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NATIONAL LEVEL SCIENCE TALENT SEARCH EXAMINATION (UPDATED)

CLASS - 9

Question Paper Code : UN464

KEY

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

EXPLANATIONS

MATHEMATICS

01. (B) LHS = $a^2c^2 - a^2d^2 - b^2c^2 + b^2d^2 - 4abcd$

$= a^2c^2 + b^2d^2 - 2abcd - a^2d^2 - b^2c^2 - 2abcd$

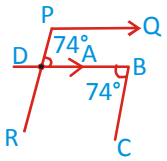
$= (ac - bd)^2 - (a^2d^2 + b^2c^2 + 2abcd)$

$= (ac - bd)^2 - (ad + bc)^2$

$= [(ac - bd) + (ad + bc)]\ [(ac - bd) - (ad + bc)]$

$= (ac - bd + ad + bc)\ (ac - bd - ad - bc)$

02. (A) Given PR || BC $\Rightarrow \angle B = \angle BDP = 74°$



[$\because$ Alternative angles]

Given AB || PQ ie DB || PQ $\Rightarrow \angle BDP + \angle P = 180°$

$74 + \angle P = 180°$

$\angle P = 180° - 74° = 106°$

03. (D) $x^2 + xy + y^2 = x^2 + 2xy + y^2 - xy$

$= (x + y)^2 - xy$

$$=\left(\frac{\sqrt{a}+\sqrt{b}}{\sqrt{a}-\sqrt{b}}+\frac{\sqrt{a}-\sqrt{b}}{\sqrt{a}+\sqrt{b}}\right)^2-\left(\frac{\cancel{\sqrt{a}+\sqrt{b}}^{1}}{\cancel{\sqrt{a}-\sqrt{b}}_{1}}\times\frac{\cancel{\sqrt{a}-\sqrt{b}}^{1}}{\cancel{\sqrt{a}+\sqrt{b}}_{1}}\right)$$

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

$$=\left[\frac{a+b+2\cancel{\sqrt{ab}}+a+b-2\cancel{\sqrt{ab}}}{(a-b)}\right]^2-1$$

$$=\left(\frac{2a+2b}{a-b}\right)^2-1$$

$$=\frac{4a^2+4b^2+8ab}{a^2-2ab+b^2}-1$$

$$=\frac{4a^2+4b^2+8ab-a^2+2ab-b^2}{(a-b)^2}$$

$$=\frac{3a^2+3b^2+10ab}{(a-b)^2}$$

04. (C)

$$S=\frac{a+b+c}{2}=\frac{21m+20m+13m}{2}=\frac{54m}{2}=27m$$

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

$$=\sqrt{27\times6\times7\times14}\ m^2$$

$$=\sqrt{3\times9\times2\times3\times7\times2\times7}\ m^x$$

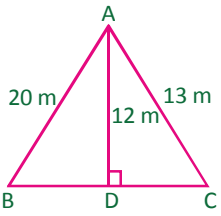
$= 3 \times 3 \times 2 \times 7\ m^2$

$= 126\ m^2$

$\frac{1}{2} \times 21\ m \times h = 126\ m^2$

$h = 126\ m^2 \times 2 \times \frac{1}{21}\ m$

$h = 12\ m$



In ΔABD, $\angle D = 90° \Rightarrow AB^2 = AD^2 + BD^2$

$\therefore$ $BD = \sqrt{20^2 - 12^2} = 16\ m$

$\therefore$ Area of $\Delta ABD = \frac{1}{2} \times BD \times AD$

$= \frac{1}{2} \times 16 \times 12\ m^2$

$= 96\ m^2$

ΔADC area $= 126\ m^2 - 96\ m^2$

$= 30\ m^2$

05. (C) In ΔABC, $\angle A + \angle B + \angle C = 180°$

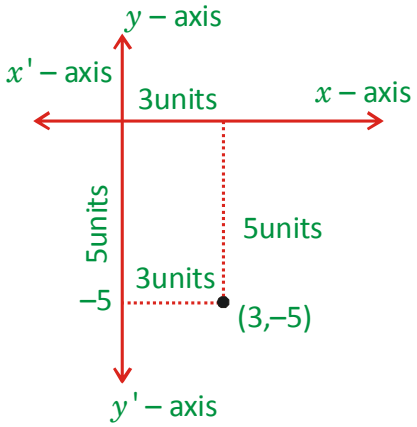
$\Rightarrow$ $3\angle C + 2\angle C + \angle C = 180$

$6\angle C = 180°$

$$\angle C=\frac{180°}{6}=30°$$

$\therefore$ $\angle A = 3\angle C = 90°$

06. (C) Distance from X-axis is 5 units



07. (D) CSA of cylinder =

$$2\pi rh=2\times\frac{22}{\cancel{7}_{1}}\times\cancel{14}^{2}\ m\times4m=352m^2$$

Total cost of cementing for CSA = 352 × ₹20 = ₹7040

08. (B) Given B : C : D = 2 : 3 : 7 = $2x : 3x : 7x$

$\therefore$ $60° + 2x + 3x + 7x = 360°$

$12x = 360° - 60°$

$$x = \frac{300°}{12} = 25°$$

$C = 3x = 3 \times 25° = 75°$

09. (A) $\angle a = 40$ & $x + 100° = 180°$

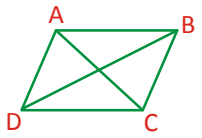
$x = 180° - 100° = 80°$

But $\angle x + \angle a + \angle y = 180°$

$40° + 80° + \angle y = 180°$

$y = 180° - 120° = 60°$

10. (B) In ΔABC, AB + BC > AC (1)



In ΔABD, AB + AD > BD (2)

In ΔACD, AD + DC > AC (3)

In $\therefore \Delta BCD$, DC + BC > BD (4)

eg (1) + (2) + (3) + (4) 2(AB + BC + CD + DA) >2 (AC + BD)

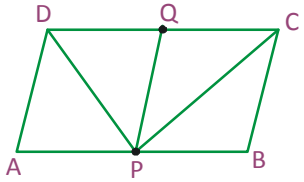
$\therefore$ AB + BC + CD+ DA > (AC + BD)

11. (A) Given area of trapezium APCD = $27cm^2$

$\therefore$ Area of the parallelogram ABCD =

$$27cm^2 \times \frac{4}{3}$$

= 36 cm^2



Area of $\Delta ABC = \frac{1}{2}$ area of parallogram ABCD

$$= \frac{1}{2} \times 36\ cm^2 = 18cm^2$$

12. (B) In ΔOQR, OQ = OR $\Rightarrow \angle ORQ = \angle OQR = y$

But $\angle QOR = 2\angle QPR = 2x$

In QOR, $\angle QOR + \angle ORQ + \angle OQR = 180°$

$2x + y + y = 180°$

$2(x + y) = 180°$

$$x + y = \frac{180°}{2} = 90°$$

13. (C) Lateral sides of a pyramid are triangles

14. (C) $h = \sqrt{l^2 - r^2} = \sqrt{5^2 - 3^2} = \sqrt{25 - 9} = \sqrt{16} = 4$

$\therefore$ Volume of double cones $= 2 \times \frac{1}{3}\pi r^2 h$

$$= \frac{2}{\cancel{3}_1} \times \pi \times \cancel{9}^3 \times 4$$

= 24π cm^3

15. (A) In given triangle s + t + 50° = 180°

s + t = 180° – 50° = 130°

Given S < 50° < t

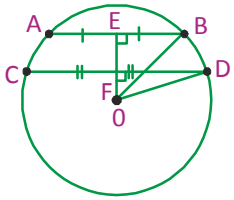
If S < 50° let S = 49°

49° + t = 130°

$\therefore$ t = 130° – 49° = 81°

$\therefore$ If S < 50° $\Rightarrow$ t > 80°

16. (B) AE = EB = $\frac{AB}{2} = \frac{12\ cm}{2}$ = 6 cm



$$CD = FD = \frac{CD}{2} = \frac{35cm}{2} = 17.5cm$$

Given EF = 11.5 cm

let OF – y cm & OB = OD = $x$cm

In ΔBOE, $\angle E = 90 \Rightarrow OB^2 = BE^2 + OE^2$

$x^2 = 6^2 + (11.5 + y)^2$ $\rightarrow$ (1)

In ΔDOF, $\angle F = 90° \Rightarrow OB^2 = DF^2 + OF^2$

$x^2 = (17.5)^2 + y^2$ $\rightarrow$ (2)

From (1) & (2) $6^2 + (11.5 + y)^2 = 17.5^2 + y^2$

$36 + 132.25 + 23y + \cancel{y^2} = 306.25 + \cancel{y^2}$

$23y = 306.25 - 36 - 132.25 = 138$

$y = \frac{138}{23} = 6$

If $y = 6$ then $x^2 = 17.5^2 + y^2 = 17.5^2 + 6^2$

$= 306.25 + 36$

$= 342.25$

Radius $(x) = \sqrt{342.25} = 18.5\text{cm}$

17. (D) Above X-axis ordinate is positive

18. (B) $x + y = 4$ is the required point

19. (A) Given $\frac{1}{x} + \frac{1}{y} = \frac{11}{24}$ & $xy = 24$

$\frac{x+y}{xy} = \frac{11}{24}$

$\frac{x+y}{24} = \frac{11}{24}$

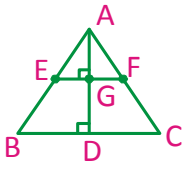
$\therefore x + y = \frac{11}{\cancel{24}} \times \cancel{24} = 11$

Sum of two number is 11 and their product is 24

$\therefore$ 8 + 3 = 11 & 8 × 3 = 24

20. (A) In ΔABC, AC = AB = 10 cm &

'D' is a midpoint of BC



$\therefore AD \perp BC$ & $EF \| BC$

$\therefore \angle G = 90°$ & $EF = \frac{BC}{2} = \frac{12\text{cm}}{2} = 6\text{cm}$

$EG = \frac{EF}{2} = \frac{6\text{cm}}{2} = 3\text{cm}$

In ΔAEG, $\angle G = 90° \Rightarrow AE^2 = AG^2 + EG^2$

$(5\text{cm})^2 = AG^2 + (3\text{cm})^2$

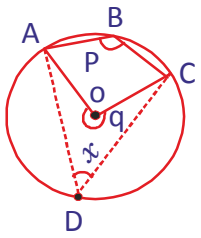
$25\text{cm}^2 - 9\text{cm}^2 = AG^2$

$AG = \sqrt{16\text{cm}^2} = 4\text{cm}$

DG = AG = 4cm

21. (A) const:- Notice 'D' on the maJor sector Join AD & DC

$\therefore$ x + P = 180°



$\therefore$ $x = 180° - P$ $\rightarrow$ (1)

But $2x = 360° - q$

$x = \frac{360° - q}{2} = 180° - \frac{q}{2}$ $\rightarrow$ (2)

From (1) & (2) $180° - p = 180° - \frac{q}{2}$

$\therefore \frac{q}{2} = P$

$\therefore q = 2P$

22. (D) From option $x = 5$ (OR)

Given $\left(\sqrt{3x+1} - \sqrt{2x-1}\right) = 1$

Squaring on both sides

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

$3x + \cancel{1} - 2\sqrt{6x^2 - x - 1} + 2x - \cancel{1} = 1$

$5x - 1 = 2\sqrt{6x^2 - x - 1}$

Squaring on both sides

$(5x)^2 - 2(5x)(1) + 1^2 = 4(6x^2 - x - 1)$

$25x^2 - 10x + 1 = 24x^2 - 4x - 4$

$25x^2 - 24x^2 - 10x + 4x + 1 + 4 = 0$

$x^2 - 6x + 5 = 0$

$x^2 - 5x - x + 5 = 0$

$x(x - 5) - 1(x - 5) = 0$

$(x - 5)(x - 1) = 0$

$\therefore$ $x = 5$ (or) 1

23. (B) Given $6x^2 = 1536\ cm^2$

$a^2 = \frac{1536}{6} cm^2 = 256\ cm^2$

$a^2 = (16cm)^2$

$a = 16\ cm$

Volume $= a^3 = (16cm)^3 = 4096\ cm^3$

24. (C) $(x^2 - 1)(x^4 + x^2 + 1) = (x^2 - 1)[(x^2)^2 + x^2(1) + 1^2]$

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

$= x^6 - 1$

25. (A) $x^3 = \left(\sqrt[3]{7+4\sqrt{3}}\right)^3 = 7+4\sqrt{3}$

$\therefore \frac{1}{x^3} = \frac{1}{7+4\sqrt{3}} = \frac{1}{7+4\sqrt{3}} \times \frac{7-4\sqrt{3}}{7-4\sqrt{3}} = \frac{7-4\sqrt{3}}{49-48}$

$= 7-4\sqrt{3}$

$\therefore x^3 + \frac{1}{x^3} = 7+4\sqrt{3}+7-4\sqrt{3} = 14$

PHYSICS

26. (A) In the figure shown, at point P_1 the kinetic energy of the planet is maximum as it has the least value of radius vector or a planet moves faster when it is closer to the sun and moves slowly when it is farther away from the sun. A planet does not move with constant speed around the sun.

27. (B) u = 0; m = 10 kg; t = 10 s

After the force ceases, the body covers 50 m in 5 s.

Therefore, the final velocity of the body,

$v = \frac{\text{Distance}}{\text{Time}} = \frac{50}{5} = 10\ m\ s^{-1}$

Now, v = u + at

$\therefore$ 10 = 0 + a × 10 or a = 1 m s^{-2}

Therefore, force applied on the body,

F = ma = 10 × 1 = 10 N

28. (B) Work done is the product of the applied force and the distance moved by the object in the direction of the force. When the object is at rest, there is no distance covered and therefore there is no work done.

29. (C) For the first 30 minutes, distance travelled

= 15 × 1800 = 27 000 m

For 20 minutes, distance travelled

= 25 × 1200 = 30 000 m

Total distance travelled = 27000 + 30000 = 57000 m

The total time taken = 1800 + 1200 + 120 = 3120 s

Average speed

$= \frac{\text{Total distance travelled}}{\text{Total time taken}} = \frac{57000}{3120} = 18.3\ m/s$

30. (C) The fuel inside the rocket burns and produces hot gases with high velocity that pass through the nozzle in the downward direction which react against the rocket and push it up in the opposite direction. Rocket works on the principle of action and reaction forces in accordance with the Law of Conservation of Momentum.

31. (D) Mass of the rice bag, (m) = 200 kg,

Potential energy, (P.E) = 9800 J

Height to which it should be raised, (h) = ?

$P.E = mgh \Rightarrow 9800 = 200 \times 9.8 \times h$

$\Rightarrow h = \frac{9800}{200 \times 9.8} \Rightarrow h = 5\ m$

The bag of rice should be raised to a height of 5 m

32. (D) Acceleration is the rate of change of velocity of a body. When a body is accelerating uniformly or with uniform acceleration along a straight road, its velocity is changing.

33. (B) $F = ma$, $m = 5$ kg, $a = 1$ m/s^2 = $F = 5 \times 1 = 5$ N

34. (B) To calculate the work done by a boy i.e. $W = F \times S$, force F or weight is known, displacement S in the case of straight line motion of bodies horizontally. In this case it is vertical displacement i.e., height is needed.

35. (A) $W = mg$

$500 = m(10)$

$m = 50$ kg

$W = mg = 50(4) = 200$ N

(Mass remains constant)

CHEMISTRY

36. (A) The number of moles of hydrogen gas = 2/2 = 1; and the number of moles of methane = 16/16 = 1. Therefore, the ratio of volumes is 1 : 1.

37. (D) $CaCO_3$ has three elements Ca – calcium, C – carbon and O – oxygen.

38. (D) No of moles of O_2 = 8/32 = 0.25. Number of atoms in O_2 sample = 2(0.25) = 0.5. As the number of moles of O atoms = number of mole of X atoms, No. of moles of X atoms = 0.5 =16/A_r of X. A_r of X = 16/0.5 = 32.

39. (D) Common salt, alum and potassium nitrate dissolve in water and do not form a residue.

40. (D) Statements (A), (B) and (C) are true about plasma state of matter.

41. (C) The molecular weights of H_2O, H_2S, CO_2 and SO_2 are 18, 34, 44 and 64 respectively. Hence, the increasing order of molecular weights is $H_2O < H_2S < CO_2 < SO_2$.

42. (D) Nitrogen and hydrogen, a gaseous mixture is difficult to separate as it has to be cooled to very low temperatures to convert them into liquids below their boiling points and then distilling them. Nitrogen and hydrogen mixture react to form ammonia. As chemical change took place it is most difficult to separate them.

43. (B) Relative molecular mass of Na_2CO_3

$= 23 \times 2 + 12 + 16 \times 3$

$= 46 + 12 + 48 = 106$

As 106 g of Na_2CO_3 contains 46 g of sodium,

$\therefore$ 100 " " $\frac{46 \times 100}{106}$

$= \frac{4600}{106} = 43.4$ g of Na

Similarly, 106 g Na_2CO_3 contains 12 g of carbon.

$\therefore 100$ " " $\frac{12 \times 100}{106} = \frac{1200}{106} = 11.3$ g of C

Again, 106 g of Na_2CO_3 contains 48 g of oxygen.

$\therefore 100$ " " $\frac{48 \times 100}{106} = \frac{4800}{106} = 45.3$ g of O

In Na_2CO_3 : Na = 43.4%, C = 11.3% and O = 45.3%

44. (D) Separation methods given in options (A), (B) and (C) are correct. Centrifugation method is used to separate cream from milk.

45. (B) Nitrate ion is NO^-_3. Hence, it is a monovalent ion.

Rest of them are divalent ions.

BIOLOGY

46. (A) (i) Nucleus contains chromosomes.

(ii) Chloroplast contains light trapping pigments called chlorophyll.

(iii) Mitochondrion contains respiratory enzymes.

(iv) Sap vacuole contain cell sap.

47. (B) Diseases that are present from birth are called congenital diseases. Congenital diseases are caused due to defective development of embryo or defective inheritance.

48. (C) Part labelled as (C) in the given diagram is xylem. Xylem is a water conducting tissue hence, it shows high concentration of red dye.

49. (D) Cells → Tissues → Organs → System → Multicellular organism

50. (C) X-Granulocytes and Y-Agranulocytes.

51. (A) The longest animal cell is nerve cell.

52. (A) The walls of xylem cells are lignified. Structure X is Lignin.

53. (C) Complex tissues are tissues that comprise different types of cells working together to perform a specific function. The leaf epidermis is a single layer comprising only a single type of cell - epidermal cells. The other three types of tissues comprise several types of cells. For instances, vascular tissue in plants is made up of phloem, cambium and xylem cells. Blood comprises of red blood cells, white blood cells, platelets and plasma.

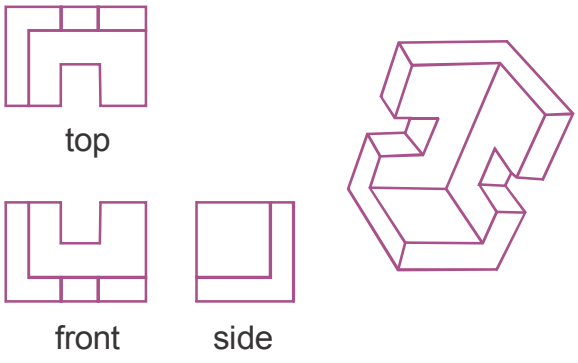
54. (B) Autolysis means self digestion.

55. (C) Development of the zygote into an embryo and replacement of worn-out muscle tissue involves mitosis.

CRITICAL THINKING

56. (A) The hour hand and the minute hand would make 90 degrees angle with each other 24 times in a day

57. (C)



58. (C) From the 1st statement: A > B, C

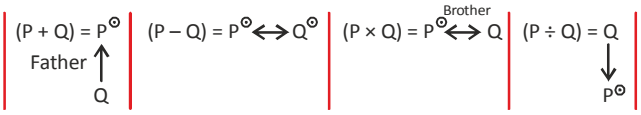
From the 2nd statement youngest

D < B, C

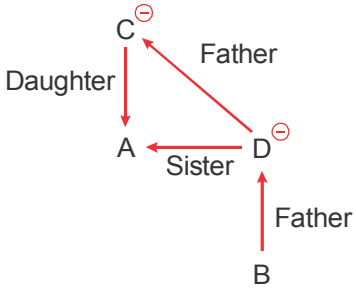
On combining them

A > B, C > D

59. (D) By decoding given information with symbols of family diagram, we get



From the given information with symbols of family diagram can be drawn



So, it is clear that A is the aunt of B.

60. (Deleted)