Monthly Progessive Test (Solution)

Class: XII

Subject: PCMB

Academic Excellence Programme TECHNO ACE

Test Booklet No.: MPT04 Test Date: 24072024

Physics

1. Ⓐ

$\vec{E} = p\vec{J}$ (ohm's Law)

2. Ⓑ

as R = (resistivity/volume)l^2 ·····for constant temperature

3. Ⓒ

as R = (resistivity × volume)/A^2 (for constant temperature) and $A = \pi r^2$

4. Ⓑ

$$R = kl^2 \Rightarrow \frac{\Delta R}{R} = 2\frac{\Delta l}{l}$$

5. Ⓓ

$$R = k \cdot r^{-4} \Rightarrow \frac{\Delta R}{R} = -4 \cdot \frac{\Delta r}{r}$$

6. Ⓑ

R = $p \cdot l$/A is true.

7. Ⓑ

E = 10 – 6 = 4 volt

8. Ⓒ

as W = $q\Delta v$

9. Ⓑ

$I_0 = I_1 + I_2$ Kirchoff's current law

10. Ⓐ

11. Ⓐ

$$q = 2t \qquad \therefore \quad \frac{dq}{dt} = 2A$$

12. Ⓐ

F = –eE $\quad \therefore \quad a = \frac{F}{m} = \frac{eF}{m}$ (– sign)

13. Ⓐ

14. Ⓐ

15. Ⓐ (case base)

V = E –i. r for discharging cell

16. Ⓒ

w = q · Δv $\quad$ 0.5 = (–0.5) Δv ⇒ Δv = –1 volt.

17. Ⓐ

$\frac{kq^2}{r} - \frac{kq^2}{r} - \frac{kq^2}{r}$

18. Ⓐ

as $|E| = \frac{dv}{dr}$

19. Ⓓ

E is radial and E_{net} = 0, inside metal.

20. Ⓒ

remains same as no supply of charge from cell.

21. Ⓐ

Formula

22. Ⓒ

Formula

23. Ⓒ

Concentric circles

24. Ⓑ

Apply F = (q) (B)V

25. Ⓑ

B (upward)

Chemistry

26. ⓓ

According to Faraday's law of electrolysis,

$$W = \frac{E.C.t}{F} = \left[\frac{40}{2} \times \frac{20 \times 96.5 \times 60}{96500}\right] = 24 \text{ gm}$$

27. ⓑ

$$NH_4Cl + NaOH \longrightarrow NaCl + NH_4OH$$

So, equivalent conductance of

$$NH_4OH = \left[(130 + 217) - 109\right] = 238 \text{ Ohm}^{-1}.\text{cm}^2.\text{equivalent}^{-1}$$

28. ⓓ

The correct order of stability of the carbocations in the given compounds is

$$\left[(C_2H_5)_2\overset{+}{C}(CH_3)\right] > \left[(CH_3)_2\overset{+}{C}(C_2H_5)\right] > \left[(CH_3)_3\overset{+}{C}\right] > \left[CH_3\overset{+}{C}HCH_2CH_3\right]$$

Now, more the stable carbocation, SN^1 reaction is more favourable

29. ⓓ

In C_2H_5Cl molecule a strong $d\pi - p\pi$ back bonding is formed between the π- molecular orbital and vacant 3d orbital of chlorine. This type of bonding is not possible in case of CH_3Cl.

So, C - Cl bond length order $C_6H_5Cl < CH_3Cl$

C - Cl bond strength order $C_6H_5Cl > CH_3Cl$

30. ⓑ

$$CH_3CH_2CH = CH_2 \xrightarrow{HBr} CH_3CH_2CH(Br)CH_3$$

$$CH_3CH_2CH(Br)CH_3 \xrightarrow{\text{alcoholic KOH}} CH_3CH = CHCH_3 + CH_3CH_2CH = CH_2$$

$CH_3CH = CHCH_3$ is more stable due to 6 hypreconjugation structures and hence it is a major product

$CH_3CH_2CH = CH_2$ is less stable due to 2 hypreconjugation structures and hence it is a minor product

31. ⓑ

$$CH_3CH = CH_2 \xrightarrow[NaBH_4]{Hg(CH_3COO)_2 \text{ in } CH_3COOH} CH_3CH(OH)CH_3 \text{ (secondary alcohol)}$$

(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

32. Ⓓ

H_2SO_4 does not suffer either oxidation or reduction

At the time of discharging, Pb is oxidised toPb^{2+} and PbO_2 is reduced to Pb^{2+}

33. Ⓐ

$$E^o_{\left(H^+/\frac{1}{2}H_2\right)} = 0 \text{ volt}$$

Now, for metals A, B and D all E^o values are negetive and hence all of them can release H_2 gas from dilute HCl solution. So, reducing power is B > D > A. So, correct representation is $B \mid B^+ \parallel D^+ \mid D$

34. Ⓒ

According to Faraday's second law,

$$\frac{W_{Ag}}{E_{Ag}} = \frac{W_{Al}}{E_{Al}}$$

$$\therefore W_{Al} = \frac{W_{Ag} \times E_{Al}}{E_{Ag}} = \frac{9 \times 54}{108} = 4.5 \text{ gm}$$

35. Ⓐ

The equation of Swarts reaction is

$$R-X + AgF \xrightarrow{\text{Acetone}} R-F + AgX \qquad (\text{where } X = Cl, Br)$$

36. Ⓓ

The correct order of surface area is

1, 4 - dichlorobenzene > 1, 3 - dichlorobenzene > 1, 2 - dichlorobenzene > Chlorobenzene

Higher the surface area, higher is the boiling point

So, 1,4 - dichlorobenzene has the highest boiling point.

37. Ⓐ

As propane –1, 2, 3 - triol contains 3 — OH groups so strong intermolecular hydrogen bonding is possible for this compound. Hence, boiling point is high.

38. Ⓑ

The compound that contains small alkyl group (less crowded) takes part in SN^2 reaction spontaneously.

39. Ⓑ

Inversion of configuration occurs in case of SN^2 reaction

40. ©

Due to presence of π-between β and γ carbon atoms, rearrangement occurs and for that reason, SN^2 reaction becomes very much favourable.

41. ©

When sugar is added in water, then solute - solvent interaction increases. Hence, much higher tempreature is needed to boil the solution.

42. ©

Standard reduction potential does not depend on the mass of the system. So, it is an intensive property while resistance depends on the mass of the system and hence it is an extensive property.

43. ©

$$E_{cell} = \left[0.45 - \left(-1.35\right)\right] = 1.80 \text{ volt}$$

$$\therefore\ 10.E_{cell} = \left(10 \times 1.8\right) = 18$$

44. Ⓑ

$$\left(\text{Rate}\right)_1 = k.\left[A\right]^2.\left[B\right]$$

$$\left(\text{Rate}\right)_2 = k.\left[3A\right]^2.\left[\frac{B}{2}\right] = (4.5).k.\left[A\right]^2.\left[B\right]$$

$$\frac{\left(\text{Rate}\right)_2}{\left(\text{Rate}\right)_1} = 4.5$$

So, the rate of reaction increases by 4.5 times

45. ©

$$4A + xB \longrightarrow 2C + 5D$$

$$\therefore -\frac{1}{4}\frac{d[A]}{dt} = -\frac{1}{x}\frac{d[B]}{dt}$$

$$\therefore \frac{4.8 \times 10^{-3}}{4} = \frac{3.6 \times 10^{-3}}{x}$$

$$\therefore x = \frac{3.6 \times 10^{-3} \times 4}{4.8 \times 10^{-3}} = 3$$

46. Ⓓ

$$C_2H_5COOH \xrightarrow{Ag_2O,\ \Delta} \underset{(X)}{C_2H_5COOAg} \xrightarrow{Br_2} \underset{(Y)}{C_2H_5Br}$$

CH_3CH_2Br contains primary carbon atoms only

47. ©

The isomers are $CH_3CH(Br)CH_2(Br)$, $CH_2(Br)CH_2CH_2(Br)$, $CH_3C(Br_2)CH_3$, $CH_3CH_2CHBr_2$
Optically active isomer is $CH_3CH(Br)CH_2(Br)$ and all carbon atoms in all isomers are sp^3 hybridized.

48. Ⓑ

Size of iodine is higher than chlorine and it is a good leaving group and hence iodobenzene takes part in the reaction with $NaNH_2$ more spontaneously. Electronegetivity of chlorine is higher than iodine. Hence, dipole moment of chlorobenzene is higher than iodobenzene.

49. ©

3 nitro groups in the compound decreases the electron density in the aromatic ring. Hence, it can react with dilute NaOH spontaneously.

50. Ⓐ

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

Mathematics

51. Ⓐ

By Definition

52. Ⓑ

By Definition

53. ©

Let $f(x) = v\,[u(x)] = v(t),\ t = u(x)$ $\quad\therefore\quad \dfrac{df}{dx} = \dfrac{dv}{dt}\cdot\dfrac{dt}{dx}$ (by chain rule)

54. Ⓓ

$y = \sin(x^2)$

$$\frac{dy}{dx} = \cos\left(x^2\right)2x = 2x\cos x^2$$

55. Ⓐ

$y^x = \pi^e$ (1)

Let, $u = y^x$

$\therefore\quad \log_e u = x\log_e y$

$$\Rightarrow \frac{1}{u}\cdot\frac{du}{dx}=\frac{x}{y}\cdot\frac{dy}{dx}+\log_e y$$

$$\Rightarrow \frac{du}{dx}=u\left(\frac{x}{y}\frac{dy}{dx}+\log_e y\right)=y^x\left(\frac{x}{y}\frac{dy}{dx}+\log_e y\right)$$

$$\therefore \quad \frac{du}{dx}=0\Rightarrow y^x\left(\frac{x}{y}\frac{dy}{dx}+\log_e y\right)=0$$

$$\Rightarrow \frac{dy}{dx}=-\frac{y\log_e y}{x}$$

56. Ⓑ

$A = \pi r^2$

$$\frac{dA}{dr}=2\pi r$$

$$\left.\frac{dA}{dr}\right|_{r=6\text{cm}}=12\pi\text{cm}$$

57. Ⓑ

$f(x) = \sin x + \cos x$

$f'(x) = \cos x - \sin x$

Critical point : $f'(x) = 0 \qquad \tan x = 1$

$\Rightarrow x = \pi/4$ and $\frac{5\pi}{4}$ as $x \in [0, 2\pi]$

$f'(x) = \cos x - \sin x \quad > 0$ when $x \in (0, \pi/4)\uparrow$

$f'(x) = \cos x - \sin x \quad < 0$ when $x \in (\pi/4, 5\pi/4)\downarrow$

$f'(x) = \cos x - \sin x \quad > 0$ when $x \in (\frac{5\pi}{4}, 2\pi)\uparrow$

58. Ⓐ

$$f(x)=\frac{x}{4+|x|}$$

$$f(x)=\begin{cases}\dfrac{x}{4+x}, & x\geq 0\\[2ex] \dfrac{x}{4-x}, & x<0\end{cases}$$

Clearly $f(x)$ is diffrentiable at every where except 0. We need to cheek its differentiability at $x = 0$

$$Lf'(0) = \lim_{h\to 0} \frac{f(0-h)-f(0)}{-h} = \lim_{h\to 0} \frac{\frac{-h}{4+h}-0}{-h}$$

$$= \lim_{h\to 0} = \frac{-h}{-h(4+h)} = \lim_{h\to 0} \frac{1}{4+h} = \frac{1}{4}$$

$$Rf'(0) = \lim_{h\to 0} \frac{f(0+h)-f(0)}{h}$$

$$= \lim_{h\to 0} \frac{\frac{h}{4+h}-0}{h} = \lim_{h\to 0} \frac{1}{4+h} = \frac{1}{4}$$

$\therefore$ f is differentiable at $x = 0 \Rightarrow f$ is differentiable in $(-\infty, \infty)$

59. Ⓑ

$$y = \cos^{-1}\left(\frac{2}{\sqrt{13}}\cos x - \frac{3}{\sqrt{13}}\sin x\right)$$

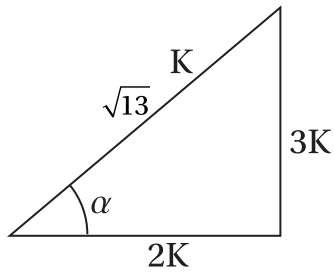
$= \cos^{-1}(\cos x \cdot \cos\alpha - \sin x \sin\alpha)$ where $\tan\alpha = \frac{3}{2}$

$= \cos^{-1}[\cos(x+\alpha)]$

$= x + \alpha$

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

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



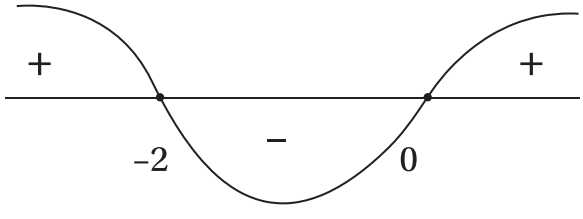
60. Ⓓ

$y = x^2 e^x$

$$\frac{dy}{dx} = 2xe^x + x^2e^x$$

$= e^x x(2 + x)$

Critical points $x = 0$, $x = -2$



$f'(x) > 0$ *if* $x \in (-\infty, -2) \cup (0, \infty) \uparrow$

$f'(x) < 0$ *if* $x \in (-2, 0) \downarrow$

61. (D)

(A): False as $f(x) = |x|$ is continuous but not differentiable.

(R): True as $\lim_{h\to 0} f(a+h) - f(a) = \lim_{h\to 0} \frac{f(a+h)-f(a)}{h} \times h$

$= f'(a) \lim_{h\to 0} h$ ($\because f$ is differentiable at $x = a$)

$= 0$

$\Rightarrow \lim_{h\to 0} f(a+h) = f(a)$

Similarly $\lim_{h\to 0} f(a-h) = f(a)$ $\quad \therefore f(x)$ is continuous at $x = a$

62. (C)

(A) : $y = \tan^{-1}\left(\frac{\cos x + \sin x}{\sin x - \cos x}\right)$

$= \tan^{-1}\left(\frac{1+\tan x}{\tan x - 1}\right) = -\tan^{-1}\tan\left(\frac{\pi}{4}+x\right) = -\left(\frac{\pi}{4}+x\right)$

$\therefore \quad \frac{dy}{dx} = -1$

$\therefore$ (A) is true

(R) : $\frac{\cos x + \sin x}{\sin x - \cos x} = \frac{1+\tan x}{\tan x - 1}$

$= -\tan\left(x + \frac{\pi}{4}\right)$

$\therefore$ (R) is false

63. (C)

$$f(x) = \begin{cases} 7-2x; & x < 3 \\ 1\ ;\ 3 \le x \le 4 \\ 2x-7;\ x > 4 \end{cases}$$

$$f'(3^+) = \lim_{h\to 0} \frac{f(3+h)-f(3)}{h} = \lim_{h\to 0} \frac{1-1}{h} = 0$$

64. (C)

$$f'(4^-) = \lim_{h\to 0} \frac{f(4-h)-f(4)}{-h} = \lim_{h\to 0} \frac{1-1}{-h} = 0$$

65. ⓓ

$$f'(3^-)=\lim_{h\to 0}\frac{f(3-h)-f(3)}{-h}$$

$$=\lim_{h\to 0}\frac{2h}{-h}=-2$$

$f'(3^+)=0$

$f'(4^-)=0$

$$f'(4^+)=\lim_{h\to 0}\frac{f(4+h)-f(4)}{h}$$

$$=\lim_{h\to 0}\frac{2h}{h}=2$$

Not differentiable at $x=3$ and $x=4$

But continuous at $x=3$ and $x=4$

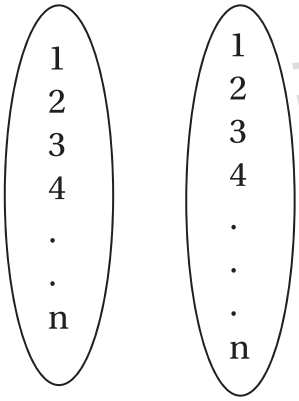
66. ⓒ

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

$$=\frac{\pi}{4}+\tan^{-1}\frac{2+3}{1-2.3}+\pi \text{ (as } 2\times 3>1)$$

$$=\frac{\pi}{4}+\tan^{-1}(-1)+\pi=\frac{\pi}{4}-\frac{\pi}{4}+\pi=\pi$$

67. ⓒ



$$n\times(n-1)\times(n-2)\times(n-3)\times\ldots\times 2\times 1=n!$$

68. ⓑ

$$A=\begin{bmatrix}a & 0 & 0\\ 0 & a & 0\\ 0 & 0 & a\end{bmatrix}$$

$$|A|=\begin{vmatrix}a & 0 & 0\\ 0 & a & 0\\ 0 & 0 & a\end{vmatrix}=a^3\begin{vmatrix}1 & 0 & 0\\ 0 & 1 & 0\\ 0 & 0 & 1\end{vmatrix}=a^3$$

$$|adjA|=|A|^2=\left(a^3\right)^2=a^6$$

69. Ⓐ

$$\begin{pmatrix}1 & 2 & x\\ 3 & -1 & 2\end{pmatrix}\begin{pmatrix}y\\ x\\ 1\end{pmatrix}=\begin{pmatrix}6\\ 8\end{pmatrix}$$

$$\Rightarrow\begin{pmatrix}y+2x+x\\ 3y-x+2\end{pmatrix}=\begin{pmatrix}6\\ 8\end{pmatrix}$$

$\Rightarrow y+3x=6 \quad \Rightarrow y=6-3x$

$3y-x+2=8$

$\Rightarrow 3(6-3x)-x+2=8$

$\Rightarrow 18-9x-x+2=8$

$\Rightarrow 20-10x=8$

$\Rightarrow -10x=8-20=-12$

$\Rightarrow x=\frac{12}{10}=\frac{6}{5}$

$y=6-3.\frac{6}{5}$

$=6-\frac{18}{5}=\frac{30-18}{5}=\frac{12}{5}$

$\boxed{y=2x}$

70. Ⓒ

Case1 : When $x\in Q$, $\lim\limits_{x\to\frac{1}{2}} f(x)=\lim\limits_{x\to\frac{1}{2}} x=\frac{1}{2}$

Case2 : When $x\in\overline{Q}$, $\lim\limits_{x\to\frac{1}{2}} f(x)=\lim\limits_{x\to\frac{1}{2}} 1-x=\frac{1}{2}$

$f\left(\frac{1}{2}\right)=\frac{1}{2}$

$\therefore$ $f(x)$ continuous at $x=\frac{1}{2}$

71. Ⓑ

Let xm be the length and

ym be the breadth

$\therefore \quad y+y+x=300$

$\Rightarrow \boxed{2y+x=300} \quad \Rightarrow 2y=(300-x) \quad \Rightarrow y=\frac{300-x}{2}$

Area = $A = xy$

$\Rightarrow \quad A = x \cdot \dfrac{(300-x)}{2} = \dfrac{1}{2}\left(300x - x^2\right)$

$\dfrac{dA}{dx} = \dfrac{1}{2}(300 - 2x)$

$= \boxed{150 - x}$

$\dfrac{d^2A}{dx^2} = -1$

$\dfrac{dA}{dx} = 0 \Rightarrow \boxed{x = 150} \Rightarrow \dfrac{d^2A}{dx^2}\Big|_{x=150} = -1 < 0$

$\therefore$ Area is maximum at $x = 150$

$\therefore \quad y = \dfrac{300-150}{2} = \dfrac{150}{2} = 75$

$\therefore$ Length = 150m

72. Ⓐ

Area = $(150 \times 75)m^2 = 11250\ \text{m}^2$

73. Ⓒ

Cost of fencing = $₹300 \times \dfrac{20}{10} = ₹600$

74. Ⓓ

(A) : $f'(x) = 3x^2 - 3 = 3(x^2 - 1) = 3\,(x+1)\,(x-1)$

$f'(x) < 0\ \forall x \in (-1,1)$

$f'(x) > 0 \forall x \in R - [-1,1]$

(A): is false

(R) : $f'(x) > 0 \Rightarrow f(x)$ is increasing True.

75. Ⓐ

(A): Let $A = \pi r^2$

$\dfrac{dA}{dr} = 2\pi r$ (True)

(R): $A = \pi r^2$ (True)

76. Ⓐ

Punnett square

77. Ⓒ

One-fourth

Pure tall : Hybrid tall : Pure dwarf = 1 : 2 : 1

78. Ⓒ

Meselson and Stahl

79. Ⓐ

DNA Dependent DNA Polymerase

The enzyme catalyses the joining of deoxyribonucleoside 5′-triphosphates (dNTPs) to form the growing DNA chain.

80. Ⓐ

Cistron

It is a segment of DNA that contains all the information for production of a single polypeptide.

81. Ⓑ

Convergent evolution

Unrelated organisms 'converge' towards the same function while adapting to a similar environment.

82. Ⓒ

Homo erectus erectus

83. Ⓐ

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

84. Ⓐ

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

85. Ⓑ

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

86. Ⓑ

Frogs

87. Ⓐ

Shrews

88. Ⓓ
Tyrannosaurus

89. Ⓓ
All of these

90. Ⓒ
Both apes and man

91. Ⓑ
Viola

92. Ⓑ
Perisperm

93. Ⓒ
Hepatitis A

94. Ⓑ
Clot buster

95. Ⓒ
Integrated Pest Management

96. Ⓑ
Variations in populations

97. Ⓑ
Klinefelter's syndrome

98. Ⓑ
Semi conservative and semi discontinuous
Original half of the DNA is conserved and a new strand is created to intertwine with it.

99. Ⓓ
64

100. Ⓓ
All
Fast evolution of many species from a single common ancestor.