SOLUTIONS

PROGRESS TEST-1

GZ-1919 To 1921

GZK-1906

JEE MAIN PATTERN

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PHYSICS

1. (C)

sum of three non coplanar vectors can not be zero

2. (A)

3. (A)

4. (A)

5. (D)

6. (D)

7. (A)

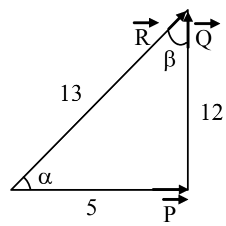
8. (D)

9. (A)

$$\vec{C} = \vec{A} + \vec{B} = (3\hat{i} + 6\hat{j} - 2\hat{k})$$

$$\hat{C} = \frac{\vec{C}}{|C|} = \frac{3\hat{i} + 6\hat{j} - 2\hat{k}}{\sqrt{3^2 + 6^2 + (-2)^2}} = \frac{3\hat{i} + 6\hat{j} - 2\hat{k}}{7}$$

10. (C)



$$\cos\beta = \frac{12}{13}$$

$$\therefore \quad \beta = \cos^{-1}\left(\frac{12}{13}\right)$$

11. (C)

$$\frac{|\vec{R}|_{min}}{|R|_{max}} = \frac{1}{4} = \frac{||\vec{A}| - |\vec{B}||}{|\vec{A}| + |\vec{B}|}$$

$$|\vec{A}| + |\vec{B}| = 4\,||\vec{A}| - |\vec{B}||$$

If $|\vec{A}| > |\vec{B}|$

$$|\vec{A}| + |\vec{B}| = 4\,(|\vec{A}| - |\vec{B}|)$$

$$3|\vec{A}| = 5|\vec{B}| \Rightarrow \frac{|\vec{A}|}{|\vec{B}|} = \frac{5}{3}$$

If $|\vec{B}| > |\vec{A}|$

$$|\vec{A}| + |\vec{B}| = 4\,(|\vec{B}| - |\vec{A}|)$$

$$\frac{|\vec{A}|}{|\vec{B}|} = \frac{3}{5}$$

12. (D)

$\because |\vec{F}_1+\vec{F}_2| = P$

$\Rightarrow F_1^2 + F_2^2 + 2F_1F_2 \cos\theta = P^2$ .....(1)

& $|\vec{F}_1-\vec{F}_2| = Q$

$\Rightarrow F_1^2 + F_2^2 - 2F_1F_2 \cos\theta = Q^2$ .....(2)

(1) + (2), $\boxed{2(F_1^2 + F_2^2) = P^2 + Q^2}$

13. (D)

14. (A)

15. (A)

Component of $\vec{A}$ along $\vec{B}$ = $\dfrac{\vec{A}.\vec{B}}{|\vec{B}|} \cdot \hat{B}$

16. (A)

17. (D)

$\vec{a} = 3\hat{i} + 4\hat{j}$. Let $\vec{c} = c_x\hat{i} + c_y\hat{j}$, $\vec{c}$ is perpendicular to $\vec{a}$ $\therefore$ $3c_x + 4c_y = 0$

$c_y = -\dfrac{3}{4}c_x$ (i)

$|\vec{c}| = 5$, $c_x^2 + c_y^2 = 25$, $c_x^2 + \dfrac{9c_x^2}{16} = 25$,

$c_x = \pm 4$, $\therefore$ $c_y = \mp 3$

18. (A)

19. (B)

20. (D)

21. (B)

$|\vec{a}-\vec{b}|^2 + |\vec{b}-\vec{c}|^2 + |\vec{c}-\vec{a}|^2$

$= (\vec{a}-\vec{b})\cdot(\vec{a}-\vec{b}) + (\vec{b}-\vec{c})\cdot(\vec{b}-\vec{c}) + (\vec{c}-\vec{a})\cdot(\vec{c}-\vec{a})$

$= a^2 + b^2 - 2\vec{a}\cdot\vec{b} + b^2 + c^2 - 2\vec{b}\cdot\vec{c} + c^2 + a^2 - 2\vec{c}\vec{a}$

$= 2(a^2 + b^2 + c^2) - 2(\vec{a}.\vec{b} + \vec{b}.\vec{c} + \vec{c}.\vec{a})$

Now, as

$|\vec{a}+\vec{b}+\vec{c}|^2 = a^2 + b^2 + c^2 + 2(\vec{a}.\vec{b} + \vec{b}.\vec{c} + \vec{c}.\vec{a}) \geq 0$

$\vec{a}\cdot\vec{b} + \vec{b}\cdot\vec{c} + \vec{c}\cdot\vec{a} \geq -\dfrac{3}{2}$

for maximum value of

$|\vec{a}-\vec{b}|^2+|\vec{b}-\vec{c}|^2+|\vec{c}-\vec{a}|^2$

the minimum value of $\vec{a}\cdot\vec{b}+\vec{b}\cdot\vec{c}+\vec{c}\cdot\vec{a}$ should be taken.

So, $2(1+1+1)-2\times\left(\frac{-3}{2}\right)=9$ is the maximum value of $|\vec{a}-\vec{b}|^2+|\vec{b}-\vec{c}|^2+|\vec{c}-\vec{a}|^2$

22. **(C)** **23.** **(A)** **24.** **(B)** **25.** **(B)**

26. **(D)** **27.** **(D)** **28.** **(A)** **29.** **(A)**

30. **(C)**

CHEMISTRY

31. **(C)**

$$\text{moles}=\frac{g}{M_0}=\frac{54}{124}=0.4355$$

32. **(C)**

Number of moles of magnesium = $\frac{0.004}{24}$ = $\frac{1}{6}x10^{-3}$

$\therefore$ Total number of atoms = $\frac{1}{6}x10^{-3}xN_A$

= $\frac{1}{6}x10^{-3}x6.022x10^{23}$

$\approx$ 10^{20} atoms

33. **(D)**

1 mole of electron contains N_A electrons.

$\therefore$ Weight of 1 mole of electrons

= 6.022 x 10^{23} x 9 x 10^{-28}

= 0.00054 gm

34. **(B)**

(A) 50 grams of iron

(B) Mass of Nitrogen (N_2) = 5 x 28 = 140 g

(C) 1 gram atom of silver means 1 mole of silver

$\therefore$ Mass of silver atom = 1 x 108 = 108 g

(D) Number of moles of C = $\frac{5x10^{23}}{6.022x10^{23}}=0.83$

$\therefore$ Mass of C = Number of moles x 12 = 0.83 x 12 = 9.96 g

So, option (B) has highest mass.

35. (D)

Moles of gas = $\frac{5.6}{22.4} = \frac{1}{4}$

Number of moles = $\frac{\text{weight}}{\text{GMM}}$

$\Rightarrow \frac{1}{4} = \frac{11}{\text{GMM}}$

$\Rightarrow$ GMM = 44 g/mol

$\therefore$ The gas is N_2O (Nitrous oxide)

36. (B)

Let the natural abundance of ^{63}Cu be x% and the natural abundance of ^{65}Cu be (100 –x) %

Average atomic mass of Copper $= \frac{\text{At. weight of } 1^{st} \text{ isotope} \times \% + \text{At. weight of } 2^{nd} \text{ Isotope x} \times \%}{100}$

$\Rightarrow 63.6 = \frac{63 \times x + 65 \times (100 - x)}{100}$

$\Rightarrow 6360 = 63x + 6500 - 65x$

$\Rightarrow 2x = 140$

$\Rightarrow x = 70\%$

37. (B)

$X_2Y_3 \rightarrow$ Pure Compound

Let the atomic weight of X be A_x and atomic weight of Y and A_y

% of X $\Rightarrow \frac{2A_x}{2A_x \times 3A_y} \times 100 = 60$

$\Rightarrow 200A_x = 120A_x + 180A_y$

$\Rightarrow 80A_x = 180A_y$

$\Rightarrow A_y = \frac{80}{180}A_x = \frac{4}{9}A_X$

38. (C)

Empirical formula represents the simple ratio of atoms in a compound.

39. (D)

$\underset{4.2g}{2NaHCO_3} \longrightarrow Na_2CO_3 + H_2O + CO_2$

Number of moles of $NaHCO_3 = \frac{4.2}{84} = \frac{1}{20}$, No of moles of CO_2 = 1/20 × 1/2 = 1/40

So, Volume of CO_2 formed at NTP $= \frac{1}{40} \times 22.4$

$= 0.56$ L

40. (A)

$CH_4 + 2O_2 \longrightarrow CO_2 + 2H_2O$

1 L at NTP

$$n_{CH_4} = \frac{1}{22.4}$$

A/c to mole – mole analysis

$$\frac{n_{CH_4}}{1} = \frac{n_{O_2}}{2} \Rightarrow n_{O_2} = 2 \times \frac{1}{22.4}$$

$\therefore$ V_{O_2} at NTP $= \frac{2}{22.4} \times 22.4 = 2L$.

41. (D)

$CS_2 + 3O_2 \longrightarrow 2SO_2 + CO_2$

(A) 1 mole of CS_2 will produce 1 mole of CO_2
(True Statement)

(B) $n_{O_2} = \frac{16}{32} = \frac{1}{2}$

A/c to mole – mole analysis

$$\frac{n_{O_2}}{3} = \frac{n_{CO_2}}{1} \Rightarrow n_{CO_2} = \frac{1}{6}$$

So, mass of $CO_2 = \frac{44}{6} = 7.33$ g. (True)

(C) A/c to mole – mole analysis

$$\frac{n_{O_2}}{3} = \frac{n_{SO_2}}{2} \Rightarrow n_{SO_2} = \frac{2}{3}$$.(True)

(D) $n_{O_2} = \frac{6}{N_A}$

A/c to mole – mole analysis

$$\frac{n_{O_2}}{3} = \frac{n_{CS_2}}{1} \Rightarrow n_{CS_2} = \frac{6}{N_A} \times \frac{1}{3}$$

$\therefore$ No. of molecules of $CS_2 = \frac{2}{N_A} \times N_A = 2.$ (False)

42. (C)

$$CaCO_3(s) \xrightarrow{\Delta} CaO(s) + CO_2(g)$$

5.6 L at NTP

$$n_{CO_2} = \frac{5.6}{22.4} = \frac{1}{4}$$

A/c to mole – mole analysis

$$\frac{n_{CaO}}{1} = \frac{n_{CO_2}}{1}$$

$$\Rightarrow n_{CaO} = \frac{1}{4}$$

$\therefore$ mass of $CaO = \frac{1}{4} \times 56 = 14\,gm.$

43. (B)

$$4\,KO_2 + 2\,H_2O \longrightarrow 4\,KOH + 3\,O_2$$

0.158 0.1

L.R. = KO_2

$\therefore$ No. of moles of O_2 formed = $\frac{3}{4} \times 0.158 = 0.1185$ mole

44. (A)

% of 'B' $= \frac{3B}{2A+3B} \times 100 = \frac{3 \times (1.5A)}{2A + 3 \times (1.5A)} \times 100 = \frac{4.5}{6.5} \times 100 = 69.2\%$

45. (C)

$$\frac{n_O}{n_B} = \frac{y}{3} = \frac{1}{0.3} \Rightarrow y = 10$$

$$\frac{n_H}{n_A} = \frac{4}{1} = \frac{2y}{x} = \frac{2 \times 10}{x} \Rightarrow x = 5$$

46. (B)

$$\%\,C = \frac{72}{180} \times 50 = 20\%$$

47. (C)

$$M_{av} = \frac{4\times80+2\times28}{6} = \frac{320+56}{6} = \frac{376}{6} = 62.66$$

$$(V.D.)_{av} = \frac{M_{av}}{2} = \frac{62.66}{2} = 31.33$$

48. (A)

(I) 0.5 mole of O_3 = 0.5×48 = 24 gm

(II) 0.5 mole of 'O' = 8 gm

(III) $\frac{1}{2}$ mole of O_2 = 16 gm

(IV) 0.25 mole of CO_2 = 11 gm

(I) > (III) > (IV) > (II)

49. (D)

$$40 = \frac{32a+80b}{a+b}$$

40 a + 40 b = 32 a + 80 b

a = 5b

$$M_{av} = \frac{32b+80a}{a+b}$$

$$= \frac{32b+400b}{5b+b}$$

$$= \frac{432}{6} = 72$$

50. (B)

$2H_2$	+	$O_2 \longrightarrow 2H_2O$
12gm		16gm
6mole		0.5mole
5mole left		LR
10g left.		

51. (D)

Molecular weight of mixture $= \frac{40\times28+40\times32+20\times44}{100}$ = 32.8 g

52. (C)

C ball 1400 can be used for 700

H ball 3600 can be used for 600

O ball 1000 can be used for 1000

Max possible is 600

53. (A)

Wt of carbon 1x10^{-6} gm

Mole of carbon = 1x 10^{-6} /12

Atom of carbon = $\frac{0.000001\times 6.023\times 10^{23}}{12}$ =5 x 10^{16}

54. (A)

$$16.12=\frac{90\times 16+x\times 17+(100-x)\times 18}{100}$$

x = 8

55. (A)

Molecular weight = $\frac{4\times 24\times 100}{0.096}=100000$

56. (D)

Mole of glucose = 54/180=0.3

Mole of CO_2 is 6 x 0.3 = 1.8 = 1.8 x 44 = 79.2g

57. (A)

$n_{O_2}=\frac{16}{32}=\frac{1}{2}$ & $n_{N_2}=\frac{14}{28}=\frac{1}{2}$

58. (C)

O_2 is the limiting reagent

59. (B)

$1\times n_{CO_2}=6\times n_{K_4[Fe(CN)_6]}$

$\therefore \quad n_{K_4[Fe(CN)_6]}=\frac{1}{6}$

60. (C)

$3BaCl_2 + 2Na_3PO_4 \longrightarrow Ba_3(PO_4)_2 + 6NaCl$

Here $BaCl_2$ is the limiting reactant number of moles of $Ba_3(PO_4)_2$ formed

= $\frac{1}{3}$ × No. of moles of $BaCl_2$ = $\frac{2}{3}$ mol.

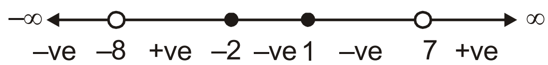
MATHEMATICS

61. (D)

$$|x|\left(\frac{1+|x|}{x^2-x+1}\right)\le 0 \quad \Rightarrow x=0$$

62. (B)

Using wavy curve method :



$\therefore \quad x \in (-\infty, 8) \cup [-2, 1] \cup [1, 7)$

i.e., $x \in (-\infty, 8) \cup [-2, 7)$

63. (A)

64. (B)

$$\frac{(x-3)^3}{(x-4)(x-1)\left(\sqrt{2}-x\right)\left(\sqrt{2}+x\right)}\le 0$$

$$x\in\left(-\sqrt{2},1\right)\cup\left(\sqrt{2},3\right]\cup(4,\infty)$$

65. (A)

Let x be the required logarithm, then by definition

$$(2\sqrt{2})^x = 32\sqrt[5]{4} \Rightarrow (2,2^{1/2})^x = 2^5.2^{2/5};\therefore 2^{\frac{3x}{2}} = 2^{5+\frac{2}{5}}$$

Here, by equating the indices, $\frac{3}{2}x=\frac{27}{5}$

$$\therefore x=\frac{18}{5}=3.6.$$

66. (B)

$$\log_{49}28=\frac{\log 28}{\log 49}=\frac{\log 7+\log 4}{2\log 7}$$

$$=\frac{\log 7}{2\log 7}+\frac{\log 4}{2\log 7}=\frac{1}{2}+\frac{1}{2}\log_7 4=\frac{1}{2}+\frac{1}{2}.2\log_7 2=\frac{1}{2}+\log_7 2=\frac{1}{2}+m=\frac{1+2m}{2}$$

67. (A)

$$\log_e\left(\frac{a+b}{2}\right)=\frac{1}{2}(\log_e a+\log_e b)=\frac{1}{2}\log_e(ab)=\log_e\sqrt{ab}$$

$$\Rightarrow \frac{a+b}{2}=\sqrt{ab}\Rightarrow a+b=2\sqrt{ab}\Rightarrow\left(\sqrt{a}-\sqrt{b}\right)^2=0\Rightarrow\sqrt{a}-\sqrt{b}=0\Rightarrow a=b.$$

68. (D)

If $\log_4 2+\log_4 4+\log_4 16+\log_4 x=6$

then $\log_4(2\times4\times16\times x)=6$

$$\Rightarrow\log_4 128x=6\Rightarrow 128x=4^6\Rightarrow x=\frac{64\times64}{128}\Rightarrow x=32$$

69. (C)

$$a=\log_{24}12=\frac{\log 12}{\log 24}=\frac{2\log 2+\log 3}{3\log 2+\log 3}$$

$$b=\log_{36}24=\frac{3\log 2+\log 3}{2(\log 2+\log 3)}$$

$$c=\log_{48}36=\frac{2(\log 2+\log 3)}{4\log 2+\log 3}$$

$$\therefore abc=\frac{2\log 2+\log 3}{4\log 2+\log 3}$$

$$\Rightarrow 1+abc=\frac{6\log 2+2\log 3}{4\log 2+\log 3}=2.\frac{3\log 2+\log 3}{4\log 2+\log 3}=2bc.$$

70. (B)

$$2^{\log_{\sqrt{2}}(x-1)}>x+5\Rightarrow(\sqrt{2})^{2\log\sqrt{2}(x-1)}>+5$$

$$\Rightarrow(x-1)^2>x+5\Rightarrow x^2-3x-4>0\Rightarrow(x-4)(x+1)>0\Rightarrow x>4 \text{ or } x<-1$$

But for $\log_{\sqrt{2}}(x-1)$ to be defined $x-1>0$

i.e., $x>1$

$\therefore x>4\Rightarrow x\in(4,\infty).$

71. (C)

$\log_{0.04}(x-1) \ge \log_{0.2}(x-1)$ ......(i)

For log to be defined $x-1>0 \Rightarrow x>1$

From (i), $\log_{(0.2)^2}(x-1) \ge \log_{0.2}(x-1)$

$\Rightarrow \frac{1}{2}\log_{0.2}(x-1) \ge \log_{0.2}(x-1) \Rightarrow \sqrt{x-1} \le (x-1)$

$\Rightarrow \sqrt{x-1}(1-\sqrt{x-1}) \le 0 \Rightarrow 1-\sqrt{x-1} \le 0$

$\Rightarrow \sqrt{x-1} \ge 1 \Rightarrow x \ge 2, \therefore x \in [2,\infty).$

72. (B)

Since $x^2+1=0$, gives $x^2=-1 \Rightarrow x=\pm i$

$\therefore x$ is not real but x is real (given)

$\therefore$ No value of x is possible.

73. (B)

$A=[x : x \in R, -1<x<1]$

$B=[x : x \in R : x-1 \le -1 \text{ or } x-1 \ge 1]$

$=[x : x \in R : x \le 0 \text{ or } x \ge 2]$

$\therefore A \cup B = R - D$, where

$D=[x : x \in R, 1 \le x < 2].$

74. (B)

$n(A \cap B) = n(A)+n(B)-n(A \cup B) = 5$

$n(A-B) = n(A)-n(A \cap B) = 11$

75. (A)

$A \cup B = \{1,2,3,4,5,6\} \therefore (A \cup B) \cap C = \{3,4,6\}.$

76. (C) Since x = 0 is one of the solution so the product will be zero.

77. (D) $|x^2-9| + |x^2-4| = 5$

$|x^2-9| + |x^2-4| = |(x^2-9)-(x^2-4)|$

$\Rightarrow (x^2-9)(x^2-4) \le 0$ $\{\therefore |a|+|b| = |a-b| \Leftrightarrow a.\, b \le 0\}$

$\Rightarrow x \in [-3,-2] \cup [2, 3]$

78. (D)

Case I when $x \ge -2$

$\frac{|x+2|-x}{2} < 2 \quad \Rightarrow \quad \frac{2}{x} < 2 \Rightarrow \frac{1}{x} < 1 \Rightarrow (x-1)/x > 0$

$x \in [-2, 0) \cup (1, \infty]$ .....(i)

Case II when $x < -2$

$\frac{|x+2|-x}{x} < 2 \Rightarrow \frac{-2-2x}{x} < 2 \Rightarrow \frac{1+x}{x} + 1 > 0$

$\Rightarrow (1 + 2x) / x > 0 \Rightarrow x \in (-\infty, -2)$ ...(ii)

$\therefore$ from (i) and (ii) we get $x \in (-\infty, 0) \cup (1, \infty)$

79. **(A)** $|a| + |b| = |a - b|$

$\Rightarrow ab \le 0$

$(x^2 - 5x + 7)(x^2 - 5x - 14) \le 0$

$(x - 7)(x + 2) \le 0$

$\Rightarrow x \in [-2, 7]$

80. **(C)** Use $A^{\log_A B} = B$

$e^{\ell n(\ell n3)} = \ell n3$

$\therefore \quad e^{e^{\ell n(\ell n3)}} = e^{\ell n3} = 3$

81. **(A)**

$N = \frac{(3^4)^{\log g^5} + 3^{3\log_3 \sqrt{6}}}{409}[7^{\log_7} - (5^3)^{\log_5 2^6}]$

$N = \frac{3^{\log_3 25} + 3^{\log_3} \sqrt{6}^3}{409} \; [25 - 6\sqrt{6}]$

$N = \frac{(25 + 6\sqrt{6})(25 - 6\sqrt{6})}{409}$

$N = 1$

$\log_2 N = \log_2 1 = 0$

82. **(C)**

$x^2 + 3x + 2 \ge 0 \Rightarrow (x+1)(x+2) \ge 0$

$\Rightarrow x \in (-\infty, -2] \cup [-1, \infty) I$

Case I. $x - 1 < 0 \Rightarrow x < 1, x - 1 < \sqrt{x^2 + 3x + 2}$ is true

$\therefore \quad x \in (-\infty, -2] \cup [-1, 1) \quad ...\text{(i)}$

Case II. if $x - 1 \geq 0 \Rightarrow x \geq 1$

$$x - 1 < \sqrt{x^2 + 3x + 2}$$

$$\Rightarrow x^2 - 2x + 1 < x^2 + 3x + 2 \Rightarrow 5x + 1 > 0 \Rightarrow x > -\frac{1}{5}$$

$\therefore \quad x \in [1, \infty) \quad ...\text{(ii)}$

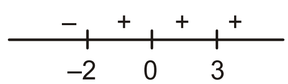
From (i) and (ii)

$x \in (-\infty, -2] \cup [-1, \infty)$

83. (D)

Using wavy curve method and the fact that x = 0 and 3 are the repeated roots of

$x(e^x - 1)(x + 2)(x - 3)^2 \leq 0$ we get the sign scheme of the given expression as



Thus complete solution is $x \in (-\infty, -2] \cup \{0, 3\}$

84. (D)

$1 \leq |3 - x| < 2$

and

$|3 - x| \geq 1$ | $|3 - x| < 2$

$\Rightarrow x \in (-\infty, 2] \cup [4, \infty)$ $\quad\quad \Rightarrow x \in (1, 5)$

Ans. $x \in (1, 2] \cup [4, 5)$

85. (C)

$$|x - 1| - |x - 2| = \frac{1}{2}$$

$x \leq 1$	$1 \leq x \leq 2$	$x \geq 2$
$-(x-1) + (x-2) = \frac{1}{2}$	$(x-1) + (x-2) = \frac{1}{2}$	$(x-1) - (x-2) = \frac{1}{2}$
$-1 = \frac{1}{2}$	$x = \frac{7}{4}$	$1 = \frac{1}{2}$
x	✓	x

86. **(B)**

$3x^2 - 10x + 3 = 0 \quad \Rightarrow \quad x = 3, 1/3$

or, $|x - 4| = 1 \quad \Rightarrow \quad x = 5, 3.$

87. **(B)**

$|x-1| \le 2 \Rightarrow -2 \le x-1 \le 2$

$\Rightarrow -1 \le x \le 3$

88. **(D)**

We have, $5x + 2 < 3x + 8$ and $\frac{x+2}{x-1} < 4 \quad \Rightarrow 2x - 6 < 0$ and $\frac{x+2}{x-1} - 4 < 0$

$\Rightarrow 2(x-3) < 0$ and $\frac{-3x+6}{x-1} < 0 \quad \Rightarrow x - 3 < 0$ and $\frac{x-2}{x-1} > 0$

$\Rightarrow x \in (-\infty, 3)$ and $x \in (-\infty, 1) \cup (2, \infty) \quad \Rightarrow x \in (-\infty, 1) \cup (2, 3)$

89. **(C)**

$\frac{4-4x+2+2x}{(1+x)(1-x)} - 1 < 0 \quad \Rightarrow \quad \frac{6-2x-1+x^2}{(1+x)(1-x)} < 0 \quad \Rightarrow \quad \frac{x^2-2x+5}{(x+1)(x-1)} > 0$

$\Rightarrow \quad \frac{1}{(x+1)(x-1)} > 0$

90. **(C)**

$x - 1 = x^2 - x = 0 \quad \Rightarrow x = 1$