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NATIONAL LEVEL SCIENCE TALENT SEARCH EXAMINATION (UPDATED)

CLASS - 10

Question Paper Code : 1P214

KEY

1. A	2. D	3. B	4. A	5. Del	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. (Delete)

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 $r + r + \frac{1}{2} \times 2\pi r = 50$ cm

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

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

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

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

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

$r = 14$ cm

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

$$= \frac{1}{4} \times \frac{22}{7} \times 14 \times 14$$

$= 154\text{ cm}^2$

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

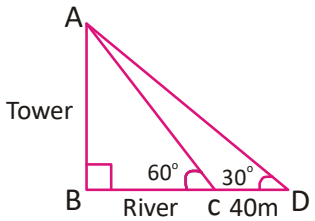
$\Rightarrow 25n + [2 + 4 + 6 + ... + 48] = 10,000$

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

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

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

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

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

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

from eq. 1 & eq. 2

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

$\therefore 3BC = BC + 40$mts

$\therefore 2BC = 40$mts

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

$\therefore$ 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 = $\frac{-(-p)}{1} = p$

p = 2a + 1

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

$a^2 + a = q$

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

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

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

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 = $\frac{7}{a} \Rightarrow a = \frac{1}{3}$

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

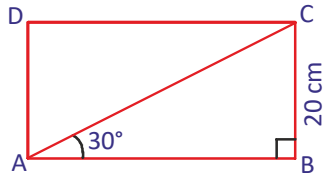
$\therefore$ b = 7

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

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

$\therefore \tan 30° = \frac{BC}{AB}$

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



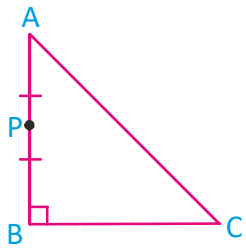
AB = 20 × $\sqrt{3}$ cm = 20 × 1.73 cm = 34.6 cm

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

$= 692\ cm^2$

15. (A) In ΔBCP, $\angle B = 90°$

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



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

$100\ cm^2 - 64\ cm^2 = PB^2$

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

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

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

$= 144\ cm^2 + 64\ cm^2 = 208\ cm^2$

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

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

$= (\tan\theta + \sin\theta + \tan\theta - \sin\theta)(\tan\theta + \sin\theta - \tan\theta + \sin\theta)$

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

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

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

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

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

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

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

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

$= \tan\theta \sin\theta$

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

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

$\therefore$ Required quadratic equation is

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

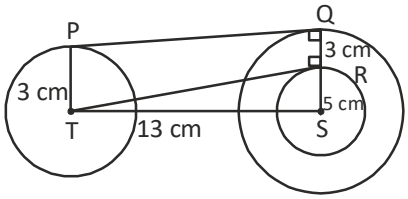
$$x^2 - x\left(\frac{\alpha+\beta}{\alpha\beta}\right) + \frac{1}{\alpha\beta} = 0$$

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

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

$$cx^2 - bx + a = 0$$

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

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

$2x - 1° + 2y + 15° = 180°$

$2x + 2y = 180° - 14°$

$2(x + y) = 166°$

$$x + y = \frac{166°}{2}$$

$x + y = 83°$

$\angle B + \angle D = 180°$

$4x + y = 180° + 2°$

$y + 5° + 4x - 7° = 180°$

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

$x = 33°$

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

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 $a_6 + a_{10} = 44$

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

$2a + 14d = 44$

$2(a + 7d) = 44$

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

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

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

$a + 5(5) = 12$

$a + 25 = 12$

$a = -13$

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

$= 5[2(-13) + 9 \times 5]$

$= 5[-26 + 45]$

$= 19 \times 5$

$= 95$

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

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

eq $2 - 1 \Rightarrow 4d = 120$

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

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

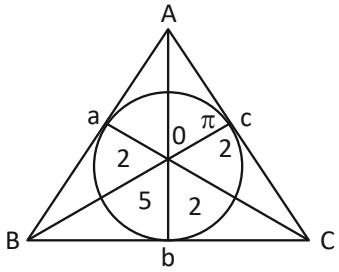
$a = 540$

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

$= 7[540 + 90]$

$= 7 \times 630 = 4410$

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) $HCF = 2^3 \times 3^2 \times 5$

$= 8 \times 9 \times 5 = 360$

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.

Although switching from dim to bright light causes the pupil to contract (miosis), spherical aberration itself depends on the entry of peripheral rays. When the pupil is dilated, more peripheral rays enter the eye, leading to increased spherical aberration and ghost images; when the pupil contracts, these rays are cut off and spherical aberration decreases. Hence, the question asks for the visual phenomenon responsible for ghosting, not the pupil reflex due to light change. The correct phenomenon is therefore spherical aberration increasing with pupil dilation.

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 is defined by the wavelengths of light it reflects, but what the eye actually detects is the frequency (or photon energy) of the light reaching the retina. Since frequency does not change when light crosses from water to air, the diver's eye receives the same frequency of green light as it would in air, and so the brain interprets it as green.

Even though the wavelength is longer in air, the photoreceptors respond to the same frequency, so the perceived colour does not shift from green to yellow.

Why the fish does not appear yellow

A green object looks green because it reflects light in the green part of the spectrum (roughly 500–570 nm in air) and absorbs other wavelengths. When that same green light comes out of water:

- Its wavelength in air is longer than in water, but still within the green range (not shifted into yellow).
- The eye and brain do not "know" that the light was once in water; they only respond to the frequency/energy of the light hitting the retina.

So, the fish appears green to the diver, not yellow.

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) The given figure is of myopia (short sightedness), not hypermetropia.

Key points for this diagram.

- The object at N is effectively at infinity, so the rays reaching the eye are parallel (distant object condition → used for myopia diagrams).
- These parallel rays are brought to a focus at N', which lies in front of the retina; by the time they reach the retina they have started to diverge again, so the image on the retina is blurred.
- That situation—distant object, image formed before the retina—is the defining textbook picture of myopia, whereas hypermetropia shows rays from a near object converging behind 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 have tiny 4-5 nm gaps that let small stuff like glucose (1) and urea (3) slip through easily to feed tissues.

WBCs (4) are huge (10-20 µm)—they can't fit and stay in blood unless infection triggers special "diapedesis" escape at venules, not normal capillaries.

"All options" is wrong; exams test routine passage, so only 1+3.

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).

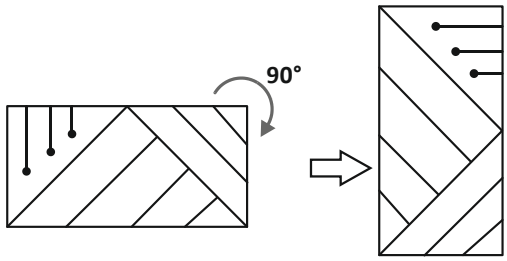
54. (B) 10 kg

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

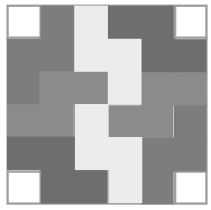
58. (A) In the direction along P

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).