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NATIONAL LEVEL SCIENCE TALENT SEARCH EXAMINATION (UPDATED)

CLASS - 9

Question Paper Code : UN497

KEY

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

SOLUTIONS

MATHEMATICS

01. (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

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

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

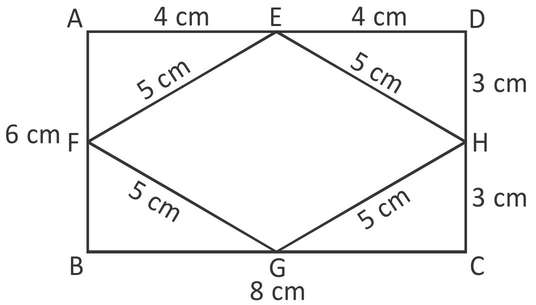
02. (D) $\frac{1}{(x^2 - 3x - 28)} - \frac{1}{(2x^2 - 17x + 21)}$

$$= \frac{1}{(x-7)(x+4)} - \frac{1}{(x-7)(2x-3)}$$

$$= \frac{(2x-3)-(x+4)}{(x-7)(x+4)(2x-3)} = \frac{2x-3-x-4}{(x-7)(x+4)(2x-3)}$$

$$= \frac{\cancel{(x-7)}}{\cancel{(x-7)}(x+4)(2x-3)} = \frac{1}{(2x^2+5x-12)}$$

03. (D) Let ABCD be the rectangle with sides 8 cm and 6 cm.



The midpoints of the adjacent sides of ABCD are joined forming a Rhombus EFGH.

Area of Rhombus = $\left(\frac{1}{2} \times 6 \times 8\right)$ cm^2

= 24 cm^2

04. (C) $\frac{(67.542)^2 - (32.458)^2}{75.458 - 40.374}$

$= \frac{100 \times 35.084}{35.084} = 100$

05. (C) According to the graph, the line passes through the points (–3, 4), (0, 2) and (3, 0)

Of the options,

$2(x - 1) + 3y = 4$ is the required equation

because for (– 3, 4),

2(– 3 – 1) + 3(4) = 4

$\Rightarrow$ 2(–4) + 12 = 4

$\Rightarrow$ 4 = 4 (True)

For (0, 2), 2(–1) + 3(2) = 4

$\Rightarrow$ – 2 + 6 = 4

$\Rightarrow$ 4 = 4 (True)

For (3, 0), 2(3 – 1) + 0 = 4

$\Rightarrow$ 2(2) = 4

$\Rightarrow$ 4 = 4 (True)

06. (A) $y = 3^x$ (Given)

$\therefore$ $3^{2x} + 3^x \times 3$

$= 3^x(3^x + 3) = y(y + 3)$

07. (B) Drop in the height of sand in a cylindrical box = 3 inches

Volume of the sand = 1 cu.foot

= 1728 cu.inches

$\Rightarrow \pi r^2 h = 1728$

[Since 1 foot = 12 inches.]

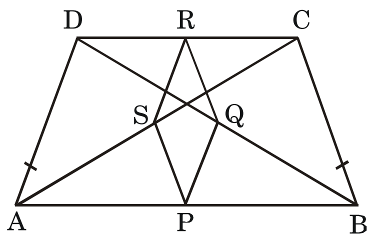
$\Rightarrow \pi r^2(3) = 1728$

$\Rightarrow r^2 = \frac{576}{\pi} \Rightarrow r = \frac{24}{\sqrt{\pi}}$ inches

Diameter of cylinder = 2r

$= 2 \times \frac{24}{\sqrt{\pi}} = \frac{48}{\sqrt{\pi}}$ inches

08. (A) In DBCD, Q and R are the mid-points of BD and CD respectively.



$\therefore$ QR || BC and QR $= \frac{1}{2}$BC

Similarly, PS || BC and PS $= \frac{1}{2}$BC

$\therefore$ PS || QR and PS = QR

$\left[\text{each equal to } \frac{1}{2}\text{BC}\right]$

Similarly PQ || SR and PQ = SR

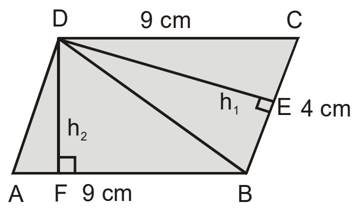
[Each equal to 1/2 AD]

$\therefore$ PS = AR = SR = PQ $[\because \text{AD} = \text{BC}]$

Hence, PQRS is a rhombus.

09. (C) Amount = 35 + 15(25) = ₹ 410

10. (B) A diagonal divides a parallelogram into two triangles of equal area.



∴ Area of parallelogram ABCD

= 4 cm × h_1 = 9 cm × h_2

$\Rightarrow \frac{h_1}{h_2} = \frac{9}{4}$ or $h_1 : h_2 = 9 : 4$

11.(D) $\angle PQR = 90^\circ$ [∴ Angle in a semi circle]

∴ $\angle QPR + \angle QRP = 90^\circ$

$\angle QPR + 30^\circ = 90^\circ$

$\angle QPR = 60^\circ$

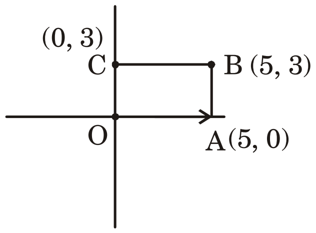
∴ $\angle TPR = 100^\circ - 60^\circ = 40^\circ$

But $\angle TPR + \angle x = 180^\circ$

$40^\circ + x = 18^\circ$

$x = 140^\circ$

12. (D) OABC is a rectangle.



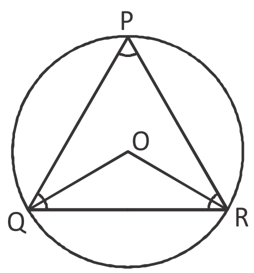
13. (A) Volume = base area × height

$= \frac{1}{2}$ h(6 cm + 4 cm) × 12 cm = 300 cm^2

60 h = 300 cm^2

h = 5 cm

14. (C)



ΔPQR is an equilateral triangle.

$\Rightarrow \angle PQR = \angle QRP = \angle QPR = 60^\circ$

$\Rightarrow RPQ = \frac{60}{2} = 30^\circ$

15. (B) Const: Extend AD upto E.

In DABD, AD = BD

$\Rightarrow \angle ABD = \angle BAD = x$

∴ $\angle BDE = 2x$

Similarly $\angle CDE = 2y$

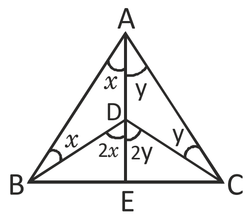
But $\angle BDE + \angle CDE = 100^\circ$

$\Rightarrow 2x + 2y = 100^\circ$

$2(x + y) = 100^\circ$

$x + y = 50^\circ$

∴ $\angle BAC = 50^\circ$



(or)

'D' is the equidistance from the vertices A, B, C

∴ 'D' is circumcenter

∴ $\angle BAC = \frac{1}{2}\angle BDC$

$= \frac{1}{2} \times 100^\circ = 50^\circ$

16. (A) A median divides the triangle into two triangles of equal area.

17. (C) $\angle PQR = \angle QRT = 65^\circ$

[PQ || RT Alternate ∠S]

$x = 65^\circ - 25^\circ = 40^\circ$

Since QPS is a triangle, right angled at P we have

$y = 180^\circ - [90^\circ + 40^\circ]$

$= 180^\circ - 130^\circ = 50^\circ$

18. (A) $\left(\sqrt{4+\sqrt{15}}\right)^3-\left(\sqrt{4+\sqrt{15}}\right)^3 = k\sqrt{6}$

$\left[\sqrt{4+\sqrt{15}}-\sqrt{4-\sqrt{15}}\right]$

$\left[\left(\sqrt{4+\sqrt{15}}\right)^2+\sqrt{4+\sqrt{15}}\times\sqrt{4-\sqrt{15}}+\left(\sqrt{4-\sqrt{15}}\right)^2\right] = k\sqrt{6}$

$\left[\frac{\sqrt{8+2\sqrt{15}}}{\sqrt{2}}-\frac{\sqrt{8-2\sqrt{15}}}{\sqrt{2}}\right]$

$\left[4+\sqrt{15}+\sqrt{4^2-(\sqrt{15})^2}+4-\sqrt{15}\right] = k = \sqrt{6}$

$\left[\frac{\sqrt{5}+\sqrt{3}}{\sqrt{2}}-\frac{(\sqrt{5}-\sqrt{3})}{\sqrt{2}}\right](9) = k\sqrt{6}.$

$\frac{2\sqrt{3}}{\sqrt{2}} x9 = k\sqrt{6}$

$\sqrt{6}x9 = k\sqrt{6}$

k = 9

19. (B) LHS

$$\frac{\left(2019^2-2019-6\right)\left(2019^2+4038-3\right)(2019+1)}{(2019-3)(2019-1)(2019+2)(2019+3)}$$

Let 2019 = x

$$=\frac{\left(x^2-x-6\right)\left(x^2+2x-3\right)(x+1)}{(x-3)(x-1)(x+2)(x+3)}$$

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

= x + 1

= 2020

20. (B) Const:- Extand GH Up to 5

$\angle AIH = 70°$ [$\because$ corresponding angles]

$\therefore \angle AIJ = 180° - 70° = 110°$

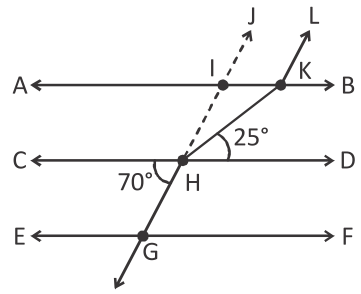
$\Rightarrow \angle IKL = \angle AIJ = 110°$

[$\because$ corresponding angles]

$\angle IKH = \angle KHD = 25°$

[$\because$ alternative angles]

$\therefore \angle HKL = \angle HKI + \angle IKL = 25° + 110° = 135°$



21. (C) $\sqrt[4]{193-4\sqrt{2178}} = \sqrt[4]{193-4\sqrt{1089\times2}}$

$=\sqrt[4]{121+72-33\times4\sqrt{2}}$

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

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

$=\sqrt[4]{\left(11-6\sqrt{2}\right)^2} = \sqrt{9+2-2\sqrt{9\times2}}$

$=\sqrt{3^2+\left(\sqrt{2}\right)^2-2\times3\times\sqrt{2}}$

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

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

22. (C) Given $\angle A + \angle B = 128°$ $\rightarrow$ (1)

$\angle A - \angle B = 22°$ $\rightarrow$ (2)

eq (1) + (2) $\Rightarrow$ $2\angle A = 150°$

$\angle A = 75°$

$\angle B = 53°$

$\therefore$ Biggest angle = $\angle A = 75°$

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

54x = 540 m

x = 10 m

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

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

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

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

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

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

$= 30 \times 3 \times 20 \times 5$

$= 9000\ m^2$

24. (C) $3^x = a$

$\Rightarrow$ $3^{2x} = (3^x)^2 = a^2$

$\therefore$ $a^2 + 9 = 10a$

$a^2 - 10a + 9 = 0$

$a^2 - 9a - a + 9 = 0$

$a(a - 9) - 1(a - 9) = 0$

$(a - 9)(a - 1) = 0$

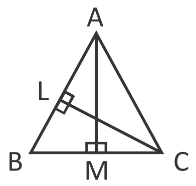
$a = 9$ (or) $a = 1$

$3^x = 9$ $3^x = 1$

$3^x = 3^2$ $3^x = 3^0$

$x = 2$

25. (D)



AB = 7.2 cm, BC = 4.8 cm, CL = 4 cm

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

$\Rightarrow \frac{1}{2} \times 4.8 \times AM = \frac{1}{2} \times 7.2 \times 4$

$\Rightarrow AM = \frac{7.2 \times 4}{4.8} = 6\,cm$

PHYSICS

26. (B) Statement (A), (C) and (D) are incorrect. Mass of objects is always constant or remains unchanged anywhere in the universe.

As W = mg. So, the mass of the rock on the earth and on the moon is 10 Kg.

Weight of rock on the moon = 10×1.6 = 16 N

Weight of rock on the earth = 10×10 = 100 N

27. (A) Using Newton's 2nd law, acceleration of car $= \frac{F}{m} = \frac{3600 - 2000}{800} = 2.0\ m/s^2$

28. (A) When the girl is on the tree, she possesses gravitational potential energy.

When she falls down due to the gravitational pull, her speed increases

constantly. During the process, gravitational potential energy is

converted into kinetic energy.

29. (C) Calculate the total distance travelled:

For the first 30 minutes, distance travelled = 15×1800 = 27000 m

For 20 minutes, distance travelled

= 25×1200 = 30000 m

Total distance travelled = 27000 + 30000 = 57000 m

The total time taken = 1800 + 1200 + 120 = 3120 s

Average speed =

$$\frac{\text{Total distance travelled}}{\text{Total time taken}}$$

$= \frac{57000}{3120} = 18.3\,m/s$

30. (D) When a bus accelerates forward from rest, the passengers in the bus lean back due to their initial inertia of rest that acts in the opposite direction.

31. (B) The work done by the car is equal to the gain in gravitational potential energy of the car up the hill.

$\therefore$ Work done = mgh

= 500 × 10 × 10 = 50000 j = 5 × 10^4 J

Note: The distance along the slope is not required in this calculation.

32. (D) Net displacement = $\sqrt{6^2+8^2}$ = 10 km

Total distance travelled = 6 + 8 = 14 km

Total time taken = 2 h

Average Speed =

$$\frac{\text{Total distance travelled}}{\text{Total time taken}} = \frac{14\text{ km}}{2\text{ h}}$$

= 7 km h^{-1}

Average Velocity =

$$\frac{\text{Total displacement}}{\text{Total time taken}} = \frac{10\text{ km}}{2\text{h}}$$

= 5 km h^{-1}

33. (D) All the given safety measures used in vehicles help to reduce the negative effects of inertia of people travelling in various vehicles.

34. (B) A guitar string has stored potential energy. When a guitar string is plucked, potential energy is converted into kinetic energy (vibration) and sound energy which we hear.

35. (C) A solid object of higher density than the liquid will sink and of lower density than the liquid will float.

R.D of liquid 1 = 0.75

R.D of liquid 2 = 0.1

R.D of object P = 0.6

R.D of object Q = 0.9

Solid Object P has R.D. less than both the liquids 1 and 2 respectively. So, it will float in both the liquids.

Solid Object Q has R.D more than liquied 1, So, it will sink in liquid 1

Solid Object Q has R.D less than liquid 2, So, it will float in liquid 2

CHEMISTRY

36. (A) 12 g of carbon combines with 32 g of oxygen to form 44g of CO_2. It is an example of Law of Conservation of Mass.

37. (C) Mercury-ethanol is an immiscible liquid mixture. Hence, it can be separated by a separating funnel.

(i) Filter paper is used to separate solid particles from a liquid.

(ii) Distillation is the process of heating a liquid to form vapour, and then cooling the vapour to get back the liquid e.g., salt water. Both salt and water can be recovered by this process.

(iii) Fractional distillation is the process of separating two or more miscible liquids based on the difference in their boiling points. Mercury-ethanol is an immiscible liquid mixture which cannot be separated either by distillation or fractional distillation.

(iv) A centrifuge works on the principle of sedimentation in which lighter particles float and heavier particle settle at the bottom.

38. (A) 1 mole of glucose weighs 180 g

$\Rightarrow$ 1 g of glucose = $\frac{1}{180}$ moles.

$\therefore$ 5.23 g of glucose = $\frac{1}{180} \times 5.23$ moles.

1 mole contains 6.023 × 10^{23} molecules

Number of molecules present in 5.23 of glucose

= $\frac{1}{180}$ × 5.23 × 6.023 × 10^{23} = 0.175 × 10^{23} or 1.75 × 10^{22} molecules.

39. (D) Elements X and Y combine to form a compound Z. X and Y being elements cannot be broken down into simpler substances. Compound Z has a fixed composition.

40. (D) There are spaces between the particles of water and alcohol. When they are mixed together, the water and alcohol particles move into these spaces. This causes the final volume to be less than 100 ml.

41. (D) Molecules of phosphorus (P_4) and ammonia (NH_3) are tetra-atomic.

42. (B) Three elements are present in $AgNO_3$. Ag-silver, N-nitrogen and O-oxygen.

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

Gram molecular weight of CO_2 = 44 g

44 g of CO_2 contains 12 g of 'C'

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

44. (A) Sample P contains both red and green dyes as per the chromatogram shown.

45. (C) The perfume molecules travel only short distances in straight lines before they collide with another molecule, change direction to collide again and so on. Infact at room temperature and atmospheric pressure, a perfume (gas) molecule in the air experiences several billion collisions per second. As the room is very large, slow diffusion occurs and perfume molecules travel in haphazard paths. So, it takes several minutes before its smell can be detected at the other end.

BIOLOGY

46. (D) Cell membrane is composed mainly of proteins and lipids. It aids in maintaining homeostasis in the cell. Plama membrane is the outer covering of cell made up of the phospholipid bilayer. Chemically, cell membrane or plasma membrane is composed of proteins (20–70 %), lipids (20, 79 %), carbohydrates (1–5 %), and water (20 %). Nucleic acids, i.e., DNA and RNA are absent. Hence, in cell membrane carbohydrates are present in least proportion.

47. (D) The integumentary system performs many intricate functions such as regulation of body temperature, cell fluid maintenance, synthesis of Vitamin D, and responds to stimuli. A circulatory system helps to provide oxygen, nutrients, and hormones to muscles.

48. (D) All the given statements are true.

49. (B) The disease caused by bacteria are diptheria, leprosy, plague.

50. (C) The adipose tissue stores fat in human body.

51. (A) If the sebaceous glands fail to function, the skin will become rough and dry.

52. (D) Lysosome is the cell organelle responsible for autolysis.

53. (C) P - (ii); Q - (iii); R - (iv); S - (i)

P : Saprophyte - Decomposition of dead organic materials.

Q : Parasite - Living on living plants or animals.

R : Lichens - Symbiotic association of fungi with roots of higher plants.

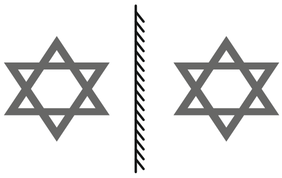
S : Mycorrhiza - Symbiotic association of algae and fungi.

54. (B) Seaweeds are rich sources of iodine. Seaweeds are also rich in minerals such as calcium, sodium, magnesium, potassium, iron, zinc, copper. Seaweeds also provide fibres, vitamins, enzyme and high quality protein.

55. (C) Endoplasmic reticulum is a cell organelle which is composed of a series of channels throughout the cytoplasm that functions in the transport of the cytoplasm that function sin the transport of molecules. A cell wall protects the structure of cell. Lysosomes digest cell parts while chloroplasts help in photosynthesis.

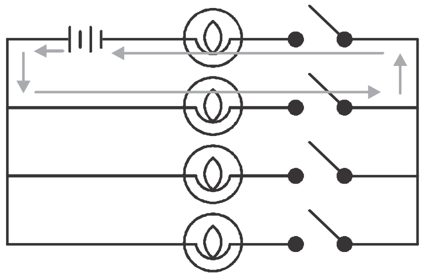
CRITICAL THINKING

56. (A)



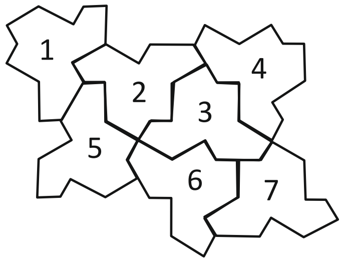
57. (D) Conclusion (1) and Conclusion (2) both are True

58. (B) To form a simple circuit, two switches need to be closed to let the current run.



59. (C) The situation demands that the education system should be more flexible and should be revised periodically.

60. (A)



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