KISHORE VAIGYANIK PROTSAHAN YOJANA - 2014

Date : 02-11-2014 **Duration : 3 Hours** **Max. Marks : 100**

STREAM - SA

GENERAL INSTRUCTIONS

- The Test Booklet consists of **80** questions.
- There are Two parts in the question paper. The distribution of marks subjectwise in each part is as under for each correct response.

MARKING SCHEME :

PART-I :

MATHEMATICS
Question No. **1 to 15** consist of **ONE (1)** mark for each correct response.

PHYSICS
Question No. **16 to 30** consist of **ONE (1)** mark for each correct response.

CHEMISTRY
Question No. **31 to 45** consist of **ONE (1)** mark for each correct response.

BIOLOGY
Question No. **46 to 60** consist of **ONE (1)** mark for each correct response.

PART-II :

MATHEMATICS
Question No. **61 to 65** consist of **TWO (2)** marks for each correct response.

PHYSICS
Question No. **66 to 70** consist of **TWO (2)** marks for each correct response.

CHEMISTRY
Question No. **71 to 75** consist of **TWO (2)** marks for each correct response.

BIOLOGY
Question No. **76 to 80** consist of **TWO (2)** marks for each correct response.

PART-I
One Mark Questions

MATHEMATICS

1.

Sol. r be a root $\Rightarrow r^2 + 2r + 6 = 0$ .....(1)

now (r+2) (r+3) (r+4) (r+5)

= $(r^2 + 5r + 6)(r2 + 9r + 20)$

= (3r) (7r + 14) using (i)

= 21 $(r^2 + 2r)$

= -126 using (i)

Ans. (C)

2.

Sol. Given $f(x) + (x+\frac{1}{2})\, f(1-x) = 1$ .....(1)

but x = 0

$f(0) + \frac{1}{2} f(1) = 1$

$\Rightarrow 2f(0) + f(1) = 2$ .....(2)

put x = 1 in (1)

$\Rightarrow f(1) + \frac{3}{2} f(0) = 1$

$\Rightarrow 2f(1) + 3f(0) = 2$ .....(3)

Solving (2) & (3) we have

F(0) = 2 & f (1) = -2

$\therefore$ 2f(0) + f (1) = 4-6 = -2

Ans. (C)

3. $$\frac{1^3 + 2^3 + ... + (2n)^3}{1^2 + 2^2 + ... + n^2} = \left(\frac{2n(2n+1)}{2}\right)^2 . \frac{6}{n(n+1)(2n+1)}$$

$$= \frac{6n(2n+1)}{n+1}$$

$$= \frac{12n^2 + 6n}{n+1} = \frac{12(n^2-1) + 6(n+1) + 6}{n+1}$$

$$= I + \frac{6}{n+1}$$

If the given terms is an intiger, then $\frac{6}{n+1}$ must be an integer

$\Rightarrow$ n = 1,2,5

Sum = 8

Ans. (A)

4. X $\rightarrow$ ab or x = 10 a + b

y $\rightarrow$ ba or y = 10 b + a

Now $x^2 - y^2 = (10a + b)^2 - (10b + a)^2$

$= 99 (a^2 - b^2)$

$= 3^2 \times 11(a + b)(a - b)$ ------ (1)

According of Q

(a + b)(a – b) = 11 and a – b = 1

$\Rightarrow$ a + b = 11 and a – b = 1

$\Rightarrow$ a = 6, b = 5

Hence

x = 65

y = 56

and m = 33 $\Rightarrow$ x + y + m = 154

Ans. (D)

5.

Sol. $\therefore$ HCF = x –1

$\Rightarrow p(x) = x^2 - 5x + a$

$= x^2 - 5x + 4$

$= (x - 1)(x - 4)$ .....(1)

and $q(x)\ x^2 - 3x + b = x^2 - 3x + 2$

$= (x - 1)(x - 2)$ .....(2)

$\Rightarrow k(x) = (x - 1)(x - 2)(x - 4)$

Hence

$(x - 1) + R(x) = (x - 1) + (x - 1)(x - 2)(x - 2)(x - 4)$

$= (x - 1)(x - 3)^2$

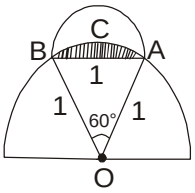
Hence sum of roots = 7

Ans. (D)

6. **Ans. (D)**

7.

Sol.



area of sector $OACB = \frac{r^2}{2}\theta = \frac{1}{2}\cdot\frac{\pi}{3} = \frac{\pi}{6}$

area of shaded region $= \frac{\pi}{6}$ – area of ΔOAB

$= \frac{\pi}{6} - \frac{\sqrt{3}}{4}$

Hence area of line = Area of semi-circle – area of shaded region

$= \frac{1}{2}\pi\left(\frac{1}{2}\right)^2 - \left(\frac{\pi}{6} - \frac{\sqrt{3}}{4}\right)$

$= \frac{\sqrt{3}}{4} + \frac{\pi}{8} - \frac{\pi}{6}$

$= \frac{\sqrt{3}}{4} - \frac{\pi}{24}$.

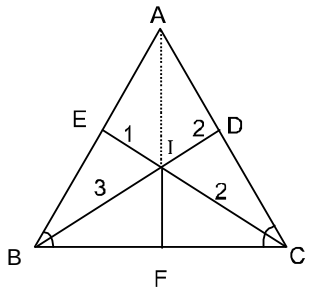
Ans. (B)

8.

Sol. $\because \frac{AI}{IF} = \frac{b+c}{a}$ ..... (1)

$\because \frac{BI}{ID} = \frac{a+c}{b} = \frac{3}{2}$ .....(2)

$\because \frac{CI}{IE} = \frac{a+c}{c} = \frac{2}{1}$



$\Rightarrow a + b = 2c$ .....(3)

(2) 2a + 2c = 3b using to

$\Rightarrow$ 2a + a + b = 3b using (3)

$\Rightarrow$ 3a = 2b

$\Rightarrow \ b = \frac{3}{2}a$ .....(4)

Now again (3) $\Rightarrow 2c = a + b$

$= a + \frac{3}{2}a$

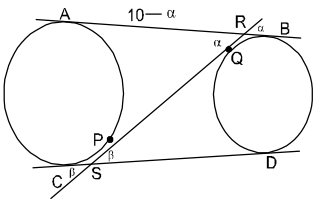
$\Rightarrow c + \frac{5}{4}a$

Hence $\frac{AI}{IF} = \frac{b+c}{a} = \frac{\frac{1}{2}a + \frac{5}{4}a}{a} = \frac{11}{4}$

Ans. (B)

9.

Sol.



$\therefore$ RP = RA = $10 - \alpha$ $\Rightarrow RS = 10 - \alpha + \beta$ ..... (1)

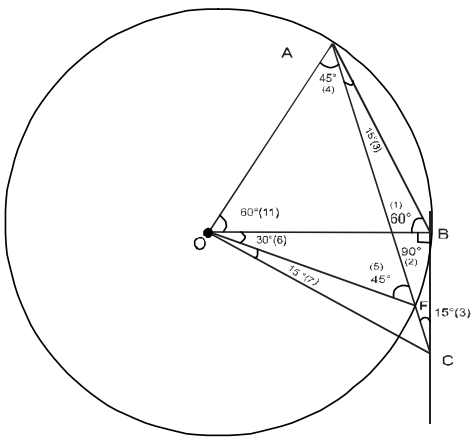
Also SQ = SD = $10 - \beta$ $\Rightarrow RS = 10 - \beta + \alpha$ .....(2)

(1) and (2) $\Rightarrow \alpha = \beta$, Hence RS = 10

Ans. (C)

10.

Sol.



1. ΔAOB is equilatrual ($\angle AOB = \angle OAB = \angle OBA = 60°$)
2. ΔOBC is right angled isosceles ($\angle OBC = 90°$)
3. ΔABC is isosceles ($\angle BAC = \angle BCA = 15°$)
4. $\angle OAC = 60° - \angle CAB = 45°$

5. ΔAOF is right angled isosceles $(\angle AOF = 90°, \angle OFA = 45°)$

6. $\angle BOF = 90° - \angle AOB = 30°$

7. ΔOBC is right angled isosceles $(\angle BOC = 45°)$

$$\therefore \frac{\angle BOF}{\angle BOC} = \frac{30°}{45°} = \frac{2}{3}$$

Ans. (B)

11.

Sol. Let total seats = 100
on first day,
Ticket price = 200
sneots ful = 60%

$$= \frac{60}{100} \times 100 = 60$$

$\therefore$ Revenue = 60 × 200

R_1 = 12000

On second day
Tricked price = 200 – 20% of 200

$$= 200 - \frac{20}{100} \times 200$$

= 200 – 40 = 160
Scents full 60 + 50% of 60

$$= 60 + \frac{50}{100} \times 60$$

= 60 + 30 = 90
Revenue = 160 × 90

R_2 = 14400

% Increase is Revenue = $\frac{R_2 - R_1}{R_1} \times 100$

$$= \frac{14400 - 12000}{12000} \times 100$$

$$= \frac{2400}{1200} \times 100$$

= 20%

Ans. (D)

12.

Sol. year Population
2010 —— 39
2011 —— 60
2012 —— x
2013 —— 123
According to Q
x - 39 = k (60) & 63 = kr

$$\Rightarrow x - 39 = \frac{63}{x}.63$$

$$\Rightarrow x^2 - 39x = -(60)(63) = 0$$

x = 84 & - 40
Ans(B)

13. N = ab ab ab

$1 < a \le 9$ $0 < b \le 9$ $a,b \in I$

$N = 10^5a + 10^4b + 10^3 a + 10^2b + 10a + b$

$= (10^4 + 10^2 + 1)(10a + b)$

$= (10^2 + 10 + 1)(10^2 - 10 + 1)\,(10a + b)$

$= 3 \times 37 \times 13 \times 7(10a + b)$ ..... (1)

then $10a + b = P_1 \times P_2$ $p_1, p_2 \in$ prime and $10 \le 10a + b \le 99$

a	b	10a + b
1	0	10 = 2 × 5
2	2	22 = 2 × 11
3	4	34 = 2 × 17
3	8	38 = 2 × 19
4	6	46 = 2 × 33
5	5	55 = 5 × 11
5	8	58 = 2 × 29
6	2	62 = 2 × 31
7	4	74 = 2 × 37
8	2	82 = 2 × 41
8	5	85 = 5 × 17
9	4	94 = 2 × 47
9	5	95 = 5 × 19

Ans(C)

14. **Sol.** Let house no are $\alpha, \alpha, +2, \alpha + 4, \alpha + 6, \alpha + 8, \alpha + 10, ...$

$\alpha + 10 = a \Rightarrow \alpha = a - 10$ ..... (1)

House no. will be (+)

$\Rightarrow \alpha = a - 10 > 0$

$\Rightarrow \alpha > 10$

$\Rightarrow \alpha \ge 12$ as a is each too .....(2)

Now $S_n = \frac{n}{2}\left[2\alpha + (n-1)d\right]$

$170 = \frac{n}{2}\left[2\alpha + (n-1)(2)\right]$

$= n(\alpha + (n-1))$

$= n(a - 10 + n - 1)$

$= n(a - 11 + n)$

$\Rightarrow n^2 + n(a - 11) - 170 = 0$

$\Rightarrow n = \frac{(11-a) \pm \sqrt{(a-11)^2 + 680}}{2}$ .....(3)

$\because n \ge 6$

$\Rightarrow \frac{(11-a) \pm \sqrt{(a-11)^2 + 680}}{2} \ge 6$

$\Rightarrow a \le \frac{800}{24}$ .....(4)

From (2) and (4) $\Rightarrow 12 \le a \le 32$

Now checking through (3) for a = 12, 14,.....;

we have a = 18, n = 10 and $S_n = 170$

Hence options

Ans(C)

15.

Sol. $\frac{5}{7} = \frac{2520a_2 + 840a_3 + 210a_4 + 42a_5 + 7a_6 + a_7}{\lfloor 7}$

$2520a_2 + 840a_3 + 210a_4 + 42a_5 + 7a_6 + a_7 = 3600$

Let $a_2 = a_3 = a_4 = 1$ $a_5 = 0$ $a_6 = 4$ $a_7 = 2$

Ans(B)

PHYSICS

16.

Sol. |slope| is increasing at point R

Ans. (A)

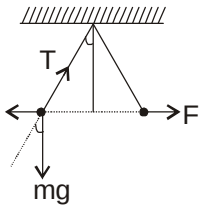
17.

Sol. No Bnoycncy force in vaccum

Ans. (D)

18.

Sol.



$\tan\theta = \frac{F}{mg}$ $(F \to same)$

$\tan\theta \ \alpha \ \frac{1}{m}$

$\therefore m_1 = m_2$

Ans. (B)

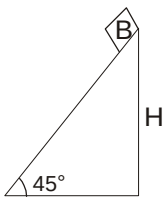
19.

Sol. Case-1

$v = \sqrt{2gh}$

Case-2

$\Delta U + \Delta kE = w_f$



$-mgh + \frac{1}{2}m\left(\frac{2gh}{9}\right) = -\mu mgh$

$\mu = \frac{8}{9}$

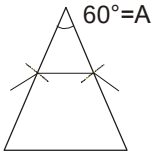
Ans. (A)

20. **Ans. (C)**

21. **Ans. (D)**

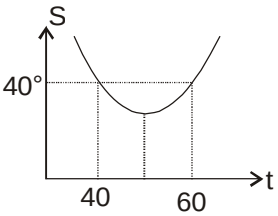
22.

Sol. For min deviatom
i = e



$r_1 = r_2 = \frac{A}{2}$

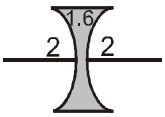
$\therefore r_1 = r_2 = 30°$



For minimum devation i should lie between 40 to 50°
Ans. (B)

23.

Sol.



$\frac{1}{F} = \left(\frac{1.6}{2} - 1\right)\left(\frac{1}{-0.2} - \frac{1}{0.2}\right)$

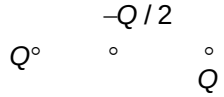
$= \frac{0.4}{2} \times \frac{1}{0.1}$

F = 0.5 converging lens
Ans. (D)

24. **Sol.** In option B it will not move, in option C & D path will be straight line.
Ans. (A)

25.

Sol. $\mu_i = \frac{kQ^2}{d} = E$

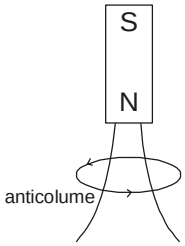


$\mu_f = \frac{kQ^2}{d} + \frac{k(-Q)^2}{d} + \frac{k-Q^2}{d}$

$= -\frac{kQ^2}{d} = -E$

Ans. (B)

26. **Sol.**Useing lenz's law upper face first become North pole then south pole



Ans. (C)

27. **Ans. (B)**

28. In SHM particle comes 2 times at every position in 1 oscillation, so actual histogram may be option (A) but since at it random snap shots so it should be option (C)
Ans. (C)

29. **Ans. (B)**

30. **Ans. (A)**

CHEMISTRY

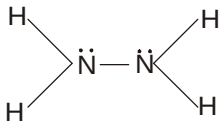
31.

Sol. CO & N_2 are isoelectronic

Ans. (A)

32.

Sol. HYDRAZINE N_2H_4



LP = 2
BP = 5
Ans. (B)

33.

Sol. $C(s) + O_2(g) \longrightarrow CO_2(g)$

moles = 1mole 1mole 1mole
weight = 12gm 32gm 44gm
12gm of C require $\rightarrow$ 1 mole of O_2

$\therefore$ 2.4gm of C will recquire $\rightarrow \frac{1}{12} \times 2.4$ mole of O_2

volume of 2.4/12 mole O_2 at STP = $\frac{22.4 \times 2.4}{12}$ litre

4.48 litre

Ans. (D)

34.

Sol. Nonpolar substance will have high R_f value as solvent is nonpolar therefore option (A) will have high R_f value as it have low dipole moment.

Ans. (A)

35. **Ans. (A)**

36.

Sol. $r_n = \dfrac{R_H\, n^2}{Z}$

$r_{H_{e+}} = \dfrac{53\, n^2}{Z}$

$= \dfrac{53 \times 1^2}{2} = 27$ approx.

Ans. (C)

37. **Ans. (D)**

38.

Sol. $NH_4Cl \rightarrow$ *acidic Salt* ($PH < 7$)

$NaCl \rightarrow$ Neutral Salt (PH = 7)

$CH_3COONa \rightarrow$ Basic salt (PH > 7)

Ans. (B)

39.

Sol. average speed $\alpha \dfrac{1}{\sqrt{M}}$

$\dfrac{V_{He}}{V_{O_2}} = \sqrt{\dfrac{32}{4}} = \sqrt{\dfrac{M_{O_2}}{M_{He}}}$

$= \sqrt{8} = 2\sqrt{2}$

Ans. (A)

40.

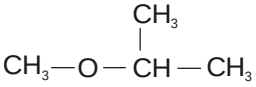
Sol. $NH_4Cl + NaNO_2 \longrightarrow NaCl + N_2 + 2H_2O$

Ans. (C)

41.

Sol. $CH_3 - O - CH_2 - CH_2 - CH_3$

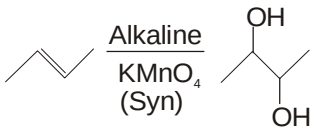
$CH_3 - CH_2 - O - CH_2 - CH_3$



Ans. (B)

42.

Sol.



Ans. (D)

43.

Sol. I,II & IV compound form H –bond III do not form H–Bond

Ans. (C)

44.

Sol. $\boxed{\Delta G^\circ = -RT \ln K_{eq}}$

Ans. (C)

45.

Sol. As we move from left to right in period ionisaton energy increases.

Ans. (A)

BIOLOGY

46.	**(B)**	**47.**	**(A)**	**48.**	**(B)**	**49.**	**(D)**	**50.**	**(B)**	**51.**	**(D)**	**52.**	**(C)**
53	**(A)**	**54.**	**(B)**	**55.**	**(A)**	**56.**	**(D)**	**57.**	**(B)**	**58.**	**(B)**	**59.**	**(C)**
60.	**(D)**												

PART-II
Two Mark Questions

MATHEMATICS

61. $a + b + c = 0, \quad a,b,c \in R \neq 0$

$a^2 + b^2 + c^2 + 2(ab + bc + ca) = 0$

$q = a^2 + b^2 + c^2, \quad r = a^4 + b^4 + c^4$

$r = q^2 - 2(a^2b^2 + b^2c^2 + c^2a^2)$

$r = q^2 - 2[(ab + bc + ca)^2 - 2abc(a + b + c)]$

$r = q^2 - 2\,(q^2 / 4)$

$r = q^2 / 2$

ANS - B

62. $$\frac{1}{1+\sqrt{2^{1947}}} + \frac{1}{2^{1947} + 2^{\frac{1947}{2}}} = \frac{1}{2^{\frac{1947}{2}}}$$

Similarly & $\therefore$

$$\sum_{n=0}^{1947} \frac{1}{2^4 + \sqrt{2^{1947}}} = \frac{974}{\sqrt{2^{1947}}} = \frac{487}{\sqrt{2^{1945}}}$$

ANS - A

63. $$\frac{x^2 - 1 + 1}{x - 1} + \frac{y^2 - 1 + 1}{y - 1} = 4$$

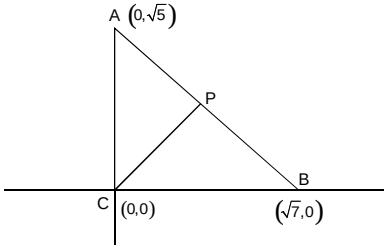
$$x + 1 + \frac{1}{x-1} + y + 1 + \frac{1}{y-1} = 4$$

$$a + 2 + \frac{1}{x-1} + \frac{1}{(a-1)-x} = 4$$

$$\frac{(a-1)-x+x-1}{(x-1)[(a-1)-x]} = 2 - a$$

$\because$ $a \neq 2$ [for a = 2 equation have infinitely many solution]
$\therefore$ $(x - 1)[(a - 1) - x] = -1$
$(x - 1)[x - (a - 1)] = 1$
$x^2 - ax + (a - 2) = 0$
$D > 0$
$\therefore$ equation have 2 real roots so
a can be 1, 3, 4..... 2014
ans 2013
ANS - C

64.



Equation of line AB is

$$\frac{x}{\sqrt{7}} + \frac{y}{\sqrt{5}} = 1$$

Let P $[\alpha, \sqrt{5}(1 - \frac{\alpha}{\sqrt{7}})]$
on solving 16(PA)2 = 9(PB)2

$$P[\frac{\sqrt{7}}{3}, \frac{2\sqrt{5}}{3}]$$

Let BP : PC = $\lambda : 1$
then $\lambda = 2$
BP:PC = 2 : 1
ANS - (A)

65. $(a \times b \times c) + (a \times b) + (c \times a) + (a + b + c) = 29$
$(1 + a)(1 + b)(1 + c) = 30$
$= 2 \times 3 \times 5 \rightarrow (a, b, c) \Rightarrow (1, 2, 3) \Rightarrow 6$
$= 1 \times 6 \times 5 \rightarrow (a, b, c) \Rightarrow (0, 5, 4) \Rightarrow 4$
$= 1 \times 3 \times 10 \rightarrow (a, b, 1) \Rightarrow (0, 2, 9) \Rightarrow 4$

14

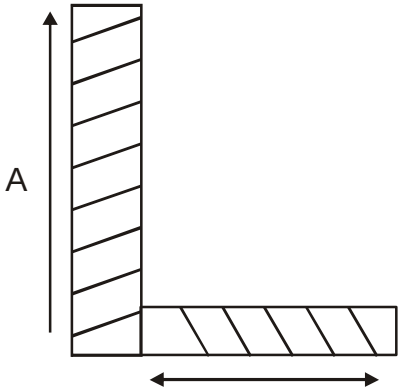
ANS - (C)

PHYSICS

66.
Sol. Finaly com at p

$$X_{am} = \frac{A_1X_1 + A_2X_2}{A_1 + A_2}$$

$$(a\text{-}b) = \frac{a(a-b)\frac{(a-b)}{2} + b(a-b)(a-b+b/2)}{a(a-b)+(a-b)b}$$



$$\therefore \left(\frac{a}{b}\right)^2 - \left(\frac{a}{b}\right) - 1 = 0$$

$$\frac{a}{b} = \frac{1+\sqrt{5}}{2}$$

Ans. (B)

67. Weight = F_0

$4\pi r^2 t \rho_W g + 4/3\pi r^3 \rho_{Ne} g = 4/3\ \pi r^3 \rho_{air} g$

$\therefore$ t = 3.5 um

Ans. (D)

68.

Sol Heat lost = heat gas

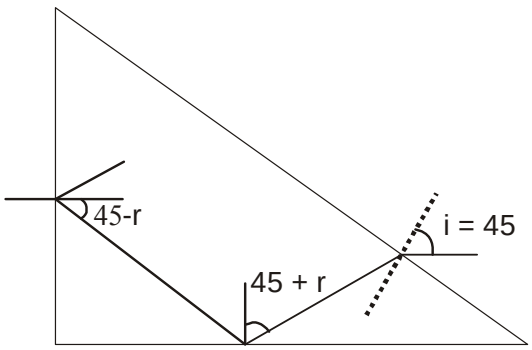
0.05 x 900 x (300 - 160) = 1 x 4200 x (T - 30)

T = 31.5 °

Ans. (C)

69.

Sol.



45 + r > C

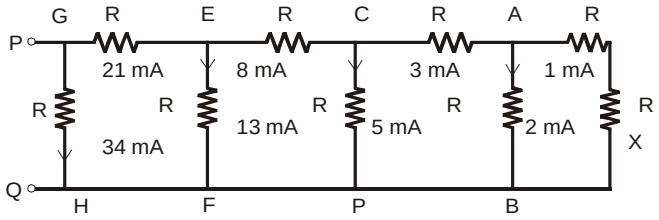
also 45 - r > C

90 > C

$\because\ \mu > \sqrt{2}$

Ans (A)

70.



Using KCL
At point A
Current is 3mA
At point C
Current is 8 mA
At point E
Current is 21 mA
At point G
Current through GH is
34 ma
$\therefore V_{PQ} = V_{GH} = i\,R_{GH}$
$= 34$ V

Ans. (D)

CHEMISTRY

71.

Sol. $2H_2(g) + O_2(g) \longrightarrow 2H_2O(l)$
0.2 mole 0.1 mole 0.2 mole

moles of gas remaining = 9.7
at constant (T) & (V)

$$\frac{n_1}{n_2} = \frac{p_1}{p_2}$$

$$\frac{10}{9.7} = \frac{1}{p_2} \;\&\; p_2 = 0.97$$

Ans. (B)

72.

Sol. $2NH_3 + H_2SO_4 \longrightarrow (NH_4)_2SO_4$
10ml
2M

millimole of $H_2SO_4 = \dfrac{mmol\ of\ NH_3}{2} = 20$

mmol $NH_3 = mmol\ of\ N = 40$

$$W_N = \frac{40 \times 14}{1000} = \frac{560}{1000} = 0.56g$$

$$\%\ of\ N = \frac{0.56}{2} \times 100 = 28$$

Ans. (A)

73.

Sol. 1.125L of H_2 produced by 0.1 equivalent of metal

1.85L a of H_2 will be produced by $= \frac{0.1 \times 1.85}{1.125}$ equivalents

$\therefore$ No of gram equivalent of metal

$$= \frac{2}{\text{Equivalent } weight} = \frac{2}{x}$$

$$\therefore \frac{0.1}{1.125} \times 1.85 = \frac{2}{x}$$

$$\boxed{x = 12.16}$$

Ans. (D)

74.

Sol. $CaO + C \longrightarrow CaC_2 + CO_2$

$CaC_2 + H_2O \longrightarrow HC \equiv CH + Ca(OH)_2$

$3HC \equiv CH \xrightarrow[Fe]{\text{Red Hot}}$ 

Ans. (A)

75.

Sol.

Ans. (A)

BIOLOGY

76. (C) 77. (C) 78. (B) 79 (A) 80. (A)