



**NATIONAL LEVEL SCIENCE TALENT SEARCH EXAMINATION (UPDATED)**

**CLASS - 9**

**Question Paper Code : 1P214**

**KEY**

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

**SOLUTIONS**

**MATHEMATICS**

01. (B)  $\sqrt{29 + \sqrt{720}} = \sqrt{29 + \sqrt{4 \times 180}}$   
 $= \sqrt{29 + 2\sqrt{180}}$   
 $= \sqrt{20 + 9 + 2\sqrt{20} \times \sqrt{9}}$   
 $= \sqrt{(\sqrt{20})^2 + (\sqrt{9})^2 + 2\sqrt{20} \times \sqrt{9}}$   
 $= \sqrt{(\sqrt{20} + \sqrt{9})^2}$   
 $= (3 + 2\sqrt{5})$

02. (D) Given  $x = \sqrt{6} + \sqrt{5}$

$$x^2 = (\sqrt{6} + \sqrt{5})^2$$

$$= 6 + 5 + 2\sqrt{30}$$

$$= 11 + 2\sqrt{30}$$

Simplify  $x^2 + \frac{1}{x^2} - 2$

$$(11 + 2\sqrt{30}) + (11 - 2\sqrt{30}) - 2 = 20$$

$$\begin{aligned}
 03. \quad (D) \quad & \sqrt{(x-1)(x-2)(x-3)(x-4)+1} \\
 &= \sqrt{(x-1)(x-4)(x-2)(x-3)+1} \\
 &= \sqrt{(x^2-5x+4)(x^2-5x+6)+1} \\
 &= \sqrt{a(a+2)+1}
 \end{aligned}$$

$$\text{where } a = x^2 - 5x + 4$$

$$= \sqrt{a^2 + 2a + 1}$$

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

$$= a + 1$$

$$= x^2 - 5x + 4 + 1$$

$$= (x^2 - 5x + 5)$$

$$\begin{aligned}
 04. \quad (B) \quad & a^2 - b^2 = (a + b)(a - b) \\
 &= (1234567 + 1234566)(1234567 - 1234566)
 \end{aligned}$$

$$= 2469133 \times 1$$

$$= 24,69,133$$

$$\begin{aligned}
 05. \quad (C) \quad & \text{If the supplement of an angle is two-third of itself. Determine the angle.}
 \end{aligned}$$

$$\text{Let angle} = x$$

$$\text{Supplement} = 180 - x$$

$$\text{Given: } 180 - x = (2/3)x$$

$$\text{Multiply both sides by 3:}$$

$$540 - 3x = 2x$$

$$5x = 540$$

$$x = 108^\circ$$

$$06. \quad (A) \quad \text{Given equations}$$

$$29x + 37y = 103 \quad \dots (1)$$

$$37x + 29y = 95 \quad \dots (2)$$

$$\text{Step 1: Add (1) and (2)}$$

$$66x + 66y = 198$$

$$x + y = 3 \quad \dots (3)$$

$$\text{Step 2 : Subtract (1) from (2)}$$

$$8x - 8y = -8$$

$$x - y = -1 \quad \dots (4)$$

$$\text{Step 3: Solve (3) and (4)}$$

$$x + y = 3, \quad x - y = -1$$

$$\text{Add}$$

$$2x = 2$$

$$x = 1$$

$$\text{Substitute } x = 1 \text{ into (3)}$$

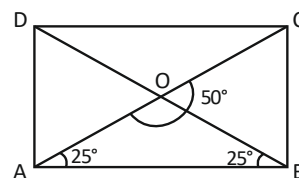
$$1 + y = 3$$

$$y = 2$$

$$07. \quad (B) \quad \text{Quadrant II : } a < 0, b > 0$$

$$\text{So, } -a > 0, -b < 0 \text{ (Quadrant IV)}$$

$$08. \quad (B) \quad \text{In a rectangle diagonals are equal and diagonals bisect each other.}$$



$$\therefore OA = OB \Rightarrow \angle OBA = \angle OAB = 25^\circ$$

[ $\because$  Given]

$$\therefore \angle BOC = \angle OAB + \angle OBA = 25^\circ + 25^\circ = 50^\circ \text{ is acute angle and } \angle AOB = 180^\circ - \angle BOC = 130^\circ \text{ is obtuse angle.}$$

$$09. \quad (B) \quad \text{Given } a = 9 \text{ cm, } b = 8 \text{ cm and } c = 13 \text{ cm}$$

$$s = \frac{a + b + c}{2} = \frac{9 \text{ cm} + 8 \text{ cm} + 13 \text{ cm}}{2} = \frac{30 \text{ cm}}{2}$$

$$s = 15 \text{ cm}$$

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

$$= \sqrt{15 \times (15 - 9)(15 - 8) \times (15 - 13)}$$

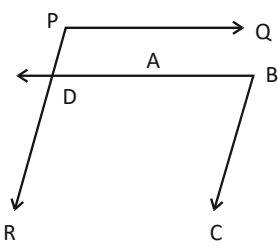
$$= \sqrt{15 \times 6 \times 7 \times 2}$$

$$= \sqrt{3 \times 5 \times 3 \times 2 \times 7 \times 2}$$

$$= 6\sqrt{35} \text{ cm}^2$$

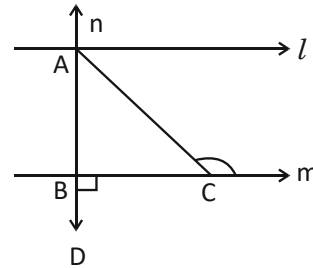
$$\text{Area of the parallelogram } ABCD = 2 \times$$

$$\text{area of } \triangle ABC = 12\sqrt{35} \text{ cm}^2$$

10. (B) Given  $\frac{1}{3}\pi r^2 h = 3696\text{m}^3$
- $$\frac{1}{3} \times \frac{22}{7} \times r^2 \times 8\text{ m} = 3696\text{m}^3$$
- $$r^2 = \frac{3696 \times 3}{\frac{22}{7} \times 8} = \frac{3696 \times 21}{22} = 354.27$$
- $$r^2 = (21\text{ m})^2$$
- $$r = 21\text{ m}$$
- $$l = \sqrt{b^2 + r^2}$$
- $$= \sqrt{8^2 + 21^2}$$
- $$= 505$$
- $$= 22.47\text{ m}$$
- CSA of a cone
- $$= \pi \times l = \frac{22}{7} \times 21 \times 22.47\text{ m}^2$$
- $$= 66 \times 22.47\text{ m}^2$$
- $$= 1483.02\text{ m}^2$$
11. (D) In  $\triangle AOB$ ,  $OA = OB \Rightarrow \angle OBA = \angle OAB = 20^\circ$
- $$\therefore 20^\circ + 20^\circ + \angle AOB = 180^\circ$$
- $$\angle AOB = 140^\circ$$
- In  $\triangle BOC$ ,  $OC = OB \Rightarrow \angle CBO = \angle C = 50^\circ$
- $$\therefore 50^\circ + 50^\circ + \angle BOC = 180^\circ$$
- $$\angle BOC = 80^\circ$$
- $$\angle AOB = \angle AOC + \angle COB$$
- $$140^\circ = \angle AOC + 80^\circ$$
- $$140^\circ - 80^\circ = \angle AOC$$
- $$\therefore \angle AOC = 60^\circ$$
12. (A) Construction:– Extend BA upto 'D' such that BA intersects PR at D.
- 
- $PR \parallel BC \Rightarrow \angle ABC + \angle BDR = 180^\circ$
- $$\therefore 74^\circ + \angle BDR = 180^\circ$$
- $$\angle BDR = 180^\circ - 74^\circ = 106^\circ$$
- $$\therefore \angle QPR = \angle BDR = 106^\circ$$
- [ $\therefore$  corresponding angles]

13. (C) Given  $\angle A = 3\angle C$  and  $\angle B = 2\angle C$
- But  $\angle A + \angle B + \angle C = 180^\circ$
- $$3\angle C + 2\angle C + \angle C = 180^\circ$$
- $$6\angle C = 180^\circ$$
- $$\angle C = 30^\circ$$
- $$\angle A = 3\angle C = 90^\circ$$
- ABC is a right angled triangle.

14. (A)  $\angle ABC + \angle CBD = 180^\circ$
- $$\angle ABC + 90^\circ = 180^\circ$$
- $$\angle ABC = 90^\circ$$



In  $\triangle ABC$

$$\angle ABC + \angle BAC = 125^\circ$$

$$90^\circ + \angle BAC = 125^\circ$$

$$\angle BAC = 125^\circ - 90^\circ = 35^\circ$$

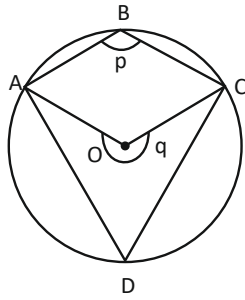
15. (A) From the second equation
- $$y = 3x - 7$$
- Substitute into the first equation
- $$2x + 3(3x - 7) = 1$$
- $$2x + 9x - 21 = 1$$
- $$11x = 22$$
- $$x = 2$$
- Then,  $y = 3(2) - 7 = -1$

16. (B) Sphere radius = half of cube side = 3 cm

$$\text{Sphere volume} = \frac{4}{3}\pi(3)^3 = 36\pi\text{ cm}^3$$

17. (D)  $\sqrt{448} - \sqrt{1008} - \sqrt{567} + \sqrt{700}$
- $$= \sqrt{64 \times 7} - \sqrt{144 \times 7} - \sqrt{81 \times 7} + \sqrt{100 \times 7}$$
- $$= 8\sqrt{7} - 12\sqrt{7} - 9\sqrt{7} + 10\sqrt{7}$$
- $$= -3\sqrt{7}$$
- $$= -\sqrt{3 \times 3 \times 7} = -\sqrt{63}$$

18. (A) Construction: Take a point 'D' on the major arc and join AD & CD



ABCD is a cyclic quadrilateral

$$\therefore \angle P + \angle D = 180^\circ$$

$$\angle D = 180^\circ - P$$

$$\text{But } \angle AOC = 2\angle D$$

$$\text{But } q + \angle AOC = 360^\circ$$

$$q + 2(180^\circ - P) = 360^\circ$$

$$q + 360^\circ - 2P = 360^\circ$$

$$q = 360^\circ - 360^\circ + 2p$$

$$2p = q$$

19. (A) Given  $\frac{4}{3}\pi(R^3 - r^3) = \frac{1}{3}\pi \times r^2 \times h$

$$\Rightarrow \frac{4}{3}\pi(4^3 - 2^3) = \frac{1}{3}\pi \times r_1^2 \times 14\text{cm}^3$$

$$4^2 \times \frac{(64 - 8)}{14} = r_1^2$$

$$2 \times \frac{56}{7} = r_1^2$$

$$r_1 = \sqrt{16}\text{cm} = 4\text{cm}$$

$$\therefore \text{Diameter} = 2r_1 = 8\text{cm}$$

20. (C) Given  $\pi r^2 = 38.5 \times \frac{2}{2} \text{ cm}^2$

$$\frac{22}{7} \times r^2 = \frac{77}{2}$$

$$r^2 = \frac{77}{2} \times \frac{7}{22}$$

$$r = \sqrt{\frac{49}{4}} = \frac{7}{2}$$

Given  $2\pi rh = 176 \text{ cm}^2$

$$2 \times \frac{22}{7} \times \frac{7}{2} \times h = 176 \text{ cm}^2$$

$$h = \frac{176}{22} \text{ cm} = 8 \text{ cm}$$

Volume of the cylinder =  $\pi r^2 h$

$$= \frac{22}{7} \times \frac{7}{2} \times \frac{7}{2} \times 8 \text{ cm}^3$$

$$= 308 \text{ cm}^3$$

21. (B)  $12x^2 - 5x - 28 = 0$

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

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

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

$$\therefore 4x = 7 \text{ and } 3x = -4$$

$$x = \frac{7}{4} \quad x = -\frac{4}{3}$$

$$\therefore \text{sum of the zeros} = \frac{7}{4} + \frac{(-4)}{3}$$

$$= \frac{21 - 16}{12}$$

$$= \frac{5}{12}$$

22. (B)  $64^2 + 31^2 + 32^2 - 2 \times 64 \times 31 + 2 \times 31 \times 32 - 2 \times 64 \times 32$

$$= (-64 + 31 + 32)^2$$

$$= (-1)^2$$

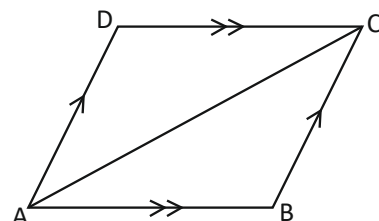
$$= 1$$

23. (B) In  $\triangle ABC$  and  $\triangle CDA$

$$\angle CAB = \angle ACD (\because \text{alternative angles})$$

$$AC = AC (\because \text{side and common})$$

$$\angle ACB = \angle CAD (\because \text{alternative angles})$$



$\therefore \triangle ABC \cong \triangle CDA$  [ $\because$  ASA congruences]

$\therefore$  Area of CDA = area of  $\triangle ABC$

$\therefore$  Area of the quadrilateral ABCD = Area of ABC + Area of  $\triangle ADC$

$$= (25 + 25) \text{ cm}^2$$

$$= 50 \text{ cm}^2$$

24. (C)  $\angle BCD = \angle BAD = 44^\circ$

[ $\because$  angles in the same segment]

In  $\triangle CDE$ ,  $\angle E = 90^\circ$  &  $\angle ECD = 44^\circ$

$$\therefore 90^\circ + 44^\circ + x = 180^\circ$$

$$\Rightarrow x = 180^\circ - 134^\circ = 46^\circ$$

25. (B) Given  $a = 8 \text{ cm}$ ,  $b = 31.5 \text{ cm}$  and  $c = 32.5 \text{ cm}$

$$s = \frac{a + b + c}{2} = \frac{(8 + 31.5 + 32.5) \text{ cm}}{2}$$

$$= \frac{72 \text{ cm}}{2} = 36 \text{ cm}$$

$$\text{Area of DABC} = \sqrt{s(s-a)(s-b)(s-c)}$$

$$= \sqrt{36 \text{ cm} \times 28 \text{ cm} \times 4.5 \text{ cm} \times 3.5 \text{ cm}}$$

$$= \sqrt{36 \times 7 \times 2 \times 2 \times 4.5 \times 3.5} \text{ cm}^2$$

$$= 7 \times 3 \times 6 \text{ cm}^2$$

$$= 126 \text{ cm}^2$$

## PHYSICS

26. (B)  $KE = 20 \text{ J}$ ,  $U = 0 \text{ J}$

At the top: Total =  $PE = 25 \text{ J}$

Energy lost to friction =  $5 \text{ J}$

Remaining mechanical energy =  $25 - 5 = 20 \text{ J}$

At the bottom,  $PE = 0 \rightarrow KE = 20 \text{ J}$

27. (A) From 4 to 6 s, the velocity remains constant  $\rightarrow$  acceleration = 0. So, the claim of uniform acceleration is incorrect.

28. (B) The knife, because the contact area is extremely small.

Pressure depends on both force and contact area. Although the elephant has a very large weight, its large foot area spreads out the force, reducing the pressure. The knife applies a relatively smaller force over a tiny contact area, causing very high pressure, which can easily cut meat. The barefoot person or brick exert lower pressure as the forces are distributed over larger areas or softer surfaces. This tests careful evaluation of force and area rather than intuitive choice based on weight alone, making it challenging and suitable for Olympiad level.

29. (B) We are given an acceleration-time graph. Key points:

0–2 s: Acceleration =  $+2 \text{ m/s}^2$  (constant)

2–4 s: Acceleration decreases linearly from  $2$  to  $0 \text{ m/s}^2$

"Velocity" = "Area under the acceleration-time graph"

0–2 s: Constant positive acceleration  $\rightarrow$  velocity increases linearly.

2–4 s: Acceleration decreasing to 0  $\rightarrow$  velocity still increases, but more slowly (slope decreases).

So, velocity is not decreasing at all from 0–4 s. It is increasing, first faster, then slower.

Conclusion: The velocity-time graph shows a straight line with positive slope that becomes less steep (still increasing), not decreasing.

So the correct option remains (C) Straight line with positive slope.

30. (C) The egg floats in salt water because density of salt water > density of egg, so the buoyant force equals or exceeds its weight.

It sinks in fresh water (less dense) and is partly submerged in honey because although honey is highly viscous, its density may not be sufficient to fully float the egg.

31. (B) Work done

$$W = \Delta KE = \frac{1}{2}mv_{\text{final}}^2 - \frac{1}{2}mv_{\text{initial}}^2$$

Since the robot starts and ends at rest,

$$W = 0 - 0 = 0 \text{ J}$$

Hence, net work done = 0 J, even though energy was expended internally to move.

32. (B) Pressure on the shoulder is  $P = \frac{F}{A}$ . A thin strap has smaller contact area A, so for the same force F (weight of bag), pressure increases → more pain. A wider strap distributes force over larger area → lower pressure → more comfort.

33. (C) Density  $\rho = \frac{\text{mass}}{\text{volume}}$

Same weight crown but larger volume → average density lower than pure gold

This proves the crown was impure, containing metals of lower density.

34. (A) In free fall (neglecting air resistance), acceleration = g for all bodies regardless of mass or material. However, Momentum  $p = mv \rightarrow$  differs since masses differ.

Potential energy  $mgh \rightarrow$  differs for unequal masses.

Kinetic energy  $\frac{1}{2}mv^2 \rightarrow$  also differs.

Thus, only acceleration remains the same for both spheres.

35. (B) The correct answer is: (B) Newton's Second Law – the force experienced depends on the change in momentum over time.

When an athlete lands on a cushioned bed, the stopping time is increased. According to Newton's Second Law ( $F = \Delta p / \Delta t$ ), increasing the time over which momentum changes reduces the force experienced by the athlete. This smaller force helps prevent injuries.

### CHEMISTRY

36. (B) Formula of glucose =  $C_6H_{12}O_6$

Molecular weight = 180 a.m.u.

One mole gram glucose = 180 g

180 g of glucose contains

1 mole of glucose

540 g of glucose contains

$$= \frac{1}{180 \text{ g}} \times 540 \text{ g} = 3 \text{ moles}$$

37. (D)  $R_f = \frac{\text{distance travelled by the solute (dye)}}{\text{distance travelled by the solvent front}} = \frac{40}{50}$

38. (C) Gases do not have any definite volume. Their volume is equal to the volume of the container.

39. (D)  $C + O_2 \rightarrow CO_2$   
 $12 \text{ g} + 32 \text{ g} = 44 \text{ g}$   
 $1.5 \text{ g} = ?$

∴ Weight of oxygen needed

$$= \frac{32 \times 1.5}{12} = 4 \text{ g}$$

40. (C) Fractional distillation is used for separating liquids in a mixture based on the difference in boiling points of the components. The one with a lower boiling point will be separated out first.

41. (A) The correct matching is 1-s, 2-p, 3-q, 4-r
- (1) Evaporation - Liquid to gas at any temperature
  - (2) Boiling - Liquid to gas at a fixed temperature
  - (3) Sublimation - Solid to gas
  - (4) Hoar frost - Gas to solid
42. (D) Carbon dioxide and nitrous oxide have the same formula unit mass.
- Option (A)  $\text{CaCl}_2 = 40 + 71 = 111$   
 $\text{K}_2\text{CO}_3 = (39 \times 2) + 12 + (16 \times 3)$   
 $= 78 + 12 + 48 = 138$
- Option (B)  $\text{CaO} = 40 + 16 = 56$   
 $\text{HCl} = 1 + 35.5 = 36.5$
- Option (C)  $\text{CO} = 12 + 16 = 28$   
 $\text{NH}_3 = 14 + 3 = 17$
- Option (D)  $\text{CO}_2 = 12 + 16 \times 2 = 44$   
 $\text{N}_2\text{O} (14 \times 2) + 16 = 44$
43. (C) The apparatus used to obtain pure compound X from a mixture with water is a filter funnel lined with filter paper (or other filtering device) and a conical flask or beaker to collect the liquid. The process is called filtration.
- Since compound X is insoluble in water, filtration separates the solid particles of X from the liquid water.
- The mixture is poured into the filter funnel.
- The solid compound X (the residue) remains trapped in the filter paper.
- The water (the filtrate) passes through the filter paper's pores and collects in the flask or beaker below.
- The melting and boiling points of compound X are very high ( $900^\circ\text{C}$  and  $1200^\circ\text{C}$ ) and do not affect this physical separation method, which relies solely on its insolubility and particle size relative to the filter's pores. Other methods like evaporation or distillation are not suitable for an insoluble solid if you want to recover the pure solid without potential decomposition or to recover the water efficiently.

44. (C) Solids have the given characteristics. Hence, they have definite shape and volume.
45. (B) 40 g of calcium constitutes one gram atom.
- 10 g of calcium accounts for gram atom
- $$= \text{Gram atoms} = \frac{\text{Mass of the element in grams}}{\text{Atomic mass of the element}}$$
- $$\frac{10}{40} = 0.25 \text{ gram atoms}$$
- According to Avogadro's number, the number of atoms in 1 g of calcium =  $6.023 \times 10^{23}$
- The number of atoms in 0.25 gram atom =  $0.25 \times 6.023 \times 10^{23} = 1.50 \times 10^{23}$  atoms.

### BIOLOGY

46. (B) In metaphase, chromosomes align along the cell's equatorial plate (middle) before separation, a key visual characteristic of this stage.
47. (B) Collenchyma cells have thickened corners, provide flexible mechanical support, and are common in young stems and leaf stalks of climbing plants.
48. (C) Sclerenchyma cells have thick, lignified walls and are dead at maturity, providing rigid support in leaves/stems of plants in harsh conditions.
49. (B) Sprinkler and drip systems can irrigate uneven land efficiently, unlike traditional methods like moat or chain pump that require more uniform terrain.
50. (A) Tendons are tough, fibrous connective tissues that attach muscles to bones, enabling movement.
51. (B) Epithelial tissue
- Skin appendages like hair, nails, feathers, and scales develop from epithelial tissues.
52. (B) Chondroblasts are cells that produce and secrete the cartilage matrix, aiding in the repair and maintenance of cartilage tissue.

53. (C) Xylem vessels and tracheids are dead cells that form hollow tubes, allowing upward movement of water and minerals via capillary action and transpiration pull.

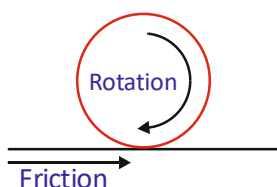
54. (D) Connective tissue  
Blood and lymph are fluid connective tissues that transport nutrients, gases, and immune cells throughout the body.

55. (B) Recycling reduces waste, conserves natural resources, and minimizes pollution, helping to preserve the environment.

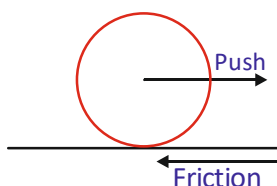
### CRITICAL THINKING

56. (B) Squares are in no particular order within the frame. It is merely the number of squares that are important for this sequence. Shaded squares change from three to two with each turn. Unshaded squares change from two to three with each turn. Semi-circle moves from top left to top right, to bottom left to bottom right with each turn.

57. (B,C) The back wheel of the bicycle is connected to the pedals. It rotates and rubs against the floor to push itself to move forward. The friction opposes the motion for back wheel as shown.



The front wheel of the bicycle is a free wheel. It is being pushed forward at the centre of the wheel by the movement of the back wheels. The lower part of the wheel is being dragged towards the right and rubbing against the floor causes the rotation. The friction opposes the motion for front wheel as shown.



If we strictly follow the labels shown in the diagram (as a student must in an exam)

- The wheel labelled "Front wheel" (actually the driven wheel) → Friction acts to the right.
- The wheel labelled "Back wheel" (actually the free wheel) → Friction acts to the left.

58. (B) Think of each pair: every time two cars swap relative order counts one overtake. Total overtakes between a pair equals number of times their relative order changes. Starting order Ramesh > Rajesh > Snehan.

R vs J swap 9 times → their final relative order is same as start if 9 is even? Actually odd swaps invert order. 9 odd ⇒ R and J end in opposite order (Rajesh ahead of Ramesh).

R vs S swap 11 times (odd) ⇒ their final order inverted (Snehan ahead of Ramesh).

J vs S swap 10 times (even) ⇒ their final order same as start (Rajesh ahead of Snehan).

Combine: From J vs S same as start: Rajesh ahead of Snehan.

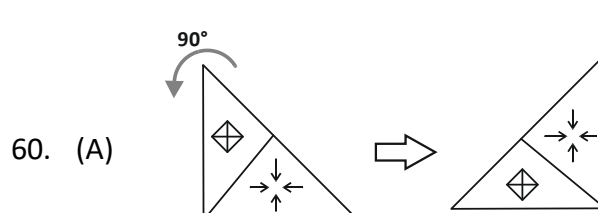
From R vs J inverted: Rajesh ahead of Ramesh.

From R vs S inverted: Snehan ahead of Ramesh.

So final order: Rajesh (1st), Snehan (2nd), Ramesh (3rd).

Answer: (B) Rajesh, Snehan, Ramesh.

59. (B) As the awareness about health in the society is increasing particularly among middle-aged group of people, the importance of Yoga and exercise is being realized by all sections of the society.



60. (A)