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NATIONAL LEVEL SCIENCE TALENT SEARCH EXAMINATION

CLASS - 9

Question Paper Code : 1O119

KEY

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

SOLUTIONS

MATHEMATICS

01. (A) $\left(\frac{2\sqrt{30}}{\sqrt{6}}-\frac{3\sqrt{140}}{\sqrt{28}}+\frac{\sqrt{55}}{\sqrt{99}}\right)$

Simplify each term

$\frac{\sqrt{30}}{\sqrt{6}}=\sqrt{\frac{30}{6}}=\sqrt{5}\Rightarrow 2\sqrt{5}$

$\frac{\sqrt{140}}{\sqrt{28}}=\sqrt{\frac{140}{28}}=\sqrt{5}\Rightarrow 3\sqrt{5}$

$\frac{\sqrt{55}}{\sqrt{99}}=\sqrt{\frac{55}{99}}=\sqrt{\frac{5}{9}}=\frac{\sqrt{5}}{3}$

Now, $2\sqrt{5}-3\sqrt{5}+\frac{\sqrt{5}}{3}$

$=-\sqrt{5}+\frac{\sqrt{5}}{3}$

$=\left(-1+\frac{1}{3}\right)\sqrt{5}=-\frac{2}{3}\sqrt{5}$

02. (C) Given $x = 7+4\sqrt{3}$

Since $xy = 1$, $y = \frac{1}{x} = 7-4\sqrt{3}$

$$\frac{1}{x^2}+\frac{1}{y^2} = x^2 + y^2$$

$$x^2 + y^2 = \left(7+4\sqrt{3}\right)^2 + \left(7-4\sqrt{3}\right)^2$$

$= 49 + 48 + 56\sqrt{3} + 49 + 48 - 56\sqrt{3}$

$= 194$

03. (A) $x^4 + 4 = (x^2)^2 + 2^2$

$=(x^2 + 2)^2 - 2 \times x^2 \times 2$

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

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

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

$$= 2 \times \frac{22}{7} \times 17.5\ (24 + 17.5)$$

$= 110 \times 41.5\ cm^2 = 4565\ cm^2$

04. (A) If divisible by $x + 1$, substituting $x = -1$ gives 0.

Steps: $(-1)^{140} + 2(-1)^{151} + k = 0$

$1 + 2(-1) + k = 0$ (since 140 is even, 151 is odd)

$1 - 2 + k = 0$

$-1 + k = 0$

$k = 1$

05. (C) Let angles be $2x$ and $3x$

$2x + 3x = 180$

$5x = 180$

$x = 36$

Larger angle = $3x = 108°$

06. (B) $\angle BOC = 2\angle BAC \Rightarrow \angle BOC + \angle BAC = 144°$

$2\angle BAC + \angle BAC = 144°$

$$\angle BAC = \frac{144°}{3} = 48°$$

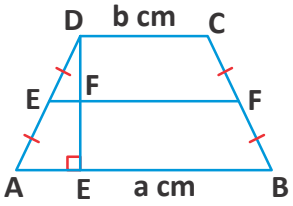
$\angle BOC = 2\angle BAC = 96°$

07. (A) In a parallelogram

opposite angles are equal and adjacent angles are supplimentary.

$\therefore$ Option 'A' is the vertices of a parallellogram

08. (B) Construction DE $\perp$ AB



$$EF = \frac{1}{2}(a + b)$$

and DF = FC = h

Area of the trapezium

$$ABFE = \frac{1}{2}\ h(EF + CD)$$

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

Area of the trapezium EFBA

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

Areas ratio of ABFE and EFBA

$$= \frac{1}{2}h\left(\frac{2b+a+b}{2}\right) : \frac{1}{2}h\left(\frac{2a+a+b}{2}\right)$$

$$= \left(\frac{a+3b}{2}\right) : \left(\frac{a+3b}{2}\right)$$

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

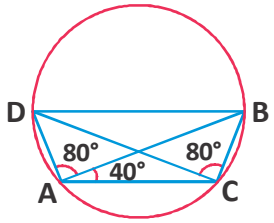
09. (D) Given $\pi r^2 h = 23.100\ cm^3$

$$\frac{22}{7} \times 17.5 \times h = 23{,}100\ cm^3$$

$$h = 23{,}100\ cm^3 \times \frac{1}{2.5} \times \frac{1}{22} \times \frac{1}{17.5}$$

$h = 24$ cm.

10. (B) Construction : Join AD



Proof :- $\angle BAD = \angle BCD = 80°$

[$\therefore$ angles in the same segment]

$\angle DAC = \angle BAD + \angle BAC = 80° + 40°$

$= 120°$

ACBD is a cyclic quadrilateral

$\therefore \angle DAC = \angle CBD = 180°$

$= 120° + \angle CBD = 180°$

$= \angle CBD = 180° - 120° = 60°$

11. (C) $2x^2 - 7x - 4 = 2x^2 - 8x + x - 4$

$= 2x(x - 4) + 1(x - 4)$

$= (2x + 1)(x - 4)$

$\therefore \sqrt{3x-3+2\sqrt{2x^2-7x-4}}$

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

$= \sqrt{\sqrt{(2x+1)^2}+\sqrt{(x-4)^2}+2\sqrt{2x+1}\sqrt{x-4}}$

$= \sqrt{\left(\sqrt{(2x+1)}+\sqrt{(x-4)}\right)^2}$

$= \left(\sqrt{2x+1}+\sqrt{x-4}\right)$

12. (C) The polynomial $f(x) = 2x^4 + 3x^3 + 2kx^2 + 3x + 6$ is divisible by $x + 2$.

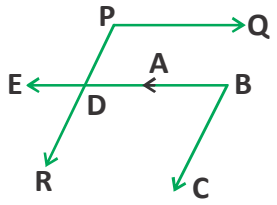
If $x + 2$ is a factor, then $f(-2) = 0$

$f(-2) = 2(-2)^4 + 3(-2)^3 + 2k(-2)^2 + 3(-2) + 6 = 32 - 24 + 8k - 6 + 6 = 8 + 8k$

$f(-2) = 0$:

$8 + 8k = 0 \Rightarrow 8k = -8 \Rightarrow k = -1$

13. (C) Construction :



Extend BA

upto E. It cuts RP at D.

proof : $PQ \parallel BE \Rightarrow \angle P + \angle PDB = 180°$.

$102° + \angle PDB = 180°$.

$\angle PDB = 180° - 102° = 78°$

$PR \parallel BC \Rightarrow \angle PDB = \angle B = 78°$

[$\therefore$ alternative angles]

14. (D) Simplify the first equation

$2m - n = 1$ (divide by 2)

From this

$n = 2m - 1$

Substitute into the second equation

$6m - 5(2m - 1) = 9$

$6m - 10m + 5 = 9$

$-4m = 4$

$m = -1$

Then, $n = 2(-1) - 1 = -3$

15. (B) Volume cone

$= \frac{1}{3}\pi r^2 h = \frac{1}{3}\pi(2.1)^2(8.4) = 12.344\pi$

Volume sphere : $\frac{4}{3}\pi R^3$

Set equal

$\frac{4}{3}\pi R^3 = 12.344\pi \Rightarrow R^3 = \frac{3}{4} \times 12.344$

$= 9.258 \Rightarrow R = \sqrt[3]{9.258} \approx 2.1$ cm

16. (C) $x^2 + x(c - b) + (c - a)(a - b) = x^2 + x(c - a + a - b) + (c - a)(a - b)$

$= x^2 + x[(c - a) + (a - b)] + (c - a)(c - b)$

$= x^2 + x(c - a) + x(a - b) + (c - a)(a - b)$

$= x(x + c - a) + (a - b)(x + c - a)$

$= (x + c - a)(x + a - b)$

17. (D) PQRS is the cyclic quadrilateral

$\therefore$ $\angle RSP = 180° - \angle PQR = 40°$

In ΔOSR, $OS = OR \Rightarrow \angle ORS = \angle RSO = 40°$

$\therefore x = \angle ORS + \angle RSO = 80°$

18. (C) Given $5x + 12x + 13x = 60$ cm

$30x = 60$ cm

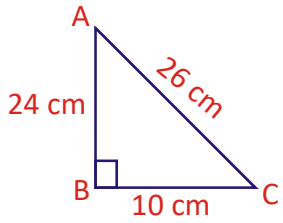
$$x = \frac{60\,cm}{30} = 2 \text{ cm}$$

$\therefore 5x = 5 \times 2$ cm $= 10$ cm, $12x$

$= 12 \times 2$ cm $= 24$ cm

and $13x = 13 \times 2$ cm $= 26$ cm

$24^2 + 10^2 = 576 + 100 = 676 = 26^2$



$\therefore$ 10 cm, 24 cm & 26 cm are the sides of a right angled triangle

Longest altitude is the perpendicular to the smallest side

$\therefore$ Longest altitude = 24 cm

19. (C) Given Diameter of sphere = side of cube = 7cm

$$\therefore \text{ Radius } = \frac{7}{2}cm$$

Volume of sphere

$$= \frac{4}{3}\pi r^3 = \frac{\cancel{4}^{2}}{3} \times \frac{\cancel{22}^{11}}{\cancel{7}} \times \frac{\cancel{7}}{\cancel{2}} \times \frac{7}{\cancel{2}_{1}} \times \frac{7}{\cancel{2}} cm^3$$

$= 179.67\ cm^3$

20. (C) Given $2\pi rh = 176\ cm^2$ &

$2\pi rh + 2\pi r^2 = 253\ cm^2$

$\therefore 176\ cm^2 + 2\pi r^2 = 253\ cm^2$

$2\pi r^2 = 253\ cm^2 - 176\ cm^2$

$$2 \times \frac{22}{7} \times r^2 = 77\ cm^2$$

$$r^2 = 77 cm^2 \times \frac{7}{2 \times 22} = \left(\frac{7}{2} cm\right)^2$$

$$\therefore r = \frac{7}{2} cm$$

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

$$h = \frac{176\ cm^2}{22\ cm}$$

$h = 8$ cm

Volume $= \pi r^2 h$

$$= \frac{22}{7} \times \frac{7}{2} \times \frac{7}{2} \times 8\ cm^3 = 308\ cm^3$$

21. (B) $60^2 + 11^2 = 3600 + 121 = 3721 = 61^2$

$\therefore$ Given sides form a right angled triangle

$\therefore$ Mid point of hypotenuse is circumradius

$$\therefore \text{ Radius } = \frac{61\,cm}{2} = 30.5\,cm$$

22. (A) Given in a quadrilateral ABCD

$\angle A + \angle C + \angle D = 360° - 90° = 270° \rightarrow (1)$

and $\angle A - \angle C - \angle D = 10° \rightarrow (2)$

equ (1) + (2)

$\Rightarrow 2\angle A = 270° + 10° = 280°$

$$\therefore \angle A = \frac{280°}{2} = 140°$$

$\angle C + \angle D = 130°$ & $\angle C - \angle D = 60°$

$\therefore$ $\angle C = 95°$ & $\angle D = 35°$

(or) Verify from options

23. (C) $$C = \left(180 \times \frac{1}{6}\right)^{\circ} = 30°$$

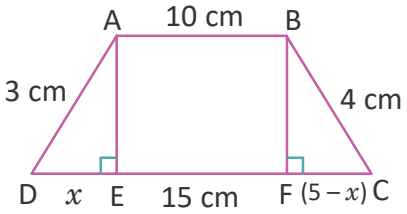
$\angle ACB + \angle ACD + \angle ECD = 180°$

[a straight angle]

$\Rightarrow 30° + 90° + \angle ECD = 180°$

$\Rightarrow \angle ECD = 60°$

24. (B)



Const : - AE $\perp$ CD and BF $\perp$ CD

Proof : - Let DE = x

EF = AB = 10cm $\Rightarrow$ FC = $5 - x$

In ΔADE, $AE^2 = 3^2 - x^2$

In ΔBCF, $BF^2 = 4^2 - (5 - x)^2$

But $AE^2 = BF^2$

$3^2 - x^2 = 4^2 - (5 - x)^2$

$9 - x^2 = 16 - (25 - 10x + x^2)$

$9 - x^2 = 16 - 25 + 10x - x^2$

$10x = 18$

$x = 1.8$

$AE^2 = 3^2 - 1.8^2 = 9 - 3.24 = 5.76$

$AE^2 = 5.76$

$AE = \sqrt{5.76}$

AE = 2.4 cm

Area of the trapezium

$$= \frac{1}{2} \times AE(AB + CD)$$

$$= \frac{1}{2} \times 2.4cm(10cm + 15cm) = 30\ cm^2$$

25. (C) Given $x - y = 14 \rightarrow (1)$

Given $x^2 - y^2 = 448$

$(x + y)(x - y) = 448$

$(x + y) \times 14 = 448$

$$x + y = \frac{448}{14} = 32$$

PHYSICS

26. (C) Since both covered same distance in same time, average speed = distance/ time $\rightarrow$ same regardless of changing speed profile.

27. (C) At the lowest point, the cord pulls up hard $\rightarrow$ tension > gravity, resulting in upward net force, reversing motion.

28. (C) Heating air lowers its density $\rightarrow$ total weight becomes less than buoyant force $\rightarrow$ balloon rises.

29. (C) In vacuum, no air resistance, so all objects fall with same acceleration due to gravity (g) $\rightarrow$ irrespective of mass.

30. (C) Lift does positive work (mgh); technician holds chest without displacement $\rightarrow$ zero mechanical work.

31. (C) Apparent weight = mg ± ma depending on direction $\rightarrow$ Upward acceleration increases net force $\rightarrow$ weight increases, and vice versa.

32. (C) As balls are tossed, reaction forces act on the hand $\rightarrow$ disturbing center of mass $\rightarrow$ increasing chance of fall.

33. (B) By stretching her limbs, she increases rotational inertia. To conserve angular momentum, rotational speed decreases — an application of Newton's 1st law in rotation.

34. (D) Density comparison with water decides sinking/floating. Cork floats $\rightarrow$ less dense; iron sinks $\rightarrow$ denser than water.

35. (A) Power = work/time. Work is done only while lifting; holding = zero displacement = zero power.

CHEMISTRY

36. (B) Number of molecules of MgO

$= 0.5 \times 6.022 \times 10^{23} = 3.011 \times 10^{23}$

37. (B) Shaving cream which produces foam is a colloid in which gas is dispersed in a liquid.

38. (C) The constituent particles of solids are closely packed and cannot be brought further nearer to each other. So, they cannot be compressed by applying external pressure.

39. (A) No. of atoms in 3 g of carbon = 0.25 × Avogadro's number.The Weight of calcium which contains the same as those in a 3 g carbon = 0.25 × GMW of Ca = 0.25 × 40 = 10 g

The number of atoms present in 3 grams(0.4 mole) of carbon is the same as in 10 g (0.4 moles) of calcium.

40. (D) Statements (A) and (B) are true.

The constituents of a compound cannot be separated easily.

41. (D) All the given statements are true of matter.

42. (C) Atomic weight of S = 32.06 a.m.u.

1 gram atomic weight of S = 32.06 g

$= 6.022 \times 10^{23}$ atoms of sulphur.

Number of atoms in 6.4 g of S

$$= \frac{6.4}{32.06} \times 6.022 \times 10^{23}$$

$= 1.2044 \times 10^{23}$ atoms

43. (D) The zig-zag motion exhibited by the particle is called Brownian motion.

44. (D) Rise in the temperature increases K.E. of the particles, due to this the particles vibrate more frequently. Hence, heat content of the body increases.

45. (B) Gram atomic weight of He = 4 g

Number of moles

$$= \frac{\text{Given weight of element}}{\text{Gramatomic weight}} = \frac{6.46\ \text{g}}{4.00\ \text{g/mol}}$$

= 1.615 moles

BIOLOGY

46. (A) 1-Q, 2-R, 3-P is correct because intercropping uses different nutrients, mixed cropping reduces crop failure risk, and crop rotation controls pests.

47. (A) I and II only. The plasma membrane is selectively permeable (I), controlling what enters and exits the cell. It also facilitates endocytosis and exocytosis (II). However, it does not control genetic functions, which are managed by the nucleus (III is incorrect).

48. (B) Ground tissue (parenchyma).

Parenchyma cells make up the cortical layer, providing flexibility and storing nutrients. They also assist in healing damaged tissues by supporting regeneration.

49. (C) (iii) and (iv)

Ribosomes help in manufacture of protein molecules and helps in the manufacturing of enzymes.

50. (C) Ligament connects bones at joints. It consists of yellow fibres they are strong and elestic.

51. (B) Connective tissue not only gives support to the animal body and protect them from pathogens but they also store food.

Callagen, adipose tissue, blood, cartilage and bones are the types of connective tissues found in animals.

52. (B) Soya beans are legumes. Legumes have root nodules which contain Rhizobium bacteria which fix atmospheric nitrogen in the soil to nitrates. This increases the nitrate content of the soil.

53. (B) 'Seeds' refers to eggs of fish.

54. (A) Growing two or more crops in definite row pattern is known as intercroping.

Intercroping seeds of two crops are not mixed and both the crops are harvested and threshed separately.

55. (C) Defeathering is the process of removing feathers after scalding, making the bird clean and ready for further processing and consumption.

CRITICAL THINKING

56. (B) Use the two fastest (daughter 1 min, son 2 min) to bring back the umbrella.

1. Daughter + Son go → 2 min

2. Daughter returns → 1 min (Total 3)

3. Father + Grandfather go → 10 min (Total 13)

4. Son returns → 2 min (Total 15)

5. Daughter + Son go → 2 min

Total time = 17 minutes

57. (C) Bowl 1: 1 sweet (equals the number of bowls with 1 sweet)

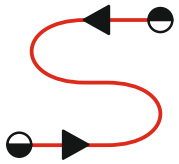
Bowl 2: 0 sweets (equals the number of bowls with 2 sweets)

Bowl 3: 0 sweets (equals the number of bowls with 3 sweets)

Bowl 4: 3 sweets (equals the number of bowls with 0 sweets, which are bowls 2, 3, and 4)

Total = 1 + 0 + 0 + 3 = 4

58. (D)



59. (B) If it is windy and Arjun does not go hunting, then it is not snowing.

60. (C) Dates of Tuesdays are 7 days apart, so their parity alternates (even, odd, even…).

To have three even Tuesdays, the month must have 5 Tuesdays, with the first Tuesday on an even date → it must be 2nd.

So the 1st is Monday.

The 21st is 20 days after Monday → Sunday.