SOLUTIONS

PROGRESS TEST-4

GR, GRK & GRS

JEE MAIN PATTERN

Test Date: 22-07-2017

Corporate Office: Paruslok, Boring Road Crossing, Patna-01
Kankarbagh Office: A-10, 1st Floor, Patrakar Nagar, Patna-20
Bazar Samiti Office : Rainbow Tower, Sai Complex, Rampur Rd.,
Bazar Samiti Patna-06
Call : 9569668800 | 7544015993/4/6/7

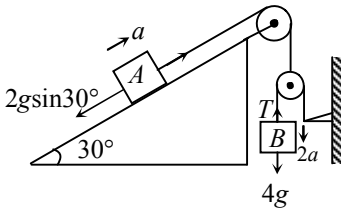
PHYSICS

1. (C)

$$\mu mg = m\left(\frac{mg}{4m}\right) \Rightarrow \mu = \frac{1}{4}$$

2. (C)

If acceleration of block *A* is *a* upward along the incline, then acceleration of block *B* is 2*a* downward.



For block *B*,

$$4g - T = 8a \quad \ldots(i)$$

For block *A*,

$$2T - 2g\sin 30° = 2a$$

$$\Rightarrow \quad T - \frac{g}{2} = a \quad \ldots(ii)$$

From (i) and (ii)

$$9a = \frac{7g}{2}$$

$$a = \frac{70}{18}\ m/s^2 = \frac{35}{9}\ m/s^2$$

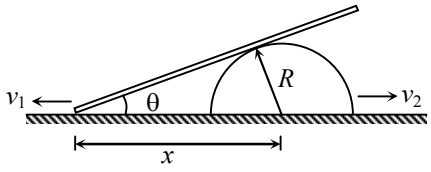
3. (A)

This is the situation similar to elastic collision of ball impinging on floor and bouncing back.

4. (B)

$$v_{avg} = \frac{\frac{1}{2}\times\frac{t}{2}\times v + \frac{t}{2}\times v}{t} = \frac{3v}{4}$$

5. (A)



$$\frac{dx}{dt} = v_1 + v_2$$

$$\sin\theta = \frac{R}{x}$$

$$x = R\ \text{cosec}\ \theta$$

$$\frac{dx}{dt} = -R\ \text{cosec}\ \theta\ \cot\theta\ \frac{d\theta}{dt}$$

$$\frac{d\theta}{dt} = \frac{-(v_1+v_2)\sin^2\theta}{R\cos\theta}$$ (–ve sign shows that θ decreasing with time)

6. (B)

$a_c = k^2 rt^2$ or $\frac{v^2}{r} = k^2 rt^2$ or $v = krt$

Therefore, tangential acceleration, $a = \frac{dv}{dt} = kr$

or tangential force, $F_t = ma_t = mkr$

Only tangential force does work,

Power = $F_t v = (mkr)(krt)$ or Power = $mk^2 r^2 t$

7. (B)

Let x be the extension in the spring when 2 kg block leaves the contact with ground. Then,

$kx = 2g$

or $x = \frac{2g}{k} = \frac{2 \times 10}{40} = \frac{1}{2}$ m

Now, from conservation of mechanical energy

$mgx = \frac{1}{2}kx^2 + \frac{1}{2}mv^2$ (m = 5 kg)

or $v = \sqrt{2gx - \frac{kx^2}{m}}$

Substituting the values $v = \sqrt{2 \times 10 \times \frac{1}{2} - \frac{(40)}{4 \times 5}} = 2\sqrt{2}$ m/s

8. (A)

If block M moves a distance of x the extension in spring increases by 2x.

By work energy theorem,

$$\frac{1}{2}k[x_0^2 - (x_0 + 2x)^2] + Mgx = O$$

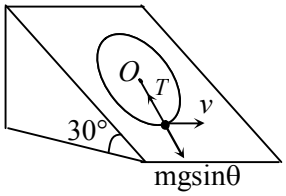
$$-\frac{1}{2}k(4x^2 + 4xx_0) + Mgx = O$$

$$\frac{1}{2}k(4x + 4x_0) = Mg$$

$$x + x_0 = \frac{Mg}{2k}$$

$$x = \frac{Mg}{2k} - x_0$$

9. (B)



$T - mg \sin\theta = \frac{mv^2}{r}$

$T = mg \sin\theta + \frac{mv^2}{r}$

$= 2 \times 10 \times \frac{1}{2} + \frac{2 \times 36}{0.5}$

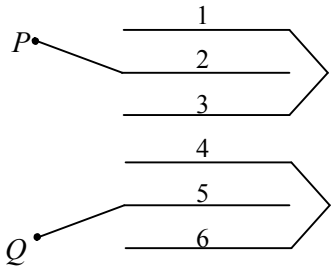
$= 10 + 144$

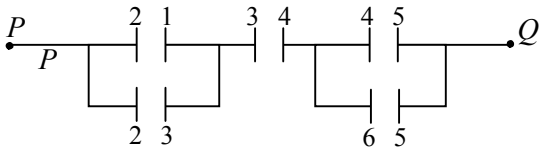
$= 154$ N

10. (D)

$$\frac{1}{C_{eff}} = \frac{1}{3C} + \frac{1}{C} \Rightarrow C_{eff} = \frac{3C}{4}$$

11. (C)





$C = \frac{\varepsilon_0 A}{d}$

$$\frac{1}{C_{eq}} = \frac{1}{2C} + \frac{1}{C} + \frac{1}{2C} = \frac{4}{2C}$$

$$C_{eq} = \frac{C}{2} = \frac{\varepsilon_0 A}{2d}$$

12. (C)

By Guass theorem, $\oint EdS = \frac{1}{\varepsilon_0}\int dq$

$\Rightarrow \quad E = \frac{\rho}{\varepsilon_0}\left(\frac{r}{2} - \frac{r^2}{9}\right)$

for max. electric field, $\frac{dE}{dr} = 0$

$\Rightarrow \quad \frac{1}{2} - \frac{2r}{9} = 0 \qquad \Rightarrow \quad r = \frac{9}{4}$

13. (C)

Centripetal force on electron at distance *r* from centre of disc.

$$m\omega^2 r = eE \Rightarrow E = \frac{m\omega^2 r}{e}$$

$$Q = \int_O^R \rho dV = \int_O^R \frac{2\varepsilon_0 m\omega^2}{e} \times 2\pi r \ell \, dr$$

$$= \frac{2\pi\varepsilon_0 m\omega^2 R^2 \ell}{\varepsilon_0}.$$

14. (B)

Work done on innermost shell

$$W_1 = \Delta U_1 + \Delta U_{12} + \Delta U_{13}$$

$$= \frac{KQ^2}{12r}$$

Work done on middle shell

$$W_2 = \Delta U_2 + \Delta U_{21} + \Delta U_{23}$$

$$= \frac{KQ^2}{3r}$$

$$\therefore \quad \frac{W_1}{W_2} = \frac{1}{4}.$$

15. (A)

Electrostatic field is always conservative.

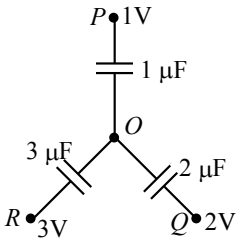
16. (D)

$C_{final} = C_1 + C_2$, $V_{common} = \left(\frac{C_1 V_0}{C_1 + C_2}\right)$

$$E_{final} = \frac{1}{2}(C_1 + C_2)\left(\frac{C_1 V_0}{C_1 + C_2}\right)^2 = \frac{C_1^2 V_0^2}{2(C_1 + C_2)} = \frac{C_1 U_0}{C_1 + C_2}$$

$$E_{initial} = \frac{1}{2} C_1 V_0^2 = U_0, \qquad E_{loss} = E_{initial} - E_{final} = \frac{C_2 U_0}{C_1 + C_2}$$

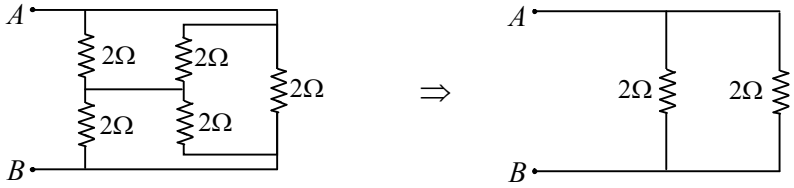
17. (D)



$$1(v-1)+2(v-2)+3(v-3)=0$$

$$v=\frac{7}{6}\text{V}$$

18. (A)



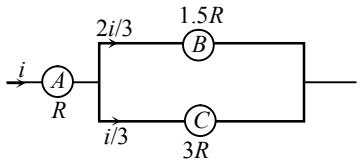
$$R_{AB}=\frac{2\times 2}{2+2}=1\Omega$$

19. (C)

Net resistance = $\frac{3}{2}\ \Omega$

Then by Kirchoff law 6 = $\frac{3}{2}i$, i = 4 amp

20. (A)



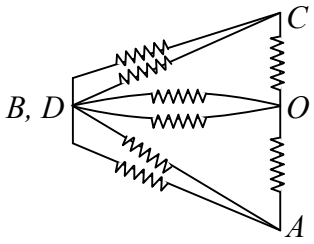
$V_A = iR$

$$V_B=\left(\frac{2i}{3}\right)1.5R=iR$$

$$V_C=\left(\frac{i}{3}\right)(3R)=iR$$

21. (A)

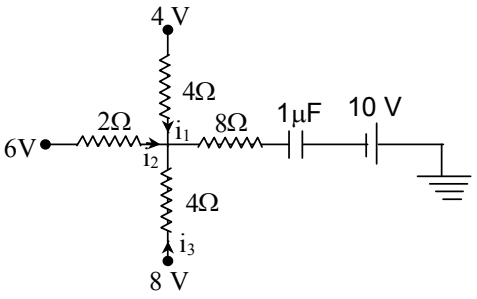
From symmetry. B and D are points having same potential so, redrawing the network as



$$R_{OA}=\frac{14}{15}\Omega$$

22. (D)

Let the potential of the junction be V. Then



$$\frac{6-V}{2}+\frac{4-V}{4}+\frac{8-V}{4}=0$$

$$12-2V+4-V+8-V=0$$

$$24=4V$$

$$V=6 \text{ volt}$$

Potential drop across capacitor

$$=6-(-10)$$

$$=16V$$

Charge on capacitor **= 16 μC**

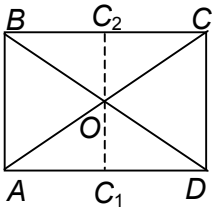
23. (D)

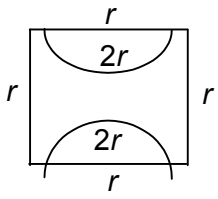
$$\frac{10}{100}\times 40=5-\frac{5}{R+1}\times 1 \Rightarrow R = 4\Omega$$

24. (D)

The circuit can be represented as C_1 O C_2

So we can arrange the circuit in following way





$$\therefore \frac{1}{\text{Re}\,q}=\frac{1}{2r+\frac{2r}{3}}+\frac{1}{2r}+\frac{1}{r}$$

$$= \frac{3}{8r}+\frac{1}{2r}+\frac{1}{r}$$

Req = $\frac{8r}{15}$

25. (B)

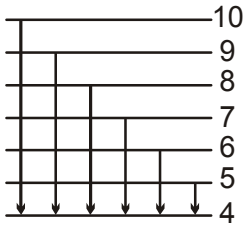
$$1\times\left(\frac{9}{100}\times x\right)=5 \Rightarrow x = 55.55 \text{ cm}$$

26. (D) **27. (C)** **28. (B)** **29.(D)**

30. (C)

CHEMISTRY

31. (B)



6 spectral lines in bracket series.

32. (B)

For $Zn + 2Fe^{+2} \rightarrow Zn^{+2} + 2Fe$ $E^{o}_{cell} = -0.44 + 0.76 = +ve$ and hence, the reaction is spontaneous.

33. (A)

A gas does not liquifies above T_C.

34. (B)

$Cl_2 + 2e^- \longrightarrow 2Cl^-$

(P_2)

$2Cl^- \longrightarrow Cl_2 + 2e^-$

$(P_2) \qquad (P_1)$

$Cl_2 \longrightarrow Cl_2$

$(P_2) \qquad (P_1)$

$$E = \frac{-0.0591}{2}\log\frac{P_1}{P_2}$$

For the cell to be spontaneous

$\Delta G = -nFE = -ve$ and $E = +ve$ i.e. $\mathbf{P_2 > P_1}$.

35. (B)

Ni reacts with CO, So [CO] decreases so, second reaction moves backward i.e $[Cl_2]$ increases so, first reaction also moves backward so, $[PCl_3]$ decreases and $[PCl_5]$ increases.

36. (B)

$$Kt = 2.303\log_{10}\frac{C_0}{Ct}$$

$$K \times 138.6 = 2.303\log_{10}\frac{1}{0.25}$$

or $K = \frac{2.303 \times 2 \times 0.301}{138.6} = \frac{2 \times 0.693}{138.6} = 0.01\,min^{-1}$

rate = K $[R]^1$ = 0.01 × 0.1 = 10^{-3} $Mmin^{-1}$.

37. (B)

For 1 F 1g.eq metal is deposited i.e, 1 mole Ag, $\frac{1}{2}$ mole Cu and $\frac{1}{3}$ mole Al

So, mole ratio $1:\frac{1}{2}:\frac{1}{3} = 6:3:2$

38. (A)

$2H^+(aq.) + 2e^- \longrightarrow H_2(g)$

$E_1 = -\frac{0.059}{2}\log_{10}\frac{P_{H_2}}{[H^+]^2}$ (i)

$E_2 = -\frac{0.059}{2}\log_{10}\frac{100P_{H_2}}{[H^+]^2}$ (ii)

$E_2 - E_1 = \frac{0.059}{2}\log_{10}10^{-2} = -0.059$ decreases

39. (C)

$$H_2(0.4\ atm) \longrightarrow 2H^+(10^{-1}M) + 2e^-$$

$$\frac{2H^+(10^{-2}M) + 2e^- \longrightarrow H_2(0.1atm)}{H_2(0.4\ atm) + 2H^+(10^{-2}M) \longrightarrow 2H^+(10^{-1}M) + H_2(0.1\,atm)}$$

$E_{cell} = 0 - \frac{0.059}{2}\log_{10}\frac{(10^{-1})^2 \times 0.1}{(10^{-2})^2 \times 0.4}$

$= -0.059 \log_{10} 5$

40. (B)

$i = 10 \times 10^{-3} A = 10^{-2} A$

t = ?

mass of $H_2 = 0.01 \times 2$

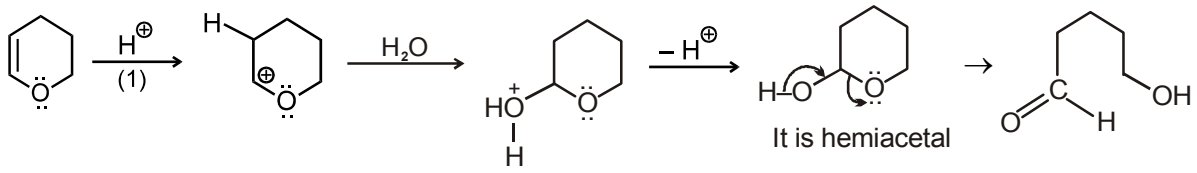
$w = \frac{i \times t}{F}E$

$$0.01\times 2=\frac{10^{-2}\times t}{96500}\times 1$$

$$\text{or}_1\ \ t=\frac{0.01\times 2\times 96500}{10^{-2}}$$

$$=19.3\times 10^{4}\ \text{s}$$

41. (D)



42. (B)

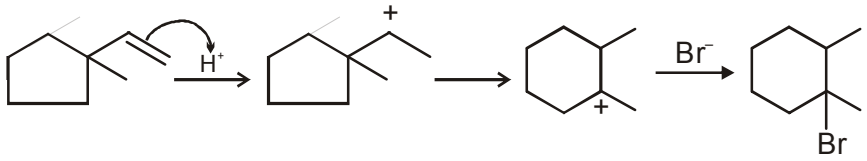
Ring contraction take place.

43. (B)

In this reaction carbocations are formed as intermediate and rearrangement also takes place.

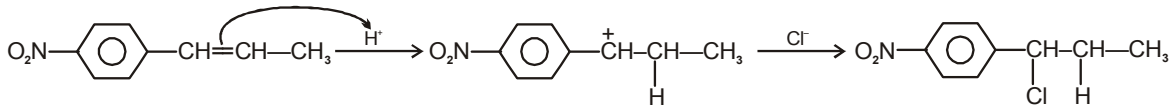
44. (A) **45. (D)** **46. (D)**

47. (A)

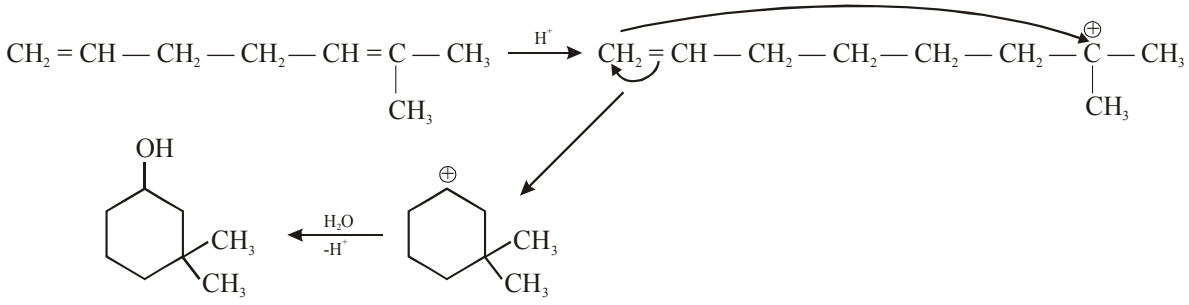


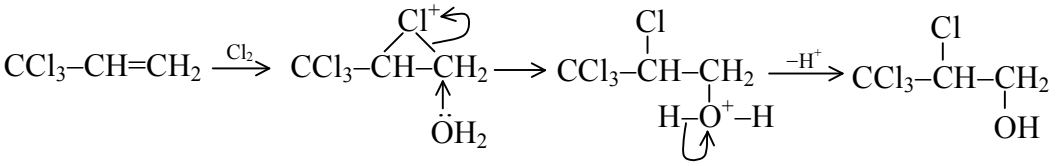
48. (B)

49. (B)



50. (D)





51. (A) **52. (B)** **53. (B)** **54. (A)**

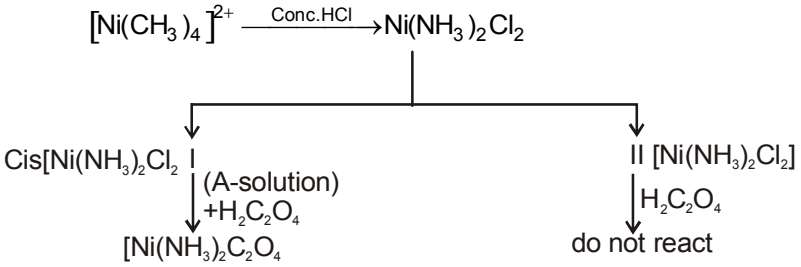
55. (B)

Argentite is a sulphide ore.

56. (D)

The anode mud in the electrolytic refining of silver contains Au.

57. (B)



I = Cis $[Ni(NH_3)_2Cl_2]$

II = Trans $[Ni(NH_3)_2Cl_2]$

58. (A) **59. (D)** **60. (C)**

MATHEMATICS

61. (C)

$$\tan^{-1}1+\tan^{-1}\frac{1}{2}+\tan^{-1}\frac{1}{3}$$

$$\tan^{-1}1+\tan^{-1}\left(\frac{\frac{1}{2}+\frac{1}{3}}{1-\frac{1}{6}}\right)=\frac{\pi}{2}$$

62. (D)

$-1 \le \sin x \le 1$

$-2 \le 2\sin x \le 2$

Range [cos2, 1]

63. (A)

64. (A)

$$\frac{\tan\theta}{\tan\theta-\tan3\theta}+\frac{\cot\theta}{\cot\theta-\cot3\theta}=1$$

65. (D)

$$\log_2\left(x^2+12\right)=4$$

$$x^2=4$$

$$x=\pm2$$

$$x=\pm1$$

x = 0

66. (B)

At x = 0

67. (C)

68. (A)

$y'=0$ at x = 5

$$bx^{\frac{3}{2}}-5a=0$$

$$\frac{a}{b}=\sqrt{5}$$

69. (A)

f(–1) = f(1)

70	**(A)**	**71. (A)**	**72. (B)**	**73. (D)**
74.	**(B)**	**75. (B)**	**76. (D)**	**77. (A)**

78. (B)

79. (D)

$$4=t^2\ ;\ 2=t^3-3t \quad \Rightarrow t=2$$

$$\frac{dy}{dx}=\frac{3t^2-3}{2t}=\frac{9}{4}$$

80.	**(D)**	**81. (C)**	**82. (A)**	**83. (C)**
84.	**(D)**	**85. (C)**	**86. (D)**	

87. (A)

Let a, and b be two number then a, A_1, A_2, b where A_1, A_2 are AM's

$\therefore$ $A_1 + A_2 = a + b$ ....(1)

a, G_1, G_2 b where G_1, G_2 are G.M's then

$G_1G_2 = ab$ ....(2)

a, H_1, H_2, b where H_1, H_2 are Hm's

$$\frac{1}{H_1}+\frac{1}{H_2}=\frac{1}{a}+\frac{1}{b}=\frac{a+b}{ab}$$

$$\therefore \frac{H_1+H_2}{H_1H_2}=\frac{a+b}{ab} \quad .....(3)$$

$$\frac{H_1+H_2}{H_1H_2}=\frac{A_1+A_2}{G_1G_2}$$

$$\frac{G_1G_2}{H_1H_2}=\frac{A_1+A_2}{H_1+H_2}$$

88. (A)

89. (A)

$$S = \frac{5}{2}+\frac{7}{4}+\frac{11}{8}+\frac{19}{16}+.....+t_n$$

$$= \left(1+\frac{3}{2}\right) + \left(1+\frac{3}{4}\right) + \left(1+\frac{3}{8}\right) + \left(1+\frac{3}{16}\right) + \text{upto n term}$$

$$= n + \left(\frac{3}{2}+\frac{3}{4}+\frac{3}{8}+.....\text{upto n term}\right) = n + \frac{\frac{3}{2}\left(1-\frac{1}{2^n}\right)}{1-\frac{1}{2}} = n + 3 - \frac{3}{2^n}$$

90. (A)

$$\cos x = \frac{2\cos(x-y)\cos(x+y)}{\cos(x+y)+\cos(x-y)}$$

$\Rightarrow 2\cos x \cos x \cos y = 2(\cos^2 x - \sin^2 y)$ $\Rightarrow \cos^2x \cos y = \cos^2x - \sin^2y$

$\Rightarrow \cos^2x(1 - \cos y) = \sin^2y$ $\Rightarrow 2\cos^2x \times \sin^2\left(\frac{y}{2}\right) = \sin^2y$

$\Rightarrow 2\cos^2x\sin^2\left(\frac{y}{2}\right) = 4\sin^2\left(\frac{y}{2}\right)\cos^2\left(\frac{y}{2}\right)$ $\Rightarrow \cos x \sec\frac{y}{2} = \pm\sqrt{2}$