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NATIONAL LEVEL SCIENCE TALENT SEARCH EXAMINATION (UPDATED)

CLASS - 10

Question Paper Code : UN446

KEY

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

SOLUTIONS

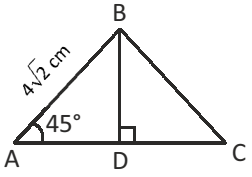
MATHEMATICS

1. **(C)** HCF of $\frac{5}{12}, \frac{10}{9}, \frac{25}{6}$ is $\frac{5}{36}$

LCM of $\frac{5}{12}, \frac{10}{9}, \frac{25}{6}$ is $\frac{50}{3}$

$\therefore$ LCM + HCF = $\frac{5}{36} + \frac{50}{3} = \frac{5+600}{36} = \frac{605}{36}$

2. **(B)** Const:- BD $\perp$ AC



In ΔABD $\sin 45° = \frac{BD}{AB}$

$\frac{1}{\sqrt{2}} = \frac{BD}{4\sqrt{2}\text{ cm}}$

BD = 4 cm

Area of $\Delta ABC = \frac{1}{2} \times BD \times AC = \frac{1}{2}$ $\times$ 4 cm $\times$ 7 cm = 14 cm^2

3. **(B)** Circumferce of circular path

$= 2\pi r = 2 \times \frac{22}{7} \times 14$ m

= 88 m

Time taken to cover 88 m to Narayana

$$= \frac{88\text{ m}}{17.6\text{ KMPH}} = \frac{88\text{ m}}{17.6 \times \frac{5\text{ m}}{18\text{ sec}}}$$

= 18 seconds

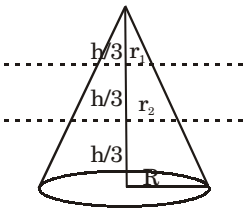
Time taken to cover 88 m to krishna

$$= \frac{88\text{ m}}{26.4\text{ KMPH}} = \frac{88\text{ m}}{26.4 \times \frac{5\text{ m}}{18\text{ sec}}}$$

= 12 seconds

LCM of 18 seconds and 12 seconds is 36 seconds.

4. **(D)**



$$v_1 : v_2 : v_3 = \frac{1}{3}\pi\left(\frac{r}{3}\right)^2\left(\frac{h}{3}\right)$$

$$:\left[\frac{1}{3}\pi\left(\frac{2r}{3}\right)^2\left(\frac{2h}{3}\right) - \frac{1}{3}\pi\left(\frac{r}{3}\right)^2\left(\frac{h}{3}\right)\right]:$$

$$\left[\frac{1}{3}\pi r^2 h - \frac{1}{3}\pi\left(\frac{2r}{3}\right)^2\left(\frac{2h}{3}\right)\right]$$

$$= \frac{\pi r^2 h}{81} : \frac{7\pi r^2 h}{81} : \frac{19\pi r^2 h}{81}$$

= 1 : 7 : 19

5. **(A)** $\frac{a_1}{a_2} = \frac{b_1}{b_2} = \frac{c_1}{c_2} \Rightarrow$

They are dependent equations

6. **(C)** (1+cotA − coseA) (1+tanA + secA)

$$= \left(1 + \frac{\cos A}{\sin A} - \frac{1}{\sin A}\right)\left(1 + \frac{\sin A}{\cos A} + \frac{1}{\cos A}\right)$$

$$= \left(\frac{\sin A + \cos A - 1}{\sin A}\right)\left(\frac{\cos A + \sin A + 1}{\cos A}\right)$$

$$= \frac{(\sin A + \cos A)^2 - 1^2}{\sin A \cos A}$$

$$= \frac{\sin^2 A + \cos^2 A + 2\sin A \cos A - 1}{2\cos A \sin A}$$

= 2

7. **(A)** 2003 statisfies the given conditions

8. **(C)** Let $\frac{2x+3}{x-3} = a \Rightarrow 2a - \frac{25}{a} = 5$

$\Rightarrow 2a^2 - 25 = 5a$

$\Rightarrow 2a^2 - 5a - 25 = 0$

$\Rightarrow 2a^2 - 10a + 5a - 25 = 0$

$2a(a - 5) + 5(a - 5) = 0$

$a = 5$ (or) $2a = -5$

$a = \frac{-5}{2}$

$\therefore \frac{2x+3}{x-3} = 5$

$2x + 3 = 5x - 15$

$3x = 18$

$x = 6$

(OR)

$\frac{2x+3}{x-3} = \frac{-5}{2}$

$4x + 6 = -5x + 15$

$9x = 9$

$x = 1$

9. **(C)** $\left(\frac{1}{2}, 4\right)$ is equidistant from the given three vertices

10. **(B)** Given $x\cot\theta + y\operatorname{cose}\theta = z$

Squaring on both sides

$x^2\cot^2\theta + y^2\operatorname{cosec}^2\theta + 2xy\cot\theta\ \operatorname{cosec}\theta = z^2$

$x^2(\operatorname{cosec}^2\theta - 1) + y^2(\cot^2\theta + 1)$

$+2xy\operatorname{cosec}\theta\cot\theta = z^2$

$x^2\operatorname{cosec}^2\theta - x^2 + y^2\cot^2\theta + y^2$

$+ 2xy\operatorname{cosec}\theta\cot\theta = z^2$

$\therefore x^2\operatorname{cosec}^2\theta + y^2\cot^2\theta + 2xy\operatorname{cosec}\theta\cot\theta$

$= z^2 + x^2 - y^2$

$(x\operatorname{cosec}\theta + y\cot\theta)^2 = z^2 + x^2 - y^2$

11. **(A)** Let fathers present age be x years and son's age be 'y' years

Given $x + y = 65$ ... (1)

$2(x - y) = 50$

$x - y = 25$ ... (2)

Solving (1) & (2)

$x = 45$ years

12. **(B)** $\alpha + \beta = -a$ & $\alpha\beta = -b$

$$\frac{1}{\alpha} + \frac{1}{\beta} = \frac{\alpha+\beta}{\alpha\beta} = \frac{a}{b}$$

Required quadratic polynomial is

$$k\left[x^2 - x\left(\frac{1}{\alpha} + \frac{1}{\beta}\right) + \frac{1}{\alpha} \times \frac{1}{\beta}\right]$$

$$k\left[x^2 - x\left(\frac{\alpha+\beta}{\alpha\beta}\right) + \left(\frac{1}{\alpha\beta}\right)\right]$$

$$k\left[x^2 - x\left(\frac{a}{b}\right) - \frac{1}{b}\right]$$

$$k\left[\frac{bx^2 - ax - 1}{b}\right]$$

If k = b then $bx^2 - ax - 1$ is one Q.E

13. **(A)** Let a_1, a_2, a_3 .... an are the Am's between a & b

$\therefore$ a, a_1, a_2, a_3 .... a_n, b are in Ar

$\therefore$ $a_1 = a + d$ $\quad a_n = b - d$

Sum of 'n' Am's = $a_1 + a_2 + a_3 + ... + a_n$

$$= \frac{n}{2}(a_1 + a_n) = \frac{n}{2}[a + d + b - d]$$

$$= \frac{n}{2}[a + b]$$

14. **(C)** Given $(3k-1)(2k + 1) = 609$ cm^2

$\Rightarrow$ $6k^2 + k - 1 = 609$

$6k^2 + k - 610 = 0$

$6k^2 + 61k - 60k - 610 = 0$

$k(6k + 61) - 10(6k + 61) = 0$

$k = 10$ (OR) $k = -\frac{61}{6}$

If k = 10 then $3k - 1 = 29$ &

$2k + 1 = 21$

Perimeter = $2[3k - 1 + 2k + 1]$

= 100 cm

15. **(B)** In Δ OTP, $\angle OTP = 90° \Rightarrow OP^2 = OT^2 + TP^2$

$= 12^2 + 5^2$

$\Rightarrow$ OP = 13

In Δ OPS, $\angle S = 90° \Rightarrow PS^2 = OP^2 - OS^2$

$= 13^2 - 5^2$

PS = 12 cm

16. **(B)** $AC^2 = AB^2 + BC^2$

$\therefore$ AC = 10 cm

$$S = \frac{a+b+c}{2} = \frac{24\,cm}{2} = 12\,cm$$

$\frac{1}{2} \times 6$ cm $\times 8$ cm = rs

$$\frac{24\,cm^2}{12\,cm} = r$$

r = 2 cm

$$= \frac{1}{2} \times 6 \times 8\,cm^2 - \frac{22}{7} \times 2 \times 2\,cm^2$$

$= 24$ cm^2 $- 12.57$ cm^2

$= 11.43$ cm^2

17. **(A)** $t_n = s_n - s_{n-1}$

$t_{12} = s_{12} - s_{11}$

$= [2(12)^2 + 3(12)] - [2(11)^2 + (3)(11)]$

$= (324) - 275 = 49$

18. **(B)** Given $\sin\theta + \sin^2\theta = 1$

$\sin\theta = 1 - \sin^2\theta$

$\sin\theta = \cos^2\theta$

$\therefore$ $\cos^2\theta + \cos^4\theta = \sin\theta + \sin^2\theta = 1$

19. **(C)** Given vertices form a right angled triangle

$\therefore$ Orthocentre is vertex of right angled

$\therefore$ Orthocentre = (0, 0)

20. **(B)** $\Delta ABC, \angle B = 90° \Rightarrow \angle A + \angle C = 90°$

$\angle A = 90° - \angle C \quad \rightarrow (1)$

In $\Delta CFG, \angle F = 90° \Rightarrow \angle FGC = 90° - C$

$\rightarrow (2)$

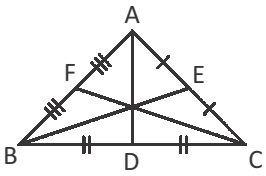
from (1) & (2) $\angle A = \angle FGC$ & $\angle E = \angle F$

$\therefore$ $\Delta ADE : \Delta GCF$ [A A similarity]

21. **(B)** In ΔABC, AD is median

$\Rightarrow AB^2 + AC^2 = 2AD^2 + 2BD^2$

$= 2AD^2 + 2\left(\frac{BC}{2}\right)^2 = 2AD^2 + \frac{BC^2}{2}$



$2AB^2 + 2AC^2 = 4AD^2 + BC^2$ ... (1)

Similarly

$2AB^2 + 2BC^2 = 4BE^2 + AC^2$ ... (2)

$2BC^2 + 2AC^2 = 4CF^2 + AB^2$ ...(3)

eq (1)+(2)+(3) $\Rightarrow 3AB^2+3BC^2+3CA^2 = 4(AD^2 + BE^2 + CF^2)$

$\Rightarrow AB^2+BC^2 + CA^2 = \frac{4}{3}(AD^2 + BE^2 + CF^2)$

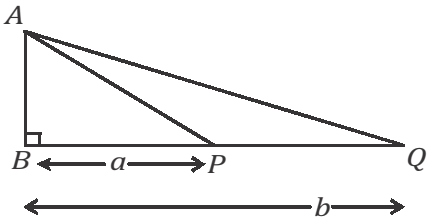
22. **(C)** $\left(2+\sqrt{3}, 5\right)$ is equidistant from the given to vertices

23. **(D)** Given $\angle APB + \angle Q = 90°$

$\angle APB + = 90° - \angle Q$

$\therefore$ tan $(\angle APB)$ = tan $(90° - \angle Q)$

tan $\angle APB$ = cotQ



In ΔABP, tan $\Delta APB = \frac{AB}{a}$

$\Rightarrow$ cotQ = $\frac{AB}{a}$ ... (1)

In ΔABQ, tanQ = $\frac{AB}{b}$ ... (2)

eq (1) $\times$ (2) $\Rightarrow 1 = \frac{AB^2}{ab}$

$\therefore AB^2 = ab$

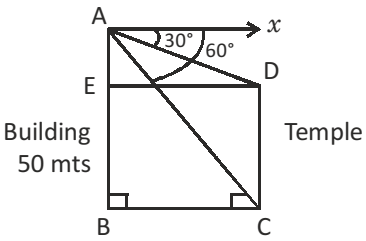
Height of tower AB = $\sqrt{ab}$

24. **(C)** a = 1, b = 0, c = – 27

$\alpha + \beta = -\frac{b}{a} = 0$

25. **(C)** Given $\angle xAD = \angle ADE = 30°$

$\angle xAC = \angle ACB = 60°$



In ΔABC tan 60° = $\frac{AB}{BC}$

$\sqrt{3} = \frac{50 \text{ mts}}{BC}$

BC = $\frac{50}{\sqrt{3}}$ mt = DE

In ΔADE tan 30° = $\frac{AE}{DE}$

$\frac{1}{\sqrt{3}} = \frac{AE}{\left(\frac{50}{\sqrt{3}}\right)}$ mts

$\therefore$ AE = $\frac{50}{3}$ mts = 16.666 mts

$\therefore$ BE = AB – AE = 50 mts – 16.666 mts

= 33.334 mts

= 33.33 mts

PHYSICS

26. **(A)** Voltmeter has the maximum resistance followed by milivoltmeter, miliammeter, and ammeter respectively.

27. **(D)** Light travels slower through a denser medium and faster in a rarer medium. The correct order of increasing speed of light is glass, water and air. This is because glass is the densest, followed by water and air, the least dense of the three.

Options (A), (B) and (C) : The order in which these mediums are arranged in these options is wrong.

28. **(C)** For objects at infinite distance, $\frac{1}{2.5}-\frac{1}{\alpha}=\frac{1}{f}$ or $f = 2.5$ cm

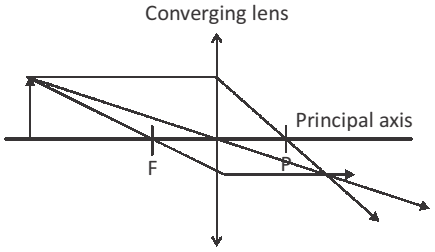
$\therefore P_{min} = \frac{1}{2.5\times10^{-2}} = 40$ D

For objects at 25 cm distance, $\frac{1}{2.5}-\frac{1}{-25}=\frac{1}{f}$ Or $f = \frac{25}{11}$ cm

$\therefore P_{max} = \frac{1}{(25/11)\times10^{-2}} = 44$ D

29. **(B)** Magnitude of magnetic field at any point due to a straight current carrying conductor depends only on the distance of the point with respect to current carrying conductor but not on the direction. Hence, $B_P = B_Q$ (at same distance). The magnetic field at P is same as at Q.

30. **(D)** All the given statements are true as per the given figure.



31. **(D)** When all the resistors are arranged in parallel, the effective resistance will be the lowest.

32. **(B)** u = ∞, v = -100 cm,

Let f be the focal length of the correcting lens.

Then $\frac{1}{f} = \frac{1}{v}-\frac{1}{u}, \frac{1}{f}=\frac{1}{-100}$ f = -100 cm.

The person should use a concave lens.

33. **(B)** An electric fuse of length l, radius r when used in series of the circuit can withstand only if the rate of heat produced due to current in it is equal to the rate of heat lost due to radiation. If H is the rate of heat lost per unit area of the fuse wire, then

$H \times 2\pi rl = I^2R = I^2\rho l/\pi r^2$

or $H = \frac{L^2\rho}{2\pi^2r^3}$ i.e., H is independent of L.

Thus, length is immaterial for an electric fuse.

34. **(C)** $\eta = \frac{\sin 70^0}{\sin 24^0} = 2.31$

$\eta = \frac{c}{v}$, $v = \frac{c}{\eta}$

$= \frac{3\times10^8}{2.31} = 1.3 \times 10^8$ m/s

35. **(B)** Current flowing through the circuit

= $P \div V$

= 2400 W ÷ 240 V

= 10 A

Resistance of heater = V ÷ I

= 240 V ÷ 10 A = 24 Ω

CHEMISTRY

36. **(B)** As per the given figure, the number of valence electrons in elements P and Q are 7 and 6 respectively. So, element P is chlorine and element Q is oxygen.

37. **(C)** White powder with odour of chlorine is bleaching powder. It is prepared by passing chlorine gas through slaked lime i.e., calcium hydroxide.

$Ca(OH)_2 + Cl_2 \rightarrow CaOCl_2 + H_2O$

Calcium oxychloride

(Bleaching powder)

38. **(B)** X and Y are two elements/substances. They react to form substance Z, a compound. This is because

(i) heat is evolved during the formation of Z.

(ii) the properties of Z are different from those of X and Y.

Hence, it is a combination reaction.

Examples of X, Y and Z are given below

X Y Z

(i) $2Mg(s) + O_2(g) \rightarrow 2MgO(s)$

(ii) $C(s) + O_2(g) \rightarrow CO_2(g)$

(iii) $H_2(g) + Cl_2(g) \rightarrow 2HCl(g)$

Heat is evolved in the above given

reactions and the properties of products(Z) formed are different from those of reactants X and Y respectively.

39. **(A)** A detergent has a sodium salt of either benzene sulphonic acid or alkyl hydrogen sulphate that has cleansing action on clothes in water.

40. **(B)** Strong acid is indicated by red, neutral by green and strong base by violet.

41. **(B)** Both zinc and aluminium form amphoteric oxides, i.e., the oxides can react with both acids and bases. Zinc oxide can be reduced by carbon but not hydrogen gas. Aluminium oxide cannot be reduced by heating with carbon or hydrogen gas.

42. **(D)** All the given statements are true of both diamond and graphite.

43. **(A)** In the given chemical reactions, chemical reaction in option (A) is balanced as well as undergoes combustion.

44. **(B)** V and Y would give a neutral solution. V has a 3 pH value below neutral and it is added to Y, which has a 3 pH value above neutral value.

Option (A): The solution formed would be acidic (3 pH value below neutral added to only 2 pH value above neutral)

Option (C): This solution formed would be alkaline (2 pH value below neutral added to 3 pH value above neutral).

Option (D): This solution formed would be alkaline, as both X and Y are alkaline to begin with.

45. **(D)** Carbon does not show semi-metallic properties.

BIOLOGY

46. **(D)** Fossils are the remanants of plants and animals that were dead and gone forever. By studying fossils people can learn about plants and animals that lived long ago.

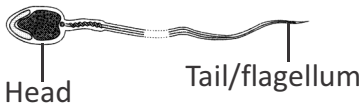
47. **(B)** Dimple character is dominant over the character not having dimples. In the given cross there is a 50% of chance of getting dimples

48. **(B)** In the given figure the capillary that receives blood from the direction Q has more concentration of carbon dioxide.

49. **(D)** The size of apple at Y shrinks due to girdling of stem.

50. **(A)** Sperms are the male reproductive cells

A sperm has head, a neck and a tail (flagellum). The nucleus that carries hereditary materials is located in the head.



Sperms are produced in the testes.

The sperm is the smallest cell in the human body. The egg is the largest cell in the human body

51. **(B)** Animal R is omnivore as it feed on both animals and plant Q.

52. **(C)** Lacteal absorbs fat.

53. **(C)** Right atrium $\rightarrow$ right ventricle $\rightarrow$ lungs

54. **(B)** The number of chromosomes is reduced to half in gametes the number of chromosomes in pollen grain of maize in 10 and in left cell is 20.

55. **(B)** The reactants of photosynthesis are the products of cellular respiration.

CRITICAL THINKING

56. **(B)** 1 pair at the end of first month

2 pairs at the end of second month

3 pairs at the end of third month

5 pairs at the end of fourth month

855 pairs at the end of fifth month

1, 2, 3, 5, 8, 13, 21, 34, 55, 89, 144, 233, ...

There will be 233 pairs of rabbits by the end of one year.

57. **(A)** $31 \div 7 = 4$ R 3

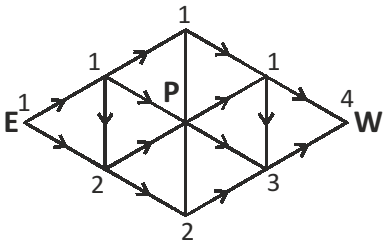
4 days of the week happened 4 times in the month of May. There were Thursday, Friday, Saturday and Sunday.

3 days of the week happened 5 times and they were Monday, Tuesday and Wednesday.

The first day of the month was Monday so is the 15^{th} of that month in that year.

15^{th} May was a Monday in that year.

58. **(D)**



59. **(A)** Without students, a school cannot exist; therefore, students are the essential part of schools. The other choices may be related, but they are not essential.

60. **(D)** Since we doesn't get the position of any of the person from both the ends before or after interchanging then it is not possible to answer how many persons are there in the row.

THE END