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NATIONAL LEVEL SCIENCE TALENT SEARCH EXAMINATION

CLASS - 09

Question Paper Code : 1O109

KEY

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

SOLUTIONS

MATHEMATICS

01. (C) In a quadrilateral ABED, AB || DE, AB = DE

$\therefore$ ABED is a parallelogram.

$\therefore$ BE = Ab and BE || AD .....(1)

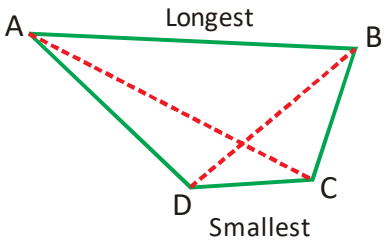
Similarly we can prove BCFE is a parallelogram.

$\therefore$ BE = CF and BE || CF .....(2)

From equation (1) & (2) AD = CF and AD || CF

$\therefore$ ADFC is a Parallelogram.

02. (B)



In ΔABC, AB > BC

$\Rightarrow \angle BCA > \angle CAB \quad \rightarrow$ (1)

In ΔACD, AD > CD

$\Rightarrow \angle ACD > \angle CAD \quad \rightarrow$ (2)

(1) + (2) $\Rightarrow \angle BCA + \angle ACD > \angle CAB + \angle CAD$

$\angle C > \angle A.$

03. (B) Radius of cylinder, r = 12 cm

Height of water level raised, h = 6.75 cm

Volume of water raised

$= \pi r^2 h = 972\pi \text{ cm}^3$

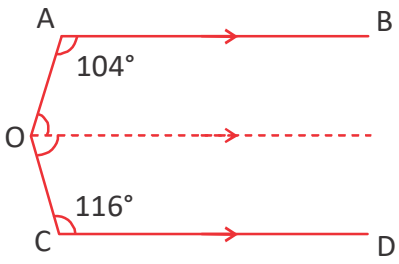
Suppose radius of sphere be R cm.

$\therefore$ Volume of sphere $= \frac{4}{3}\pi R^3$

Now, volume of sphere = volume of water raised

$\therefore \frac{4}{3}\pi R^3 = 972\pi \Rightarrow R = 9$ cm

04. (C)



Through O draw OE || AB || CD

Then, $\angle AOE + \angle COE = x°$

Now, AB || OE and AO is the transversal

$\therefore \angle OAB + \angle AOE = 180°$

$\Rightarrow 104° + \angle AOE = 180°$

$\Rightarrow \angle AOE = (180° - 104°) = 76°$

Again, CD || OE and OC is the transversal.

$\therefore \angle COE + \angle OCD = 180°$

$\Rightarrow \angle COE + 116° = 180°$

$\Rightarrow \angle COE = (180° - 116°) = 64°$

$\therefore \angle AOC = \angle AOE + \angle COE = (76° + 64°) = 140°$

Hence, $x = 140°$

05. (D) In a porallelogram opposite angles are equal.

$\therefore \angle A = \angle C = 58°$

But $\angle F = \angle A$

$\therefore \angle F = 58°$

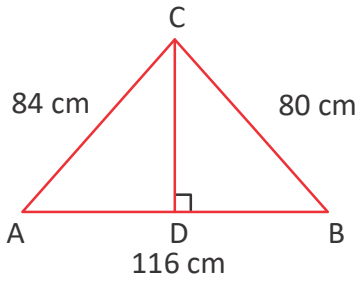
06. (A) Given that $\angle A = 38°$

$\angle A + \angle B + \angle C + \angle D = 360°$

$\Rightarrow \angle A + \angle B + 3\angle A + 4\angle A = 360°$

$\Rightarrow \angle B = 56°$

07. (B)



Given a = 84 cm, b = 80 cm and c = 116 cm

$s = \frac{a+b+c}{2} = \frac{84\text{cm}+80\text{cm}+116\text{cm}}{2} = \frac{280\text{cm}}{2}$

s = 140 cm

Area of the triangle

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

$= \sqrt{140 \times (140-84)(140-80)(140-116)}\ \text{cm}^2$

$= \sqrt{140 \times 56 \times 60 \times 24}\ \text{cm}^2$

$= \sqrt{14 \times 10 \times 14 \times 4 \times 10 \times 6 \times 6 \times 4}\ \text{cm}^2$

$= 14 \times 10 \times 4 \times 6\ \text{cm}^2$

$\Rightarrow \frac{1}{2} \times$ longest side $= 3360\ \text{cm}^2$

$\Rightarrow \frac{1}{2} \times 116\text{ cm} \times \text{CD } 3360\ \text{cm}^2$

$\text{CD} = \frac{3360\ \text{cm}^2}{58\ \text{cm}}$

$\therefore$ Shortest altitude (CD) = 57.93 cm

08. (A) Let $\left(\sqrt{2}, -\sqrt{7}\right)$ lies on

$\sqrt{2}x + \sqrt{7}y + 5 = 0$

$\Rightarrow \sqrt{2}\left(\sqrt{2}\right) + \sqrt{7}\left(-\sqrt{7}\right) + 5 = 0$

$\Rightarrow \quad 2 - 7 + 5 = 0$

$\Rightarrow \quad -5 + 5 = 0$

$\Rightarrow \quad 0 = 0$ (True)

$\therefore \quad \left(\sqrt{2}, -\sqrt{7}\right)$ lies on $\sqrt{2}x + \sqrt{7}y + 5 = 0$

09. (A) $\angle PMN = 180° - [90° + 20°]$

$= 70°$

$\angle PKL = 180° - 70° = 110°$

$\angle PML = 180° - 110° = 70°$

$\angle NML = \angle PML + \angle PMN$

$= 70° + 70° = 140°$

10. (C) Let the sides be $13x$, $14x$ and $15x$ units

$\Rightarrow$ Perimeter = $13x + 14x + 15x$

$= 84 = 42x$

$$x = \frac{84}{42} = 2$$

Sides of the triangle are 26 cm, 28 cm and 30 cm

Area of the triangle

$$\Delta = \sqrt{42(42-26)(42-28)(42-30)}$$

$= 336 \text{ cm}^2$

11. (B) $$\frac{14}{\sqrt{6}-\sqrt{5}-\sqrt{11}} = \frac{14}{(\sqrt{6}-\sqrt{5})-\sqrt{11}} \times$$

$$\frac{(\sqrt{6}-\sqrt{5})+(\sqrt{11})}{(\sqrt{6}-\sqrt{5})+\sqrt{11}}$$

$$= \frac{14(\sqrt{6}-\sqrt{5}+\sqrt{11})}{-2\sqrt{30}}$$

$$= \frac{-7(\sqrt{6}-\sqrt{5}+\sqrt{11})}{\sqrt{30}} \times \frac{\sqrt{30}}{\sqrt{30}}$$

$$= \frac{-7(\sqrt{5}-\sqrt{6}-\sqrt{11})\sqrt{30}}{30}$$

$$= \frac{7(5\sqrt{6}-6\sqrt{5}-\sqrt{330})}{30}$$

12. (D) Given AB || CD

$\angle ABC + \angle BCD = 180°$

$4y + 5y = 180°$

$9y = 180°$

$$y = \frac{180°}{9} = 20°$$

13. (A)

$$\sqrt{(3+\sqrt{2})(12-\sqrt{16\times 2})} = \sqrt{(3+\sqrt{2})[12-4\sqrt{2}]}$$

$$= \sqrt{(3+\sqrt{2})\times 4(3-\sqrt{2})}$$

$$= \sqrt{4\times[3^2-(\sqrt{2})^2]}$$

$$= \sqrt{(4)(9-2)}$$

$$= \sqrt{4\times 7}$$

$$= 2\sqrt{7}$$

14. (C) Given $a + b + c = 0 \Rightarrow a^3 + b^3 + c^3 = 3abc$

$$\frac{a^2}{bc} + \frac{b^2}{ca} + \frac{c^2}{ab} = \frac{a^3+b^3+c^3}{abc} = \frac{3abc}{cabc} = 3$$

15. (C) Side of each tile are 36 cm, 29 cm and 25 cm

$$S = \frac{a+b+c}{2} = \frac{(36+29+25)}{2} \text{cm}$$

S = 45 cm

Area of each tile

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

$$= \sqrt{45\times 9\times 16\times 20} \text{ cm}^2$$

$$= \sqrt{5\times 9\times 9\times 4\times 4\times 5\times 2\times 2} \text{ cm}^2$$

$= 5 \times 9 \times 4 \times 2 \text{ cm}^2$

$= 360 \text{ cm}^2$

Area of 16 tiles = $360 \text{ cm}^2 \times 16$

$= 5760 \text{ cm}^2$

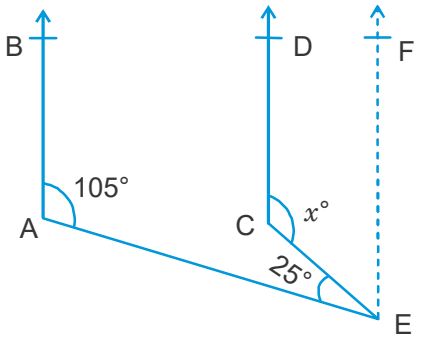
Total cost for polishing

$$= 5760 \text{ cm}^2 \times \frac{80 \text{ paise}}{1 \text{ cm}^2}$$

$$= \text{Rs.}5760 \times \frac{80}{100}$$

= Rs. 4608

16. (D)



From E, draw EF || AB || CD.

Now, EF || CD and CE is the transversal.

$\therefore \angle DCE + \angle CEF = 180°$ [co. int. $\angle$s]

$\Rightarrow x° + \angle CEF = 180°$

$\Rightarrow \angle CEF = (180° - x°)$

Again, EF || AB and AE is the transversal.

$\therefore \angle BAE + \angle AEF = 180°$ [co. int. $\angle$s]

$\Rightarrow 105° + \angle AEC + \angle CEF = 180°$

$\Rightarrow 105° + 25° + (180° - x°) = 180°$

$\Rightarrow x° = 130°$.

Hence, $x = 130°$

17. (A) Given $\pi r l = 308\ cm^2$

$$\frac{22}{7} \times r \times 14\ cm = 308\ cm^2$$

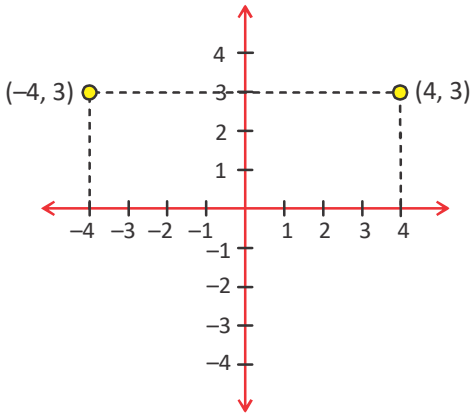
$$r = \frac{308\ cm^2}{22 \times 2\,cm} = 7\,cm$$

TSA of a cone = $\pi r(l + r)$

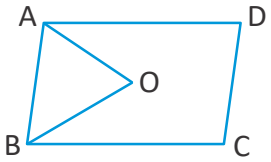
$$= \frac{22}{7} \times 7cm\left(14\,cm + 7\,cm\right)$$

$= 22 \times 21\ cm^2 = 462\ cm^2$

18. (D)



19. (D)



ABCD is a parallolagram.

The bisectors of $\angle A$ & $\angle B$ intersect at '0'

$$\frac{\angle A}{2} + \frac{\angle B}{2} + \angle AOB = 180°$$

$$\frac{\angle A + \angle B + 2\angle AOB}{2} = 180°$$

$\angle A + \angle B + 2\angle AOB = 2 \times 180°$

$180° + 2\angle AOB = 360°$

$2\angle AOB = 360° - 180°$

$$\angle AOB = \frac{180°}{2} = 90°$$

20. (B) Let r be the common radius of a sphere, a cone and a cylinder. Then, Height of the cone = Height of the cylinder = Height of the sphere = 2r. Let l be the slant height of the cone. Then,

$$l = \sqrt{r^2 + h^2} \Rightarrow l = \sqrt{r^2 + 4r^2} = \sqrt{5}r$$

$\therefore$ S_1 = Curved surface area of sphere = $4\pi r^2$

S_2 = Curved surface area of cylinder

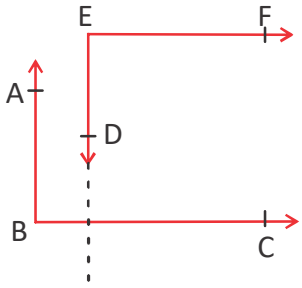
$= 2\pi r \times 2r = 4\pi r^2$

S_3 = Curved surface area of cone

$= \pi r l = \pi r \times \sqrt{5}r = \sqrt{5}\pi r^2$

$S_1 : S_2 : S_3 = 4\pi r^2 : 4\pi r^2 : \sqrt{5}\pi r^2 = 4 : 4 : \sqrt{5}$

21. (C)



Produce ED to meet BC at p

AB || PE and BPC is the transversal

$\therefore \angle ABP + \angle BPE = 180°$

$\Rightarrow \angle ABC + \angle BPE = 180°$ ..... (i)

Now, EF || BPC and EP is the transversal

$\angle BPE = \angle PEF \Rightarrow \angle BPE = \angle DE$ ..... (ii)

Hence, $\angle ABC + \angle DEF = 180°$ [using (ii)]

22. (A) ΔOAD is an isosceles triangle. Therefore

$\angle ODA = \angle OAD = 50°$.

Using exterior angle property in Δ OAD, we obtain $y = \angle OAD + \angle ODA = 100°$

Quadrilateral ABCD is a cyclic quadrilateral.

$\angle A + \angle C = 180°$

$50° + x = 180°$

$x = 130°$

23. (B) $$\frac{5^{n+2} - 6\times5^{n+1}}{13\times5^n - 2\times5^{n+1}} = \frac{5^n\times5^2 - 6\times5^n\times5}{13\times5^n - 2\times5^n\times5}$$

$$= \frac{5^n\left(5^2 - 6\times5\right)}{5^n\left(13 - 2\times5\right)} = \frac{25-30}{13-10} = \frac{-5}{3}$$

24. (C) Given $\angle A - \angle B = 28°$

$\angle A - 28° = \angle B$

Given $\angle A + \angle B = 122°$

$\angle A + \angle A - 28° = 122°$

$2\angle A = 122 + 28$

$$\angle A = \frac{150°}{2} \Rightarrow \angle A = 75$$

In ΔABC, $\angle A + \angle B + \angle C = 180°$

$75° + \angle B + \angle C = 180°$

$\angle B + \angle C = 180° - 75$

$\angle B + \angle C = 105°$

25. (C) $\angle AOC = 90° + \angle BOC$

$\angle AOC = \angle BOC + \angle COD + \angle BOC$

$\angle AOC - \angle COD = 2\angle BOC$

$$\angle BOC = \frac{1}{2}\left(\angle AOC - \angle COD\right)$$

PHYSICS

26. (D) All the given statements are correct

27. (B) As per Newton's Second Law of Motion

$F = ma$

$m = 5$ kg, $a = 1$ m/s^2 $= 5 \times 1 = 5$ N.

28. (B) Acceleration =

$$\frac{\text{Change in velocity}}{\text{Time}} = \frac{v_2 - v_1}{t_2 - t_1}$$

From 0 to A, $a = \frac{40-0}{0.5-0} = 80$ km/h^2

Now, Speed of the car from A to B is constant.

From B to C, $a = \frac{160-40}{1.5-1} = 240$ km/h^2

From C to E, $a = \frac{160-0}{2.5-1.5} = 160$ km/h^2

$\therefore$ The maximum acceleration of a car is 240 km/h^2.

29. (B) Case - I : Ball 'P'

Mass = m Velocity = v

$$KE_P = \frac{1}{2}mv^2$$

Case - II : Ball 'Q'

$$\text{Mass} = \frac{1}{2}\times \text{mass of ball P} = \frac{m}{2}$$

Velocity = 2 × velocity of ball P = 2 v

$$KE_Q = \frac{1}{2}\times\frac{m}{2}\times(2v)^2 = mv^2$$

$$\frac{K.E_P}{K.E_Q} = \frac{\frac{1}{2}mv^2}{mv^2} = \frac{1}{2}$$

30. (B) The mass of the body remains the same, both on the earth and on the moon. But the weight of the body on the moon is $\frac{1}{6}$th as that on the weight of the earth due to the variation of 'g' value.

31. (C) Given, mass (m) = 200 g = 0.2 kg

Initial velocity (u) = 0

Displacement (S) = 400 cm = 4 m

Time taken (t) = 2 s

We have $S = ut + \frac{1}{2}at^2$

$4 = 0(2) + \frac{1}{2}a(2^2)$

$4 = \frac{1}{2}a(4)$

$4 = 2a$

$a = \frac{4}{2} = 2\ m\ s^{-2}$

Now, Force (F) = ma = 0.2 × 2 = 0.4 N

32. (B) Average speed of the car

$$= \frac{\frac{80\times1000}{60\times60} + \frac{40\times1000}{60\times60}}{1+1}$$

$$= \frac{80\times5}{2\times18} + \frac{40\times5}{2\times18} = 16.7\ m\ s^{-1}$$

33. (D) According to the law of conservation of energy, the total energy at X = Total energy at Y

When the ball is thrown up from the point 'X', it has some kinetic energy. As it is on the ground, its potential energy is zero.

When the ball reaches the highest point 'Y', its velocity is zero. Therefore, its kinetic energy is zero. It has only potential energy.

At 'X' total energy is only kinetic and at 'Y', total energy is only potential.

So, Potential energy at Y = Kinetic energy at X.

34. (C) F = ma.

F_1 = (2.0 kg) (2.5 m/s^2)

F_2 = (5.0 kg) (2.0 m/s^2)

$$\frac{F_2}{F_1} = \frac{5.0\times2.0}{2.0\times2.5} = \frac{10\ N}{5\ N}$$

So, F_1 = 5 N and F_2 = 10 N

35. (C) Container 'R' holds maximum quantity of water. Hence, the thrust is the largest in Container R.

CHEMISTRY

36. (D) An atom gains or loses electrons when it becomes an ion. The number of protons before the gain/lose of electrons in an atom is same. Its atomic number or protan number remains the same.

37. (D) Elements X and Y combine to form a compound Z. X and Y being elements cannot be broken down into simpler substances. Compound Z has a fixed composition.

38. (D) An ice cube and water have mass and occupy space, so they are matter.

An ice cube has a definite shape and a definite volume, so it is a solid.

Water has a definite volume but has no definite shape, so it is a liquid.

39. (A) CuO (Copper oxide) contains only 2 atoms but H_2O and CO_2 contain 3 atoms.

Option (B) All the three molecules

(CO, O_2, MgO) contain 2 atoms.

Option (C) All the three molecules

(NH_3, PCl_3, H_2O_2) contain 4 atoms.

Option (D) All the three molecules

(N_2O, NO_2, O_3) contain 3 atoms.

40. (D) Milk is a mixture of casein and water. Sea water is a mixture of several salts and water. X is Milk, and Y is Sea water.

41. (A) Throughout the day, water will evaporate from the glass, and hence the volume will reduce. The correct graph in option (A) shows the decrease in the volume of water with time.

42. (C) Relative atomic mass of neon

$$= \frac{20\times90+21\times1+22\times9}{90+1+9} = 20.19$$

43. (C) Soap solution is a colloid.

Brass is a solution of zinc in copper, a solid in a solid metallic alloy.

Milk of magnesia is a sol, i.e., a collidal suspension of magnesium hydroxide in water.

Copper sulphate dissolves in water, it is a true solution.

44. (B) Average kinetic energy depends only on temperature and does not depend upon the nature of the gas.

45. (D) The relative molecular mass of $C_{12}H_{22}O_{11}$

= 12×12+1×22+16×11

= 144 + 22 + 176 = 342

The relative molecular mass of $C_{12}H_{22}O_{11}$ = 342.

BIOLOGY

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

47. (D) Vacuole, Lysosome, Ribosome

48. (C) Eagles are both secondary and teritiary consumer.

49. (C) Xylem and phloem are complex tissues composed of various types of cells that performs various functions paranchyma and collenchyma composed of a single type of cells performs similar functions.

50. (A) The symbiotic microorganisms Rhizobium is present in root nodules of legume plants.

51. (C) The given diagram is of adipose tissue.

52. (A) Sclerenchyma provides mechanical strength to plants.

53. (B) A tissue comprises an ensemble of cells that are ot necessarily identical but are derived from the same origin, working together to carry out a particuular function.

54. (B) The process of preparing manure the help of earthworms is known as vermicomposting.

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

CRITICAL THINKING

56. (A) The correct answer is A, B, D, F

57. (C) Pick a section and rotate it step-by-step. It's easiest if you pick a large section like the three orange circles in the top right-hand corner with the blue circle next to it. If you rotate this you can see the answer in (C) where the same pattern is in the bottom right hand corner.

58. (A) The earthen pots have pores through which water can evaporate, and it is a fact that evaporation causes cooling.

59. (D) P's travel denoted by green line and Q's travel by orange line. R's travel by Purple line.

P met Q at the green dot as shown while Q was supposed to travel along the dotted line. After they met at the dot, they walk and reach R. From R's home, the three travel to T's home.

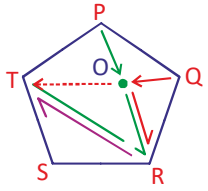
Assuming that all the friends walk at same pace (speed), let's check the option and see which are correct.

A) Actually the distance travelled by P and Q to reach the green dot (O) is the same, i.e., PO = QO. So, the distance travelled by P and Q are actually same.

B) The above discussion applies here. Note that T is quite opposite to T, just like R is quite opposite to P, they meet at the same distance.

C) Since PO = QO, QO + OR = PO + OR, which is equal to RT. R walked a distance of RT while Q walked a distance of QO + OR + RT = 2RT

D) As is clear from the drawing, P has to travel just by distance TP, which is the least.



60. (C)