Monthly Progressive Test (Solution)

Class: XII

Subject: PCMB

Academic Excellence Programme TECHNO ACE

Test Booklet No.: MPT06 | Test Date: 03102024

Physics

1. Ⓐ

$$h_2 = \frac{12.5}{1.63} = 7.67 \text{ cm}$$

$$h_1 - h_2 = 9.4 - 7.67 = 1.73$$

2. Ⓑ

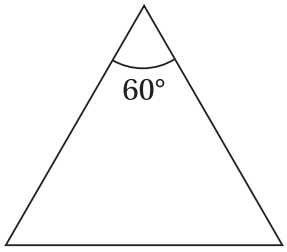
$$(\sin i)\cdot\frac{4}{3} = (\sin r)\cdot\frac{3}{2}$$

$$\sin r = (\sin 45^\circ)\times\frac{8}{9} = \frac{4\sqrt{2}}{9} = \frac{5.656}{9} = 0.63$$

3. Ⓒ

$$\delta_{\min} = 40^\circ$$

$$\mu = \frac{\sin\left(\frac{60+40}{2}\right)}{\sin\left(\frac{60}{2}\right)} = \frac{\sin(50^\circ)}{\sin 30^\circ} = 2\sin 50^\circ = 1.53 \qquad (\sin 50^\circ = 0.766)$$



4. Ⓒ

$$r = \frac{h}{\sqrt{\mu^2 - 1}} = \frac{80}{\sqrt{\frac{16}{9} - 1}} = \frac{80\times 3}{\sqrt{7}} \text{ cm}$$

$$\pi r^2 = \frac{22}{7}\times\frac{6400\times 9\times 10^{-4}}{7} \text{ m}^2 = 2.58 \text{ m}^2 \text{(c)} \qquad (\mu = 4/3)$$

5. Ⓓ

$$\frac{1}{20} = (1.55 - 1)\times\frac{2}{R} \quad \Rightarrow R = 40\times 0.55 = 22 \text{ cm}$$

6. Ⓐ

$$\frac{1}{20}=\frac{1}{v}-\frac{1}{12} \quad \Rightarrow \frac{1}{v}=\frac{32}{20\times 12} \quad \Rightarrow v=\frac{15}{2}=7.5 \text{ cm}$$

7. Ⓑ

$$\frac{1}{-21}=\frac{1}{v}-\frac{1}{-14} \quad \Rightarrow \frac{1}{v}=-\left(\frac{1}{21}+\frac{1}{14}\right)$$

$$\frac{1}{v}=-\frac{35}{21\times 14} \quad \Rightarrow v=-\frac{42}{5}=-8.4 \text{ cm}$$

8. Ⓒ

$$\frac{1}{F}=\frac{1}{30}-\frac{1}{20}=-\frac{10}{30\times 20}$$

$F = -60$ cm

9. Ⓓ

$$\text{Apparent depth} = \frac{15}{1.5}=10 \text{ cm}$$

Vertical shift = 15 – 10 = 5 cm

10. Ⓐ

For normal eye, far point is at infinity.

11. Ⓑ

$f_0 = 140$ cm $\qquad f_e = 5$ cm

$$m=-\left(\frac{f_0}{f_e}\right)=-\frac{140}{5}=-28$$

12. Ⓐ

$l = f_0 + f_e$ when final image is at infinity.

13. ©

$$\sqrt{3} = \frac{\sin\left(\frac{A+A}{2}\right)}{\sin\left(\frac{A}{2}\right)} = \frac{\sin A}{\sin\frac{A}{2}} = 2\cdot\cos\left(\frac{A}{2}\right)$$

$$\therefore \frac{\sqrt{3}}{2} = \cos\frac{A}{2} = \cos 30^\circ \qquad \therefore\ A = 60^\circ$$

(A) ✓

(R) ×

14. Ⓐ

$$\frac{1}{D-u} - \frac{1}{-u} = \frac{1}{f} \Rightarrow \frac{u+D-u}{(D-u)u} = \frac{1}{f} \Rightarrow Df = uD - u^2 \Rightarrow u^2 - uD + df = 0$$

$B^2 = 4AC$ (real roots)

$D^2 \geq 4\cdot 1\cdot Df$

$D \geq 4f$ i.e., $4f \leq D$

Or, $4f = D$ for maximum focal length.

15. Ⓓ

$$R \propto \frac{1}{r^4} \Rightarrow R = \frac{k}{r^4} \Rightarrow \ln R = \ln k - 4\ln r \Rightarrow \frac{dR}{R} = -4\frac{dr}{r}$$

16. Ⓑ

$i_0 = i_1 + i_2$ apply Kirchoff's current law.

17. Ⓐ

$$i = \frac{dq}{dt} = \frac{d}{dt}(2t) = 2A$$

18. Ⓐ

The terminal potential difference of discharging type cells is $V = E - i\cdot r$.

19. Ⓓ

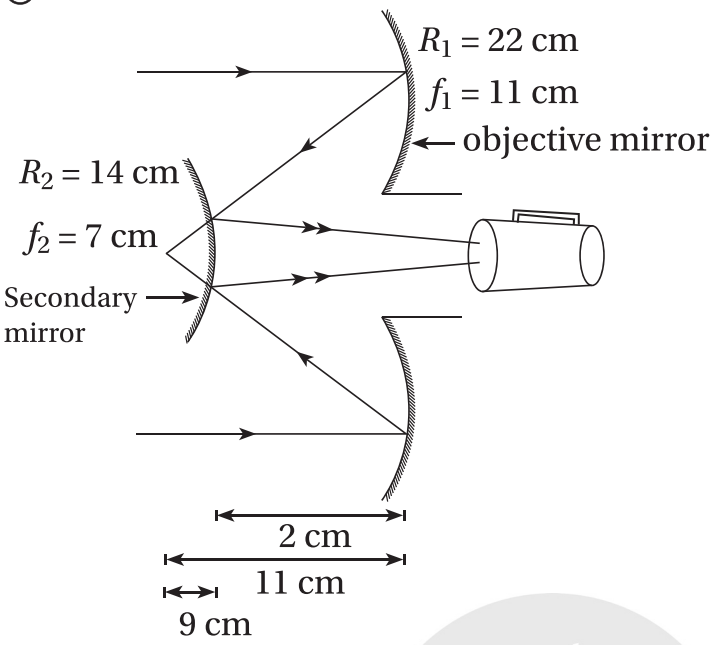
$E_{net} = 0$ inside metal

20. Ⓑ

One convex mirror and another concave mirror.

$\therefore\ n = 2$

21. ©



$$\frac{1}{v}+\frac{1}{u}=\frac{1}{7}$$

$$\frac{1}{v}+\frac{1}{+9}=\frac{1}{7}$$

$$v=\frac{63}{2}=31.5 \text{ cm}$$

Thus, the final image is formed at 31.5 cm from small mirror.

22. Ⓓ

$$|m|=\left[\frac{f_0}{f_e}\left(1+\frac{f_e}{D}\right)\right]=\left[\frac{140}{5}\left(1+\frac{5}{25}\right)\right]=33.6$$

23. Ⓓ

$$\frac{1}{F}=\frac{1}{f_1}+\frac{1}{f_2}-\frac{d}{f_1\cdot f_2}=\frac{1}{3}-\frac{1}{20}-\frac{8}{30\times(-20)}=-\frac{10}{30\times 20}+\frac{8}{6\times 100}$$

$$=-\frac{1}{60}+\frac{2}{6\times 25}=-\frac{1}{6}\cdot\left[\frac{1}{10}-\frac{2}{25}\right]=-\frac{1}{6}\times\frac{5}{250}$$

$F = -300$ cm

24. Ⓑ

On doubling the slit width $d' = 2d$

using formula $\theta' = \frac{\lambda}{d'} = \frac{\lambda}{2d} = \frac{\theta}{2}$

The angular width of central maximum which is $\frac{\lambda}{2d}$ is halved. As the area of central becomes $\frac{1}{4}$ times and the intensity is also one-fourth.

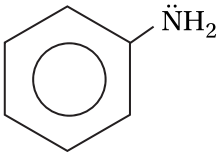
25. Ⓑ

$\sin\theta = \frac{\lambda}{d} = \frac{10^{-7}}{3} \qquad \therefore \theta \cong 0$

i.e., the bending of light waves is almost zero.

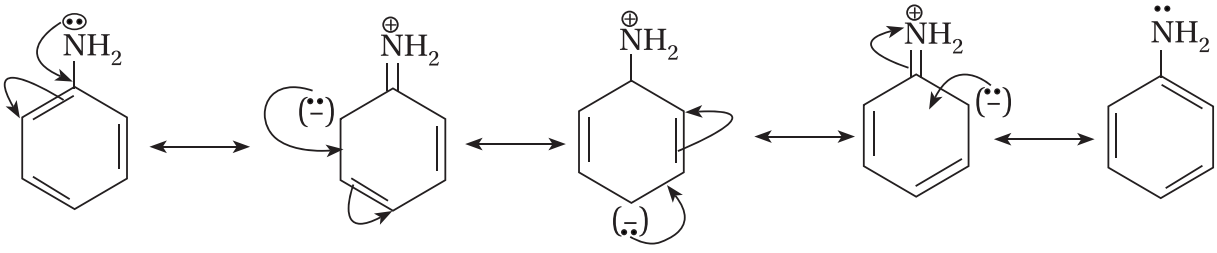
Chemistry

26. Ⓐ



Explanation:

Aliphatic amine is more basic than aromatic amine. Aniline is weakest Bronsted base among the given four compounds due to resonance present in aniline.

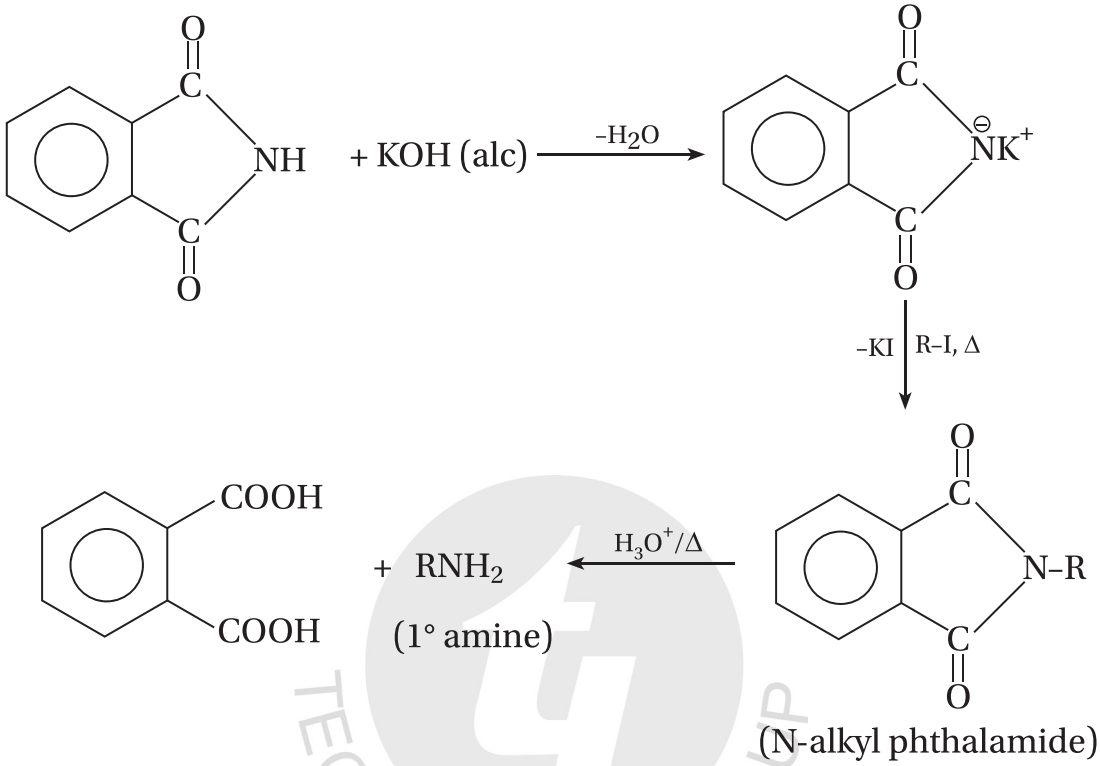


Hence, lone pair of Nitrogen are less available for donation to the acid.

27. Ⓓ

Potassium phthalamide, $C_6H_4(CO_2)N^-K^+$

Source of Nitrogen in Gabriel phthalamide synthesis is potassium phthalamide.



(N-alkyl phthalamide)

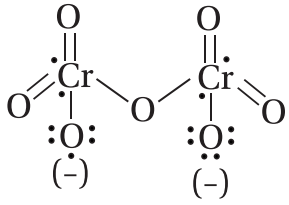
28. Ⓐ

Methyl isocyanate:

CH_3–N=C=0 (MIC) gas was leaked from the storage tank of the Union Carbide Plant in Bhopal gas tragedy.

29. Ⓑ

The structure of dichromate is :



It exhibit resonance phenomenon except the bridged Cr—O—Cr. Hence, all 6Cr—O bonds are equivalent.

30. Ⓒ

Cationic part is named first

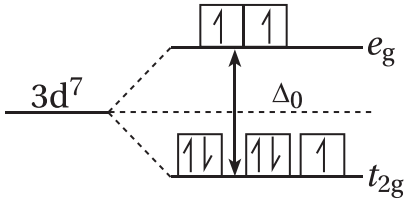
$[Ni(NH_3)_4]^{2+}$ = tetra amine nickel (II)

$[NiCl_4]^{2-}$ = tetrachloro nickelate (II)

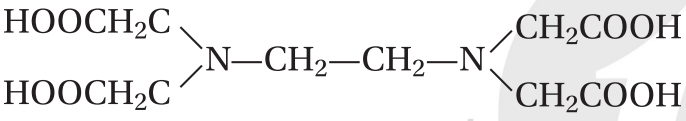
Hence, tetra amine nickel (II) — tetrachloro nickelate (II)

31. Ⓐ

In the complex $[Fe(H_2O)_5NO] \cdot SO_4$, Fe is in +1 oxidation state become NO is in +1 state. Since weak field complex has $3d^7$ configuration at Fe (I). Since, in the complex Fe has 3 unpaired electrons it is paramagnetic. Thus both assertion and reason both are true and reason is the correct explanation of assertion.



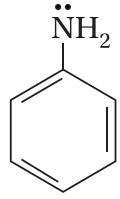
32. Ⓒ

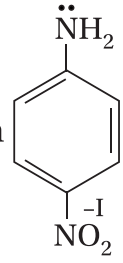
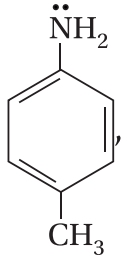


(E.D.T.A)

(ethylene diamine tetra acetic acid)

33. Ⓓ

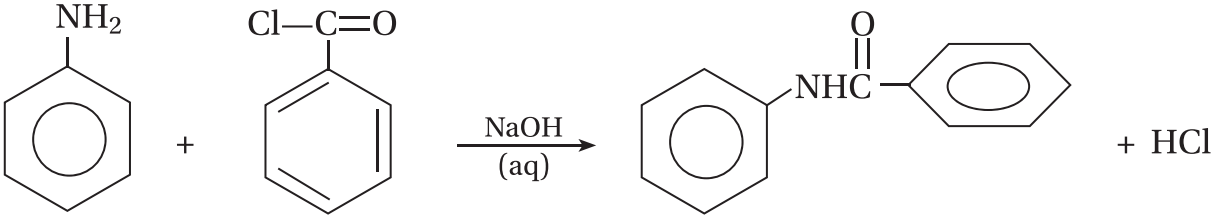
In,  (I) due to the presence of lone pair of 'N' atom it is basic which can donate.

In  (II), due to presence of –I effect of $-NO_2$ group electron density over the 'N' atom further decrease so it is less basic than aniline. While in  , due to presence of +I effect of $-CH_3$ group electron density over the 'N' atom is further increased and hence it is the most basic. Thus, basic strength increases II < I < III in this order.

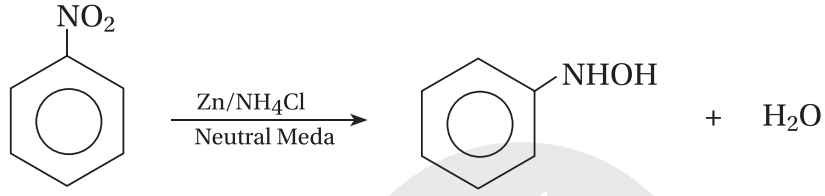
34. Ⓑ

Scotten-Baumann Reaction

Acylation of amine by the action of acid chloride in the aqueous alkali solution is known as Schotten-Baumann reaction.



35. Ⓑ



(Nitrobenzene) 4[H] (N-phenyl hydroxyl amine)

36. Ⓒ

$3° > 2° > 1° > NH_3$

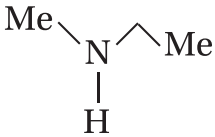
In gas phase there is no solvation effect. Hence, basic strength only depends on +I effect. Also, greater the number of alkyl group higher is the +I effect. So, decrease basic strength $R_3N > R_2NH > RNH_2 > NH_3$

37. Ⓒ

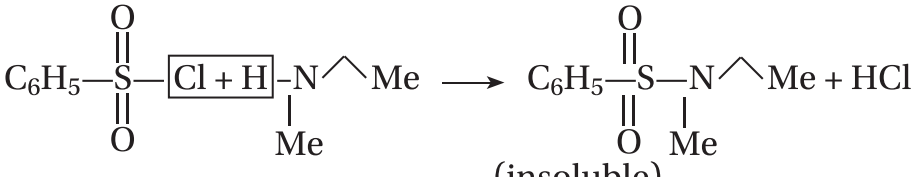
$(CH_3)_3N$; The amine that does not react with acetyle chloride is $(CH_3)_3N$ as it has Hydrogen.

38. Ⓑ

1°, 2° & 3° amine can be distinguish by using Hinsberg's reagent i.e., benzene sulphonyl chloride, 1° amine reacts with it to give white ppt which is soluble in aqueous NaOH.

C_3H_9N i.e.,  being a 2° amine forms a white precipitate which is insoluble in aqueous NaOH.

3° amine; or Me_3 does not react with benzene sulphonyl chloride.



(insoluble)

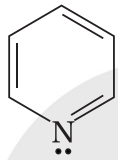
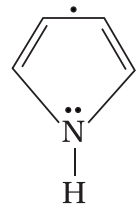
39. Ⓓ

The product formed by the reaction of acetamide with bromide in preserve of NaOH is CH_3NH_2. This is known as Hoffman's Degradation.

$$\underset{\text{(Acetamide)}}{CH_3-\overset{\overset{O}{\|}}{C}-NH_2} + Br_2 + 4NaOH \xrightarrow{\Delta} \underset{\substack{\text{Methyl}\\\text{amine}}}{CH_3NH_2} + Na_2CO_3 + 2NaBr + 2H_2O$$

This reaction involves the migration of an alkyl group from the Carbonyl carbon atom of amide to the nitrogen atom. Carbonylic acid group leaves as metal carbonate by-product.

40. Ⓐ

The most nucleophilic nitrogen is  (Pyridine). In 

In other compounds l.p. of 'N' atom is delocalised in ring & less available.

41. Ⓑ

$$CH_3-CH=CH_2 \xrightarrow[NaBH_4]{Hg(CH_3CO)_2 \text{ in } CH_3COOH} \underset{\text{(secondary alcohol)}}{CH_3-CH(OH)CH_3}$$

(i) Product is optically inactive.
(ii) Product is less soluble in water than $CH_3CH_2CH_2OH$.
(iii) After oxidation, it produces CH_3CH_2CHO

42. Ⓓ

H_2SO_4 does not suffer either oxidation or reduction. At the time of discharging, Pb is oxidised to Pb^{2+} and PbO_2 is reduced to Pb^{++}

43. Ⓐ

Chloride ion (Cl^-) reacts with the cations and solid compounds like AgCl, Hg_2Cl_2, TlCl are produced. Thus, the cell is destroyed.

44. Ⓐ

$$CH_3CHO \xrightarrow[NaOH/\Delta]{\text{Dilute}} CH_3CHCHCHO \xrightarrow[H_3O^+]{LiAlH_4} CH_3CH_2CH_2CH_2OH$$

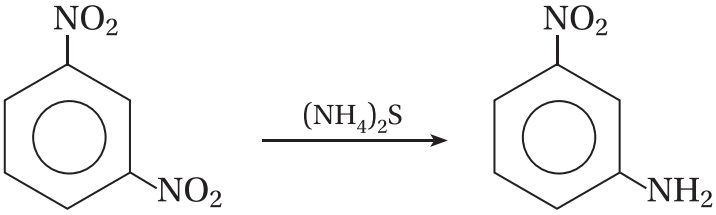
$$CH_3CH_2CH_2CH2-OH \xrightarrow[KMnO_4]{\text{Alkaline}} CH_3CH_2CH_2COOH \xrightarrow[\Delta]{NaOH/CaO} CH_3CH_2CH_3$$

45. Ⓑ

C—Cl bond is weaker than C—C bond and C—O bond. Hence, chloride is released from the molecule very easily.

46. Ⓒ

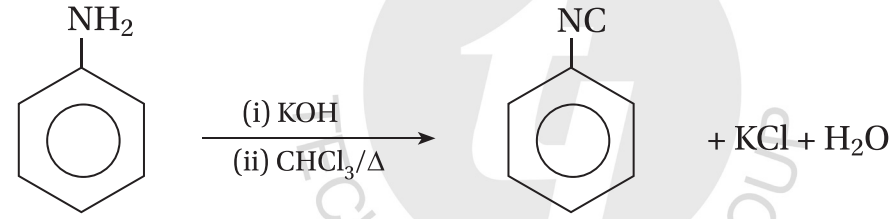
The selective reduction of nitro group is Zinin reaction or Zinin reduction.



(m-nitroaniline)

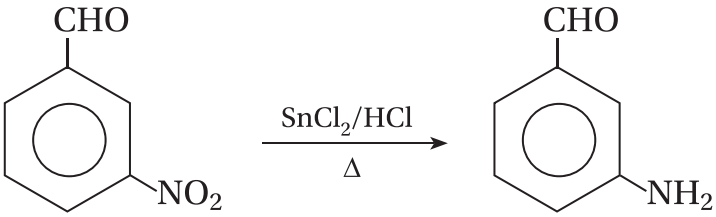
47. Ⓐ

1° amino like aniline gives isocyanide test. This is Carbylamine test,



(Aniline) (Foul smelling gas Benzeneisocyamide)

48. Ⓒ



49. Ⓐ

CO is the strongest ligand, all electrons paired. So, spin magnetic moment is zero.

50. Ⓓ

Diammine tetra aquacobalt (III) chloride, is the I.U.P.A.C. nomenclature of the complex.

$[Co(H_2O)_4(NH_3)_2]Cl_3$

51. Ⓐ

Order 2 as $\frac{d^2y}{dx^2}$ present

Degree 2 as $\frac{d^2y}{dx^2}$ present with power 2

52. Ⓒ

$$\frac{dy}{dx}=e^{-2y} \Rightarrow \frac{e^{2y}}{2}+c=x \Rightarrow c=\frac{9}{2} \Rightarrow x=\frac{e^6+9}{2}$$

53. Ⓑ

$$IF=e^{\int\frac{2x\,dx}{1+x^2}}=e^{\log_e|1+x^2|}=(1+x^2)$$

$$y\times(1+x^2)=\int\frac{\cos x}{1+x^2}\times(1+x^2)dy+c=\sin x+c$$

54. Ⓐ

$$IF=e^{\int\frac{2}{x}dx}=e^{2\log_e x}=x^2$$

$y\times x^2=c \Rightarrow \boxed{c=1}$ as $x=1, y=1$

$$\therefore y\times x^2=1 \quad \therefore y=\frac{1}{x^2} \qquad y(2)=\frac{1}{4}$$

55. Ⓑ

$$\lim_{x\to 3}\frac{x^2-3^2}{x-3}=2\cdot 3^{2-1}=6 \qquad \therefore\ k=6$$

56. Ⓒ

$$\frac{dv}{dt}=\frac{d}{dt}\left(\frac{4}{3}\pi r^3\right)=4\pi r^2\times\frac{dr}{dt}=4\pi 1^2\times 0.5\ \text{cm}^3/\text{sec}=2\pi\ \text{cm}^3/\text{sec} \quad (\because r=1)$$

57. Ⓐ

$$\int\frac{\cos 2x}{\cos x}dx=\int\frac{2\cos^2 x-1}{\cos x}dx=2\int\cos x-\sec dx=2\sin x-\log_e|\sec x+\tan x|+c$$

58. Ⓓ

$\frac{x^2}{a^2}+\frac{y^2}{b^2}=1 \rightarrow$ order $=2$ as two arbitrary constants a and b are present. So (A) is false.

R is true.

59. Ⓐ

$$y\frac{dy}{1+y^2}=\frac{x\,dx}{1+x^2} \Rightarrow \int\frac{2y\,dy}{1+y^2}=\int\frac{2x\,dx}{1+x^2} \Rightarrow \log|1+y^2|=\log|1+x^2|+c_1$$

$$\Rightarrow \log\left|\frac{1+y^2}{1+x^2}\right|=c_1 \Rightarrow \left(1+y^2\right)=e^{c_1}\left(1+x^2\right) \Rightarrow \left(1+y^2\right)=A\left(1+x^2\right)$$

$\therefore$ (A) is true

(R) : $\int\frac{x\,dx}{1+x^2}=\frac{1}{2}\log\left|1+x^2\right|+c$

(R) is true and it is the correct explanation of (A).

60. Ⓑ

$$IF=e^{\int\frac{\cos x}{1+\sin x}dx}=e^{\log_e|1+\sin x|}=1+\sin x$$

$$\therefore P=\frac{\cos x}{1+\sin x};\quad Q=-\frac{x}{1+\sin x}$$

61. Ⓒ

$$e^{\int\frac{\cos x\,dx}{1+\sin x}}=e^{\log(1+\sin x)}=1+\sin x$$

62. Ⓓ

$$y(1+\sin x)=\int-\frac{x}{1+\sin x}\times(1+\sin x)dx+c=-\frac{x^2}{2}+c$$

63. Ⓓ

$$\int\frac{dx}{\tan x+\cot x}=\int\frac{\sin 2x}{2}dx=-\frac{\cos 2x}{4}+c$$

64. Ⓓ

$$f(x)=2x^3-9x^2+12x-6$$

$$f'(x)=6x^2-18x+12=6(x-2)(x-1)>0 \Rightarrow (x<1)\cup(x>2)$$

65. Ⓑ

$$I=\int_0^{\pi/4}x\ (\tan x\cdot\sec^2 x)dx=\left[\frac{x\cdot(\tan x)^2}{2}\right]_0^{\pi/4}-\frac{1}{2}\left[\tan x\right]_0^{1/4}+\frac{1}{2}\left[x\right]_0^{\pi/4}=\left(\frac{\pi}{4}-\frac{1}{2}\right)$$

66. Ⓐ

$$f(x)=\log_e\left(x^2+\sqrt{x^2+1}\right)$$

$$f(-x)=\log_e\left(x^2+\sqrt{x^2+1}\right)=f(x)$$

Even function

67. Ⓑ

$|A| = 1 \neq 0 \quad \Rightarrow A^{-1}$ exists

$$A^{-1} = \frac{1}{|A|}(adj\, A) = \begin{pmatrix} \cos\theta & \sin\theta \\ -\sin\theta & \cos\theta \end{pmatrix}$$

68. Ⓒ

$$m\frac{\pi}{2} + 1 = 1 + n \quad \Rightarrow n = \frac{m\pi}{2}$$

69. Ⓑ

$y = \cos^{-1}(\cos\alpha \cdot \cos x - \sin\alpha \cdot \sin x)$ where $\tan\alpha = 3/2$

$= \cos^{-1}(\cos(x+\alpha)) = x + \alpha = x + \tan^{-1}(3/2)$

$$\frac{dy}{dx} = 1$$

70. Ⓒ

$$\int \frac{dx}{x(x^4-1)} = \frac{1}{4}\int \frac{4x^3\,dx}{x^4\left(x^4-1\right)} \qquad \text{put } x^4 = t \quad \Rightarrow 4x^3\,dx = dt$$

$$= \frac{1}{4}\int \frac{dt}{t(t-1)} = \frac{1}{4}\int \frac{t-(t-1)}{t(t-1)}dt = \frac{1}{4}\log|t-1| - \frac{1}{4}\log t + c$$

$$= \frac{1}{4}\log\left|\frac{t-1}{t}\right| + c = \frac{1}{4}\log\left|\frac{x^4-1}{x^4}\right| + c$$

71. Ⓓ

$x + y = 20 \qquad \ldots (1)$

$P = x^3 \cdot y^2 \qquad \ldots (2)$

$= x^3(20 - x)^2 = x^5 - 40x^4 + 400x^3$

$$\frac{dP}{dx} = 5x^4 - 160x^3 + 12x^2$$

$$\frac{d^2P}{dx^2} = 20x^3 - 480x^2 + 2400x$$

$\frac{dP}{dx}=0 \quad \Rightarrow x=0,12,20$

$\frac{d^2P}{dx^2}\Big|_{x=0}=0$ (no conclusion)

$\frac{d^2P}{dx^2}\Big|_{x=12}<0 \quad \Rightarrow$ Max value and

$\frac{d^2P}{dx^2}\Big|_{x=20}>0 \quad \Rightarrow$ Min. value

$\therefore x=12,\ y=8$

72. ©

$$\int \frac{\sec^2 x}{4\tan^2 x+5}dx=\int \frac{d(tanx)}{(2\tan x)^2+\left(\sqrt{5}\right)^2}=\frac{1}{2\sqrt{5}}\tan^{-1}\left(\frac{2\tan x}{\sqrt{5}}\right)+c$$

73. Ⓐ

$$I=\int_3^6 \frac{\sqrt{x}}{\sqrt{9-x}+\sqrt{x}}dx=\int_3^6 \frac{\sqrt{9-x}}{\sqrt{x}+\sqrt{9-x}}dx \quad \left(as \int_a^b f(x)dx=\int_a^b f(a+b-x)dx\right)$$

$$2I=\int_3^6 dx=[x]_3^6=3 \qquad \therefore I=\frac{3}{2}$$

74. ©

$$y=\sin^{-1}\left(\frac{x}{\sqrt{1+x^2}}\right)+\cos^{-1}\left(\frac{1}{\sqrt{1+x^2}}\right)=\tan^{-1}x+\tan^{-1}x=2\tan^{-1}x \qquad \therefore \frac{dy}{dx}=\frac{2}{1+x^2}$$

75. Ⓐ

$$y\frac{dy}{dx}=5x^2+2$$

$$\int y\,dy=\int 5x^2\,dx+\int 2dx \quad \Rightarrow \frac{y^2}{2}=\frac{5x^3}{3}+2x+c \quad \Rightarrow 5x^3+12x-3y^2+c=0$$

76. Ⓓ

All of these

77. Ⓒ

Transpiration

Sunken stomata slows down the speed of evaporation

78. Ⓐ

Increasing production of RBCs

Increased number of RBCs carry more oxygen per unit time, meeting the respiratory demand of the person

79. Ⓐ

Euryhalines

80. Ⓑ

Archaebacteria

81. Ⓒ

1000

82. Ⓓ

Predation pressure has no effect on population growth

Predation decreases the number of organisms preyed upon

83. Ⓐ

Both A and R are true and R is the correct explanation of A

Camouflaging helps animals to outwit their enemies

84. Ⓐ

Both A and R are true and R is the correct explanation of A

Keeping warm would require a high expenditure of energy

85. Ⓑ

Both A and R are true but R is not the correct explanation of A

Epiphytes depend on their hosts for structural support but do not derive nourishment from them or harm them in any way

86. Ⓐ

A – Expanding pyramid;

B – Stable pyramid

87. Ⓑ

Pyramid B

88. Ⓑ

Logarithmic

89. Ⓐ

Ectoparasite

90. Ⓐ

Sandalwood

Their roots, called haustoria, penetrate host plants to take nutrition from them

91. Ⓒ

Biopiracy

92. Ⓑ

Convergent evolution

93. Ⓐ

IgA

94. Ⓒ

Middle piece

95. Ⓐ

Shock

96. Ⓑ

Both A and R are true but R is not the correct explanation of A

The Monarch butterfly does not use camouflage to escape its preadator

97. Ⓒ

A is true but R is false

Heat tolerance is an important factor deciding the existence of a species in a particular habitat

98. ©

A is true but R is false

The blubber acts as an insulating layer

99. ©

Sexual deceit

100. ©

Snail and fish