UNIFIED COUNCIL

An ISO 9001:2008 Certified Organisation

nstse

Test • Assess • Achieve

NATIONAL LEVEL SCIENCE TALENT SEARCH EXAMINATION

Paper Code: UN423 (UPDATED)

Solutions for Class : 8

Mathematics

1. **(D)** $2^x \times 2^y \times 2^z = 2^6$

$\Rightarrow x + y + z = 6$

$\therefore \quad \frac{x+y+z}{3} = \frac{6}{3} = 2$

$\therefore$ Average value = 2

2. **(A)** Let the total marks be 'x'. According to the problem,

$\frac{5}{6}x = 80 \quad \Rightarrow \quad x = 80 \times \frac{6}{5} = 96$

3. **(C)** $1331 = 11 \times 11 \times 11 = 11^3$

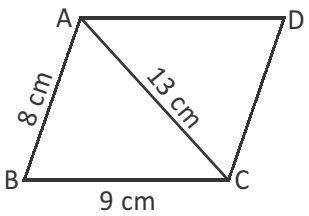
$216 = 6 \times 6 \times 6 = 6^3$

$243 = 9 \times 9 \times 3$

$512 = 8 \times 8 \times 8 = 8^3$

$\therefore$ 243 is not a perfect cube.

4. **(B)**



Area of parallelogram ABCD = 2 x Area of Δ ABC

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

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

$\therefore$ Area of Δ ABC

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

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

$= \sqrt{3\times5\times7\times2\times3\times2}$

$= 2\times3\sqrt{35}$ sq.cm

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

$\therefore$ Area of parallelogram ABCD = $2\times6\sqrt{35}$ sq.cm

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

5. **(B)** Given, perimeter of (square plot = circular plot)

$\Rightarrow 4a = 2\pi r \quad \Rightarrow a = \frac{2\pi r}{4} = \frac{\pi r}{2}$

Now, circular plot area : square plot area.

$\cancel{\pi} \cancel{r^2} : \frac{\cancel{\pi r}}{2} \times \frac{\cancel{\pi r}}{2}$

$1 : \frac{\pi}{4}$

$1 : \frac{{}^{11}\cancel{22}}{7 \times \cancel{4}^2}$

$1 : \frac{11}{14}$

$\Rightarrow$ 14 : 11

6. **(A)** $\frac{(-1)^{13}}{2^3} + \frac{2^3 - 1^{10} + 3^2}{3^2 - 2^2} + \left(\frac{7}{11}\right)^3 \div \frac{98}{121}$

$= \frac{-1}{8} + \frac{8-1+9}{9-4} + \frac{343}{1331} \times \frac{121}{98}$

$= \frac{-1}{8} + \frac{16}{5} + \frac{7}{11} \times \frac{1}{2}$

$= \frac{-1}{8} + \frac{16}{5} + \frac{7}{22}$

$= \frac{-5+128}{40} + \frac{7}{22}$

$= \frac{123}{40} + \frac{7}{22} = \frac{1353+140}{440} = \frac{1493}{440} = 3\frac{173}{440}$

7. **(A)** Given 0 < a < 1 (This means 'a' lies between 0 and 1)

Substitute any value that lies between 0 and 1 in $a + \frac{1}{a}$.

we observe $\left(a + \frac{1}{a}\right) > 2$

Hence, option (A) is correct.

8. **(C)** Difference before CI and SI

₹ (410 – 400) = ₹ 10

Use, formula for 2 yr

$$r = \frac{2 \times \text{Difference in CI and SI}}{\text{SI}} \times 100$$

$$= \frac{2 \times 10}{400} \times 100 = 5\%$$

9. **(A)** Length of each side of the square field

$$= \sqrt{80\frac{244}{729}} = \sqrt{\frac{58564}{729}} = \frac{242}{27} = 8.96\,\text{m}$$

10. **(B)** Let the number be 'x'.

According to the given problem,

$4x + 10 = 5x - 5$

$\Rightarrow x = 15$

11. **Deleted**

12. **(A)** Let the required speed be 'x' km/h.

Speed is inversely proportional to the time taken.

$\therefore$ 24 : 18 : : x : 15

$$\Rightarrow x = \frac{24 \times 15}{18} = 20$$

$\therefore$ Satish must go at a speed of 20 km/h to reach his school in 18 minutes.

13. **(C)** The solid shown in option (c), has pentagon as base.

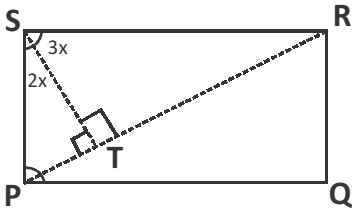
14. **(B)** Total number of alphabet = 26

Number of vowels = 5

Probability of choosing a vowel = $\frac{5}{26}$

15. **(B)** As per the property of rectangle,

$2x + 3x = 90° \Rightarrow 5x = 90° \Rightarrow x = 18°$



Now in Δ PST,

$\angle PST = 2x = 2\,(18°) = 36°$

$\angle STP = 90°$ (Given ST $\perp$ PR)

$\therefore \angle TPS = 180° - (36° + 90°) = 180° - 126° = 54°$

Hence, $\angle TPQ = 90° - \angle TPS = 90° - 54° = 36°$

16. **(C)** Last digit always repeats after every 4th power

So 333 = 4 x 83 +1

So, last digit will be $(373)^{333} = (373)^{4 \times 83+1}$

$= (373)^1$

So, the last digit will be 3

17. **(A)** Capacity of cup = 300 ml

Capacity of jug = 2 x 300 ml = 600 ml

3 cups + 3 jugs = (3 x 300 + 3 x 600)ml

= (900 + 1800) ml

= 2700 ml

= 2.7 l

18. **(C)** By trial and error method,

8 : 4 = 2 : 1

If A gives 2 to B the ratio becomes 6 : 6 = 1 : 1.

19. **(C)** Let the number be x.

According to the question,

$$x\,\frac{1}{5} + 30 = \frac{x}{4} - 30$$

$$\Rightarrow \frac{x}{5} + 30 = \frac{x}{4} - 30$$

$$\Rightarrow \frac{x}{4} - \frac{x}{5} = 60 \Rightarrow \frac{x}{20} = 60$$

$\therefore$ x = 1200

20. **(C)** $x^4 - (x - z)^4$

$= \{x^2\}^2 - \{(x - z)^2\}^2$

$= \{x^2 - (x - z)^2\}\ \{(x^2 + (x - z)^2\}$

$[a^2 - b^2 = (a - b)\,(a + b)]$

$= \{(x - x + z)\,(x + x - z)\}$

$\{x^2 + (x - z)^2\}$

$= z(2x - z)\,\{x^2 + (x - z)^2\}$

21. **(A)** 546 = 2 × 3 × 7 × 13

294 = 2 × 3 × 7 × 7

3066 = 2 × 3 × 7 × 73

A = HCF = 2 × 3 × 7 = 42

2	42, 14, 21
3	21, 7, 21
7	7, 7, 7
	1, 1, 1

B = LCM of 42, 14 and 21 = 2×3×7=42; clearly, A = B.

22. **(D)** $(6^{30} + 6^{-30})\,(6^{30} - 6^{-30}) = 3^A \,.\, 8^B - 3^{-A} \,.\, 8^{-B}$

$\Rightarrow (6^{30})^2 - (6^{-30})^2 = 3^A \,.\, 8^B - 3^{-A} \,.\, 8^{-B}$

$\Rightarrow 6^{60} - 6^{-60} = 3^A \,.\, 8^B - 3^{-A} \,.\, 8^{-B}$

$\Rightarrow (3\times2)^{60} - (3\times2)^{-60} = 3^A \,.\, (2^3)^B - 3^{-A} \,.\, (2^3)^{-B}$

$\Rightarrow 3^{60} \,.\, 2^{60} - 3^{-60} \,.\, 2^{-60} = 3^A \,.\, 2^{3B} - 3^{-A} \,.\, 2^{-3B}$

on comparing, A = 60 and 3B = 60 $\Rightarrow$ B = 20

$\therefore$ A + B = 60 + 20 = 80

23. **(C)** No. of revolutions in 3 hrs = 19500

No. of revolutions in 1 hr = $\frac{19500}{3}$

= 6500

No of revolutions in 7 hrs = 7 x 6500

= 45500

24. **(B)** $x = 10, y = 25$

$x \propto y$

$x = k\,y$

$\frac{x}{y} = k$

$\Rightarrow \frac{10}{25} = k \Rightarrow k = \frac{2}{5}$

[direct proportion, $\frac{x}{y} = K$]

25. **(C)** If 'n' is even then square root will contain $\frac{n}{2}$ digits.

If 'n' is odd then square root will contain $\frac{n+1}{2}$ digits.

Physics

26. **(B)** Ultrasound is a sound which has a frequency above 20,000 Hz (limit of human hearing). Accordingly only 30 kHz (30,000 Hz) is an ultrasound. 10,000 Hz and 0.015 MHz (15,000 Hz) are below the threshold for ultrasound.

27. **(C)** Point charge 1 and point charge 3 are positive charges. Point charge 2 is a negative charge. Since, unlike charges attract, point charges 1 and 2, point charges 2 and 3 will attract each other.

28. **(D)** A boy wearing shoes is pedalling a bicycle on the road. As there is no contact between his shoes and the road, friction is not involved.

29. **(C)** From the given figure, $\angle i = 90° - 25°$

$\angle i = 65° = \angle r$ (laws of reflection)

The angle between the incident ray and reflected ray

$= \angle i + \angle r$

$\angle i + \angle r = 65° + 65° = 130°$

30. **(D)** Both $CaCO_3$ and Cu are insoluble in water. Ethanol is a non-electrolyte with no ions available to conduct electricity. Sodium hydroxide dissolves in water to form a solution of sodium ions and hydroxide ions that move freely to conduct electricity.

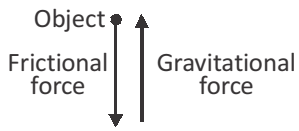
31. **(D)** Frictional force can produce sound and heat. It also reduces the speed of a moving object.

32. **(C)** As a sharp knife has a smaller area of contact and exerts greater pressure, it is easy to cut fruits and vegetables.

33. **(D)** When current is passed through molten sodium chloride, sodium is deposited at the negative electrode and the chlorine gas is formed at the positive electrode.

34. **(D)** A kaleidoscope, a plane mirror and side mirror (convex) of a car, all the three use the principle of reflection of light.

35. **(A)** A freely falling object passing through the air at a constant speed is acted upon by two forces i.e., the frictional force of air in the downward direction. A similar force of gravitation is also exerted on the object to bring it down to the earth in upward direction. Hence, the two forces are acting equally on a freely falling object in the opposite direction as shown below.



36. **(A)** As the plastic rod is negatively charged, the charge induced in the metal sphere at X is positive and at Y it is negative. Electric charge can be transferred from a charged object to another through a metal conductor.

37. **(B)** Sound waves are longitudinal or mechanical in nature that need a medium to propagate. Sound is an invisible form of energy as its vibrations are not visible to human eyes when they pass through the air. It is not a type of radiation nor it is a part of the light spectrum.

38. **(A)** In the electrolysis of $CuSO_4(aq)$ using Cu electrodes, the Cu anode dissolves to form Cu^{2+} while Cu is deposited at the Cu cathode.

Anode: $Cu(s) \longrightarrow Cu^{2+}(aq) + 2e^-$

Cathode: $Cu^{2+}(aq) + 2e^- \longrightarrow Cu(s)$

The overall result is the transfer of Cu from anode to cathode and there is no change in the concentration of the solution.

39. **(D)** Except Bihar, all the given areas are prone to earthquakes. In India, the areas most threatened to earthquakes are Kashmir, Western and Central Himalayas, the whole of North-East, Rann of Kutch. Rajasthan and the Indo-Gangetic plane.

40. **(C)** Frequency and pitch are directly proportional thus; if the frequency increases, then the pitch will also increase (and vice versa).

41. **(C)** An ideal mirror reflects all the light.

42. **(D)** Pressure (P) = $\frac{\text{Force}(F)}{\text{Area}(A)}$

Therefore, F = P × A and A = F / P.

43. **(C)** An elephant weighing 50 000 N with a foot size of 400 cm^2.

Pressure = force ÷ area
= 50 000 N ÷ (0.04 m^2 × 4)
= 312.5 kN m^{-2}

A 50 kg lady wearing a pair of high heel shoes. Each shoe has a contact area of 9 cm^2 with the floor.

Pressure = force ÷ area
= 500 N ÷ (2 × 0.0009 m^2)
= 277.8 kN m^{-2}

A 100 kg washing machine standing on a surface area of 6500 cm^2.

Pressure = force ÷ area
= 1000 N ÷ 0.65 m^2
= 1.538 kN m^{-2}

A designer's table weighing 1000 N standing on 3 legs. Each leg has a contact area of 0.1 cm^2 with the floor.

Pressure = force ÷ area
= 1000 N ÷ (3 × 0.00001 m^2)
= 33 333 kN m^{-2}

44. **(D)** All the charged objects, regardless of the type of charge it carries and its material, can attract a stream of water (neutral). Neutral objects cannot attract or repel another neutral object.

45. **(B)** When an image of an object is formed on the retina of a human eye, it does not vanish immediately, but it stays there for about $1/16^{th}$ of a second.

46. **(D)** Cassiopeia is another prominent constellation in the northern sky. It is visible during winter in the early part of the night. It looks like a distorted letter W or M.

47. **(B)** Fluids such as water and air also exert friction on objects moving through them. It depends on the nature of the fluid, the shape of the object and the speed of the object with respect to the fluid. Friction is minimum for a streamlined shape, which is rounded in the front and narrow at the back. Streamlined shapes help to reduce friction in water.

48. **(D)** Ag^+ is to migrate to the spoon to electroplate it. Hence, it must be the cathode.

49. **(A)** Loudness of sound is proportional to the square of the amplitude of the vibration producing the sound. If the amplitude of sound becomes twice, the loudness increases by a factor of 4.

50. **(D)** As altitude increases, the air gets thinner and hence atmospheric pressure decreases. Mine workers who work in underground mine experience higher air pressure because air sinks and hence there is a higher concentration of air particles at the bottom of the mine. For this question, option (B) and option (C) have similar atmospheric pressure because the air pressure in a commerical plane is regulated to be close to atmospheric pressure at sea level, to minimise the discomfort level of their passengers.

Chemistry

51. **(D)** Carbon monoxide is produced due to incomplete burning of fuels such as petrol and diesel. It is a poisonous gas. When inhaled, it reduces the oxygen-carrying capacity of the blood in humans.

52. **(B)** Ductility and malleability are properties that apply to metals. Pencil lead is a non-metal and not flexible. However, the softness of the pencil lead makes it suitable for writing on the paper.

53. **(D)** Stainless steel is the most common alloy made by combining iron with carbon and traces of other metals, such as chromium and nickel.

54. **(B)** The heat from the lit match stick provides the heat energy to initiate the combustion. Thereafter, the heat generated by the reaction keeps the reaction going.

55. **(C)** Boxes used for packing takeaway food must prevent heat from being lost to the surroundings so that the food is kept warm. Boxes used to store cold items must prevent heat entering so that the items remain cold. Polystyrene is a good insulator of heat to prevent heat from being transmitted into or out of the box.

56. **(B)** Brass is a mixture of copper and zinc.

57. **(B)** Incomplete combustion of hydrocarbons like diesel, methane and petrol produce carbon monoxide, water and heat energy. Hydrogen burns to produce water only.

58. **(C)** Heat energy is not stored but applied externally to the carbon compounds to initiate burning in the presence of oxygen. During combustion of fossil fuels, oxygen reacts with the fuel to convert the stored chemical energy into heat and light energy. Complete combustion of the fuel produces carbon dioxide and water.

59. **(B)** The raw materials used to manufacture plastics are derived from petroleum, a fossil fuel. e.g., ethene used to produce poly(ethene) plastic is produced from cracking of heavier fractions of petroleum.

60. **(D)** Metals generally have higher melting and boiling points.

61. **(A)** The given polymer is a part of poly(ethene), made from ethene monomers, C_2H_4.

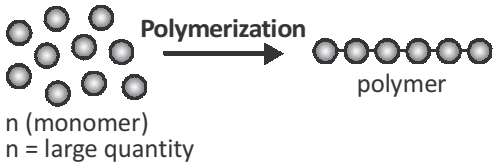
62. **(C)** Diesel gives out maximum amount of heat by complete combustion when compared with wood, coal and biogas.

(i) Diesel – 45,000 kJ/kg.
(ii) Wood – 17,000 - 22,000 kJ/kg.
(iii) Coal – 25,000 - 33,000 kJ/kg.
(iv) Biogas – 35,000 - 40,000 kJ/kg.

63. **(C)** The reaction of aluminium with oxygen to form aluminium oxide is a chemical change which requires energy to occur. It is an irreversible change. The layer of aluminium oxide protects the underlying aluminium from coming into contact with air. This prevents further oxidation and keeps the aluminium shiny.

64. **(D)** Polymerization is the process of joining together thousands of monomers to form a polymer by chemical reactions.

The joining together of thousands of small monomer molecules by chemical reaction forms long chained big molecules called polymers.



65. **(D)** Fuels are used to drive motor vehicles and CO_2 is emitted. The burning of coal and oil also gives out CO_2. So, the concentration of CO_2 increases in the atmosphere. CO_2 is used by green plants not given out during photosynthesis.

66. **(C)** The metals in the reactivity series are in the following decreasing order of their reactivity:

Potassium, sodium, calcium, magnesium, aluminium, zinc, iron, tin, lead, copper, mercury, silver, gold and platinum.

67. **(B)** Bakelite is a poor conductor of heat and electricity. It is widely used in making of handles for kettles, pans, telephone sets, electric switches, electric lamp holders, pins and plugs.

68. **(A)** Biogas is obtained from plant and animal wastes.

69. **(B)** Sodium has less density than water. Hence, it floats and reacts rapidly with water forming sodium hydroxide (NaOH) and hydrogen gas (H_2) is released. When a lighted splinter is brought near a piece of sodium, it burns with a pop sound. Density of zinc is higher than sodium, it sinks and is unreactive with water.

70. **(D)** Margarine (Dalda) is made by hydrogenation of unsaturated oils into saturated fats.

Biology

71. **(C)** Growing different crops in succession in the same field is the technique used in crop rotation method of agriculture.

72. **(C)** The given figure is of a virus that uses bacteria as a host.

73. **(D)** Cholera, anthrax, tuberculosis and typhoid are bacterial diseases.

74. **(A)** WWF works in the field of wild life conservation.

75. **(C)** Centriole and centrosome are present in animal cell.

76. **(A)** The given microorganism is nostoc. Nostoc helps in nitrogen fixation.

77. **(A)** Sickle is used for harvesting.

78. **(A)** Algae are autotrophs. chlamydomones is an algae with flagella. B and C are consumers, B has pseudopods so it could be amoeba and C has cilia that could be a paramecium.

79. **(D)** Diagram P is mitochondria and R is chloroplast which contains both DNA and ribosome and it can multiply by itself. Hence, they are called semi-autonomous cell organelles.

80. **(C)** Nitrogen is important for growth of plants, but no plant can absorb the nitrogen present in the air directly.

81. **(A)** In the given figure Hydra exhibits budding a type of asexual reproduction.

82. **(B)** Pancreas is called as both exo and endocrine gland.

83. **(D)** The given microorganism is a mould it belongs to fungus.

84. **(C)** Amoeba, Paramecium and Plasmodium are protozoans,

85. **(D)** Chlamydomonas is an algae, i.e., a large group of simple plant like organism. It contains chlorophyll and produces food by photosynthesis just like plants.

86. **(B)** Red blood cells are enucleated cells. These cells flow as part of blood throughout the body. Their main function is to deliver oxygen to the body tissues.

87. **(B)** Soil preparation, sowing, adding manure, irrigation, protection from weeds, harvesting and storage, is the correct sequence to grow a crop.

88. **(B)** Egg cell is formed due to the meiotic cell division. Hence, the number of chromosomes are reduced to half.

89. **(A)** Rhizobium bacteria is present in the root nodules of legumes.

90. **(B)** Fertilization of X chromosome in mother's ovum with Y chromosome of father's sperm produces a male baby.

91. **(B)**

92. **(A)**

93. **(B)**

94. **(D)**

95. **(B)**

96. **(A)**

97. **(C)**

98. **(B)**

99. **(A)**

100. **(A)**