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NATIONAL LEVEL SCIENCE TALENT SEARCH EXAMINATION (UPDATED)

CLASS - 9

Question Paper Code : 1P104

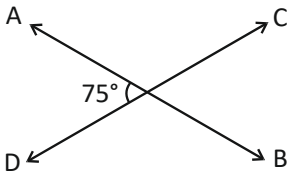
KEY

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

SOLUTIONS

MATHEMATICS

01. (B) Given $\angle AOD = 75°$



$\angle AOD + \angle AOC = 180°$

$75° + \angle AOC = 180°$

$\angle AOC = 180° - 75°$

$= 105°$

$\therefore$ $\angle BOD = \angle AOC = 105°$ [$\because$ Vertically opposite angles]

$\therefore$ $\angle AOC + \angle BOD = 105° + 105°$

$= 210°$

02. (D) $100^{200} = (10^2)^{200} = 10^{400} = 1000 \ldots. 00$ (400 zeros)

$\therefore$ $100^{200} - 99 = 10000 \ldots.. 00$ (400 zeros) $- 99$

$= 9999 \ldots\ldots\ldots 9901$ (398 nines)

$\therefore$ Sum of the digits $= 9 \times 398 + 0 + 1$

$= 3582 + 1 = 3583$

03. (A) Given $p(x) = \left(x^2 - \frac{16x}{3} + \frac{15}{4}\right)$

$$p\left(\frac{5}{6}\right)=\left(\frac{5}{6}\right)^2-\frac{\cancel{16}^{8}}{3}\times\frac{5}{\cancel{6}_{3}}+\frac{15}{4}$$

$$=\frac{25}{36}-\frac{40}{9}+\frac{15}{4}$$

$$=\frac{25-160+135}{36}$$

$= \frac{160-160}{35} = 0 \Rightarrow (6x - 5)$ is a factor of $p(x)$

04. (A) $x=\sqrt{3}-\sqrt{2},\ y=\sqrt{2}-\sqrt{6},\ z=\sqrt{6}-\sqrt{3}$

$$\therefore x+y+z=\cancel{\sqrt{3}}-\cancel{\sqrt{2}}+\cancel{\sqrt{2}}-\cancel{\sqrt{6}}+\cancel{\sqrt{6}}-\cancel{\sqrt{3}}=0$$

If $x + y + z = 0 \Rightarrow$

$x^3 + y^3 + z^3 = 3xy$

$\therefore$ $x^3 + y^3 + z^3 - 3xyz = 3xyz - 3xyz$

$= 0$

05. (C) $\angle AOC + \angle COD = 180°$ [$\because$ Linear pair]

$115° + \angle COD = 180°$

$\angle COD = 180° - 115° = 65°$

$\angle COD = 65°$

$\angle AOB + \angle BOD = 180°$ [$\because$ Linear pair]

But given $\angle BOD = 120°$

$\angle BOC + \angle COD = 120°$

$\angle BOC + 65° = 120°$

$\angle BOC = 120° - 65° = 55°$

06. (B) Given $\angle A - \angle B = 15° \Rightarrow \angle A = \angle B + 15°$

Given $\angle B - \angle C = 15° \Rightarrow \angle B - 15° = \angle C$

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

$$\angle B + \cancel{15^\circ} + \angle B + \angle B - \cancel{15^\circ} = 180°$$

$3\angle B = 180°$

$$\angle B = \frac{180^\circ}{3} = 60^\circ$$

$\angle A = \angle B + 15° = 60° + 15° = 75°$

07. (A) Given $2\pi r(h + r) = 1155\ cm^2$

$$\Rightarrow 2\times\frac{22}{7}\times r(7+r)=1155\ cm^2$$

$$7r+r^2=\cancel{1155}^{105}\times\frac{7}{\cancel{22}_{2}}\times\frac{1}{2}$$

$4(7r + r^2) = 105 \times 7$

$4r^2 + 28r - 735 = 0$

$4r^2 + 70r - 42r - 735 = 0$

$2r(2r + 35) - 21(2r + 35) = 0$

(2r+35=0 (or) 2r-21 = 0

$2r = -35$

$r = \frac{-35}{2}$ is rejected because radius is never negative.

$\therefore$ $2r - 21 = 0$

$2r = 21$

$$r=\frac{21}{2}$$

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

$$=\frac{\cancel{22}^{\cancel{11}^{55}}}{\cancel{7}}\times\frac{21}{\cancel{2}_{1}}\times\frac{21}{\cancel{2}}\times\cancel{7}\ cm^3$$

$= 2425.5\ cm^3$

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

substitute $y = 0$ in $ax + by + c = 0$

$ax + b(0) + c = 0$

$ax = -c$

$$x=\frac{-c}{a}$$

$\therefore$ Required point on x-axis = $\left(\frac{-c}{a},0\right)$

09. (A) $$\sqrt{\frac{a}{b}+2+\frac{b}{a}}=\sqrt{\frac{a^2+2ab+b^2}{ab}}$$

$$=\sqrt{\frac{(a+b)^2}{\sqrt{ab}}}=\frac{a}{\sqrt{ab}}+\frac{b}{\sqrt{ab}}$$

$$= \frac{\sqrt{a^2}}{\sqrt{ab}} + \frac{\sqrt{b^2}}{\sqrt{ab}}$$

$$= \sqrt{\frac{\cancel{a^2}}{\cancel{ab}}} + \sqrt{\frac{\cancel{b^2}}{a\cancel{b}}}$$

$$= \sqrt{\frac{a}{b}} + \sqrt{\frac{b}{a}}$$

10. (C) In ΔABC, F & E are the mid points of AB & AC.

$\therefore$ FE = $\frac{BC}{2}$ [$\because$ Midpoint theorem]

Similarly BD = $\frac{AC}{2}$ & DE = $\frac{AB}{2}$

In ΔAFE and ΔFBD

AF = BF [$\because$ side and given]

FE = BD = $\frac{BC}{2}$ [$\because$ side]

FD = AE = $\frac{AC}{2}$ [$\because$ side]

$\therefore$ $\Delta AFE \cong \Delta FBD$ [$\because$ sss concruency]

similarly we can prove

$\therefore$ $\Delta AFE \cong \Delta FBD \cong \Delta EDC \cong \Delta DEF$

$\therefore$ Area of ΔAFE = area of ΔFBD = area of ΔCDE = area of ΔDEF

[$\because$ Congruent figures have same area]

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

= $\frac{1}{4} \times 60$ cm^2

= 15 cm^2

11. (B) Given $a = \frac{\sqrt{3}-\sqrt{2}}{\sqrt{3}+\sqrt{2}} \times \frac{\sqrt{3}-\sqrt{2}}{\sqrt{3}-\sqrt{2}}$

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

$$= \frac{\sqrt{3}^2 - 2\sqrt{3}\times\sqrt{2} + \sqrt{2}^2}{3-2}$$

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

$$a = 5 - 2\sqrt{6}$$

similarly we can get $b = 5 + 2\sqrt{6}$

$\therefore$ $a^2 + b^2 + 4ab$

$$= (5-2\sqrt{6})^2 + (5+2\sqrt{6})^2 + 4\left(\frac{\cancel{\sqrt{3}-\sqrt{2}}}{\cancel{\sqrt{3}+\sqrt{2}}} \times \frac{\cancel{\sqrt{3}+\sqrt{2}}}{\cancel{\sqrt{3}-\sqrt{2}}}\right)$$

$$= 5^2 - \cancel{2\times5\times2\sqrt{6}} + (2\sqrt{6})^2 + 5^2 + \cancel{2\times5\times2\sqrt{6}} + (2\sqrt{6})^2 + 4$$

= 25 + 24 + 25 + 24 + 4

= 102

12. (B) AB||CD and AC cuts them.

$\therefore$ $\angle BAC + \angle ACD = 180°$

$\Rightarrow$ $75 + \angle ACD = 180° \Rightarrow \angle ACD = 105°$

$\therefore$ $\angle ECF = \angle ACD = 105°$

Sum of the angles of a triangle is 180°

$\therefore$ $105° + 35° + x = 180°$ $x = (180° - 140°) = 40°$.

13. (D) If $x = 2$ and $y = -2.5$ then $5(2) - 4(-2.5) = 10 + 10 = 20$

$\therefore$ $(2, -2.5)$ is the solution of $5x - 4y = 20$

14. (A) $\sqrt[3]{40} - \sqrt[3]{320} + \sqrt[3]{2560} = \sqrt[3]{2\times2\times2\times5} - \sqrt[3]{4\times4\times4\times5} + \sqrt[3]{8\times8\times8\times5}$

$$2\sqrt[3]{5} - 4\sqrt[3]{5} + 8\sqrt[3]{5}$$

= $(2 - 4 + 8)\ \sqrt[3]{5}$

= $6\sqrt[3]{5}$

$$= \sqrt[3]{6\times6\times6\times5}$$

$$= \sqrt[3]{1080}$$

15. (D) LHS =

$$\sqrt{11+3+2+2\sqrt{2}\times\sqrt{3}+2\sqrt{2}\times\sqrt{11}+\sqrt{11}\times\sqrt{3}}$$

$$\sqrt{\left(\sqrt{11}\right)^2+\left(\sqrt{3}\right)^2+\left(\sqrt{2}\right)^2+2\sqrt{2}\times\sqrt{3}+2\sqrt{2}\times\sqrt{11}+2\sqrt{11}\times\sqrt{3}}$$

= $\sqrt{\left(\sqrt{11}+\sqrt{3}+\sqrt{2}\right)^2}$

= $\sqrt{11}+\sqrt{3}+\sqrt{2}$

16. (B) Given ABCD is a cyclic quadrilateral

$\therefore$ $\angle BAD + \angle BCD = 180°$

$105° + \angle BCD = 180°$

$\angle BCD = 180° - 105° = 75°$

But $\angle BCD + \angle CBA = 180°$

[$\because$ sum of the interior angles]

$75° + \angle CBA = 180° - 75°$

$\angle CBA = 105°$

17. (A) Given $\frac{4}{3}\pi r^3 = \frac{1}{3}\pi \times 6 \times 6 \times 24\ cm^3$

$r = 6$ cm

18. (D) Given $p(x) = (2x^3 + ax^2 + 11x + a + 3)$ and $(2x - 1)$ is a factor of $p(x)$

$$p\left(\frac{1}{2}\right) = 0$$

$$p\left(\frac{1}{2}\right) = 2\left(\frac{1}{2}\right)^3 + a\left(\frac{1}{2}\right)^2 + 11\left(\frac{1}{2}\right) + a + 3 = 0$$

$$2 \times \frac{1}{8_4} + a \times \frac{1}{4} + \frac{11}{2} + a + 3 = 0$$

$$\frac{1 + a + 22 + 4a + 12}{4} = 0$$

$35 + 5a = 0 \times 4$

$5a + 35 = 0$

$5a = -35$

$$a = \frac{-35}{5}$$

$a = -7$

19. (C) Given $25x + 17x + 12x = 540$ m

$54x = 540$ m

$x = 10$ m

$\therefore$ sides are 250 m, 170 m & 120 m

$$s = \frac{a+b+c}{2} = 270 \text{ m}$$

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

$$= \sqrt{270\,(270-250)\,(270-170)\,(270-120)}$$

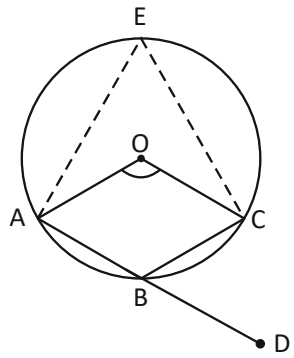
$$= \sqrt{270 \times 20 \times 100 \times 150}$$

$$= \sqrt{30 \times 9 \times 20 \times 20 \times 5 \times 5 \times 30}$$

$= 30 \times 3 \times 20 \times 5 = 9000\ m^2$

20. (D) Construction:- Take 'E' on major arc. Join AE & CE

$$\angle AEC = \frac{\angle AOC}{2} = \frac{x}{2}$$



But $\angle AEC + \angle ABC = 180$

[$\because$ ABCE is a cyclic quadrilateral]

$$\frac{x}{2} + \angle ABC = 180°$$

$$\angle ABC = 180° - \frac{x}{2}$$

But $\angle ABC + \angle CBD = 180$

[$\because$ Linear pair]

$$180° - \frac{x}{2} + \angle CBD = 180°$$

$$\angle CBD = 180° - 180° + \frac{x}{2}$$

$$= \frac{x°}{2}$$

21. (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 $x^2 + x + 1 = 0$

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

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

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

22. (C) Given AC = 2 BM [$\because \angle B = 90°$]

AC = 8.5 cm

Given AB + BC = 11.5 cm

squaring on both sides

$AB^2 + BC^2 + 2AB \times BC = 132.25\ cm^2$

$AC^2 + 2AB \times BC = 132.25\ cm^2$

$(8.5)^2 + 2AB \times BC = 132.25\ cm^2$

$72.25\ cm^2 + 2AB \times BC = 132.25\ cm^2$

$2AB \times BC = 60\ cm^2$

$AB \times BC = 30\ cm^2$

Area of $\Delta ABC = \frac{1}{2} \times AB \times BC = \frac{1}{2} \times 30$

$cm^2 = 15\ cm^2$

23. (C) $\sqrt[4]{193 - 4\sqrt{2178}} = \sqrt[4]{193 - 4\sqrt{1089 \times 2}}$

$= \sqrt[4]{121 + 72 - 33 \times 4\sqrt{2}}$

$= \sqrt[4]{121 + 72 - 132\sqrt{2}}$

$= \sqrt[4]{11^2 + \left(6\sqrt{2}\right)^2 - 2(11)\left(6\sqrt{2}\right)}$

$= \sqrt[4]{\left(11 - 6\sqrt{2}\right)^2}$

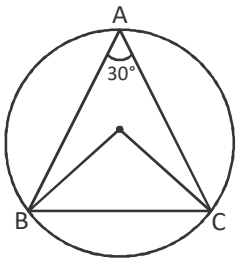
$= \sqrt{9 + 2 - 2\sqrt{9 \times 2}}$

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

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

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

24. (B) $\angle BOC = 2\angle BAC = 60°$



$\therefore$ OBC is an equilateral triangle

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

25. (A) Const:- Draw DE through 'P'

Proof:- $\Delta AQB \cong \Delta CPD$

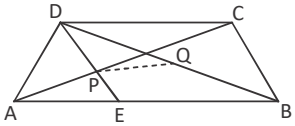
[$\because$ ASA congrucney]

$\therefore$ DP = PE & AE = CD

In ΔBDE, P & Q are mid points of DE & BD respectively

$\therefore$ $PQ = \frac{1}{2}$ BE

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



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

$AB - CD = 2PQ = 2 \times 5\ cm = 10\ cm$

PHYSICS

26. (A) The correct words to fill in the blanks are force, Newton (N), downward, g, mass.

27. (A) Mass of bullet, m = 100 g

$= \frac{100}{1000}\text{kg} = \frac{1}{10}\text{kg}$

Velocity of bullet, υ = 100 m s^{-1}

Mass of gun, M = 20 kg

Recoil velocity of the gun be V.

Before firing, the system (gun + bullet) is at rest. Therefore, initial momentum of the system = 0

Final momentum of the system = Momentum of bullet + Momentum of gun

$= m\upsilon + MV$

$= \frac{1}{10} \times 100 + 20\ V = 10 + 20\ V$

By applying the law of conservation of momentum

Final momentum = Initial momentum

i.e., 10 + 20 V = 0

$\Rightarrow$ 20 V = –10

or $V = -\frac{10}{20} = -0.5\ \text{m s}^{-1}$

Negative sign shows that the direction of recoil velocity of the gun is opposite to the direction of the velocity of the bullet.

28. (D) Distance is the total path length covered by the boy = 40 m

Displacement is the shortest distance between initial and final points = 20 m.

29. (B) X is Kinetic energy, Y is Weight.

30. (C) According to the law of gravitation, the gravitational force acting between two bodies is given by.

$F = G \times \frac{m_1 m_2}{r^2}$

Where, m_1 and m_2 are masses of two objects and r is the distance between them, G is universal gravitational constant. If the distance is reduced to half,

$r' = \frac{r}{2}$

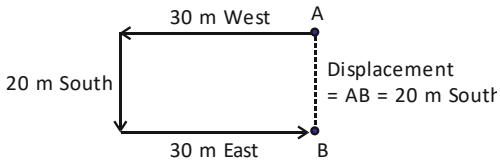
Then, $F' = G \times \frac{m_1 \times m_2}{\left(\frac{r}{2}\right)^2}$

$F' = 4\ G \times \frac{m_1 \times m_2}{r^2}$

$F' = 4\ F$

31. (D) When a motorcar makes a sharp turn at a high speed, we tend to get thrown to one side because we tend to continue in our straight line motion and an unbalanced force is applied by the engine of the motorcar that changes the direction of motion of the motorcar. So, we slip to one side of the seat due to the inertia of our body.

32. (C) His displacement is towards AB = 20 m south.



33. (C) When there is no energy lost to the surroundings, the bob will conserve its energy and go to position 3. At position 3 the bob's total energy is the same as the total energy at the initial state at S. At position 3 the bob comes to a momentary rest.

34. (B) Using Newton's 2nd law,

54 – F = ma

F = 54 – ma = 54 – (6)(6) = 18 N

35. (B) An iron ball is weighed in air and then in water by a spring balance, its weight in water is less than that in air.

CHEMISTRY

36. (C)

Compounds	% of Hydrogen	% of Carbon
P	25.0	(100 – 25.0) = 75.0
Q	14.3	(100 – 14.3) = 85.7
R	7.7	(100 – 7.7) = 92.3

In compound P

25 parts of hydrogen combines with 75 parts of carbon,

1 part of hydrogen combines with $\frac{75}{25} = 3$ parts of carbon.

In compound Q

14.3 parts of hydrogen combines with 85.7 parts of Carbon,

1 part of hydrogen combines with $\frac{85.7}{14.3} = 6.0$ parts of carbon.

In compound R

7.7 parts of hydrogen combines with 92.3 parts of carbon,

1 part of hydrogen combines with parts $\frac{92.3}{7.7} = 12$ of carbon

Thus, the masses of carbon in three compounds A, B and C which combine with a fixed mass of hydrogen are in the ratio of 3:6:12 or 1:2:4. This is a simple ratio. Hence, the data illustrates the law of multiple proportion.

37. (B) 60 g of KNO_3 dissolves in 100 g of water at 40 °C

..... g of KNO_3 dissolves in 25 g of water at 40° C

$= \frac{60 \times 25}{100} = 15$ g

So, 15 g of KNO_3 dissolves in 25 g of water to produce a saturated solution at 40°C.

38. (A) P is Shadow ; Q is Wind ; R is Milk ; S is Brick

39. (C) Atomic number 11 has one electron in its third shell. It loses one electron to form an ion with a charge of + 1.

40. (D) Statements (A) and (B) are true of homogeneous and heterogeneous mixtures.

41. (A) Lower the melting points of substances, weaker or lower are the interparticle forces of attraction. Higher the melting points of substances, stronger or higher are the interparticle forces of attraction. The increasing order of four substances P, Q, R and S based on their interparticle forces of attraction is P (78 °C), R (100 °C), S (168 °C) and Q (262 °C).

42. (A) $\text{Carbon compound} \xrightarrow{\text{Combustion}} CO_2 + H_2O$

Gram molecular weight of CO_2 = 44 g

44g of CO_2 contains 12 g of 'C'

$\%$ of carbon $= \frac{0.361 \times 12 \times 100}{0.202 \times 44} = 48.74\ \%$

43. (B) Solution in beaker 2 has the most concentrated salt solution as the concentration of the solution is 16 g/ 100 cm^3.

44. (B) The mass of an object is the amount of matter the object has.

As P floats on R but Q floats on P, P has a smaller mass than R but a greater mass than Q. Hence, R has the greatest mass among P, Q and R.

As R floats on S, S has a greater mass than R. Hence, S has the greatest amount of matter among the four liquids.

45. (C) Formula mass of K_2CO_3 = Mass of 2K atoms + Mass of one C atom + Mass of 3 O atoms.

= 2 × 39 + 12 + 3 × 16

= 78 + 12 + 48 = 138 u

BIOLOGY

46. (C) Chloroplast are pigment cells or plastids they are round oval or disc shaped the convert of light energy to chemical energy.

47. (D) p - RBCs help in transport of oxygen.

q - WBCs help in the production of antibodies.

r - Platelets help in blood clotting.

48. (A) The walls of xylem cells are lignified. Structure X is Lignin.

49. (B) Crop rotation and field fallow helps to improve soil fertility when a field lies fallow the soil regains nutrients that are lost by over planting.

50. (C) Phloem is a food conducting tissue. It transports food made in leaves to other parts of the plant.

51. (A) The correct sequence is

$Q \rightarrow R \rightarrow P \rightarrow S$

52. (A)

(i) Nucleus contains chromosomes.

(ii) Chloroplast contains light trapping pigments called chlorophyll.

(iii) Mitochondrion contains respiratory enzymes.

(iv) Sap vacuole contain cell sap.

53. (C) R is Red blood Cell. It is the cell found in circulatory system.

54. (B) In the given options, option B is a sperm produced after meiosis.

55. (B) Nitrogen phosphorus and potassium are the three primary nutrients needed for plant growth.

CRITICAL THINKING

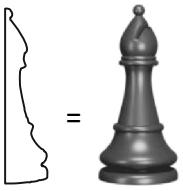
56. (B) Conclusion I : The statement does not provide any information about the specific conditions or the type of volcanic activity (e.g., violent or non-violent) that leads to the formation of calderas. Therefore, we cannot infer that calderas are formed as a result of violent volcanoes based solely on the given statement.

Conclusion II : The statement mentions that all types of calderas are volcanoes. This implies that whatever characteristics define a volcano will also apply to calderas since calderas are a subset of volcanoes. Therefore, this conclusion follows from the statement.

57. (B) The passage emphasizes that dogs and cats should not eat chocolate because it can be poisonous to them. It explains that theobromine in chocolate is harmful to pets, details the lethal amounts for dogs, and mentions that cats are less likely to eat chocolate but are still at risk. Pet owners are advised to keep chocolate out of reach.

The best summary for this passage is (B) Pet food for pets, people food for people.

58. (C) Introduction of new job sectors. AI advancements could create new job opportunities in emerging sectors in India.

59. (D) 

60. (C) The distance from the center of the merry-go-round to the position where you are sitting or standing. The further you are from the center, the faster the tangential speed you experience.

The End