NATIONAL LEVEL SCIENCE TALENT SEARCH EXAMINATION

Paper Code: UN423
Solutions for Class : 10

Mathematics

1. (B) Let the present age of the son be 'x' years. Then the father's age is x^2 years.
One year ago, the son's age was $(x - 1)$ years and the father's age was $(x^2 - 1)$ years.
According to the problem,
$(x^2 - 1) = 8 (x - 1)$
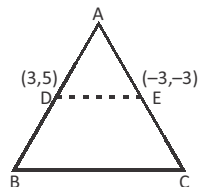$\Rightarrow (x - 7)(x - 1) = 0$
$\Rightarrow x = 1$ or 7
If $x = 1$, $x^2 = 1$
$\Rightarrow$ the father's age 1 year cannot be considered because
If $x = 7$, then $x^2 = 49$.
Hence, the present age of the father is 49 years.

2. (B)

Length of BC = 2(length of DE)
$\Rightarrow$ BC $= 2\sqrt{(-3-3)^2+(-3-5)^2}$
$= 2\sqrt{36+64} = 2\sqrt{100}$
$= 2(10) = 20$
$\therefore$ The length of BC is 20

3. (C) Given $2(\cos\theta + \sec\theta) = 5$
$\Rightarrow (\cos\theta + \sec\theta) = \dfrac{5}{2}$
Squaring on both sides
$\Rightarrow \cos^2\theta + \sec^2\theta + 2\cos\theta\sec\theta = \left(\dfrac{5}{2}\right)^2$
$\Rightarrow \cos^2\theta + \sec^2\theta = \dfrac{25}{4} - 2 = \dfrac{17}{4}$
$\therefore \cos^2\theta + \sec^2\theta = \dfrac{17}{4}$

4 (B) Given, HCF (6, 12) = 6 is one of the roots.
$\therefore$ f(6) = 0
$\Rightarrow (6)^2 - 8(6) + k = 0$
$\Rightarrow 36 - 48 + k = 0$
$\Rightarrow -12 + k = 0$
$\Rightarrow k = 12$

5. (D) Given, $4^{x+y} = 256 \Rightarrow 4^{x+y} = 4^4$
$\therefore x + y = 4$, slope of this line $= -1 = m_1$
$x - y$
Also, $256 = 4 \Rightarrow (4^4)^{x-y} = 4$
$\Rightarrow 4^{4(x-y)} = 4^1$
$\therefore 4(x-y) = 1 \Rightarrow x - y = \dfrac{1}{4}$
Slope of the line $= 1 = m_2$
we notice, $m_1 \times m_2 = -1$
Hence the two lines are perpendicular.

6. (C) $a_{18} = a + (18 - 1)d = a + 17d$
and $a_{11} = a + 10d$
Given, $\dfrac{a_{18}}{a_{11}} = \dfrac{3}{2}$
$\Rightarrow \dfrac{a+17d}{a+10d} = \dfrac{3}{2}$
$\Rightarrow 2a + 34d = 3a + 30d$
$\Rightarrow 4d = a$ ... (i)
Now,
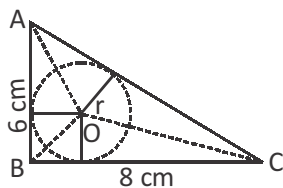$\dfrac{a_{29}}{a_5} = \dfrac{a+28d}{a+4d} = \dfrac{3}{2}$
$\dfrac{4d+28d}{4d+4d}$ [from Eq. (i)]
$\dfrac{32d}{8d} = \dfrac{4}{1}$

7. (A) Given, a circular piece is cut from the triangle sheet ABC with AB = 6 cm, BC = 8 cm

Now in $\triangle ABC$, by Pythagoras theorem,

$$AC^2 = AB^2 + BC^2$$
$$= 6^2 + 8^2$$
$$= 36 + 64 = 100$$
$$AC = 10 \text{ cm}$$

Area of $\triangle ABC$,

$$= \frac{1}{2} \times b \times h = \frac{1}{2} \times 8 \times 6$$
$$= 24 \text{ cm}^2$$

Also,

Area of $\triangle ABC$ = Area of $\triangle OBC$

+ Area of $\triangle OBA$ + Area of $\triangle OAC$

$$\Rightarrow \quad 24 = \frac{1}{2} \times 8 \times r + \frac{1}{2} \times 6 \times r$$
$$+ \frac{1}{2} \times 10 \times r = \frac{1}{2} r \,(6 + 8 + 10)$$
$$\Rightarrow \quad 48 = r\,(24)$$
$$\Rightarrow \quad r = 2 \text{ cm}$$

$\therefore$ Perimeter of circle = $2\pi r$
$$= 2\pi \times 2 = 4\pi$$

8. (C) Given, $\dfrac{n}{2}(n-3) = 90$

$$\Rightarrow \quad\quad n(n-3) = 180$$
$$\Rightarrow \quad\quad n^2 - 3n - 180 = 0$$
$$\Rightarrow \quad n^2 - 15n + 12n - 180 = 0$$
$$\Rightarrow \quad n(n-15) + 12(n-15) = 0$$
$$\Rightarrow \quad\quad n = 15, -12$$

Hence n = 15

9. (A) Let r_1 = 8 cm : r_2 = 2 cm and d = 10 cm
length of direct common tangent

$$= \sqrt{d^2 - (r_1 - r_2)^2}$$
$$= \sqrt{10^2 - (8-2)^2}$$
$$= \sqrt{100 - 36}$$
$$= \sqrt{64}$$
$$= 8 \text{ cm.}$$

10. (C) Let the age of Arun = x

The age of Tarun = y

$$\Rightarrow x + \frac{y}{2} = 4 \text{ and } \frac{1}{3}x + 2y = 5$$
$$\Rightarrow 2x + y = 8 \text{ and } x + 6y = 15$$

By solving the given equations, we get
x = 3 and y = 2

$\therefore$ The required sum = 3 + 2 = 5

11. (D) $p(x) = 2x^2 - 6 + 6x$

Sum of zeros = $\dfrac{-b}{a} = \dfrac{-6}{2} = -3$

Product of zeros = $\dfrac{c}{a} = \dfrac{-6}{2} = -3$

Given, α and β are the zeros

$$\Rightarrow \alpha + \beta = \alpha\beta$$

12. (D) $\cos 30^\circ \cos 45^\circ - \sin 30^\circ \sin 45^\circ$

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

13. (A) Radius of sphere = r = $6\sqrt{3}$ cm

$$\Rightarrow d = 2\left(6\sqrt{3}\right) = 12\sqrt{3} \text{ cm}$$

from the data given, it is understood

diagonal of cube = diameter of sphere

$$\Rightarrow \sqrt{3}\,a = 12\sqrt{3} \Rightarrow a = 12 \text{ cm}$$

$\therefore$ total surface area of cube = $6a^2 = 6(12)^2$
= 6 (144) = 864 cm^2.

14 (D) Given, α, β are the zeros of $x^2 - 8x + \lambda = 0$

sum of the zeroes = $\dfrac{-b}{a}$

$$\alpha + \beta = \frac{-(-8)}{1} = 8 \qquad \rightarrow (1)$$

Product of the zeroes = $\dfrac{c}{a}$

$$\alpha\beta = \frac{\lambda}{1} = \lambda \quad \rightarrow (2)$$

Also given, $\alpha - \beta = 2 \quad \rightarrow (3)$

solving (1) & (2), we set $\alpha = 5$ and $\beta = 3$

$(2) \Rightarrow \alpha\beta = \lambda \Rightarrow (5)(3) = \lambda$

$\therefore \lambda = 15$.

15. **Deleted**

16. (C) Given, when 'n' is divided by 8 leaves a remainder 5, let the quotient be 'n'.

$\therefore$ n = 8x + 5   (As per division rule)

2n + 4 = 2 (8x + 5) + 4

$\qquad$ = 16x + 10 + 4

$\qquad$ = 16x + 14

$\qquad$ = 16x + 8 + 6

$\qquad$ = 8 (2x + 1) + 6

It is clear to say from the above step, the remainder is '6' when 2n + 4 is divided by 8.

17. (D) We have, $\dfrac{BC}{DE} = \dfrac{2}{1}$

$\qquad$ [by basic proportionally theorem]

$\Rightarrow$ $\quad$ BC = 2 DE

$\Rightarrow$ $\quad$ z − 33 = 2 (z − 37)

$\Rightarrow$ $\quad$ z − 33 = 2z − 74

$\Rightarrow$ $\quad$ z = 41

$\therefore$ $\quad$ BC = z − 33 = 8

18. (B) Given $\angle ACP = a°$ and $\angle BPC = b°$.
from the figure, $\angle APC = \angle APB + \angle BPC$

but $\angle APB = 90°$ ($\because$ angle in a same - circle)

$\therefore$ $\angle APC$ = 90° + b°

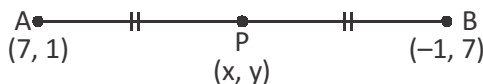now in $\triangle APC$, we have $\angle ACP$ = a° and $\angle APC$ = 90° + b° and $\angle CAP$ = b°
($\because$ $\angle BPC = \angle CAP$ alternate angles)

$\therefore$ sum of 3 angles of $\triangle APC$

a° + 90° + b° + b° = 180°

a° + 2b° = 90°

19. (D) Given,

A•―――⊩――――•――⊩―――•B
(7, 1) $\qquad$ P $\qquad$ (−1, 7)
$\qquad\qquad$ (x, y)

By using distance formula,

(x − 7)² + (y − 1)² = (x + 1)² + (y−7)²

$\Rightarrow$ $\quad$ x² + 49 − 14x + y² + 1 − 2y

$\qquad$ = x² + 1 + 2x + y² + 49 − 14y

$\Rightarrow$ $\quad$ 12y = 16x

$\Rightarrow$ $\quad$ 3y = 4x $\Rightarrow$ 4x = 3y

20. (A) Let CD − be the height of tower = h mt let A, B be the end points of 100 mt wide road.

in $\triangle ADC$, tan 45° = $\dfrac{h}{x}$ $\Rightarrow$ 1 = $\dfrac{h}{x}$

$\qquad\qquad\qquad$ $\Rightarrow$ h = x → (1)
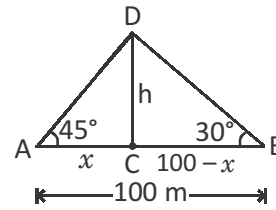
in BDC, tan 30° = $\dfrac{h}{100-x}$

$\Rightarrow$ $\dfrac{1}{\sqrt{3}}$ = $\dfrac{h}{100-x}$ $\Rightarrow$ h = $\dfrac{100-x}{\sqrt{3}}$ → (2)

from (1) & (2)

x = $\dfrac{100-x}{\sqrt{3}}$

$\sqrt{3}x$ = 100 − x

$\sqrt{3}x$ + x = 100

x $\left(\sqrt{3}+1\right)$ = 100

x = $\dfrac{100}{\left(\sqrt{3}+1\right)} \times \dfrac{\left(\sqrt{3}-1\right)}{\left(\sqrt{3}-1\right)} = \dfrac{100\left(1.732-1\right)}{3-1}$

$\quad$ = $\dfrac{100\left(0.732\right)}{2}$

x = 36.6

now from (1) $\Rightarrow$ h = x $\Rightarrow$ h = 36.6 m.

$\therefore$ Height of tower = 36.6 m.

21. (B) Let C be the circumference and d be the diameter.
Then, C = d + 30

$\Rightarrow$ $\quad$ $2\pi \cdot \dfrac{d}{2} = (d+30)$

$\Rightarrow$ $\quad$ $2\pi d$ = 2d + 60

$\Rightarrow$ $\quad$ $d\left(\dfrac{22-7}{7}\right) = 30$

$\Rightarrow$ $\quad$ $d\left(\dfrac{15}{7}\right) = 30$

$\Rightarrow$ $\quad$ d = 7 $\times$ 2

$\qquad$ r = 7 cm

22. (C) Since, HCF doesn't divide L.C.M.

$\therefore$ No such pair exists.

23. (B) Given,

$$4x + 6y = 14$$
$$4ax + 2(a + b)y = 56$$

For infinitely many solutions, we have,

$$\frac{a_1}{a_2} = \frac{b_1}{b_2} = \frac{c_1}{c_2}$$

$$\Rightarrow \quad \frac{4}{4a} = \frac{6}{2(a+b)} = \frac{14}{56}$$

$$\Rightarrow \quad \frac{4}{4a} = \frac{14}{56}$$

$$\Rightarrow \quad \frac{1}{a} = \frac{1}{4}$$

$$\Rightarrow \quad a = 4$$

Also, $\dfrac{6}{2(a+b)} = \dfrac{1}{4}$

$$\Rightarrow \quad 12 = a + b$$

[Substituting the value of a]

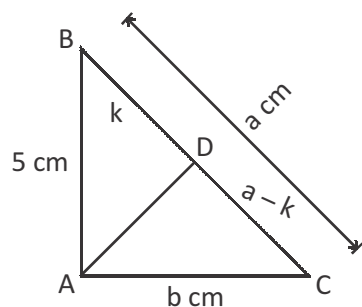$$\therefore \quad b = 2a$$

24. (A) The maximum strength of class X

$$= \text{H.C.F. } (910, 1001)$$

$$1001 = 91 \times 10 + 91$$
$$910 = 91 \times 10 + 0$$

Hence the maximum strength of class X is 91.

25. (B)

Given in $\triangle ABC$, $\angle A = 90°$ and $AD \perp BC$.

Let $BD = k$ cm $\therefore DC = (a - k)$ cm

from right $\triangle ADB$,

$$AD^2 = AB^2 - BD^2$$
$$AD^2 = 5^2 - k^2$$
$$AD^2 = 25 - k^2 \qquad \rightarrow (1)$$

from right $\triangle ADC$,

$$AD^2 = AC^2 - DC^2$$
$$AD^2 = b^2 - (a - k)^2$$
$$AD^2 = b^2 - (a^2 + k^2 - 2aK)$$
$$Ad^2 = b^2 - a^2 - k^2 + 2ak \qquad \rightarrow (2)$$

from (1) & (2)

$$b^2 - a^2 - \cancel{k^2} + 2ak = 25 - \cancel{k^2}$$
$$b^2 - a^2 + 2ak = 25$$
$$2ak = a^2 - b^2 + 25$$
$$k = \frac{a^2 - b^2 + 25}{2a}$$

$$\therefore \; k = BD = \frac{a^2 - b^2 + 25}{2a}$$

Physics

26. (C) Let 'R' be the resistance of the second wire. We have for the first wire.

$$12 = \frac{\rho L}{A} \qquad \dots\dots (1)$$

Where 'ρ' is the resistivity of the material of the wire. This will be the same for the second wire, since it is made out of the same material.

For the second wire,

$$R = \frac{\rho(2.5\,L)}{5\,A} \qquad \dots\dots (2)$$

Dividing (1) by (2), we have

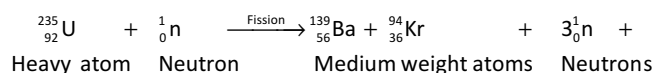$$\frac{12}{R} = \frac{\rho L}{A} \times \frac{5A}{\rho(2.5L)}$$

$$= \frac{5}{2.5} = 2$$

$$\therefore \; 2R = 12$$

$$R = 6 \text{ ohms}$$

27. (B) When uranium-235 atoms are bombarded with slow moving neutrons, the heavy uranium nucleus breaks up to produce two medium-weight atoms, barium - 139 and krypton - 94, with the emission of 3 neutrons. A tremendous amount of energy is produced during the fission of uranium. This fission reaction can be represented in the form of a nuclear equation as:

$$\underset{\text{Heavy atom}}{^{235}_{92}U} + \underset{\text{Neutron}}{^{1}_{0}n} \xrightarrow{\text{Fission}} \underset{\text{Medium weight atoms}}{^{139}_{56}Ba + ^{94}_{36}Kr} + \underset{\text{Neutrons}}{3\,^{1}_{0}n} +$$

Tremendous amount of energy

In the fissioning of uranium, some mass of uranium disappears (is lost), and a tremendous amount of energy is produced. The fission of 1 atom of uranium-235 produces 10 million times more energy than the energy produced by the burning of 1 atom of carbon from coal. In the nuclear fission reaction equation, we find that the neutrons are used up as well as produced. For example, in the nuclear fission of uranium –235, only 1 neutron is consumed and 3 neutrons are produced in the fission of each nucleus.

28. **(B)** The diagram can therefore be simplified to as shown below. The voltmeter measures the p.d. across the 3 resistors.

Total p.d. across the 4 resistors

= IR = (2) (4 + 2 + 3) = 18 V
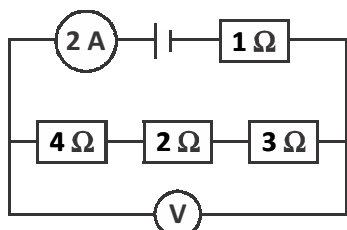
29. **(A)** A magnified, virtual image is formed by a convex lens when the object is within the focus, at a distance less than the focal length. Lesser the focal length of a convex lens, greater will be the magnification to see clearly small parts in a wrist watch to repair it.

30. **(D)** An ammeter should be connected in series while a volmeter should be connected in parallel.

31. **(D)** The ciliary muscles attached to the eye-lens become weak and cannot make the eye-lens thicker to increase its converging power. Due to the low converging power of eye-lens in an eye suffering from hypermetropia, the image of nearby object is formed behind the retina and hence, the eye cannot see it clearly. When a convex lens of suitable power is placed in front of the hypermetropic eye, then the diverging rays of light coming from the nearby object (at 25cm) are first converged by this convex lens. Due to this, the convex lens forms a virtual image of the nearby object. The rays of light now appear to be coming from this eye's near point and they can be easily focussed by the eye-lens to form an image on the retina.

32. **(C)** The distance between the focus (Q) and the optical centre (S) of the given concave lens represents focal length.

33. **(D)** The burning of coal produces a lot of smoke which pollutes the air. Hence, it is not a clean source of energy.

34. **(D)** l_1 = ?; R_1 = 5.6 Ω ; l_2 = 80 cm ; R_2 = 4.2 Ω

$$\frac{R_1}{R_2} = \frac{l_1}{l_2} = l_1 = \frac{R_1}{R_2} \times l_2 = \frac{5.6 \times 80}{4.2}$$

= 106.67 cm

35. **(C)** The iron core is a soft magnetic material which is easily magnetised. When the iron core is placed inside a solenoid, it is being induced as a strong magnet by the magnetic field of the solenoid. The magnetic fields of both the solenoid and the iron core combine to produce a stronger magnetic field around the solenoid as compared to the solenoid without the iron core.

36. **(A)** The refracted angle in a denser medium is less than the incident angle because the speed of light slows down in a denser medium. In slowing down, the light bends towards the normal and the refracted angle is therefore less than the angle of incidence. 35° is less than 45°. The other options are incorrect.

37. **(C)** Coal, oil or gas is burnt in a furnace to produce heat This heat boils the water in a boiler to form steam. The steam formed from the boiling water builds up a pressure. The hot steam at high pressure is introduced into a turbine chamber having a steam turbine. The steam passes over the blades of the turbine as a high pressure jet making the turbine rotate. The shaft of turbine is connected to a generator. When the turbine rotates, its shaft also rotates and drives the generator. The generator produces electricity. The spent steam coming out of turbine chamber is cooled. On cooling, steam condenses to form water. This water is again sent to the boiler to form fresh steam. This process is repeated again and again. At thermal power plants, it is the chemical energy of fossil fuels (coal, oil or gas) which is transformed into heat energy, kinetic energy and electrical energy

38. **(B)** The scattering of blue component of the white sunlight by air molecules present in the atmosphere causes the blue colour of the sky. The sun appears red at sunrise and at sunset because at that time most of the blue colour present in the sunlight has been scattered out and away from our line of sight, leaving behind mainly red colour in the direct sunlight beam that reaches our eyes.

39. **(B)** The incident, reflected and refracted rays are all in the same plane.

Option (A): The angle of refraction (for a ray of light going into a denser medium) is less than the angle of reflection.

Option (C): The angle of incidence (for a ray of light going into a denser medium) is greater than the angle of refraction.

Option (D): Refraction occurs through both water and glass.

40. **(C)** As Q and R are connected in series to P, the current through them would be the same as P, which is 3 A. Options (A), (B) and (D) give the wrong current passing through Q and R.

41. **(D)** The burning of cow-dung cakes is not advisable because of following reasons:

(i) It produces a lot of ash as residue.

(ii) It produces a lot of smoke and causes air pollution as well as creates health hazards.

(iii) It is a low, heat efficient fuel.

(iv) It destroys the useful manure.

In the production of biogas, only organic matter is decomposed by anaerobic bacteria and converts it into biogas. So, use of biogas obtained from cow dung is advised in preference as it gives (i) a clean fuel, free from pollution and (ii) spent slurry can be used as a manure.

42. **(D)** All the given three materials glass, plastic and water are transparent and can cause dispersion of light.

43. **(C)** The current flowing in the live wire and the neutral wire are both 0.5 A. The earth wire should not have any current flowing through it when the appliance is operating normally.

44. **(C)** The incident angle (i_1) is equal to the second refracted angle (r_2) so, the ray emerges parallel to the original ray.

Options (A), (B) and (D), these are incorrect as the pairs of given angles are not equal.

45. **(B)** Basically the fuse and the switch are placed along the live wire to disconnect the high voltage supply from the appliance. If the fuse or switch is placed on the neutral wire when it is open, it may have cut the current supply but the appliance is still connected to the high voltage supply. Someone who accidentally touches the 'live' wire, the appliance may get an electric shock even though there is an open circuit.
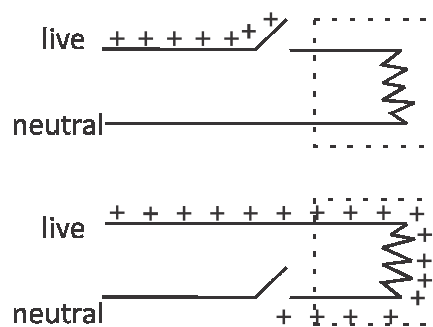
46. **(C)** Voltage of (6V) is equal to the current (3A) multiplied by the resistance $(2\,\Omega)$.

Option (A): If current = 4 A and resistance = $6\,\Omega$, voltage should be 6 x 4 = 24 V not 10 V.

Option (B): If current = 2 A and resistance = $10\,\Omega$, voltage should be 2 x 10 =20 V not 5 V.

Option (D): If current = 3 A and resistance = $12\,\Omega$, voltage should be 3 x 12 = 36 V not 4 V.

47. **(C)** When white light consisting of seven colours falls on a glass prism, each colour in it is refracted by a different angle, with the result that seven colours are spread out to form a spectrum. The red colour has the maximum speed in glass prism, so the red colour is deviated the least. The red colour (P) forms the upper part of the spectrum. On the other hand, the violet colour has the minimum speed in glass prism, so the violet colour is deviated the maximum. The violet colour (R) appears at the bottom of the spectrum. (Q) is green that forms the middle part of the spectrum.

48. **(B)** When we go from a bright room into a dark room, at first we cannot see clearly. After a short time, our vision improves. This is due to the fact that in bright light, the pupil of our eye is small. So, when we enter the dark room, very little light enters our eye and we cannot see properly. After a short time, the pupil of our eye expands and becomes large. More light then enters our eye and we can see clearly.

49. **(A)** Power of lamp = 40 W = 0.04 kW

Duration of operation = 30 min = 0.5 h

Energy used = Pt

= 0.04 kW × 0.5 h = 0.02 kWh.

50. **(D)** Resistance $R = \dfrac{\rho L}{A}$

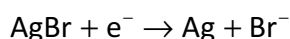$$= \frac{100 \times 10^{-8} \times 12}{2.5 \times 10^{-7}} = 48\ \Omega$$

Cross sectional area of tungsten wire

$$A = \frac{\rho L}{R} \Rightarrow \frac{5.5 \times 10^{-8} \times 12}{48}$$
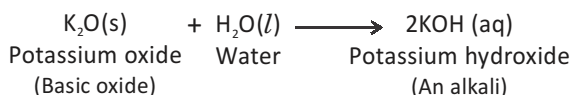
$$= 1.375 \times 10^{-8}\ m^2$$

Chemistry

51. **(D)** When exposed to light, the silver salt is reduced to metallic silver.

$$AgBr + e^- \rightarrow Ag + Br^-$$

52. **(C)** The carbon atoms in graphite are covalently bonded to 3 other carbon atoms in hexagons, which are arranged in layers.

53. **(C)** Most of the metal oxides are insoluble in water. But some of the metal oxides dissolve in water to form alkalis. Sodium oxide and potassium oxide are the two metal oxides which are soluble in water. Potassium oxide is also a basic oxide which reacts with water to form an alkali called potassium hydroxide.

$$\underset{\substack{\text{Potassium oxide}\\ \text{(Basic oxide)}}}{K_2O(s)} + \underset{\text{Water}}{H_2O(l)} \longrightarrow \underset{\substack{\text{Potassium hydroxide}\\ \text{(An alkali)}}}{2KOH\ (aq)}$$

54. **(B)** Copper hydroxide (P) is the precipitate and sodium sulfate (Q) is the solution formed.

55. **(B)** 1 mol of sulphuric acid dissociates completely in water to form 2 moles of hydrogen ions, $2H^+$ and 1 mole of sulphate ions, SO_4^{2-}.

56. **(B)** The 3 periods are H-He, Li-Ne and Na-Ar.

57. **(C)** In C_2H_6, all the valence electrons of all C and H are used to form covalent bonds. However, in each C atom, there are 2 inner shell electrons not involved in bonding. Hence, there are 2 + 2 = 4 electrons in a molecule of C_2H_6 not involved in bonding.

58. **(B)** Metals have delocalised electrons which are contributed by the valence electrons of the regularly arranged metal atoms in the metal lattice. Electrolytes are molten liquids or aqueous solutions that contain mobile positive and negative ions to conduct electricity.

59. **(B)** There are more metallic elements than non-metallic elements in the Periodic Table.

Option (A): Horizontal rows in the Periodic Table are called Periods.

Option (C): Vertical columns in the Periodic Table are called groups.

Option (D): Metals are found on the left-hand side of the Periodic Table.

60. **(B)** In the given chemical reaction, X can be HCl or H_2SO_4.

(i) $CaCO_3 + 2HCl \rightarrow CaCl_2 + CO_2 + H_2O$

(ii) $CaCO_3 + H_2SO_4 \rightarrow CaSO_4 + CO_2 + H_2O$
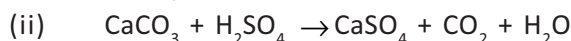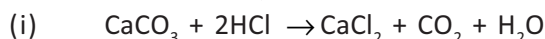
61. **(B)** Ethanol, C_2H_5OH, is an organic compound which exists as a liquid at room temperature. It does not conduct electricity because it does not contain free electrons or ions.

62. **(C)** Sodium hydroxide is an alkali that dissolves in water to form a solution of hydroxide ions. Copper (II) hydroxide and calcium carbonate are insoluble in water, sulphur dioxide dissolves in water to form an acidic solution.

63. **(B)** When an element burns in an excess of oxygen, it combines chemically with oxygen to form an oxide. The mass of the oxide formed is greater than that of the element due to the additional mass of the oxygen atoms.

64. **(B)** Thermal decomposition of copper carbonate breaks it down into copper oxide and carbon dioxide.

Option (A): This reaction is a combustion (burning) of carbon.

Option (C): The reaction of an acid with magnesium is a chemical reaction.

Option (D): This reaction is a chemical reaction.

65. **(D)** M_r of $C_{60} = 60 \times 12 = 720$

Hence, 1 mole of C_{60} weighs 720 g.

66. **(C)** The atomic number of the element X = 3, and the element is lithium, Li.

The number of protons in X = 3.

The number of electrons in X = 3.

The number of neutrons in X = 7 − 3 = 4.

67. **(A)** $2NH_3(aq) + H_2SO_4(aq) \rightarrow (NH_4)_2SO_4(aq)$

This is an acid-base reaction.

Option (B): NH_3 is oxidised.

Option (C): S is oxidised.

Option (D): ZnS is reduced.

68. (B) The various properties of a metal like malleability, ductility, strength, hardness, resistance to corrosion, appearance, etc., can be improved by mixing other metals with it. This mixture of two or more metals is called an alloy and the process is called alloying. The properties of an alloy are different from the properties of the constituent metals (from which it is made). In general, alloys are stronger, harder than the constituent metals. They are more resistant to corrosion, have lower melting points than the constituent metals and have lower electrical conductivity than pure metals.

69. (B) An acid reacts with chalk (calcium carbonate) to produce a salt, water and carbon dioxide. Acids turn blue litmus red. It also reacts with metals to produce a salt and hydrogen.

70. (D) CH_4, HCl and NH_3 are covalent compounds. An ionic compound is formed between a metal and a non-metal. Sodium hydride is an ionic compound formed when sodium atom transfers its valence electron to hydrogen atom to form stable Na^+ and H^- ions respectively.

Biology

71. (B) The cell wall is made up of cellulose which is indigestible. This add bulk to the intestinal content, allowing food to be moved along by peristalsis more easily.

72. (A) $6CO_2 + 12H_2O \xrightarrow[\text{sunlight}]{\text{chlorophyll}} C_6H_{12}O_6 + 6O_2 + 6H_2O$

73. (B) 'X' represents a synapse. Synapse is a junction between two nerve cells consisting of minute gap across which impulses pass by diffusion of a neurotransmitter.

74. (B) The removal of a ring of a bark around the trunk causes the removal of phloem. Thus, the translocation of sugars and amino acids from the leaves to the roots is affected. However, water can continue to be transported up the trunk since the xylem would remain intact.

75. (C) The central nervous system consists of the brain and spinal cord. Nerves and sensory organs are considered parts of the peripheral nervous system.

76. (D) Nephron is the structural and functional unit of kidneys. It removes nitrogenous wastes from the blood.

77. (D) The pollen tube grows from the pollen grain, secreting enzymes that digest through the tissue of the stigma, followed by the tissue of the style and finally the ovary wall to reach the ovule(s).

78. (D) Organs with different origin but have the same function are known to be analogous.

79. (A) Mushroom is a fungus. It is a saprophyte.

80. (C) During clotting, prothrombin is converted by thrombokinase (produced by platelets) into thrombin. Thrombin will convert fibrinogen into insoluble fibrin threads. Any deficiency in these proteins could result in haemophilia.

81. (A) Blood pressure is highest in the Aorta.

82. (C) The nail will remain at the same position as the height of the tree increases from top and not from bottom.

83. (C) Absorption of water take place in the large intestine and kidneys.

84. (B) A sphygmomanometer or blood pressure meter is a device used to measure blood pressure, comprising of an inflatable cuff to restrict blood flow, and a mercury or mechanical manometer to measure the pressure. Manual sphygmomanometers are used in conjunction with a stethoscope.

85. (A) When the 'X' chromosome of a sperm fertilises with 'X' chromosome of an egg, it produces a baby girl.

86. (A) Onion, gladioli and dahlia reproduce by stem.

87. (B) The production of ovum is called ovulation. Sperm fuses with ovum and this process is called fertilisation. The fertilised egg is called a zygote and undergoes changes to form embryo. Embryo is implanted in the uterus. Embryo undergoes changes to form into a foetus and then followed by the birth of the child.

88. (A) Potassium hydroxide (KOH) is kept in watch glass in bell jar experiment. KOH absorbs carbon dioxide to prove that carbon dioxide is essential for photosynthesis.

89. (C) Steps d, c, a and b show the correct sequence of ingestion of food in amoeba.

90. (B) Auxin is responsible for phototropism in plants.

91. (A)	**92. (D)**	**93. (B)**	**94. (B)**
95. (C)	**96. (B)**	**97. (A)**	**98. (C)**
99. (C)	**100. (A)**		