Neuron / Cerebrum
NEET - 2020
Test - 25 / 61

Physics (Solution) Date: 22/03/20

1. [2]

2. [1]

3. [1] $|E| = \frac{d\Phi}{dt} = \frac{d}{dt}(BA) = A\frac{dB}{dt} = \frac{\pi r^2}{2}\frac{dB}{dt}$

$\therefore \quad |E| = \frac{3.14}{2} \times \frac{1}{10} \times \frac{1}{10} \times 10^{-2} = 1.57 \times 10^{-4}$ V

$\therefore \quad i = \frac{E}{R} = \frac{1.57}{4} \times 10^{-4} = 3.9 \times 10^{-3}$ A.

4. [4] $X_L = X_C \quad \Rightarrow \quad Z = R \quad \Rightarrow \quad V = 0$

$I = \frac{V}{R} = \frac{240}{30} = 8$ A.

5. [3] $X_L = \omega L = 2000 \times 5 \times 10^{-3} = 10$

$X_C = \frac{1}{\omega C} = \frac{1}{50 \times 10^{-6} \times 2000}$

$X_C = 10$

$\because \quad X_L = X_C \quad \Rightarrow$ circuit is at resonance.

$\therefore \quad Z = R = 10\Omega$ reading of ammeter.

$= i_{rms} = \frac{v_{rms}}{z} = \frac{20}{\sqrt{2}} \times \frac{1}{10} = 1.4$ A

reading of voltmeter $= 2_{times} R = 1.4 \times 4 = 5.6$ V.

6. [1] By KVL, $V_B - EL\frac{di}{dt} + iR = V_A$

$\Rightarrow V_B - 10 + 1 \times 10 + 3 \times 5 = V_A \quad \Rightarrow \quad V_A - V_B = 15$ V.

7. [2] $I = I_0\left(1 - e^{-t/\tau}\right)$; $\frac{3}{4}I_0 = I_0\left(1 - e^{4/\tau}\right)$

on solving $\tau = \frac{2}{\ln 2}$ sec.

8. [3] When capacitor is removed, $\tan\phi_1 = \frac{X_L}{R}$

when inductor is removed, $\tan\phi_2 = \frac{X_L}{R}$

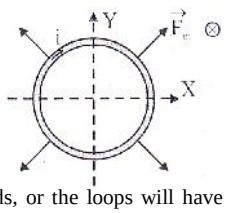
$\because \quad \phi_1 = \phi_2 \quad \Rightarrow \quad X_L = X_C$

$\Rightarrow$ series L-C-R circuit is at resonance

$\therefore \quad Z = R$ and $i = \frac{V}{Z} = \frac{V}{R}$

$\therefore \quad i = \frac{200}{100} = 2.$

9. [2] Net force on a current carrying loop in uniform magnetic field is zero. Hence the loop can't translate. So, options (3) and (4) are wrong. From Fleming's left hand rule we can see that if magnetic field is perpendicular to paper inwards and current in the loop is clockwise (as shown) the magnetic force $\vec{F}_m$ on each element of the loop is radially outwards, or the loops will have a tendency to expand.



10. [4] $u_{C,\max} = u_{L,\max} \quad \Rightarrow \quad \frac{1}{2}cv^2 = \frac{1}{2}Li_{max}^2$

$\Rightarrow \quad \frac{1}{2} \times 60 \times 10^{-6} \times 50 \times 50 = \frac{1}{2} \times 1.5 \times 10^{-3} \times i_{rms}^2$

$\therefore \quad i_{max} = 10$ A.

11. [4] $\left(T = \frac{2\pi m}{qB}\right)$.

12. [3] Moment of inertia of the solid cylinder about its axis is

$I = \frac{MR^2}{2}$

$\therefore$ Rotational kinetic energy of the cylinder is

$K = \frac{1}{2}I\omega^2 = \frac{1}{2}\frac{MR^2}{2}\omega^2 = \frac{1}{4}MR^2\omega^2.$

13. [1] Here, $\omega = 100\,\text{rad s}^{-1}$, $\tau = 100\,\text{N m}$

As $P = \tau\omega$

$\therefore \quad P = (100\,\text{N m})(100\,\text{rad s}^{-1}) = 10 \times 10^3\,\text{W} = 10\,\text{kW}.$

14. [2] The relation between linear velocity $\vec{v}$ and angular velocity $\vec{\omega}$ is $\vec{v} = \vec{\omega} \times \vec{r}$.

15. [1] The constant downward force of pull exerts a torque τ on the disc,

$\tau = I\alpha = F \cdot R \quad \Rightarrow \quad FR = I\frac{a_1}{R}\left\{\alpha = \frac{at}{R}\right\}$ and $I = \frac{1}{2}MR^2$

$a_t = \frac{2F}{M}$.

16. [3] If the motor pumps water (density ρ) continuously through a pipe of area of cross-section A with velocity v, then mass flowing out per second.

$m = Av\rho$ ...(i)

Rate of increase of kinetic energy $= \frac{1}{2}mv^2 = \frac{1}{2}(Av\rho)v^2$ ...(ii)

Mass m, flowing out per, sec, can be increased to m' by increasing v be v', then power increases from P to P'.

$\frac{P'}{P} = \frac{\frac{1}{2}A\rho v'^3}{\frac{1}{2}A\rho v^3}$ or $\frac{P'}{P} = \left(\frac{v'}{v}\right)^3$ Now $\frac{m'}{m} = \frac{A\rho v'}{A\rho v} = \frac{v'}{v}$

As $m' = nm$; $v' = nv$

$\therefore \quad \frac{P'}{P} = n^3$ or $P' = n^3P.$

17. [2] Loss in PE between A and D = gain in KE between A and D

$mg(h - 2r) = \frac{1}{2}m(v^2 - 0)$ $(\because K_A = 0)$

$v^2 = 2g(g - 2r)$ ...(i)

If the block is to complete the loop path then at D

$$\frac{mv^2}{r} \geq mg$$

$v^2 \geq rg$ ...(ii)

From Eqs.(i) and (ii)

$2g(h-2r) \geq rg$

$h \geq \frac{5}{2}r.$

18. [2] Force, $\vec{F} = -2\hat{i} + 15\hat{j} + 6\hat{k}$ N

Displacement, $\vec{s} = 0\hat{i} + 10\hat{j} + 0\hat{k}$ m

$\therefore$ work done, $W = \vec{F} \cdot \vec{s} = (-2\hat{i} + 15\hat{j} + 6\hat{k})(0\hat{i} + 0\hat{j} + 0\hat{k}) = 150$ J.

19. [1] $v^2 = «Rg$ or $v^2 = 0.8 \times 84.5 \times 10$ or $v = 26\,\text{m s}^{-1}$.

20. [2] Total mechanical energy, $E = -\frac{GMm}{2r}$

$\therefore \quad \frac{E_1}{E_2} = \frac{m_1}{m_2} \times \frac{r_2}{r_1} = \frac{3}{1} \times \frac{4r}{1} = \frac{12}{1}.$

21. [1] $S = R\left[\frac{100-25}{25}\right] \Rightarrow S = 3R$

$\frac{10S}{10+S} = R\left(\frac{100-50}{50}\right) \Rightarrow \frac{30R}{10+3R} = R$

$3R = 20$

$R = 6.67\,\Omega.$

22. [3] **23. [1]**

24. [2] $(V_A - V_B) - \frac{q}{2} - 8 - \frac{q}{3} + 15 - \frac{q}{4} = 0$

$26 = q\left[\frac{1}{2} + \frac{1}{3} + \frac{1}{4}\right]$

$q = 24\,«\,\text{C}$ Now $V = \frac{24}{3} = 8$ V.

25. [1]

26. [2] $M = NiA$

$N = I$ $A = \frac{1}{2}\left(®(2R)^2 - ®R^2\right) = \frac{3}{4}®R^2$

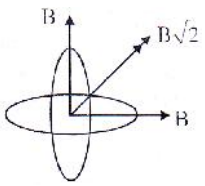
$M = \frac{3}{4}®iR^2.$

27. [4] The given current is a mixture of a dc component of 3A and an alternating current of maximum value 6 A. Hence r.m.s. value

$= \sqrt{(dc)^2 + (\text{r.m.s.value of ac})^2} = \sqrt{(3)^2 + \left(\frac{6}{\sqrt{2}}\right)^2}$

$= \sqrt{(3)^2 + \left(3\sqrt{2}\right)^2} = 3\sqrt{3}$ A.

28. [4]



$\frac{B_{\text{tiet}}}{B_{\text{coil}}} = \frac{\sqrt{2}B}{B} = \frac{\sqrt{2}}{1}.$

29. [1]

30. [1] Net magnetic field at P, $B_{net} = 2B\sin^{-}$, where

B = magnetic field due to one wire at P, i.e., $B = \frac{«_0 i}{2®r}$, and $\sin^{-} = \frac{a}{r}$

$\therefore \quad B_{net} = 2 \times \frac{«_0}{2®} \cdot \frac{i}{r} \times \frac{a}{r} = \frac{«_0 ia}{®r^2}.$

31. [2] Ammeter reads r.m.s. value so, $i_{\text{rms}} = \frac{V_{\text{rms}}}{X_C} = V_{rms} \times \mu \times C$

$\Rightarrow i_{rms} = \left(\frac{200\sqrt{2}}{\sqrt{2}}\right) \times 100 \times \left(1 \times 10^{-6}\right) = 2 \times 10^{-2} = 20\,\text{mA}.$

32. [1] ¤ = MI $\Rightarrow$ $d¤ = MdI.$

33. [3] Current in LCR circuit becomes highest at resonance when $X_C = X_L$.

34. [4] By Kepler's law, $T^2 \propto R^3$ so $\frac{T^2}{R^3} = \text{const.}$

35. [2] $\mu_0 = 20®$, $\mu = 40®$, $² = 10$s

$\mu = \mu_0 + \sim t$

$20® = \sim(10) \Rightarrow \sim = 2®$ rad / s^2

$^{-} = 20®(10) + \frac{1}{2}(2®)(10)^2$

$^{-} = 200® + 100®$

$^{-} = 300®$

$2n® = 300®$

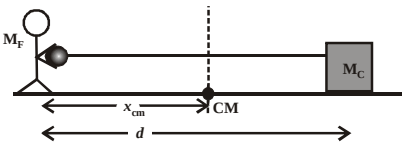
$n = 150$ rounds.

36. [3] **37. [3]** **38. [1]**

39. [1] **40. [2]** **41. [4]**

42. [1]

43. [3] As no external force acts on the system of fisherman (M_F) and crate M_C, so the centre of mass remains at rest while the M_F and M_C are in motion. They will meet at the centre of mass which is located at a distance of



$x_{cm} = \frac{M_C d}{M_C + M_F} = \left(\frac{500}{500+100}\right)600 = 500\,\text{m}$

from the fisherman.

[This is also the distance covered by fisherman before crate reaches him]

44. [1] Rate of change of momentum $\frac{dp}{dt} = F$ and since force on rock remains same it will gain an equal amount of momentum during each second. While rate of change of kinetic energy $\frac{dk}{dt} = Fv$ will increase as it descends down. Also $a = \frac{vdv}{dv}$

$\therefore \quad \frac{dv}{dx} = \frac{a}{v}$ and since v is increasing with distance it falls it can't gain an equal amount of speed for each meter through which it falls.

45. [3] At time t, $\vec{V}_A = \left(\frac{F}{m}\right)t\,\hat{i}$ and $\vec{V}_B = \frac{F}{2m}t\,\hat{i}$

$\therefore \quad \vec{V}_{cm} = \frac{2Ft}{3m}\hat{i}$

thus $\vec{p}_{A'} = m\left[\vec{V}_A - \vec{V}_{cm}\right] = \frac{Ft}{3}\hat{i}$

$\vec{p}_{B'} = 2m\left[\vec{V}_B - \vec{V}_{cm}\right] = -\frac{Ft}{3}\hat{i}$.

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PHYSICS		CHEMISTRY		BOTANY		ZOOLOGY	
1	2	**46**	2	**91**	3	**136**	3
2	1	**47**	3	**92**	1	**137**	2
3	1	**48**	3	**93**	3	**138**	1
4	4	**49**	4	**94**	1	**139**	1
5	3	**50**	3	**95**	4	**140**	3
6	1	**51**	4	**96**	1	**141**	4
7	2	**52**	2	**97**	1	**142**	4
8	3	**53**	2	**98**	2	**143**	4
9	2	**54**	4	**99**	3	**144**	3
10	4	**55**	3	**100**	4	**145**	3
11	4	**56**	3	**101**	3	**146**	3
12	3	**57**	4	**102**	2	**147**	3
13	1	**58**	1	**103**	4	**148**	4
14	2	**59**	2	**104**	4	**149**	1
15	1	**60**	2	**105**	3	**150**	2
16	3	**61**	2	**106**	2	**151**	1
17	2	**62**	3	**107**	4	**152**	1
18	2	**63**	2	**108**	1	**153**	1
19	1	**64**	4	**109**	3	**154**	4
20	2	**65**	1	**110**	2	**155**	4
21	1	**66**	1	**111**	2	**156**	1
22	3	**67**	1	**112**	1	**157**	1
23	1	**68**	2	**113**	1	**158**	4
24	2	**69**	4	**114**	1	**159**	4
25	1	**70**	2	**115**	4	**160**	2
26	2	**71**	1	**116**	2	**161**	4
27	4	**72**	3	**117**	4	**162**	2
28	4	**73**	4	**118**	4	**163**	3
29	1	**74**	2	**119**	2	**164**	3
30	1	**75**	1	**120**	2	**165**	3
31	2	**76**	3	**121**	3	**166**	1
32	1	**77**	3	**122**	2	**167**	2
33	3	**78**	1	**123**	3	**168**	3
34	4	**79**	2	**124**	4	**169**	3
35	2	**80**	3	**125**	2	**170**	3
36	3	**81**	3	**126**	2	**171**	2
37	3	**82**	3	**127**	2	**172**	3
38	1	**83**	4	**128**	2	**173**	4
39	1	**84**	2	**129**	3	**174**	2
40	2	**85**	3	**130**	4	**175**	2
41	4	**86**	3	**131**	4	**176**	1
42	1	**87**	4	**132**	2	**177**	4
43	3	**88**	2	**133**	2	**178**	1
44	1	**89**	2	**134**	3	**179**	4
45	3	**90**	1	**135**	2	**180**	2