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STATE LEVEL SCIENCE TALENT SEARCH EXAMINATION - 2013

SOLUTIONS FOR CLASS : 10

Mathematics

1. (A) $\sin A = \frac{12}{13} \Rightarrow \cos A = \sqrt{1-\sin^2 A}$

$= \sqrt{1-\frac{144}{169}} = \frac{5}{13}$

$\cos B = \frac{3}{5} \Rightarrow \sin B = \sqrt{1-\cos^2 B}$

$= \sqrt{1-\frac{9}{25}} = \frac{4}{5}$

$\therefore \tan A \tan B = \frac{\sin A}{\cos A} \times \frac{\sin B}{\cos B} = \frac{12}{5} \times \frac{4}{3} = \frac{16}{5}$

2. (C) Median marks for test 1: $\frac{20+22}{2} = 21$

Median marks for test 2: $\frac{18+23}{2} = 20.5$

Their difference = 21 – 20.5 = 0.5

3. (D) For the given A.P., a = 1, d = k + 1, $n_1 = 30$ and $n_2 = 20$. So, $S_{n_1} = S_{30}$

$= \frac{30}{2}[2(1)+(30-1)(k+1)]$

$= 15[2+29(k+1)]$

$= 15[29k+31]$

Similarly, $S_{20} = \frac{20}{2}[2(1)+(20-1)(k+1)]$

$= 10[2+19(k+1)] = 10[19k+21]$

$\therefore$ The required ratio is $\frac{S_{30}}{S_{20}}$

$= \frac{15(29k+31)}{10(19k+21)}$

$= \frac{3(29k+31)}{2(19k+21)}$

Given that $\frac{S_{30}}{S_{20}} = \frac{9}{4} \Rightarrow \frac{3(29k+31)}{2(19k+21)} = \frac{9}{4}$

$\Rightarrow 2(29k+31) = 3(19k+21)$

$\Rightarrow k = 1$

4. (B) Let $p(x)$ be $x^3 + 18x^2 + 80x + 96$.

Volume of the given solid = Area of the rectangular base × Height.

Clearly $p(-4) = 0$ and $p(-12) = 0$. So, the third factor of $p(x)$ gives the expression for the missing dimension.

Computing $p(-2)$,
we get $(-2)^3 + 18(-2)^2 + 80(-2) + 96$

$= -8 + 72 - 160 + 96$

$= -168 + 168 = 0$

$\Rightarrow p(-20) = 0$

$\Rightarrow (x+2)$ is a factor of $p(x)$.

Therefore, the expression for the missing dimension is $(x + 2)$ cm.

5. (A) Given $A = \begin{pmatrix} 3 & 1 \\ 2 & -1 \end{pmatrix}$ and $I = \begin{pmatrix} 1 & 0 \\ 0 & 1 \end{pmatrix}$

$\lambda I = \lambda \begin{pmatrix} 1 & 0 \\ 0 & 1 \end{pmatrix} = \begin{pmatrix} \lambda & 0 \\ 0 & \lambda \end{pmatrix}$

$A - \lambda I = \begin{pmatrix} 3 & 1 \\ 2 & -1 \end{pmatrix} - \begin{pmatrix} \lambda & 0 \\ 0 & \lambda \end{pmatrix}$

$= \begin{pmatrix} 3-\lambda & 1-0 \\ 2-0 & -1-\lambda \end{pmatrix} = \begin{pmatrix} 3-\lambda & 1 \\ 2 & -1-\lambda \end{pmatrix}$

$|A - \lambda I| = \begin{vmatrix} 3-\lambda & 1 \\ 2 & -1-\lambda \end{vmatrix}$

$= (3-\lambda)(-1-\lambda) - (1)(2)$

$= -3 + \lambda - 3\lambda + \lambda^2 - 2$

Given $|A - \lambda I| = -5 \Rightarrow \lambda^2 - 2\lambda - 5 = -5$

$\Rightarrow \lambda^2 - 2\lambda = 0$

$\Rightarrow \lambda(\lambda-2)=0$

$\Rightarrow \lambda=0$ or $\lambda=2$

6. (B) $A=\{x/x$ is a multiple of $8<70\}$

$\Rightarrow A=\{8, 16, 24, 32, 40, 48, 56, 64\}$

$\Rightarrow n(A)=8$

And $B=\{x/x$ is a factor of $20\}$

$\Rightarrow B=\{1, 2, 4, 5, 10, 20\}$

$\Rightarrow n(B)=6$

Clearly $n(A\cap B)=\varnothing$ as A and B are disjoint.

$\therefore n(A\cup B)=n(A)+n(B)-n(A\cap B)$

$=8+6-0=14$

7. (D) The centroid of Δ PQR $=\left(\frac{5}{3},\frac{10}{3}\right)$. S is a point on QR such that $2QS=QR \Rightarrow$ S is the midpoint of QR. Centroid of Δ PQR divides the median PS in the ratio 2 : 1 from P.

Let the coordinates of S be (x, y).

Then $\left(\frac{5}{3},\frac{10}{3}\right)=\left(\frac{2(x)+1(-1)}{2+1},\frac{2(y)+1(2)}{2+1}\right)$

$=\left(\frac{2x-1}{3},\frac{2y+2}{3}\right)$

Hence $\frac{5}{3}=\frac{2x-1}{3}\Rightarrow 5=2x-1\Rightarrow x=3$

and $\frac{10}{3}=\frac{2y+2}{3}\Rightarrow 10=2y+2\Rightarrow y=4$.

$\therefore$ The required coordinates of S are (3, 4).

8. (C) We know that $\lim_{x\to a}\frac{x^n-a^n}{x-a}=n.a^{n-1}$.

$\lim_{x\to 6}\frac{x^n-6^n}{x-6}=6480$

$\Rightarrow n.6^{n-1}=6480$

$=5\times 6^4$

$=5\times 6^{5-1}$

Comparing corresponding terms on both the sides, we get n = 5.

9. (A) $r=p\wedge q$ is a conjunction.

The conjunction of two statements is true only when both the statements are true.

10. (C) Line p passes through (1, 0) & (0, 1).

$\therefore$ Its equation is $x+y=1$ (or)

$y=1-x\Rightarrow m=-1$

Line t passes through (–2, 0) and (0, 2).

$\therefore$ Its equation is $y=x+2\Rightarrow m=1$

The product of their slopes is $1\times(-1)=(-1)$

Therefore, p and t are perpendicular.

(*Note*: The slope of (r, t), (p, s) and (q, r) are equal and hence they are parallel).

11. (D) We know that ${}^nC_r=\frac{n!}{r!(n-r)!}$.

${}^7C_3=\frac{7\times6\times5\times4!}{3\times2\times4!}=35$

${}^8C_4=\frac{8\times7\times6\times5\times4!}{4\times3\times2\times4!}=70$

${}^9C_3=\frac{9\times8\times7\times6!}{3\times2\times6!}=84$

${}^{10}C_4=\frac{10\times9\times8\times7\times6!}{4\times3\times2\times6!}=210$

Clearly, $3\times{}^8C_4=3\times70=210={}^{10}C_4$ is true.

Also,

$35\neq\frac{1}{2}(84)$ as in option (A); $210\neq70+84$ as in option (B) and $84\neq70-14$ as in option (C).

12. (A) $\lim_{x\to 2}\frac{x^2-4}{\sqrt{x+2}-\sqrt{3x-2}}$

$=\lim_{x\to 2}\frac{(x+2)(x-2)}{\sqrt{x+2}-\sqrt{3x-2}}\times\frac{\sqrt{x+2}+\sqrt{3x-2}}{\sqrt{x+2}+\sqrt{3x-2}}$

$=\lim_{x\to 2}\frac{(x+2)(x-2)\left(\sqrt{x+2}+\sqrt{3x-2}\right)}{\left(\sqrt{x+2}\right)^2-\left(\sqrt{3x-2}\right)^2}$

$=\lim_{x\to 2}\frac{(x+2)(x-2)\left(\sqrt{x+2}+\sqrt{3x-2}\right)}{(x+2)-(3x-2)}$

$=\lim_{x\to 2}\frac{(x+2)(x-2)\left(\sqrt{x+2}+\sqrt{3x-2}\right)}{-2x+4}$

$=\lim_{x\to 2}\frac{(x+2)(x-2)\left(\sqrt{x+2}+\sqrt{3x-2}\right)}{-2(x-2)}$

$=\lim_{x\to 2}\frac{(x+2)\left(\sqrt{x+2}+\sqrt{3x-2}\right)}{-2}$

$=\frac{(2+2)\left(\sqrt{2+2}+\sqrt{3(2)-2}\right)}{-2}=-8$

13. (B) When two chords intersect externally,

$PA\times PB=PC\times PD$

$\Rightarrow (9+x)\times x=(4+5)(4)$

$\Rightarrow 9x+x^2=36$

$\Rightarrow x^2 + 9x - 36 = 0 \Rightarrow (x + 12)(x - 3) = 0$

$\Rightarrow x = -12$ or $x = 3$

Since length cannot be negative, $x = 3$ is the required value.

14. (D) Let the depth of the well be x m. Then according to the problem, $\frac{6}{x} = \frac{2}{6}$

$\Rightarrow x = \frac{36}{2} = 18\,\text{m}$

15. (C) Given $f(x) = (x + 5)(3x^2 - 7x + a)$ and $g(x) = (x - 5)(2x^2 + 3x - b)$

H.C.F. of $f(x)$ and $g(x)$ is $x^2 - 25$.

Hence, $(x - 5)$ is a factor of $f(x)$ and $(x + 5)$ is a factor of $g(x)$.

Using the remainder theorem, $f(5) = 0$ and $g(-5) = 0$.

$f(5) = 3(5)^2 - 7(5) + a = 0$
$\Rightarrow 75 - 35 + a = 0$
$\Rightarrow a = -40$

$g(-5) = 2(-5)^2 + 3(-5) - b = 0$
$\Rightarrow 50 - 15 - b = 0$
$\Rightarrow 35 - b = 0$
$\Rightarrow b = 35$

$\therefore a - b = (-40) - (35) = -75$

16. (A) The required mean price of a ticket

$$= \frac{(180 \times ₹\,6.50) + (215 \times ₹\,8) + (124 \times ₹\,10)}{(180 + 215 + 124)}$$

$$= \frac{₹\,(1170 + 1720 + 1240)}{519} = \frac{₹\,4130}{519} = ₹\,7.9576$$

$\approx ₹\,7.96$

17. (C) Clearly h: $X \to Y$ in option (C) is a bijective function as it is both one-one and onto.

18. (A) $3^{2x+1} - 4 \times 3^{x+1} + 9 = 0$

$\Rightarrow 3^{2x} \times 3 - 4 \times 3^x \times 3 = -(3)^2$

$\Rightarrow 3(3^{2x} - 4 \times 3^x) = (-3) \times 3$

$\Rightarrow 3^{2x} - 4 \times 3^x = (-3)$

$\Rightarrow (3^x)^2 - 2 \times 3^x \times (2) + 2^2$

$= (-3) + 2^2$ [Adding 2^2 on both the sides].

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

$\Rightarrow 3^x = 3$

$\Rightarrow x = 1$

19. (D) Let the smallest of the three consecutive odd numbers be x.

Then according to the problem,

$x(x + 2)(x + 4) = (x + 4)x^2 + 1050$

$\Rightarrow (x^2 + 2x)(x + 4) - x^2(x + 4) = 1050$

$\Rightarrow 2x(x + 4) = 1050$

$\Rightarrow x(x + 4) = 525 \Rightarrow x^2 + 4x - 525 = 0$

$\Rightarrow x^2 + 25x - 21x - 525 = 0$

$\Rightarrow x(x + 25) - 21(x + 25) = 0$

$\Rightarrow x = -25$ or 21

$\therefore$ The required odd numbers are 21, 23 and 25.

20. (B) $S_n = \frac{a(1 - r^n)}{1 - r}$ and $S_\infty = \frac{a}{1 - r}$ for a G. P.

S_{12} of $2 - \frac{1}{2} + \frac{1}{8} - \ldots = \frac{8}{5}\left(1 - \frac{1}{4^{12}}\right) \neq 8\left(1 - \frac{1}{4^{12}}\right)$

S_∞ of $2 - \frac{4}{3} + \frac{8}{9} - \frac{16}{27} + \ldots = \frac{6}{5}$ (Correct)

S_n of $1 + \frac{2}{3} + \frac{4}{9} + \frac{8}{27} + \ldots$

$= 3^{(1-n)}(3^n - 2^n) \neq 3(3^n - 2^n)$

S_∞ of $1 + \frac{1}{2} + \frac{1}{4} + \ldots = 2 \neq \frac{1}{2}$

Therefore, the statement in option (B) is correct.

21. (C) Numbers of the form $2^{3n} - 1$ are divisible by 7. Hence it is the required incorrect statement. The statements in options (A), (B) and (D) are correct.

22. (D) The y-intercept of the line parallel to $y = x$ is $(-5) \Rightarrow B = (0, -5)$.

The line parallel to $y = x$ passing through $(0, -5)$

$= y - (-5) = 1(x - 0) \Rightarrow y + 5 = x$

$\Rightarrow y = x - 5$

$\therefore$ Point A = (5, 0)

Thus, midpoint of AB $= \left(\frac{x_1 + x_2}{2}, \frac{y_1 + y_2}{2}\right)$

$= \left(\frac{5 + 0}{2}, \frac{0 - 5}{2}\right)$

$= (2.5, -2.5)$

23. (B) In the expansion of $(2 - 3x)^8$, the 6^{th} term has x^5.

6^{th} term of $(2 - 3x)^8 = {}^8C_5\,(2)^{8-5}\,(-3x)^5$

$= \frac{8 \times 7 \times 6 \times 5!}{5! \times 3!}(2^3)(-3)^5 x^5$

$= (56 \times 8 \times -243)x^5$

$= [2 \times (-3) \times 4 \times 7 \times 8 \times 9^2]x^5$

$\therefore$ The required coefficient of x^5 is $2\times(-3)\times4\times7\times8\times9^2$.

24. (A) The outputs in each iteration of the loop in the given flow chart are 15, 15^2, 15^3 and 15^4.

Their sum = $15 + 15^2 + 15^3 + 15^4$

25. (C) $\angle BRC = 360^\circ - (92^\circ + 86^\circ + 76^\circ)$
$= 360^\circ - 254^\circ = 106^\circ$

Since PA and PD are the lengths of the tangents PA and PD,
$\angle PDA = \angle DAP$

$$= \frac{1}{2}(180^\circ - 92^\circ) = \frac{1}{2}(88^\circ) = 44^\circ$$

Similarly, $\angle QAB = \angle QBA$

$$= \frac{1}{2}(180^\circ - 86^\circ) = \frac{1}{2}(94^\circ) = 47^\circ$$

$$\angle RBC = \frac{180^\circ - 106^\circ}{2} = \frac{74^\circ}{2} = 37^\circ$$

$$= \angle RCB$$

and $\angle SCD = \angle SDC$

$$= \frac{180^\circ - 76^\circ}{2} = \frac{104^\circ}{2} = 52^\circ$$

In quadrilateral ABCD, $\angle A = 180^\circ - \angle DAP - \angle BAQ = 180^\circ - (44^\circ + 47^\circ) = 180^\circ - 91^\circ = 89^\circ$.

Similarly, $\angle B = 96^\circ$, $\angle C = 91^\circ$ and $\angle D = 84^\circ$.

Physics

26. (B) When the ball reaches a maximum height, its velocity becomes zero. By taking the upward direction as positive $v^2 = u^2 - 2gh$.

or $0^2 = u^2 - 2\times(9.8\text{ m s}^{-2})\times(19.6\text{ m})$

or $u^2 = (2\times9.8\times19.6)\text{ m}^2\text{ s}^{-2}$

or $u = 19.6\text{ m s}^{-1}$.

27. (D) The following statements show correct relationship between current, voltage and resistance :

(A) Flow of current is directly proportional to the applied voltage.

(B) The ratio of voltage and current is constant and equal to the resistance of the resistor.

(C) The flow of current is inversely proportional to the resistance, if the voltage is fixed.

28. (D) In a nuclear generator

(i) uranium atoms split to produce nuclear energy which is used to boil water to get steam (heat energy)

(ii) steam with high pressure turns the turbines possessing potential energy.

(iii) turbines in motion acquire kinetic energy which drives a dynamo to produce electrical energy. This process continues to produce large amount of electrical energy.

29. (C) According to the formula $\frac{V_p}{V_s} = \frac{N_p}{N_s}$

$V_p = 10\text{ V}$ $N_p = 100$ turns

$V_s = ?$ $N_s = 200$ turns

$$= \frac{10}{V_s} = \frac{100}{200}$$

$$V_s = \frac{V_p \times N_s}{N_p}$$

$$V_s = \frac{10\times \cancel{200^2}}{\cancel{100}} = 20\text{ V}$$

When the number of turns of wire in a secondary coil are more than the turns of wire in a primary coil, it is a step-up transformer. Hence, output voltage V_s is more than the input voltage V_p.

30. (C) According to Hooke's law "when a spring is fixed at one end and a force is applied at the other end, the stretching of the spring is proportional to the applied force", provided the force is within the elastic limit of the spring.

31. (C) Plasma is the fourth state of matter. The nature of plasma can be studied using lasers.

32. (B) According to the formula, we have,

$$v = \nu\,\lambda$$

$$\text{or } \lambda = \frac{v}{\nu} = \frac{330\text{ m s}^{-1}}{300\text{ s}^{-1}} = 1.1\text{ m}$$

33. (D) (i) Gamma rays have more penetrating power than alpha and beta particles. Cancer cells are killed by targeting them with a beam of gamma rays of high intensity.

(ii) They are used to sterilize food before packing in tins or cans and also surgical instruments in hospitals.

(iii) Radiographic equipment which uses only gamma rays are used to detect damaged parts and flaws in metals.

34. (A) By doubling the length of the wire, resistance also will be doubled as $R \propto l$

Doubling the cross - sectional area of the wire will reduce the resistance to half as

$$\frac{R \propto l}{A}$$

$\therefore$ Resistance of 4 m long wire with 2 mm^2 cross - sectional area is 16 Ω as given below.

Given	Required
$R_1 = 16\ \Omega$	$R_2 = ?$
$l_1 = 2$ m	$l_2 = 4$ m
$A_1 = 1$ mm^2	$A_2 = 2$ mm^2

$$R\alpha \frac{l}{A} = 16 \times \frac{2}{1} \times R_2 \times \frac{4}{2}$$

$$R_2 = \frac{16 \times \cancel{2}^{1}}{1} \times \frac{\cancel{2}^{1}}{\cancel{4}\,\cancel{2}^{1}} = 16\ \Omega$$

35. (B) The speed of a ball thrown up decreases as the height increases. When the ball reaches its maximum height, the speed becomes zero. It falls down due to gravitational force of the earth.

36. (C) In He–Ne laser, Ne acts as the active system and pumping is achieved by using a radio-frequency generator.

37. (D) By increasing the number of divisions on the circular scale of a screw gauge, its least count decreases. Hence, relative error also decreases because the error of measurement is equal to the least count.

38. (B) The weight of the baby

W = mg

= (5 kg) × (9.8 m s^{-2}) = 49.0 kg m s^{-2} = 49 N

39. (A) $\text{Amperes} = \frac{\text{watts}}{\text{volts}} = \frac{3000}{240} = 12.5$ A

40. (A) (i) The description of instrument given under X is of Vernier callipers. It has two jaws internal and external.

(ii) The description of instrument given under Y is of Screw gauge (micrometer). It has two studs, 1 is fixed and the other is movable.

41. (D) All the given characteristics are of diamagnetic substances.

42. (D) According to the formula = $F = G\frac{m_1 m_2}{r^2}$

$$F = 6.67 \times 10^{-11}\ \text{Nm}^2/\text{kg}^2 \times \frac{1\text{kg} \times 1\text{kg}}{1\text{m}^2}$$

$$= 6.67 \times 10^{-11}\text{N}$$

43. (B) (i) Total power consumed by the lamps

= 8 × 40 W = 320 W

Total time of lighting the lamps in a month = 3 × 30 = 90 hours

Energy consumed by lamps in one month (30 days) $= \frac{320 \times 90}{1000} = 28.8$ kWh

= 28.8 units

(ii) Power consumed by one fan

P = I × V = 0.25 × 220 = 55 W

Total energy consumed by two fans in 30 days $= \frac{2 \times 55 \times 6 \times 30}{1000}$

= 1.98 kWh = 19.8 units

Total units = 28.8 + 19.8 = 48.6 units

Total bill per month = Total units × Cost of one unit = 48.6 × 75 p = 3,645 paise or ₹ 36.45.

44. (D) Mass m = 20 g = 0.20 kg

Radius r = 25 cm = 0.25 m

Linear speed v = 0.6 m s^{-1}

Hence, centripetal acceleration $a = \frac{v^2}{r}$

$$\therefore a = \frac{(0.6)^2}{0.25} = \frac{0.36}{0.25} = \frac{3.6}{2.5} = 1.44\ \text{m s}^{-2}$$

Centripetal force $F = \frac{mv^2}{r} = m\omega^2 r$ or

F = m × a = 0.20 × 1.44 = 0.288 N

45. (D) Thermopiles, bolometers and thermometers are used to detect the presence of IR rays.

46. (D) (i) Ferromagnetic substances are strongly attracted by a magnet. They align themselves easily in the direction of the applied magnetic field.

(ii) Their relative permeability is very high. The magnetic susceptibility is very high and positive.

(iii) Fe, Co, Ni, Gd, Dy and a large number of their alloys are examples of ferromagnetic substances.

47. (D) Electro chemical equivalent $Z = \frac{m}{it}$

$$= \frac{0.067}{1 \times 5 \times 60} = 0.000223\ \text{g C}^{-1}$$

48. (C) Number of revolutions made by a record player in one minute

n = 60

Number of revolutions in one second

$n = \frac{60}{60}$ rps = 1

One revolution = 2π radians

$\therefore$ Angular velocity $\omega = 2\pi \times n$

$= 2\pi$ radians s^{-1}

49. (D) Frequency of tuning fork

$= \frac{\text{no. of oscillations}}{\text{time}} = \frac{768}{6} = 128$ Hz

50. (B) A crest formed in a ripple tank behaves as a convex lens and converges light to form a bright band.

A trough formed in a ripple tank behaves as a concave lens and diverges light to form a dark band.

Bright and dark bands can be clearly seen on a paper kept below the ripple tank which demonstrates water waves.

Chemistry

51. (D) Fluorine is a least electropositive element.

52. (A) The general structure of amino-acids is shown in option (A). Properties of R change according to the type of amino acid. Most of the amino-acids are water soluble with high melting points similar to salts. Based on salt like structures, amino-acids form "Zwitter ions" due to the transfer of a proton from carboxylic acid (COOH) group to amine group (NH_2) to form NH_3^+. Zwitter ions are amphoteric in nature due to acidic and basic properties. Also they have both + ve and –ve charges.

53. (B) $MgCl_2$ is the salt formed due to the reaction of a strong acid with a strong base as shown below.

$Mg(OH)_2 + 2HCl \rightarrow MgCl_2 + H_2O$.

Its solution in water will be neutral and its pH = 7.

54. (D) Compounds of carbon and water are called hydrates or hydrated carbons. Hence, the name carbohydrates. They get charred leaving behind a residue of carbon when treated with conc. H_2SO_4. Conc. H_2SO_4 is a dehydrating agent and it takes up water molecules from carbohydrates.

55. (C) Oxides of non-metals are usually acidic and metals are basic. P_2O_5 is the most acidic oxide.

56. (B) Aluminium carbide (Al_4C_3), a covalent compound on hydrolysis gives methane. Methane is a saturated hydrocarbon.

57. (A) Electron affinity is the energy released when an electron is added to a neutral gaseous atom in the ground state. Among halogens, chlorine has the highest electron affinity. The order is Cl > F > Br > I.

58. (B) The given characteristics belong to alkaline earth metals.

59. (D) (i) *p*-orbitals overlapping given under option (D) is the correct one.

(ii) It is an end-on-end overlap in which the end part of an orbital overlaps with the end part of another orbital.

(iii) Due to the maximum overlap of orbitals and interlocking, a strong, sigma bond is formed.

60. (A) 11 gaseous elements are present in the periodic table. They include H_2, He, N_2, O_2, F_2, Ne, Cl_2, Ar, Kr, Xe and Rn.

61. (C) (i) Among the three allotropic forms of carbon, diamond is the hardest. It is a non-metal with very high density of 3.51 g cm^{-3}.

62. (C) (i) Pauli's principle is known as Pauli's exclusion principle because it excludes the possibility of third electron in an orbital.

(ii) Only two electrons with opposite sign can be accommodated in an orbital.

63. (C) Aldehydes (–CHO) functional group forms a silver coating on the walls of a test tube, when silver nitrate solution is added to ammonia solution (Tollen's reagent). This occurs due to reduction of Ag^+ ions to Ag by glucose. This reaction is specific for –CHO group.

64. (C) For n^{th} energy level, the maximum number of sub-shells = n

Number of orbitals = n^2

Number of electrons = $2n^2$

As the 'n' value increases, the size and the energy of the orbit also increases. The number of sub-energy levels (sub stationary states) in a given shell is equal to n^2.

65. (B) The conductivity of a weak electrolyte increases with increase in dilution due to the increase in the ionization percentage. Dilution with decrease in concentration helps to achieve greater ionization percentage.

66. (A) 1 mol of HCl gives 1 mol Cl^-

$\therefore$ 0.4 mol of HCl will give 0.4 mol Cl^-

1 mol of $CaCl_2$ gives 2 mol Cl^-

$\therefore$ 0.2 mol of $CaCl_2$ gives $2 \times 0.2 = 0.4$ mol of Cl^-

Total moles of Cl^- = 0.4 + 0.4 = 0.8 mol

$$\text{Molarity} = \frac{\text{moles}}{V(l)} = \frac{0.8}{0.5} = 1.6 \text{ M}$$

67. (D) Melting and boiling points show gradation (regular increase and decrease) in alkaline earth metals due to their different crystal structures, strong metallic bonds and more closely packed atoms and different interatomic forces.

68. (C) Ethyl alcohol is an industrial solvent. It is supplied to industries at low cost by the government. In order to prevent misuse of the above, a small quantity of pyridine or methyl alcohol is added. This ethyl alcohol is called denatured spirit. Consumption of denatured spirit leads to blindness and death in human beings.

69. (A) (i) The solubility of a solution depends on the nature of solute, solvent and temperature.

(ii) The effect of dilution increases the extent of dissociation in weak electrolytes.

70. (B) A non-polar compound (napthalene) dissolves in a non-polar solvent (kerosene) to form a solution.

Biology

71. (A) The substance kept in glass beaker is potassium hydroxide. It absorbs CO_2.

72. (C) Pulmonary vein carries oxygenated blood from lungs to the left auricle of heart.

73. (D) To stop chemical reactions in the cells, a leaf is boiled in alcohol before carrying out the starch test on it.

74. (C) In the given flow chart X - glycolysis, Y-aerobic and Z - anaerobic.

75. (B) Heart beat and peristalsis are the functions of medulla oblongata.

76. (B) Endocrine glands are ductless glands. They secretes hormones directly into the blood.

77. (D) The person with Blood Group A can donate blood to Blood Group A and Blood Group A B.

78. (A) When we breathe in oxygen leaves the lung and enters into the blood cells and when we breathe out carbondioxide leaves the blood vessels and enters into the lungs.

79. (B) Vitamin D is essential for healthy and strong bones.

80. (D) Yeast reproduces by budding.

81. (C) Fertilisation occurs in the fallopian tube of female reproductive system.

82. (C) The pulse rate of the heart is examined by touching at the wrist.

83. (C) In the given figure part 'P' is cerebellum. Cerebellum controls and coordinates the stability of the body.

84. (B) There are 31 pairs of spinal nerves present in man.

85. (B) The chemical name of vitamin D is calciferol. Vitamin D is essential for the growth of strong bones. Deficiency of vitamin D leads to bow shaped legs called rickets.

86. (B) Girdling is done to reduce the downward movement of nutrients through phloem tissue.

87. (C) By conjugation, a single paramecium produces four daughter paramecia.

88. (D) After splitting of anthers pollen grains are liberated out by the process of pollination, the pollen grains germinate ensuring fertilisation.

After this process, the ovary develops into fruit and the ovule develops into seed.

89. (C) Thyroxine controls the metabolic rate, adrenaline prepares the body for an emergency, insulin regulates blood sugar level. Puberty in females is caused by estrogen and testosterone in males.

90. (C) Monocytes are the biggest of all white blood cells. Its nucleus is kidney shaped.