SOLUTIONS

Mentors Eduserv

All India Test Series 2018

PART TEST-2

AIIMS Pattern

Test Date: 01-12-2017

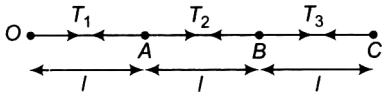
PHYSICS

1. (3)

$$a = \sqrt{a_n^2 + a_t^2} = \sqrt{\left(\frac{v^2}{r}\right)^2 + a^2} = \sqrt{\frac{v^2}{r^2} + a^2}$$

2. (4)

Let ω is the angular speed of revolution.



$T_3 = m\omega^2(3\ell)$

$T_2 - T_3 = m\omega^2 2\ell$

$\Rightarrow T_2 = m\omega^2(5\ell)$

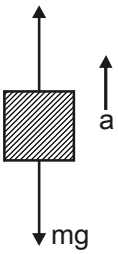
$T_1 - T_2 = m\omega^2\ell$

$\Rightarrow T_1 = m\omega^2(6\ell)$

$T_3 : T_2 : T_1 = 3 : 5 : 6$

3. (2)

F – mg = ma (F = thrust)

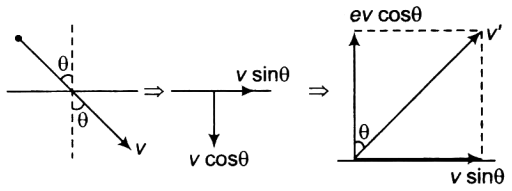


F = m(g + a)

= (3.5×10^4) (10 + 10)

= 7.0×10^5 N

4. (2)



$$\tan\theta' = \frac{v\sin\theta}{ev\cos\theta} = \frac{\tan\theta}{e}$$

or $$\theta = \tan^{-1}\left(\frac{\tan\theta}{e}\right)$$

5. (1)

$$2mv\cos\theta = (2m)v'$$

$$\therefore\ v' = v\cos\theta$$

6. (4)

From conservation of linear momentum, velocity of combined mass just after collision will be 50 cm/s as mass has doubled.

Now $$H = \frac{u^2}{2g} = \frac{(0.5)^2}{20}\text{m} = 1.25 \text{ cm}$$

7. (4)

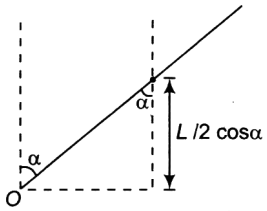
$$a_{CM} = \frac{\text{External force}}{\text{Total mass}}$$

$$= \frac{\text{Force of friction from ground}}{\text{Total mass}}$$

$$= \frac{0.2\times(2+1)(10)}{1+2} = 2 \text{ m/s}^2$$

8. **(2)**

Decrease in gravitational PE = Increase in rotational KE



$$\therefore\ mgh = \frac{1}{2}I\omega^2$$

$$mg\left[\frac{L}{2} - \frac{L}{2}\cos\alpha\right] = \frac{1}{2}\left(\frac{mL^2}{3}\right)\omega^2$$

$$\therefore\ \omega = \sqrt{\frac{3g}{L}(1-\cos\alpha)}$$

$$= \sqrt{\frac{3g}{L}\left(2\sin^2\frac{\alpha}{2}\right)} = \sqrt{\frac{6g}{L}}\sin\frac{\alpha}{2}$$

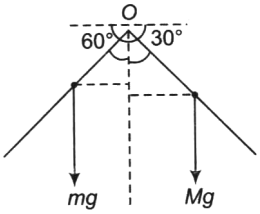
9. **(1)**

$$L = I\omega = I(2\pi f)$$

Frequency f is doubled. Hence, angular momentum will become 2L.

10. **(4)**

Net torque about O should be zero



$$\therefore\ Mg\frac{\ell}{2}\sin 30° = mg\frac{\ell}{2}\sin 60°\quad \frac{M}{m} = \frac{\sin 60°}{\sin 30°} = \sqrt{3}$$

11. **(1)**

$$L = mvR + I_C\omega = mvR + \frac{1}{2}mvR = \frac{3}{2}mvR$$

12. (1)

Relative velocity of A with respect to C perpendicular to AC is 14 m/s.

$$\therefore\ \omega = \frac{14}{AC} = \frac{14}{7/2} = 4 \text{ rad/s}$$

A and α are zero. Hence, acceleration of any point is

$$a_n = r\omega^2$$

$$\therefore\ |a_A| = |a_B|$$

$$= r\omega^2 = \frac{\ell}{2}\cdot\omega^2 = 56 \text{ m/s}^2$$

13. (4)

In case of pure rolling ratio of rotational to translational kinetic energy is $\frac{2}{5}$. Therefore, total kinetic energy is $\frac{7}{5}$ times the translational kinetic energy. At maximum compression whole of energy is elastic potential. Hence,

$$\frac{7}{5}\left(\frac{1}{2}Mv^2\right) = \frac{1}{2}kx_{max}^2$$

$$\therefore\ x_{max} = v\sqrt{\frac{7M}{5k}}$$

14. (4)

$$I_1\omega_1 = I_2\omega_2 = \frac{1}{2}\omega_1$$

$$\therefore\ I_2 = 2I_1 \qquad \frac{1}{2}m_0R^2 + (\mu t)R^2 = 2\left[\frac{1}{2}m_0R^2\right]$$

$$\therefore\ t = \frac{m_0}{2\mu}$$

15. (3)

$$(M-m)gh = \frac{1}{2}(M+m)v^2$$

$$\therefore\ v = \sqrt{\frac{2gh(M-m)}{M+m}}$$

16. (2)

F = μmg and W = F.S

17. (3)

18. (2)

$N = mg - F\sin\theta$

Block moves with uniform velocity. Hence net force = 0

or, $F\cos\theta = \mu N = \mu(mg - F\sin\theta)$

$\therefore\ F = \dfrac{\mu mg}{\cos\theta + \mu\sin\theta}$

$W = Fs\cos\theta = \dfrac{\mu mgd\cos\theta}{\cos\theta + \mu\sin\theta}$

19. (1, 3)

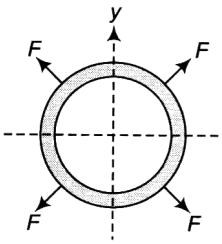
Work done by conservative forces = $U_i - U_f$

Work don by external forces = $E_f - E_i$

and net work done by all the forces = $K_f - K_i$

20. (2)

Applying Fleming's left-hand rule, we see that, if magnetic field is perpendicular to paper inwards and current in the loop is clockwise, the magnetic force F on each element of loop is radially outwards and loop has a tendency to expand outwards.



Also, when a current carrying loop placed in uniform magnetic field, then net force on it is zero and loop cannot have translation motion.

21. (2)

22. (2)

$W = MB(1 - cso\theta)$

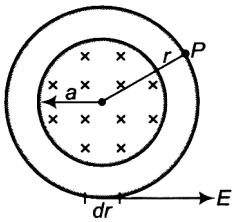
and = MB(1 – cos 180°) = 2MB

23. **(1)**

It is a standard result.

24. **(3)**

25. **(2)**



Draw a concentric circle of radius r. The induced electric field (E) at any point on the circle is equal to that at P.

For this circle, induced emf

$$e = \oint E\,dl = \left|\frac{d\phi}{dt}\right| = A\left|\frac{dB}{dt}\right|$$

$$\therefore\ E = \oint dl = \pi a^2\left|\frac{dB}{dt}\right|$$

(but, $\oint dl = 2\pi r$)

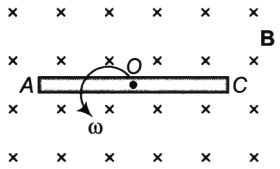
$$\therefore\ E\times(2\pi r) = \pi a^2\left|\frac{dB}{dt}\right|$$

$$\therefore\ E = \frac{a^2}{2r}\left|\frac{dB}{dt}\right| \Rightarrow E \propto \frac{1}{r}$$

26. **(3)**

For rotating rod, induced emf

$$e = \frac{1}{2}BI^2\omega$$



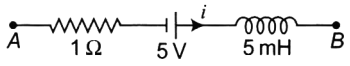
For part AO, $e_{OA} = e_O - e_A = \frac{1}{2}BI^2\omega$

For part OC, $e_{OC} = e_O - e_C = \frac{1}{2}B(3I)^2\omega$

$$\therefore\ e_A - e_C = 4BI^2\omega$$

27. (3)

Applying Kirchhoff's second law to above circuit,



$$V_A - iR + 15 - L\frac{di}{dt} = V_B$$

or $V_A - 5\times 1 + 15 - (5\times 10^{-3})(-10^3) = V_B$

$\therefore\ V_B - V_A = 15$ volt

28. (3)

At point A, $X_C > X_L$

at point B, $X_C = X_L$

at point C, $X_C < X_L$

So at C, circuit is inductive.

29. (3)

At resonance frequency current is maximum.

30. (3)

$$i_{rms}^2 = \frac{\int i^2\,dt}{\int dt} = \frac{\int_2^4 (4t)dt}{\int_2^4 dt} = \frac{4\int_2^4 t\,dt}{2} = 2\left[\frac{t^2}{2}\right]_2^4 = 12\,A^2$$

$$i_{rms} = 2\sqrt{3}\,A$$

31. (1)

Current is halved, means impedance is doubled.

$$X_C \propto \frac{1}{\omega}$$

$\therefore$ When ω is made $\frac{1}{3}$rd, X_C will become 3 times.

$$Z' = 2Z$$

$$\therefore\ \sqrt{R^2 + (3X_C)^2} = 2\sqrt{R^2 + X_C^2}$$

$$\therefore\ \frac{X_C}{R} = \sqrt{\frac{3}{5}}$$

32. **(4)**

Phase angle, $\tan\phi = \frac{X_L}{R} = \frac{X_C}{R}$

$\Rightarrow \tan 60^\circ = \frac{X_L}{R} = \frac{X_C}{R}$

$\Rightarrow X_L = X_C = \sqrt{3}R$

i.e., $Z = \sqrt{R^2 + (\sqrt{3}R - \sqrt{3}R)^2}$

$\Rightarrow Z = R$

So, average power, $P = \frac{V^2}{R} = \frac{200 \times 200}{100}$

33. **(3)**

Total power = solar constant × area

$= 10^4 \times (10 \times 10) = 10^6$ W

34. **(2)**

35. **(4)**

36. **(3)**

37. **(2)**

$i = \frac{V}{Z} = \frac{V}{\sqrt{R^2 + (2\pi fL)^2}} = \frac{120}{\sqrt{(10)^2 + (2\pi \times 60 \times 2)^2}}$

$= 0.16$ A

38. **(2)**

$\tau_L = \frac{L}{R} = 0.5$ s

$\frac{i_\infty}{i_1} = \frac{(1 - e^{-\infty})}{(1 - e^{-1/0.5})} = \frac{1}{1 - e^{-2}} = \frac{e^2}{e^2 - 1}$

39. **(3)**

Four resistances form a balanced Wheatstone bridge.

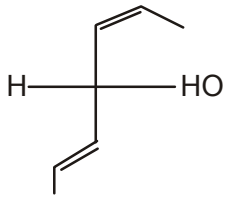
40.	**(3)**	**41.**	**(1)**	**42.**	**(1)**	**43.**	**(2)**	**44.**	**(2)**	**45.**	**(3)**	**46.**	**(4)**
47.	**(1)**	**48.**	**(4)**	**49.**	**(3)**	**50.**	**(2)**	**51.**	**(4)**	**52.**	**(1)**	**53.**	**(4)**
54.	**(4)**	**55.**	**(1)**	**56.**	**(2)**	**57.**	**(4)**	**58.**	**(4)**	**59.**	**(1)**	**60.**	**(4)**

CHEMISTRY

61. **(3)**

Factual

62. **(1)**



63. **(4)**

64. **(4)**

Factual

65. **(1)** **66.** **(4)** **67.** **(4)** **68.** **(2)**

69. **(4)**

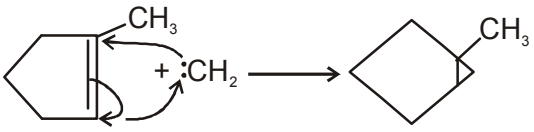
Factual

70. **(2)**

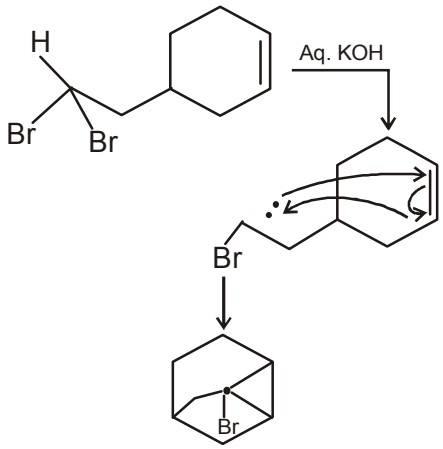
It is oxidative ozonolysis

71. **(1)**

$CH_2ZnI_2 \longrightarrow :CH + ZnI_2$



72. **(4)**



73. **(3)**

Factual based on chirality

74. **(3)**

$\Delta n = 2 - 3 = -1$

$\Delta H = \Delta U - (-1 \times RT) \quad \therefore \Delta H < \Delta V$

75. **(2)**

$$\Delta S = \frac{\Delta H_f}{T} = \frac{9710}{373} = 26.032 \text{ cal mol}^{-1} \text{ K}^{-1}.$$

76. **(2)**

77. **(1)**

$$H_2(g) + \frac{1}{2}O_2(g) \rightarrow H_2O(l), \quad \Delta H = -68.3 \text{ k cal}$$

$$H_2O(l) \rightarrow H_2O(g), \quad \Delta H = 10.5 \text{ k cal}$$

$$\text{So, } H_2(g) + \frac{1}{2}O_2(g) \rightarrow H_2O(g)$$

$\Delta H = -68.3 + 10.5 = -57.8$ k cal

78. **(1)**

79. **(1)**

$$\underset{0.78}{\overset{1.0}{2HI}} \rightleftharpoons \underset{0.11}{H_2} + \underset{0.11}{I_2} \quad K_C = \frac{0.11 \times 0.11}{0.78 \times 0.78} = 0.0199$$

80. **(1)**

$$\underset{\frac{0.8}{3}}{\overset{1}{N_2}} + \underset{\frac{2.4}{3}}{\overset{3}{3H_2}} + \rightleftharpoons \underset{\frac{0.4}{3}}{2NH_3} \quad \frac{1}{2}N_2 + \frac{3}{2}H_2 \rightleftharpoons NH_3 \quad K_{C_2}$$

$$K_{C_2} = \sqrt{K_{C_1}} \text{ or } K_{C_1} = K_{C_2}^2$$

$$K_{C_1} = \frac{\left(\frac{0.4}{3}\right)^2}{\left(\frac{0.8}{3}\right)\left(\frac{2.4}{3}\right)^3} = 0.13$$

81. (1)

$$\underset{1.0}{\overset{1.1}{A}} + \underset{2.0}{\overset{2.2}{2B}} \rightleftharpoons \underset{0.2}{2C} + \underset{0.1}{D}$$

$$K_C = \frac{(0.2)^2(0.1)}{(1.0)(2.0)^2} = 0.001$$

82. (1)

Increase in the value of K_C with increase in temperature indicates that forward reaction is taking place more with increase in temperature. So, the reaction is endothermic.

83. (3)

84. (4)

85. (2)

86. (2) $pH = pK_a$

$$\therefore [CH_3COONa] = [CH_3COOH]$$

$$50 \times 0.2 = 25 \times M_z$$

$$M_z = 0.4$$

87.	**(3)**	**88.**	**(3)**	**89.**	**(2)**	**90.**	**(1)**	**91.**	**(2)**	**92.**	**(2)**	**93.**	**(4)**
94.	**(2)**	**95.**	**(3)**	**96.**	**(2)**	**97.**	**(4)**	**98.**	**(1)**	**99.**	**(4)**	**100.**	**(3)**
101.	**(1)**	**102.**	**(2)**	**103.**	**(2)**	**104.**	**(1)**	**105.**	**(2)**	**106.**	**(4)**	**107.**	**(2)**
108.	**(3)**	**109.**	**(1)**	**110.**	**(1)**	**111.**	**(3)**	**112.**	**(4)**	**113.**	**(3)**	**114.**	**(1)**
115.	**(3)**	**116.**	**(2)**	**117.**	**(3)**	**118.**	**(3)**	**119.**	**(3)**	**120.**	**(1)**		

BOTANY

121.	**(3)**	**122.**	**(3)**	**123.**	**(3)**	**124.**	**(1)**	**125.**	**(2)**	**126.**	**(3)**	**127.**	**(2)**
128.	**(1)**	**129.**	**(2)**										

130. (1)

During acetyl CoA formation by pyruvic acid, only one $NADH_2$ is formed by which 3 molecules of ATP are formed.

131. (3)

NADP is a coenzyme of dehydrogenases participating in photosynthesis and pentose phosphate pathway. In TCA cycle the coenzyme is either NAD or FAD.

132. (1)

133. (2) **134.** (4) **135.** (2) **136.** (3) **137.** (3) **138.** (1) **139.** (4)

140. (3) **161.** (4) **162.** (3) **163.** (2) **164.** (3) **165.** (4) **166.** (2)

167. (1) **168.** (4) **169.** (3) **170.** (4)

ZOOLOGY

141. (3)

Acetabulum in pelvic girdle present at junction of all three bones.

142. (3) **143.** (2)

144. (1)

EDTA is an anticoagulant.

145. (4)

When Ca^{++} channel protein is blocked the neurotransmitter does not released in synaptic gap.

146. (2) **147.** (4) **148.** (3)

149. (2)

Inferior colliculi/Auditory lobes rotate head towards source of sound to foccussing ear.

150. (3) **151.** (2) **152.** (2) **153.** (3) **154.** (2)

155. (2)

Adrenalin is a broncho-dilator provides releif in asthama.

156. (1)

157. (4)

cGMP is antagonistic to cAMP.

158. (4) **159.** (2) **160.** (3) **171.** (2) **172.** (1)

173. (1)

Vasopressin prevents diuresis (excess loss of water with wine), hence called anit-diuretic hormone also.

174. (4) **175.** (1) **176.** (1) **177.** (2) **178.** (4) **179.** (3) **180.** (1)