JEE EXPERT

JEE MAIN EXCLUSIVE TOPICS

(SPECIAL TEST - 02)
PHYSICS, CHEMISTRY & MATHEMATICS
Batch : 12th & 12th Pass [22.12.2019]

Answer Key

PHYSICS

1.	(A)	2.	(D)	3.	(B)	4.	(A)	5.	(B)
6.	(B)	7.	(B)	8.	(B)	9.	(D)	10.	(B)
11.	(D)	12.	(B)	13.	(D)	14.	(C)	15.	(C)
16.	(A)	17.	(B)	18.	(A)	19.	(D)	20.	(A)
21.	(A)	22.	(C)	23.	(D)	24.	(D)	25.	(C)
26.	(C)	27.	(A)	28.	(C)	29.	(C)	30.	(B)

CHEMISTRY

31.	(D)	32.	(A)	33.	(C)	34.	(A)	35.	(B)
36.	(C)	37.	(D)	38.	(A)	39.	(A)	40.	(A)
41.	(B)	42.	(C)	43.	(A)	44.	(C)	45.	(D)
46.	(D)	47.	(A & C)	48.	(B)	49.	(A)	50.	(D)
51.	(B)	52.	(A)	53.	(A)	54.	(B)	55.	(D)
56.	(B)	57.	(A)	58.	(C)	59.	(B)	60.	(B)

MATHEMATICS

61.	(C)	62.	(B)	63.	(C)	64.	(B)	65.	(D)
66.	(A)	67.	(B)	68.	(D)	69.	(D)	70.	(A)
71.	(B)	72.	(A)	73.	(A)	74.	(B)	75.	(A)
76.	(D)	77.	(C)	78.	(D)	79.	(C)	80.	(D)
81.	(B)	82.	(B)	83.	(B)	84.	(A)	85.	(A)
86.	(C)	87.	(C)	88.	(C)	89.	(A)	90.	(C)

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Solutions

PHYSICS

1. An audio signal ....

Sol. Band width for both signals

15200 Hz – 200 Hz = 15000 Hz

Band width for human speech

2700 Hz – 200 Hz = 2500 Hz

The ratio = $\frac{15000}{2500} = 6$

2. In a common emitter ....

Sol. $A_V = \beta \frac{R_{out}}{R_{in}} \Rightarrow G = 25\frac{R_{out}}{R_1}$ ....(i)

$9_m = \frac{\beta}{R_1} \Rightarrow R_1 = \frac{\beta}{g_m} = \frac{25}{0.03}$

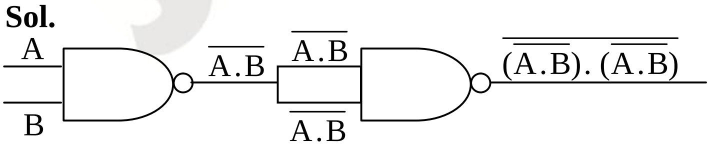
$G = 25\frac{R_{out}}{25} \times 0.03$ .... (i)

$G' = 20\frac{R_{out}}{20} \times 0.02$ .... (ii)

$G' = \frac{2}{3}G$

3. The output (X) ....

Sol.



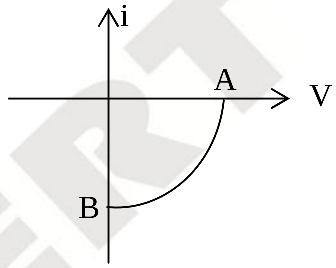
$= \overline{\overline{A\ .\ B}} = AB$

Alternate:

A	B	X
0	0	0
1	0	0
0	1	0
1	1	1

4. The given graph ....

Sol.



It is V – i cherecterstic curve for a solar cell, where A represent open circuit voltage of solar cell and B represent short circuit current.

5. Which logic gate ....

Sol. Truth table

A	B	Y
0	0	0
0	1	0
1	0	0
1	1	1

6. A npn transistor ....

Sol. Voltage gain = [current gain] [resistance gain]

$[.96]\ \frac{800}{192} = 4$

power gain = [current gain] [resistance gain]

[.96] [4] = 3.84

7. A in single-slit ....

Sol. Width of maximas $\propto \lambda$ so. ans. (2)

8. If a Fraunhofer ....

Sol. Fringe width $W = \dfrac{2f\lambda}{a}$

$$W \propto \frac{1}{a}$$

It means a increase and W decrease.

9. In an experiment ....

Sol. $P = \dfrac{a^3b^2}{cd}$

$$\frac{\Delta P}{P}\times 100\ \% = 3\frac{\Delta a}{a}\times 100\% + 2\frac{\Delta b}{b}100\% + \frac{\Delta c}{c}100$$

$$\% + \frac{\Delta d}{d}\times 100\%$$

= 3.1 + 2.2 + 3 + 4 = 3 + 4 + 3 + 4

= 14 %

10. Two carnot engines ....

Sol. Say input is 100 J

Net loss = 100 $\times$ 0.5 $\times$ 0.6 = 30 J

efficiency = $\dfrac{100-30}{100} = 70\%$

11. Consider an ....

Sol. If wave is propagating in x direction, $\vec{E}$ & $\vec{B}$ must be functions of (x, t) & must be in y –z plane.

12. Two stars are ....

Sol. $\theta = \dfrac{1.22\lambda}{D}$

$$\frac{x}{10\,\text{light year}} = \frac{1.22\times 600\times 10^{-9}}{30\times 10^{-2}}$$

$$\frac{x}{10\,\text{light year}} = 2.44\times 10^{-6}$$

$x = 2.44\times 10^{-5}\times 9.46\times 10^{15}\,\text{m}$

$= 23.08\times 10^{7}\,\text{km}$

13. If it takes 5 ....

Sol. $\dfrac{dm}{dt} = \rho A v$

$$\frac{15}{5\times 60} = 10^3\times \pi\left(\frac{1}{\sqrt{\pi}}\right)^2\times 10^{-4}\,V$$

V = 0.5 m/s

$R_e = \dfrac{\rho v d}{\eta}$

$$= \frac{10^3\times 0.5\times \frac{2}{\sqrt{\pi}}10^{-2}}{10^{-3}}$$

$\cong 5500$ Ans.

14. The radius of ....

Sol. % error = $\dfrac{3\Delta r}{r}$

$$\frac{3\Delta r}{r} = \frac{3\times 0.01\times 100}{3.75} = 0.8\%$$

15. Diameter of a steel ....

Sol. Least count = 0.01 cm

d_1 = 0.5 + 8$\times$0.01 + 0.03 = 0.61 cm

d_2 = 0.5 + 4$\times$0.01 + 0.03 = 0.57 cm

d_3 = 0.5 + 6$\times$0.01 + 0.03 = 0.59 cm

$$\text{Mean diameter} = \frac{0.61+0.57+0.59}{3} = 0.59\,\text{cm}$$

16. Unpolarized light ....

Sol. When unpolarised light is incident at Brewster's angle then the intensity of the reflected light is less than half of the incident light.

17. A transmitting ....

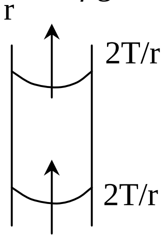
Sol. $d_m = \sqrt{2\times 64\times 10^5\times 32} + \sqrt{2\times 64\times 10^5\times 50}\,\text{m}$

$= 64\times 10^2\times\sqrt{10} + 8\times 10^3\times\sqrt{10}\,\text{m}$

$= 144\times 10^2\times\sqrt{10}\,\text{m} = 45.5\ \text{km}$

18. A long capillary ....

Sol. $\dfrac{4T}{r} = h\rho g$



$$\frac{4\times 72}{0.0288} = h\times 1\times 1000$$

h = 10 cm

19. A large number of ....

Sol. Energy released = $[n\times 4\pi a^2 - 4\pi b^2]\sigma$

Now $n\times\frac{4}{3}\pi r^3 = \frac{4}{3}\pi b^3$ or $n = \frac{b^3}{a^3}$

$\therefore$ Energy released

$$\left[\frac{b^3}{a^3}\times 4\pi a^2 - 4\pi b^2\right]\sigma = 4\pi b^2\left[\frac{b}{a}-1\right]\sigma$$

Now, $\frac{1}{2}\left(\frac{4}{3}\pi b^3\right)\rho v^2 = 4\pi b^2\left[\frac{b}{a}-1\right]\sigma$

or v = $\left[\frac{6\sigma}{\rho}\left(\frac{1}{a}-\frac{1}{b}\right)\right]^{1/2}$

20. A metal wire ....

Sol. $\sigma\times 2\ell = \ell\times\pi r^2\times d\times g$

$r = \sqrt{\frac{2\sigma}{\pi dg}}$

21. A block of mass ....

Sol. For under damping, $b^2 - 4mK < 0$

$\Rightarrow K > \frac{b^2}{4m} \Rightarrow K > \frac{20^2}{4(1)} \Rightarrow K > 100$

22. The plane of the ....

Sol. $\tan\theta_1 = \frac{\tan\theta}{\cos\alpha}$

and $\tan\theta_2 = \frac{\tan\theta}{\cos(90^o-\alpha)} = \frac{\tan}{\sin\alpha}$

$\Rightarrow \cos\alpha = \frac{\tan\theta}{\tan\theta_1}$.

.......(1)

and $\sin\alpha = \frac{\tan\theta}{\tan\theta 2}$

.......(2)

dividing (2) by (1), we have

$\tan\alpha = \frac{\tan\theta_1}{\tan\theta_2}$

23. An iron rod of ....

Sol. we have, $B = \mu_0 H + \mu_0 I$

or $I = \frac{B-\mu_0 H}{\mu_0}$

or $I = \frac{\mu H - \mu_0 H}{\mu_0} = \left(\frac{\mu}{\mu_0}-1\right)H$

$I = (\mu_r - 1)H$

For a solenoid of n-turns per unit length and current i H = ni

$\therefore$ $I = (\mu_r - 1)ni$

$I = (1000-1)\times 500\times 0.5$

$i = 2.5\times 10^5\ Am^{-1}$

$\therefore$ Magnetic moment M = IV

$M = 2.5\times 10^5\times 10^{-4}$

$M = 25\ Am^2$

24. A bar magnet has ....

Sol. The bar magnet has coercivity $4\times 10^3\ Am^{-1}$ i.e It requires a magnetic intensity H = 4×10^3 Am^{-1} to get demagnetised. Let i be the current carried by solenoid having n number of turns per metre length, then by definition

H = nl

Here H = 4×10^3 Amp turn metre^{-1}

$n = \frac{N}{\ell} = \frac{60}{0.12} = 500$ turn metre^{-1}

$\Rightarrow i = \frac{H}{n} = \frac{4\times 10^3}{500} = 8.0A$

25. Two identical spherical ....

Sol. When two drops of radius r each combine to form a big drop, the radius of big drop will be given by

$\frac{4}{3}\pi R^3 = \frac{4\pi}{3}r^2 + \frac{4\pi}{3}r^3$

or $R^3 = 2r^3$ or $R = 2^{1/3}r$

Now $\frac{V_R}{V_r} = \left(\frac{R}{r}\right)^2 = 2^{\frac{2}{3}} = 4^{\frac{1}{3}}$

$V_R = 5\times 4^{1/3}$ cm/s

26. A uniform solid ball ....

Sol. $Vdg - V\rho g - 6\pi\eta r\nu = Vd\frac{g}{2}$

$\Rightarrow \nu = \frac{2}{9}\frac{r^2 g}{\eta}\left(\frac{d}{2}-\rho\right)$

$= \frac{2}{27}\frac{r^2 gd}{\eta}$

27. The vernier of a ....

Sol. Least count $=\left(1-\frac{49}{50}\right)0.5^{o}=\frac{1^{o}}{100}=0.6'$

28. The pitch of a ....

Sol. p = 1mm, N = 100

Least count, $C=\frac{P}{N}=\frac{1mm}{100}=0.01mm$

The instrument has a positive zero error e = +NC

= + 4 $\times$ 0.01 = + 0.04 mm

= + 0.04 mm

Main scale reading is 2 $\times$ (1 mm) = 2 mm

Circular scale reading is 67(0.01) = 0.67 mm

$\therefore$ observed reading is R_0 = 2 + 0.67 = 2.67 mm

So true reading = R_0 – e = 2.63 mm

29. One centimetre ....

Least count = 1MSD – 1VSD

$1MSD=\frac{1cm}{10}=1mm$

8MSD = 10 VSD

L.C = 1MSD – $\frac{8}{10}$MSD

$=\frac{1}{5}MSD=\frac{1}{5}mm$ = 0 2mm = 0 02cm

30. The length of ....

Sol. $v=\pi r^2\ell$

$\%\frac{\Delta v}{v}=\left(\frac{2\Delta r}{r}+\frac{\Delta\ell}{\ell}\right)\times100$

$=\left(2\times\frac{0.1}{20}+\frac{1}{50}\right)\times100$

= 3 %

CHEMISTRY

31. $SnO_2+2KOH\rightarrow K_2SnO_3+H_2O$

SnO_3^{2-} ion would be preferentially adsorbed by SnO_2 particles.

32. Total no. of surface sites = $1000\times6.023\times10^{14}$

= 6.023×10^{17}

Total no. of sites occupied $=\frac{1}{5}\times6.023\times10^{17}$

= $2\times6.023\times10^{16}$

Amount of nitrogen desorbed = n

$=\frac{PV}{RT}=\frac{0.001\times2.46\times10^{-3}}{0.082\times300}$

so, no. of nitrogen molecules

$=\frac{2.46\times10^{-6}}{24.6}\times6.023\times10^{23}=6.023\times10^{16}$

no. of sites per molecule of

$N_2=\frac{2\times6.023\times10^{16}}{6.023\times10^{16}}=2$

33. Haemoglobin is positively charged sol whereas blood is negatively charged sol.

There sols having negatively charge will precipitate haemoglobin sol.

Starch, Clay, As_2S_3, CdS, Gelatin

35. (2) Aluminium hydroxide is a +ve sol, so –ve ions are effective in coagulation.

(3) Cellulose solution is an example of macromolecular colloid.

36. Freundlich equation $\frac{x}{m}=Kp^{1/n}=Kp^{1/n}$

37. (1) Gold sol (negatively charged) : colloidal particles move towards anode (positive terminal) during electrophoresis.

(4) Polarity of dispersion medium increases : CMC decreases.

38. (1) $2AuCl_3 + 3HCHO + 3H_2O \xrightarrow{\text{Reduction}} \underset{(sol)}{2Au} + 3HCOOH + 6HCl$

(2) It is also called Bredig's Arc method

(3) It is dialysis process

(4) Peptization need small amount of electrolyte.

MATHEMATICS

61. Consider the ....

Sol. $\sim q \to \sim p$ (Given statement) $\Rightarrow$ then $p \to q$

62. Let q : you have ....

Sol. $\sim p \to q$

$\sim (\sim p) \vee q) \wedge ((\sim p) \vee \sim q)$

$(p \vee q) \wedge (\sim p \wedge \sim q)$

$(p \vee q) \wedge (\sim (p \wedge q)$

63. Let p : you ....

Sol. We know $\sim (p \to q) \equiv p \wedge \sim q$

Given statement is $p \wedge q$

$= p \wedge \sim (\sim q) \equiv \sim (p \to \sim q)$

64. The proposition ....

$(p \to \sim p) \wedge (\sim p \to p)$

Sol. $(p \to q) \wedge (q \to p) \equiv (p \leftrightarrow q)$

$\therefore$ $(p \to \sim p) \wedge (\sim p \to p) \equiv (p \leftrightarrow \sim p) \equiv$ Fallacy/ contradiction

65. Negation of the ....

Sol. $(p \wedge r) \wedge (\sim r \wedge \sim q) = p \wedge (r \wedge \sim r) \wedge \sim q = p \wedge f \wedge \sim q = f$

66. The contrapositive ....

Sol. $\sim (\sim q \to \sim r) \to \sim p \equiv (\sim q \wedge q) \to \sim p$

67. Which of the following ....

Sol.

A	B	$A \to B$	$A \wedge (A \to B)$	$[A \wedge (A \to B)] \to B$
T	F	F	F	T
F	T	T	F	T
T	T	T	T	T
F	F	T	F	F

68. Which of the ....

Sol. Obviously

69. The statement ....

Sol.

p	q	$q \to p$	$p \to (q \to p)$	$p \wedge q$	$p \to (p \wedge q)$	$q \leftrightarrow p$	$p \to (p \leftrightarrow q)$	$q \to p$	$p \to (p \to p)$
T	T	T	T	T	T	T	T	T	T
F	F	T	T	F	T	T	T	T	T
T	F	T	T	F	F	F	F	F	F
F	T	F	T	F	T	F	T	T	T

70. Consider the ....

Sol. "p only is q" is equivalent to "if p then q"

71. Which of the ....

Sol. Obviously

72. Consider statements ....

Sol. $((A \cap B) \cup C)' = (A \cap B)' \cap C' = (A' \cap C') \cup (B' \cap C')$

73. Consider statement ....

Sol. converse of $p \to q$ is $q \to p$

74. Let S be a non-empty ....

Sol. Obviously

75. Consider statement ....

Sol. If p, then q

$\Rightarrow$ q is necessary for p and p is sufficient for q.

76. If p, q, r and s ....

Sol. (1) $p \wedge q = T \wedge T = T$

$(p \wedge q) \to S = T \to T = T$

(2) $(q \vee r) = T \vee T = T, \sim s = F$

$(q \vee r) \to \sim s = T \to F = F$

(3) $(p \wedge \sim q) = T \wedge F = F$

$q \to s = T \to T = T$

$(p \wedge \sim q) \wedge (q \to s) = F \wedge T = F$

77. If the compound ....

Sol. Given that $(p \leftrightarrow q) \wedge r$ is true

$\Rightarrow (p \leftrightarrow q)$ is true and r is true

$\Rightarrow$ p and q are both true or both false

Therefore, the truth values of p, q and r are respectively T, T or F, F and T.

78. Let p : Team India ....
Sol. Contrapositive of $(p \to q)$ is $(\sim q \to \sim p)$

79. The incorrect..........................
Sol.

p	~ p	$p \wedge \sim p$	$p \vee \sim p$	$\sim(\sim p) \leftrightarrow p$
T	F	F	T	T
F	T	F	T	T

80. Negation of the ....
Sol. Negation of $p \leftrightarrow q$ is $p \leftrightarrow \sim q$

81. "If India beats ....
Sol. Negation of $(p \to q)$ is $(p \wedge \sim q)$

82. S_1 : f(x) is not ....
Sol. S_1 : f(x) is not continuous is [a, b]
~S_1 : f(x) is continuous in [a, b]
given statement $(\sim S_1 \wedge S_2) \to S_3$

83. p : you want ....
Sol. $\sim(p \vee r) \equiv \sim p \wedge \sim r$

84. The statement ....
Sol. Use truth table

85. Consider the ....
Sol. Statement P is False
Statement Q is True.
$V_1 \equiv F$
$V_2 \equiv T$

86. Let p and q be ....
Sol.

$$\sim(\sim p \wedge q) \wedge (p \vee q) \equiv [\sim(\sim p) \vee (-q)] \wedge (p \vee q)$$

$$\equiv [p \vee (\sim q) \wedge (p \vee q]$$

$$\equiv p \vee [(\sim q) \wedge q]$$

$$\equiv p \vee F \equiv p$$

87. Negation of $(\sim p \to q)$ ....
Sol. $(\sim p \to q) \equiv \sim(\sim(\sim p) \vee q)$
$\equiv \sim(p \vee q)$
clearly option (3) is correct
$\sim(p \vee q) \wedge (p \vee (\sim p))$
$\equiv \sim(p \vee q) \wedge T$
$\equiv \sim(p \vee q)$

p	q	$p \to q$	$\sim p \to \sim q$	$(p \to q) \leftrightarrow (\sim q \to \sim p)$
T	T	T	T	T
T	F	F	F	T
F	T	T	T	T
F	F	T	T	T

88. **Statement-1** : $\sim(p \leftrightarrow \sim q)$ ....
Sol. Truth table for the logical statements in statement-1

p	q	~ q	$p \leftrightarrow \sim q$	$\sim(p \leftrightarrow \sim q)$	$p \leftrightarrow q$
T	T	F	F	T	T
T	F	T	T	F	F
F	T	F	T	F	F
F	F	T	F	T	F

$\therefore \sim(p \leftrightarrow \sim q)$ and $p \leftrightarrow q$ are identical
Also $\sim(p \leftrightarrow q)$ is not a tautology as all entries in its column are not T.
$\therefore$ statement-1 in true but statement-2 is false

89. **Statement-1:** The type ....
Sol. Statement-2 is correct definition of inclusive Or and also the correct reason of statement-1

90. Which of the following ....
Sol. Obvious