Monthly Progressive Test

Class: XII

Subject: PCMB

Solution

Physics

1. Ⓐ

   Quantization of Charge

2. Ⓒ

   Volume charge density

3. Ⓑ

   $ke^2/r^2 = kqe/(r/2)^2 \Rightarrow (e/q) = 4$

4. Ⓐ

   $F = eE = 1.6 \times 10^5/10^{19} = 16/10^{15}$N

   due North

5. Ⓒ

   as $E_{||} = 2p/r^3$ and $E_{\perp} = p/r^3$

6. Ⓓ

   $U = (½)CV^2 = (½)(CV)V = (½)\,QV$

   $= Q^2/2C$

7. Ⓑ

   $C = A\epsilon_0/(d - t)$ and $t = d/2$

   $= A\epsilon_0/(d/2) = 2A\epsilon_0/d = 2C_0$

8. Ⓓ

   $V = k\,[(q/r) - (q/r)]$

9. Ⓐ

micro farad

10. Ⓒ

For dipole: E proportional to $(1/r^3)$, as $E = -(dv/dr)$, so V proportional to$(1/r^2)$

11. Ⓓ

as $12C/(C + 12) = 3$

12. Ⓐ

$F = (\text{surface charge density}/2\epsilon_0)Q$

$= (½)(\text{surface charge density}/\epsilon_0).Q$

$= (½)\, QE$

13. Ⓒ

potential is scalar but as $E = -dv/dr$

as well E is vector quantity, therefore dv/dr is vector quantity.

14. Ⓓ

As work done is zero to move charge on equipotential surface

15. Ⓐ

$C = C_0 + C_0 + C_0 = 3C_0$

16. Ⓐ

As $E = kq/x^2$

17. Ⓑ

Refer the formula

$E = kqx/\{\sqrt{(x^2 + r^2)}\}^3$

18. Ⓒ

as $E = kq/r^2$ and $V = kq/r$, so $E = V/r$

or $30 = 15/r \Rightarrow r = 0.5\,m$

19. Ⓒ

Common potential $= (C_1V_1+C_2 . V_2)/(C_1 + C_2) = (CV + 2CV)/2C$

$= (3/2)V$

20. Ⓒ

As capacitor is disconnected from battery, which is source of supply of charge to capacitor, so charge remains same.

21. Ⓓ

as $|p| = (q)(2l)$, direction of dipole is from – q to + q

22. Ⓒ

in order to attain minimum potential energy, F(net) = qE – qE = 0

23. Ⓐ

$E = \lim_{+Q_0 \to 0} F/(+Q_0)$

24. Ⓐ

$R^2 = p^2 + p^2 + 2p^2 \cos 120°$

gives R = p

25. Ⓑ

$U = -pE \cos\phi$ where $\phi = 90°$,

gives U = 0

Chemistry

26. Ⓓ

The correct equation of Galvanic cell is $Zn(s) + CuSO_4(aq) \rightarrow ZnSO_4(aq) + Cu(s)$

So, blue colour of $CuSO_4$ gradually gets faded. Zinc electrode gets corroded and concentration of $ZnSO_4$ increases gradually

27. Ⓑ

More the negative value of $E^o_{(M^{n+}/M)}$, more is the capacity to release electron(s) and its more positive value suggests less capacity to release electron(s) by the metal.

28. Ⓑ

When a cell is formed then the voltage of the cell does not depend on the mass of the electrodes. It depends on the concentration of the electrolytes. If concentration of cathode chamber electrolyte is higher than that in anode chamber.

29. Ⓒ

A | A^+|| B^+| B

$$\therefore\ E_{cell} = \left[E^o_{(B^+/B)} - E^o_{(A^+/A)}\right] = [0.45 - (-1.35)] = +1.80\ \text{volt}$$

$\therefore\ (10.E_{cell}) = 18$

30. Ⓓ

The E_{cell} value does not depend on the number of electron(s) transferred and it depends on the values of $E^o_{cathode}$ and E^o_{anode}.

31. Ⓐ

Metallic conduction is associated only with electron transfer from one end to other without facing either oxidation or reduction of the conductor.

32. Ⓒ

Salt bridge is used in Daniel cell and it minimizes the liquid - liquid junction potential value. The salt bridge acts as an electrical contact between two half cell.

33. Ⓐ

Due to higher ionic character of $CuSO_4$, the rate of electricity conduction is higher than CCl_4.

34. Ⓐ

Platinum is weak metal and it does not react with either electrolytes or products.

35. Ⓑ

When temperature is changed then concentration of the electrolytes change sharply. So, temperature remains constant.

36. Ⓒ

Ohm's law is associated with voltage, current and resistance and hence it is associated with all types electrical processes.

37. Ⓑ

$$H_2SO_4 \rightleftharpoons 2H^+ + SO_4^{2-}$$

$$2H^+ + 2e^- \longrightarrow H_2$$

now, H^+ will accept electron(s) from those elements which have negative value of $E^o_{(M^{n+}/M)}$ as they are strong reducing agents. Hence, metal A and metal C can release H_2 gas from dilute H_2SO_4.

38. Ⓒ

$$\therefore\ E_{cell}=\left[E^{o}_{(Zn^{2+}/Zn)}-E^{o}_{(Na^{+}/Na)}\right]=[-0.76-(-2.7)]=+1.94\text{ volt}$$

39. Ⓒ

If salt bridge is removed then the circuit ends. Hence, neither electron nor current flow in the system

40. Ⓓ

Electron releasing capacity

41. Ⓒ

$i_1.C_1 = C_2$

$$\therefore\ i_1=\frac{C_2}{C_1}=\frac{0.01}{0.004}=2.5$$

$$Na_2SO_4 \longrightarrow 2Na^{+}+SO_4^{2-} \qquad (n=3)$$

$$\alpha=\frac{i-1}{n-1}$$

$$\therefore\ \alpha=\frac{2.5-1}{3-1}$$

$\therefore$ a = 0.75

$\therefore$ 75% dissociated

42. Ⓐ

$$k=A.e^{-\frac{E_a}{RT}}$$

So, activation energy is associated only with reaction rate constant, not with the equilibrium constant.

43. Ⓐ

Rate = k.[A].[B]

When volume of the vessel becomes one forth then concentration becomes 4 times.

$(\text{rate})_1$ = k.[4A].[4B]

$\therefore$ $(\text{rate})_1$ = 16k.[A].[B]

$\therefore$ $(\text{rate})_1$ = 16.(rate)

44. Ⓒ

Catalyst can change the reaction rate constant value but cannot change the equilibrium constant of a reaction.

45. Ⓒ

Strong solute - solvent attractive interaction is generated when sugar is added to water. Hence, higher temperature is needed for breaking the solute - solvent interaction. Thus boiling point increases.

46. Ⓒ

Glass does not react with the electrolyte. Hence, the reaction can occur spontaneously.

47. Ⓐ

More the negative value of $E^{o}_{(M^{n+}/M)}$ means the ion is not a good electron acceptor i.e. oxidising agent.

Now, more the positive value suggests good electron accepting ion.

48. Ⓑ

More the positive value of E°, more is electron accepting capacity. Now, E° value of dichromate is less positive than that of chlorine. So, $K_2Cr_2O_7$ cannot oxidise HCl into Cl_2.

49. Ⓒ

50. Ⓒ

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

Mathematics

51. Ⓑ

The given function is continuous $\forall\, x \in R$

$\therefore$ It is continuous at $x = 0$.

Now, $\lim\limits_{x\to 0^-} \dfrac{\sin(p+1)x + \sin x}{x}$

$= \lim\limits_{x\to 0^-} \dfrac{\sin(p+1)x}{(p+1)x} \times (p+1) + \lim\limits_{x\to 0^-} \dfrac{\sin x}{x}$

$= p + 1 + 1 = p + 2$

$$\lim_{x\to 0^+}\frac{\sqrt{x+x^2}-\sqrt{x}}{x^{3/2}}$$

$$=\lim_{x\to 0^+}\frac{\sqrt{1+x}-1}{x}$$

$$=\lim_{x\to 0^+}\frac{1}{\sqrt{1+x}+1}=\frac{1}{2}$$

$$f(0)=q$$

$$\therefore\ p+2=\frac{1}{2}=q\ \Rightarrow\ p=\frac{-3}{2}\text{ and }q=\frac{1}{2}$$

52. ©

$$f(x)=[x],\ x\in\left(\frac{-7}{2},100\right)$$

This function is discontinuous for all integral values of x.

Number of integers in the interval $\left(\frac{-7}{2},100\right)=103$

$\therefore$ The number of discontinuities = 103

53. ©

$\tan x$ is undefined for $x=(2n+1)\frac{\pi}{2}, n\in I$

$\therefore$ The points of discontinuity of $\tan x$ are $x=(2n+1)\frac{\pi}{2}, n\in I$

54. Ⓑ

$$f(x)=\frac{1-\cos\lambda x}{x\sin x},\ x\neq 0$$

$$=\frac{1}{2},\ x=0$$

$$\lim_{x\to 0}\frac{1-\cos\lambda x}{x\sin x}=\lim_{x\to 0}\frac{\lambda\sin\lambda x}{\sin x+x\cos x}$$

$$=\lim_{x\to 0}\frac{\lambda^2\cos\lambda x}{\cos x+\cos x-x\sin x}$$

$$=\frac{\lambda^2}{2}$$

$f(0)=\frac{1}{2}$

$\therefore \frac{\lambda^2}{2}=\frac{1}{2} \Rightarrow \lambda=\pm 1$

55. Ⓓ

$f(x)=\frac{x-|x|}{x}$

$\therefore f(x)=0, \quad x>0$

$=2; \quad x<0$

Let $x=c>0 \quad \therefore \lim_{x\to c} f(x)=\lim_{x\to c} 0=0$

$f(c)=0$

$\therefore f(x)$ is continuous $\forall\, c>0$

Let $x=c<0 \quad \therefore \lim_{x\to c} f(x)=\lim_{x\to c} 2=2$

$f(c)=2$

$\therefore f(x)$ is continuous $\forall\, c<0$

Let $x=c=0 \quad \lim_{x\to 0^+} f(x)=\lim_{x\to 0^+} 0=0$

$\lim_{x\to 0^-} f(x)=\lim_{x\to 0^-} 2=2$

$f(0)$ is not defined.

$\therefore f(x)$ is not continuous at $x=0$

$\therefore f(x)$ is continuous $\forall x$ except $x=0$

56. Ⓒ

$f(x)=x;\ x$ is rational

$=1-x;\ x$ is irrational

Case 1 : When $x\in Q$

$$\lim_{x\to\frac{1}{2}} f(x)=\lim_{x\to\frac{1}{2}} x=\frac{1}{2}$$

Case 2: When $x\in \bar{Q}$, $\lim_{x\to\frac{1}{2}} f(x)=\lim_{x\to\frac{1}{2}} 1-x=1-\frac{1}{2}=\frac{1}{2}$

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

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

57. Ⓑ

$$f(x)=\frac{\sqrt{1+px}-\sqrt{1-px}}{x}, -1 \le x<0$$

$$=\frac{2x+1}{x-2},\ 0 \le x \le 1$$

The given function is continuous in [–1, 1].

$\therefore$ It is continuous at $x = 0$.

$$\lim_{x\to 0^+} f(x)=\lim_{x\to 0^+}\frac{2x+1}{x-2}=-\frac{1}{2}$$

$$\lim_{x\to 0^-} f(x)=\lim_{x\to 0^-}\frac{\sqrt{1+px}-\sqrt{1-px}}{x}$$

$$=\lim_{x\to 0^-}\frac{2p}{\sqrt{1+px}+\sqrt{1-px}}$$

$$= p$$

$$f(0)=-\frac{1}{2}$$

$$\therefore\ p=-\frac{1}{2}$$

58. Ⓑ

$$\lim_{x\to 0}\frac{\log(1+ax)-\log(1-bx)}{x}$$

$$=\lim_{x\to 0}\frac{\log(1+ax)}{ax}\times a+\lim_{x\to 0}\frac{\log(1-bx)}{-bx}\times b$$

$$= a + b$$

$$f(0) = K \quad \therefore \quad K = a + b$$

59. Ⓒ

$$f(x)=|x|\cos\frac{1}{x}+15x^3\ ;\ x\ne 0$$

$$= K \qquad\qquad ;\ x = 0$$

$$\lim_{x\to 0^+} f(x) = \lim_{x\to 0^+} x\cos\frac{1}{x} + 15x^3$$

$$= 0$$

$$\lim_{x\to 0^-} f(x) = \lim_{x\to 0^-} -x\cos\frac{1}{x} + 15x^3$$

$$= 0$$

$f(0) = K$

$\therefore\ K = 0$

60. Ⓐ

$f(x) = x + 2\ ;\ x < 0$

$= -x^2 - 2,\ 0 \le x < 1$

$= x \quad ,\quad x \ge 1$

$\therefore\ g(x) = |f(x)| = -x - 2 \quad ; \quad x < -2$

$= x + 2 \quad ; \quad -2 \le x < 0$

$= x^2 + 2 \quad ; \quad 0 \le x < 1$

$= x \quad ; \quad x \ge 1$

$$\lim_{x\to -2^-} g(x) = \lim_{x\to -2^-} -x - 2 = 2 - 2 = 0$$

$$\lim_{x\to -2^+} g(x) = \lim_{x\to -2^+} x + 2 = -2 + 2 = 0$$

$$g(-2) = -2 + 2 = 0$$

$\therefore\ g(x)$ is continuous at $x = -2$

$$\lim_{x\to 0^+} g(x) = \lim_{x\to 0^+} x + 2 = 2$$

$$\lim_{x\to 0^-} g(x) = \lim_{x\to 0^-} x + 2 = 2$$

$$g(0) = 2$$

$\therefore\ g(x)$ is continuous at $x = 0$

$$\lim_{x\to 1^-} g(x) = \lim_{x\to 1^-} x^2 + 2 = 3$$

$$\lim_{x\to 1^+} g(x) = \lim_{x\to 1^+} x = 1$$

$$g(1) = 1$$

$\therefore$ $g(x)$ is not continuous at $x = 1$

$\therefore$ number of points of discontinuity = 1

61. Ⓑ

Given, $f(0) = k$

$$\lim_{x\to 0} f(x) = \lim_{x\to 0} (\cos x)^{1/\sin x} \qquad [1^{\infty} \text{ form}]$$

$$= e^{\lim_{x\to 0} \frac{1}{\sin x} \log \cos x}$$

$$= e^{0} = 1$$

For $f(x)$ to be continuous at $x = 0$, $k = 1$.

62. Ⓒ

$$\lim_{x\to 0} f(x) = \lim_{x\to 0} \frac{(27-2x)^{1/3} - (27)^{1/3}}{3[3-(243+5x)^{1/5}]} = \lim_{x\to 0} \frac{\frac{(27-2x)^{1/3} - (27)^{1/3}}{(27-2x)-27}(-2x)}{-3\left[\frac{(243+5x)^{1/5} - (243)^{1/5}}{243+5x-243}.5x\right]}$$

$$= \frac{2}{15} \frac{\frac{1}{3}(27)^{-2/3}}{\frac{1}{5}(243)^{-4/5}} = \frac{2}{15}.\frac{5}{3}.\frac{1}{9}.81 = 2$$

63. Ⓓ

Let k is integer

$f(k) = 0, f(k-0) = (k-1)^2 - (k^2 - 1) = 2 - 2k$

$f(k+0) = k^2 - (k^2) = 0$

If $f(x)$ is continuous at $x = k$, then $2 - 2k = 0 \;\Rightarrow\; k = 1$

64. Ⓐ

Case-1: When $x = a \in Q$

$$\lim_{x\to a} f(x) = \lim_{x\to a} 5x = 5a$$

Case-2: When $x = a \in R - Q$

$$\lim_{x\to a} f(x) = \lim_{x\to a} x^2 + 6 = a^2 + 6$$

$f(x)$ is continuous when $5a = a^2 + 6 \;\Rightarrow\; a = 2, 3$

65. Ⓓ

Since, $f(x)$ is continuous at $x = 0$

$$\therefore \lim_{x\to 0} f(x) = f(0)$$

$$\Rightarrow \lim_{x\to 0} \frac{-e^x + 2^x}{x} = f(0)$$

$$\Rightarrow \lim_{x\to 0} \frac{-e^x + 2^x \log 2}{1} = f(0) \qquad \text{[by } L \text{ 'Hospital's rule]}$$

$$\Rightarrow f(0) = -1 + \log 2$$

66. Ⓐ

Reflexive but not symmetric

67. Ⓐ

$$\sin^{-1}\left[\cos\left(\sin^{-1}\frac{\sqrt{3}}{2}\right)\right] = \sin^{-1}\left[\cos\frac{\pi}{3}\right] = \sin^{-1}\left(\frac{1}{2}\right) = \frac{\pi}{6}$$

68. Ⓐ

$$A = \begin{bmatrix} 0 & 1 \\ 1 & 0 \end{bmatrix}$$

$$A^2 = \begin{bmatrix} 0 & 1 \\ 1 & 0 \end{bmatrix}\begin{bmatrix} 0 & 1 \\ 1 & 0 \end{bmatrix} = \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}$$

$$A^4 = A^2 \times A^2 = \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}\begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix} = \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}$$

69. Ⓑ

$$A = \begin{bmatrix} a & 0 & 0 \\ 0 & a & 0 \\ 0 & 0 & a \end{bmatrix} \quad \therefore \ |adj\ A| = |A|^{3-1} = |A|^2$$

$$= a^6$$

70. Ⓐ

$$A = \begin{bmatrix} 1 & 2 & x \\ 3 & -1 & 2 \end{bmatrix}, \ B = \begin{bmatrix} y \\ x \\ 1 \end{bmatrix}$$

$$AB = \begin{bmatrix} 1 & 2 & x \\ 3 & -1 & 2 \end{bmatrix} \begin{bmatrix} y \\ x \\ 1 \end{bmatrix}$$

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

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

$\therefore$ $3x + y = 3y - x$

$\Rightarrow$ $4x = 2y$

$\Rightarrow$ $2x = y$

71. Ⓓ

$$f(x) = 2x,\ g(x) = \frac{x^2}{2} + 1$$

$\therefore$ $\dfrac{g(x)}{f(x)} = \dfrac{\frac{x^2}{2}+1}{2x}$ which can be discontinuous function.

72. Ⓒ

$$f(x) = \frac{4-x^2}{4x-x^3} = \frac{4-x^2}{x(4-x^2)}$$

$\therefore$ Points of discontinuity are 0, 2, –2.

73. Ⓐ

$$\lim_{x \to 0} f(x) = \lim_{x \to 0} x^2 \sin\left(\frac{1}{x}\right) = 0$$

$\therefore$ $f(0) = 0$ if $f(x)$ is continuous at $x = 0$

74. Ⓒ

$$\lim_{x \to \frac{\pi}{2}^+} f(x) = \lim_{x \to \frac{\pi}{2}^+} \sin x + n = n + 1$$

$$\lim_{x \to \frac{\pi}{2}^-} f(x) = \lim_{x \to \frac{\pi}{2}^-} mx + 1 = m\frac{\pi}{2} + 1$$

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

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

$$\Rightarrow\ n = m\frac{\pi}{2}$$

75. Ⓑ

$$f(x)=\frac{\sqrt{4+x}-2}{x}\;;\quad x\neq 0$$

$$\lim_{x\to 0} f(x)=\lim_{x\to 0}\frac{\not{x}}{\not{x}(\sqrt{4+x}+2)}=\frac{1}{4}$$

$$\therefore\; f(0)=\frac{1}{4}$$

Biology

76. Ⓓ

Flocs significantly increase the BOD of the sewage

Flocs decrease the BOD

77. Ⓓ

H_2O

78. Ⓓ

All of the above

79. Ⓓ

To make plants resistant to insects

The plants produce a toxin that kills insects

80. Ⓐ

Azotobacter

81. Ⓐ

A-Sludge tank, B – Gas holder, C- Slurry

82. Ⓐ

Dung + water

83. Ⓒ

Integrated Pest Management

84. Ⓑ

Saccharomyces cerevisiae

Its an yeast used commercially in bakeries and breweries

85. Ⓐ

Phosphate

86. Ⓑ

Viola

87. Ⓓ

They turn to seed coats

88. Ⓐ

GIFT

89. Ⓒ

Middle piece

90. Ⓑ

Cryptorchidism

91. Ⓐ

Sporopollenin

Due to absence of sporopollenin, the pollen grain germinates as a pollen tube through the germ pores.

92. Ⓑ

Arctic Tundra

93. Ⓓ

All of the above

94. Ⓒ

Pericarp

95. Ⓒ

Both A and B

96. Ⓐ

Haploid

It is formed by meiosis 1 in oogenesis

97. Ⓓ

Parturition

98. Ⓒ

72

99. Ⓓ

MTP

100. Ⓐ

GIFT