SOLUTIONS

PROGRESS TEST-1

RB-1810

JEE MAIN PATTERN

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PHYSICS

1. (D)

Given $\left(\vec{a}+3\vec{b}\right).\left(7\vec{a}-5\vec{b}\right)=0 \Rightarrow 7a^2-15b^2+16\,\vec{a}.\vec{b}=0$ ..... (1)

Also, $(\vec{a}-4\vec{b}).(7\vec{a}-2\vec{b})=0 \Rightarrow 7a^2+8b^2-30\,\vec{a}.\vec{b}=0$ ..... (2)

Subtracting, $-23b^2+46\,\vec{a}.\vec{b}=0 \Rightarrow \vec{a}.\vec{b}=\frac{b^2}{2}$

Putting this in (1),

$7a^2-7b^2=0 \Rightarrow |\vec{a}|=|\vec{b}|$. Thus $\vec{a}.\vec{b}=ab\cos\theta$

$\Rightarrow \frac{b^2}{2}=b^2\cos\theta \Rightarrow \cos\theta=\frac{1}{2}$ or $\theta=60°$.

2. (A)

3. (B)

4. (D)

$A=3N,\ B=2N$ then

$R=\sqrt{A^2+B^2+2AB\cos\theta}$

$R=\sqrt{9+4+12\cos\theta}$ …(i)

Now $A=6N,\ B=2N$ then

$2R=\sqrt{36+4+24\cos\theta}$ …(ii)

from (i) and (ii) we get $\cos\theta=-\frac{1}{2} \therefore\ \theta=120°$

5. (B)

6. (C)

Kx = mg

x = $\frac{mg}{K}=\frac{0.1\times10}{20}=\frac{1}{20}$ = 5 cm,

Apply $\frac{1}{v}+\frac{1}{u}=\frac{1}{f}$

7. (C)

8. (D)

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

$$-\frac{dv}{v^2}+\left(\frac{-du}{u^2}\right)=0$$

$$dv=-\left(\frac{v}{u}\right)^2 du$$

$$=-(2)^2\times 1\text{mm}$$

$$=-4\text{mm} \Rightarrow \text{length of image = 4 mm}$$

9. (D)

10. (B)

11. (B)

12. (C)

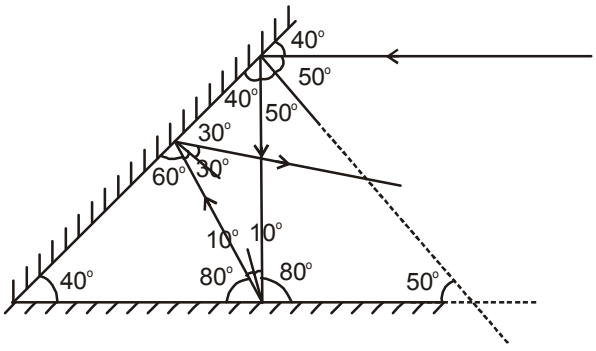
13. (D)

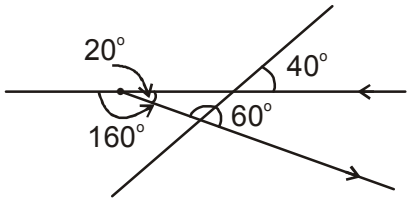
In given figure, reflected light from one surface will not strike on another surface

So, only two images are formed.

Hence statment 1 is false but statement 2 is ture.

14. (D)





$\delta = 160^\circ$ (anticlockwise)

15. (B)

16. (B)

$$\hat{n} = \frac{\vec{A} \times \vec{B}}{|\vec{A} \times \vec{B}|}$$

$$\vec{A} \times \vec{B} = \begin{vmatrix} \hat{i} & \hat{j} & \hat{k} \\ 1 & 1 & 0 \\ 0 & 1 & -1 \end{vmatrix} = \hat{i}(-1-0) - \hat{j}(-1-0) + \hat{k}(1-0) = -\hat{i} + \hat{j} + \hat{k}$$

$$|\vec{A} \times \vec{B}| = \sqrt{3}, \qquad \hat{n} = \frac{1}{\sqrt{3}}(-\hat{i} + \hat{j} + \hat{k})$$

17. (D)

$$\vec{A} = 4\hat{i} - 2\hat{j} + 6\hat{k}, \qquad \vec{B} = \hat{i} - 2\hat{j} - 3\hat{k},$$

$$\vec{A} - 4\vec{B} = 6(\hat{j} + 3\hat{k})$$

$\therefore$ Perpendicular to x–axis

18. (A)

Let that vector be $\vec{C}$. Then

$$\vec{C} = C\hat{C} = b\hat{a} \quad \Rightarrow \vec{C} = \frac{b\vec{a}}{a} = \frac{5}{\sqrt{2}}\left(\hat{i} - \hat{j}\right)$$

19. (C)

20. (A)

21. (A)

component of $\vec{A}$ along $\vec{B}$, $\vec{A}_{\|\vec{B}} = \frac{\vec{A} \cdot \vec{B}}{\vec{B} \cdot \vec{B}}\vec{B} = \frac{-7}{10}\left(\hat{i} - 3\hat{j}\right)$

component of $\vec{A} \perp^r$ to $\vec{B}$, $\vec{A}_{\perp^r \vec{B}} = \vec{A} - \vec{A}_{\| \vec{B}}$

$$= \left(2\hat{i} + 3\hat{j}\right) - \frac{-7}{10}\left(\hat{i} - 3\hat{j}\right)$$

$$= \left(2\hat{i} + 3\hat{j}\right) + \frac{7}{10}\hat{i} - \frac{21}{10}\hat{j}$$

$$= \frac{27}{10}\hat{i} + \frac{9}{10}\hat{j}$$

22. (B)

component of velocity along shore line

is $4 \times \cos 60^\circ$ = 2 km/h

23. (A)

Let direction of river flow be along x-axis.

$\therefore$ Angle made by $\vec{V}_{MG}$ with x-axis, $\tan\theta = \frac{V_{MR}}{V_{RG}}$

24. (A)

25. (C)

26. (B)

As $\vec{A} \cdot \vec{B} = 0$

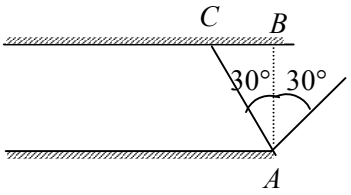
$(3i - 5j + 5k) \cdot (5i - j - 4k) = 15 + 5 - 20 = 0$

hence angle between $\vec{A}$ and $\vec{B}$ is 90°

27. (B)

28. (B)

From the law of refection



$\tan 30^\circ = \frac{BC}{AB} = \frac{BC}{0.2}$; $BC = 0.2 \times \frac{1}{\sqrt{3}} = 0.115$

Total no. of reflection = 30

29. (B)

30. (B)

CHEMISTRY

31. (D)

Gm–atoms of $C = \frac{24}{12} = 2$;

Gm–atoms of H = $\frac{1}{4} = 4$.

Gm–atoms of $O = \frac{32}{16} = 2$.

Hence, the formula is $C_2H_4O_2$ or CH_2O.

32. (D)

If mass of P is 10^{-2}g, mass of compound is 100g

If mass of P is 31g, mass of compound

$$= \frac{100 \times 31}{10^{-2}} \qquad = 31 \times 10^{+4}.$$

33. (C)

Let the atomic mass be m.

$$= \frac{n_M}{n_0} = \frac{4}{6} = \frac{2}{3}$$

$$\frac{10/m}{8.88/16} = \frac{2}{3} \Rightarrow m = 27$$

34. (D)

Number of iron atoms in haemoglobin

$$= \frac{\text{Molecular weight of haemoglobin} \times \text{Percentage of iron}}{100 \times \text{Molecular weight of iron}}$$

$$= \frac{67200 \times 0.33}{100 \times 56} = 4$$

35. (C)

no. of values e^- = $\left(\frac{4.2}{14} N_A\right) \times 8 = 2.4\, N_A$

36. (D)

Number of molecules in 3.5g of CO

$$= \frac{3.5 \times 6.02 \times 10^{23}}{28} = 1.25 \times 10^{22}$$

37. (A)

If the ratio of $^{10}_{5}B$ and $^{11}_{5}B$ is x : y, then

$$\frac{10x + 11y}{x + y} = 10.81$$

or $0.81\ x = 0.19\ y$

or $\frac{x}{y} = \frac{19}{81}$

38. (A)

In 125 g (GFM) of $ZnCO_3$,

number of O atoms = $3N_A$.

In 12.5g of $ZnCO_3$, number of O atoms

$= 0.3\ N_A$

$= 0.3 \times 6.02 \times 10^{23}$

$= 1.806 \times 10^{23}$

39. (A)

Since gram atomic weight of any gas has

N_A (6.023×10^{23}) atoms, therefore

(a) 4 gm hydrogen contains = $4 \times 6.023 \times 10^{23}$

$= 24.092 \times 10^{23}$ atoms

(b) 71 gm chlorine contains = $2 \times 6.023 \times 10^{23}$

$= 12.046 \times 10^{23}$ atoms

(c) 48 gm magnesium contains = $2 \times 6.023 \times 10^{23} = 12.046 \times 10^{23}$ atoms

(d) 127 gm iodine contains = $2 \times 6.023 \times 10^{23}$

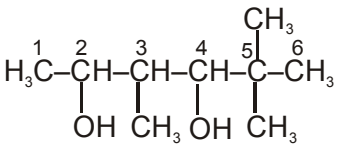
$= 12.046 \times 10^{23}$ atoms

40. (A)

$V_{Nugget} = V_{gold} + V_{quartz}$

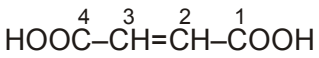
$\frac{x + y}{d} = \frac{x}{d_1} + \frac{y}{d_2}$

41. (A)



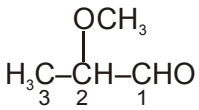
3,5,5-Trimethylhexane-2,4-diol

42. (B)



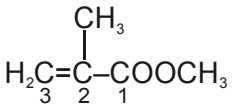
But-2-ene-1,4-dioicacid

43. (C)



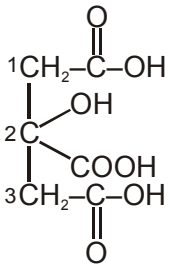
2-Methoxypropanal

44. (D)



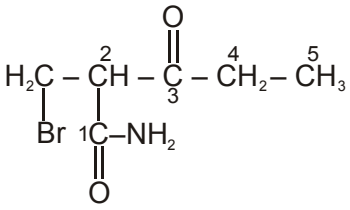
Methyl-1,2-Methylprop-2-enoate

45. (B)



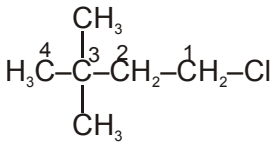
2-Hydroxypropane-1,2,3-tricarboxylic acid

46. (D)



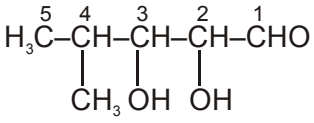
2-(Bromomethyl)-3-oxopentanamide

47. (B)



1-Chloro-3,3-dimethylbutane

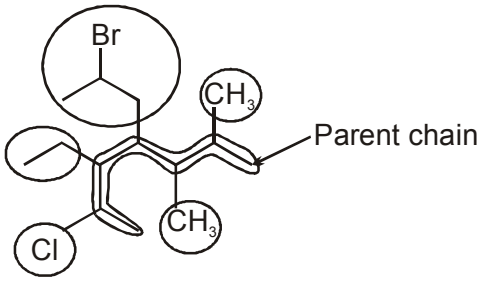
48. (A)



2,3-Dihydroxy-4-methylpentanal

49. (B)

50. (C)



5-Substituents

51. (C)

A large difference between the fourth and fifth ionization energ in four valence electrons.

Ex - $_6C = 1s^2, 2s^2, 2p^2$ valence shell electron

Due to loss of four electron fifth electron loss from inner shell electron.

52. (B)

(A) Mg (B) Na

(C) Ne (D) F

$1P_1$ Na $< Mg < F < Ne$

$2p^6$ $2p^6 3s^2$ $2p^4$ $2p^5$

After loss of one electron

$1P_2$ = Mg < F < Ne < Na

53. (D)

54. (A)

Ni = 3d

Pd = 4d

Pt = 5d

$1P_1$ = 3d < 4d < 5d

55. (A)

Order of radius = V.R. > Crystal > Covalent radius.

56. (B)

(i) Na_2CO_3 form by option V and it is not dicomposed due to high lattic energy.

(ii) D-block elements are most likely to forms coloured ionic compound option – X

(iii) As per option above given mention electronic configuration element is (Kr) krypton and this is belong from.inert gases Group VIII-A and has vender wall forces. So it has largest atomic radius.

(iv) Option (W) can forms only oxides.

Like - MgO

57. (D)

B < S < P < F (Data base)

58. (B)

$Pb > Pb^{2+} > Pb^{4+}$

59. (C)

iso - electronic species

60. (B)

Due to smaller size and half filled atomic orbital.

MATHEMATICS

61. (D)

We have, $\tan\theta = \frac{1}{2}$

$\therefore \quad \tan 2\theta = \frac{2\tan\theta}{1-\tan^2\theta} = \frac{4}{3}$

Now, $\tan(2\theta+\phi) = \frac{\tan 2\theta + \tan\phi}{1-\tan 2\theta\tan\phi} = \frac{\frac{4}{3}+\frac{1}{3}}{1-\frac{4}{3}\times\frac{1}{3}} = 3$

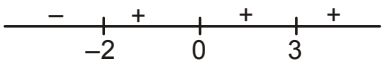
62. (B)

$-\sqrt{49+25} \le 2k+1 \le \sqrt{49+25}$

63. (C)

$\sin(2n\pi+\theta) = \sin\theta$, there are total 10 terms.

64. (C)



65. (A)

$$\cos\frac{\pi}{19}+\cos\frac{3\pi}{19}+\cos\frac{5\pi}{19}+...+\cos\frac{17\pi}{19}$$

Use formula

$$\text{if } \cos\alpha+\cos(\alpha+\beta)+...+\cos(\alpha+(n-1)\beta)=\frac{\cos(\alpha+(n-1)\beta/2)\sin\left(\beta\frac{n}{2}\right)}{\sin\left(\frac{\beta}{2}\right)}$$

where $\alpha=\frac{\pi}{19}$, $\beta=\frac{2\pi}{9}$, n = 9

66. (B)

We have,

$$\cos\theta\cos2\theta\cos2^2\theta\ ...\ \cos2^{n-1}\theta = \frac{\sin2^n\theta}{2^n\sin\theta} = \frac{\sin(\pi-\theta)}{2^n\sin\theta} \qquad [\because 2^n\theta=\pi-\theta]$$

$$= \frac{1}{2^n}$$

67. (C)

$7x - 1 = 12$, $7x - 1 = -12$

68. (B)

$$\alpha=\beta=\gamma=\frac{\pi}{2}$$

69. (B)

5 lies in Fourth quadrant

70. (D)

The given expression is equal to

$(\sin 47^0 + \sin 61^0) - (\sin 11^0 + \sin 25^0) = 2\sin54^0\cos7^0 - 2\sin18^0\cos7^0$

$$= 2\cos7^0(\sin54^0-\sin18^0) = 2\cos7^0\left[\frac{\sqrt{5}+1}{4}-\frac{\sqrt{5}-1}{4}\right] = \cos7^0$$

71. (A)

$$(a\cdot\frac{1-\tan^2\theta}{1+\tan^2\theta}+b\cdot\frac{2\tan\theta}{1+\tan^2\theta}) = a$$

72. (B)

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

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

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

73. (A)

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

$$=\frac{1}{2}\log_e(ab)=\log_e\sqrt{ab}$$

$$\Rightarrow\frac{a+b}{2}=\sqrt{ab}\Rightarrow a+b=2\sqrt{ab}$$

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

74. (D)

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

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

$\Rightarrow\log_4 128x=6\Rightarrow 128x=4^6$

$$\Rightarrow x=\frac{64\times64}{128}\Rightarrow x=32$$

75. (D)

$\cos 90^0=0$

76. (A)

$x^2=16\Rightarrow x=\pm4$

$2x=6\Rightarrow x=3$

There is no value of x which satisfies both the above equation. Thus, $A=\phi.$

77. (C)

$n(A^c \cap B^c) = n[(A \cup B)^c] = n(U) - n(A \cup B)$

$= n(U) - [n(A) + n(B) - n(A \cap B)]$

$= 700 - [200 + 300 - 100] = 300.$

78. (B)

$x^2 - 5x + 7 < 1 \quad ; \quad x^2 - 5x + 6 < 0$

$(x - 2)\ (x - 3) < 0$

79. (B)

$$\begin{cases} 0 \le \alpha \le \frac{\pi}{2} \\ 0 \le \beta \le \frac{\pi}{2} \end{cases} \Rightarrow \begin{cases} 0 \le \alpha + \beta \le \pi \\ -\frac{\pi}{2} \le \alpha - \beta \le \frac{\pi}{2} \end{cases}$$

$$\cos(\alpha + \beta) = -\frac{4}{5} \Rightarrow \frac{\pi}{2} \le \alpha + \beta \le \pi \Rightarrow \tan(\alpha + \beta) = -\frac{3}{4}$$

$$\sin(\alpha - \beta) = \frac{5}{13} \Rightarrow 0 \le \alpha - \beta \le \frac{\pi}{2} \Rightarrow \tan(\alpha - \beta) = \frac{5}{12}$$

$$\therefore \quad \tan 2\beta = \tan((\alpha + \beta) - (\alpha - \beta)) = \frac{-\frac{3}{4} - \frac{5}{12}}{1 - \frac{15}{48}} = -\frac{56}{33}$$

80. (D)

$2\cos(A + B)\cos(A - B) + \cos 2C = -2\sin C \cos(A - B) + 1 - 2\sin^2 C$

$= 1 - 2\sin C\,(\cos(A - B) + \sin C)$

$= 1 - 2\sin C\,(\cos(A - B) - \cos(A + B))$

$= 1 - 4\sin A \sin B \sin C$

81. (B)

From $3\tan A + 4 = 0$, we get $\tan A = -4/3$, so that

$$\sin A = \frac{-\tan A}{\sqrt{1 + \tan^2 A}} = \frac{4/3}{\sqrt{1 + 16/9}} = \frac{4}{5} \qquad \left[\because \sin A > 0 \text{ and } \tan A < 0 \text{ in quad. II}\right]$$

$$\text{and } \cos A = -\frac{1}{\sqrt{1 + \tan^2 A}} = -\frac{3}{5} \qquad \left[\because \cos A \text{ is negative in quad. II}\right]$$

Hence 2 cot A – 5 cosA + sin A = $2\left(-\frac{3}{4}\right)-5\left(-\frac{3}{5}\right)+\frac{4}{5}=\frac{23}{10}$

82. (B)

$3\sin\theta = 5(1-\cos\theta) = 5\times 2\sin^2\theta/2 \Rightarrow \tan\theta/2 = 3/5$

$$5\sin\theta - 3\cos\theta = 5\times\frac{2\tan\frac{\theta}{2}}{1+\tan^2\frac{\theta}{2}} - 3\frac{\left(1-\tan^2\frac{\theta}{2}\right)}{1+\tan^2\frac{\theta}{2}} = 5\times\frac{2\times\frac{3}{5}}{1+\frac{9}{25}} - \frac{3\times\left(1-\frac{9}{25}\right)}{1+\frac{9}{25}} = 3$$

83. (D)

$(\sin x+1)^2+2\in[2,6]$

84. (A)

$3x-1=2x$; $x\geq\frac{1}{3}$

$1-3x=2x$; $x<\frac{1}{3}$

85. (C)

$2^{2\log_2(2x)}=36$; $4x^2=36$; $x=\pm 3$

86. (C)

We have,

$5^{\log_a x}+5x^{\log_a 5}=3 \Rightarrow x^{\log_a 5}+5x^{\log_a 5}=3$ $\quad[\because x^{\log_a y}=y^{\log_a x}]$

$\Rightarrow 6\cdot x^{\log_a 5}=3 \Rightarrow x^{\log_a 5}=\frac{1}{2}$

$\Rightarrow x=(2^{-1})^{\log_5 a}=2^{-\log_5 a}$

87. (A)

$\sin\theta=\operatorname{cosec}\theta=1$

88. (C)

According to property $|f(x)|=-f(x)$, then $f(x)\leq 0$

$|x-1|\,|x-2|=-(x-2)(x-1)\Rightarrow(x-1)(x-2)\leq 0\Rightarrow 1\leq x\leq 2$

89. (C)

(1) If $x^2 + 4x + 2 \geq 0$, then the equation is equivalent to the system $\begin{cases} x^2 + 4x + 2 \geq 0 \text{ and} \\ 3x^2 + 7x - 10 = 0, \end{cases}$ solving which we find x = 1.

(2) If $x^2 + 4x + 2 < 0$, then the equation is equivalent to the system $\begin{cases} x^2 + 4x + 2 < 0 \text{ and} \\ 3x^2 + 17x + 22 = 0, \end{cases}$ solving which we find x = –2.

90. (C)

We have $2^{x+2} > 2^{-2/x}$. Since the base 2 > 1, we have $x + 2 > -2/x$ (the sign of the inequality is retained). Solving the last inequality, we obtain $x \in (0, \infty)$