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NATIONAL LEVEL SCIENCE TALENT SEARCH EXAMINATION

CLASS - 9

Question Paper Code : UN494

KEY

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11. D	12. A	13. B	14. C	15. D	16. C	17. B	18. A	19. C	20. A
21. D	22. D	23. B	24. C	25. C	26. C	27. C	28. D	29. C	30. B
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41. C	42. A	43. C	44. D	45. A	46. A	47. D	48. B	49. A	50. A
51. D	52. D	53. B	54. C	55. C	56. B	57. C	58. B	59. A	60. B

SOLUTIONS

MATHEMATICS

01. (Delete)

02. (C) $5x^2 - 320 = 5(x^2 - 64)$

$= 5(x + 8)(x - 8)$

03. (C) Given $2^{\frac{x}{2}} = 2^8$

$\frac{x}{2} = 8 \quad \therefore x = 16$

04. (C) 48°

05. (B) Rise in level $= \frac{\text{Volume of water}}{\text{Base area}}$

$= \frac{500 \times 0.4\ m^3}{80 \times 50\ m^2} = \frac{4}{80} m$

$= \frac{4}{80} \times \frac{100}{20} = 5\ cm$

06. (B) Volume of the pyramid

$= \frac{1}{3} \times$ base area $\times$ height

$= \frac{1}{3} \times 8 \times 8 \times 12\ cm^3$

$= 256\ cm^3$

07. (D) 65°

08. (B) CD = 22 – 16 = 6 cm

AD 6 + 2 = 8 cm

$AC = \sqrt{6^2 + 8^2} = 10$ cm

$\Rightarrow$ The line joining the mid points of AB and BC is parallel to AC and half of AC

$\Rightarrow$ The required length

$= \frac{1}{2} \times 10 = 5$ cm

09. (B) Total number of units

$\rightarrow$ 2 + 3 + 1 + 4 = 10

10 units $\rightarrow$ 28

1 unit $\rightarrow$ 28 ÷ 10 = 2.8

2 units $\rightarrow$ 2 × 2.8 = 5.6

3 units $\rightarrow$ 3 × 2.8 = 8.4

4 units $\rightarrow$ 4 × 2.8 = 11.2

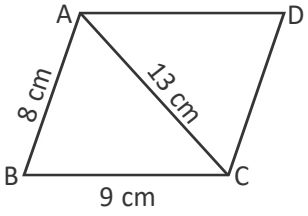
Perimeter

$= \frac{22}{7} \times \frac{5.6}{2} + \frac{22}{7} \times \frac{8.4}{2} + \frac{22}{7} \times \frac{2.8}{2}$

$+ \frac{22}{7} \times \frac{11.2}{2} + \frac{22}{7} \times \frac{28}{2}$ = 88 cm

10. (B) Area of parallelogram ABCD

= 2 × Area of ΔABC



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

$s = \frac{a+b+c}{2} = \frac{8+9+13}{2} = 15$ cm

$\therefore$ Area of ΔABC

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

$\Rightarrow$ Area of $\Delta ABC = \sqrt{15(7)(6)(2)}$

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

$= 2 \times 3\sqrt{35}$ sq.cm

$= 6\sqrt{35}$ sq.cm

$\therefore$ Area of parallelogram ABCD

$= 2 \times 6\sqrt{35}$ sq.cm

$= 12\sqrt{35}$ cm^2

11. (D) 11 cm

12. (A) $\frac{de}{cd} \times \frac{bc}{ab} = \frac{5}{4} \times \frac{3}{2}$

$\frac{e}{a} = \frac{15}{8}$

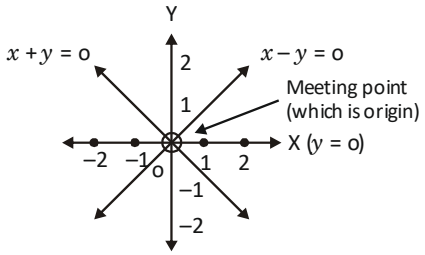
13. (B) $4x \times 3x = 120$

$12x^2 = 120$

$x^2 = 10$

4 : 3 is not the ratio of dimensions of the rectangle

14. (C) Answer is option (C)



15. (D) $x = 2 + \sqrt{3}$

$y = 2 - \sqrt{3}$

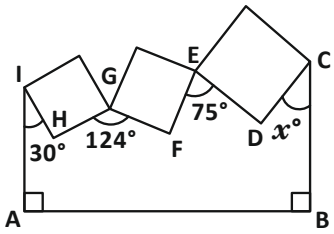
$\frac{x}{2-x} + \frac{y}{2-y}$

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

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

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

16. (C) The sum of the interior angles of the polygon ABCDEFGHI = 180° × (9 – 2)



= 180° × (7) = 1260°

i.e., 30° + 124° + 75° + x° + 3(270°)

= 1260°

$\Rightarrow$ 1219° + x° = 1260° or x° = 41°

17. (B) Edge of big cube = k units

Let the edge of small cube be 'a' units.

Volume of each small cube = a^3 cu.units;

$\Rightarrow$ Volume of big cube = k^3

Given there are 'n' small cubes

$\Rightarrow$ $k^3 = n.a^3$

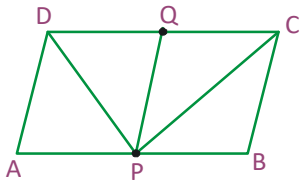
$$\Rightarrow a^3 = \frac{k^3}{n} \Rightarrow a = \frac{k}{\sqrt[3]{n}}$$

$\therefore$ Length of the edge of new cube is $\frac{k}{\sqrt[3]{n}}$

18. (A) Given area of trapezium APCD = $27cm^2$

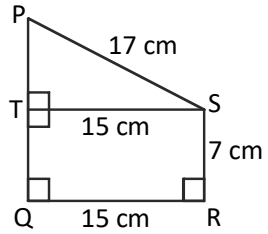
$\therefore$ Area of the parallelogram ABCD

$$= 27cm^2 \times \frac{4}{3} = 36\ cm^2$$



Area of DABC $= \frac{1}{2}$ area of parallogram ABCD = $\frac{1}{2} \times 36\ cm^2 = 18cm^2$

19. (C) Construction : ST $\perp$ PQ



QRST is a rectangle

$\therefore$ Area of QRST = 15 cm × 7 cm = 105 cm^2

In ΔPTS, LT = 90°

$\therefore$ $PS^2 = PT^2 + TS^2$

$17^2 = PT^2 + 15^2$

$289 - 225 = PT^2$

$$PT = \sqrt{64} = 8\ cm$$

$$\text{Area of } \Delta PTS = \frac{1}{2} \times PT \times TS$$

$$= \frac{1}{2} \times 8\ cm \times 15\ cm = 60 cm^2$$

Area of the quadrilateral PQRS

= 105 cm^2 + 60 cm^2

= 165 cm^2

20. (A) $\sqrt{3}x^2 + 2\sqrt{2}x - 2\sqrt{3} = 0$

$\sqrt{3}x^2 + 3\sqrt{2}x - \sqrt{2}x - 2\sqrt{3} = 0$

$\sqrt{3}x\left(x + \sqrt{6}\right) - \sqrt{2}\left(x + \sqrt{6}\right) = 0$

$\left(x + \sqrt{6}\right)\left(\sqrt{3}x - \sqrt{2}\right) = 0$

$x + \sqrt{6} = 0$ or $\sqrt{3}x - \sqrt{2} = 0$

$x = -\sqrt{6}$ or $\sqrt{3}x = \sqrt{2}$

$$x = \sqrt{\frac{2}{3}}$$

21. (D) $3\pi r^2 = 1039.5\ cm^2$

$$= 1039.5 \times \frac{2}{2} cm^2 = \frac{2079}{2} cm^2$$

$$\Rightarrow 3 \times \frac{22}{7} \times r^2 = \frac{2079}{2} cm^2$$

$$\therefore r^2 = \frac{\cancel{2079}^{\cancel{693}^{63}}}{2} \times \frac{7}{\cancel{22}_{2}} \times \frac{1}{\cancel{3}_{1}} = \frac{3\times3\times7\times7}{2\times2} cm^2$$

$$r = \sqrt{\frac{9\times49}{4}} = \frac{3\times7}{2} = \frac{21}{2} cm$$

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

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

$= 2425.5 \text{ cm}^3$

22. (D) Given $(1-x)(1+x+x^2+x^3+x^4) = \frac{31}{32}$

$$\Rightarrow 1+\cancel{x}+\cancel{x^2}+\cancel{x^3}+\cancel{x^4}-\cancel{x}-\cancel{x^2}-\cancel{x^3}-\cancel{x^4}-x^5 = \frac{31}{32}$$

$$\therefore 1 - x^5 = \frac{31}{32}$$

$$1 - \frac{31}{32} = x^5$$

$$\left(\frac{1}{32}\right) = x^5$$

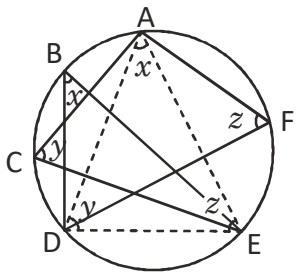
$$\left(\frac{1}{2}\right)^5 = x^5$$

$\therefore$ $x = \frac{1}{2}$

$$\left(1-\frac{1}{2}\right)\left(1+x+x^2+x^3+x^4\right) = \frac{31}{32}$$

$$\left(1+x+x^2+x^3+x^4\right) = \frac{31}{\cancel{32}_{16}} \times \cancel{2}^{1} = \frac{31}{16}$$

23. (B) Join AD, DE and EA



$\angle ACE = \angle ADE = y$

$\angle EBD = \angle EAD = x$

$\angle AFD = \angle AED = z$

$\therefore$ $\angle ACE + \angle EBD + \angle AFD$

$= x + y + z = 180°$

24. (C) Infinite lines passing through the point (3, 2)

25. (C) Given $\sqrt{2x+9} = (13-x)$

squaring on both sides

$2x + 9 = 169 + x^2 - 26x$

$\therefore x^2 - 28x + 160 = 0$

$x^2 - 20x - 8x + 160 = 0$

$x(x-20) - 8(x-20) = 0$

$\therefore x = 20$ (or) $x = 8$

But $x = 20$ is rejected it does not satisfy the given equation

PHYSICS

26. (C) According to Kepler's second law, the time rate of area swept out by a planet is constant. If area is double, then time is also double i.e., $t_1 = 2t_2$.

27. (C) Acceleration of bus

$$a - \frac{v-u}{\Delta t} = \frac{30-10}{16} = 1.25 \text{ ms}^{-2}$$

The average force F_{ave} as per Newton's 2nd law,

$F_{ave} = m \times a$

$= 12000 \text{ kg} \times 1.25 \text{ ms}^{-2}$

$= 15000 \text{ N}$

28. (D) Car I is not moving, so it has no kinetic energy. Bus I has a bigger mass than car II, so bus I has more kinetic energy even though they are moving at the same speed. Bus II has the same mass as bus I, but it is moving at the fastest speed, so it has the most kinetic energy. Bus I and car II are moving at the same speed, but car II has less kinetic energy because it has a smaller mass.

29. (C) Distance = 10 + 12 + 5 = 27 m

Displacement = straight path from A to E

$= \sqrt{5^2 + 12^2} = 13\,\text{m}$

Average speed

$= \frac{\text{Distance}}{\text{Time}} = \frac{27}{0.5} = 54\ \text{m s}^{-1}$

Average velocity

$= \frac{\text{Displacement}}{\text{Time}} = \frac{13}{0.5} = 26\ \text{m s}^{-1}$

The direction of average velocity is A to E.

30. (B) For a stone lying on a table, the weight of stone is vertically downwards which is the action of stone on table, the reaction of table on stone is equal and acts in the upward direction. The action and the reaction forces act perpendicular to the surfaces of contact.

31. (B) Average power output = $\frac{\text{Work done}}{\text{Time}}$

Total work done = force × distance × quantity = (300)(0.5)(10)

Average power output = $\frac{1500}{30} = 50\ \text{W}$

32. (D) In the given v – t graph, the area under graph gives distance travelled.

Area of trapezium = $\frac{1}{2}(1+9)\times 10 = 50\,\text{m}$

Acceleration, a = $\frac{9-1}{10} = 0.8\ \text{m s}^{-2}$

As the particle is moving in a straight line with an increase in velocity at equal intervals of time, the graph shows uniform acceleration.

33. (A) The heavier bag has a greater mass and has more inertia as mass is a measure of inertia. Therefore, heavier bag has a greater tendency to remain at rest. Hence, the person needs to push the heavy bag with great difficulty.

34. (A) Potential energy of a body is due to its highest position above the earth. It is equal to the work done on the body against gravity. Among points P and Q, P has the greatest vertical height. So, point P has most of the potential energy. Point R and S have the lowest potential energy.

35. (A) Volume of steel block = 10^3 cm^3

Weight of steel block = 7.8×10^3 g

Let x be the length of the steel block above the mercury level.

Then weight of mercury displaced

= $(10 - x) \times 10^2 \times 13.6$ g

$(10 - x) \times 10^2 \times 13.6$ g

= 7.8×10^3 g or x = 4.26 cm

Let *h* be the height of the water column.

Weight of steel block = Weight of water displaced + Weight of mercury displaced

7.8×10^{-3} g = $h \times 10^2$ g + $(10 - h) \times 10^2 \times 13.6$ g

h = 4.6 cm

CHEMISTRY

36. (A) 24 g of carbon (12) has maximum number of atoms as it has 2 moles while others are only 1 mole.

37. (C) The presence of impurities like salt in a pure substance or water will decrease its melting point and increase its boiling point.

For example when a little salt is added to pure water, the water will boil at a temperature higher than 100 °C and will melt at a temperature lower than 0 °C.

38. (C) The correct relative mass of sulphur is 32, oxygen, 16, and carbon, 12.

i.e., 64 × 0.5 = 32, 32 × 0.5 = 16, 16 × 0.75 = 12

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

40. (C) Among the three states of matter, the rate of diffusion is very fast in gases. The particles in gases move very quickly in all directions. The rate of diffusion of a gas depends on its density. Lighter gases diffuse faster than heavier gases.

Nitrogen and carbon monoxide are a pair of gases which diffuse into the vacuum at the same speed due to their equal molecular weights.

Nitrogen (N_2) = $2 \times 14 = 28$

Carbon monoxide (CO) = Carbon 12, Oxygen16 = 28

41. (C) According to Avogadro's law, 1 mole of any substance contains 6×10^{23} particles. Therefore, 1 mole of ethanol contains 6×10^{23} ethanol molecules and 1 mole of ethane also contains 6×10^{23} ethane molecules.

42. (A) In the apparatus shown for distillation of salt solution, a stopper should be placed at point P and another stopper at point Q.

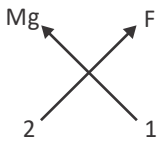
43. (C)

(i) The electron structure of atom 'X' is magnesium. Its atomic number is 12 and mass number is 24.

(ii) The electron structure of atom 'Y' is fluorine. Its atomic number is 9 and mass number is 19

(iii) Valency of magnesium is +2 and fluorine is –1

(iv) Atoms 'X' and 'Y' combine to form one molecule of compound called Magnesium fluoride (MgF_2).



(v) Atomic mass of magnesium = 24 g

Atomic mass of fluorine (2 × 19) = 38 g

= 62 g

The mass of one molecule of compound MgF_2 is 62 g.

44. (D) The water from a river is pumped into a large reservoir. Coagulant alum is added to the impure water and this water is sent into the coagulation tank. The heavy particles of dissolved alum deposit on the suspended clay particles in impure water. This water is allowed to stand in the sedimentation tank(1) for some time. During this time, many of the insoluble substances present in water settle down at the bottom of the tank.

The clear water is then passed into a chlorination tank(2). A little chlorine gas (disinfectant) is added or passed into water in this tank. Chlorine gas is added to water to kill the germs present in it.

45. (A) Solubility of a solute (salt) with its solvent (water) increases with an increase in temperature. Generally, the higher the temperature the more soluble the salt in water.

BIOLOGY

46. (A) Parenchyma is a simple permanent tissue found in plants.

47. (D) The strongest muscle in human beings is the masseter muscle. The muscle masseter is a thick muscle of mastication in the cheek and is situated at the back of the jaw. It is responsible for opening and closing the jaw during chewing. Therefore, the strongest muscle is present in jaw.

48. (B) Drip irrigation is a method of micro-irrigation because it involves system of pipes and tubes which supply water to the plants drop-by-drop, thus, minimizing wastage of water.

49. (A) Tuberculosis (TB) is caused by a bacterium called Mycobacterium tuberculosis. It affects the lungs of the infected person.

50. (A) Tendons are fibrous tissue with great strength and limited flexibility. It connects muscles to bones. Cartilage is widely spaced and smoothens bone surfaces at joints.

51. (D) 'X' in the given figure of nerve cell represents synapse which is a junction between axons and dendrites.

52. (D) If ribosomes of a cell are completely destroyed, the cell would be unable to synthesize proteins.

53. (B) P-iv ; Q-v ; R-i ; S-ii

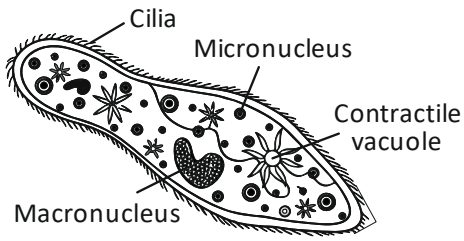
Amoebiasis – Entamoeba histolytica

Ascariasis – Ascaris lumbricoides

Malaria – Plasmodium

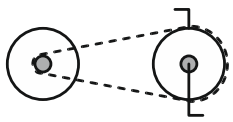
Filariasis – Wuchereria bancrofti

54. (C) A – Cilia, B – Micronucleus,
C – Macronucleus, D - Contractile vacuole.



55. (C) The function of vacuoles is to store extra nutrients, food etc. Lysosomes undergo cellular digestion. Cell membrane acts as a protective shield for cell organelles. Ribosomes help in making proteins. In this case, vacuole failed to store these nutrients in a plant cell.

CRITICAL THINKING

56. (B) 

57. (C)

	Day 1	Day 2	Day 3	Day 4	Day 5	Day 6
P	✘	✘	✔	✘	✘	✘
Q	✘	✔	✘	✘	✘	✘
R	✘	✘	✘	✘	✘	✔
S	✘	✘	✘	✘	✔	✘
T	✘	✘	✘	✔	✘	✘
U	✔	✘	✘	✘	✘	✘

1. P must be distributed exactly before T; therefore the order should be PT and no other book in between them.

2. R must not be the second book to be distributed and Q not be distributed on the 3rd day – as shown above we add a '✘' fpr day 2/R and day 3/Q.

3. Q must be distributed immediately the next day after U is distributed; therefore the order should be UQ and no other book in between them.

4. S must be on the 5th day and not after Q; so S on day 5, Q cannot be on day 4 or 5. Also from above Q cannot be on day 3. And since Q has U preceding it, Q cannot be 6th or 1st (as U cannot be 5th). So Q has to be on day 2 and U on day 1.

5. T is not the last book to be distributed; The only slot left for T are day 3 or day 3 (as day 1 is U, day 2 is Q, day 5 is S and T cannot go on day 6); Now since P precedes T, therefore T is on day 4 and P on day 3. So the final table is as shown above.

58. (B) The correct answer is (B) Listen respectfully, then respond with evidence to support your viewpoint. Constructive discussions rely on facts rather than emotions.

59. (A) 

60. (B)