



UNIFIED COUNCIL

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NATIONAL LEVEL SCIENCE TALENT SEARCH EXAMINATION (UPDATED)

CLASS - 9

Question Paper Code : **UN449**

KEY

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

SOLUTIONS

MATHEMATICS

$$\begin{aligned}
 1. \quad (C) \quad & \sqrt[4]{193 - 4\sqrt{2178}} = \sqrt[4]{193 - 4\sqrt{1089 \times 2}} \\
 & = \sqrt[4]{121 + 72 - 33 \times 4\sqrt{2}} \\
 & = \sqrt[4]{121 + 72 - 132\sqrt{2}} \\
 & = \sqrt[4]{11^2 + (6\sqrt{2})^2 - 2(11)(6\sqrt{2})} \\
 & = \sqrt[4]{(11 - 6\sqrt{2})^2} \\
 & = \sqrt{9 + 2 - 2\sqrt{9 \times 2}} \\
 & = \sqrt{3^2 + (\sqrt{2})^2 - 2 \times 3 \times \sqrt{2}}
 \end{aligned}$$

$$= \sqrt{(3 - \sqrt{2})^2}$$

$$\sqrt[4]{193 - 4\sqrt{2178}} = (3 - \sqrt{2})$$

$$\begin{aligned}
 2. \quad (B) \quad & \text{LHS} = \sqrt{\sqrt{3} - \sqrt{4 - \sqrt{5}} - \sqrt{12 + 5 - 2\sqrt{12} \times \sqrt{5}}} \\
 & = \sqrt{\sqrt{3} - \sqrt{4 - \sqrt{5}} - \sqrt{(\sqrt{12} - \sqrt{5})^2}} \\
 & = \sqrt{\sqrt{3} - \sqrt{4 - \sqrt{5}} - (\sqrt{12} - \sqrt{5})} \\
 & = \sqrt{\sqrt{3} - \sqrt{4 - \sqrt{5}} - \sqrt{12} + \sqrt{5}} \\
 & = \sqrt{\sqrt{3} - \sqrt{4 - \sqrt{12}}}
 \end{aligned}$$

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

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

$$= \sqrt{1} = 1$$

3. (A) The remainder when $f(x)$ is divided by $(x-1)(x+1)$ is of the form $ax + b$.

$$\therefore f(x) = Q(x) \cdot (x-1)(x+1) + (ax + b)$$

From the given condition $f(1) = 6$,

$$f(-1) = 8$$

$$\Rightarrow a + b = 6 \dots (1), -a + b = 8 \dots (2)$$

From (1) and (2), we get $b = 7, a = -1$

Required remainder = $7 - x$.

4. (A) P lies $x = -5$ line & $y = 1$ line

$$\therefore P = (-5, 1)$$

5. (A) Given $x^2 + x + 1 = 0$

$$\frac{x^2}{x} + \frac{x}{x} + \frac{1}{x} = 0$$

$$x + 1 + \frac{1}{x} = 0$$

$$x + \frac{1}{x} = -1$$

cubing on both sides

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

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

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

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

cubing in both sides

$$\left(x^3 + \frac{1}{x^3}\right)^3 = 8.$$

(OR) Given $x^2 + x + 1 = 0$

$$(x-1)(x^2 + x + 1) = 0 \quad (x-1)$$

$$x^3 - 1^3 = 0 \Rightarrow x^3 = 1$$

$$\therefore \left(x^3 + \frac{1}{x^3}\right)^3 = \left(1 + \frac{1}{1}\right)^3 = 2^3 = 8$$

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6. (A) Given $14x + 19x + 21x + 13x = 360^\circ$

$$72x = 360^\circ$$

$$x = 5^\circ \Rightarrow 18x = 18 \times 5^\circ = 90^\circ$$

7. (C) $x + y = 2xy \rightarrow (1)$

$$x - y = 6xy \rightarrow (2)$$

$$\text{eq (1) + (2)} \Rightarrow 2x = 8xy$$

$$\Rightarrow y = \frac{1}{4}$$

$$x + \frac{1}{4} = 2x \times \frac{1}{4}$$

$$x + \frac{1}{4} = \frac{x}{2}$$

$$\frac{x}{2} = -\frac{1}{4}$$

$$x = -\frac{1}{2}$$

8. (D) Const:- Join CM

$$\text{Area of } \triangle BCM = \frac{1}{2} \text{ area of } \triangle ABC$$

[A median divides the triangle into two triangles of equal area]

$$\text{Area of } \triangle BDM + \text{area of } \triangle MDC$$

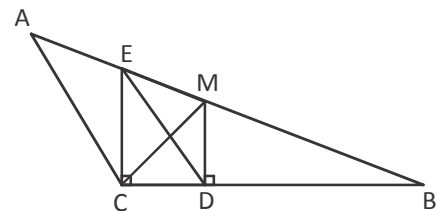
$$= 18 \text{ cm}^2$$

$$\Rightarrow \text{Arera of } \triangle BDM + \text{area of } \triangle MDE$$

$$= 18 \text{ cm}^2$$

[Triangles lie between same parallel lines having common base are equal in area]

$$\Rightarrow \text{Area of } \triangle BDE = 18 \text{ cm}^2$$



9. (C) Given $6a^2 = 216 \text{ cm}^2$

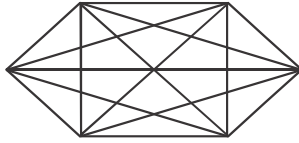
$$a = 6 \text{ cm}$$

$$\text{Volume of each cube} = a^3 = 216 \text{ cm}^3$$

$$\text{Volume of 16 cubes} = 3456 \text{ cm}^3.$$

10. (D) Number of diagonals

$$= \frac{n(n-3)}{2} = \frac{6 \times 3}{2} = 9 \quad (\text{OR})$$



11. (B) Given $x + y = 14$

$$\text{Given } \frac{1}{x} + \frac{1}{y} = \frac{7}{24}$$

$$\frac{x+y}{xy} = \frac{7}{24}$$

$$\frac{14}{xy} = \frac{7}{24} \Rightarrow xy = 48$$

$$8 + 6 = 14 \text{ \& } 8 \times 6 = 48$$

\therefore Biggest number = 8.

12. (D) Let total cows be 'x'

$$\frac{x}{4} + 2\sqrt{x} + 15 = x$$

$$2\sqrt{x} + 15 = \frac{3x}{4}$$

$$2\sqrt{x} = \frac{3x}{4} - 15$$

squaring on both sides

$$4x = \frac{9x^2}{16} + 225 - \frac{45x}{2}$$

$$4x = \frac{9x^2 + 3600 - 360x}{16}$$

$$64x = 9x^2 + 3600 - 360x$$

$$9x^2 - 424x + 3600 = 0$$

$$9x^2 - 324x - 100x + 3600 = 0$$

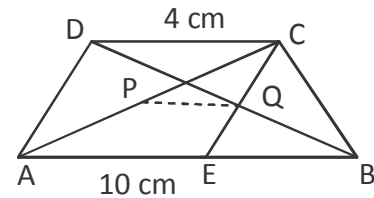
$$9x(x-36) - 100(x-36) = 0$$

$$(x-36)(9x-100) = 0$$

$$x = 36 \quad (\text{or}) \quad x = \frac{100}{9}$$

$$(\text{OR}) \quad \frac{36}{4} + 2\sqrt{36} + 15 = 9 + 12 + 15 = 36$$

13. (D)



Const: Draw CE through E

Proof: In $\triangle DCQ$ and $\triangle BEQ$

$$\angle CDQ = \angle QBE \quad (\text{Alternative angle})$$

$\overline{DQ} = \overline{QB}$ CQ is mid point of BD and side)

$\angle DCQ = \angle BQE$ (Vertically opposite angles)

$$\therefore \triangle DCQ \cong \triangle BEQ \quad (\because \text{ASA congruency})$$

$$\therefore CQ = QE \quad [\because \text{CPCT}]$$

In $\triangle ACE$, P and Q are mid points of AC and CE respectively.

$$PQ = \frac{1}{2} AE = \frac{1}{2} (AB - EB)$$

$$= \frac{1}{2} (AB - CD)$$

$$= \frac{1}{2} (10\text{cm} - 4\text{ cm})$$

$$= \frac{1}{2} \times 6\text{ cm}$$

$$PQ = 3\text{cm}$$

14. (C) Given $f(x) = x^{2018} - y^{2018}$

$$f(y) = y^{2018} - y^{2018}$$

$$f(y) = 0 \Rightarrow (x-y) \text{ is a factor of } f(x)$$

$$f(-y) = (-y)^{2018} - y^{2018}$$

$$= y^{2018} - y^{2018}$$

$$f(-y) = 0 \Rightarrow (x+y) \text{ is a factor of } f(x)$$

15. (B) $\text{LHS} = \sqrt{(3x - 4y + 5z)^2} = (3x - 4y + 5z)$

16. (B) $\text{LHS} = \frac{(2019^2 - 2019 - 6)(2019^2 + 4038 - 3)(2019 + 1)}{(2019 - 3)(2019 - 1)(2019 + 2)(2019 + 3)}$

Let $2019 = x$

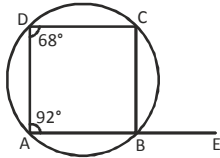
$$= \frac{(x^2 - x - 6)(x^2 + 2x - 3)(x+1)}{(x-3)(x-1)(x+2)(x+3)}$$

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

$$= x + 1$$

$$= 2020$$

17. (B) $\angle ADC = 68^\circ$



$$\angle CBA = 180^\circ - \angle ADC$$

$$= 180^\circ - 68^\circ = 112^\circ$$

But $\angle CBA + \angle EBC = 180^\circ$

$$\Rightarrow \angle EBC = 68^\circ$$

18. (D) $(x-y)^2 = (x+y)^2 - 4xy = 49 - 8 = 41$

$$x - y = \sqrt{41}$$

$$x^2 - y^2 = (x+y)(x-y) = 7\sqrt{41}$$

19. (B) Volume of prism = Base area \times height

$$120 \text{ cm}^3 = \frac{1}{2} \times 3 \times 4 \text{ cm}^2 \times \text{height}$$

$$h = 20 \text{ cm}$$

20. (B) Let base be x cm

$$\text{Given } \frac{1}{2} x(x+7) \text{ cm}^2 = 114 \text{ cm}^2$$

$$x^2 + 7x - 228 = 0$$

$$x^2 + 19x - 12x - 228 = 0$$

$$x = 12$$

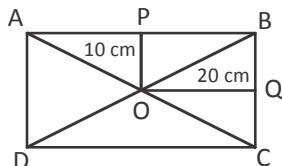
$$\therefore \text{Altitude} = (x+7) = 19 \text{ cm}$$

21. (D) $BC = AD = 2PO = 20 \text{ cm}$

$$AB = DC = 2 \times OQ = 40 \text{ cm}$$

$$\text{Perimeter of rectangle} = 2(AB + BC)$$

$$= 120 \text{ cm}$$



22. (A) In a quadrilateral PMLK $KL \parallel PM$

$$\therefore \text{PMLK is a cyclic trapezium}$$

$$\therefore \angle KLM = 180^\circ - 70^\circ = 110^\circ$$

$$KL \parallel PM \Rightarrow \angle KLM + \angle LMP = 180^\circ$$

$$\therefore \angle LMP = 70^\circ$$

In $\triangle PMN$, PM is diameter

$$\Rightarrow \angle PNM = 90^\circ$$

$$\Rightarrow \angle PMN = 90^\circ - 20^\circ = 70^\circ$$

$$\angle x = \angle PML + \angle PMN = 70^\circ + 70^\circ = 140^\circ$$

23. (B) Const:- Extend GH Up to 5

$$\angle AIH = 70^\circ [\because \text{corresponding angles}]$$

$$\therefore \angle AIJ = 180^\circ - 70^\circ = 110^\circ$$

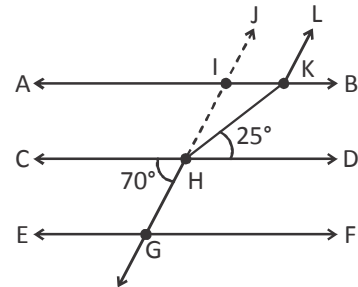
$$\Rightarrow \angle IKL = \angle AIJ = 110^\circ$$

$$[\because \text{corresponding angles}]$$

$$\angle IKH = \angle KHD = 25^\circ$$

$$[\because \text{alternative angles}]$$

$$\therefore \angle HKL = \angle HKI + \angle IKL = 25^\circ + 110^\circ = 135^\circ$$



24. (C) Given $\left(\frac{d_1}{2}\right)^2 + \left(\frac{d_2}{2}\right)^2 = \left(\frac{34}{4} \text{ cm}\right)^2$

$$\frac{d_1^2}{4} + \frac{d_2^2}{4} = \frac{289}{4} \text{ cm}^2$$

$$\therefore d_1^2 + d_2^2 = 289$$

$$\text{Given } d_1 + d_2 = 23 \text{ cm}$$

squaring on both sides

$$d_1^2 + d_2^2 + 2d_1 d_2 = 529$$

$$289 + 2d_1 d_2 = 529$$

$$2d_1 d_2 = 240$$

$$\frac{2d_1 d_2}{4} = \frac{240}{4} \text{ cm}^2$$

$$\text{Area of rhombus} = \frac{d_1 d_2}{2} = 60 \text{ cm}^2$$

25. (B) Area to be painted = LSA + ceiling area

$$= 2h(l+b) + l \times b$$

$$= 6m(7m) + 12 \text{ m}^2$$

$$= 42 \text{ m}^2 + 12 \text{ m}^2$$

$$= 54 \text{ m}^2$$

PHYSICS

26. (D) Cube (D) has the smallest density as given below.

	Side of cube	Volume of cube	Mass of cube	Density (mass/volume)
(A)	2 cm	8 cm ³	40.0 g	5 g cm ⁻³
(B)	3 cm	27 cm ³	216.0 g	8 g cm ⁻³
(C)	4 cm	64 cm ³	755.2 g	11.8 g cm ⁻³
(D)	5 cm	125 cm ³	337.5 g	2.7 g cm ⁻³

27. (C) As $\frac{1}{2} m_p v_p^2 = \frac{1}{2} m_q v_q^2 \therefore \frac{v_p}{v_q} = \sqrt{\frac{m_q}{m_p}}$

$$\frac{p_q}{p_p} = \frac{m_q v_q}{m_p v_p} = \frac{m_q}{m_p} \sqrt{\frac{m_p}{m_q}} = \sqrt{\frac{m_q}{m_p}} = \frac{1}{\sqrt{3}}$$

28. (D) The linear momentum of the bullet must have the same magnitude as the linear momentum of the block in order for their combined momentum after impact to be zero. The block has momentum MV to the left, so the bullet must have momentum MV to the right. As the bullet's mass is m, its speed must be

$$v = \frac{MV}{m}$$

29. (D) Area of contact = 3 m x 1 m = 3 m² ;
Force due to the liquid = weight = 12 000 N
Pressure exerted by the liquid = $\frac{12\ 000}{3} = 4000$ Pa

30. (C) From $W = F_s \cos q$

$$\cos q = \frac{W}{F_s} = \frac{50}{10 \times 10^2} = \frac{1}{2}$$

$$q = 60^\circ$$

31. (B) Volume

$$= \frac{\text{Mass}}{\text{Density}} = \frac{28.95\text{g}}{19.3\text{g}} \text{cm}^{-3} = 1.5 \text{cm}^{-3}$$

32. (B) Mass is a measure of an object. Object Q has more mass, so it has more inertia than object P.

33. (A) As the particle covers a distance of 20 m in 2 seconds, and its initial velocity is 10 m s⁻¹, the particle is moving with constant velocity or uniform velocity. So, when a particle is moving with zero constant / uniform velocity, its acceleration will be zero.

34. (C) The mass of iron, loosely packed feathers and water is same. For lifting the above, we need to consider that $W = m \times g \times h$. The question asked is about an object that is easier to lift.

Option (A) 10 kg of iron is more dense
a n d
compact – Not easy to lift.

Option (B) 10 kg of loosely packed feathers are less dense, not compact and the volume is more. It is easier to lift.

Option (C) 10 kg of water needs a container to hold water and
l i f t
it up — Not easy to lift.

35. (C) $h = \frac{Pt}{mg} = \frac{50 \times 10 \times 60}{250 \times 10} = 12$ m

CHEMISTRY

36. (C) Melting point and boiling point of a substance is a measure of the amount of energy needed to overcome the attractive forces between particles. Sodium chloride, being a solid and an ionic compound, its particles in crystalline lattice form are held by strong electrostatic force of attraction. High temperature, or strong heating is required to break the secured bonds between its particles. Due to the above reason, ionic compound like sodium chloride has a high melting point.

37. (B) Gases have very low densities. They do not have definite shape or volume. They can be compressed easily into a small volume by applying pressure that reduces the interpartide spaces between the particles.

38. (D) Milk is a suspension of tiny droplets of cream in a watery liquid. The process of centrifugation is used to separate cream from milk.

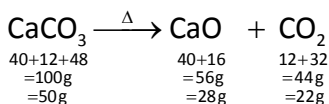
39. (D) The relative molecular mass of $C_{12}H_{22}O_{11}$
 $= 12 \times 12 + 1 \times 22 + 16 \times 11$

$$= 144 + 22 + 176 = 342$$

The relative molecular mass of

$$C_{12}H_{22}O_{11} = 342.$$

40. (A) Solids cannot be compressed because the constituent particles are very closely packed and there are hardly any spaces between them. Properties of solids given in options (B) and (C) are true but not the correct reason for its compression. For compressibility to occur in solids, there must be intermolecular spaces between the particles such that they can be brought closer to reduce the volume.
41. (D) As table salt is soluble in water, the mixture can be added to water to dissolve the table salt. The resulting immiscible liquid mixture can be separated using a separating funnel. The salt solution can then be evaporated to recover the solid salt.
42. (D) For calcium, P = 20, E = 20, N = 20. Therefore, the following relationships are true P = N, E = N and 2E = P + N.
43. (C) The rapid, random and constant movement of tiny particles of smoke suspended in air proves that there are collisions between the smoke particles and air particles which explains the Brownian motion of smoke particles.
44. (D) In fractional distillation, liquid X with lower boiling point than water distilled first.
45. (B) 100 g of calcium carbonate on heating produces 56g of calcium oxide and 44g of carbon dioxide as given below:



So, when 50 g of CaCO_3 is heated, it produces 28 g of CaO and 22 g of CO_2 .

BIOLOGY

46. (B) Organelles labelled 2 is mitochondria. Mitochondria is responsible for cellular respiration.

47. (D) Avoid eating raw or half cooked food can effectively stop all tapeworms intesting humans
48. (A) Cell wall is made up of cellulose and is semipermeable.
49. (B) Cell X is ciliated cell intrachea. Cilia is responsible for sweeping away the mucus from the trachea.
50. (A) Pollen are formed as a result of meiosis. It is halploid.
51. (C) Lysosomes are reservoirs of hydrolytic enzymes.
52. (D) By eating plants and animals.
53. (A) Light energy first enters the food chain, which is absorbed by the producers (i.e. grass) found at the beginning of the food chain. Light energy is then converted to form chemical energy during photosynthesis.
54. (D) In the given food chain, due to decrease in frog population, the number of grasshoppers increase and feed more on grass and cause decrease in 'X'. Frogs can feed on other insects during drought. Predator is an animal that hunts, kills and eat other animals.
55. (B) Structure Q is the phloem tissue.

CRITICAL THINKING

56. (A)
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- ```

 graph LR
 Kolkata --- Lawyer
 Kolkata --- Doctor
 Varanasi --- Accountant
 Varanasi --- Doctor
 Delhi --- Accountant
 Delhi --- Lawyer

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From the clues given chakri is not the lawyer neither he is born in varanasi. Since the person from kolkata is a lawyer, chakri must be doctor from delhi Anand is accountant and balu is a lawyer from kolkata.

57. (C) A good estimate is 300 pages.  
digit '3' in the ones place  
 3, 13, 23, .....93 : 10 times  
 103, 113,.....193 : 10 times

203, 213, ... 293 : 10 times

303, 313, 323, .3 : 3 times

digit '3' in the tens place

30, 31, ..... 39 : 10 times

130, 131, .....139 : 10 times

230, 231, ... 239 : 10 times

$87 - 60 = 27$

digit '3' in the hundreds place

300, 301, .... 390 : 10 times

310, 311, .....319 : 10 times

320, 321, 322, 323 : 4 times

digit '3' in the ones place

The book has 323 pages.

58. (D)

59. (B) The seating arrangement is as follows,

• • • • •  
P X S Z R A

Therefore, right of P is X.

60. (A) Because Mr. Sachin spends many hours during the weekend working in his vegetable garden, it is reasonable to suggest that he enjoys this work. There is no information to suggest that he does not like classical music. Although Mrs. Sanchez likes to cook, there is nothing that indicates she cooks vegetables (choice c). Mrs. Sachin likes to read, but there is no information regarding the types of books she reads (choice d).

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**THE END**

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