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NATIONAL LEVEL SCIENCE TALENT SEARCH EXAMINATION (UPDATED)

CLASS - 9

Question Paper Code : 1P204

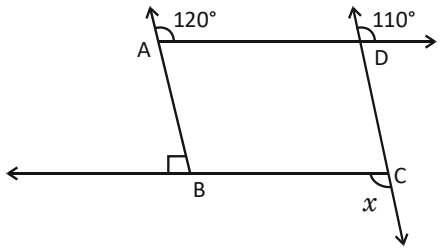
KEY

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

SOLUTIONS

MATHEMATICS

01. (B)



$\angle BAD = 180° - 120° = 60°$

$\angle ADC = 110°$

$\angle ABC = 180° - 90° = 90°$

In a quadrilateral ABCD

$60° + 110° + 90° + \angle BCD = 360°$

$\angle BCD = 360° - 260°$

$\angle BCD = 100°$

But $\angle BCD + x = 180°$

[$\because$ Linear pair]

$100° + x = 180°$

$x = 180° - 100°$

$x = 80°$

02. (C) Given $\pi r(l + r) = 7920\ cm^2$

$$\frac{22}{7} r(37 + r) = 7\,920$$

$$r^2 + 37r = \cancel{7920}^{360} \times \frac{7}{\cancel{22}}$$

$r^2 + 37r - 2520 = 0$

$r^2 + 72r - 35r - 2520$

$r(r + 72) - 35(r + 72) = 0$

$(r + 72)(r - 35) = 0$

$r + 72 = 0$ (or) $r - 35 = 0$

$r = -72$ (or) $r = 35$

$r = 35$ is selected $r = -72$ is rejected

$\therefore \quad l^2 = r^2 + h^2$

$37^2 = 35^2 + h^2$

$1369 - 1225 = h^2$

$h^2 = 144$

$h = \sqrt{144} = 12$

Volume $= \frac{1}{3}\pi r^2 h$

$= \frac{1}{\cancel{3}} \times \frac{22}{\cancel{7}} \times \cancel{35}^{5} \times 35 \times \cancel{12}^{4}$ cm^3

03. (A) On x-axis all y – coordinates are zero.

$\therefore \quad y = 0$ $2x + 3(0) = 0$

$2x = 0$

$x = \frac{0}{2}$

$x = 0$

$\therefore \quad 2x + 3y = 0$ line intersects x-axis at (0, 0)

04. (C) $\sqrt[3]{27x^3 - 9x^2 + \frac{1}{3x} - \frac{1}{27x^3}}$

$= \sqrt[3]{(3x)^3 - 3(3x)^2 \times \frac{1}{3x} + 3(3x)\frac{1}{(3x)^2} - \frac{1}{(3x)^3}}$

05. (B) Given r : h = 7 : 10 = $7x$: $10x$

Given $\pi r^2 h = 5{,}197.5$ cm^3

$\frac{22}{7} \times 7 \times 7x^3 \times 10 = 5{,}197.5$

$x^3 = 3.375$

$x^3 = (1.5)^3$

$x = 1.5$

CSA of the cylinder $= 2\pi rh$

$= 2 \times \frac{22}{7} \times 1.5 \times 15$ cm^2

$= 990$ cm^2

06. (C) $(a^3 - 4a^2 + 3a - 8)(a^3 + 4a^2 + 8a + 8)$

$= [(a^3 + 8a) - (4a^2 + 8)]\,[(a^3 + 8a) - (4a^2 + 8)]$

$= (a^3 + 8a)^2 - (4a^2 + 8)^2$

$= (a^6 + 16a^4 + 64a^2) - (16a^4 + 64a^2 + 64)$

$= a^6 + 16a^4 + 64a^2 - 16a^4 - 64a^2 - 64$

$= a^6 - 64$

07. (B) Given $\angle EAD = 32° \Rightarrow GFB = 32°$

[$\because$ Corresponding angles]

$\angle ABC + \angle CBF = 180°$

[$\because$ Linear pair]

$104° + \angle CBF = 180°$

$\angle CBF = 180° - 104° = 76°$

$\angle FCG = \angle GFB + \angle CBF$

$= 76° + 32° = 108°$

08. (C) $\left(\sqrt{18} + \sqrt{32} + \sqrt{50}\right)^2$

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

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

$= \left(12\sqrt{2}\right)^2$

$= 12^2 \times \left(\sqrt{2}\right)^2$

$= 144 \times 2 = 288$

09. (B) Given a = 24 cm, b = 70 cm, c = 74 cn

$S = \frac{a+b+c}{2} = \frac{24 \text{ cm} + 70 \text{ cm} + 74 \text{ cm}}{2} = \frac{168}{2}$ cm

S = 84 cm

Area of a triangle

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

$= \sqrt{84 \times 60 \times 14 \times 10}$ cm^2

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

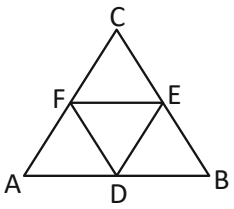
$= 14 \times 6 \times 10$ cm^2

$= 840$ cm^2

10. (C) Given AB = c = 22 cm

BC = a = 122 cm

CA = b = 120 cm



$S = \frac{a+b+c}{2} = \frac{264\text{ cm}}{2} = 132\text{ cm}$

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

$= \sqrt{132\times110\times10\times12}\text{ cm}^2$

$= \sqrt{11\times12\times11\times10\times10\times12}\text{ cm}^2$

$= 10 \times 11 \times 12\text{ cm}^2$

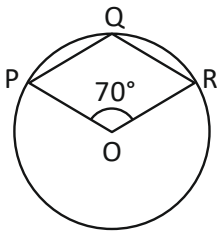
Area of $\Delta ABC = 1320\text{ cm}^2$

$\therefore$ Area of $\Delta DEF = \frac{1}{4}$ of area of ΔABC

$= \frac{1}{4} \times 1320\text{ cm}^2$

$= 330\text{ cm}^2$

11. (D) Construction. Extend PO upto S. Join SR.



Reflex $\angle POR = 360° - 70° = 290°$

$\angle Q = \frac{\text{Ref } \angle POR}{2} = \frac{290°}{2}$

$x = 145°$

12. (C) Option (C) is false.

13. (D) Given $(x - 1)$ is a factor of $(x - 1)^{2024}$

$\therefore$ Let $x = 1$

$\Rightarrow (1 - 1)^{2024} = a_0 \times 1^{2024} + a_1 \times 1^{2023} + ... + a_{2025}$

$\therefore$ $a_0 + a_1 + a_2 + ... + a_{2025} = 0$

14. (D) Const:- Join BD

In ΔBCD given BC = CD

$\angle BDC = \angle CBD = a$

In ΔBCD $a + a + 50° = 180°$

$2a = 180° - 50° = 130°$

$a = \frac{130°}{2} = 65°$

$\therefore$ In a cyclic quadrilateral ABDE, BDC = x

$\therefore$ $x = \angle BCDB = 65°$

15. (B) $\frac{1}{(x-3)} + \frac{1}{(x-3)(x-1)} - \frac{2}{(x-5)(x-1)}$

$= \frac{x-1+x-5-2(x-3)}{(x-1)(x-3)(x-5)}$

$= \frac{2x-6-2x+6}{(x-1)(x-3)(x-5)}$

$= \frac{0}{(x-1)(x-3)(x-5)}$

$= 0$

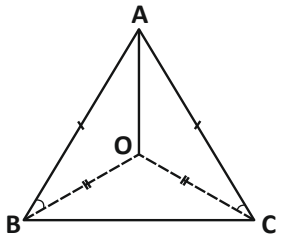
16. (A) $5y° + 7y° = 180° \Rightarrow 12y° = 180° \Rightarrow y = 15$

$3y + x + 5y = 180 \Rightarrow 8y + x = 180 \Rightarrow 120 + x = 180 \Rightarrow x = 60$

17. (A) Join OA

In OAB and OAC, we have

AB = AC (given),



OB = OC (given)

and OA = OA.

$\therefore$ $\Delta OAB \cong \Delta OAC \Rightarrow \angle ABO = \angle ACO$.

$\therefore$ $\angle ABO : ACO = 1 : 1$

18. (C) Clearly, A ↓ Q, B ↓ R, C ↓ P

So, $\Delta CAB \cong \Delta PQR$

19. (C) Let one angle of a parallelogram be $x°$.

$\therefore$ Other angle = $\frac{2}{3}x$

But $x+\frac{2x}{3}=180°$

$\frac{3x+2x}{3}=180°$

$5x = 180° \times 3$

$x=\frac{180°\times 3}{5}$

$x = 108°$

$\therefore$ $\frac{2x}{3}=\frac{2}{3}\times 108°=72°$

20. (D) In ΔADE, $\angle E = 90° \Rightarrow AD^2 = AE^2 + ED^2$

[$\because$ pythagorus theorem]

$29^2 = AE^2 + 21^2$

$841 = AE^2 + 441$

$AE = \sqrt{841-441} = \sqrt{400} = 20$

$\therefore$ BF = 20 cm

In ΔBCF, $\angle F = 90° \Rightarrow BC^2 = BF^2 + FC^2$

$25^2 = 20^2 + FC^2$

$FC = \sqrt{(20+25)(25-20)}$

$= \sqrt{45\times 5}$

= 15 cm

$\therefore$ CD = CF + FE + ED

= 15 cm + 32 cm + 21 cm = 68 cm

$\therefore$ Area of the trapezium ABCD

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

$=\frac{1}{2}\times 20\text{ cm}(32\text{ cm}+68\text{ cm})$

$= 10 \times 100\ cm^2$

$= 1000\ cm^2$

21. (D) Putting $x = 2$ and $y = 0$ in $2x + 3y = k$, we get k = (2 × 2 + 3 0) = (4 + 0) = 4.

22. (C) Substitute $y = x + 3$ in eq $3x + y = 11$

$3x + x + 3 = 11$

$4x = 8$

$x = 2$

If $x = 2$ then $y = 2 + 3 = 5$

$\therefore$ (2, 5) lies on $y = x + 3$ and $3x + y = 11$ line

23. (B) Given

$x=\sqrt{3}+\sqrt{2} \Rightarrow \frac{1}{x}=\frac{1}{\sqrt{3}+\sqrt{2}}\times\frac{\sqrt{3}-\sqrt{2}}{\sqrt{3}-\sqrt{2}}=\sqrt{3}-\sqrt{2}$

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

Cubing on both sides

$x^3+\frac{1}{x^3}+3x\times\frac{1}{x}\left(x+\frac{1}{x}\right)=\left(2\sqrt{3}\right)^3=8\times 3\sqrt{3}=24\sqrt{3}$

$x^3+\frac{1}{x^3}+3\times 2\sqrt{3}=24\sqrt{3}$

$x^3+\frac{1}{x^3}=18\sqrt{3}$

$\therefore x+\frac{1}{x}+x^3+\frac{1}{x^3}=2\sqrt{3}+18\sqrt{3}=20\sqrt{3}$

24. (D) $\frac{5+\sqrt{10}}{5\sqrt{5}-2\sqrt{20}-\sqrt{32}+\sqrt{50}}=\frac{5+\sqrt{5}\times\sqrt{2}}{5\sqrt{5}-4\sqrt{5}-4\sqrt{2}+5\sqrt{2}}$

$=\frac{\sqrt{5}(\sqrt{5}+\sqrt{2})}{(\sqrt{5}+\sqrt{2})}=\sqrt{5}$

25. (A) Let $\sqrt{49-x^2}+\sqrt{25-x^2}$ = k then

$(\sqrt{49-x^2}+\sqrt{25-x^2})(\sqrt{49-x^2}-\sqrt{25-x^2})$

= 3k

$[49 - x^2 - (25 - x^2)] = 3k$

24 = 3k

k = 8

PHYSICS

26. (C) X is a spring balance which is used to measure weight of brick whereas Y is a common balance used for measuring mass of brick.

27. (B) A man getting down from a running bus, falls forward due to inertia of motion. As the upper part of the man continues to be in motion as the bus is also in motion. The man's feet which were in motion in a running bus come to rest once they touch the road due to inertia of rest.

28. (B) Total distance covered by the car

= (30 + 30)km = 60 km

The time taken to cover first 30 km,

$t_1 = \frac{30}{40}h = \frac{3}{4}h$

The time taken to cover next 30 km,

$t_2 = \frac{30}{20}h = \frac{3}{2}h$

So, the total time taken

$= t_1 + t_2 = \left(\frac{3}{4} + \frac{3}{2}\right)h = \frac{9}{4}h$

Average speed

$= \frac{\text{Total distance covered}}{\text{Total time}} = \frac{60}{9/4}\text{km/h}$

$= \frac{60 \times 4}{9}\text{km/h}$

= 26.7 km/h

29. (C) Figure I : W = FS Cos θ , where θ is the angle between the force and the displacement (in the direction of motion).

In figure I : θ = 90°

$\therefore$ W = FS Cos 90° = 0

($\because$ Cos 90° = 0)

Thus, work done by the force in this figure is zero.

Figure II : θ = 180°

$\therefore$ W = FS Cos 180° = – FS

($\because$ Cos 180° = –1)

Thus, work done by the force in this figure is negative.

Figure III : θ = 0°

$\therefore$ W = FS Cos 0° = FS

($\because$ Cos 0° = 1)

Thus, work done by the force in this case is positive.

30. (C) If the string breaks, the force that was causing it to move along a circular path, i.e., centripetal force is no longer there, so the stone will move along a straight line tangential to the circular path.

31. (C) (m) = 200 g = 0.2 kg

Initial velocity (u) = 15 m s^{-1}

Final velocity (v) = 25 m s^{-1}

time taken (t) = 2.5 s

We have, $a = \frac{v-u}{t}$

$= \frac{25-15}{2.5} = \frac{10}{2.5} = 4\text{ m s}^{-2}$

Now, Force (F) = ma = 0.2 × 4 = 0.8 N

32. (C) Let 's' be the total distance travelled by the body. If t_1 is the time taken to cover first one third distance, then $t_1 = \frac{s/3}{4} = \frac{s}{12}$

Let t_2 be the time for each of the remaining two journeys. Then $\frac{2s}{3} = 2t_2 + 6t_2 = 8t_2$

$t_2 = \frac{2s}{3 \times 8} = \frac{s}{12}$

Average velocity = $\frac{\text{Displacement}}{\text{Total time}}$

$$= \frac{s}{t_1 + 2t^2} = \frac{s}{\left(\frac{s}{12}\right) + 2\left(\frac{s}{12}\right)} = 4\ m/s$$

33. (D) Work done to raise the object from position X to position Z = mgh.

Thus, potential energy of the object when raised through height h = mgh

Similarly, potential energy of the object when raised through height h_1 = mgh_1

From this activity, we conclude that more work is done by object to raise the object upto height Z.

As h > h_1, so potential energy of the object raised through height h is greater than the potential energy of the object raised through height h_1.

34. (A) Using Newton's second law,

$$\text{Acceleration of car (a)} = \frac{F}{m}$$

$$= \frac{3600 - 2000}{800} = 2\ m/s^2$$

35. (D) Forces F_1 and F_2 are equal as Newton's law of gravitation obeys the Newton's third law of motion, i.e., if an object exerts a force on another object, then the second object exerts an equal and opposite force on the first object.

CHEMISTRY

36. (C) Equal volumes contain equal no. of molecules. Hence, no. of atoms of H_2, He, O_2 and O_3 will be in the ratio 2 : 1 : 2 : 3.

37. (A,D) Sulphur is soluble in carbon disulphide. It forms a homogeneous solution and does not show Tyndall effect.

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 liquid 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 statement that atoms neither be created or destroyed supports the law of conservation of mass which holds well even today.

40. (B) $\text{Mass\%} = \frac{\text{Mass of solute}}{\text{Mass of solute + solvent}}$

Option (A) : $\text{Mass\%} = \frac{5}{5+95} \times 100 = 5$

Option (B) : $\text{Mass\%} = \frac{15}{150} \times 100 = 10$

Option (C) : $\text{Mass\%} = \frac{10}{190} \times 100 = 5.26$

Option (D) : $\text{Mass\%}\ \frac{25}{400} \times 100 = 6.25$

Therefore, mass% of solution (B) is maximum.

41. (C) Matter is anything that has mass and occupies space.

Air is a mixture of gases. It can be compressed but ice cannot be compressed [Option (A) is false]

Light is a form of energy, not matter. Stone is a solid. It cannot be compressed. [Option (B) is false]

Milk is a liquid. It cannot be compressed as it has no definite shape, but has volume. A Brick is a solid. It cannot be compressed. [Option (C) is true]

Smoke and cork are solids. They cannot be compressed. [Option (D) is false]

42. (A) 1 mole of glucose weighs 180 g.

$\Rightarrow$ 1 g of glucose $= \frac{1}{180}$ moles.

$\therefore$ 5.23 g of glucose $= \frac{1}{180} \times 5.23$ moles.

1 mole contains 6.023×10^{23} molecules

$\therefore$ Number of molecules in $= \frac{1}{180} \times 5.23$

$= \frac{1}{180} \times 5.23 \times 6.023 \times 10^{23}$

$= 0.175 \times 10^{23}$ molecules (or) 1.75×10^{22} molecules.

43. (C) Melting of iron metal, bending of a brass strip and making a wire of copper metal are all physical changes as no new substances are formed. Only rusting of iron article is a chemical change as a new substance rust is formed.

44. (D) The given diagrams show that the particles of the object in the solid state are very closely packed. The particles in the liquid state are farther apart and the particles in the gaseous state are very far apart.

45. (B) Potassium and chlorine react to form K^+ and Cl^- ions of 2.8.8 electronic configuration, which is similar to that of argon electronic configuration of 2, 8, 8

BIOLOGY

46. (A) The red blood cell or erythrocyte transports oxygen as oxyhaemoglobin and carbon dioxide as carbamino haemoglobin.

47. (C) Azolla spp. is a biofertilisers.

48. (C) Zygote is formed by the Union of sperm and Ovum. It is a diploid cell.

49. (C) Y is lymphocyte. Lymphocyte produces antibodies to fight pathogen.

50. (B) Crop rotation maintain soil fertility.

51. (B) Chloroplasts contains DNA and RNA that help them to multiply on their own. Hence, they are called semi-autonomous organelles.

52. (C) The given cropping pattern is inter cropping, it helps in maintaining soil fertility and makes better use of resources.

53. (B) The drawing shows a plant cell, as seen by the presence of the cell wall, cell membrane and tonoplast. The long cytoplasmic extension is the root hair.

54. (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.

55. (A) Sperm is a haploid cell.

CRITICAL THINKING

56. (C) The passage describes a 'slip of the tongue' as an unintentional or accidental utterance that can lead to misunderstandings or offense. This aligns with option C, which indicates that a 'slip of the tongue' occurs when something is said without giving proper thought. Options A, B, and D do not correctly capture the unintentional nature of a 'slip of the tongue'.

57. (D) 51

58. (A) Assertion (A) states that people in areas with more intense sunlight have darker skin.

Reason (R) explains that melanin causes darker skin color and that sunlight exposure increases melanin production.

Relationship :

Reason (R) directly explains why people in areas with intense sunlight have darker skin: because more sunlight leads to increased melanin production, resulting in darker skin color.

Given this analysis, it is clear that the reason (R) correctly explains the assertion (A).

59. (C) As the water level in the bucket goes down, the speed of the water coming out of the hole decreases. This is because the speed of the outflow is proportional to the square root of the water height above the hole, and a lower water level results in a lower speed.

60. (A)

- Firoj - President
- Esha - Vice president
- Bhavya - Secretary
- Chaitu - Treasurer

Let Firoj be the President and complying with his conditions, Esha the Vice President.

Bhavya does not wish to be either the President, Vice-President, so he is most likely to be the Secretary or Treasurer. Let him be the Secretary.

Besides it will not violate Esha 's condition who would not work if both Aarva and Bhavya work, but can work with either of them.

Divya cannot be appointed as Treasurer, with in the work force. Hence the last option is Chaitu, whose conditions are compatible with the elected work force.

The End