = 10 \sqrt{3} \)

\[ F = 20N \]

36) \( c \)

\[ \eta = 1 - \frac{T_2}{T_1} \]

Using \( T_1 V_B^{\gamma - 1} = T_2 V_C^{\gamma - 1} \)

\[ \frac{T_2}{T_1} = \frac{1}{4} \text{ in Carnot Engine.} \]
\( A_1 = A_0, \quad A_2 = 2A_0 \)

\[ I_1 \times A_2 = I_1 = I_0 \]

\[ I_2 = 4I_0 \]

\[ I = I_0 + 4I_0 + 2\sqrt{I_0 \times 4I_0 \cos \phi} \]

for \( I_{\text{max}} \), \( \cos \phi = 1 \)

\[ I_{\text{Im}} = 9I_0, \quad I_0 = \frac{I_{\text{Im}}}{9} \]

for phase difference \( \phi \),

\[ I = I_0 + 4I_0 + 2\sqrt{I_0^2 \cos \phi} \]

\[ I = I_0 \left( 1 + 8\cos^2 \phi \right) \]

\[ \Rightarrow I = \frac{I_{\text{Im}}}{9} \left( 1 + 8\cos^2 \phi \right) \]

\( c \)

\[ P \times t = m \Delta \theta \]

\[ \Rightarrow t = \frac{m \Delta \theta}{P} = \frac{4200 \ m \Delta \theta}{VI} \]

\[ \Rightarrow t = 6.3 \text{ min} \]

\( c \)

Acceleration of body along \( AB \) is \( g \cos \theta \).

Distance travelled in time \( t \) is \( AB = \frac{1}{2} g \cos \theta t^2 \)

From \( \Delta ABC \), \( AB = 2R \cos \theta = \frac{1}{2} g \cos \theta \cdot t^2 \)

\[ t = 2\sqrt{\frac{g}{\cos \theta}} \]
44. (3)
45. (2)
46. (3) Conceptual

47. (4) Conceptual

48. (1) Starch \((C_6H_{10}O_5)_n\) is a polymer of glucose

49. (4) Conceptual

50. (1) The balanced chemical equation is

\[
\text{Mg} + \frac{1}{2} \text{O}_2 \rightarrow \text{MgO}
\]

\[
\begin{array}{c c c}
24g & 16g & 40g \\
\end{array}
\]

\[
\therefore \text{0.56 g O}_2 \text{ will react with } \text{Mg} = \frac{24}{16} \times 0.56 = 0.84g
\]

\[
\therefore \text{Amount of Mg left unreacted} = 1.0 - 0.84 = 0.16g \text{Mg}
\]

Hence, Mg is present in excess and 0.16 g Mg is left behind unreacted.

51. (2) \[\Delta S = \int \frac{dq}{T} = 0\]

For adiabatic changes \(dq = 0\) hence

52. (1) NaOH when reacts with sand \((\text{SiO}_2)\), it forms sodium silicate which is generally called glass

\[
2\text{NaOH} + \text{SiO}_2 \rightarrow \text{Na}_2\text{SiO}_3 + \text{H}_2\text{O}
\]

Sodium silicate (Glass)

53. (3)

Initially \[
\begin{array}{c c c c c}
\text{A(g)} & + & \text{B(g)} & \rightarrow & \text{C(g)} & + & \text{D(g)} \\
2 & 2 & 0 & 0 \\
\end{array}
\]

At equilibrium \[
\begin{array}{c c c c c}
\text{A(g)} & + & \text{B(g)} & \rightarrow & \text{C(g)} & + & \text{D(g)} \\
2 - x & 2 - x & 0 & 0 \\
\end{array}
\]

At equilibrium given that, \(3[B] = [C]\) (given)

\[
3(2 - x) = x \Rightarrow x = \frac{3}{2}
\]

\[
K_c = \frac{[C][D]}{[A][B]} = \frac{\left( \frac{x}{V} \right)^2}{\left( \frac{2-x}{V} \right)^2} = \frac{\left( \frac{3}{2} \right)^2}{\left( \frac{2-3}{2} \right)^2} = 9
\]

54. (3) Conceptual

55. (2) As \(C_2\) has max. bond order = 2, hence max. B.E & min. bond length.

56. (1) Lets total no. of moles of the gas be \(n\), of which \(n_1\) are in the larges sphere & \(n_2\) in the smaller sphere after the stop cock is opened

\[
N = n_1 + n_2 \& pV = nRT
\]
\[ \frac{pV}{RT_i} = \frac{p'V}{RT_i} + \frac{pV}{2T_iR} \]
\[ \Rightarrow p' = \frac{2pT_i}{2T_i + T_i} \]

57. Lattice energy of hydrides of alkali metals decreases down the group, hence stability of hydrides and reactivity of GPlA elements with \( \text{H}_2 \) decreases.

58. (4)
\[ K_i = A_i e^{-E_i/RT} \quad \text{wherei} = 1,2,3 \ldots \ldots \rightarrow \]
\[ K = A e^{-E_i/RT} \]
\[ K = \frac{3K_i^3.K_3}{K_2^2} = \frac{3.A_i^3.e^{-3E_i/RT}.A_i.e^{-E_i/RT}}{A_2^2.e^{-2E_i/RT}} \]

Putting 1 to
\[ \frac{3.A_i^3.A_3}{A_2^2} e^{-\frac{1}{RT}(3E_i-2E_i+E_i)} \rightarrow \]

Now comparison 2 with 3 we get the ans.

59. (2)
\[ 2\text{BaCl}_2 + K_2\text{Cr}_2\text{O}_7 + 3\text{H}_2\text{SO}_4 \rightarrow K_2\text{SO}_4 + 2\text{CrO}_3\text{Cl}_2 + 2\text{BaSO}_4 + 3\text{H}_2\text{O} \]
\[ \text{CrO}_3\text{Cl}_2 + 4\text{NaOH} \rightarrow \text{Na}_2\text{CrO}_4 + 2\text{NaCl} + 2\text{H}_2\text{O} \]
\[ (\text{CH}_3\text{COO})_2\text{Pb} + \text{Na}_2\text{CrO}_4 \rightarrow \text{PbCrO}_4 + 2\text{CH}_3\text{COONa} \]

60. (4)
\[ \Delta E = -\frac{M}{w} \times C \times \Delta t \]
\[ = -\frac{16}{0.1} \times 500 \times 2 = -160 \times 10^3 J = -160KJ \]

(minus sign is used as heat is evolved)

61. (1)
Acidic strength of hydrides increases as the size of central atom increases which weakens the \( \text{M–H} \) bond. Since, the size increases from \( \text{S} \) to \( \text{Te} \), thus acidic strength follows the order
\[ \text{H}_2\text{S} < \text{H}_2\text{Se} < \text{H}_2\text{Te} \]
or as we go down the group, acidic strength of hydride increases.

62. (3) Conceptual

63. (3) Conceptual

64. (2) Conceptual

65. (2)
\[ \text{CH}_3\text{CH} = \text{CHCH}_3 \quad \text{and} \quad \text{CH}_3\text{CH}_2\text{CH} = \text{CH}_2 \text{ are position isomers. The two isomers differ in the position of double bond.} \]

66. (4) Conceptual
67. (4) Conceptual
68. (1) Conceptual
69. (1) Conceptual
70. (2) Conceptual
71. (2) Conceptual
72. (4) Conceptual
73. (4) Conceptual
74. (2) Conceptual
75. (4) Conceptual
76. (4) \( \text{Be(OH)}_2 \) which is least soluble in \( \text{H}_2\text{O} \)
77. (2)
    \( \text{Na}_2\text{CO}_3 \xrightarrow{\Delta} \text{No effect} \)
    \( \text{CaCO}_3 \xrightarrow{\Delta} \text{CaO} + \text{CO}_2 \)
    \( \text{MgCl}_2.6\text{H}_2\text{O} \xrightarrow{\Delta} \text{Mg(OH)}\text{Cl} + \text{HCl} + 5\text{H}_2\text{O} \)
    \( \text{CaCl}_2.6\text{H}_2\text{O} \xrightarrow{\Delta} \text{CaCl}_2 + 6\text{H}_2\text{O} \)
    \( \text{Ca(NO}_3)_2 \xrightarrow{\Delta} \text{CaO} + 2\text{NO}_2 + \frac{1}{2}\text{O}_2 \)
    \( \text{NaNO}_3 \xrightarrow{\Delta} \text{NaNO}_2 + \frac{1}{2}\text{O}_2 \)
78. (1)
    \( X = B_2N_3H_6 \)
79. (1) Meso product is obtained.
80. (2) Acidic oxide
81. (2) Conceptual
82. (2)
83. (3)
    \( \therefore \) 22400 mL water contains water molecules = \( 6.023 \times 10^{23} \)
    \( \therefore \) In 1 mL, the number of water molecules = \( \frac{6.023 \times 10^{23}}{22400} \)
    Since, 1 mL contains 20 drops.
    Therefore, number of water molecules in 1 drop
    \( = \frac{6.023 \times 10^{23}}{22400 \times 20} = 1.344 \times 10^{18} \text{ molecules} \)
84. \( \Delta T_f = i \times K_f \times m \Rightarrow 0.372 = 0.186 \times i \times 0.1 \); \( i = 2 \)

85. (1)

86. (3) Dehydration leading to conjugation

87. (2)

88. (1)

89. (1) Product is formed through the formation of stable \( \text{C}^{\text{\dagger}} \) ion.

90. (3) 30 alkyl halide

91 (1) NCERT XII (pg.no.97)

92 (2) NCERT XI (pg. no. 132)

93 (1) Diploid female will have haploid egg cell and haploid polar nuclei. The polar nuclei will fuse to form secondary nucleus and thus become diploid. On the other hand, the male is tetraploid thus after meiosis the gametes will be diploid (Half the number of chromosomes). This diploid male gamete will fuse with the diploid secondary nucleus to make the endosperm tetraploid.

94 (1) NCERT XI (pg.no.71)

95 (1) By 10% law of energy transfer, 0.2J energy will be transferred to lion which is at third tropic level in the given chain.

96 (1)

97 (4) NCERT XI (pg.no.232)

98 (2) NCERT XI (pg.no. 197)

99 (2) Ovary, anther and zygote are diploid while egg, pollen and male gametes are products of meiosis thus are haploid.

100 (3) NCERT XI (pg. no. 97)

101 (4) NCERT XII (Pg.no.184) BOD measures the amount of organic matter in water by measuring the rate of oxygen uptake by microbes.

102 (1) NCERT XI (pg.no. 204)

103 (4) NCERT XI (pg.no.223)

104 (3) NCERT (pg.no.262)

105 (1) NCERT XI (pg. no. 14)
106. The wavelength at which there is maximum absorption by chlorophyll a, i.e., in the blue and red regions also shows higher rate of photosynthesis while minimum absorption is of green light hence shows least rate of photosynthesis.

107. NCERT XI (pg.no.243)

108. NCERT XII (pg.no.99)

109. Solution B has higher water potential than solution A, thus movement of water will take place from higher water potential to lower water potential. (Not given in NCERT)

110. NCERT XI (pg.no.228-233)

111. NCERT XI (pg. no. 168)

112. Supplementary reading NCERT XII (pg. no. 287, 288)
DNA polymerase is active during DNA replication that occurs in S-phase of interphase.

Glomus is a genus of Arbuscular mycorrhiza fungi. It helps in nutrient uptake mainly the absorption of phosphorus.

Since the endosperm is haploid in case of gymnosperms, the number of chromosomes in endosperm would be equal to the number of chromosomes in egg which is haploid too, i.e. 10.

Since assimilatory power has been produced during the light reaction, the process will continue till it is used up completely and then the reactions stop.

G₀ and G₁: Amount of DNA is 2C. S: Amount of DNA doubles i.e., 2C becomes 4C but G₁ has 2C thus option (b) is incorrect. In G₂, the amount of DNA is in doubled stage i.e., 4C as it is the stage after S phase where doubling has occurred. Thus option (c) is correct. In option along with G₂, M phase is also mentioned where the cell undergoes equational division thus the amount of DNA halves. Thus option (d) is also incorrect.

Less the number of GC pairs, lesser is the heat required to break the bonds.

Species diversity decreases as we move away from the equator to the poles.
144. (2) XII NCERT pg 43
145. (2) XI NCERT pg 53
146. (3) XII NCERT pg 45
147. (2) XI NCERT pg 55
148. (1) XII NCERT pg 53
149. (3) XI NCERT pg 316 - 317
150. (4) XII NCERT pg 59
151. (3) XI NCERT pg 113
152. (2) XII NCERT pg 59
153. (4) XI NCERT pg 148
154. (3)
155. (4) XI NCERT pg 152 - 153
156. (1) XII NCERT pg 133
157. (3) XI NCERT pg 148
158. (4) XII NCERT pg 127
159. (3) XI NCERT pg 261
160. (4) XII NCERT pg 147
161. (3) XI NCERT pg 263
162. (3) XII NCERT pg 148
163. (3) XI NCERT pg 269
164. (1)
165. (2) XI NCERT pg 275
166. (2)
167. (3) XI NCERT pg 285
168. (2)
169. (3) XI NCERT pg 288
170. (2) XII NCERT pg 199
171. (4) XI NCERT pg 297
172. (3) Insulin being proteinaceous will get digested in stomach.
173. (1) XI NCERT pg 294
174. (3) XI NCERT pg 336
175. (1) Odontoid (also called dens) is a part of Axis vertebra (C2)
176. (4) Kupffer cells are phagocytic
177. (3) XI NCERT pg 321
178. (1) XI NCERT pg 336
179. (2) 3rd, 4th, and 6th cranial nerves innervate extrinsic eye muscles.
180. (4) XI NCERT pg 319