SOLUTIONS

PROGRESS TEST-1

GZBS-1904

JEE MAIN PATTERN

Test Date: 29-07-2017

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PHYSICS

1. (C)

sum of three non coplanar vectors can not be zero

2. (B)

3. (A)

4. (A)

5. (D)

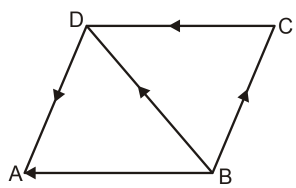
6. (D)

7. (C)

8. (D)

9. (A)

According to addition law of vectors.



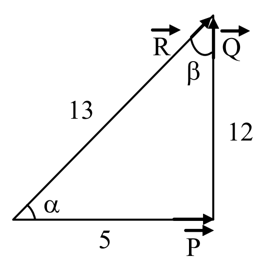
$$\overrightarrow{BC}+\overrightarrow{CD}=\overrightarrow{BD}$$

Also, $$\overrightarrow{BD}+\overrightarrow{DA}=\overrightarrow{BA}$$

$\therefore\quad \overrightarrow{BC}+\overrightarrow{CD}+\overrightarrow{DA}+\overrightarrow{BA}=2\overrightarrow{BA}$

$\therefore\quad n = 2$

10. (C)



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

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)

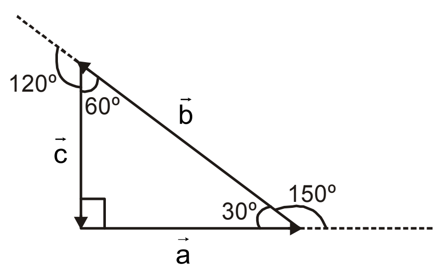
& $|\vec{F}_1 - \vec{F}_2| = Q$

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

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

13. (C)

If $\vec{a} + \vec{b} + \vec{c} = 0,$ then they form slides of a triangle taken in order, according to Polygon Law.



$\sin 30° = \frac{c}{b}$

$\therefore b : c = 2 : 1$ ....(i)

$\cos 30^{o} = \frac{a}{b}$

$\therefore \quad a : b = \sqrt{3} : 2 \qquad$ ...(ii)

From (i) and (ii) we get

$\Rightarrow a : b : c = \sqrt{3} : 2 : 1$

14. (A)	**15. (C)**	**16. (B)**	**17. (C)**
18. (A)	**19. (C)**	**20. (A)**	**21. (B)**
22. (C)	**23. (B)**	**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 = $\frac{0.004}{24}$ = $\frac{1}{6} x 10^{-3}$

$\therefore$ Total number of atoms = $\frac{1}{6} x 10^{-3} x N_A$

= $\frac{1}{6} x 10^{-3} x 6.022 x 10^{23}$

$\approx 10^{20}$ 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 = $\frac{5 x 10^{23}}{6.022 x 10^{23}} = 0.83$

$\therefore$ 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 $\Rightarrow \frac{2A_x}{2A_x \times 3A_y} \times 100 = 60$

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

$\Rightarrow 80 A_x = 180 A_y$

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

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 $CO_2 = \frac{44}{6} = 7.33g$. (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)

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

47. (C)

$$M_{av} = \frac{4 \times 80 + 2 \times 28}{6} = \frac{320 + 56}{6} = \frac{376}{6} = 62.66$$

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

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 $=\dfrac{40\times 28+40\times 32+20\times 44}{100}$ = 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 $1\text{x}10^{-6}$ gm

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

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

54. (A)

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

x = 8

55. (A)

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

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)

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

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

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

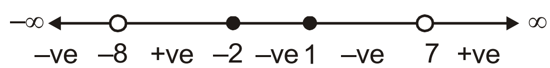
MATHEMATICS

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 $\log_4(2\times 4\times 16\times x)=6$

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

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)

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

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

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

$\Rightarrow \frac{1}{2}\log_{0.2}(x-1) \geq \log_{0.2}(x-1) \Rightarrow \sqrt{x-1} \leq (x-1)$

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

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

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)

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

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

$=[x : x \in R : x \leq 0 \text{ or } x \geq 2]$

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

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

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) $|x^2-9| + |x^2-4| = 5$

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

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

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

78. (D)

Case I when $x \geq -2$

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

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

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

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

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

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

$\therefore \ x \in [1, \infty) \qquad \ldots \text{(ii)}$

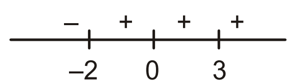
From (i) and (ii)

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

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 ≤ |3 – x| < 2

and

$\|3 - x\| \geq 1$	$\|3 - x\| < 2$
$\Rightarrow x \in (-\infty, 2] \cup [4, \infty)$	$\Rightarrow x \in (1, 5)$

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

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

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)

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