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NATIONAL LEVEL SCIENCE TALENT SEARCH EXAMINATION (UPDATED)

CLASS - 8

Question Paper Code : 1P114

KEY

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

SOLUTIONS

MATHEMATICS

01. (B) $(1^3 + 2^3 + 3^3 + 4^3 + 5^3 + 6^3 + 7^3 + 8^3 + 9^3)$

$= 1 + 8 + 27 + 64 + 125 + 216 + 343 + 512 + 729$

$= 2025$

02. (A) $(x - 3)(x^2 + 3x + 9) = x(x^2 + 3x + 9) - 3(x^2 + 3x + 9) = x^3 + 3x^2 + 9x - 3x^2 - 9x - 27$

$= (x^3 - 27)$

03. (C) $(-20) + (-15) + \frac{(-20) \times (-15)}{100} = -32$

04. (C) $\alpha\beta = \left(\frac{-b + \sqrt{b^2 - 4ac}}{2a}\right)\left(\frac{-b - \sqrt{b^2 - 4ac}}{2a}\right)$

$= \frac{(-b)^2 - \left(\sqrt{b^2 - 4ac}\right)^2}{4a^2}$

$= \frac{b^2 - \left(b^2 - 4ac\right)}{4a^2} = \frac{b^2 - b^2 + 4ac}{4a^2}$

$= \frac{4ac}{4a^2} = \frac{c}{a}$

05. (B) $\sqrt{2027^2-4053}=\sqrt{2027^2-4053-1+1}$

$=\sqrt{2027^2-4054+1}$

$=\sqrt{2027^2-2\times2027\times1+1^2}$

$=\sqrt{(2027-1)^2}$

= 2026

06. (C) $4x^2 + 12x + 9 = (2x)^2 + 2(2x)(3) + 3^2$

$= (2x + 3)^2$

Given $s^2 = (2x + 3)^2$

$\therefore$ $s = (2x + 3)$

$\therefore$ Perimeter of the square = $4s = 4(2x + 3)$

$= (8x + 12)$

07. (D) Area of a square = $\frac{d^2}{2}$

$=\frac{1}{2}\times\left(15\sqrt{2}\text{cm}\right)^2$

$=\frac{1}{2}\times15\sqrt{2}\times15\sqrt{2}\,\text{cm}^2$

= 225 cm^2

08. (A) Let 2018 = x then 2019 = $(x + 1)$, 2020 = $(x + 2)$ & 2021 = $(x + 3)$

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

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

$=\sqrt{(x^2+3x)(x^2+3x+2)+1}$

$=\sqrt{(x^2+3x)^2+2(x^2+3x)(1)+1^2}$

$=\sqrt{(x^2+3x+1)^2}$

$= (x^2 + 3x\ 1) = (2018)^2 + 2(2018) + 1$

= 4072324 + 6054 +1

= 4078379

09. (D) $\sqrt{\frac{a}{b}+\frac{b}{a}-2}=\sqrt{\left(\sqrt{\frac{a}{b}}\right)^2+\left(\sqrt{\frac{b}{a}}\right)^2-2\sqrt{\frac{a}{b}\times\frac{b}{a}}}$

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

10. (C) Except option 'C' remaining are rational numbers

11. (B) Length of rectangle

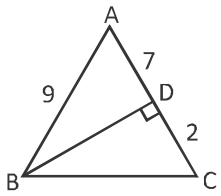
$=\frac{\text{Area}}{\text{breadth}}=\frac{5\text{cm}^2}{\left(\frac{20}{13}\right)\text{cm}}$

$=\cancel{5}\,\text{cm}^2\times\frac{13}{\cancel{20}_4\,\text{cm}}$

$=\frac{13}{4}\text{cm}$

$=3\frac{1}{4}\text{cm}$

12. (A) In Δ ABD, D = 90°



$AB^2 = 90^2 + BD^2$

$9^2 = 7^2 + BD^2$

$81 = 49 + BD^2$

$BD^2 = 32$

In Δ BCD, $\angle D = 90°$

$BC^2 = BD^2 + DC^2 = 32 + 2^2 = 32 + 4$

$BC^2 = 36$

$BD = \sqrt{36} = 6$

13. (C) $4(x^2 + 10x + 25) - (4x^2 + 4x + 1)$

$= 3x - 15 + 180$

$4x^2 + 40x + 100 - 4x^2 - 4x - 1$

$= 3x + 165$

$36x + 99 = 3x + 165$

$33x = 66$

$x = 2$

14. (D) $1^3 + 12^3 = 10^3 + 9^3$ ie Both are equal to 1729.

$\therefore \sqrt{x}=3$

$x = 9$

15. (B) Middle most value in the ascending order are $2x$ & $2x + 4$

$$\therefore \frac{2x+2x+4}{2}=63$$

$2x + 2 = 63$

$2x = 63 - 2$

$2x = 61$

$x = 30.5$

16. (C) Given $2\pi rh = 264\ m^2$ & $\pi r^2h = 924\ m^3$

$$\therefore \frac{\pi r^{\cancel{2}}\cancel{h}}{\cancel{2}\,\cancel{\pi}\,\cancel{r}\,\cancel{h}}=\frac{\cancel{924}^{7}\ m^3}{\cancel{264}_{2}\ m^2}$$

$\therefore r = 7$ m

$$2\times\frac{22}{\cancel{7}}\times\cancel{7}\times h=264\,m^2$$

$$h=\frac{\cancel{264}^{132^{\cancel{12}^{6}}}\ m^2}{\cancel{2}\times\cancel{22}_{\cancel{1}_{1}}\ m}=6m$$

$\therefore$ The ratio of height and diameter

$= \cancel{6}^{3} : \cancel{14}^{7} = 3:7$

17. (A) $$\frac{\sqrt{32}+\sqrt{48}}{\sqrt{8}+\sqrt{12}}=\frac{\sqrt{16\times2}+\sqrt{16\times3}}{\sqrt{4\times2}+\sqrt{4\times3}}$$

$$=\frac{4\sqrt{2}+4\sqrt{3}}{2\sqrt{2}+2\sqrt{3}}$$

$$=\frac{4\cancel{\left(\sqrt{2}+\sqrt{3}\right)}}{2\cancel{\left(\sqrt{2}+\sqrt{3}\right)}}=2$$

18. (B) Let the first part be ₹ x

$\therefore$ second part = ₹ $(45000 - x)$

Given 10% ₹ x = 5% of ₹$(45,000 - x)$

$$\Rightarrow \frac{\cancel{10}^{2}}{\cancel{100}}\times₹x=\frac{\cancel{5}}{\cancel{100}}\times₹(45000-x)$$

$2x + x$ = ₹45000

$3x$ = ₹45000

$$x=\frac{₹45000}{3}=₹15,000$$

$\therefore$ Bigger part = ₹(45000 – x) = ₹30,000.

19. (D) Given

$$P+\frac{P\times3\times R}{100}=₹\ 3220\ \&\ P+\frac{P+6\times R}{100}=₹\ 3640$$

$$\therefore \cancel{P}+\frac{6PR}{100}-\cancel{P}-\frac{3PR}{100}=₹3640-₹3220$$

$$\frac{3PR}{100}=₹420$$

But $$P+\frac{3PR}{100}=₹3220$$

P + ₹ 420 = ₹ 3220

$\therefore$ P = ₹ 3220 – ₹ 420

= ₹ 2800

20. (D) Given $2x + 25° + 3x - 15° = 180°$

$5x + 10° = 180°$

$5x = 170°$

$$x = \frac{170°}{5} = 34°$$

$2x + 25° = 2 \times 34° + 25° = 68° + 25° = 93°$

21. (A) Radius of the tank

$$= \frac{\text{Circumference}}{2\pi}=\frac{10\pi}{2\pi}=5\text{ cm}$$

$\Rightarrow$ Diameter = 10 cm = Height of the tank

$\therefore$ Capacity of the tank

$$= \pi r^2h=\frac{22}{7}\times5\times5\times10\text{ cm}^3$$

$$= \frac{22\times250}{7}\text{ cm}^3$$

$$= \frac{22\times250}{7\times1000}\text{ litres}$$

$$= \frac{11}{14}\text{ litres}$$

= 0.78 litres

22. (C) In a pentagon ABCDE sum of interior angles = sum of interior angles of a quadrilateral ABCD + sum of interior angles of a ΔADE

= 360° + 180° = 540°

23. (C) Given $x^4 + \frac{1}{x^4} = 727$

Adding '2' on both sides

$$(x^2)^2 + 2 + \frac{1}{(x^2)^2} = 727 + 2$$

$$(x^2)^2 + 2x^2 \times \frac{1}{x^2} + \left(\frac{1}{x^2}\right)^2 = 729$$

$$\left(x^2 + \frac{1}{x^2}\right)^2 = (27)^2$$

$$x^2 + \frac{1}{x^2} = 27$$

Subtractions '2' on both sides

$$x^2 - 2 + \frac{1}{x^2} = 25$$

$$\left(x - \frac{1}{x}\right)^2 = 5^2$$

24. (C) HCF of 35 & 125 is 5

$\therefore$ $(3^5 - 1)$ is the HCF of $(3^{125} = 1)$ & $(3^{35} - 1)$

$\therefore$ $3^5 - 1 = 243 - 1 = 242$

25. (B) Let the height of the building be x metres. Less the length of shadow, less is the height.

$\therefore$ $40.25 : 28.75 :: 17.5 : x$

$\Rightarrow 40.25 \times x = 28.75 \times 17.5$

$$\Rightarrow x = \frac{28.75 \times 17.5}{40.25} \Rightarrow x = 12.5 \text{ m}$$

PHYSICS

26. (C) Static friction between the log and ground

Explanation: At rest, the log is opposed by static friction, which resists the initiation of motion. The elephant must exert a force greater than this static friction to start moving the log.

27. (C) Charge movement by induction causes repulsion.

Explanation: When a charged plastic rod is brought near the metal cap of a leaf electroscope, it induces a redistribution of charges in the electroscope. Here's how it works:

Induction occurs when the charged rod brings opposite charges to the near side of the metal cap and like charges to the far side of the cap. This results in a separation of charges within the electroscope.

The redistribution of charges causes the gold leaves to acquire like charges (both leaves now have the same type of charge, either both positive or both negative).

Since like charges repel each other, the gold leaves spread apart.

28. (C) $1 \rightarrow$ Tuning fork, $2 \rightarrow$ Guitar, $3 \rightarrow$ Speech

Explanation: Waveform 1 (Perfectly smooth): A tuning fork produces a pure tone which has a single, fundamental frequency with very few overtones. This results in a smooth, regular, and simple sinusoidal waveform on an oscilloscope, as shown in waveform 1.

Waveform 2 (Smooth but with minor additional crests): A guitar string, while producing a musical note, vibrates at its fundamental frequency along with several overtones (harmonics). These overtones create the specific quality or timbre of the guitar's sound, which appears as minor complexities in the waveform, making it less pure than a tuning fork but still regular and periodic, matching waveform 2.

Waveform 3 (Highly irregular): Human

speech is a complex combination of various frequencies that change rapidly over time. It is generally considered a form of noise with no fixed repeating pattern, resulting in a highly irregular and aperiodic waveform like waveform 3

29. (C) The copper deposited on the key will slowly dissolve back into the solution.

When the polarity of the battery is reversed, the key (previously cathode) becomes the anode. The deposited copper on its surface will oxidize and go back into the copper sulfate solution as Cu^{2+} ions, while the copper plate now acts as the cathode and starts receiving deposition. Hence, the electroplating on the key starts reversing.

30. (D) Mountain Formation

Mountain formation occurs over millions of years due to the slow, sustained collision of tectonic plates (a process called orogeny). This is in contrast to the other options, which generally occur more suddenly or as continuous, but not necessarily slow, processes:

(A) Magma Ejection (volcanic eruptions) can be sudden and violent.

(B) A crack on the Earth's surface (faulting or rifting) can also be sudden (e.g., during an earthquake).

(C) Plate Movement is a continuous process, but the result of slow, sustained collision is mountain building.

31. (B) Reflection of sound and interpretation of the echo pattern

(A) Refraction doesn't occur because sound travels in the same medium (air).

(B) Reflection (echo) helps detect obstacles – correct principle.

(C) Sound-to-electric conversion happens in the sensor, not in detection principle.

(D) No standing waves form since emitted and reflected waves don't overlap continuously.

The device works on the principle of echolocation, where emitted sound waves reflect off obstacles and return as echoes. Measuring the time interval between emission and reception allows the distance and position of objects to be determined — the same mechanism used by bats, dolphins, and sonar systems.

32. (C) Diffused Reflection

The setup showing multiple parallel incident rays reflecting in various directions.

Diffused reflection occurs when parallel rays of light strike a rough or irregular surface and are reflected in many different directions. This is distinct from regular reflection, where parallel incident rays reflect as parallel rays from a smooth surface, as shown in setup (A). Setup (C) correctly illustrates this principle with parallel incoming rays scattering in an unorganized manner after hitting the surface

33. (C) The correct option is (C) Static friction is greater than kinetic friction, hence initial peak.

The observation that the spring balance reading peaks before the block moves and then drops to a lower, stable value once in motion is due to the difference between static and kinetic friction

34. (B) Explanation: The formula to calculate the number of images formed by two plane mirrors inclined at an angle θ is:

$$n = \frac{360^\circ}{\theta} - 1$$

This formula applies when $\frac{360^\circ}{\theta}$ is an even integer, and the object is placed asymmetrically.

Given: Angle of inclination $\theta = 60^\circ$

Using the formula:

$$n = \frac{360^\circ}{60^\circ} - 1$$

$n = 6 - 1$

$n = 5$

Thus, the number of images formed is 5.

Conclusion: Therefore, a student can see 5 images of the bottle when the mirrors are inclined at an angle of 60°.

The correct answer is (B) 5.

35. (D) Sandpaper has a higher coefficient of friction than glass.

The higher force measured on sandpaper is due to its higher coefficient of friction compared to glass. Sandpaper's rough surface creates more resistance when the block moves, while glass, being smooth, generates less friction. The normal force remains the same, but friction is greater on sandpaper.

Thus, the correct answer is (D) Sandpaper has a higher coefficient of friction than glass.

CHEMISTRY

36. (A) The products formed in the destructive distillation of coal at

X = Coal gas, Y = Coal tar, Z = Coke

37. (C) (i), (ii), (iv), (v) and (vi) only

Substances like candle wax, magnesium ribbon and petrol will produce a flame on burning due to their ability to vaporize and undergo combustion. Camphor and paper burn in a different manner. Camphor undergoes sublimation and changes directly to gas with no residue. Paper undergoes incomplete combustion producing yellow flame with ash as residue. Charcoal does not producing a visible flame.

38. (B) Above – Lighter

Petroleum and gas are lighter than water, so in oil wells, they float above the water layer.

39. (B) Fire can be controlled by removing any one or more factors like combustible substance, oxygen and fire. Different substances have different ignition temperature and hence catch fire at different temperatures. Further, the ignition temperature is very low for inflammable substances like petrol, LPG, etc. Fire can be controlled by carbon dioxide.

40. (D) Coal causes air pollution when burnt in the form of toxic gases like sulphur dioxide, nitrogen oxide etc.

41. (C) Diesel will give out maximum amount of heat 45 kJ/g by complete combustion when compared with wood 17 - 22, coal 25 - 33 kJ/g and biogas 35 - 40 kJ/g.

42. (A) I and III only

Coke and coal are different substances. Natural gas has about 85% to 95% methane. So, I and III statements are incorrect.

43. (B) To cut off the air supply of the fire, so that the fire is put off and the person could be saved from fire.

Covering a person with a blanket deprives the fire of oxygen, thus stopping the combustion process. This is one of the most effective methods to save someone from fire without the risk of spreading the flames.

44. (C) I, IV, III, II

Petroleum gas is at the top (lowest boiling point), followed by gasoline, then kerosene, and lubricating oil at the bottom.

45. (D) The head of the safety match stick contains only antimony trisulphide and potassium chlorate. The rubbing surface has powdered glass and a little red phosphorus (which is much less dangerous). When the match is struck against the rubbing surface, some red phosphorus gets converted into white phosphorus. This immediately reacts with potassium chlorate in the matchstick head to produce enough heat to ignite antimony trisulphide and start the combustion.

BIOLOGY

46. (B) Organelles labelled 2 is mitochondria. Mitochondria is responsible for cellular respiration.

47. (B) In a 4-link food chain, the biomass of the food producers is much higher than the biomass of each population of food consumers. The population of the tertiary food consumers (highest predators) in the 4-link food chain will have the least biomass.

48. (C) Amoeba, bacteria, paramecium reproduce asexually by binary fission.

49. (B) Recycling drink cans.

Buying household products designed with less packaging material, help to save our earth.

50. (D) Earthworms do not feed on the green leaves of crops. They speed up the decomposition of fallen leaves. When the leaves decompose in the soil, the soil becomes fertile. Their casting also make the soil fertile. They help to loosen and aerate the soil too.

51. (C) Hydra reproduces by budding, where a small outgrowth forms and detaches to become a new individual.

52. (B) Scurvy occurs due to the deficiency of vitamin C and the deficiency of vitamin A results into night blindness. Goitre occurs due to the deficiency of iodine.

53. (D) These microorganisms form a symbiotic relationship with the fruit to delay spoilage.

The correct answer is D, which is incorrect because mold does not form a symbiotic relationship with fruit. Instead, it has a parasitic role, breaking down the fruit's tissues using enzymes and accelerating spoilage, not delaying it.

54. (C) Haemophilia is a genetic bleeding disorder caused by the deficiency of substances called clotting factors that are necessary to control bleeding. ThisBdisease transmitted through the X-chromosome.

55. (B) The amoeba moves using pseudopodia (1 – Image A), the paramecium uses cilia (2 – Image B), and the euglena uses flagella and performs photosynthesis (3 – Image C). Thus, the correct match is option B.

CRITICAL THINKING

56. (B) To determine the minimum number of tile pieces needed to construct a path from tile A to tile B, considering all the given constraints, follow these steps:

- Identify distinct paths on each tile: Analyze the available tiles and the unique paths on each tile. Ensure each tile type is used at least once and remember that rotation is not allowed, so orientation matters.
- Plan the path: Strategically plan the path from tile A to tile B while following these critical rules:

  Sequence different tile types continuously since the same type cannot be used consecutively.

  Ensure paths align properly since they have to be connected.
- Count the tiles: Exclude tile A and tile B from the count and ensure all other tiles are used at least once without overlap.
- Verify against range: Compute the total number of tiles and validate that it aligns with the given range 12 to 12.

By carefully analyzing the tiles' connections and ensuring all constraints are met, the calculated minimum number of tiles is 12. This solution adheres to all criteria: no overlap, different tile sequences, connected paths, and compliance with the given range.

57. (C) 0 appears 5 times : pages 10, 20, 30, 40, 50 $\rightarrow$ last page = 59

8 appears 6 times : pages 8, 18, 28, 38, 48, 58 $\rightarrow$ last page = 59

58. (B) Let the distances between them be

Isaak–Max = IM

Isaak–Oskar = IO

Max–Oskar = MO

According to their statements:

1. Isaak: IM > 2 × IO

2. Max: MO > 2 × MI

3. Oskar: MO > 2 × OI

If Isaak's statement (1) is true ? IM is the largest distance.

Then (2) cannot be true because MO cannot also be more than twice IM.

(3) can still be true if MO > 2 × OI (possible when Oskar is far from Max and closer to Isaak).

Thus Isaak and Oskar can both be telling the truth, satisfying "at least two speak the truth."

Hence Max is the one who is lying.

59. (B) The Borromean (Brunnian) rings are linked as a whole but no two rings are linked by themselves — if you cut/ remove any one ring the other two become unlinked and fall apart. In diagram B each ring passes over one neighbour and under the other, so every pair has cancelling crossings and is not directly linked (pairwise linking number = 0), while the three together form a non-trivial link. In A, C or D at least one pair of rings remains actually interlocked (you can follow the crossings and see one ring encloses part of another), so they fail the Borromean property. Hence B is the correct picture.

60. (A) The question asks to mirror the heptagon with the triangle along the common dotted line. This means the shape and the triangle inside it will be flipped over the dotted line.

- The original heptagon has the triangle at the bottom left side.
- When mirrored along the dotted line, the triangle will be at the bottom right side.
- Option A shows the heptagon with the triangle at the bottom right side.
- Options B, C and D do not show the correct mirrored position of the triangle.

The End