



# UNIFIED COUNCIL

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## NATIONAL LEVEL SCIENCE TALENT SEARCH EXAMINATION (UPDATED)

CLASS - 9

Question Paper Code : UN444

### KEY

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

### SOLUTIONS

#### MATHEMATICS

1. (D)  $\frac{\sqrt[6]{12}}{\sqrt{3} \times \sqrt[3]{2}} = \frac{\sqrt[6]{12}}{\sqrt[6]{3^3 \times \sqrt[6]{2^2}}} = \sqrt[6]{\frac{12}{27 \times 4}} = \sqrt[6]{\frac{1}{9}} = \sqrt[3]{\frac{1}{3}}$
2. (B) Given  $R_1 = f(-1) = -1 + 2a + 5 - 7 = 2a - 3$   
 $R_2 = g(2) = 8 + 4 - 24 + 6a = 6a - 12$   
 Given  $2R_1 + R_2 = 12$   
 $4a - 6 + 6a - 12 = 12$   
 $10a = 30$   
 $a = 3.$
3. (C) Let 'a' to be subtracted  
 $\therefore 4x^3 + 16x^2 - x + 5 - a$  is exactly

divisible by  $(x + 5)$

$$\therefore f(-5) = 0$$

$$f(-5) = 4(-5)^3 + 16(-5)^2 - (-5) + 5 - a = 0$$

$$- 500 + 400 + 5 + 5 - a = 0$$

$$- 90 = a$$

4. (B) LHS

$$= a^3x - a^2bx + a^2by - ab^2y + ab^2z - b^3z$$

$$= a^3x + a^2by + ab^2z - a^2bx - ab^2y - b^3z$$

$$= a(a^2x + aby + b^2z) - b(a^2x + aby + b^2z)$$

$$= (a^2x + aby + b^2z)(a - b)$$

5. (D)  $y = x$  line passes through  $Q_1, Q_3$ , origin

6. (C) Let  $x$  &  $(180^\circ - x)$  are supplant angles

Given  $x = 2(180^\circ - x)$

$\therefore x = 360^\circ - 2x$

$3x = 360^\circ$

$x = 120^\circ$

7. (C) Given  $\angle A + \angle B = 128^\circ \rightarrow (1)$

$\angle A - \angle B = 22^\circ \rightarrow (2)$

eq (1) + (2)  $\Rightarrow 2\angle A = 150^\circ$

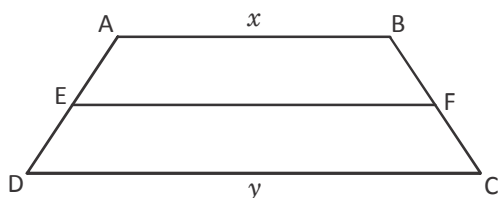
$\angle A = 75^\circ$

$\angle B = 53^\circ$

$\therefore$  Biggest angle =  $\angle A = 75^\circ$

8. (A)  $EF = \frac{1}{2}(AB + CD)$

$EF = \frac{1}{2}(x + y)$



9. (A)  $\triangle AOD \cong \triangle BOC$  [RHS congruency]

$\therefore AO = OB$

$\therefore AO = AD$  [Given  $l = 2b$ ]

In  $\triangle AOD$ ,  $OD^2 = AD^2 + OA^2$

$= b^2 + b^2$

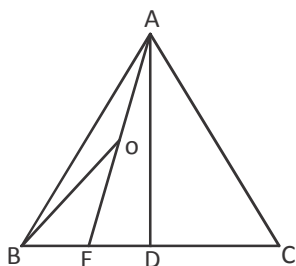
$OD = \sqrt{2}b$

$\therefore$  Ratio of perimeter of rectangle & diameter =  $6b : 2\sqrt{2}b$

$= 3 : \sqrt{2}$

10. (D) Given 'D' is mid point of  $\triangle ABC$

$\therefore$  Area of  $\triangle ABD = \frac{1}{2}$  area of  $\triangle ABC$



'E' is the midpoint of BD

$\therefore$  Area of  $\triangle ABE = \frac{1}{2}$  area of  $\triangle ABD$

$= \frac{1}{4}$  area of  $\triangle ABC$

'O' is mid point of AE

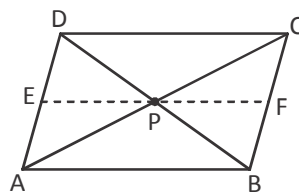
$\therefore$  Area of  $\triangle BOE = \frac{1}{2}$  area of  $\triangle ABE$

$= \frac{1}{2} \times \frac{1}{4}$  of area of  $\triangle ABC$

11. (A) Construction :-

EF // AB through P.

ABFE is a parallelogram



$\Rightarrow$  Area of  $\triangle APB = \frac{1}{2}$  area of parallelogram ABFE  $\rightarrow (1)$

Similarly Area of  $\triangle CPD = \frac{1}{2}$  area of parallelogram CFED  $\rightarrow (2)$

eq (1) + (2)  $\Rightarrow$  Area of  $(\triangle APB + \triangle CPD)$

$= \frac{1}{2}$  area of parallelogram (ABFE + CFED)

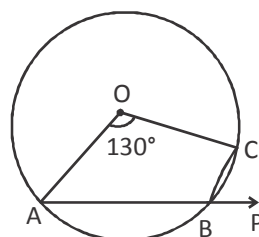
$= \frac{1}{2}$  area of parallelogram ABCD

12. (A) Reflex  $\angle AOC = 360^\circ - 130^\circ = 230^\circ$

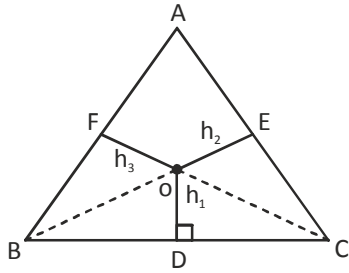
$\therefore \angle ABC = \frac{\text{Ref } \angle AOC}{2}$

$= 115^\circ$

$\therefore \angle PBC = 180^\circ - 115^\circ = 65^\circ$



13. (B) Given  $h_1 = 8$  cm,  $h_2 = 10$  cm  
&  $h_3 = 11$  cm



$$\therefore \frac{1}{2} \times AB \times h_3 + \frac{1}{2} BC \times h_1 + \frac{1}{2} \times AC \times h_2 = \frac{\sqrt{3}}{4} \times AB^2$$

$$\frac{1}{2} AB \times h_3 + \frac{1}{2} AB \times h_1 + \frac{1}{2} \times AB \times h_2 = \frac{\sqrt{3}}{4} \times AB^2$$

$$\frac{1}{2} AB (h_1 + h_2 + h_3) = \frac{\sqrt{3}}{4} \times AB^2$$

$$\frac{1}{2} (8 \text{ cm} + 10 \text{ cm} + 11 \text{ cm}) = \frac{\sqrt{3}}{4} AB$$

$$\therefore AB = 29 \times \frac{2}{\sqrt{3}}$$

Area of equilateral triangle

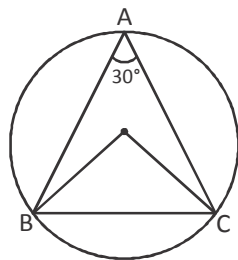
$$= \frac{\sqrt{3}}{4} AB^2$$

$$= \frac{\sqrt{3}}{4} \times 29 \times \frac{2}{\sqrt{3}} \times 29 \times \frac{2}{\sqrt{3}}$$

$$= \frac{29 \times 29 \sqrt{3}}{3} \text{ cm}^2$$

$$= 485.5 \text{ cm}^2 \text{ (Nearly)}$$

14. (B)  $\angle BOC = 2\angle BAC = 60^\circ$



$\therefore$  OBC is an equilateral triangle

$\therefore$  OB = OC = BC = 8 cm

15. (D) Given In  $\triangle ABC$ ,  $AB = AC$

$$\Rightarrow \angle ACB = \angle ABC = x$$

In  $\triangle BCD$ ,  $BO = BC \Rightarrow \angle DBC = \angle DCB = y$

$$\therefore \angle ABD = \angle ACD = x - y$$

$$\therefore \frac{\angle ABD}{\angle ACD} = \frac{x - y}{x - y} = 1$$

16. (B)

$$\text{LHS} = \frac{7\sqrt{3}}{\sqrt{10} + \sqrt{3}} \times \frac{(\sqrt{10} - \sqrt{3})}{(\sqrt{10} - \sqrt{3})}$$

$$- \frac{2\sqrt{5}}{\sqrt{6} + \sqrt{5}} \times \frac{(\sqrt{6} - \sqrt{5})}{(\sqrt{6} - \sqrt{5})}$$

$$- \frac{3\sqrt{2}}{\sqrt{15} + 3\sqrt{2}} \times \frac{\sqrt{15} - 3\sqrt{2}}{\sqrt{15} - 3\sqrt{2}}$$

$$= \sqrt{3}(\sqrt{10} - \sqrt{3}) - 2\sqrt{5}(\sqrt{6} - \sqrt{5})$$

$$- \frac{3\sqrt{2}(3\sqrt{2} - \sqrt{15})}{3}$$

$$= \sqrt{30} - 3 - 2\sqrt{30} + 10 - 6 + \sqrt{30}$$

$$= 2\sqrt{30} - 2\sqrt{30} + 10 - 9$$

$$= 1$$

17. (C)

Let number of hens be 'x' & number of buffaloes be 'y'

$$\text{Given } 2x + 2y = 120$$

$$x + y = 60$$

$$2x + 4y = 190$$

$$x + 2y = 95$$

$$\text{eq (2) - (1)} \Rightarrow y = 35$$

18. (C)

$$\text{LHS} = a^2 - b^2 - 4c^2 + 4d^2 - 4ad + 4bc$$

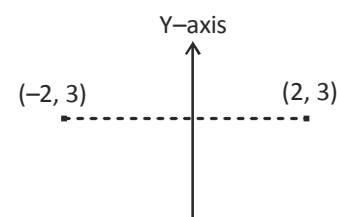
$$= a^2 - 4ad + 4d^2 - (b^2 - 4bc + 4c^2)$$

$$= (a - 2d)^2 - (b - 2c)^2$$

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

$$= (a + b - 2c - 2d) (a - b + 2c - 2d)$$

19. (B)



20. (C) Given  $25x + 17x + 12x = 540$  m  
 $54x = 540$  m  
 $x = 10$  m  
 $\therefore$  sides are 250 m, 170 m & 120 m  
 $s = \frac{a+b+c}{2} = 270$  m  
 $\Delta = \sqrt{s(s-a)(s-b)(s-c)}$   
 $= \sqrt{270(270-250)(270-170)(270-120)}$   
 $= \sqrt{270 \times 20 \times 100 \times 150}$   
 $= \sqrt{30 \times 9 \times 20 \times 20 \times 5 \times 5 \times 30}$   
 $= 30 \times 3 \times 20 \times 5$   
 $= 9000$  m<sup>2</sup>

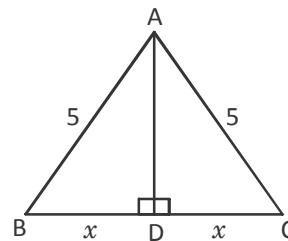
21. (C) Given  $\angle ABC = 100^\circ$   
 $\therefore$  Ref  $\angle AOC = 200^\circ$   
 $\therefore \angle AOC = 360^\circ - 200^\circ = 160^\circ$   
 $\therefore \angle COD = \angle AOD - \angle AOC = 180^\circ - 160^\circ = 20^\circ$

22. (B) Given  $\frac{\sqrt{3}}{4}(x+2)^2 - \frac{\sqrt{3}}{4}x^2 = 3\sqrt{3}$  m<sup>2</sup>  
 $\frac{(x+2)^2}{4} - \frac{x^2}{4} = 3$  m<sup>2</sup>  
 $(x+2)^2 - x^2 = 12$  m<sup>2</sup>  
 $x^2 + 4x + 4 - x^2 = 12$   
 $x = 2$  m

23. (D) Given  $a - b = 14$  m  
&  $\frac{1}{2}ab = 120$  cm<sup>2</sup>  
 $ab = 240$   
 $(a+b)^2 = (a-b)^2 + 4ab$   
 $= 14^2 + 4 \times 240$   
 $a+b = \sqrt{1156}$   
 $a+b = 34$  cm  
 $\therefore a = 24$  cm &  $b = 10$  cm  
 $\therefore c^2 = a^2 + b^2 = 24^2 + 10^2 = 576 + 100$   
 $= 676$   
 $c = 26$  cm  
Perimeter =  $a + b + c = 24$  cm +  $10$  cm +  $26$  cm =  $60$  cm

24. (B) Total area to be painted  
 $= \pi(R^2 - r^2) + 2\pi R^2 + 2\pi r^2$   
 $= 3\pi R^2 + \pi r^2$   
 $= \pi \left[ 3 \times \left( \frac{25}{2} \right)^2 + (12)^2 \right]$   
 $= \pi [468.75 + 144]$   
 $= \frac{22}{7} \times 612.75$  cm<sup>2</sup>  
 $= 1925.78$  cm

25. (B) Given  $\frac{1}{2} \times 2x \times AD = 12$  cm<sup>2</sup>  
 $AD = \frac{12}{x}$



But  $AB^2 = AD^2 + BD^2$

$$25 = \left( \frac{12}{x} \right)^2 + x^2$$

$$25 = \frac{144}{x^2} + x^2$$

$$\therefore x^4 - 25x^2 + 144 = 0$$

$$(x^2)^2 - 16x^2 - 9x^2 + 144 = 0$$

$$x^2(x^2 - 16) - 9(x^2 - 16) = 0$$

$$(x^2 - 16)(x^2 - 9) = 0$$

$$x^2 = 16 \quad (\text{OR}) \quad x^2 = 9$$

$$x = 4 \quad (\text{OR}) \quad x = 3$$

$$2x = 8 \quad (\text{OR}) \quad 2x = 6$$

### PHYSICS

26. (C) Given:  $m = 0.25 \text{ kg}$  ;  $g = 10 \text{ m s}^{-2}$   
 $h = 18 \text{ m}$   
 $PE = mgh = 0.25 \times 10 \times 18 = 45 \text{ J}$   
The minimum energy required is 45 J.
27. (D) Energy supplied  
 $= \frac{1}{2} mv^2 = \frac{1}{2} (0.5) 14^2 = 49 \text{ J}$   
Energy stored  
 $= mgh = 0.5 \times 9.8 \times 8 = 39.2 \text{ J}$   
 $\therefore$  Energy dissipated =  $49 - 39.2 = 9.8 \text{ J}$ .
28. (D) Action is directed opposite to the reaction. So, the angle between the action of the book on the table and the reaction of the table on the book is  $180^\circ$ .
29. (C) Density of oil is  $0.78 \text{ g/cm}^3$  whereas density of water is  $1 \text{ g/cm}^3$ . So, oil is less dense and floats on water.
30. (D) The correct matching is A-S, B-P, C-Q, D-R  
When a body does work against friction, its K.E decreases. Work done by a body is independent of time. Power of a body ( $P = W/t$ ) varies inversely as time. When work done over a closed path is zero, force must be conservative.
31. (B) A nail being hammered into a wall has a very small area of contact, so it exerts greatest pressure.
32. (D) Impulse = Change in momentum  
 $F \times t = m (v - u)$   
 $F \times 0.4 = 80(5 - 0), \frac{80 \times 5}{0.4} = 1000 \text{ N}$
33. (C) Here  $v = a_1 t_1 = a_2 t_2$ . That is  $t_1 = \frac{a_2}{a_1} \times t_2$   
 $= \frac{4}{2} \times t_2 = 2t_2$ . Since  $t_1 + t_2 = 3 \text{ s}$ .  
Hence  $t_1 = 2 \text{ s}$  and  $t_2 = 1 \text{ s}$   
Therefore,  $v = 2 \times 2 \text{ m s}^{-2} = 4 \text{ m s}^{-1}$
34. (A) When an iron ball is weighed in air and then in water with a spring balance, its weight in air is more than in water.
35. (B)  $PE = (mg)h = 450 \times 5 = 2250 \text{ J}$

### CHEMISTRY

36. (C) Mass of boron in the compound  
 $= 0.096 \text{ g}$   
Mass of sample =  $0.24 \text{ g}$   
So, Percentage of boron  
(in compound)  
 $= \frac{\text{Mass of boron in compound}}{\text{Mass of sample}} \times 100$   
 $= \frac{0.096}{0.24} \times 100 = 40$   
Mass of oxygen in the compound  
 $= 0.144 \text{ g}$   
Mass of sample =  $0.24 \text{ g}$   
Percentage of oxygen (in compound)  
 $= \frac{\text{Mass of oxygen in compound}}{\text{Mass of sample}} \times 100$   
 $= \frac{0.144}{0.24} \times 100 = 60$   
The percentage composition of boron is 40 and oxygen is 60 by mass.
37. (A) Statements (B), (C) and (D) are true about boiling. Only evaporation has the cooling effect on the liquid.
38. (A) Chalk (insoluble) and salt (soluble) can be separated by adding water, stirring and then filtering.  
**Option (B):** Neither iron nor sulfur are soluble in water.  
**Option (C):** Both sugar and instant coffee powder are soluble in water.  
**Option (D):** Both sulfuric and hydrochloric acids are water-soluble.
39. (A) 24 g of carbon (12) has maximum number of atoms as it has 2 moles while other substances are only 1 mole.
40. (A)  $\text{CuO}$  (copper oxide) contains only 2 atoms but  $\text{H}_2\text{O}$  and  $\text{CO}_2$  contain 3 atoms.  
**Option (B):** All the three molecules ( $\text{CO}$ ,  $\text{O}_2$ ,  $\text{MgO}$ ) contain 2 atoms.  
**Option (C):** All the three molecules ( $\text{NH}_3$ ,  $\text{PCl}_3$ ,  $\text{H}_2\text{O}_2$ ) contain 4 atoms.

**Option (D):** All the three molecules ( $N_2O$ ,  $NO_2$ ,  $O_3$ ) contain 3 atoms.

41. (D) Diffusion is the movement of particles from a region of higher concentration to a region of lower concentration.
42. (C) The condenser cools down the vapour to form a liquid.
- Option (A):** A miscible liquid dissolves in another liquid and is therefore not denser.
- Option (B):** A distillate is the condensed liquid collected after distillation.
- Option (D):** Distillation is used to obtain a pure liquid (solvent) from a solution.
43. (B) Amount of ethene,  $C_2H_4 = 28 / (12 \times 2 + 1 \times 4) = 1.00 \text{ mol}$  .  
Amount of carbon =  $1.00 \times 2 = 2.00 \text{ mol}$
44. (D) Sugar being a solid, its particles exhibit the strongest intermolecular attractive forces.
45. (C) Compressibility is the least in solids and the greatest in gases. Thus, options (A), (B) and (D) are incorrect

### BIOLOGY

46. (D) the plant cell differs from the animal cell in the absence of centrioles.
47. (B) The membrane surrounding the vacuoles is tonoplast.
48. (C) Xylem is a complex tissue.
49. (D) The insects which transmit diseases but does not cause disease itself are called vectors.
50. (C) Diphtheria is the communicable disease.
51. (D) Natural gas is a non-renewable energy.
52. (A) Pteridophytes are vascular plants.
53. (D) Nodules with  $N_2$  fixing bacteria are present in legumes like beans.
54. (D) Gundhi bug is a pest that attacks rice.
55. (C) Exotic breed of poultry birds, with high egg laying capacity are white leghorn.

### CRITICAL THINKING

56. (A) Grana means big; melke means tree; pini means little; hoon means house. Therefore, granahoon means big house.
57. (D)  $M \times N \rightarrow M$  is the father of N.  
 $N - C \rightarrow N$  is the sister of C.  
and  $C + F \rightarrow C$  is the brother of F.  
Hence, M is the father of C or C is the son of M.
58. (A)  $10 \text{ rabbits} \rightarrow 2 \text{ goats}$   
 $9 \text{ goats} \rightarrow 3 \text{ cows}$   
 $8 \text{ cows} \rightarrow 2 \text{ horses}$   
 $(5 \div 2) \times 8 \text{ cows} \leftarrow 5 \text{ horses}$   
 $20 \text{ cows} \leftarrow 5 \text{ horses}$   
 $(3 \times 20) \text{ goats} \leftarrow 20 \text{ cows}$   
 $60 \text{ goats} \leftarrow 20 \text{ cows}$   
 $(30 \times 10) \text{ rabbits} \leftarrow 60 \text{ goats}$   
 $300 \text{ rabbits} \leftarrow 60 \text{ goats}$   
5 horses can be exchanged for 300 rabbits.
59. (B) There are 31 days in January.  
 $31 \div 7 = 4 \text{ R } 3$   
Sunday, Monday and Tuesday appeared five times in January.  
Therefore, 1st January fell on a Sunday.
- | Sun | Mon | Tue | Wed | Thu |
|-----|-----|-----|-----|-----|
| 1st | 2nd | 3rd | 4th | 5th |
- 5th January in that year was a Thursday.
60. (C) The answer is C. Because the boxes weight the same and are on the same degree of incline. Friction also remains same, hence both will slide down with equal ease.