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NATIONAL LEVEL SCIENCE TALENT SEARCH EXAMINATION

Paper Code: UN423

Solutions for Class : 7

Mathematics

1. **(A)** $(-2) \div 3 \times (-4) \div 1$

Given, '÷' is replaced by '×'

$\Rightarrow (-2) \times 3 \times (-4) \times 1$

$\Rightarrow -6 \times -4$

$\Rightarrow +24 = 24$

2. **(B)** Given, circumference of circle radius = 37 m

$\Rightarrow 2\pi r - r = 37$

$\Rightarrow r(2\pi - 1) = 37$

$\Rightarrow r\left(2.\frac{22}{7} - 1\right) = 37$

$\Rightarrow r\left(\frac{44}{7} - 1\right) = 37$

$\Rightarrow r\left(\frac{44 - 7}{7}\right) = 37$

$\Rightarrow r\left(\frac{37}{7}\right) = 37$

$\Rightarrow r = \cancel{37} \times \frac{7}{\cancel{37}} = 7m$

Now, circumference = $2\pi r = 37 + r$

37 + 7 = 44 m

3. **(C)** Quantity of chocolates madhavi ate

$= \left(1 \text{ whole} + \frac{3}{5} \text{ of}\right) \text{chocolate}$

$= 1 + \frac{3}{5}$

$= \frac{5+3}{5} = \frac{8}{5}$

4. **(C)** $\angle ABC = \angle ACB$

$= \angle BAC = 60°$

$\angle ACD = 90° - 60°$

$= 30°$

So, $\angle CAD = \angle CDA$

$= \frac{180 - 30}{2} = 75°$

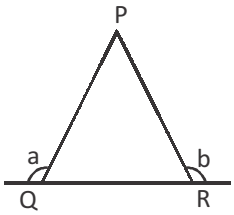
$\therefore \angle m = 360 - 60 - 75 - 75 = 150°.$

5. **(C)** $x = 0.34 \times 0.2$

$x = 0.068$

6. **(B)** Let ΔPQR,

$\angle Q = 80°$ and $\angle R = 50°$



from the figure

$\angle Q = 180 - a$

$\angle R = 180 - b$

Given $\angle Q > \angle R$

$\Rightarrow 180° - a > 180° - b$

$\Rightarrow -a > -b$

$\Rightarrow a < b$

7. **(C)** Given, two triangles are congruent

$\therefore$ they should be alike in all respects.

$\angle P = \angle U = x°$

In P Q R, $\angle P + \angle Q + \angle R = 180°$

$\angle P + 65° + 35° = 180°$

$\angle P = 180° - (65° + 35°)$

$= 180° - 100°$

$= 80°$

Hence, $x = 80°$

8. **(D)** C.P = ₹ 48,000

Profit = 15% of 48,000

$= \frac{15}{\cancel{100}} \times 48{,}000$

= ₹ 7200

9. **(B)** a, b, c, d are said to be in proportion if product of extremes = product of means.

$a \times d = b \times c$

$3 \times 100 = 4 \times 75$

$300 = 300$

10. **(A)** Given $\frac{\sum x}{5} = 27$

$\Rightarrow \sum x = 27 \times 5 = 135$ and also, when one value excluded the mean gets reduced by 2.

$\therefore \frac{\sum x}{4} = 27 - 2$

$\Rightarrow \frac{\sum x}{4} = 25 \Rightarrow \in x = 25 \times 4$

$\Rightarrow \sum x = 100$

$\therefore$ Excluded value = 135 – 100 = 35

11. **(B)** AD in the median

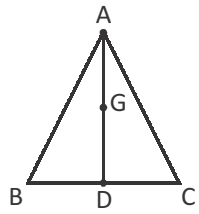
G is centroid

we have AG : GD = 2 : 1

Given GD = 2 cm

$1x = 2 \Rightarrow x = 2$

$AD = 2x + 1x = 3x = 3(2) = 6$cm.



12. **(D)** Let b = 24 m

we have area of parallelogram = b × h

Given, b × h = 576 m^2

$24 \times h = 576$

$\Rightarrow h = \frac{576}{24} = 24$

Hence, altitude = 24 m

13. **(A)** we know $(-1)^{even} = 1$ and $(-1)^{odd} = -1$

$(-1)^{101} + (-1)^{102} + (-1)^{103} + (-1)^{104} + \text{-----} (-1)^{199} + (-1)^{200} = (-1 + 1) + (-1 + 1) + \text{----} + (-1 + 1) = 0 + 0 + \text{-----} + 0$

= 0

14. **(D)** They are the rules of comparison of fractions in a short method.

15. **(C)** $4a^3y^2z^3$ and $7z^3a^3y^2$ are like terms because they have the same variable part.

16. **(C)** Writing the numbers is ascending order

10, 12, 14, 17, 26, 28, 35

Median = middle value

= 17.

17. **(B)** (i) $1^5 = 1$ (ii) $0^5 = 0$

(iii) $5^0 = 1$ (iv) $5^1 = 5$

from the above $1^5 = 5^0 = 1$

Hence (i) and (iii) are equal.

18. **(A)** From the given data, we can understand

÷ is denoted by ⬠

× is denoted by ✡

– is denoted by ▭

+ is denoted by △

0 ▭ 7 ✡ 8 ⬠ (2 △ – 10)

$0 - 7 \times 8 \div (2 + (-10))$

$-56 \div -8$

7

19. **(A)** One number = – 340

quotient = – 17

let another number = x

As per data given, $\frac{+340}{x} = 17$

$\Rightarrow x = \frac{\cancel{340}^{20}}{\cancel{17}} = 20$

Hence, other number = 20.

20. **(B)** $\angle A = (4x + 2)°$

Complementary of $\angle A = 90° - (4x + 2)°$

$= 90° - 4x - 2°$

$= (88 - 4x)°$

21. **(C)**

Option A: $\sqrt{225} + 625$ 80% of 1200 – 320

= 15 + 625 $= \frac{80}{100} \times 1200 - 320$

= 640 = 960 – 320

= 640

$\therefore$ LHS = RHS.

Option B: $5\frac{1}{2}$ of 240 150% of 880

$= \frac{11}{\cancel{2}} \times \cancel{240}^{120}$ $= \frac{150}{\cancel{100}} \times 88$

= 1320 = 1320

$\therefore$ LHS = RHS.

Option C: 25% of 50 0.125

$= \frac{25}{\cancel{100}_2} \times \cancel{50}$

$= \frac{25}{2} = 12.5 \neq 0.125$

LHS $\neq$ RHS.

Hence, option (C) is wrong statement.

22. **(B)** $\not\forall\, x, y \in I, \quad x + y \in I$

$\not\forall\, x, r \in I, \quad x - y \in I$

Hence, integers are closed under addition and subtraction.

23. **(A)** 5,976,000,000,000,000,000,000,000. kg

5976×10^{21} kg

5.976×10^{24} kg.

24. **(C)** Longest side = side opposite to greatest angle.

Hence longest side = side opposite to $\angle B$. = AC

25. **(A)** In a triangle, the sum of the length of any two sides should be greater than third side and difference between any two sides should be less then third side.

Physics

26. **(D)** Heat is transmitted in the metal bar from the point of heating by conduction. Since, the bar is fixed at one end, it is unable to expand in that direction (X). Hence, expansion in direction Y will take place. Different metals have different rates of expansion, so using different metals will give different results.

27. **(D)** The average speed of a motorist on a journey is the total distance travelled divided by the total time taken for the journey. The other options are incorrect.

28. **(C)** When electric current (electrical energy) passes through a thin, coiled, tungsten filament in an electric bulb, it glows to give out heat and light energies respectively.

29. **(C)** A poor heat conductor will not conduct heat away from our feet quickly, so we feel warmer.

A better heat conductor will conduct heat away from our feet quickly, so we feel cooler.

30. **(D)** An electric motor and an electric door-bell require an electromagnet in order to work. The electric light bulb does not require an electromagnet to work. It makes use of a high resistance wire.

31. **(C)** Time taken till noon = 12 h – 7 h 35 min = 4 h 25 min.

Time taken from noon to 10:15 pm = 10 h 15 min.

Total time taken = 4 h 25 min + 10 h 15 min = 14 h 40 min.

32. **(B)** Our eyes enable us to see near and far objects. Use of plane mirrors in a periscope helps us to see around the corners, over an obstacle, above the heads of crowds and to observe the movements of soldiers in a trench warfare. Use of two convex lenses, as an objective and as an eye piece in a microscope helps to magnify very tiny objects to enable us to see clearly. A periscope and a microscope help us to overcome the limitations of sight. A stethoscope works due to multiple reflections of sound not light.

33. **(B)** $\text{Speed} = \frac{\text{Distance}}{\text{Time}}$

$3,00,000 = \frac{\text{Distance}}{500}$

Distance = 500 × 3,00,000

= 15,00,00,000 km

= 150 million km.

34. **(B)** Heat always flows from a hotter region to a colder region. When the wax gains heat, it melts. The drop of wax that is nearest to X will melt first while the drop of wax that is farthest away from X will melt last.

35. **(A)** A periscope has plane mirrors.

A telescope has plane or concave mirrors to make larger images, not a convex mirror which makes smaller images. A car wing mirror has a convex mirror to make smaller images so that you see a larger area. A wardrobe mirror has a plane mirror, so the image is of the same size as the object.

36. **(A)** To make a strong electromagnet, it depends on:

(i) the current flowing in the nail. If the current in the nail is increased, the strength of an electromagnet increases.

(ii) the number of turns on the nail. If we increase the number of turns on the nail, the strength of an electromagnet increases.

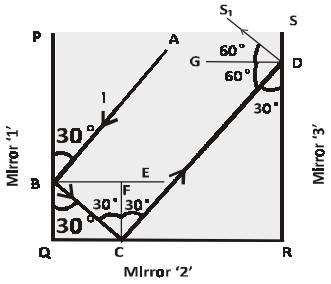
Setup IV has more (3) cells and more (20) turns. Hence, this nail becomes a strong electromagnet.

37. **(B)** As the light beam emitted from a torch is starting from a point and travels in various directions, it is said to be a divergent beam of light.

38. **(C)** An ammeter is not a safety device as it measures the magnitude of current in a circuit. The circuit breaker, fuse and switch are safety devices.

39. **(C)** Cold air is denser than warm air. Thus, warm air rises and cold air sinks. Placing the air conditioner near the ceiling will help to set up a convection current so that the air is cooled more effectively.

40. **(C)**



$\angle ABP = \angle QBC = 30°$

$\angle BCF = \angle FCD = 30°$

$\therefore \angle CDR = 30°$

$\therefore$ Angle of incidence on mirror 3,

$\angle CDG = 60°$

As per the laws of reflection $\angle i = \angle r$

$\therefore$ Angle of reflection $\angle GDS^{I} = 60°$

41. **(A)** Heat is a form of energy that makes things hot. Not all sources of heat give out light. Temperature is not a form of energy. It is a measure of the degree of hotness or coldness of an object.

42. **(C)** The positive terminal of one cell is connected to the negative terminal of the next cell.

43. **(D)** Distance to be covered(s) = 15 km.

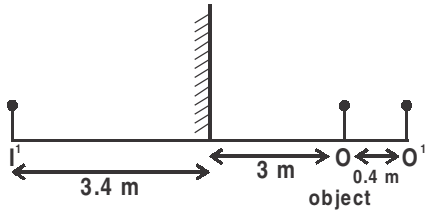
Speed = 120 km/h

$$\text{Time (t)} = \frac{S}{\text{Speed}} = \frac{15\ \text{km}}{120\ \text{km/h}}$$

$$= \frac{1}{8}\text{h} = \frac{1}{8} \times 60 = 7.5\ \text{min.}$$

44. **(D)** The stopper is made of a poor conductor of heat, so it reduces heat loss by conduction. It also reduces heat loss by convection because it stops the heated air in the flask from rising. The double-layered wall containing vacuum between the layers reduces heat loss by conduction and convection. The vacuum cannot reduce heat loss by radiation because heat transfer by radiation does not require a medium. However, the silvered inner surface is able to reflect radiations, and so can reduce heat loss by radiation.

45. **(B)** Distance between the object and its image = (3.4 + 3.4)m = 6.8 m



46. **(C)** $\text{Speed} = \dfrac{\text{Distance travelled}}{\text{Time taken}}$

Distance travelled = Speed × Time taken

The time taken to travel = $\dfrac{30}{60}$ minutes

= 0.5 hours.

= 100 × 0.5 = 50 km

47. **(B)** Radiation is the transfer of heat without the need for a medium. The objects involved in the heat transfer also do not need to be in contact. The heat responsible for heating the road comes from the sun. It is transferred to the road via radiation. The egg is in contact with the hot oil. Water in the water heater is warmed up when hot water rises and cold water sinks, forming convection currents. The handle of a frying pan is made up of an insulator that does not conduct heat to the handle. One can hold the handle as it is not hot.

48. **(C)** The size of the object determines the size of the image in a plane mirror.

49. **(B)** The 'period' is the time taken for one complete swing (from P to Q and back again).

Period = 16.4 / 20 = 0.82 s

50. **(C)** More chemical energy is converted to electrical energy when two cells are used. Consequently, the flow of electric current is greater.

Chemistry

51. **(D)** During photosynthesis, CO_2 and H_2O are used in the presence of sunlight and chlorophyll. The products formed are glucose along with water vapour and oxygen gas

$6CO_2 + 12H_2O \longrightarrow C_6H_{12}O_6 + 6H_2O + 6O_2\uparrow$

52. **(D)** Electric charges present in the clouds is the cause for lightning.

53. **(D)** Acids react with metals to produce a salt, and hydrogen gas.

$Mg + 2HCl \longrightarrow MgCl_2 + H_2\uparrow$

Magnesium chloride has the formula $MgCl_2$.

Hydrogen gas has the formula H_2.

54. **(D)** All the given precautions must be taken as per the situation when a storm is a accompanied by lightning.

55. **(A)** Oxygen is an element. Water and carbon dioxide are compounds while air is a mixture.

56. **(B)** Phenolphthalein turns pink in basic solution and colourless in acidic solution respectively.

57. **(C)** A method of storing rainwater at home for future use is called rain water harvesting and it does not form a part of 3 Rs in water conservation. Rain water that falls on roofs of houses is made to flow into a deep trench constructed in the underground of a house. It is stored and used in future instead of utilising ground water. This method helps in replenishing ground water.

58. **(A)** Pure water does not change the colour of blue litmus as pure water is neutral.

59. **(A)** When two clouds with unlike charges come near each other, there can be very heavy discharge between them. Huge amount of energy is released in the form of heat, light and sound during such a discharge. This is the lightning we see as a flash of bright light and the thunder we hear during a storm.

60. **(B)** Liquid alcohol evaporates to form vapours of alcohol. It is a physical change as there is only change of state from liquid to gas.

61. **(A)** When strong winds blow over a weak thatched roof, it creates a low pressure over it and a high pressure inside it causing the roof to blow off. Opening the doors and windows reduces this pressure difference and prevents the roof from being blown off.

62. **(C)** An acid reacts with a base neutralising one another and forming a salt and water is called a neutralisation reaction as given below:

$$\underset{\text{Sulphuric acid}}{H_2SO_4\,(dil)} + \underset{\text{Sodium hydroxide}}{2NaOH} \longrightarrow \underset{\text{Sodium sulphate}}{Na_2SO_4} + \underset{\text{Water}}{2H_2O}$$

63. **(B)** Carbon dioxide dissolves in water to form carbonic acid (weak acid) and this causes the decrease in the pH value of water.

64. **(B)** Production of spark during lightning heats up the air around, expands all of a sudden creating the effect of explosion and resulting in thunder.

65. **(B)** Water consumed per day by 10 members

= 15000 L / 30 days = 500 L

Water consumed by each member in a day = $\frac{500}{10}$ = 50 L

Water consumed by each member for 365 days = 50 × 365 = 18,250 litres.

66. **(C)** Sodium chloride (common salt) is a compound that is made from two elements, sodium and chlorine. Chalk is made up of calcium, carbon, oxygen and sugar is made up of carbon, hydrogen and oxygen. These two are compounds that are made from three kinds of elements. Seawater is a mixture of sodium chloride and other compounds dissolved in water.

67. **(C)** In areas of scanty rainfall, the plants do not get required amount of water and salts. In the absence of the above, growth stops by wilting (folding of leaves inwards, curl or shrivel) slowly and ultimately die and dry up.

68. **(A)** Heat causes the green powder to decompose, resulting in two products – the black solid and the gas. This chemical reaction is not reversible. After heating, the black solid and the gas cannot recombine to give the green powder. Hence, the colour change cannot be reversed.

69. **(C)** An acid reacts with sodium hydroxide to produce a salt and water. Acids have pH values of less than 7.

70. **(D)** The function of lightning conductor installed on a building is to conduct electric charge to the ground when lightning strikes the building.

Biology

71. **(B)** The layer of oil blocks the stomata, preventing air from entering the plant. Without carbon dioxide, the plant is unable to make food. Without food, the plant will die.

72. **(D)** Wool fibre on burning gives out the smell of burnt hair.

73. **(D)** The roots of the seedlings will appear first.

74. **(C)** The hump of camel contains stored food in the form of fat. When it requires energy, it takes stored energy from fat stored in hump, hence it get shinked.

75. **(C)** Mitochondria are the sites for respiration.

76. **(D)** P is a red blood cell, Q is a white blood cell and R is platelets.

77. **(C)** Fats and carbohydrates are the main sources of energy for the body.

78. **(D)** Plant synthesise their food in the presence of sunlight in the form of solar energy. Herbivores obtain their energy from plants by eating plant parts.

79. **(B)** As the food-carrying tubes are removed, the food made by the leaves is unable to be transported downwards beyond X. As a result, the food accumulates at X, causing X to bulge.

80. **(A)** Bacteria enter the body together with the air that is breathed in. It is then carried by the respiratory tract into the blood stream. As the blood circulates around the body to the organs, for example the lungs, the organs are infected.

81. **(B)** A whale can swim and move easily in the ocean as it has a pair of powerful flippers. its streamlined body shape helps it to move in water by reducing water resistance. A whale breathes using its lungs through the blowhole on the top of its head. The large amount of air sacs and capillaries in its lungs increases the rate of gaseous exchange and thus, allows the whale to absorb a large amount of oxygen. However, it does not store oxygen in its lungs. The oxygen is stored in its muscles, which is particularly useful during diving.

82. **(C)** A potato is an underground stem. New plants will only grow from a potato where buds are found. In the diagram, only parts A, C and D contain buds.

83. **(B)** Canines help in tearing the flesh. Hence canines are specially developed in carnivores.

84. **(A)** A leaf with the lowest surface area would lose the least amount of water.

85. **(D)** Peristalsis is the wave-like muscular contractions of the walls of the oesophagus that enable food to be pushed down.

86. **(C)** Clay has the smallest size of particles.

87. **(B)** P presents an artery because of its thick muscular wall and narrow lumen. Q represents a vein because it has a thin muscular wall and a wide lumen. R represents a capillary because its wall is one-cell thick.

88. **(A)** Phloem carries sugars up and down the plant whereas xylem carries only water up the plant.

89. **(A)** Structure Q is cuticle made of epidermal cells.

90. **(A)** Photosynthesis can be represented by using a chemical equation. The overall balanced equation is

$$\underset{\text{Carbon dioxide}}{6CO_2} + \underset{\text{Water}}{6H_2O} \xrightarrow[\text{Chlorophyll}]{\text{Sunlight}} \underset{\text{Glucose}}{C_6H_{12}O_6} + 6O_2$$

91. **(B)**

92. **(C)**

93. **(A)**

94. **(D)**

95. **(A)**

96. **(A)**

97. **(D)**

98. **(B)**

99. **(B)**

100. **(C)**