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NATIONAL LEVEL SCIENCE TALENT SEARCH EXAMINATION

CLASS - 7

Question Paper Code : 1P114

KEY

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

SOLUTIONS

MATHEMATICS

01. (B) Product 2021 negative integers is negative. Product positive integers is positve. Product of this two is negative.

02. (B) $LHS = \frac{3}{4}\left(\frac{1}{32}-\frac{1}{16}+\frac{1}{8}-\frac{1}{4}+\frac{1}{32}-\frac{1}{2}\right)$

$= \frac{3}{4}\left(\frac{1-2+4-8+1-16}{32}\right)$

$= \frac{3}{4} \times \frac{-\cancel{20}^{5}}{\cancel{32}_{8}} = \frac{-15}{32}$

03. (D) Given $2l = l + 4b$

$\Rightarrow$ $2l - l = 4b$

$l = 4b$

Given $2l = 32$ cm

$l = \frac{\cancel{32}^{16}}{\cancel{2}}$ cm

$\therefore$ $4b = 16$ cm

$b = \frac{\cancel{16}^{4}}{\cancel{4}}$ cm

Shaded area = $lb = 16 \text{ cm} \times 4 \text{ cm} = 64$

cm^2

04. (A) $\frac{2(x+4)+3(1+2x)}{4}=0$

$2x + 8 + 3 + 6x = 0$

$8x = -11$

$x = -\frac{11}{8}$

05. (A) $x^2 - 2x - x(x + 1) = x^2 - 2x - x^2 - x$

$= -3x = -3 \times 2025 = -6075$

06. (B) $4^{3.5} : 2^5 = (2^2)^{3.5} : 2^5$

$= 2^7 : 2^5$

$= 2^5 \times 2^2 : 2^5$

$= 4 : 1$

07. (A) The sum of weights of 10 apples before the error was detected is 520 g. Increase in the weight after the correction is 10 g per apple $\Rightarrow$ for 10 apples, = 10 × 10 g = 100 g

$\therefore$ Correct sum of weight of apples

= (520 + 100) g = 620 g

Hence, correct average weight

$= \frac{620}{10} = 62$ g

08. (B) Let the required number be x. Then,

$\frac{-13}{6} + x = -5 \Rightarrow x = -5 - \left(\frac{-13}{6}\right)$

$= \frac{-5}{1} + \frac{13}{6} \qquad \left[\because -\left(\frac{-13}{6}\right) = \frac{13}{6}\right]$

$= \frac{-30+13}{6} = \frac{-17}{6}$

$\therefore$ Required difference $= \frac{-13}{6} - \left(\frac{-17}{6}\right)$

$= \frac{-13+17}{6} = \frac{4}{6} = \frac{2}{3}$

09. (D) Consider a right ΔABC in which $\angle B = 90°$

BC = 12 cm and AC = 13 cm

Now, $AB^2 + BC^2 = AC^2$

(By Pythagoras theorem)

$\Rightarrow$ $AB^2 = (AC^2 - BC^2)$

$\Rightarrow$ $AB^2 = 169 - 144 = 25$

$\Rightarrow$ AB = 5 cm

$\Rightarrow$ AB = 5 cm

$\therefore$ Area of triangle ABC = $\left(\frac{1}{2} \times BC \times AB\right) cm^2$

$= \left(\frac{1}{2} \times 12 \times 5\right) cm^2 = 30\ cm^2$

10. (D) Remaining part = $1 - \left(\frac{1}{3} + \frac{1}{6}\right) = \frac{1}{2}$

Average rate % per annum (R)

$= \left(\frac{1}{3} \times 3\right) + \left(\frac{1}{6} \times 6\right) + \left(\frac{1}{2} \times 8\right) = 6\%$

S.I = ₹ 600

T = 2 years, P = ?

$I = \frac{PTR}{100}$

$\Rightarrow P = \frac{100 \times I}{TR} = \frac{100 \times 600}{2 \times 6}$

= ₹ 5000

11. (B) CP = CP of 40 mts thread

P = CP of 8 mts thread

Profit% =

$\frac{P}{CP} \times 100 = \frac{\text{CP of 8 mts thread}}{\text{CP of 40 mts thread}} \times 100 = 20\%$

12. (C) Given $(side)^2 = 196\ cm^2 = (14\ cm)^2$

$\therefore$ Side = 14 cm

$\therefore$ Diameter of the circle = 14 cm

$\therefore$ Radius = $\frac{d}{2}$ = 7 cm

Area of the circle = $\pi r^2 = \frac{22}{7} \times 7 \times 7\ cm^2$

$= 154\ cm^2$

Remaining area = $196\ cm^2 - 154\ cm^2 = 42\ cm^2$

13. (B) $\text{LHS} = \frac{1}{3}y^2 - \frac{4}{7}y + 11 - \frac{1}{7}y$

$+ 3 - 2y^2 - \frac{2}{7}y + \frac{2}{3}y^2 - 2$

$= \left(\frac{1}{3}y^2 - 2y^2 + \frac{2}{3}y^2\right) + \left(\frac{-4}{7}y - \frac{1}{7}y - \frac{2}{7}y\right)$

$+ (11 + 3 - 2)$

$= \left(\frac{-y^2 - 6y^2 + 2y^2}{3}\right) + \left(\frac{-4y - y - 2y}{7}\right) + 12$

$= \frac{-3y^2}{3} - y + 12$

$= (-y^2 - y + 12)$

14. (C) Sum of length of edges = 12a

12 × 4 cm = 48 cm

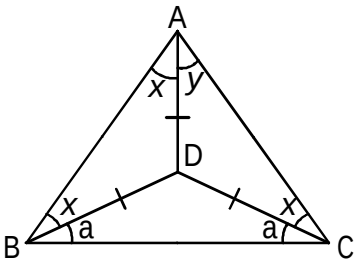
15. (C) $998^2 - 2 \times 998 \times 1002 + 1002^2$

= 996004 – 1999992 + 1004004

= 2000008 – 1999992

= 16

16. (B) In ΔBCD, BD = CD



∠BCD = ∠CBD = a

∴ a + a + 110° = 180°

2a = 180° – 110° = 70°

$a = \frac{70}{2} = 35°$

In ΔABD, AD = BD

∠ABD = ∠BAD = x

In ΔACD, AD = CD

∠ACD = ∠CAD = y

In ΔABC,

∠DAB + ∠BAD + ∠DAC + ∠ACD + ∠BCD + ∠CBD = 180°

$x + x + y + y + 35° + 35° = 180°$

$2x + 2y = 180° - 70° = 110°$

$2(x + y) = 110°$

$x + y = \frac{110°}{2} = 55°$

∴ ∠BAC = $x + y$ = 55°

17. (C) Given ST = `23,673, R = 10%

T = 3 years

But $\text{SI} = \frac{\text{PTR}}{100}$

$\text{P} = \frac{\text{SI} \times 100}{\text{TR}} = \frac{\text{`}23673 \times 100}{3 \times 10} = \frac{\text{`}236730}{3} = \text{`}78,910$

18. (B) Let the weight of three pumkins be x kg, y kg & z kg

Given x + y = 12 kg, y + z = 13 kg, z + x = 15 kg

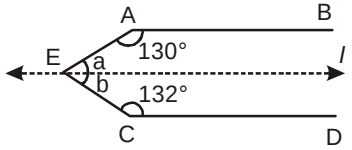
∴ $\cancel{x} + y + y + \cancel{z} - \cancel{z} - \cancel{x}$ = 12 kg+13 kg–15 kg

2y = 10 kg

y = 5 kg

∴ x = 7 kg & z = 8 kg

19. (D) Through E, draw a line l parallel to AB ⇒ l || CD.



∴ 130° + a = 180° ⇒ a = 50° .....(1)

and 132° + b = 180° ⇒ b = 48° .....(2)

From (1) and (2),

x = a + b = 50° + 48° = 98°

20. (D) Let Sheila's money be ` x

∴ Rita's money = ` (300 – x)

Given ` 5($x$ – 56) = `(300 – x + 56)

5x – 280 = 356 – x

5x + x = 356 + 280

$6x = 636$

$x = ₹106$

21. (A) Option 'A' is the required number.

22. (C) $\left(\frac{-1.5^{5}x^{5}}{0.3x^{2}y^{3}} \times \frac{{}^{2}9y^{7}}{{}_{1}7.5y^{2}z^{2}} \times \frac{{}^{2}15z^{6}}{{}_{1}4.5z^{2}x^{3}}\right)$

$= -20\,x^{5-2-3}\ y^{7-3-2}\ z^{6-2-3}$

$= -20\,y^{2}z$

23. (C) In Δ ABC, $\angle A + \angle B + \angle C = 180°$

$\angle C + \angle C = 180°$ [$\because$ Given $\angle A + B + = \angle C$]

$2\angle C = 180°$

$\angle C = \frac{180°}{2} = 90°$

24. (A) Third side = $(5a^2 - 10a - 8) - [a^2 + 2a - 1 + 3a^2 + 7a - 5]$

$= (5a^2 - 10a - 8) - (4a^2 + 9a - 6)$

$= 5a^2 - 10a - 8 - 4a^2 - 9a + 6$

$= (a^2 - 19a - 2)$

25. (A) $\angle D = \angle E$ [$\because$ Corresponding angles]

$\therefore \angle D = x = 47°$

In ΔACD, $y + x + 108° = 180°$

$y + 47° + 108° = 180°$

$y = 180° - 155° = 25°$

PHYSICS

26. (A) A rheostat is a type of variable resistor that allows for the manual adjustment of resistance in an electrical circuit. By changing the resistance, the current flowing to the motor can be controlled, which in turn changes the motor's speed. Resistors (A) and (C) have a fixed resistance and cannot be used to control speed manually. A fuse (D) is a safety device designed to break a circuit if the current exceeds a certain level, it does not control speed

27. (A) The correct option is (A) The wet cloth cools the bottle faster because heat from the bottle is used to evaporate water.

Evaporation is a cooling process: Water requires energy (latent heat of vaporization) to change from a liquid to a gas.

Heat absorption: When a wet cloth is wrapped around a bottle, the water in the cloth absorbs this heat energy from the bottle and its contents to evaporate. This removal of heat makes the bottle cooler.

This principle is why sweating cools the human body and why earthen pots (matkas) are wrapped in wet cloth in the summer.

28. (C) A thermos flask is designed to minimize all modes of heat loss:

Vacuum between walls $\rightarrow$ reduces conduction and convection

Conduction and convection require a medium (air, liquid, or solid) to transfer heat.

The vacuum has almost no particles, so heat cannot be transferred efficiently via conduction or convection.

Reflective inner surface $\rightarrow$ reduces radiation

All objects emit heat as infrared radiation.

A shiny, reflective inner surface reflects infrared radiation back into the liquid, reducing heat loss.

Tight lid $\rightarrow$ limits evaporation

Evaporation causes cooling of the liquid inside.

A properly sealed lid prevents escape of vapor, maintaining the liquid's temperature.

29. (B) In a distance-time graph, the slope represents speed.

Narrow tunnel sections $\rightarrow$ robot moves faster ? steeper slope.

Wider tunnel sections $\rightarrow$ robot moves slower ? gentler slope.

Since the slope varies along the graph, the motion is non-uniform, and the

graph is curved with varying slope, which matches option (B).

30. (C) From A → B → A is one oscillation; motion is accelerated from A → O and retarded from O → B.

One complete oscillation (or time period) for a pendulum is the movement from one extreme point back to that same point, passing through the mean position twice. The motion described in option (C), from A to B and back to A, passes through the mean position O and represents one full oscillation.

The motion is non-uniform because the speed changes throughout the swing.

The pendulum is released from rest at A, so its speed is zero at A. As it moves towards the mean position O, gravity pulls it downwards and the speed increases (accelerated motion). The speed is maximum at O.

As it moves from O towards B, it is moving against gravity and the speed decreases (retarded motion), becoming zero at B.

Therefore, the motion is accelerated from A → O and retarded from O → B.

31. (A) A reached first and moved faster, taking 3 hours to cover 9 km, while B took 8 hours.

A reached the destination first because A's speed is greater than B's.

Here's the reasoning:

Person A's speed:

Distance = 9 km

Time = 3 hours

$$\text{Speed} = \frac{9\text{ km}}{3\text{ hours}} = 3\text{ km/h}$$

Person B's speed:

Distance = 9 km

Time = 8 hours

$$\text{Speed} = \frac{9\text{ km}}{8\text{ hours}} = 1.125\text{ km/h}$$

Since A's speed (3 km/h) is greater than B's speed (1.125 km/h), A moves faster. On a distance-time graph, this means that A's line will be steeper than B's, showing a greater rate of motion (faster speed).

Thus, the correct interpretation is:

A reaches the destination first because A has a higher speed and thus a steeper line on the distance-time graph.

This confirms that the line for A is steeper than the line for B, indicating that A moves faster and reaches the destination in less time.

32. (A) The most likely explanation is that the voltage across each LED is insufficient for it to emit light. The correct option is (A).

LEDs (Light Emitting Diodes) require a specific minimum voltage (forward voltage, typically around 1.8V to 3V, depending on the color and type) to turn on and allow current to flow.

When two identical LEDs are connected in series to a 3V battery, the total voltage is shared between them.

The voltage across each LED would be approximately 1.5V (3V / 2 LEDs = 1.5V per LED).

Since 1.5V is typically less than the required forward voltage for most LEDs to glow brightly (or at all), neither of them glows.

Why other options are incorrect

(B) Series connection prevents current flow: A series connection does not inherently prevent current flow; current flows equally through all components in a series circuit if the circuit is complete and the voltage is sufficient. The issue here is insufficient voltage for the specific components.

(C) LED glows only with AC: LEDs are diodes, meaning they only allow current to flow in one direction (DC). They can be made to work with AC,

but they typically require a rectification circuit or a series diode to prevent damage from reverse voltage and will flicker. A battery provides DC power.

(D) LED emits heat instead of light: LEDs are highly efficient at producing light and emit very little heat compared to incandescent bulbs. If they are not glowing, it is due to a lack of current flow, not a change in their emission type.

33. (B) Current flow increases because copper is a good conductor

Plastic is an insulator, so current cannot pass through it easily.

Copper is a conductor, allowing current to flow freely.

Using conductive materials like copper ensures proper operation of circuits connected to the pipe.

This directly relates to Circuits and their Components, focusing on current, resistance, and material properties.

34. (B) In arrangement B, the metal rod is straight, and heat is supplied at one end.

Heat travels in one direction only — from the heated end towards the other end — by conduction through the metal.

The pin closer to the flame (P) receives heat earlier.

The wax holding this pin melts first, so pin P falls before pin Q.

Since pin Q is farther from the heat source, it takes longer for enough heat to reach and melt its wax.

Thus, the difference in fall time between pins P and Q is greatest in arrangement B, because heat travels sequentially along the rod, not simultaneously as in arrangement A (where the loop lets heat reach both pins nearly together).

35. (B) The connection between wires and bulb holder

If the bulb does not glow even when a known conductor is connected, it indicates a break in the circuit, preventing the flow of current. The most common and likely place for a break in a simple circuit assembled with wires and a bulb holder is at the points where the wires connect to the holder. A loose or improper connection at the bulb holder would prevent the current from reaching the bulb's filament. Other potential issues, such as a dead cell, are less specific to the connection of a known conductor. The paper sheet under the safety pin would only be an issue if it was acting as an insulator where a conductor was needed, which is not the case here as a known conductor is already in use. The metallic body of the bulb is part of the circuit path, but the connection point is the more probable failure point.

CHEMISTRY

36. (B) Sodium and potassium are metals. They are soft and can be cut with a knife. They are solids at room temperature. They react with oxygen to form respective oxides.

37. (B) An acid base reaction is an example of neutralization reaction.

38. (C) Cooking vessels usually have copper bottoms because copper being a metal, is a good conductor of heat.

39. (B) An indicator prepared from turmeric (Haldi) when added to a strong basic solution changes its colour to brick red.

40. (B) Aluminium foil is prepared by beating it into sheets. i.e., property of malleability. Hence, aluminium foil is used for the given application.

41. (C) The solutions which do not change their colour to either red or blue litmus are known as neutral solutions.

42. (A) Metal zinc in molten or liquid state is used for galvanisation of an iron article.

43. (B) Organic matter releases acids which neutralises the basic nature of soil.

44. (C) Metals are good conductors of electricity and not bad conductors of electricity.

45. (B) Lemon juice contains citric acid that turned blue litmus paper to red.

BIOLOGY

46. (A) Phloem is not transporting food from leaves to the roots for growth.

The plant's weak and underdeveloped roots despite healthy leaves indicate that the roots are not receiving enough food to grow properly. If the phloem is not functioning well, the roots won't get enough energy to develop, causing weak root growth.

47. (A) X - identify, Y - develop

Microscopes allow scientists to see microorganisms that are invisible to the naked eye. By identifying harmful microbes, scientists can understand which organisms cause diseases. This helps them to develop effective treatment and medicine.

48. (A) p – larynx, q – vocal cords

The Adam's apple is a noticeable bump in the throat area, formed by the growing larynx (voice box) during puberty, in males. As the larynx enlarges vocal cord becomes thicker and longer. So, the voice deepens and may crack temporarily.

49. (A) Each change is a normal sign of puberty in girls — growth hormones cause height increase, oestrogen develops breasts, menstruation marks reproductive maturity, and hormonal activity makes skin oily leading to acne.

50. (A) Large food chunks slow down the stomach's digestive process, causing discomfort

The stomach's role is to break down food mechanically and chemically. Large, unchewed food chunks take longer to digest, which can cause discomfort.

51. (A) Chyle — transports absorbed fats from the small intestine to the lymphatic system

Chyle is a milky fluid formed in the small intestine that carries absorbed fats through the lymphatic system to the bloodstream.

52. (C) Only 2 and 3

Statement 1 is incorrect because the trachea serves as a passageway for air but does not directly exchange gases with the blood.

Statement 2 is correct as bronchioles regulate airflow by expanding or contracting.

Statement 3 is correct because alveoli have thin walls and a large surface area, making them the primary site for efficient gas exchange.

53. (B) The plant will stop photosynthesis due to lack of CO_2.

If all the stomata on a leaf close completely, the plant cannot take in carbon dioxide (CO_2) from the air, which is essential for photosynthesis. Without CO_2, the plant cannot produce food, so photosynthesis stops.

54. (A) 1 – Q

The rumen is the first chamber of the stomach in ruminant animals like cows and buffaloes. Its primary function is to ferment and break down cellulose in plant-based food with the help of microbes.

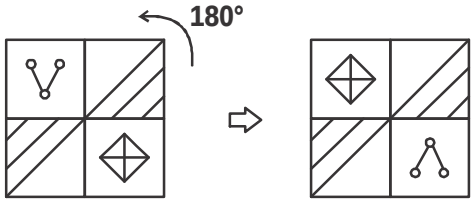
55. (B) Food accumulates above the ring due to blocked phloem.

When the ring of bark, including the phloem, is removed from the stem, the transport of food (mainly glucose) from the leaves to the lower parts of the plant is interrupted. This causes the food to accumulate above the ring, leading to swelling in that area.

CRITICAL THINKING

56. (A) 45-degree angle allows for the best balance between horizontal and vertical components of the arrow's motion, maximizing its range.

57. (B) 10

58. (D) 

59. (B) Q pant = Yellow → Q shirt → Yellow → from (2), Q shirt → Yellow already →so Q shirt = Orange.

- Shirts left: Yellow, Pink for P & R.
- From (3), R shirt → Pink → so R shirt = Yellow, P shirt = Pink.
- Pants left: Blue, Green for P & R.
- From (4), P pant → Blue → so P pant = Green, R pant = Blue.

So P = Pink shirt + Green pant.

Correct answer: (D) Pink and Green.

60. (C) Other than in C, the designs are made up with a square, a triangle, a rectangle, a right angle and a line. In C, there are two squares, two right angles and 1 triangle but no rectangle and a line.