UNIFIED COUNCIL
Foundation for Success

UNIFIED COUNCIL OLYMPIADS

nstse
Test • Assess • Achieve

NATIONAL LEVEL SCIENCE TALENT SEARCH EXAMINATION

CLASS - 9

Question Paper Code : 1P114

KEY

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

SOLUTIONS

MATHEMATICS

01. (C) $\sqrt{21-4\sqrt{5}+8\sqrt{3}-4\sqrt{15}}$

$= \sqrt{21-2\times 2\sqrt{5}+2\times 4\sqrt{3}-2\times 2\sqrt{5}}$

$= \sqrt{21-2\times\sqrt{4}\times\sqrt{5}+2\times\sqrt{4}\times\sqrt{12}-2\sqrt{5}\times\sqrt{12}}$

$= \sqrt{12+4+5-2\sqrt{4}\times\sqrt{5}+2\sqrt{4}\times\sqrt{12}-2\sqrt{5}\times\sqrt{12}}$

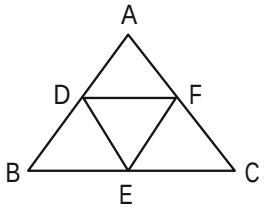
$= \sqrt{\left(\sqrt{12}\right)^2+\left(\sqrt{4}\right)^2+\left(\sqrt{5}\right)^2-2\sqrt{4}\times\sqrt{5}+2\sqrt{4}\times\sqrt{12}-2\sqrt{5}\times\sqrt{12}}$

$= \sqrt{\left(\sqrt{12}+\sqrt{4}-\sqrt{5}\right)^2} = \left(2\sqrt{3}+2-\sqrt{5}\right)$

02. (C) Given AB = c = 61 cm, BC = a = 100 cm and CA = b = 91 cm.

$\therefore \quad s = \frac{a+b+c}{2} = \frac{(61+100+91)\text{ cm}}{2}$

$= \frac{252\text{ cm}}{2} = 126\text{ cm}$



Area of $\Delta ABC = \sqrt{s(s-a)(s-b)(s-c)}$

$= \sqrt{126 \times 65 \times 26 \times 35}$ cm2

$= \sqrt{7 \times 9 \times 2 \times 13 \times 5 \times 2 \times 13 \times 7 \times 5}$ cm2

$= 7 \times 3 \times 2 \times 13 \times 5$ cm2

$= 2730$ cm2

Area of $\Delta DEF = \frac{\text{Area of } \Delta ABC}{4}$

$= \frac{2730 \text{ cm}^2}{4} = 682.5 \text{ cm}^2$

03. (B) Given $p(x) = 2x^4 - 5x^2 + 5x - 2$

$p(-2) = 2(-2)^4 - 5(-2)^2 + 5(-2) - 2$

$= 32 - 20 - 10 - 2$

$p(-2) = 0 \Rightarrow (x + 2)$ is a factor of $p(x)$

04. (D) In ΔPQR, $\angle P + 60° + 70° = 180°$

$\angle p = 180° - 130°$

$\Rightarrow \angle p = 50°$

In ΔABC and ΔRPQ

$\angle A = \angle R = 70°$ ($\because$ angle)

AB = PR = 6.5 cm ($\because$ side)

$\angle B = \angle p = 50°$ ($\because$ Angle)

$\therefore$ $\Delta ABC \cong RPQ$ ($\because$ ASA congruency)

05. (B) $(2x - 10) + (x - 5) = 90$

$3x - 15 = 90$

$3x = 105$

$x = 35°$

06. (D) Given

If $x = k + 1$, $y = 2k - 1$ is a solution of $3x - 2y + 7 = 0$.

Step 1 : Substitute x and y

$3(k + 1) - 2(2k - 1) + 7 = 0$

$3k + 3 - 4k + 2 + 7 = 0$

$-k + 12 = 0$

$k = 12$

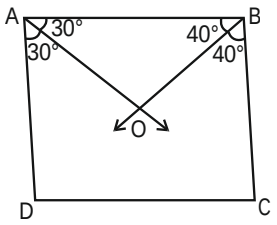
07. (C) Since y-coordinates are equal

$|7 - (-5)| = 12$ units

08. (C) Given $\angle A : \angle B : \angle C : \angle D = 3 : 4 : 4 : 7 = 3x : 4x : 4x : 7x$

But in a quadrilateral $\angle A + \angle B + \angle C + \angle D = 360°$

$3x + 4x + 4x + 7x = 360°$



$18x = 360°$

$x = \frac{360°}{18} = 20°$

$\angle A = 3x = 60°$ & $B = 4x = 4 \times 20° = 80°$

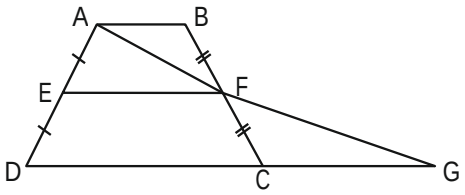
$\Rightarrow \frac{\angle B}{2} = 40°$

$\therefore$ $\frac{\angle A}{2} = \frac{60°}{2} = 30$

In ΔAOB, $30° + \angle AOB + 40° = 180°$

$\angle AOB = 180° - 70° = 110°$

09. (C) Construction: Join AF. Extend AF up to G such that CD meets (Extention at G).



In ΔAFB and ΔGFC

$\angle AFB = \angle GFC$ ($\because$ Vertically opposite angles)

FB = FC ($\because$ side & given)

$\angle ABC = \angle FCG$($\because$ alternative angles)

$\therefore$ $\Delta AFB \cong \Delta GFC$ ($\because$ ASA congruency)

$\therefore$ AF = FG and AB = CG

In ΔADG, AE = ED and AF = FG $\Rightarrow$ EF || DG

and $EF = \frac{1}{2} GD$

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

$= \frac{1}{2}(AB + CD)$ [$\because$ CG = AB]

10. (D) Given D = 4.5 cm $\Rightarrow R = \frac{D}{2} = 2.25$ cm = $\frac{9}{4}$ cm.

Given d = 4 cm $\Rightarrow r = \frac{d}{2} = 2$ cm.

Volume of the hollow pipe = $p(R^2 - r^2)h$

$= \frac{22}{7}\left[\left(\frac{9}{4}\right)^2 - 2^2\right] \times 7 \times 11 \text{ cm}^3$

$= 22 \times 11\left(\frac{81}{16} - 4\right) \text{ cm}^3$

$= 242\left(\frac{81 - 64}{16}\right) \text{ cm}^3$

$= \frac{121 \times 17}{8} \text{ cm}^3$

Weight = Volume × density

$= \frac{2057}{8} \text{ cm}^3 \times \frac{8 \text{ g}}{\text{cm}^3}$

= 2057 g

= 2.057 kg

11. (B) In a cyclic quadrilateral ABCD

$\angle D + \angle B = 180°$

$120° + \angle B = 180°$

$\angle B = 180° - 120° = 60°$

In ΔABC, $\angle ACB = 90°$

($\because$ Angle in a semicircle)

In ΔABC $60° + 90° + \angle BAC = 180°$

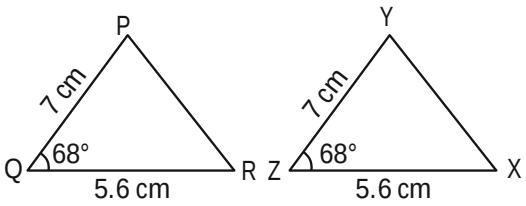
$\angle BAC = 180° - 150°$

$\angle BAC = 30°$

12. (C) Option (C) is correct.

13. (B) By CPCT.

DPQR DYZX [SAS congruency]



14. (B) Given HF || AD $\Rightarrow \angle ADF = \angle HFC = 28°$ [$\because$ corresponding angles]

But $\angle ADF + \angle FDE + \angle EDB = 180°$ [$\because$ straight angle]

$28° + \angle FDE + 72° = 180°$

$\angle FDE = 180° - 100° = 80°$

$\angle CFG = \angle FDE = 80°$ [$\because$ corresponding angles]

15. (B) Add the two equations

$(x + y)(x - y) = 7 + 1$

$2x = 8$

$\therefore \quad x = \frac{8}{2} = 4$

16. (D) Given diameter of sphere = Side of the cube

$\therefore$ d = s

Volumes ratio of sphere and cube= $\frac{4}{3}\pi r^3 = 8^3$

$= \frac{4}{3} \times \frac{22}{7} \times \frac{3}{8} = 8$

$= \frac{11}{21} : 1$

$= \frac{11}{21} \times 21 : 1 \times 21$

= 11 : 21

17. (B) Given $x+\frac{1}{x}=5.2 \;=5+0.2=5+\frac{1}{5}$

$\therefore x=5 \Rightarrow x^3+\frac{1}{x^3}=5^3+\frac{1}{5^3}$

$=125+\frac{1}{125}=125.008$

(OR)

Given $x+\frac{1}{x}=\frac{52}{10}=\frac{26}{5}$

Cubing on both sides

$\left(x+\frac{1}{x}\right)^3=5.2^3$

$x^3+\frac{1}{x^3}+3x\times\frac{1}{x}\left(x+\frac{1}{x}\right)=140.608$

$x^3+\frac{1}{x^3}+3(5.2)=140.608$

$x^3+\frac{1}{x^3}=140.608-15.6=125.008$

18. (B) $\frac{\sqrt[6]{36}}{\sqrt[3]{3}}=\frac{\sqrt[6]{36}}{\sqrt[6]{3^2}}=\sqrt[6]{\frac{36^4}{9^4}}=\sqrt[6]{4}=\sqrt[6]{2^2}=\sqrt[3]{2}$

19. (C) $p^3(q-r)^3+q^3(r-p)^3+r^3(p-q)^3$

$=[p(q-r)]^3+[q(r-p)]^3+[r(p-q)]^3$

$=(pq-pr)^3+(qr-pq)^3+(pr-qr)^3$

Let $a = pq - pr$, $b = qr - pq$ and $c = pr - qr$

$\therefore$ $a + b + c = pq - pr + qr - pq + pr - qr = 0$

$\therefore$ $a^3 + b^3 + c^3 = 3abc$

$\therefore$ $p^3(q-r)^3+q^3(r-p)^3+r^3(p-q)^3 = 3pqr$

$(p - r)(q - r)(r - p)$

20. (B) Given $\frac{x+y}{\sqrt{xy}}=\frac{10}{3}$

$\Rightarrow\frac{10}{\sqrt{xy}}=\frac{10}{3}\Rightarrow\sqrt{xy}=3$ [$\because$ Given $x + y = 10$]

$\therefore xy = 9$

$(x-y)^2 = (x+y)^2 - 4xy = (10)^2 - 4 \times 9$

$= 100 - 36$

$x - y = \pm\sqrt{64}$

$x - y = \pm 8$

21. (D) TSA $= 2\pi r(r + h)$

$220 = 2 \times \frac{22}{7} \times r\left(r+\frac{13}{2}\right)$

$\left[\text{since, } h = 6.5 = \frac{13}{2}\right]$

$\Rightarrow 2r^2 + 13r - 70 = 0$

$\Rightarrow 2r^2 + 20r - 7r - 70 = 0$

$\Rightarrow 2r(r + 10) - 7(r + 10) = 0$

$\Rightarrow r = -10, \frac{7}{2}$

since radius cannot be -ve,

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

$\Rightarrow r = \frac{7}{2}$

$\therefore V = \pi r^2 h$

$=\frac{22}{7}\times\left(\frac{7}{2}\right)^2\times\frac{13}{2}$

$= 250.25 \text{ cm}^3$

Hence volume of the cylinder $= 250.25 \text{ cm}^3$.

22. (D) $\frac{x^4-y^4}{x+y}=\frac{\left(x^2\right)^2-\left(y^2\right)^2}{(x+y)}$

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

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

$= (x^3 + xy^2 - x^2y - y^3)$

23. (D) $12x^2 - 5x - 28 = 0$

$12x^2 - 21x + 16x - 28 = 0$

$3x(4x - 7) + 4(4x - 7) = 0$

$(4x - 7)(3x + 4) = 0$

$\frac{7}{4}$ & $\frac{-4}{3}$ are the zeros of P(x)

$\therefore \quad P = \frac{7}{4}$ & $q = \frac{-4}{3}$

$pq = \frac{7}{4} \times \frac{-4}{3} = \frac{-7}{3}$

24. (D) Given a = 56 cm, b = 61 cm and c = 75 cm

$$s = \frac{a + b + c}{2} = \frac{56\text{ cm} + 61\text{ cm} + 75\text{ cm}}{2}$$

$$= \frac{192\text{ cm}}{2} = 96\text{ cm}$$

Area of the triangle = $\sqrt{s(s-a)(s-b)(s-c)}$

$= \sqrt{96 \times 40 \times 35 \times 21}\ \text{cm}^2$

$= \sqrt{4^2 \times 3 \times 2 \times 2^2 \times 5 \times 2 \times 7 \times 5 \times 7 \times 3}\ \text{cm}^2$

$= 4 \times 3 \times 2 \times 2 \times 5 \times 7\ \text{cm}^2$

$= 1680\ \text{cm}^2$

25. (C) $\angle BAC = 90°$ (Angle in a semicircle)

Given $\angle D = 90 \Rightarrow AC \parallel DO$

In ΔABC, BO = OC and OD || AC $\Rightarrow$ BD = DA

In ΔABC, BD = DA and BO = OC $\Rightarrow$ DO = $\frac{1}{2}AC$

$7.5\text{ cm} = \frac{1}{2}AC$

$AC = 2 \times 7.5\text{ cm} = 15\text{ cm}$

PHYSICS

26. (A) Displacement = $100\sqrt{2}$ meters; Distance = $100\sqrt{2}$ meters; Ratio = 1:1

Given:Side of the square park = 100 m

Time taken = 2 minutes

Distance travelled: Since you walk along the diagonal, the distance travelled equals the diagonal of the square.

Distance = $\sqrt{(100)^2 + (100)^2} = \sqrt{20000} = 141.4\text{ m}$

Displacement: Because the motion is along a straight line from one corner to the opposite corner,

Displacement = Distance = 141.4 m

Ratio of displacement to distance:

$\text{Ratio} = \frac{141.4}{141.4} = 1$

Final Answer: Distance = 141.4 m

Displacement = 141.4 m

Ratio of displacement to distance = 1 : 1

27. (C) When the performer tilts slightly, gravity produces a torque trying to rotate the performer further.

The long pole distributes mass farther from the rotation axis $\rightarrow$ increases moment of inertia (I).

From Newton's Second Law for Rotation, $\tau = I\alpha$, so for the same torque τ, a larger Igives smaller angular acceleration (α).

Thus, the pole slows down tipping and gives more time to correct balance $\rightarrow$ dynamic equilibrium maintained.

28. (B) Turning point on top; acceleration $\neq 0$

Here's why this is the correct answer:

1. Instantaneous Velocity is Zero: At the very peak of the U-turn (i.e., at the turning point), the biker momentarily changes direction from moving

upwards to moving downwards.

At this point, the vertical component of the velocity is zero because, for an instant, the biker is not moving up or down—they have momentarily stopped in the vertical direction before reversing.

This is why the instantaneous velocity at the turning point is zero.

2. Acceleration is Not Zero: Although the instantaneous velocity is zero, the biker is still following a curved path (the arc of the U-turn).

- To maintain this curved motion, a net force must act on the biker, which causes a centripetal acceleration. This acceleration points towards the center of the curve (in this case, downwards) and is required to change the direction of the biker's velocity.
- Gravity also acts on the biker at all times, adding to the net acceleration. The biker doesn't just stop at the turning point—they experience an acceleration due to gravity and centripetal acceleration, so the acceleration is not zero.

29. (C) The correct answer is: (B) Apparent weight changes due to acceleration.

When the lift rises, it accelerates upward, making you feel heavier.

When the lift descends, it accelerates downward, making you feel lighter.

This is due to changes in the normal force (apparent weight) caused by the lift's acceleration.

30. (D) $v_A = 40\ km\ h^{-1}$, $v_B = 20\ km\ h^{-1}$

Steps:

1. Velocity from a displacement-time graph:

Velocity is the slope of the displacement-time graph.

The slope of a straight line is calculated as the change in displacement divided by the change in time, i.e.,

$$v = \frac{\Delta \text{ displacement}}{\Delta \text{ time}}$$

2. Car A (line A):

From the graph, the line for car A has a slope of $\frac{160\ km - 0\ km}{4\ h - 0\ h}$

$= \frac{160\ km}{4\ h} = 40\ km/h$.

So, the velocity of car A is 40 km/h" .

Car B (line B):

From the graph, the line for car B has a slope of

$$\frac{80\ km - 0\ km}{4\ h - 0\ h} = \frac{80\ km}{4\ h} = 20\ km/h$$

So, the velocity of car B is 20" km/h" .

Conclusion: The velocities of car A and car B are 40 km/h and 20 km/h, respectively.

Thus, the correct answer is: (D) vA = 40 km/h, vB = 20 km/h.

31. (C) Upthrust (buoyant force) partially opposes her weight.

The buoyant force exerted by the water opposes the diver's weight, making her feel lighter underwater. This reduces her apparent weight, but her actual weight remains the same.

32. (A) The correct answer is (A) Straight increasing line.

Power is constant, meaning the rate of change of kinetic energy is constant.

Integrating the equation $P = \frac{d(KE)}{dt}$ gives $KE(t) = P \cdot t + KE(0)$, showing that kinetic energy increases linearly with time.

The velocity doubling every 5 seconds does not affect the constant power-kinetic energy relationship.

Thus, the graph of kinetic energy vs. time is a straight increasing line.

33. (B) This matches option (B).

1. Work done in lifting the weight

$W = mgh = 100 \times 9.8 \times 2 = 1960$ J

2. Average power

$$P = \frac{W}{t} = \frac{1960\ J}{5\ s} = 392\ W$$

So, the correct answer is: (B) 392 W

34. (B) Float, because its density is less than water

Short Explanation: The density of the body is 800 kg/m³.

The density of water is 1000 kg/m³.

A body with a density less than the fluid it is placed in will float because the upthrust (buoyant force) is greater than its weight.

So, since 800 < 1000, the body will float.

35. (C) The coin's inertia prevents it from immediately following the card's motion.

This phenomenon is a classic demonstration of Newton's First Law of Motion, often referred to as the Law of Inertia. It states:

"An object at rest will remain at rest, and an object in motion will remain in motion at a constant velocity unless acted upon by an unbalanced external force."

In the experiment: Setup: A coin is placed on a card, which is positioned over the opening of a glass.

Action: When the card is pulled quickly, the coin tends to stay in its initial position due to its inertia.

Result: The card moves away, but the coin remains momentarily stationary and then falls straight down into the glass due to gravity.

This behaviour occurs because the coin resists the change in motion imparted by the sudden pull of the card. The force applied to the card does not immediately affect the coin, causing it to remain at rest relative to its initial position. Only after the card has moved away does gravity act on the coin, causing it to fall vertically into the glass.

CHEMISTRY

36. (D) Weight of 1 molecule of H_2O

$$= \frac{\text{Gram molecular weight of } H_2O}{\text{Avogadro's number}}$$

$$= \frac{18}{6.023 \times 10^{23}} = 2.988 \times 10^{-23}\ g$$

37. (A) As X and Y can be separated by a magnet so X, Y are solids. Y, Z can be separated by distillation method so, Y, Z must be a solid-liquid mixture. Already we know that,Y is a solid. Hence, Z is a liquid. So, X and Y are solids and Y is a liquid.

38. (A) In liquids, particles have greater intermolecular spaces compared to those of solids. Hence, a small amount of sugar or salt, when added to the water will occupy the space available in between the particles of the liquid.

Hence, we do not observe any change in the volume.

39. (D) The molecular mass of HNO_3 = the atomic mass of H + the atomic mass of N+ 3 × the atomic mass of O.

= 1 + 14 + 48 = 63 u

40. (B) An emulsion is a type of colloidal solution of a liquid dispersed in another liquid which is not miscible with it.

Ex: milk , face cream, etc.

41. (B) The water molecule 'X' at the surface can easily escape to form water vapour.

42. (B) All pure samples of water contain hydrogen and oxygen in fixed mass ratio of 1 : 8.

This is in agreement with the law of constant or definite proportion.

43. (D) Mixture in a combination of two or more different substances not bound chemically. Crushing of a marble tile

into small particles, breaking of ice cubes into small pieces and powdering of rock crystals involve a charge of same solid into smaller particles, pieces or powder to which there is no addition of another substance. Hence, they are not mixture.

Addition of milk into water results in the formation of a mixture.

44. (C) The experiment was not a fair one as the amount of water taken in the four containers was different.

45. (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 $H_2O < H_2S < CO_2 < SO_2$.

BIOLOGY

46. (C) Mitochondrion

Mitochondria are double-membraned organelles with their own DNA, enabling self-replication. They are responsible for energy production in the form of ATP through cellular respiration, making them essential for cellular energy release.

47. (B) Chromoplast – Provides pigmentation to attract pollinators and aid seed dispersal

Chromoplasts are plastids that store pigments, giving color to fruits and flowers. This color attracts pollinators and aids in seed dispersal. They do not perform photosynthesis, unlike chloroplasts.

48. (B) Nervous tissue quickly detects the heat and triggers a reflex action, sending signals to muscles before the brain senses the pain.

49. (A) Nitrogen is essential for healthy leaf growth and green color. Deficiency causes pale leaves and stunted growth. Applying urea, a nitrogen-rich fertilizer, helps restore these symptoms.

50. (D) The muscles that are not found in the heart and not attached to the skeletal system are called smooth muscles.

Smooth muscles are present in the iris of eye, uterus and bronchi.

51. (A) RBCs are produced in the bone marrow and the process is called erythropoesis.

52. (B) Collenchyma cells have thickened, flexible cell walls that allow the young stem to bend without breaking and recover from minor injuries, making them ideal for mechanical support in growing parts of plants.

53. (A) A-2, B-1, C-3

Muscle cells have contractile proteins for contraction (A-2).

Nerve cells have long extensions (axons) for signal transmission (B-1).

Sperm cells have a tail (flagellum) for movement (C-3).

54. (C) Lenticels are small, porous openings in the bark of woody stems that allow direct gas exchange between internal tissues and the atmosphere. They help the plant take in oxygen and release carbon dioxide.

55. (B) The practice of growing a legume followed by a non-legume on the same field is called crop rotation.

Growing same crop in given field reduces fertility of a field. Hence crop rotation method should be adopted.

The process of growing different crops preferably a leguminous crops in between raising of two similar crops is called rotation of crops.

CRITICAL THINKING

56. (B) Tina had the pen but wanted the ball ? she gets ball.

Suresh gets pen, Biju gets book.

57. (A) Lower gear will turn in the direction along P.

58. (B) ~~KNOWLEDGE~~

59. (B) Three person lives between I and M.

Floor	Person
7	I
6	L
5	N
4	K
3	M
2	J
1	O

60. (C) The dot in the question figure is placed in the region common to the tilted square and the larger circle, but outside the smaller circle that is inside the square.

In option (C), the smaller circle is concentric with the large circle, and both are inside the square. The region that is common to the square and the large circle is the large circle itself, and it is entirely outside the smaller circle. Thus, a dot can be placed in the required region in option (C). This condition cannot be met in options (A), (B), or (D) due to the relative positions and overlaps of the shapes.