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NATIONAL LEVEL SCIENCE TALENT SEARCH EXAMINATION

CLASS - 10

Question Paper Code : 1P214

KEY

1. A	2. D	3. B	4. A	5. A	6. C	7. A	8. D	9. D	10. D
11. C	12. B	13. B	14. C	15. A	16. A	17. D	18. B	19. C	20. A
21. C	22. A	23. D	24. D	25. A	26. A	27. C	28. A	29. A	30. B
31. D	32. A	33. A	34. C	35. Del	36. A	37. B	38. A	39. C	40. A
41. A	42. B	43. B	44. A	45. D	46. C	47. B	48. B	49. D	50. A
51. D	52. A	53. C	54. B	55. C	56. C	57. B	58. A	59. B	60. B

SOLUTIONS

MATHEMATICS

01. (A) $a = 5, b = -2\sqrt{6}$ $c = -2$

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

$$= \frac{-(-2\sqrt{6}) \pm \sqrt{(-2\sqrt{6})^2 - 4 \times 5 \times -2}}{2(5)}$$

$$= \frac{2\sqrt{6} \pm \sqrt{24 + 40}}{10}$$

$$= \frac{2\sqrt{6} \pm 8}{10} = \frac{2(\sqrt{6} \pm 4)}{10}$$

$$= \frac{4 + \sqrt{6}}{5} \text{ (OR) } \frac{-4 + \sqrt{6}}{5}$$

02. (D) $\frac{1}{a} + \frac{1}{b} + \frac{1}{c} = \frac{ab + bc + ca}{abc} = \frac{2}{-1} = -2$

03. (B) Given $\Delta ABC \sim \Delta DAC$ [$\because$ A. A similarity]

$$\therefore \frac{BC}{AC} = \frac{AC}{DC}$$

$$\frac{12\text{ cm}}{AC} = \frac{AC}{3\text{ cm}} \Rightarrow AC = 6\text{ cm}$$

04. (A) $\tan 30° = \frac{AB}{BC}$

$$\frac{1}{\sqrt{3}} = \frac{AB}{100\text{ mts}}$$

$$AB = \frac{100\text{ mts}}{\sqrt{3}} \times \frac{\sqrt{3}}{\sqrt{3}} = \frac{173.2\text{ m}}{3}$$

$= 57.73$ m

05. (A) $\frac{2\tan A}{1+\tan^2 A} = \frac{2\tan 45°}{1+\tan^2 45°} = \frac{2}{1+1} = \frac{2}{2} = 1$

$\sin 2 \times 45° = \sin 90° = 1$

$$\therefore \sin 2A = \frac{2\tan A}{1+\tan^2 A}$$

06. (C) $LCM(a, b) = \frac{a \times b}{HCF(a, b)} = \frac{1008}{12} = 84$

07. (A) Area of $\Delta ABC = \frac{1}{2} \times 6\text{ cm} \times 8\text{ cm}$

$= \frac{1}{2} AC \times BD$

$48\text{ cm}^2 = 10\text{ cm} \times BD$

$BD = 4.8$ cm

In ΔABD, $\angle D = 90°$

$\Rightarrow 6\text{ cm}^2 = (4.8\text{ cm})^2 + x^2$

$x^2 = 36\text{ cm}^2 - 23.04\text{ cm}^2$

$x = \sqrt{12.96\text{ cm}^2}$

$= 3.6$ cm

08. (D) Given $r + r + \frac{1}{\cancel{4}_2} \times \cancel{2}\pi r = 50$ cm

$$2r + \frac{\pi r}{2} = 50\text{ cm}$$

$$r\left(2 + \frac{\pi}{2}\right) = 50\text{ cm}$$

$$r\left(2 + \frac{\cancel{22}^{11}}{7} \times \frac{1}{\cancel{2}_1}\right) = 50\text{ cm}$$

$$r\left(\frac{14+11}{7}\right) = 50\text{ cm}$$

$$r = \cancel{50}^{2}\text{ cm} \times \frac{7}{\cancel{25}}$$

$r = 14$ cm

Area of the quadrant circle $= \frac{1}{4}\pi r^2$

$$= \frac{1}{\cancel{4}_2} \times \frac{\cancel{22}^{11}}{\cancel{7}} \times \cancel{14}^{2} \times 14$$

$= 154\text{ cm}^2$

09. (D) Given $n + n + 2 + n + 4 + ... + n + 48 = 10,000$

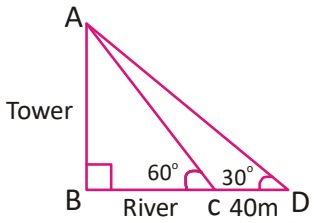
$\Rightarrow 25n + [2 + 4 + 6 + ... + 48] = 10,000$

$\Rightarrow 25n + 600 = 10,000$

$\Rightarrow n = \frac{9400}{25} = 376$

$\therefore n + 48 = 376 + 48 = 424$

10. (D) Given In $\Delta ABC, \angle B = 90°$ & $\angle ABC = 60°$



$$\therefore \tan 60° = \frac{AB}{BC}$$

$$\sqrt{3} = \frac{AB}{BC} \Rightarrow AB = \sqrt{3}\,BC \rightarrow 1$$

In ΔABD, $\angle D = 30° \Rightarrow \tan 30° = \frac{AB}{BC + 40\text{mts}}$

$$\frac{1}{\sqrt{3}} = \frac{AB}{BC + 40\text{mts}}$$

$\therefore$ $AB = \dfrac{BC + 40mts}{\sqrt{3}} \rightarrow 2$

from eq. 1 & eq. 2

$\Rightarrow \sqrt{3}BC = \dfrac{BC + 40mts}{\sqrt{3}}$

$\therefore$ 3BC = BC + 40mts

$\therefore$ 2BC = 40mts

$BC = \dfrac{40mts}{2} = 20mts$

$\therefore$ Height of tower = AB =

$\sqrt{3}BC = 20\sqrt{3}mts$

11. (C) Two roots of $x^2 - px + q = 0$ be a & a + 1

Given a + a + 1 = $\dfrac{-(-p)}{1} = p$

p = 2a + 1

a (a + 1) = $\dfrac{q}{1}$

$a^2 + a = q$

$\therefore p^2 - 4q = (2a + 1)^2 - 4(a^2 + a)$

$= 4a^2 + 4a + 1 - 4a^2 - 4a$

= 1

12. (B)

$AB = \sqrt{(-a-a)^2 + (-a-a)^2} = \sqrt{4a^2 + 4a^2} = 2\sqrt{2}$ cm

$BC = \sqrt{(-\sqrt{3}a + a)^2 + (\sqrt{3}a + a)^2}$

$= \sqrt{a^2 - 2\sqrt{3}a^2 + 3a^2 + 3a^2 + 2\sqrt{3}a^2 + a^2} = 2\sqrt{2}$ cm

$= 2\sqrt{2}a$

CA = $= 2\sqrt{2}a$

$S = \dfrac{a+b+c}{2} = \dfrac{2\sqrt{2}a + 2\sqrt{2}a + 2\sqrt{2}a}{2} = \dfrac{3\sqrt{2}a}{2}$

Area of DABC = $\sqrt{s(s-a)(s-b)(s-c)}$

$= \sqrt{3\sqrt{2}a(3\sqrt{2}a - 2\sqrt{2}a)(3\sqrt{2}a - 2\sqrt{2}a)(3\sqrt{2}a - 2\sqrt{2}a)}$

$= \sqrt{3\sqrt{2}a \times \sqrt{2}a \times \sqrt{2}a \times \sqrt{2}a}$

$= 2\sqrt{3}a^2$

13. (B) Given m + n = 21 = $\dfrac{7}{a} \Rightarrow a = \dfrac{1}{3}$

Given mn = 21 = $\dfrac{b}{a} \Rightarrow 21 = \dfrac{b}{\left(\frac{1}{3}\right)}$

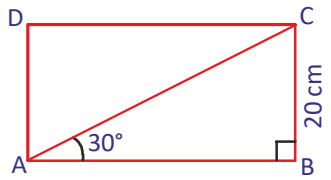
$\therefore$ b = 7

$\therefore$ a + b = $\dfrac{1}{3} + 7 = \dfrac{1 + 21}{3} = \dfrac{22}{3}$

14. (C) In ΔABC, $\angle B = 90°$ & $\angle BAC = 30°$

$\therefore \tan 30° = \dfrac{BC}{AB}$

$\dfrac{1}{\sqrt{3}} = \dfrac{20\text{ cm}}{AB}$



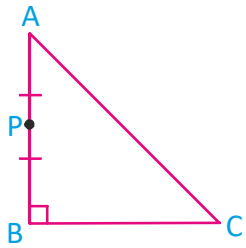
AB = 20 × $\sqrt{3}$ cm = 20 × 1.73 cm = 34.6 cm

$\therefore$ Area of rectangle = ℓb = 34.6 × 20 cm^2

= 692 cm^2

15. (A) In ΔBCP, $\angle B = 90°$

$\therefore PC^2 = PB^2 + BC^2$



$(10cm)^2 = PB^2 + (8\text{ cm})^2$

$100\text{ cm}^2 - 64\text{ cm}^2 = PB^2$

$\therefore PB = \sqrt{36\text{ cm}^2} = 6$ cm

$\therefore AB = 2\overline{PB} = 2 \times 6$ cm = 12 cm

$\therefore AC^2 = AB^2 + BC^2 = (12\text{ cm})^2 + (8\text{ cm})^2$

$= 144\text{ cm}^2 + 64\text{ cm}^2 = 208\text{ cm}^2$

16. (A) Given $\tan\theta + \sin\theta = m$ & $\tan\theta - \sin\theta = n$

$\therefore m^2 - n^2 = (m+n)(m-n)$

$= (\tan\theta + \cancel{\sin\theta} + \tan\theta - \cancel{\sin\theta})(\cancel{\tan\theta} + \sin\theta - \cancel{\tan\theta} + \sin\theta)$

$= 2\tan\theta \times 2\sin\theta$

$m^2 - n^2 = 4\tan\theta\sin\theta$

$\sqrt{mn} = \sqrt{(\tan\theta+\sin\theta)(\tan\theta-\sin\theta)}$

$= \sqrt{\tan^2\theta - \sin^2\theta}$

$= \sqrt{\frac{\sin^2\theta}{\cos^2\theta} - \sin^2\theta}$

$= \sqrt{\sin^2\theta\left(\frac{1}{\cos^2\theta} - 1\right)}$

$= \sqrt{\sin^2\theta\frac{(1-\cos^2\theta)}{\cos^2\theta}}$

$= \sqrt{\sin^2\theta \times \frac{\sin^2\theta}{\cos^2\theta}}$

$= \tan\theta\sin\theta$

$\therefore m^2 - n^2 = 4\sqrt{mn}$

17. (D) Given $\alpha + \beta = -\frac{(-b)}{a} = \frac{b}{a}$ & $\alpha\beta = \frac{c}{a}$

$\therefore$ Required quadratic equation is

$x^2 - x\left(\frac{1}{\alpha} + \frac{1}{\beta}\right) + \frac{1}{\alpha\beta} = 0$

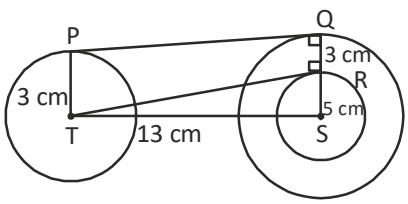
$x^2 - x\left(\frac{\alpha+\beta}{\alpha\beta}\right) + \frac{1}{\alpha\beta} = 0$

$x^2 - x\frac{\left(\frac{b}{\cancel{a}}\right)}{\left(\frac{c}{\cancel{a}}\right)} + \frac{a}{c} = 0$

$\frac{cx^2 - bx + a}{c} = 0$

$cx^2 - bx + a = 0$

18. (B)



Cost : Draw a circle of radius (8cm – 3cm) i.e., 5 cm of centre 'S'. Join TR

PQRT is a rectangle of breadth 3 cm

In ΔRST, $\angle R = 90°$ and SR = 5 cm

$\therefore TR = \sqrt{TS^2 - SR^2} = 12\text{cm}$

19. (C) In a cyclic quadrilateral opposite are supplimentary

$\therefore \angle A + \angle C = 180°$

$2x - 1° + 2y + 15° = 180°$

$2x + 2y = 180° - 14°$

$2(x + y) = 166°$

$x + y = \frac{166°}{2}$

$x + y = 83°$

$\angle B + \angle D = 180°$

$4x + y = 180° + 2°$

$y + 5° + 4x - 7° = 180°$

$4x + y = 182° \longrightarrow (2)$
$4x + y = 182° \longrightarrow (2)$
$x + y = 83° \longrightarrow (1)$
$(-)\ (-)\ \ (-)$
$3x = 99°$

$x = 33°$

$\angle A = 2x - 1° = 2 \times 35° - 1° = 66° - 1° = 65°$

20. (A) Given $a_4 + a_8 = 24$

$a + 3d + a + 7d = 24$

$2a + 10d = 24$

$2(a + 5d) = 24$ $a + 5d = 12 \longrightarrow (1)$

Given $a_6 + a_{10} = 44$

$a + 5d + a + 9d = 44$

$2a + 14d = 44$

$2(a + 7d) = 44$

$a + 7d = \frac{44}{2} = 22 \longrightarrow (2)$

$a + 7d = 22 \longrightarrow (2)$
$a + 5d = 12 \longrightarrow (1)$
$(-)\ (-)$
$2d = 10$

$d = \frac{10}{2} = 5$

a + 5(5) = 12

a + 25 = 12

a = –13

$S_{10} = \frac{10}{2}[2a + 9d]$

= 5[2(–13) + 9 × 5]

= 5[–26 + 45]

= 19 × 5

= 95

21. (C) Given a_3 = a + 2d = 600 $\rightarrow$ 1

a_7 = a + 6d = 720 $\rightarrow$ 2

eq 2 – 1 $\Rightarrow$ 4d = 120

$d = \frac{120}{4} = 30$

$\therefore$ a + 2(30) = 600

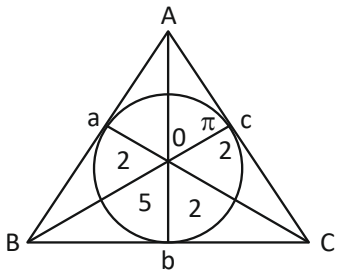
a = 540

$S_7 = \frac{7}{2}[2a + 6d] = \frac{7}{\cancel{2}} \times \cancel{2}[a + 3d]$

= 7 [540 + 90]

= 7 × 630 = 4410

22. (A) Area of ΔABC = Area of ΔAOB + Area of ΔBOC = area of ΔCOA



$= \frac{1}{\cancel{2}} a \times \cancel{2}^{1}\ cm^2 + \frac{1}{\cancel{2}} b \times \cancel{2}\ cm^2 + \frac{1}{\cancel{2}} c \times \cancel{2}\ cm^2$

= (a + b + c) cm^2

= 24 cm^2 [$\because$ Given a + b + c = 24 cm]

23. (D) The required distance

$= \sqrt{\left[\left(\sqrt{3}+1\right)-\left(\sqrt{3}-1\right)\right]^2 + \left[\left(\sqrt{2}-1\right)-\left(\sqrt{2}+1\right)\right]^2}$

$= \sqrt{(2)^2 + (2)^2} = 2\sqrt{2}$

24. (D) Given $\pi r l = 2\pi r^2$

$\frac{\cancel{\pi}^{1}}{2\cancel{\pi}_{1}} = \frac{\cancel{r}^{2}}{\cancel{r} l}$

$r : l = 1 : 2$

25. (A) HCF = $2^3 \times 3^2 \times 5$

= 8 × 9 × 5 = 360

PHYSICS

26. (A) For clear, magnified, virtual view, the tooth must be between pole (P) and focus (F).

If the mirror moves slightly away, the tooth lies beyond focus, and the image becomes real and inverted — thus blurred in practical viewing.

27. (C) Spherical aberration increases when the pupil dilates.

When the artist switches from bright to dim light, her pupils dilate (get larger) to let in more light. A larger pupil size means that light rays pass through a wider area of the eye's lens, including the periphery. Rays passing through the periphery focus at different points than those passing through the center, a phenomenon known as spherical aberration. This increased aberration in dim light, when the pupil is larger, causes the image quality to degrade, leading to the reported "ghost images" and making her reading glasses less effective.

28. (A) The series connection has a higher equivalent resistance because its V-I graph has a larger slope.

The slope of a V-I graph represents resistance ($R = \frac{V}{I}$).

A steeper slope means higher resistance.

Series resistors add up, so equivalent resistance is larger, causing steeper slope.

Parallel resistors reduce overall resistance, causing less steep slope.

29. (A) The colour of an object depends on the frequency of light reflected to the eye.

When light enters water, its speed and wavelength change, but frequency remains constant.

Therefore, although the wavelength shortens by a factor of μ=1.33, the frequency — and hence perceived colour — remains unchanged (green).

30. (B) Light moves from denser (glass) → rarer (water) medium, so it bends away from normal, meaning angle of incidence < angle of refraction.

31. (D) Field at center: $B \propto \frac{1}{R}$. Highest value is with highest current and smallest radius: 2 A, 5 cm.

32. (A) Copper wire

Copper has a much lower resistivity than nichrome, so it offers less resistance to the flow of electrons. When connected in parallel across the same potential difference, the copper wire allows more current to pass through it than nichrome.

33. (A) Myopia – Eyeball too long – Concave lens

In myopia (short-sightedness), light rays from distant objects converge before the retina because the eyeball is too long or the lens is too powerful.

A concave (diverging) lens corrects this by spreading the rays so they focus exactly on the retina.

34. (C) Rod (c)

A circuit breaker requires a core material that:

- Becomes strongly magnetised when current flows (to operate the mechanism), and
- Loses magnetism immediately when current is switched off (so it can reset quickly).

From the table:

- Rod (a): Very weak magnetism ? not suitable
- Rod (b): Retains some magnetism after current OFF ? not ideal
- Rod (c): Attracts many paper clips when current is ON (35) and none when current is OFF (0) ? ideal behavior of soft iron
- Rod (d): Retains strong magnetism even after current OFF ? behaves like a permanent magnet, unsuitable

Conclusion: Rod (c) shows strong temporary magnetism and no residual magnetism, making it best suited as the core of a circuit breaker.

35. Delete

CHEMISTRY

36. (A) Both mercury and copper can be extracted just by heating their sulphide ores in air. The oxides obtained are further heated to get pure metals.

37. (B) There was an increase in temperature due to the release of heat as exothermic reaction took place.

38. (A) Ethanoic acid reacts with sodium carbonate and sodium bicarbonate to give rise to a salt, carbon dioxide and water. The salt produced is commonly called sodium acetate.

$2CH_3COOH + Na_2CO_3 \rightarrow 2CH_3COONa + H_2O + CO_2$

$CH_3COOH + NaHCO_3 \rightarrow CH_3COONa + H_2O + CO_2$

39. (C) Zinc granules dissolve in sodium hydroxide solution to liberate hydrogen and produce sodium zincate.

40. (A) A mixture of Fe_2O_3 and aluminium powder is called thermite.

41. (A) $\underset{\text{compound}}{H_2O} + \underset{\text{compound}}{CaO} \longrightarrow \underset{\text{compound}}{Ca(OH)_2}$

Hence, it is a compound - compound combination reaction.

42. (B) When ethanol reacts with sodium, sodium ethoxide is formed and hydrogen gas is evolved.

43. (B) Bleaching powder produces smell of chlorine, because it reacts with carbon dioxide in the atmosphere to form calcium carbonate and releases chlorine gas.

44. (A) The balanced chemical equation is $3\ Fe + 4H_2O \rightarrow Fe_3O_4 + 4H_2$. So, a = 3, b = 4

45. (D) Magnesium is a metal, and metals generally form ionic bonds only. The other elements are non-metals and can bond covalently as well as form the O^{2-}, F^- and H^-/H^+ ions respectively by gain/ loss of electrons.

BIOLOGY

46. (C) The medulla oblongata is the lowest part of the brainstem and connects to the spinalcord

47. (B) 3 and 4 only

Proteins are partially digested in the stomach by pepsin and fully broken down in the small intestine by pancreatic and intestinal enzymes.

48. (B) 1 and 2 only

Gall bladder stores and releases bile; its removal impairs fat digestion (1) and can cause pale stools due to less bile entering the intestine (2). Bile is produced by the liver, so production isn't reduced (4 incorrect). Amino acid absorption is not directly affected (3 incorrect).

49. (D) Gaseous exchange with the environment is more efficient.

Intercellular air spaces in leaves allow CO_2 to reach mesophyll cells and O_2 to exit, supporting efficient photosynthesis and respiration.

50. (A) 1 and 3 only

Capillary walls are permeable to small molecules like glucose and urea, but not to red or white blood cells, which are too large to pass through.

51. (D) Stomata

Structure Q in the leaf diagram likely represents stomata—tiny openings for gas exchange and transpiration, typically between guard cells.

52. (A) alveolus

The diagram likely shows the structure of alveoli (tiny air sacs in lungs) where gaseous exchange occurs they have a characteristic thin, sac-like appearance.

53. (C) 1, 2 and 3 only

Proteins function as enzymes (1), transport oxygen (via hemoglobin) (2), and act as antibodies (3). Thermal insulation is mainly provided by fats, not proteins (4 incorrect).

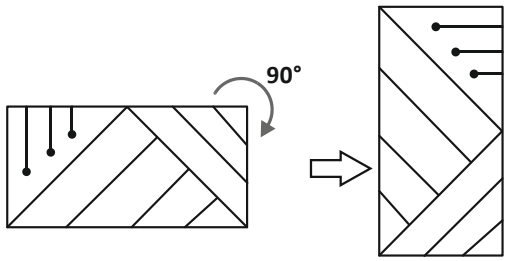
54. (B) 10 kg

Energy/biomass decreases by ~90% at each trophic level; producers: 10,000 kg $\rightarrow$ primary consumers: ~1,000 kg $\rightarrow$ secondary consumers ~100 kg $\rightarrow$ tertiary consumers ~10 kg.

55. (C) Planaria can regenerate due to neoblasts specialized stem cells that divide and differentiate to regrow missing body parts.

CRITICAL THINKING

56. (C)



57. (B) Every second day means she chased mice on 7 days and was lazy on 7 days.

Lazy day: 60 ml

Chase day: 60 + (1/3) 60 = 80 ml

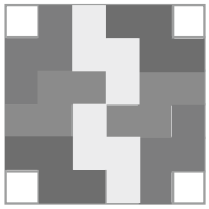
Total = 7.60 + 7.80 = 420 + 560 = 980 ml.

58. (A) In the direction along P

The string connecting wheel X and wheel W is a single, continuous, and taut string.

As wheel X rotates in the counter-clockwise direction (as indicated by the arrow), it pulls the string from the top side of the diagram and feeds the string to the bottom side.

The string being pulled from the top side of wheel W causes wheel W to rotate in the counter-clockwise direction, which is the direction indicated by P.

59. (B) 

60. (B) Statement II is the cause and statement I is its effect.

Reason: The teachers' petition about disturbances (II) would prompt the university to instruct a ban (I).

The End