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**NATIONAL LEVEL SCIENCE TALENT SEARCH EXAMINATION - UN401 (UPDATED)**

Solutions for Class: 8

Mathematics

1. (D)  $\sqrt{2} + \sqrt{3} < \sqrt{11}$ . So, the triangle **does not exist**.

2. (B)  $(1-p)^{20} = [(1-p)^2]^{10} = [1+p^2-2p]^{10} = (-2p)^{10}$   
 $= 2^{10}p^{10}$

$= -1024$  [Since  $p = \sqrt{-1}$ .]

3. (A) The square of an odd number can not have 4 as the units digit. The square of a 3 digit number will have at least 5 digits and at the most 6 digits. So, **the number in option (A) is the correct answer**.

4. (A) The required cost is the product of  $5a^2b^2$  and  $3a^2 - 4ab + 6b^2$  which is  **$15a^4b^2 - 20a^3b^3 + 30a^2b^4$** .

5. (C) Let the maximum marks be 'x'.

$$\frac{40x}{100} = 30 + 50$$

$$\Rightarrow x = 200$$

$\therefore$  The maximum marks of the test is **200**.

6. (C)  $A = P \left( 1 + \frac{R}{100} \right)^n$

$$\Rightarrow 4500 = 3125 \left( 1 + \frac{R}{100} \right)^2$$

$$\Rightarrow \left( 1 + \frac{R}{100} \right)^2 = \frac{4500}{3125}$$

$$\Rightarrow 1 + \frac{R}{100} = \frac{6}{5}$$

$$\Rightarrow R = 20\%$$

7. (B)  $\triangle BFE$  is isosceles

$$\Rightarrow \angle BFE = \angle BEF$$

$\triangle FDE$  is isosceles

$$\Rightarrow \angle DFE = 45^\circ$$

$$\Rightarrow \angle BFE = 180^\circ - (70^\circ + 45^\circ)$$

$$= 180^\circ - 115^\circ = 65^\circ$$

$$\therefore \angle FBE = 180^\circ - (2 \times 65^\circ)$$

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

8. (B)  **$M + 2\sqrt{M} + 1$**

e.g., Let us consider  $M = 4$ , a square number.

$$M + 2\sqrt{M} + 1 = 4 + 2\sqrt{4} + 1$$

$$= 4 + 2 \times 2 + 1 = 9 \text{ which is the next square number.}$$

9. (A) Expenditure on food (in percentage)

$$= 100\% - (15\% + 10\% + 5\% + 20\% + 15\% + 10\%)$$

$$= 100\% - 75\% = 25\%$$

$\therefore$  The expenditure on **food** is maximum.

10. (B) Perimeter of the given figure

$$= 5p + 2p + 7p + 3p + 2p = 19p \text{ cm.}$$

Given that the perimeter of the given figure is 57 cm

$$\Rightarrow 19p = 57$$

$$\Rightarrow p = 3$$

Perimeter of the triangular part in the figure

$$= 7p + 3p + 5p = 15p = 15 \times 3 \text{ cm}$$

$$= 45 \text{ cm}$$

11. (D) The reciprocal of a number less than 1 is greater than 1. So, (i) is true  $\Rightarrow \frac{1}{m} > m$ .

$$\frac{m+1}{m} = 1 + \frac{1}{m}, \text{ which is greater than 1. So,}$$

$$(ii) \text{ is true } \Rightarrow \frac{m+1}{m} > m.$$

When  $m = \frac{9}{11}$ ,  $m + 1$  is positive, whereas

$m - 1$  is negative. So,  $\frac{m+1}{m-1}$  is negative and hence less than 1. So, (iii) is false

$$\Rightarrow \frac{m+1}{m-1} \neq m.$$

12. (C) The solid in option (C) can be formed using the given net. Hence, only (i) and (ii) are true.

13. (B)  $864 \times (-2) = (-1728) = (-12)^3$  is a perfect cube. Hence, the smallest possible value of ' $n$ ' is  $-2$ .

14. (C) Let the angles be  $3x$ ,  $7x$ ,  $6x$  and  $4x$ .  
 $\therefore 3x + 7x + 6x + 4x = 360^\circ$  or  
 $20x = 360^\circ$  or  $x = 18^\circ$ . The angles are  $54^\circ$ ,  $126^\circ$ ,  $108^\circ$  and  $72^\circ$ . We see that adjacent angles are supplementary but opposite angles are not equal. Clearly, **it is a trapezium**.

15. (C) For the perimeters being equal with increase in number of sides, the length of side decreases and area increases.

16. (A) Total C.P. = ₹ 6000

Profit = 25%

$$\text{Overall S.P.} = ₹ 6000 \times \frac{100 + 25}{100}$$

$$= ₹ 7500$$

S.P. of half of the goods

$$= ₹ 3000 \times \frac{100 + 10}{100} = ₹ 3300$$

S.P. of remaining half goods

$$= ₹ (7500 - 3300) = ₹ 4200$$

Profit on remaining half of the goods costing ₹ 3000

$$= ₹ 4200 - ₹ 3000$$

$$= ₹ 1200$$

$$\text{Profit \%} = \frac{1200}{3000} \times 100 \% = \mathbf{40 \%}$$

17. (C) Speed of the man in still water

$$= 8 \text{ kmph}$$

Speed of the river = 2 kmph

Speed downstream

$$= 8 + 2 = 10 \text{ kmph}$$

Speed upstream =  $8 - 2 = 6 \text{ kmph}$

Let the distance between the two places be  $x \text{ km}$ . Then

$$\frac{x}{10} + \frac{x}{6} = \frac{48}{60} \text{ (From the problem.)}$$

$$\Rightarrow 8x = 24 \Rightarrow \mathbf{x = 3 \text{ km}}$$

18. (C) Since, the width of the compasses for step 1 and step 2 are the same,  $m\angle NKL = 60^\circ$  and hence,  $\angle KLM = 180^\circ - 60^\circ = 120^\circ$ .

19. (A) The given net when folded gives the solid in (iii), when the base is  $X$ .

20. (C) The descending order is  $\frac{4}{9}, \frac{2}{5}, \frac{-1}{6}, \frac{-3}{4}, \frac{-6}{7}$ .

$$\therefore \text{The middle number is } \frac{-1}{6}.$$

21. (C) From the given bar chart, the difference between the highest and the least bars is 5 squares.

Given that the difference is 15, each square represents  $\frac{15}{5} = 3$  units.

$\therefore$  The number of cell phones sold on Thursday represented by 6 squares =  $6 \times 3 = \mathbf{18}$ .

22. (A)  $x + y = 6$

$$3x - y = 4$$

$$\Rightarrow 4x = 10$$

$$\Rightarrow x = \frac{5}{2}, y = \frac{15}{2} - 4 = \frac{7}{2}$$

$$\therefore x - y = \frac{5}{2} - \frac{7}{2} = \mathbf{-1}$$

23. (B) Volume of the cuboid

$$= (24 \times 30 \times 36) \text{ cm}^3 = 25920 \text{ cm}^3$$

Volume of the remaining block

$$= 20088 \text{ cm}^3$$

$\Rightarrow$  Volume of the 8 cubes cut from all the corners of the cuboid

$$= 25920 - 20088 = 5832 \text{ cm}^3$$

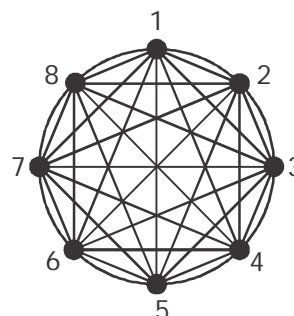
$$\Rightarrow \text{Volume of 1 cube} = \frac{5832}{8}$$

$$= 729 \text{ cm}^3$$

$$\therefore \text{Side of each cube} = \sqrt[3]{729} = \mathbf{9 \text{ cm}}$$

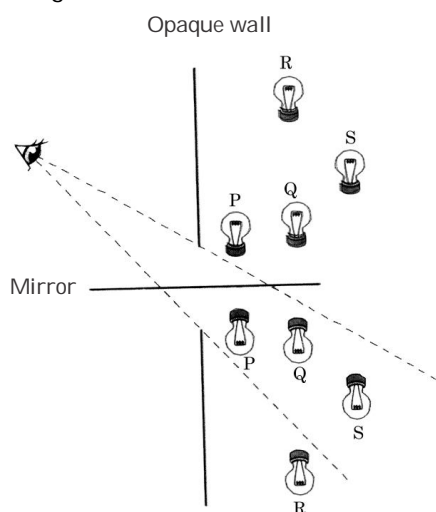
24. (Del)

25. (D) 28 chords as a chord is determined by 2 unique points. The no. of chords with 1, as one of the endpoints is 7 [(1, 2), (1, 3), (1, 4), (1, 5), (1, 6), (1, 7) and (1, 8)]. Similarly, counting the total no. of chords =  $7 + 6 + 5 + 4 + 3 + 2 + 1$  which is 28.



## Physics

26. (C) Light rays from objects P, Q, R and S are incident on the plane mirror which is placed perpendicular to the opaque wall. They get reflected and the observer on the other side of the opaque wall can see images of objects P, Q and S only as shown in the following figure.



By drawing two rays, the images that are within the rays would be the images that the observer can see. There are altogether three images within the range.

27. (C) Cement floor is smooth, even and offers the least friction. Hence, the football covers a longer distance.
28. (A) When camels with their flat-foot walk in sandy deserts, the pressure per unit area on the sand is decreased due to increase in the area of the surface in contact. Hence, they can walk easily in sandy deserts.
29. (B) The apparatus used for electrolysis of substances is a Voltmeter.
30. (C) Increase in the pitch to obtain a louder sound of second musical note on piano increases both the frequency and amplitude when compared with the first musical note. Hence, the frequency and amplitude become larger.
31. (B) Blood pressure is measured on the left arm above the elbow as the heart is at the same level. Measuring blood pressure at a level lower than that will give a pressure higher than the pressure at the heart.
32. (A) The image formed inside the plane mirror is of the same size as the size of the object in all positions.
33. (B) Ozone layer is formed when electric charge passes through oxygen in the air during lightning.
34. (B) A roller with paint is pushed up vertically to paint the upper surface of the wall. After painting the upper part of the wall, slowly it is pulled down vertically to paint the wall completely. Both push and pull are involved in the painting of a wall by a painter.

35. (B,D) Both infrasonic and ultrasonic waves are used to relieve pain in muscles and joints in a human body. By doing this at regular intervals of time, pain can be relieved.
36. (A) The strength of a force is usually expressed by its magnitude.
37. (D) When we see an object that is near or far, an image is formed on the retina of the eye. It plays an important role in sensing the images of various objects in the surroundings.
38. (C) An uncharged body can be charged by the following processes given in (i), (ii) and (iii):
- Conduction of charges (in close contact with a charged body).
  - Induction of charges (without any contact with charged body).
  - Friction of charge (by rubbing with a charged body).
39. (C) The use of wheels in vehicles and rollers in travelling luggage, smooth surfaces of objects, use of lubricants in machines and streamlining the shapes of objects reduce friction between two objects to a great extent.
40. (A) As X applied more force, the rope broke at a point nearer to X in the game of tug-of-war between the two teams X and Y.
41. (C) The decibel range of busy traffic is 70 dB or more. It is noisy, and not calm.
42. (D) The violet light has the shortest wavelength in a rainbow.
43. (A) Brass articles used in the kitchen are coated with tin. The article to be coated is heated first and a coating of molten tin is applied on it. As this process involves heating, it is called thermoplasting process.
44. (C) Electrolyte 'Z' is copper sulphate.
45. (B) Fluid is of the smallest friction in magnitude.
46. (B) Nitrogen and oxygen in the air combine to form two gases, nitric oxide and nitrogen dioxide respectively due to lightning. High discharge of electric charges through air during lightning helps in fixing atmospheric nitrogen.
47. (D) The S.I. unit of pressure is  $\text{N/m}^2$ .
48. (B) Human ear consists of three parts-outer, middle and inner ear. In the middle ear, there are three bones called the hammer, the anvil and the stirrup and it is the correct order. When sound vibrations fall on these bones, they vibrate and pass on the same to the inner ear.
49. (B) If two plane mirrors are placed at an angle between them, a number of images are formed. If the angle between the mirrors is  $\theta$ , then the number of images formed "n" is given by the formula,

$$n = \left[ \frac{360}{\theta} - 1 \right], \text{ if } \frac{360}{\theta} \text{ is even and } n = \frac{360}{\theta},$$

if it is odd.

The number of images formed by two mirrors inclined at  $72^\circ$  is given by the formula,

$$n = \frac{360^\circ}{\theta}.$$

Given  $\theta = 72^\circ$ ,

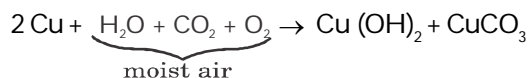
$$n = \frac{360^\circ}{72^\circ} = 5 \text{ images}$$

50. (B) Muscular force is applied on the hammer to fix a nail into the wall, for cutting vegetables and fruits and bullocks ploughing the field.

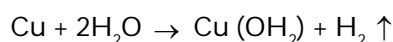
### Chemistry

51. (B) In anodising process, metals like copper and aluminium are electrically coated with their oxides to prevent corrosion.
52. (B) A gas stove on being lighted, burns with a blue flame. It shows that the burner is clean, sufficient oxygen is available to the fuel to produce fire and there is complete burning of the fuel.
53. (A) (i) Silk and wool are natural polymers. They are made up of amino - acids or proteins.  
(ii) Cotton is a polymer of glucose.
54. (D) Graphite is used as a moderator in nuclear reactors.
55. (A) Copper, gold, silver, platinum, tin and lead do not react with water.
56. (B) The burning of a wax candle is similar to breathing in human beings. Oxygen is needed for both. The end products obtained in both the processes are the same e.g.  $\text{CO}_2$ , water vapour and energy.
57. (C) Spandex, a type of fibre made up of polyurethane, is light in weight, elastic and soft with smooth finish. It fits closely, comfortably and gives an elegant look to the wearer.
58. (C) The constituents of LPG are propane ( $\text{C}_3\text{H}_8$ ) and butane ( $\text{C}_4\text{H}_{10}$ ) which are used domestically for cooking.
59. (C) The given characteristics belong to the non-luminous zone.
60. (A) Polyethylene tetraphthalate is used for making microwave ovenware.
61. (A,C) All petroleum products, ethane, propane, benzene, toluene, esters, fibre, styrene, etc. are the various raw materials used for making synthetic plastics.
62. (A) Gaseous hydrogen as a fuel forms an explosive mixture with air due to which it cannot be used as a fuel.

63. (A) The green coating is formed due to the chemical reaction between copper and atmospheric moist air as shown.



Copper reacts with moist air to form copper hydroxide with the release of hydrogen gas.



Copper is oxidised to carbonic acid formed in moist air to form copper carbonate.

64. (A) Petroleum has various components like petroleum gas, petrol, kerosene, diesel, fuel oil, lubricating oil, paraffin wax, asphalt, etc. which are separated by a process called fractional distillation which is carried out in the fractionating column/tower.
65. (C) Polyurethane is used for making bulletproof glass.  
It can bridge the gap between rubber and plastic and can stop the speeding bullet.
66. (B) Statements (A), (C) and (D) are false. Gaseous fuels have high calorific value, low ignition temperature and burn with moderate speed. They burn completely without leaving any residue and safe to handle.
67. (A) The given uses are those of chlorine.
68. (C) Cuprammonium or cupro rayon is a mixture of cellulose, copper sulphate, and excess of ammonia.
69. (B) Anthracite has 92 - 98 % of carbon and gives large amounts of heat compared to other kinds of coal during burning.
70. (A) Maintain a constant and moderate speed to save fuel while driving a motor bike on the road.

### Biology

71. (C) The part labelled as 'R' contains nucleus and protoplasm, which is essential for an organism to live and reproduce.
72. (A,B) Antibiotics like streptomycin and tetracycline are made from bacteria. These antibiotics kill or stop the growth of the disease - causing microorganisms.
73. (D) Cultivating earthworms to get organic manure is called vermiculture.
74. (C) Earthworms flourish well in moist soil rich in decaying organic matter. Worms eat into the soil to burrow themselves, leaving behind the casts and canals making the soil airy, soft and fertile.
75. (D) Joseph Lister an English surgeon found that pus formation in a wound is reduced or checked when it is immediately treated with carbolic acid. He named carbolic acid as antiseptic. Louis pasteur discovered pasteurisation.

76. (C) Fermentation of sugar by yeast produces alcohol and carbon dioxide gas.
77. (B) Kharif crops are sown in the months of June/ July (Rainy season).  
Rabi is sown in the months of Oct/Nov. (Winter season).  
Zayed are grown in March/April (Summer crops).
78. (B) Root nodules of leguminous plants houses a nitrogen fixing bacteria called rhizobium. Nitrogen fixed by the bacterium is supplied as additional nitrogenous nutrition to the leguminous plants. In turn, the host plant provides shelter and carbohydrate food to the bacteria.
79. (C) The life cycle of a butterfly has four stages - egg → larva → pupa → adult. Chicken resembles its parent. Frog's young one is called tadpole. It resembles to a fish.
80. (B) Cell membrane functions as a sieve. It controls the movement of substances in and out of the cell. Cytoplasm is a jelly like substance in the cells. Nucleus is the controlling centre of the cell. It functions like a brain. It controls all the activities of cell.
81. (D) Decomposers break down dead organisms into simpler substances and thereby replenish nutrients to the soil and help in the removal of dead organisms by decomposing it.
82. (C) Tiger is a carnivore and it has been the most endangered species, especially in India since forests are being cut and destroyed. Most of tigers are killed by hunters for their skin, bones, nails and teeth.
83. (B) Stem parts of some plants contain chloroplast. Stomata are absent in stem region. Leaves contain chloroplast and stomata. Chloroplasts and stomata are absent in root part of the plant.
84. (D) Crop transport management has no relation with the activities for improving crop yield. It is only related with the transport of crops from one place to another.
85. (C) The figure in option 'C' represent budding in Hydra.
86. (A) X is egg, Y is ovary and Z is the sperm.
87. (C) The various changes which occur in girls at puberty are; Hair grow under armpits and pubic region. Mammary glands develop and enlarge. The hips and pelvis broaden. Ovaries start to release eggs (ovulation). Menstruation starts.
88. (C) At the onset of puberty in boys testosterone controls development of secondary sexual characters and estrogen controls development of secondary sexual characters in females.
89. (B) A sickle is used for harvesting.
90. (D) Continuous cutting of trees has a disastrous effect on surroundings causing soil erosion, global warming and increase in the level of carbon dioxide in air.

