

**Answer Keys:****Section-I: General Ability**

1	B	2	C	3	D	4	D	5	D	6	B	7	C
8	D	9	D	10	B	11	B	12	B	13	B	14	C
15	C	16	C	17	B	18	B	19	B	20	A		

Section-II: Mathematics, Chemistry, Physics

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

Explanations:**Section-I**

1. CP = 5 x 18 = 90/-
SP = 5 x 1.2 x 20 = 120/-
Gain = 30

$$P\% = 33\frac{1}{3}\%$$

2. $p = \frac{1}{2}, q = \frac{1}{2}$

$$B(n, k) = nC_k p^k q^{n-k} = 5C_2 \left(\frac{1}{2}\right)^2 \left(\frac{1}{2}\right)^3 = 5C_2 \left(\frac{1}{2}\right)^5$$

3. King, Queen and Jack are only cards with double face. There are 12 double face cards for four suits.

$$n(s) = 52, n(E) = 12$$

$$P(E) = \frac{n(E)}{n(s)} = \frac{12}{52} = \frac{3}{13}$$

4. If E is last year's 4th quarter earnings per share, then the analyst consensus estimate for this year's 4th quarter earnings per share is 1.2E. Since actual earnings were 30% lower than analyst estimates, we need to decrease this number by 30% = .7(1.2E) = .84E. If the company reported earnings per share that were 84% of last year's 4th quarter earnings per share, then there was a 16% = (100% - 84%) decrease in the current year's 4th quarter EPS.



5. Let principal amount be 100/-
 $SI_2 = 16$
 $CI_2 = 16.64$
 Difference = 0.64
 But the actual difference is 8/-
 Therefore actual principal amount = $\frac{8 \times 100}{0.64} = 1250$
6. Length of faster train = relative speed \times time to overtake = $(70 - 43) \times \frac{1000}{3600} \times 10 = 75$
7. $n(A \cup B \cup C) = n(A) + n(B) + n(C) - n(A \cap B) - n(A \cap C) - n(B \cap C) + n(A \cap B \cap C)$
 or $n(A \cap B) + n(A \cap C) + n(B \cap C) = 550 - 350 = 200$
 Number of people in exactly two sets is given as =
 $n(A \cap B) + n(A \cap C) + n(B \cap C) - 3n(A \cap B \cap C)$
 $= 200 - 3 \times 50 = 50$
8. As price increased by 25 percent, new price is 1.25 times old price
 $P \times q = 1.25P \times q'$
 $\Rightarrow 0.8q = q'$ or 20% reduction
9. For first or last position if a child A is seated then possible position for B are n-2 excluding A ___ or ___ A
 For 2nd, 3rd, ..., (n-1)th position of A being seated, possible position for B is n-3 excluding ___ A ___
 Total choices $(n-2) \times 2 + (n-3)(n-2) = n^2 - 3n + 2$
10. Initial height is 4 ft (right)
 After 3 Years --- $4+3d$
 After 5 Years --- $4+5d$
 The height at the 5th year is $\frac{1}{6}$ greater than the height of the 3rd year.
 It should be $(4+5d) = (4+3d) + \frac{1}{6}(4+3d)$
 $(4+5d) = \frac{7}{6}(4+3d)$
 Multiply each side by 6:
 $(6)(4+5d) = 7(4+3d)$
 $24+30d = 28+21d$
 Solve for d: $15d = 4$
 $d = \frac{4}{15}$
18. We think her a silly girl.
 Think is not followed by 'as'



Section-II

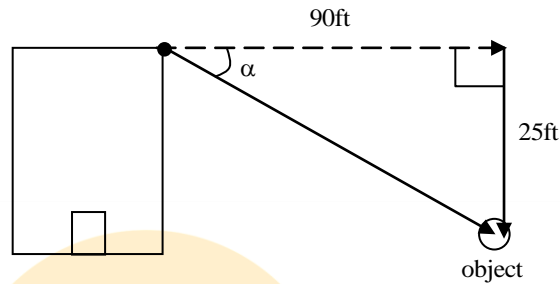
1. If
- z
- is purely real then solution is

$$2\sin\theta - \sqrt{3} = 0 \Rightarrow 2\sin\theta = \sqrt{3}$$

$$\Rightarrow \sin\theta = \frac{\sqrt{3}}{2} = \sin\frac{\pi}{3}$$

$$\Rightarrow \theta = n\pi + (-1)^n \frac{\pi}{3}$$

2. $\tan\alpha = \frac{25}{90}$
- $$\Rightarrow \alpha = \tan^{-1}\left(\frac{25}{90}\right)$$
- $$\Rightarrow \alpha \cong 15.52$$



3. $\frac{T_2}{T_1} = \frac{x}{1+x}$, $n = 1001$
- $$a = (1+x)^{1000} \text{ (first term)}$$
- Common ratio, $r = \frac{x}{1+x}$

$$S_{1001} = a \left(\frac{1-r^n}{1-r} \right)$$

$$= (1+x)^{1000} \frac{\left(1 - \left(\frac{x}{1+x} \right)^{1001} \right)}{\left(1 - \frac{x}{1+x} \right)}$$

$$= (1+x)^{1001} - x^{1001}$$

$$\text{coefficient of } x^{50} = 1001C_{50} - 0 = 1001C_{50}$$

4. Given $\tan x = \frac{b}{a}$

$$\text{We know that } a\cos 2x + b\sin 2x = a \frac{1 - \tan^2 x}{1 + \tan^2 x} + b \frac{2\tan x}{1 + \tan^2 x}$$

$$= a \frac{1 - \frac{b^2}{a^2}}{1 + \frac{b^2}{a^2}} + b \frac{2(b/a)}{1 + b^2/a^2} = a \frac{(a^2 - b^2)}{a^2 + b^2} + \frac{2ab^2}{a^2 + b^2}$$

$$= \frac{a}{a^2 + b^2} [a^2 - b^2 + 2b^2] = \frac{a}{a^2 + b^2} [a^2 + b^2] = a$$



5. Given $\sin A = \frac{1}{\sqrt{10}}$ and $\sin B = \frac{1}{\sqrt{5}}$
- $$\begin{aligned}\sin(A+B) &= \sin A \cos B + \sin B \cos A \\ &= \frac{1}{\sqrt{10}} \sqrt{1-\frac{1}{5}} + \frac{1}{\sqrt{5}} \sqrt{1-\frac{1}{10}} \\ &= \frac{1}{\sqrt{10}} \sqrt{\frac{4}{5}} + \frac{1}{\sqrt{5}} \sqrt{\frac{9}{10}} = \frac{1}{\sqrt{50}}(2+3) = \frac{5}{\sqrt{50}} = \frac{1}{\sqrt{2}}\end{aligned}$$
- $$\sin(A+B) = \frac{1}{\sqrt{2}} \Rightarrow A+B = \frac{\pi}{4}$$
6. $P = \left(\frac{1}{2}, 0\right), Q = \left(0, \frac{1}{3}\right), R = \left(-\frac{2}{3}, 0\right)$ & $s = (0, -1)$. Equation of the circle passing through these points is $6x^2 + 6y^2 + x + 4y - 2 = 0$.
Aliter: - Delete the xy term, gives the circle equation.
7. Let the equation of the circle be $x^2 + y^2 + ax + by = 0 \dots (1)$
Given $S_{11} = 4 \Rightarrow 2a + b = 1 \dots (2)$ and centre lies on $x - y = 3.5$
 $\Rightarrow -a + b = 7 \dots (3)$.
Solving, we get $a = -2, b = 5 \Rightarrow \text{Centre} = \left(1, -\frac{5}{2}\right)$
8. The equations are inconsistent.
9. First 4 girls can be seated around a round table in $(4-1)! = 6$ ways
Then there will be four places for 4 boys, and they can be seated in $4! = 24$ ways
Hence required no. of ways = $24 \times 6 = 144$
10. $a - a \pmod{10} = 0$ so reflexive
 $a - b \pmod{10} = 0 \Rightarrow b - a \pmod{10} = 0$ so symmetric
 $a - b \pmod{10} = 0; b - c \pmod{10} = 0 \Rightarrow a - c \pmod{10} = 0$ transitive
It is also anti symmetric
11. $E = \frac{-13.6}{n^2} \text{eV}$
 $-3.4 \text{eV} = \frac{-13.6}{n^2} \text{eV}$
 $n = 2$
The angular momentum of an electron in n^{th} orbit is given as
 $mvr = \frac{nh}{2\pi} = \frac{2 \times 6.63 \times 10^{-34}}{2 \times 3.14} = 2.11 \times 10^{-34} \text{ JS}$



12. For $n = 3$ there are 3 sub shells with $\ell = 0, \ell = 1, \ell = 2$, designated as s, p, d

l	Sub shell	m-values	Number of orbital's ($2\ell + 1$)
0	s	0	1
1	p	+1, 0, -1	3
2	d	+2, +1, 0, -1, -2	5

\therefore There are 9 orbitals in the shell with $n = 3$

13. CuF_2 has Cu^{2+} ion which has one unpaired electron. Hence it is colored.

14.
$$\frac{r_{\text{CH}_4}}{r_x} = \sqrt{\frac{M_x}{M_{\text{CH}_4}}}$$
$$\frac{2}{1} = \sqrt{\frac{M_x}{16}} \Rightarrow M_x = 64$$

15. Atomic number $\rightarrow 9$ represents a halogen (10 is noble gas)

\therefore It forms M^- ion

16. According to Electron Sea model the metal ions are arranged in a definite geometrical shape and valence electrons are moving freely.

17. In the reaction $\text{NH}_3(\text{g}) + \text{HCl} \rightarrow \text{NH}_4\text{Cl}(\text{S})$ gases become a solid disorder decreases, Entropy decreases.

18. Clouds which are oppositely charged neutralized each other causing coagulation. Thus clouds burst.

19. When ionic salts of alkyl metals and alkaline earth are heated, the anions escape from the surface and combine with metal ion. This causes one free electron occupying the anion site.

As the anion escape it causes metal excess defect.

20.
$$k_h = \frac{k_w}{k_c} = \frac{10^{-14}}{10^{-5}} = 10^{-9} \text{ for NaX}$$
$$k_h = C\alpha^2 \Rightarrow \alpha = \sqrt{\frac{k_h}{c}} = \sqrt{\frac{10^{-9}}{0.1}} = 10^{-4}$$

$$\text{Degree of hydrolysis} = 10^{-4} \Rightarrow 10^{-4} \times 100 = 0.01\%$$

21. According to first law of thermodynamics $\Delta U = q + w$. Hence ΔU , q and w are related to first law. But entropy is related to second law of thermodynamics



22. X-rays have the least frequency and hence the longest wavelength

23. Maximum wavelength of red light is 800 nm,
energy of photon $E = hc/\lambda = 6.6 \times 10^{-34} \times 3 \times 10^8 / 800 \times 10^{-9}$
 $= 2.5 \times 10^{-19} = 1.5 \text{ eV}$

24. Ratio of KE's is, $\frac{\frac{1}{2} m_1 v_1^2}{\frac{1}{2} m_2 v_2^2} = \frac{m_1 v_1^2}{m_2 v_2^2} = 2 \frac{m_1}{m_2}$
 $P_1 / P_2 = \sqrt{2 \frac{m_1}{m_2}} = \sqrt{\frac{2}{4}} = 1/\sqrt{2}$

25. The speed of satellite is given by $v = \sqrt{\frac{GM}{r}}$
Therefore its period of revolution is $T = \frac{2\pi r}{v} = \frac{2\pi}{\sqrt{GM}} r^{\frac{3}{2}}$

26. Current gain $\beta = I_c/I_b = 40/1 = 40$. then $\alpha = \beta/(1 + \beta) = 40/41$

27. Resistance of a good conductor decreases with decrease of temperature. On other hand the resistance of a semiconductor increases as temperature decreases.

28. Two or more OR or AND or NOT gates do not yield a new gate. But the repeated use of NAND or NOR gates can give all other gates like OR, AND and NOT.

29. Since the two atoms have the same mass, the centre of mass is at a distance of $R/2$ from each atom. Therefore, the moment of inertia of the molecule about its centre of mass is

$$I = M \left(\frac{R}{2} \right)^2 + M \left(\frac{R}{2} \right)^2 = \frac{MR^2}{2}$$

30. Particle velocity $V = dy/dt = d/dt \left[A \sin 2\pi \left(\frac{x}{\lambda} - \frac{t}{T} \right) \right] = A\omega \cos 2\pi \left(\frac{x}{\lambda} - \frac{t}{T} \right)$.

Hence $V_{\max} = A\omega$