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NATIONAL LEVEL SCIENCE TALENT SEARCH EXAMINATION (UPDATED)

CLASS - 9

Question Paper Code : UN487

KEY

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

SOLUTIONS

MATHEMATICS

01. (D) $\dfrac{\sqrt{x+4}+\sqrt{x-4}}{\sqrt{x+4}-\sqrt{x-4}} \times \dfrac{\sqrt{x+4}+\sqrt{x-4}}{\sqrt{x+4}+\sqrt{x-4}} = 2$

$$\Rightarrow \frac{\left(\sqrt{x+4}+\sqrt{x-4}\right)^2}{\left(\sqrt{x+4}\right)^2-\left(\sqrt{x-4}\right)^2} = 2$$

$$\Rightarrow \frac{x+4+x-4+2\sqrt{x^2-16}}{x+4-x+4} = 2$$

$$\frac{2\left(x+\sqrt{x^2-16}\right)}{8} = 2$$

$$x+\sqrt{x^2-16} = 8$$

$$\sqrt{x^2-16} = (8-x)$$

$$\Rightarrow \left(\sqrt{x^2-16}\right)^2 = (8-x)^2$$

$x^2 - 16 = 64 + x^2 - 16x$

$16x = 64 + 16 = 80$

$$x = \frac{80}{16} = 5$$

$x = 5$

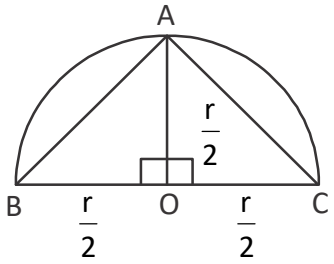
02. (D) $\alpha\beta = \left(\frac{-b+\sqrt{b^2-4ac}}{2a}\right)\left(\frac{-b-\sqrt{b^2-4ac}}{2a}\right)$

$= \frac{(-b)^2 - \left(\sqrt{b^2-4ac}\right)^2}{4a^2}$

$= \frac{b^2 - \left(b^2-4ac\right)}{4a^2}$

$= \frac{b^2 - b^2 + 4ac}{4a^2} = \frac{4ac}{4a^2} = \frac{c}{a}$

03. (A) Height is maximum if it is equal to radius



$\therefore$ b = r & h = $\frac{r}{2}$

Area of the greatest triangle

$= \frac{1}{2}bh = \frac{1}{2} \times r \times \frac{r}{2} cm^2 = \frac{r^2}{4} cm^2$

04. (D) $18x^4 - 36x^3 + 18x^2 = 18x^2(x^2 - 2x + 1)$

$= 18x^2(x-1)^2$

$= 2 \times 9x^2(x-1)^2$

$45x^6 - 45x^3 = 45x^3(x^3 - 1)$

$= 45x^3(x-1)(x^2 + x + 1)$

$= 5 \times 9x^3(x-1)(x^2 + x + 1)$

$\therefore$ LCM $= 2 \times 9 \times 5x^3(x-1)^2(x^2 + x + 1)$

$= 90x^3(x-1)(x^3 - 1)$

05. (A) If $x = 2 + 2^{\frac{1}{3}} + 2^{\frac{2}{3}}$

$\Rightarrow x - 2 = 2^{\frac{1}{3}} + 2^{\frac{2}{3}}$

Cubing on both sides, we get

$(x-2)^3 = \left(2^{\frac{1}{3}} + 2^{\frac{2}{3}}\right)^3$

$\Rightarrow x^3 - 6x(x-2) - 8 = 2 + 6(x-2) + 4$

$\Rightarrow x^3 - 6x^2 + 12x - 8 = 6 + 6(x-2)$

$\Rightarrow x^3 - 6x^2 + 6x = -6 + 8$

$\Rightarrow x^3 - 6x^2 + 6x = 2$

06. (C) In ΔAOB, OA = OB [$\because$ In a rectangle diagonals are equal and bisect each other]

$\therefore \angle OBA = \angle OAB = 33°$

In ΔAOB, $33° + 33° + \angle AOB = 180°$

$\angle AOB = 180° - 66° = 114°$

$\therefore x = \angle OAB = 114°$

But $\angle OBA + \angle OBC = 90°$

$33° + y = 90°$

$y = 90° - 33° = 57°$

$\therefore x + y = 114° + 57° = 171°$

07. (B) Given x = 2.4178178.....

$1000x = 2417.8178178.....$

$x = 2.4178178.....$

(–) (–)

$999x = 2415.4$

$x = \frac{2415.4}{999} \times \frac{10}{10}$

$= \frac{24154}{9990} = \frac{12077}{4995}$

$x = 2.4\overline{178} = \frac{12077}{4995}$

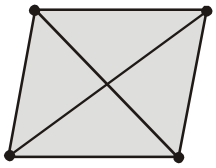
08. (C) Given $3x^2 - 1 = 0$

$3x^2 = 1$

$x^2 = \frac{1}{3}$

$x = \pm\sqrt{\frac{1}{3}} = \pm\frac{1}{\sqrt{3}}$

09. (C) Of the four points which are given, no three points are collinear



$\therefore$ It is clear that 6 lines can be drawn through them

10. (B) $\angle EGH = \angle AEF = 95°$
[Corresponding angles PQ ||RS.]

$\angle BGH = 180° - 95° = 85°$

$\angle GBH = 110° - 85° = 25°$
[Exterior angle of ΔBGH]

$\therefore$ $\angle ABC = \angle GBH = 25°$

11. (A) $6x^2 + \sqrt{5}x - 60 = 6x^2 + 9\sqrt{5} - 8\sqrt{5}x - 60$

$= 3x\left(2x + 3\sqrt{5}\right) - 4\sqrt{5}\left(2x + 3\sqrt{5}\right)$

$= \left(2x + 3\sqrt{5}\right)\left(3x - 4\sqrt{5}\right)$

12. (D) $(a + b + c)^3 = (a + b + c)^3$

$= (a + b)^3 + 3(a + b)^2c + 3(a + b)c^2 + c^3$

$= a^3 + b^3 + 3ab(a + b) + 3(a + b)^2c + 3(a + b)c^2 + c^3$

$= a^3 + b^3 + c^3 + 3(a + b)[ab + ac + bc + c^2]$

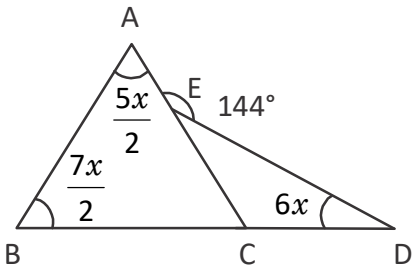
$= a^3 + b^3 + c^3 + 3(a + b)[a(b + c) + c(b + c)]$

$= a^3 + b^3 + c^3 + 3(a + b)(b + c)(c + a)$

$\therefore$ $(a + b + c)^3 - a^3 - b^3 - c^3 = a^3 + b^3 + c^3 + 3(a + b)(b + c)(c + a) - a^3 - b^3 - c^3$

$= 3(a + b)(b + c)(c + a)$

13. (D) In ΔABC, $\angle ACD$



$= \frac{5x}{2} + \frac{7x}{2} = \frac{5x + 7x}{2} = \frac{12x}{2} = 6x$

But $6x + 6x = 144°$

$12x = 144$

$x = \frac{144°}{12} = 12°$

14. (B) Given $\frac{2x}{5} + \frac{3y}{10} = 3$

$\therefore$ $\frac{4x + 3y}{10} = 3$

$\therefore$ $4x + 3y = 3 \times 10 = 30$

Let $(-11.25, 5) \Rightarrow 4(-11.25) + 3(5)$

$= -45 + 15 = -30$

$\therefore$ $(-11.25, 5)$ does n't lie on $\frac{2x}{5} + \frac{3y}{10} = 3$

Let $(11.25, -5) \Rightarrow 4(11.25) + 3(-5)$

$= 45 - 15 = 30$

$\therefore$ $(11.25, -5)$ lies on the line $\frac{2x}{5} + \frac{3y}{10} = 3$

15. (D) If $x < 0$ then $-x$ is + ve

$y < 0$ then y is –ve

$\therefore$ $(-x, y)$ ie (+, –) lies in Q_4

16. (A) Let the average speed of first plane be x and second plane be y

Given $5x + 5y = 3400$

$x + y = \frac{3400}{5} = 680$ km

17. (A) The side opposite to smaller angle is shorter. So, PS < QR.

18. (B) $x = \sqrt[3]{2 + \sqrt{3}}$

$\Rightarrow$ $x^3 = 2 + \sqrt{3}$ and $\frac{1}{x^3} = 2 - \sqrt{3}$

$x^3 + \frac{1}{x^3} = 2 + \sqrt{3} + 2 - \sqrt{3} = 4$

19. (C) Given a = 187 m, b = 140 m & c = 173 m

$\therefore s = \frac{a + b + c}{2} = \frac{(187 + 140 + 173)}{2}$ m

$= \frac{500}{2}$ m $= 250$m

Area of given triangle

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

$= \sqrt{250(250-187)(250-140)(250-173)}\ m^2$

$= \sqrt{250 \times 63 \times 110 \times 77}\ m^2$

$= \sqrt{5^2 \times 10 \times 3^2 \times 7 \times 10 \times 11 \times 11 \times 7}\ m^2$

$= 5 \times 10 \times 3 \times 7 \times 11\ m^2$

$= 11{,}550\ m^2$

20. (A) Given AOB is an equilateral triangle

$\therefore \angle OAB = \angle OBA = \angle AOB = 60°$

$\therefore \angle OAD = \angle OBC = 90° - 60° = 30°$

In ΔAOD and ΔBOC

$\overline{OA} = \overline{OB}$ ($\because$ side & sides of equilateral triangle)

$\angle OAD = \angle OBC$ [$\because$ Angle]

$\overline{AD} = \overline{BC}$ ($\because$ side & side of a square)

$\therefore \Delta AOD \cong \Delta BOC$ [$\because$ SAS congruency]

$\therefore$ OD = OC [$\because$ CPCT]

In ΔCOD, $OD = OC \Rightarrow \angle OCD = \angle ODC = 42°$

$\therefore \angle ODA = 90° - \angle ODC = 90° - 42° = 48°$

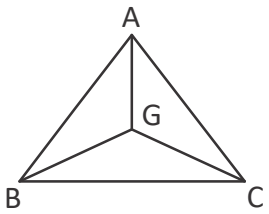
In ΔAOD, $\angle ODA + \angle OAD + \angle DOA = 180°$

$48° + 30° + \angle DOA = 180°$

$78° + \angle DOA = 180°$

$\angle DOA = 180° - 78° = 102°$

21. (D) In ΔABC, 'G' is the point of concurance of medians



$\therefore$ Area of ΔABG = Area of ΔBCG = area of ΔACG = 24 cm^2

$\therefore$ Area of the quadrilateral ABCG = Area of ΔABG + area of ΔACG

= 24 cm^2 + 24 cm^2 = 48 cm^2

22. (D) In ΔABD, $\angle ABD = 90° \Rightarrow AD^2 = AB^2 + BD^2$

$101^2 = AB^2 + 99^2$

$101^2 - 99^2 = AB^2$

$AB = \sqrt{(101+99)(101-99)}$

$= \sqrt{200 \times 2}$

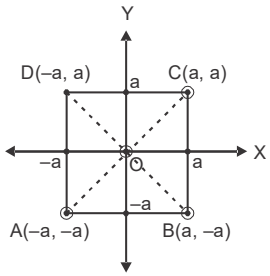
AB = 20 cm

Area of the parallelogram ABCD

= AB × BD = 20 cm × 99 cm

= 1980 cm^2

23. (D) Given points are A(–a, –a), B(a, –a), C (a, a) and D(–a, a)



Hence, it is clear that the given points form a square and the origin lies at the point where the diagonals of the square intersect.

24. (A) $\angle ACD = \angle ABD = 40°$

[$\because$ In a circle angle in the same segment are equal]

25. (C) Total surface area = CSA of a cylinder + 2CSA of the hemisphere

$= 2\pi rh + 2 \times 2\pi r^2$

$= 2\pi r(h + 2r)$

$= 2 \times \frac{22}{7} \times 35\ cm(100 + 70)\ cm$

= 37,400 cm^2

PHYSICS

26. (C) X is a spring balance which is used to measure weight of a brick whereas Y is a common balance which is used to measure mass of a brick.

27. (C) Acceleration can be calculated as

$$a = \frac{v-u}{t} = \frac{30-10}{16} = 1.25 \text{ ms}^{-2}$$

The average force F_{ave} as per the Newton's 2nd law,

F_{ave} = m × a = 12000 kg × 1.25 ms^{-2} = 15000 N.

28. (D) The units for force, distance and work done are newton (N), metre (m) and Joule (J) respectively.

29. (B) Acceleration =

$$\frac{\text{Change in velocity}}{\text{Time}} = \frac{v_2 - v_1}{t_2 - t_1}$$

From 0 to A, $a = \frac{40-0}{0.5-0}$ = 80 km/h^2

Now, Speed of the car from A to B is constant.

From B to C, $a = \frac{160-40}{1.5-1}$ = 240 km/h^2

From C to E, $a = \frac{160-0}{2.5-1.5}$ = 160 km/h^2

∴ The maximum acceleration of a car is 240 km/h^2.

30. (C) As long as the object is moving, the frictional force remains at its maximum value of 4 N.

Using Newton's 2nd law,

$$\text{Acceleration} = \frac{\text{Resultant force}}{\text{Mass}}$$

$$= \frac{10-4}{2} = 3 \text{ m/s}^2$$

31. (A) The work done on the crate by the mover is W = Fd = (300 N)(6 m) = 1,800 J. If this much work is done in 20 s, then the power delivered is P = W/t = (1,800 J)/(20 s) = 90 W.

32. (B) By Newton's first law, as the speed is constant, there is no net force. This means that the weight (downwards) of parachutist must be balanced by parachute (upwards).

33. (D) The car is first at rest (gradient is zero, a horizontal line).

The car then moves with increasing non-uniform acceleration (gradient varies, a curve).

Finally, it moves with uniform acceleration (gradient is constant, a straight line). The speed increases uniformly as time increases.

34. (D) Work done = F × S

The applied force and the distance moved must be in the same direction. The force is a vertical force, thus the vertical distance is the same in all the 3 cases.

35. (A) X = 0.5 + weight of block P inside the liquid

= 0.5 + (0.2 – 0.15)

= 0.5 + 0.05 = 0.55 kg.

CHEMISTRY

36. (B) $K_2CO_3 = 2 \times 39 + 12 + 3 \times 16 = 138$ u

$Na_2O = 2 \times 23 + 16 = 46 + 16 = 62$ u

$HNO_3 = 1 + 14 + 3 \times 16 = 63$ u

$SO_2 = 32 + 2 \times 16 = 64$ u

37. (B) Chemical composition of oil and water are different as they differ in their odour as well as in inflammability.

38. (B)

Formula of sulphide	Mass of S in 10 g sample
NiS	$\frac{32}{90} \times 10 = 3.5$ g
FeS_2	$\frac{2(32)}{120} \times 10 = 5.3$ g
MoS_2	$\frac{2(32)}{160} \times 10 = 4$ g
PbS	$\frac{32}{239} \times 10 = 1.3$ g

39. (B) The amount added by the student is 90 g or 0.09 kg.

As the amount required to prepare a saturated solution is 0.1 kg which is greater than the amount available.

So, he gets only an unsaturated solution.

40. (C) Matter is anything that has mass and occupies space.

Both the objects P and Q are not gases because gases can be compressed but objects P and Q cannot be compressed. Air is a mixture of gases. [Option (A) is false]

Both the objects P and Q are matter. Heat is a form of energy, not matter. Stone is a solid. It cannot be compressed. [Option (B) is false]

Object P cannot be compressed as it has no definite shape, so it is a liquid. Milk is a liquid. Object Q cannot be compressed as it has a definite shape, so it is a solid. An eraser is a solid. It cannot be compressed. [Option (C) is true]

Snow and cork are solids. They cannot be compressed. [Option (D) is false]

41. (C) Atomic number 11 has one election in its third shell. It loses one electron to form an ion with a charge of +1.

42. (A) Beaker (I) has a suspension. The particles in it are large enough and visible to the naked eyes.

Beaker (II) with undissolved solid and liquid after keeping it for a long period of time. The larger particles settle down and form sediment.

Beaker (III) is addition of solid solute to a liquid component called solvent.

Beaker (IV) with dissolved solute and solvent is called a solution.

43. (B) $\underset{6.3\,g}{NaHCO_3} + \underset{15\,g}{CH_3COOH} \longrightarrow \underset{18\,g}{\text{Residue}} + \underset{x\,g}{CO_2}$

According to law of conservation of mass.

Mass of reactants = Mass of products

$6.3 + 15 = 18 + x$

$x = 6.3 + 15 - 18 = 3.3$ g

So, the mass of CO_2 released is 3.3 g.

44. (C) The solubility of sodium carbonate at 30° C is 40 g in 100 g of water as solvent.

45. (C) Leaking out of some hydrogen gas and increasing the volume of the container of hydrogen gas increases the distance between the molecules of hydrogen gas.

BIOLOGY

46. (B) Intercropping is a systematic modification of mixed cropping. Intercropping allows different crops to be harvested and threshed separately.

47. (B) Addison's disease occurs due to hyposecretion of aldoesterone hormone.

48. (D) If ribosomes of a cell are completely destroyed, the cell would be unable to synthesize proteins.

49. (B) The diseases caused by bacteria are diptheria, leprosy, plague.

50. (D) Plastids has same basic structure because one type of plastid can form into another type of plastid, depending upon cell requirements.

51. (D) The taste and the quality of the honey is determined by:

(i) Variety of honeybee selected

(ii) Quality and quantity of pasturage

(iii) Kind of flowers available

52. (D) Seed coat of legumes, grit of guava and pear and fruit walls of nuts, all have sclereids.

53. (A) The traditional method of irrigation, based on lever system is rahat.

54. (B) Nereis, earthworm and leech are animals belonging to the same phylum Annelide.

55. (B) a - iii; b - iv; c - i; d - ii

Amoebiasis - Entamoeba histolytica

Ascariasis - Ascaris lumbricoides

Malaria - Plasmodium

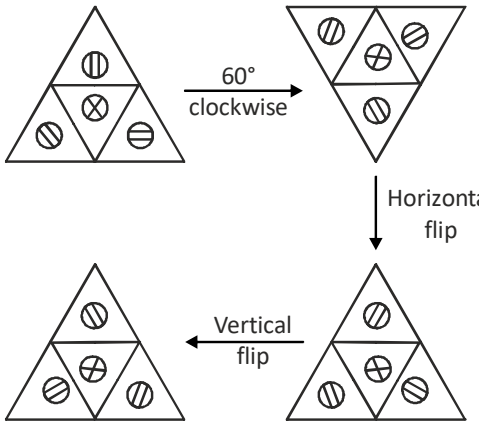
Filariasis - Wuchereria bancrofti

CRITICAL THINKING

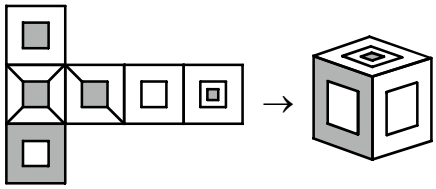
56. (C) As we already now, at the outset, the number of rabbits in the green hutch was twice as large as the number of rabbits in the yellow hutch. This mean that the number of rabbits in the green hutch was an even number. After the farmer removed five rabbits from the left-side hutch. The number of rabbits that remained there also became an even number (this is proven by the fact that it was divisible by two. Therefore, before those five were removed. The left-side hutch contained an uneven number of rabbits. Hence the left-side hutch can't be the green colored one. But, based on the information we have got it can't be the red colored one, either !

57. (B) Man B will easily cut the tree because the weight of tree B is opposite to man cutting tree. Which will easily fall on ground. While man A has to put more struggle to cut tree

58. (C)



59. (D)



60. (C) Statements I and II are not supported by the facts. Statement III is true because if all story-books have pictures and only some have words, then some storybooks have both words and pictures.