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NATIONAL LEVEL SCIENCE TALENT SEARCH EXAMINATION (UPDATED)

CLASS - 7

Question Paper Code : UN487

KEY

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

SOLUTIONS

MATHEMATICS

01. (C) $\frac{1}{2\times2} \times \frac{2}{2\times3} \times \frac{3}{2\times4} \times \frac{4}{2\times5} \times \frac{5}{2\times6} \times$

$\ldots\ldots \times \frac{30}{2\times31} \times \frac{31}{64} = 2^x$

$= \frac{1}{2^{30}\times2^6} = 2^x$

$= 2^{-36} = 2^x$

$\therefore x = -36$

02. (B) $2^{50} - 2^{49} - 2^{48} = 2^{48} \times 2^2 - 2^{48} \times 2 - 2^{48}$

$= 2^{48}(2^2 - 2 - 1)$

$= 2^{48}(4 - 3) \quad = 2^{48}$

03. (C) $123^3 + 345^3 - 468^3 + 369 \times 345 \times 468$

$= 1860867 + 41063625 - 102503132 + 59578740$

$= 102503232 - 102503232 = 0$

04. (D) Given $2\pi r = 176$ cm

$2 \times \frac{22}{7} \times r = 176$ cm

$r = 176 \text{ cm} \times \frac{7}{22} \times \frac{1}{2}$

$\therefore$ Area of the circle $= \pi r^2 = \frac{22}{7} \times 28 \times 28$

$= 2464 \text{ cm}^2$

5. (A) $1 - 2 = -1$ & $3 - 4 = -1$

$\therefore$ There are 25 pairs of numbers from 1 to 50

$\therefore$ $1 - 2 + 3 - 4 + 5 - 6 + \ldots\ldots + 47 - 48 + 49 - 50 + 51 = -25 + 51 = 26$

6. (A) Marks obtained by

Sharanya = 500

Deepa = 300

Shravan = 500

Nandan = 600

Nandan's performance was the best, as he scored the maximum marks

7. (C) $\frac{26}{7} + \frac{63}{11} \div \frac{189}{22} - \frac{50}{7} \times \frac{77}{10}$

$= \frac{26}{7} + \frac{63}{11} \times \frac{22}{189} - \frac{50}{7} \times \frac{77}{10}$

$= \frac{26}{7} + \frac{2}{3} - 55$

$= \frac{78 + 14 - 1155}{21}$

$= -\frac{1063}{21}$

$= -50\frac{13}{21}$

8. (C) The middle most observations in the ascending order are $167 + x$ & $171 + 5x$

$\therefore$ Median $= \frac{167 + x + 171 + 5x}{2} = 184$

$338 + 6x = 2 \times 184 = 368$

$6x = 368 - 338 = 30$

$x = \frac{30}{6} = 5$

9. (B) Given $\frac{3z - 15}{4} - 4z + \frac{(z - 3)}{2} = 3$

$= \frac{2(3z - 15) - 8 \times 4z + 4(z - 3)}{8} = 3$

$= 6z - 30 - 32z + 4z - 12 = 8 \times 3$

$= 10z - 32z = 24 + 30 + 12 - 22z = 66$

$z = \frac{66}{22}$

$z = -3$

10. (A) Side of an equilateral triangle

$= \frac{\text{Perimeter}}{3}$

$= \frac{\left(3a - \frac{b}{9} + \frac{c}{81}\right)}{3}$ cm

$= \left(\frac{3a}{3} - \frac{b}{9} \times \frac{1}{3} + \frac{6}{81} \times \frac{l}{3}\right)$ cm

$= \left(a - \frac{b}{27} + \frac{c}{243}\right)$ cm

11. (C) $(-1)^{2022} = 1$ and $(-1)^{2023} = -1$

$\therefore (-1)^{2022} + (-1)^{2023} = 1 + (-1) = 1 - 1 = 0$

12. (D) $100^3 - 3 \times 100^2 \times 88 + 3 \times 100 \times 88^2 - 88^3$

$= 1000000 - 264 \times 10000 + 300 \times 7744 - 6,81,472$

$= 10,00,000 - 26,40,000 + 23,23,200 - 6,81,472$

$= 33,23,200 - 33,21,472$

$= 1728$

13. (C) Given the angles ratio = 8 : 9 : 19 = $8x$: $9x$: $19x$

$\therefore$ $8x + 9x + 19x = 180°$

$36x = 180°$

$x = \frac{180°}{36} = 5°$

$\therefore$ $8x = 8 \times 5° = 40°$

$9x = 9 \times 5° = 45°$ &

$19x = 19 \times 5° = 95°$

It is an obtuse angled triangle

14. (D) Given side of the square (S) = $8\frac{1}{3}$ cm = $\frac{25}{3}$ cm

$\therefore$ Area of the square = $S^2 = \left(\frac{25}{3}\text{cm}\right)^2$

$= \frac{25}{3}\text{ cm} \times \frac{25}{3}\text{cm}$

$= \frac{625}{9}\text{cm}^2$

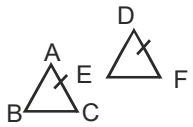
$= 69\frac{4}{9}\text{cm}^2$

15. (C) Let x g be the weight of each cube. Then $4x$ g = 20 g $\Rightarrow x$ = 5 grams

16. (D) P × –6 = –48, where P is the unknown integer

$\Rightarrow$ P = –48 ÷ –6 = 8

17. (C) Figures of the same shape and size are congruent



18. (A) Given 3a + 85° + 2a = 180° {$\because$ straight angle}

5a = 180° – 85°

$a = \frac{95^\circ}{5} = 19^\circ$

19. (A) LCM of 10, 15, 20 & 30 = 60.

$-\frac{7}{30} = -\frac{7}{30} \times \frac{2}{2} = -\frac{14}{60}$

$-\frac{3}{20} = -\frac{3}{20} \times \frac{3}{3} = -\frac{9}{60}$

$-\frac{11}{15} = -\frac{11}{15} \times \frac{4}{4} = -\frac{44}{60}$

$-\frac{7}{10} = -\frac{7}{10} \times \frac{6}{6} = -\frac{42}{60}$

$\therefore$ $-\frac{11}{15} < -\frac{7}{10} < -\frac{7}{30} < -\frac{3}{20}$

20. (D) $(2x + 3y : (5x - 3y) =$

$(2 \times 3 + 3 \times 4) : (5 \times 3 - 3 \times 4)$

= 18 : 3

= 6 : 1

21. (C) Given AB||DC

$\angle DAB + \angle ADC = 180^\circ$ _____(1)

But given AD||BC

$= \angle BCD + \angle ADC = 180^\circ$ _____(2)

from equation (1) & (2)

$\angle DAB + \angle ADC = \angle BCD + \angle ADC$

$\therefore$ $\angle DAB = \angle BCD$

But given $\angle DAB + \angle BCD = 230^\circ$

$\angle DAB + \angle DAB = 230^\circ$

[$\because \angle BCD = \angle DAB$]

$2\angle DAB = 230^\circ$

$\angle DAB = \frac{220^\circ}{2} = 115^\circ$

But $\angle DAB + \angle ABC = 180^\circ$

$115^\circ + \angle ABC = 180^\circ$

$2ABC = 180^\circ - 115^\circ = 65^\circ$

22. (C) Let the other number be 'x'

$\therefore$ $7\frac{1}{2} \times x = -303$

$\frac{15}{2} \times x = -303$

$x = -303 \times \frac{2}{15} = \frac{-202}{5}$

$= -40\frac{2}{5}$

23. (B) $\left(-2^{-3}-3^{-4}\right)\div 6^{-2} = \dfrac{\left(-\frac{1}{2^3}-\frac{1}{2^4}\right)}{6^{-2}}$

$= \left(-\frac{1}{8}-\frac{1}{81}\right)\times 6^2$

$= \dfrac{-81-8}{8\times 81}\times 6^2$

$= \dfrac{-89}{2^2\times 3^2\times 2\times 3^2}\times 6^2$

$= \dfrac{-89}{18\times 6^2}\times 6^2$

$= -\dfrac{89}{18}$

$= -4\dfrac{17}{18}$

24. (A) $\dfrac{-2x^3}{\left(\frac{4x}{7}\right)} = -2x^3\times\dfrac{7}{4x} = \dfrac{-7x^2}{2}$

25. (A) The required perimeter

= 2 × circumference of circle of radius $\dfrac{28}{2}$ i.e., 14 cm

$= 2\times 2\times \dfrac{22}{\cancel{7}_1}\times \cancel{14}^2 = 176$ cm

PHYSICS

26. (B) The positive terminal of one cell should be connected to the negative terminal of the second cell to form a battery.

27. (C) For every 5 minutes, the car is moving a distance of 3 km,

Speed = $\dfrac{\text{Distance}}{\text{Time}} = \dfrac{3\text{ km}}{5\text{ min}} = \dfrac{3000\text{ m}}{5\times 60\text{ s}}$

= 10 m/s

28. (C) The mass of the cup remains the same even if it has gained heat and expanded. Cup Y moved up while Cup Z moved down. This was because the heat from the candle flame heated the air in Cup Y, causing it to expand and rise, moving Cup Y upwards and Cup Z downwards in the process.

29. (C) The strength of an electromagnet depends on the number of coils per unit length and the number of turns. The number of turns of 50 is least for a coil length of 10 cm. Hence, a coil length of 10 cm with 50 turns produces a weakest electromagnet.

30. (B) Time taken to reach park = $\dfrac{\text{Distance}}{\text{Speed}}$

$= \dfrac{0.5\times 60}{2} = 15\text{min}$

Time taken for jogging = 30 min

Time taken for back home journey = $\dfrac{0.5\times 60}{1.5} = 20\text{min}$

Total time taken = (15 + 30 + 20)min = 65 min

So, 6:30 pm + 65 min = 7:35 pm

31. (B) Heat from the hot stones is transferred to the air in the bottle. As the bottle is airtight, the heat cannot escape and it caused the temperature of air in the bottle to rise.

32. (A) Only bells 1, 5 and 6 ring when the switch is closed. This shows that electric current can flow through object X. Thus, object X is an electrical conductor. As bells 2, 3 and 4 did not ring when the switch is closed, it shows that object Y is not an electrical conductor. Object 2 may be an electrical conductor or insulator.

33. (A) The graph in option (A) does NOT represent constant speed of an object.

34. (C) When water is heated in a beaker, the water near the flame gets hot. Hot water rises up. The cold water from the sides moves down towards the source of heat. This water also gets hot and rises and water from the sides moves down. This process continues till the whole water gets heated.

35. (D) The correct words to complete the paragraph are Heating, filament, tungsten, current, argon gas, prevents.

CHEMISTRY

36. (D) Wind movements are caused by uneven heating of air on the earth.

37. (C) Turmeric solution remains yellow in neutral (common salt) and acidic solution (vinegar). Turmeric solution turns red in basic solution (washing soda).

38. (C) A physical change is reversible whereas a chemical change is irreversible.

39. (D) W: In the process of condensation, a gaseous substance changes to liquid state at low temperature with the release of heat. It is a physical change.

X: Burning of wood produces heat and light.

Y: Bursting of crackers produces sound along with heat and light. Both X and Y are chemical changes.

Z: Ice melts by absorbing heat. It is a physical change.

40. (B) Sodium hydrogen carbonate + Lemon juice $\rightarrow$ Salt + Water (X) and Carbon dioxide (Y).

41. (B) Winds that are cold usually show lateral (sideways) movement while the ones that are warm show vertical movement. As, the winds blow from the north and the south towards the equator, it is hotter than the other places.

42. (A) X is blue vitriol $CuSO_4.5H_2O$ which is blue in colour. This on heating loses water of crystallization and forms anhydrous salt which is colourless. When water is added to anhydrous salt it forms copper sulphate pentahydrate which is blue in colour.

$$\underset{\text{(Blue)}}{CuSO_4.5H_2O} \xrightarrow{\text{heating}} \underset{\text{(Colourless)}}{CuSO_4} \xrightarrow{+H_2O} \underset{\text{(Blue)}}{CuSO_4.5H_2O}$$

Y is limestone, $CaCO_3$ which on heating gives CaO, it is an exothermic reaction and hence water starts boiling.

43. (C) Magnesium hydroxide is a base. Its source is milk of magnesia sourced by hydration or hydrolysis of magnesium oxide. Calcium oxide is used for white wash.

44. (C) The correct matching is
P-iii, Q-i, R-iv, S-ii

Repositing a layer of zinc on iron articles is done by galvanisation process.

Iron oxide is rust.

Dissolving common salt in water is a physical change Souring of milk is a chemical change.

45. (A) CO_2 + $Ca(OH)_2$ X (Lime water) $\longrightarrow$ $CaCO_3$ + H_2O 'Y' (Water)

BIOLOGY

46. (A) a – iii; b – i; c – ii; d – iv

47. (B) X - Penguins, Y - Polar bears

48. (B) The aim of the experiment is to determine if light energy is needed by leaves to carry out photosynthesis.

49. (B) (iii) → (i) → (ii) → (iv)

50. (A) Pulmonary artery carries deoxygenated (CO_2 rich) blood that enters from the heart to lungs. The blood in pulmonary artery contains least amount of oxygen and highest amount of carbon dioxide.

51. (B) P - Kidney, Q - Ureter

R - Urinary bladder, S - Urethra

52. (C) Upon burning wool smell like burning hair. Therefore, fibre that Tarun tested is woollen fibre.

53. (C) Platelets, RBC, WBC

54. (D) Capillaries are one celled thin vessels that connects arteries and veins.

55. (C) P - Bryophyllum

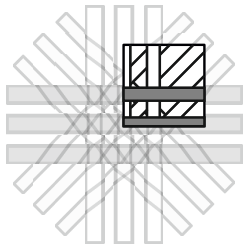
Q - Sweet potato

R - Ginger

CRITICAL THINKING

56. (D) After 65 min : 27 seconds, the hour hand and minute hand will be at 180°.

57. (C)



58. (A) Let us assume three girls are x, y, z. Since we know the end result (each girl finished with 40 chips), a natural strategy is to work backward through the three rounds to the beginning.

	x	y	z
Beginning	65	35	20
First round	10	70	40
Second round	20	20	80
Third round	40	40	40

59. (B)

60. (D) If neither I nor II follows the statement.

The End