SOLUTIONS

PHASE TEST-2

GR, GRK & GRS

(JEE ADVANCED PATTERN)

Test Date: 24-09-2017

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PHYSICS

1. (C)

2. (C)

3. (B)

$\therefore$ $C_{eq} = 3/2\ \mu F$

Charge flow $\Delta q = C_{eq}\ (10 - \frac{15}{3}) = \frac{3}{2} \times 5 = 7.5\ \mu C$

4. (A)

Magnetic moment vectors of three bar magnets represent three side of a triangle taken in order.

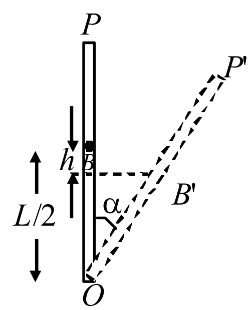
5. (D)

Due to symmetry of the circuit, field will be zero at centre.

6. (B)

When the rod falls through an angle α the C.G. falls through a height *h*.

In $\Delta OB'B$,



$$\cos\alpha = \frac{\left(\frac{L}{2} - h\right)}{L/2}$$

i.e. $h = \frac{1}{2}(1 - \cos\alpha)$

K.E. rotation = Decrease in P.E.

i.e. $\frac{1}{2}I\omega^2 = mgh$

i.e. $\frac{1}{2}\left(\frac{mL^2}{3}\right)\omega^2 = mg\frac{L}{2}(1 - \cos\alpha)$ or $\omega = \sqrt{\frac{6g}{L}}\sin\frac{\alpha}{2}$

7. (A, D) **8. (A,B,C)** **9. (A,C,D)**

10. (A,B,C)

Maximum acceleration block $A = \frac{0.5mg}{m} = \frac{g}{2}$

So, if $M = 2m$, $a_A = a_B = \frac{2mg}{4m} = \frac{g}{2}$ and friction force is $\frac{1}{2}$*mg*.

11. (A,C)

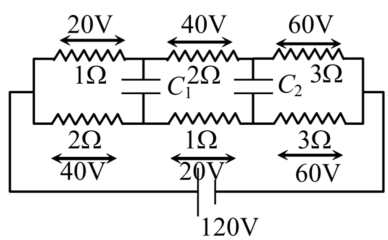
$$\tau = \frac{L}{Req} = \frac{2}{8} = \frac{1}{4}$$

at steady state inductor short circuited

Hence $i = 0.75$

12. (B, D)

Now, potential difference across C_1 is 20 V and across C_2 is zero.



$\therefore$ charge stored in C_1 is 40 μC and in C_2 is zero.

13. (B, D)

R_{eq} = 400 Ω, $I = \frac{100}{400} = \frac{1}{4} A$

Potential difference across voltmeter $= \frac{1}{4} \times 200\Omega$ = 50V

14. (A,C,D)

$$V_0 - V_A = B\frac{(\omega l)l}{2} = \frac{B\omega l^2}{2}$$

$$V_0 - V_C = \frac{B\omega(3l)3l}{2} = \frac{9}{2}B\omega l^2$$

$V_A - V_C = 4B\omega l^2$ or $V_A > V_C$

15. (A) **16. (D)** **17. A)** **18. (D)**

CHEMISTRY

19. (B)

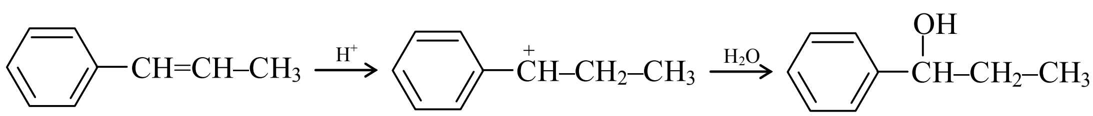
Degree of dissociation

$$\alpha = \frac{(\Lambda_M^c)}{(\Lambda_M^o)} = \frac{3.9}{390} = 0.01$$

$$K_a = \frac{[H^+][A^-]}{[HA]} = \frac{c\alpha.c\alpha}{c - c\alpha} = \frac{c\alpha^2}{1-\alpha} \approx c\alpha^2 = 10^{-6}$$

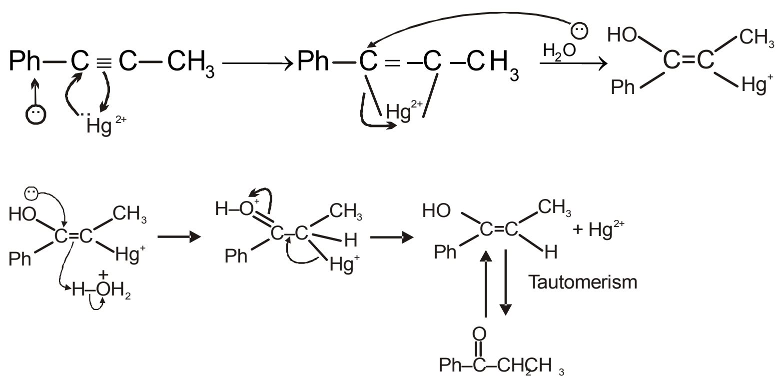
$p^{ka} = 6$

20. (B)



21. (B)

22. (A)



23. (A)

24. (D)

$\underset{A}{C \equiv C}$ $\qquad$ $C = C \underset{B}{-} C \equiv C$ $\qquad$ $C = C \underset{C}{-} C = C$

25. (A,D)

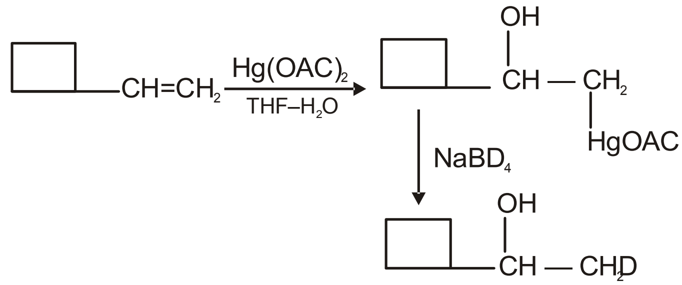
$$P = \frac{A}{Z}$$

When P > 1 experimentally determined value is higher than the predicted value by Arrhenius

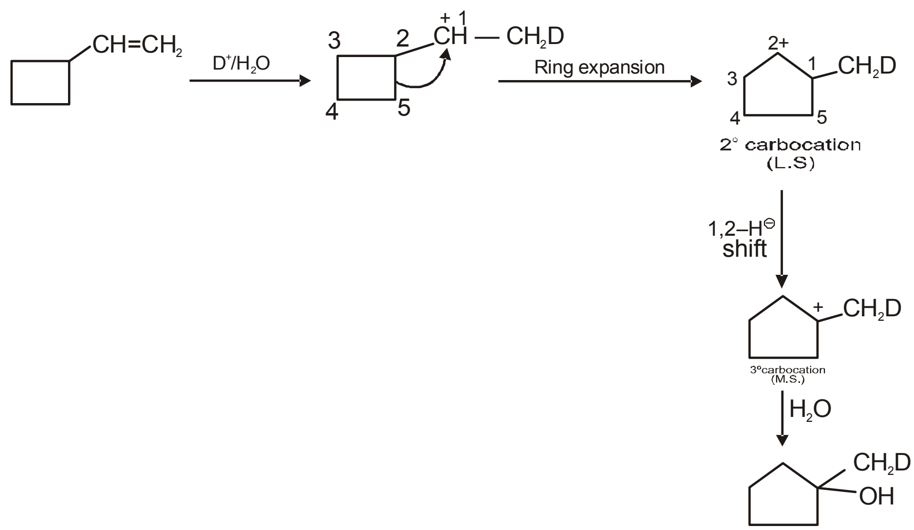
P < < 1, use of catalyst is required.

P > 1. no need to add catalyst. Activation energy can be experimetally calculated by eliminating steric factor.

26. (B,D)



In oxymercuration-demercuration the rearrangement of carbon skeleton doesnot involved.



In acid catalysed-hydration the rearrangement of carbon skeleton involve.

27. (A, B, C, D)

$$\text{RLVP} = \frac{20}{760} = \frac{1}{38} \text{ Ans. (D)}$$

Also, $\frac{P^0 - P_s}{P_s} = \frac{n}{N} \Rightarrow \frac{20}{740} = \frac{1}{N} \Rightarrow N = 37 \text{ mol}$

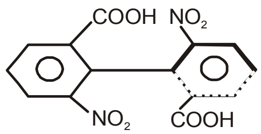
$\therefore$ No. of moles of ice separated = (200 – 37) = 163 moles Ans. (A)

For original solution : $\Delta T_f = 2 \times \frac{1 \times 1000}{200 \times 18} = \left(\frac{10}{18}\right) K = \left(\frac{10}{18}\right) ^\circ C$

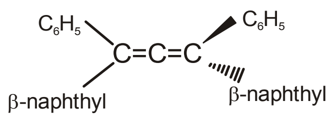
$\therefore$ Freezing point = $0^\circ C - \left(\frac{10}{18}\right) ^\circ C = -\left(\frac{10}{18}\right) ^\circ C$ Ans. (C)

28. (B), (C) **29. (A), (C)** **30. (A), (C)**

31. (A, C)

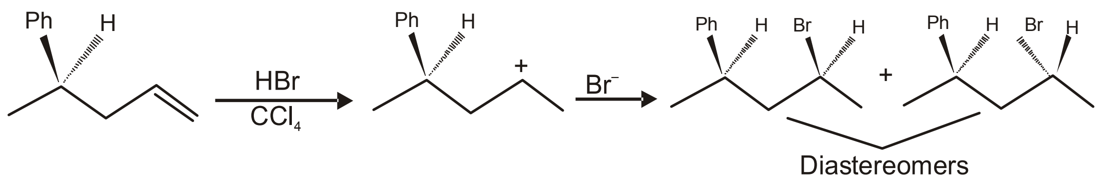


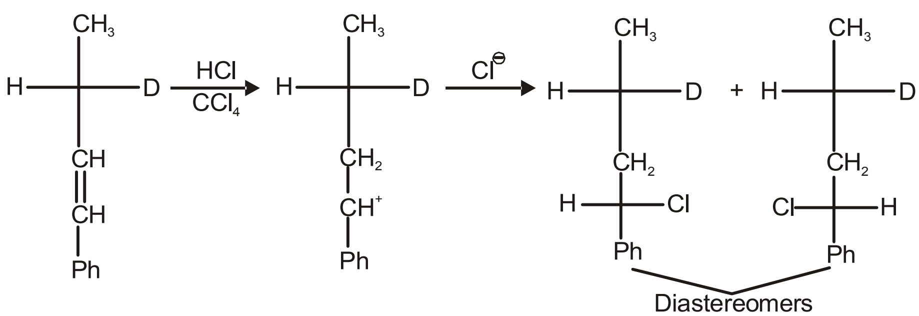
Chiral i.e. why it show optical isomerism

(C) 

Chiral i.e. why it show optical isomerism.

32. (B), (D)

(B) 

(D) 

33. (D)

In the given solution 'M', H_2O is solute.

Therefore, molality of H_2O = $\frac{0.1}{0.9 \times 46} \times 1000 = 2.4$

$\Rightarrow \Delta T_f = k_f^{ethanol} \times 2.4 = 2 \times 2.4 = 4.8$

$\Rightarrow T_f = 155.7 - 4.8 = 150.9$ K

34. (B)

Now ethanol is solute.

Molality of solute = $\frac{0.1}{0.9\times 18}\times 1000 = 6.17$

$\Rightarrow \quad \Delta T_b = 6.17\times 0.52 = 3.20$

$\Rightarrow \quad T_b = 373 + 3.2 = 376.2$ K

35. (B)

36. (C)

Stability of C^+.

MATHEMATICS

37. (A)

$$\int_0^3 (3x - x^2)dx = \left[\frac{3x^2}{2} - \frac{x^3}{3}\right]_0^3 = \left[\frac{27}{2} - 9\right] = \frac{9}{2}$$

38. (A)

Family of parabolas is $y^2 = \alpha(x-\beta)$

$\Rightarrow 2yy' = \alpha \Rightarrow (y')^2 + yy'' = 0$

order $\rightarrow 2$, degree $\rightarrow 1$

39. (D)

Let $g(x) = f^{-1}(x)$; $f\left(\frac{\pi}{2}\right) = \pi \;\Rightarrow\; f^{-1}(\pi) = \frac{\pi}{2}$

$f'(x) = 6(2x-\pi)^2 + 2 + \sin x \;\Rightarrow\; f'\left(\frac{\pi}{2}\right) = 3$

Also $g(\pi) = \frac{\pi}{2}$

Now f(g(x)) = x $\Rightarrow \quad f'(g(x)).g'(x) = 1$

$\Rightarrow \; f'(g(\pi)).g'(\pi) = 1 \;\Rightarrow\; f'\left(\frac{\pi}{2}\right)\cdot g'(\pi) = 1 \;\Rightarrow 3g'(\pi) = 1 \;\Rightarrow g'(\pi) = \frac{1}{3}$

40 (D)

$$I=\int\frac{x^2+2}{x^4-x^2+4}=\int\frac{1+\frac{2}{x^2}}{x^2+\frac{4}{x^2}-1}dx$$

say $x-\frac{2}{x}=t \Rightarrow \left(1+\frac{2}{x^2}\right)dx=dt$

$$\Rightarrow\ I=\int\frac{dt}{t^2+3}=\frac{1}{\sqrt{3}}\tan^{-1}\left(\frac{t}{\sqrt{3}}\right)+c=\frac{1}{\sqrt{3}}\tan^{-1}\left(\frac{x^2-2}{\sqrt{3}x}\right)+c.$$

41. (C)

The given expression can be written as 4 sin3x (cos3x – sin3x) + 5

= 2 sin6x + 5 – 4 $\sin^2$3x = 2 (sin6x + cos6x) + 4

Hence minimum value = $3-2\sqrt{2}$

42. (C)

We have $\lim\limits_{n\to\infty}\frac{3n\cdot 4^{2n}}{3n(x-3)^{2n}+3n\cdot 4^{2n+1}-4^{2n}}=\frac{1}{4}$;

So $\lim\limits_{n\to\infty}\frac{1}{\left(\frac{x-3}{4}\right)^{2n}+4-\frac{1}{3n}}=\frac{1}{4}$

Clearly $-1<\frac{x-3}{4}<1 \Rightarrow \quad -1<x<7$

$\therefore$ Possible integers in the range 'x' are 0, 1, 2, 3, 4, 5, 6 $\Rightarrow$ 7 integers

43. (A, B)

Normal is y = mx – 2am – am^3 passes through (5a, 2a)

$\Rightarrow am^3-3am+2a=0\Rightarrow m^3-3m+2=0,(m-1)(m^2+m-2)=0$

$\Rightarrow m=1,-2\Rightarrow$ normals are $y=x-3a$ and $y=-2x+12a$

44. (A, B, C, D)

45. (A,B,D)

We have $f(x)=\cos^{-1}(-\{-x\})$

D_f = R

As $0\le\{-x\}<1\ \forall x\in R$ $\qquad\Rightarrow\ -1<-\{-x\}\le 0$

So $R_f = \left[\frac{\pi}{2}, \pi\right)$

Clearly, f is neither even nor odd.

But f (x + 1) = f (x) $\Rightarrow$ f is periodic with period 1.

46. (B, C)

From given

$$\sum_{i=1}^{2p} \sin^{-1} x_i = -(2p)\frac{\pi}{2} \quad p \in N \Rightarrow \sin^{-1} x_i = -\frac{\pi}{2} \quad \forall i \Rightarrow x_i = -1 \; \forall i$$

So, (B) and (C) are true

47. (B, D)

For (A) Put $\sqrt{3}x = y$, we get $\int_0^\infty e^{-3x^2} dx = \frac{\sqrt{\pi}}{2\sqrt{3}}$

For (B) $\int_0^\infty xe^{-x^2} dx = \left|-\frac{1}{2}e^{-x^2}\right|_0^\infty = \frac{1}{2}$

But $\int_0^\infty x^2 e^{-x^2} dx = \left|x\left(-\frac{1}{2}e^{-x^2}\right)\right|_0^\infty + \frac{1}{2}\int_0^\infty e^{-x^2} dx = \frac{\sqrt{\pi}}{4}$

48. (B, C)

$4a^2 + b^2 = 4c^2 + 4ab \Rightarrow 4a^2 + b^2 - 4ab = 4c^2 \Rightarrow (2a - b)^2 = 4c^2$

$\Rightarrow 2a - b - 2c = 0, 2a - b + 2c = 0$

Take 2a – b – 2c = 0 the 2ax + by + 2c = 0

$\Rightarrow 2ax + by + (2a - b) = 0$

2a (x + 1) + b(y - 1) = 0

$\Rightarrow y - 1 = \lambda(x + 1)$

Hence differential equation of the family is $y - 1 = y'(x + 1)$

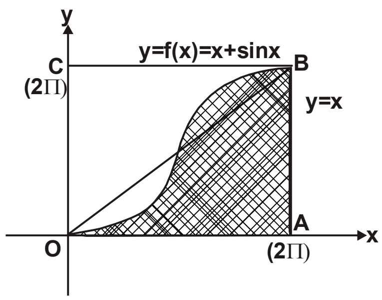
$\Rightarrow$ orthogonal trajectory is $(x + 1)^2 + (y - 1)^2 = \alpha$

Also for 2a – b + 2c = 0 orthogonal trajectory $(x - 1)^2 + (y + 1)^2 = \beta$, where α and β are parameters.

49. (B, C)

50. (B, C)

The required area is equivalent to the area bounded by f(x) with x-axis from x = 0 to $x = 2\pi$.



Thus Required Area = $\int_0^{2\pi} f(x)dx = \int_0^{2\pi}(\sin x + x)dx = \left[-\cos x + \frac{x^2}{2}\right]_0^{2\pi}$ = $2\pi^2$ sq.units

51. (B)

52. (C)

$$I_n = \int_0^{\pi/4} \tan^{n-2} x(\sec^2 x - 1)\,dx = \int_0^1 t^{n-2}dx - I_{n-2}$$

$$\Rightarrow I_n + I_{n-2} = \frac{1}{n-1} \Rightarrow I_{n+1} + I_{n-1} = \frac{1}{n}$$

$$\because I_n < I_{n-2} \Rightarrow 2I_n < I_n + I_{n-2} = \frac{1}{n-1}$$

Also, $I_n > I_{n+2} \Rightarrow 2I_n > I_n + I_{n+2} = \frac{1}{n+1}$

Hence $\frac{1}{n+1} < 2I_n < \frac{1}{n-1}$

53. (C)

54. (B)

$$y = vx \Rightarrow v + x\frac{dv}{dx} = v + \tan v$$

$$\Rightarrow \cot v\, dv = \frac{dx}{x} \Rightarrow \ell n(\sin v) = \ell n(x) + \ell n(k)$$

$$\Rightarrow \sin v = kx \Rightarrow y = x\sin^{-1}(kx)$$

putting x = 1, y = $\pi/2$ we have k = 1

$\Rightarrow$ Solution is y = x $\sin^{-1} x$