Corporate Office : Aakash Tower, 8, Pusa Road, New Delhi-110005. Phone : (011) 47623456

Aakash National Talent Hunt Exam 2021

SAMPLE PAPER

(*Class XI Studying Moving to Class XII*)

Time : 1 Hour **MM : 90**

ANSWERS

Physics	Chemistry	Mathematics
1. (3)	12. (2)	23. (4)
2. (4)	13. (4)	24. (4)
3. (1)	14. (1)	25. (3)
4. (1)	15. (3)	26. (3)
5. (2)	16. (4)	27. (2)
6. (1, 3, 4)	17. (1, 2)	28. (2)
7. (1, 3)	18. (2, 3)	29. (1, 2, 3)
8. (1)	19. (2)	30. (3, 4)
9. (4)	20. (2)	31. (2, 3)
10. (3)	21. (1)	32. (3)
11. A $\rightarrow$ (P, S)	22. A $\rightarrow$ (R, S)	33. (1)
B $\rightarrow$ (R)	B $\rightarrow$ (P, S)	34. (1)
C $\rightarrow$ (P, Q)	C $\rightarrow$ (Q, R, S)	35. A $\rightarrow$ (Q)
D $\rightarrow$ (P)	D $\rightarrow$ (P, Q, S)	B $\rightarrow$ (R)
		C $\rightarrow$ (P)
		D $\rightarrow$ (S)

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ANSWERS & SOLUTIONS

PHYSICS

1. Answer (3)

   If $A = B + C$, then

   $[A] = [B] = [C]$

2. Answer (4)

   $$a = \frac{d^2s}{dt^2} = \frac{d}{dt}(4t + 3t^2) = (4 + 6t)\ \text{m/s}^2$$

   At $t = 1$ s,

   $a = 10\ \text{m/s}^2$

3. Answer (1)

   For maximum range,

   $$\theta = \frac{(90 - 30)}{2}$$

   $\therefore \quad \theta = 30°$

4. Answer (1)

   $$a_1 = a_2 = \frac{5g\ \sin 37° - 2g}{(5 + 2)} = \left(\frac{g}{7}\right) = \frac{10}{7}\ \text{m/s}^2$$

5. Answer (2)

   $W_T = \Delta KE$

   $\Rightarrow \quad W_F + W_{mg} = 0$

   $\Rightarrow \quad W_F = mgh$

6. Answer (1, 3, 4)

   $F_x \le \mu N$

   $\Rightarrow \quad 10 \le \mu \cdot 40$

   $\Rightarrow \quad \frac{1}{4} < \mu$

7. Answer (1, 3)

At $X = X_{max}$,

$$v_1 = v_2 = \frac{v_0}{2}$$

$$\Delta KE = \frac{1}{2}mv_0^2 - 2\frac{1}{2}m\left(\frac{v_0}{2}\right)^2 = \frac{mv_0^2}{4}$$

8. Answer (1)

9. Answer (4)

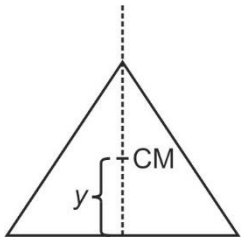
Solution for Q. Nos. 8 and 9 :

$a_p = a_0 - R\alpha$ (Rolling condition)

10. Answer (3)

Work done by conservative forces may be positive or negative.

11. Answer A(P, S); B(R); C(P, Q); D(P)



$$y = \frac{L\sqrt{3}}{2}\frac{1}{3} = \frac{L}{2\sqrt{3}}$$

CHEMISTRY

12. Answer (2)

Bond order $\propto$ bond dissociation energy

Bond order $(O_2)^{2-}$ = 1.0

Bond order $(O_2)^{-}$ = 1.5

Bond order (O_2) = 2.0

Bond order (O_2^+) = 2.5

13. Answer (4)

For isoelectronic ions,

IE $\propto$ Atomic number (Z)

14. Answer (1)

For complete neutralisation,

$$100 \times M = 50 \times \frac{1}{2}$$

$$\Rightarrow \quad M = \frac{1}{4} \text{ molar}$$

15. Answer (3)

Number of moles of He + unknown gas = $\frac{5.7 \times 4}{0.08 \times 300}$ = 0.95

Number of moles of unknown gas = 0.95 – 0.76 = 0.19

$$\frac{r_{He}}{r_X} = \sqrt{\frac{M_X}{4}} = \frac{0.76}{0.19} = 4; \quad M_X = 64$$

16. Answer (4)

$C_p = C_v + R = 25 + 0.03T + R$

$dQ = nC_p dT = 2(25 + 0.03T + R)\, dT$

$$dS = \frac{dQ}{T} = 2(25 + 0.03T + R)\frac{dT}{T}$$

$$\Delta S = 50 \ln \frac{T_2}{T_1} + 0.06(T_2 - T_1) + 2R \ln \frac{T_2}{T_1}$$

$$\Delta S = 50 \ln \frac{600}{300} + 0.06(600 - 300) + 2 \times 8.314 \ln \frac{600}{300} = 64.17 \text{ JK}^{-1}$$

17. Answer (1, 2)

Binding energy of 4th state = $\frac{13.6Z^2}{(n)^2}$ = 13.6 eV

$\Rightarrow$ Z = 4

Binding energy of 2nd excited state = $\frac{13.6(4)^2}{(3)^2}$ = 24.17 eV

18. Answer (2, 3)

$$\underset{n=5}{MnO_4^-} + \underset{n=2}{H_2O_2} + H^+ \longrightarrow Mn^{2+} + \underset{n=2}{O_2} + H_2O$$

Milliequivalents of H_2O_2 = 25 × 2 × 0.5 = 25

Milliequivalents of $KMnO_4$ = 50 × 5 × 0.2 = 50

Milliequivalents of $KMnO_4$ left unreacted = 50 – 25 = 25

Moles of $KMnO_4$ left unreacted = $\frac{25}{5 \times 1000} = 0.005$

Moles of O_2 produced = $\frac{25}{2 \times 1000} = 0.0125$

19. Answer (2)

Density of the gas, $d = 2p - 0.2p^2$

Density will be maximum, when $\frac{d(d)}{dp} = 0$

$$\frac{d(d)}{dp} = 2 - 0.4p = 0; \quad p = 5 \text{ atm}$$

20. Answer (2)

$$d_{max} = \frac{M}{\text{Molar volume}}; \text{ Molar volume} = \frac{M}{5} \text{ litre}$$

21. Answer (1)

n-Factor of $H_3PO_4 = 2$

Equivalent weight of $H_3PO_4 = \frac{98}{2} = 49$

22. Answer A(R, S); B(P, S); C(Q, R, S); D(P, Q, S)

$n = 6 \longrightarrow n = 3$; 6 lines in the IR region

$n = 7 \longrightarrow n = 3$; 10 lines in the IR region

$n = 5 \longrightarrow n = 2$; 3 lines in the visible region and 3 lines in the IR region

$n = 6 \longrightarrow n = 2$; 4 lines in the visible region and 6 lines in the IR region

MATHEMATICS

23. Answer (4)

$\cos 2\theta = 2\cos^2\theta - 1$

$= 1 - 2\sin^2\theta$

$= \cos^2\theta - \sin^2\theta$

But $2\sin\theta \cdot \cos\theta = \sin 2\theta$

24. Answer (4)

$x^2 - y^2 + 2xyi + x - iy = 0$

$\Rightarrow x^2 + x - y^2 = 0$ and $2xy - y = 0$

$$y = 0 \text{ or } x = \frac{1}{2}$$

$y = 0$; $x = 0, -1$

$$x = \frac{1}{2},\ y = \pm\frac{\sqrt{3}}{2}$$

The possible values of z are

$$z = 0 + 0i,\ -1 + 0i,\ \frac{1}{2} + \frac{\sqrt{3}}{2}i \text{ and } \frac{1}{2} - \frac{\sqrt{3}}{2}i$$

25. Answer (3)

$$S = \frac{15}{2}\{2 + 14 \times 3\} = 330$$

26. Answer (3)

$(2p - 3q)^2 + (3q - 4r)^2 + (4r - 2p)^2 = 0$

$\Rightarrow 2p = 3q = 4r$

$\Rightarrow \frac{1}{p}, \frac{1}{q}$ and $\frac{1}{r}$ are in AP.

$\Rightarrow p, q$ and r are in HP.

27. Answer (2)

$$1 + (-1) + \frac{1}{2} = \frac{1}{2}$$

28. Answer (2)

$16 - x^2 \geq 0 \Rightarrow x \in [-4, 4]$

29. Answer (1, 2, 3)

$f(x) = x^2 + x$

$\Rightarrow$ $f(2) = 6$, $f(-1) = 0$, $f(-2) = 2$, $f(3) = 2$

30. Answer (3, 4)

$P \cap Q = \{3, 4, 5\}$

$Q \cap R = \{4, 6\}$

$P \cap Q \cap R = \{4\}$

31. Answer (2, 3)

$$\frac{9}{8} + 2\cos^2 x + \cos x - 1 = 2\cos^2 x + \cos x + \frac{1}{8} \quad (D \geq 0)$$

32. Answer (3)

MASHU EE NN

Total words – (words in which EE together + NN together – EE and NN both together)

$$= \frac{9!}{2!\,2!} - \left(\frac{2.8!}{2!} - 7!\right) = 11(7!)$$

33. Answer (1)

EEAU, MNNSH

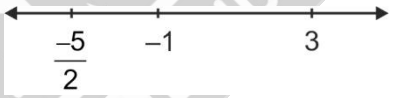
Select only 4 positions for vowels and arrange in 1 way.

$\therefore$ Total number of arrangement = ${}^9C_4$

34. Answer (1)

$(x^2 - 2x - 3)(2x + 5) \leq 0$

$(x + 1)(x - 3)(2x + 5) \leq 0$



$$x \in \left(-\infty, -\frac{5}{2}\right] \cup [-1, 3]$$

35. Answer A(Q); B(R); C(P); D(S)

(A) $S_n = \frac{1}{3} - \frac{1}{4} + \frac{1}{4} - \frac{1}{5} + \ldots + \frac{1}{n+2} - \frac{1}{n+3} \Rightarrow S_n = \frac{n}{3(n+3)}$

$\therefore \quad S_\infty = \frac{1}{3}$

(B) $S_\infty = \frac{1}{1 - \frac{2}{3}} = 3$

(C) $\text{H.M.} = \frac{2\alpha\beta}{\alpha + \beta} = \frac{2(8 + 2\sqrt{5})}{(4 + \sqrt{5})} = 4 \Rightarrow \frac{1}{H} = \frac{1}{4}$

(D) $(\text{G.M.})^2 = \frac{1}{9} \cdot \frac{1}{4}$

$\text{G.M.} = \frac{1}{6}$

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