**ENTHUSIAST, LEADER & ACHIEVER COURSE**

**TARGET : PRE-MEDICAL 2016**

**Test Type : MAJOR**

**TEST DATE : 21 - 05 - 2016**

**TEST SYLLABUS : FULL SYLLABUS**

### ANSWER KEY

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### HINT – SHEET

1. \( \vec{C} = \vec{A} + \vec{B} \)
   \[
   |\vec{C}| = \sqrt{A^2 + B^2 + 2AB \cos(\theta)}
   \]

2. Since friction is absent acceleration of each is \( g \sin \theta \).
   
   Therefore \( a = g \sin \theta \) for all.

3. \( B_0 = \frac{\mu_0 i}{2R} \)
   
   \[
   B = \frac{\mu_0 i}{2(R^2 + x^2)^{3/2}} = \frac{B_0}{8}
   \]
   
   \[
   x = \sqrt{3R}
   \]
4. \( f \propto \frac{V}{\ell} = \frac{\sqrt{T}}{\ell} \)

\( \Rightarrow \frac{\sqrt{T}}{\ell_1} = \frac{\sqrt{T_2}}{\ell_2} \)

\( \Rightarrow \frac{T_1}{T_2} = \frac{\ell_1^2}{\ell_2^2} \)

\( \Rightarrow \frac{\sigma V g}{(\sigma - \rho) V g} = \frac{\ell_1^2}{\ell_2^2} \)

\( \Rightarrow \frac{\sigma}{\rho} = \text{relative density} = \frac{1}{1 - \left(\frac{\ell_2}{\ell_1}\right)^3} \)

6. \( I = I_{\text{CM}} + M d^2 \)

\( I = \frac{M R^2}{2} + M R^2 \)

\( I = \frac{3}{2} \cdot M R^2 \)

now, \( L = 2\pi R \implies R = \frac{L}{2\pi} \)

and \( M = \lambda L \)

\( \Rightarrow I = \frac{3\lambda L^2}{8\pi^2} \)

7. \( i = i_0(1 - e^{-\tau i}) \)

where \( \tau = L/R \) and \( i = \frac{9i_0}{10} \)

8. \( B = \frac{\Delta P}{\Delta V} \)

9. \( y_1 = 5\sin(\omega t - kx) \)

\( y_2 = 5\cos(\omega t - kx - 150^\circ) \)

\( y_3 = 5\cos(\omega t - kx + 180 - 150^\circ) \)

\( y_4 = 5\sin(\omega t - kx + 120^\circ) \)

\[ y_{\text{res}} = \sqrt{s^2 + s^2 + 2(5)(5)\left(\frac{1}{2}\right)} \]

\[ y_{\text{res}} = 5 \]

10. \( V \propto T \implies \text{isobaric process.} \)

\( \Rightarrow dQ = nC_p dT \)

and \( dW = PdV = nRdT \)

Therefore \( \frac{dQ}{dW} = \frac{C_p}{R} = \frac{\gamma}{\gamma - 1} \)

12. \( \eta = \frac{\Delta W}{Q_{\text{BC}}} \)

\[ \eta = \frac{\text{Area of } \Delta ABC}{\text{Area under curve } BC} = \frac{1}{3} \]

13. \( \frac{3\lambda}{2} = L \quad \lambda = 2L/3 \)

\( f = \frac{v}{\lambda} = \frac{3vL}{2L} \quad \text{and} \quad k = \frac{2\pi}{\lambda} = \frac{3\pi}{L} \)

\( \omega = 2\pi f = 2\pi \frac{3v}{2L} = \frac{3\pi v}{L} \)

\( y = \text{Asin}(kx) \cos(\omega t) \)

14. According to newtons law of cooling \( \frac{\Delta \theta}{\Delta t} \propto (\theta_{\text{avg}} - \theta_s) \)

Case I :-

\( 80^\circ \rightarrow 50^\circ \)

\( \theta_{\text{avg}} = \frac{80 + 50}{2} = 65^\circ \)

\( \Delta \theta = 30^\circ, \quad \Delta t = 5 \text{ min} \)

\( \Rightarrow \frac{30}{5} \propto (65^\circ - 20^\circ) \quad ....(i) \)

Case II :-

\( 60^\circ \rightarrow 30^\circ \)

\( \theta_{\text{avg}} = \frac{60 + 30}{2} = 45^\circ \)

\( \Delta \theta = 30^\circ, \Delta t = ? \)

\( \Rightarrow \frac{30}{\Delta t} \propto (45^\circ - 20^\circ) \quad ....(ii) \)

from (i) and (ii)

\( \Delta t = \frac{5 \times (65^\circ - 20^\circ)}{(45^\circ - 20^\circ)} = 9 \text{ min} \)
15. \( R_2 \) is in series with \( L \)

\[ i = \frac{E}{R_2} \left(1 - e^{-\frac{R_2 t}{L}}\right) \]

So, \( V_L = \frac{L}{dt} = E e^{-\frac{R_2 t}{L}} = 12 e^{-5t} \)

16. Electrical pressure \( P = \frac{1}{2} \varepsilon_0 E^2 \)

as \( E = \frac{V}{r} \Rightarrow P = \frac{1}{2} \varepsilon_0 \frac{V^2}{r^2} \)

17. Total photons from \( n^{\text{th}} \) excited state is

\[ \frac{n(n-1)}{2} = 10 \Rightarrow n = 5 \]

\( E = 13.6 \left[1 - \frac{1}{25}\right] \approx 13 \text{ eV} \)

\( \lambda = \frac{1242}{E} = \frac{1242}{13} \approx 95 \text{ nm.} \)

18. 10 g ice at 0°C

+ calorimeter (10g) @ 0°C + Heat

\[ v = 0 \]

Finally 10 g steam at 100°C

+ calorimeter at 100°C

\( \Delta Q = 10 \times 80 + 20 \times 1 \times 100 + 10 \times 540 \)

\( \Delta Q = 8200 \text{ cal.} \)

19. \( v_{\text{ms}} = \sqrt{2g\ell} \)

20. \( I_{\text{rms}} = \frac{P}{V_{\text{rms}}} = \frac{12}{24} = \frac{1}{2} \text{ A} \)

Peak value of current

\( I_0 = I_{\text{rms}} \sqrt{2} = \frac{1}{2} \sqrt{2} \text{ A} \)

\( I_0 = \frac{1}{2} \frac{\sqrt{2}}{2} \text{ A} = \frac{1}{2} \sqrt{2} \text{ A} \)

21. \( \frac{dN}{dt} = \alpha - \lambda N \)

\[ \int_0^t \frac{dN}{10 - \frac{N}{2}} = \int dt \]

\( \Rightarrow N = 20(1 - e^{-t/2}) \)

when \( N = 10 \)

\( \Rightarrow t = 2 \ln(2) = 1.386 \text{ sec.} \)

22. \( C_v \text{ mix} = \frac{n_1 C_{v_1} + n_2 C_{v_2}}{(n_1 + n_2)} \)

\[ = 5 \times \left(\frac{3R}{2}\right) + 2 \times \left(\frac{5R}{2}\right) = \frac{25R}{2} = \frac{25}{14} \]

\( C_p \text{ mix} = C_v \text{ mix} + R = 39R/14 \)

\( \gamma_{\text{mix}} = \frac{C_p \text{ mix}}{C_v \text{ mix}} = \frac{39}{25} = 1.56 \)

23. Given \( a_1 = a_\text{c} \)

\[ \frac{dv}{dt} = \frac{v^2}{R} \Rightarrow \frac{dv}{v^2} = \frac{dt}{R} \Rightarrow \int \frac{dv}{v^2} = \int \frac{dt}{R} \]

\( v = \frac{v_0 R}{R - v_0 t} \)

\[ \Rightarrow \int_0^{2\pi R} ds = v_0 R \int_0^{2\pi R} \frac{dt}{R - v_0 t} \]

\( \Rightarrow t = \frac{R}{v_0} (1 - e^{-2\pi}) \)

24. \( T_1 \cos \theta = T_2 \) and \( T_1 \sin \theta = W/2 \)

solving \( T_2 = \frac{W}{2} \cot \theta \)
25. \[ V_f = \frac{C_1V_i + C_2V_2}{C_1 + C_2} \quad \left\{ \begin{array}{l} C_1 = C, \ V_i = -V \\ C_2 = 2C, \ V_2 = 2V \end{array} \right. \]

\[ \Rightarrow V_f = V \]

\[ V_i = \frac{1}{2}(C_1 + C_2)V^2 = \frac{1}{2}(3C)(V)^2 = \frac{3}{2}CV^2 \]

26. \[ A = 2 \text{cm} \]

\[ V_{\text{max}} = \omega A = 2\pi f A = 12 \text{cm/s} \]

\[ \Rightarrow f = \frac{V_{\text{max}}}{2\pi A} = \frac{12}{2\pi \times 2} = \frac{3}{\pi} \text{Hz} \]

27. \[ U_i = \frac{1}{2}Kx^2 \quad \Rightarrow \quad K = \frac{2U}{x^2} \]

\[ U_f = \frac{1}{2}Kx_f^2 = \frac{1}{2} \frac{2U}{x^2} \cdot n^2x^2 = n^2U \]

28. \[ 3m \quad \text{Original path of 3m} \]

\[ \text{path of 2m} \]

\[ 3m(R) = m \frac{R}{2} + 2m(x) \]

\[ \Rightarrow x = 5 \frac{R}{4} \]

30. Power increase in decibel = \( 10 \log_{10} \left( \frac{P_f}{P_i} \right) \)

\[ \Rightarrow 10\log_{10} \left( \frac{400}{20} \right) = 10\log_{10} (20) = 13 \text{ dB} \]

31. \[ m \rightarrow v \]

\[ \text{as } \vec{p}_i = \vec{p}_t \]

\[ e = \frac{v/3}{v} = \frac{1}{3} \]

32. \[ X_{cm} = \frac{M_1X_1 - M_2X_2}{M_1 - M_2} \quad \text{(mass } \propto \text{ area)} \]

for disc COM is at \[ \frac{4R}{3\pi} \]

\[ X_{cm} = \frac{\sigma \times \pi \left( 6\pi \right)^2 \times \frac{4}{3\pi} - \sigma \times \pi (2)^2 \times 8}{\sigma \times \pi \left( 6\pi \right)^2 - \sigma \times \pi (2)^2} \]

\[ X_{cm} = \frac{360 	imes 4 - 32}{180 - 4} = \frac{360 - 8}{45 - 1} = \frac{352}{44} = 8 \text{cm} \]

33. \[ U = U_0/n \left( \frac{r}{r_0} \right) \]

\[ |F| = \left| \frac{dU}{dr} \right| \]

\[ \Rightarrow \frac{mv^2}{r} = \frac{U_0}{r} \]

\[ \Rightarrow v = \text{const} \]

now, \[ mvr = \frac{nh}{2\pi} \]

So, \[ r \propto n \]

34. apply KVL in loop

\[ 10 - \frac{10 + q}{1} - \frac{q}{1} = 0 \]

\[ \Rightarrow q = 0 \]

therefore \[ q_1 = 10 + q = 10 \mu\text{C} \] and \[ q_2 = q = 0 \mu\text{C} \]
35. \[ T = 2\pi \sqrt{\frac{m}{k}} \]

Time period does not depend on gravity and buoyancy force.

36. \[ a = 1.2 \times 10^{-2} \text{ m (no. of significant figure = 2)} \]

\[ V = a^3 \]

\[ V = (1.2 \times 10^{-3})^3 \text{ m}^3 \]

\[ V = 1.728 \times 10^{-6} \text{ m}^3 \]

\[ V = 1.7 \times 10^{-6} \text{ m}^3 \]

{no. of significant figure in V should be same as 'a'}

37. Angular Impulse = Charge in angular momentum.

So, about COM

\[ P \frac{\ell}{2} = \frac{m\ell^2}{12} \omega \]

\[ \Rightarrow \omega = \frac{6P}{m\ell} \]

Now, \( \theta = \frac{\pi}{2} = \omega t \)

\[ \Rightarrow t = \frac{\pi}{2\omega} = \frac{\pi m\ell}{12P} \]

38. Applying KVL to the upper triangular loop, we have

\[ i_{5\Omega} = 2/5 = 0.4 \text{ A} \]

39. \[ W = \Delta U = S(8\pi R_2^2 - 8\pi R_1^2) \]

\[ \Rightarrow W = 8\pi \times 0.03 \left( \frac{4}{\pi} - \frac{1}{\pi} \right) \times 10^{-4} \text{ J} \]

\[ \Rightarrow W = 7.2 \times 10^{-4} \text{ J} \]

40. Voltage gain \( A_v = \beta \frac{R_0}{R_1} = 50 \Rightarrow \beta = 25 \)

Power gain \( A_p = \beta \frac{R_0}{R_1} = (25)^2 \times 2 = 1250 \)

43. rate of Isocyanide text \( \propto \) Nucleophilicity of 'N'

47. \( \text{SN Reaction} \)

48. \( \text{H}_2\text{O} > \text{SbH}_3 > \text{NH}_3 > \text{AsH}_3 > \text{PH}_3 \)

49. \( \text{PV} = \text{RT} \)

50. \( 2^2 = 4, \ 3^2 = 9 \)

51. \( \text{XeO}_3 \]

52. \( \text{XeOF}_4 \]

55. Cl (a) is more reactive towards ArSN reaction because two EWG are at O- and P- positions w.r.t. Cl (a) Hence the product is
56. Size decreases on moving L → R in a periodic table
   La > Hf Atomic size

57. No. of O\(^{-2}\) ions = 4
   No. of X\(^{2+}\) ions = \(\frac{1}{5} \times 8 = \frac{8}{5}\)
   No. of Y\(^{3+}\) ions = \(\frac{1}{2} \times 4 = 2\)
   X : Y : O
   \(\frac{8}{5} : 2 : 4\)
   4 : 5 : 10

59. \[ \text{CH}_3\text{MgBr} + \text{H}_2\text{O} \rightarrow \text{CH}_3\text{OH} + \text{MgBr}_2\]
   \[ \text{MeO} \]
   \[ \text{Mg/ether} \]
   \[ \text{CH}_3\text{MgBr} \]
   \[ \text{CH}_3\text{Br} \]
   \[ \text{CH}_3\text{OH} \]
   \[ \text{MeO} \]
   \[ \text{HBr} \]
   \[ \text{H}_2\text{O}^+ \]

60. Basic character \(\propto \frac{1}{EN}\)

62. 4–methyl carboxylic acid is

63. Nylon–6 is homopolymer of caprolactum

65. \[ \Delta S = \frac{q}{T} \]
   \[ 14.4 = \frac{q}{391} \]
   \[ q = 5630.4 \text{ Cal} \]
   \[ q = \frac{5630.4 \text{ Cal}}{60} \]

66. Conceptual

70. Reaction proceed through allylic free radical substitution.

71. X is Nonmetal & Y is metal.

74. Birch reduction

75. B.O of \(O_2\) = 2
   B.O of \(O_2^+\) = 2.5
   B.O of \(O_2^-\) = 1.5

78. \[ \text{CH}_3\text{C–O} + \text{C}_2\text{H}_5\text{OH} \rightarrow \text{esterification} \]
   \[ \text{O} \]
   \[ \text{CH}_3\text{C–O} \text{C}_2\text{H}_5 \]
   \[ \text{O} \]
   \[ \text{LiAlH}_4 \]
   \[ \text{H}_2\text{O} \]
   CH\(_3\text{CH}_2\text{OH} + \text{C}_2\text{H}_5\text{OH}\]

79. \[ \text{HO} \]
   \[ \text{OH} \]
   \[ \text{CH}_3 \]

82. NCERT (XII), Pg. # 35 (E), 37 (H)
83. NCERT (XI) Pg. # 248 to 250
86. NCERT (XI), Pg. # 101, 102, para-I, II
89. NCERT (XI), Pg. # 54, para-4.2.9
93. NCERT Pg.# 87,89
97. NCERT Pg.# 87
101. NCERT Pg.# 86, 84
105. NCERT (XI), Pg. # 71, 77
109. NCERT (XI), Pg. # 79
113. NCERT (XII), Pg. # 23 (E), 24(H)
117. NCERT (XII), Pg. # 25, 31, 35 (E), 27, 33, 37 (H)
148. \(\Delta = (4/9)\Delta_0\). This is because of:
   (i) there are only four ligands instead of six, so
       the ligand field is only two thirds the size; as the
       ligand field splitting is also the two thirds the size
       and (ii) the direction of the orbitals does not
       coincide with the direction of the ligands.
   This reduces the crystal field splitting by roughly
   further two third. So \(\Delta = \frac{2}{3} \times \frac{2}{3} = \frac{4}{9} \Delta_0\).
   Consequently, the orbital splitting energies are not
   sufficiently large for forcing pairing and,
   therefore, low spin configurations are rarely
   observed.
150. Assertion : As they accept electrons from the central metal in \( \pi \)-symmetry.

152. Both are true statements but the Reason is not the true explanation of the Assertion.

156. Assertion : \( 4M(s) + 8CN^{-}(aq) + 2H_2O(aq) + O_2(g) \rightarrow [M(CN)_2]^{-}(aq) + 4OH^{-}(aq) + 4H^+(aq) \).
M = Au or Ag it is clear from the equation that CN does not act as reducing agent. However \( O_2 \) oxidises metal to metal ion which they react with CN ions to form complex from which metal is obtained by reduction by more electropositive metal, zinc.

Reason : \( 4M(s) + 8CN^{-}(aq) + 2H_2O(g) \rightarrow [M(CN)_2]^{-}(aq) + 4OH^{-}(aq) \).
M = Au or Ag.

158. Assertion and Reason are correct but Reason is not correct explanation of \( S_2 \).

Assertion : \( MnO_4^+ + 8H^+ + 5e^- \rightarrow Mn^{2+} + 4H_2O; E^o = +1.51 \text{ V} \)
\( Reason : 2MnO_4^+ + 3Mn^{2+} + 2H_2O \rightarrow 5MnO_2(s) + 4H^+; E^o = +0.46 \text{ V}. \)

160. Assertion and Reason both are correct and Reason is the correct explanation of Assertion 2HCl+[O→H_2O+Cl_2(s)].

162. NCERT XI (H) Pg. # 297

163. NCERT (XI), Pg. # 57

164. NCERT XI (H) Pg. # 287

165. NCERT Pg.# 93

167. NCERT (XI), Pg. # 72

173. NCERT (XI), Pg. # 104, para-III

179. NCERT (XI) Pg. # 214 to 215

181. Malala Yousafzai is a Pakistani activist for female education and the youngest ever Nobel Prize laureate.

182. Modulator-DeModulator

183. Sanjeev Chaturvedi who served as the chief vigilance officer at AIIMS and founder of NGO 'Goonj' Anshu Gupta are the two indians who won Ramon Magsaysay award 2015.

184. At the Point Of Sale (POS) the retailer would calculate the amount owed by the customer and provide option for customer to make payment.

185. 'Earth Hour' is a world wide movement for the planet organized by the world wide fund for nature (WWF). The event is held world wide annually encouraging individuals, communities house hold and businesses to turn off their non-essential lights for one hour, from 8 : 30 to 9 : 30 pm towards the end of March.

186. Nokrek Biosphere reserve is a National Park located in West Garo hills district of Meghalaya.

187. Banaras Hindu University was established in 1916 by Pandit Madan Mohan Malviya. He played important role in the Indian independence movement. He was awarded Bharat Ratna in 2015.

188. WHO declared public health emergency for international concern in Latin America regarding infections by Zika virus. Zika virus was first discovered in 1947 at Uganda. Aedes mosquito is main vector of this disease.

189. India won the top UNESCO prize 'Award of Excellence' 2015 for remarkable conservation efforts of the majestic Sree Vadakkunnathan Temple in Kerala.
190. Autism is a mental condition present from early age. Characterized by great difficulty in communication, learning and forming relations. 'आंतरिक विकास में रोग है जो कम उम्र में ही हो दिखाई पड़ता है कि इसे दूर करने के लिए जो दृष्टि रखी जाती है महसूस सकता है।

191. According to Swachh Sarvekshan, Mysuru is India’s cleanest city. Dhanbad has been found the dirtiest city by the survey.

192. Bailadila range of southern chhattisgarh is famous for Iron-ore.


194. Morarji Desai was the Prime Minister of India from (1977-1979). He was the first Prime Minister to resign from office. He was also the first non-congress Prime Minister.

195. World Food Day is celebrated on 16th october every year since 1980.

196. Study of soils in their natural environment is called pedology.

197. Indian postal network is the largest in the world.

198. The inspiration for the WWF logo came from Chi Chi, a giant panda that was living at the London Zoo in 1961. The same year WWF was created.

199. Ray Tomlison used '@' as a symbol to separate name and location in an email.

200. Sumit Nagal is an Indian tennis player. He won the Wimbledon Junior Men's double title with partner Nam Hoangly in year 2015.