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NATIONAL LEVEL SCIENCE TALENT SEARCH EXAMINATION - 2015 (UPDATED)

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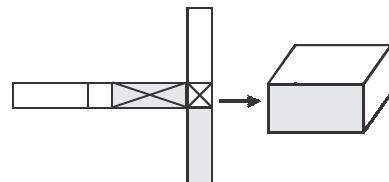
Solutions for Class : 8

Mathematics

- (B)** $(a + b)(a^2 + b^2)(a - b)(a^4 + b^4)$
 $= (a^2 + b^2)(a + b)(a - b)(a^4 + b^4)$
 $= (a^2 + b^2)(a^2 - b^2)(a^4 + b^4)$
 $= (a^4 - b^4)(a^4 + b^4)$
 $= a^8 - b^8$
- (D)** $(a - b) \div c = \frac{a}{c} + \frac{-b}{c}$
- (B)** We have, $M_1 = 10, D_1 = 2, W_1 = 15$
 $M_2 = 10 - 2 = 8, D_2 = 3, W_2 = ?$
 $\therefore M_1 D_1 W_2 = M_2 D_2 W_1$
 $10 \times 2 \times W_2 = 8 \times 3 \times 15$
 $\Rightarrow W_2 = 18$ trees
Hence, 18 trees will be cut in 3 hours.
- (B)** When $x = 0$, the given statement does not satisfy.
 \therefore For $x = 0$, the given statement is false.
- (A)** Let $\frac{x}{\sqrt{128}} = \frac{\sqrt{162}}{x}$
Then,
 $x^2 = \sqrt{128 \times 162}$
 $= \sqrt{64 \times 2 \times 18 \times 9}$
 $= \sqrt{8^2 \times 6^2 \times 3^2}$
 $= 8 \times 6 \times 3 = 144 \Rightarrow x = 12$
- (B)** $AB = BC = AC$
 $\therefore \angle CAB = \angle B = \angle BCA = 60^\circ \dots (i)$
Similarly, $\triangle ADC$ is equilateral
 $\therefore \angle DAC = \angle D = \angle DCA = 60^\circ \dots (ii)$
From (i) and (ii), we get

$\angle DAB = \angle DAC + \angle CAB = 60^\circ + 60^\circ = 120^\circ$

- (C)** $(x + y)^2 - (x - y)^2 = 100 - 16$
 $4xy = 84 \Rightarrow xy = 21$
- (A)** The median of seven numbers is 4th term.
In the given list 4th term is 7.
When 'n' is added before 7, the 4th term is 6.
When 'n' is added after '7', the 4th term is 7.
Hence, median can be either **6 or 7**.
- (C)** S.I. on ₹ 800 for 1 year = ₹ (840 - 800) = ₹ 40
 $\therefore \text{Rate} = \left(\frac{100 \times 40}{800 \times 1} \right) \% = 5\%$
- (B)** Total number of units $\rightarrow 2 + 3 + 1 + 4 = 10$
10 units $\rightarrow 28$
1 unit $\rightarrow 28 \div 10 = 2.8$
2 units $\rightarrow 2 \times 2.8 = 5.6$
3 units $\rightarrow 3 \times 2.8 = 8.4$
4 units $\rightarrow 4 \times 2.8 = 11.2$
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



11. **(D)**

12. (A) $\frac{7}{9} = 0.777$

$\frac{9}{11} = 0.818$

$\frac{11}{13} = 0.846$

$\therefore 0.777 < 0.818 < 0.846$

$\therefore \frac{7}{9} < \frac{9}{11} < \frac{11}{13}$

13. (B) Clearly, **9261** is a perfect cube satisfying the given property.

14. (D) In parallelogram ABCD,

$\angle A + \angle D = 180^\circ$

Let $\angle D = x^\circ$, $\angle A = 2x - 30^\circ$

$\therefore (2x - 30^\circ) + x^\circ = 180^\circ$

$\Rightarrow 3x^\circ = 210^\circ$ or $x = \frac{210^\circ}{3}$

$\therefore x^\circ = 70^\circ$

$\therefore \angle D = 70^\circ = \angle B$

and $\angle A = 2x - 30^\circ = 110^\circ = \angle C$

15. (C) $90 : 1080 = 120 : x$

$\frac{90}{1080} = \frac{120}{x}$

$\therefore x = \frac{120 \times 1080}{90} = 1440$

16. (B) $54^4 = (27 \times 2)^4 = (3^3 \times 2)^4$
 $= 3^{12} \times 2^4$

$21^{12} = (3 \times 7)^{12} = 3^{12} \times 7^{12}$

$18^6 = (9 \times 2)^6$

$= (3^2 \times 2)^6$

$= 3^{12} \times 2^6$

$45^6 = (9 \times 5)^6$

$= (3^2 \times 5)^6 = 3^{12} \times 5^6$

$\therefore 21^{12}$ is the greatest.

17. (A) $\angle D = \angle BCD = \angle ABC = 5x$

From the given options,
only for $x = 30^\circ$, $\angle ABC$ satisfies.

18. (D) Volume of tank P = $15 \times 10 \times 12$
 $= 1800 \text{ cm}^3$

Since, tank P is half-filled, amount of water

$= \frac{1800}{2} = 900 \text{ cm}^3$

\therefore Water in tank Q = 900 cm^3

$\Rightarrow 10 \times 9 \times h = 900$

$h = 10 \text{ cm}$

Hence, height of water in tank Q is **10 cm**.

19. (B) Time taken to hear the sound

$= \frac{3 \text{ km}}{1200 \text{ km/hr}} = \frac{1}{400} \text{ hr}$

$= \frac{1}{400} \times 60 \times 60 \text{ seconds}$

= 9 seconds

20. (C) Since, equation in **option (C)** has a degree of '2'. Hence, it is not a linear equation.

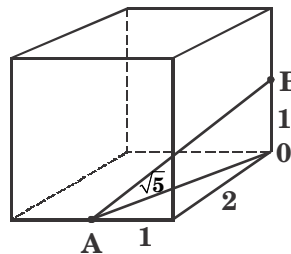
21. (D) $2x + 3x + 4x = 180^\circ$

$9x = 180^\circ$

$x = 20^\circ$

$\therefore 4x - 2x = 2x = 2 \times 20^\circ = 40^\circ$

22. (D)



Length of AO = $\sqrt{1+4} = \sqrt{5}$

Length of AB = $\sqrt{5+1} = \sqrt{6}$

23. (C) Given $a^2bc^3 = 5^3$, $ab^2 = 5^6$

$\therefore (a^2bc^3)(ab^2) = (5^3)(5^6)$

$\Rightarrow a^3b^3c^3 = 5^9$

$\Rightarrow abc = 5^3$

24. (A) Discount % = $\left(\frac{800-700}{800}\right) \times 100 = 12.5\%$

25. (B) $4(a-b)^2 - 9(b-c)^2$

$= 2^2(a-b)^2 - 3^2(b-c)^2$

$= \{2(a-b)\}^2 - \{3(b-c)\}^2$

$= (2a-2b)^2 - (3b-3c)^2$

$= (2a-2b+3b-3c)(2a-2b-3b+3c)$

$= (2a+b-3c)(2a-5b+3c)$

Physics

26. (B) Sounds higher than 20 kHz are called ultrasounds. Ultrasounds have high pitch (frequency) than the human audible frequency. So, ultrasounds cannot be heard by the human ear because the pitch (frequency) of the sound is too high.
27. (A) Streamline or torpedo shape will give the least resistance when moving through water.
28. (C) A series of fast moving still pictures can create an illusion of movement in our eyes. The impression of an image does not disappear immediately from the retina of the eye. It persists on the retina for about 1/16th of a second. So, if still pictures (images) of a moving object are flashed on the eye at a rate faster than 16 per second, then the eye perceives this object as moving. When the second image is flashed on the retina within a time less than 1/16th of a second, the brain cannot distinguish them as two images and takes them as continuity. So, the eye can separate two images only when the interval of separation between them is 1/16th of a second. This happens due to a phenomenon called persistence of vision.
29. (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.
30. (C) According to the given graph, spring S is the strongest as it could stretch or extend upto 5 cm only when a load of 400 g was added to the pan attached to the spring.

	Type of spring	Weight	Stretching of spring in cm
(A)	P	170 g	10 cm
(B)	Q	240 g	8.5 cm
(C)	R	320 g	6.5 cm
(D)	S	400 g	5.0 cm

31. (C) The point nearest to the eye at which an object is distinctly visible is called the near point of the eye. The distance of the near point of the eye is called the least distance of distinct vision. It varies with age. For an infant, it is 5 to 8 cm, for an adult, it is 20 to 25 cm.
32. (B) The ball travels a longer distance on the mirror as it is smooth and offers least friction.
33. (D) The given figure shows the process of electroplating. When electric current is

passed through copper sulphate solution, copper sulphate dissociates into copper (cations) (+ ions) and sulphate (anions) (- ions). The free copper ions are deposited on the carbon rod (cathode) which is connected to the negative terminal of the battery.

Copper ions lost from the copper sulphate solution are replaced with the copper atoms from the anode (the copper plate). Net result is that the concentration of the electrolyte (copper sulphate salt in solution) remains the same. In the process, it is the anode which loses the metal atoms to the electrolyte which in turn gets deposited on anode. The metal plate gradually gets degenerated.



Copper sulphate (salt) Copper Sulphate (Cations) (anions)

Copper cations get deposited on cathode. Sulphate ions react with copper on copper plate to form copper sulphate.

Due to the above reason, the mass of electrode (copper plate) decreases.

34. (B) X is liquid mercury which is filled in the syringe. When the plunger is pushed inwards, there is no change in volume of mercury. A liquid cannot be compressed much due to its high density and also its particles are still quite close together by slightly, weak, interparticle force of attraction. Helium, Nitrogen and Carbon dioxide are gases at room temperature and they can be compressed easily.
35. (C) Some times at night, we observe small glowing objects rapidly falling down from the sky. They are masses of rocks and minerals falling from the outer space and are called meteors. Meteors enter into the earth's atmosphere with high speed. Due to friction of air, they get heated up. They burn leaving behind a streak of light which appears like a shooting star. The remains of some of the meteors reach the earth as meteorites.
36. (B) We know that for a reflected ray, the angle that the incident ray makes with the line perpendicular to the surface is equal to the angle made by the reflected ray with this perpendicular line. N is the correct reflected ray of X.
37. (B) Protons are positively charged and electrons are negatively charged.
38. (B) Stars in the sky differ in size, colour, temperature and brightness. The colour of a star depends upon its surface

- temperature. Blue stars are the hottest with a surface temperature between 28000 – 30000 °C.
39. (C) In solid state, potassium iodide does not conduct electricity because the potassium (K^+) ions and iodide (I^-) ions are held together by strong electrostatic forces of attraction. In molten state, the respective ions are set free. During electrolysis the K^+ ions move towards the cathode and I^- ions move towards the anode. This property of ions K^+ I^- and starch solution is used in an electric pen for writing on the surface with special compounds and material.
 $KI \rightarrow K^+ + I^-$
40. (A) Two columns, air column and water column respectively are formed in four bottles P, Q, R and S, which are filled with different volumes of water. When air is blown into the four bottles separately, sounds of varying loudness are produced.
- The bottle with least level of water has longest air column above water and has low frequency and low pitch. So, feeble sound is produced.
 - The bottle with highest level of water has least air column above water and has high frequency and high pitch. So, loud sound is produced.
 - In jaltarang musical instrument, the cup containing minimum water produces the sound of lowest frequency. As the amount of water in the cup goes on increasing, the frequency of the sound produced also goes on increasing.
 The correct sequence of increasing loudness of sound in bottles P, Q, R and S is $R \rightarrow P \rightarrow Q \rightarrow S$.
41. (A) In voltaic cell, copper plate acts as anode (+) and zinc plate acts as cathode (-). Electric current is produced inside the cell through the electrolyte, dilute H_2SO_4 which passes through electric wires from anode to cathode outside the cell. So, when two copper plates are used as electrodes in the voltaic cell, electric current is not produced.
42. (C) There are several effects of forces :
- Change the speed of an object (option A)
 - Change the direction of motion of an object
 - Change the energy of the system (option B)
 - Change the shape of an object (option D)
43. (A) Pitch is measured in hertz.
44. (D) Object distance after shifting the object = 4 m + 0.5 m = 4.5 m
 For a plane mirror;
 Object distance = Image distance = 4.5 m
 Distance between the object and its image = 4.5 + 4.5 = 9 m
45. (D) The free electrons in the conducting sphere are being repelled to the right by the negatively charged rod. The protons are fixed in the nucleus and the nucleus is not free to move from its fixed position in the conducting sphere. So, the protons in the conducting sphere do not move.
46. (B) Among the given solutions, sodium chloride is a strong electrolyte because it ionizes completely. NaCl (Sodium chloride) solution allows current to pass through it as it contains positively charged sodium (Na^+) and negatively charged chloride (Cl^-) ions. When current is passed through strong electrolyte like sodium chloride, the bulb will glow the brightest. Ammonium hydroxide and ethanoic acid are weak electrolytes because they do not ionize completely. So, the bulb does not glow brightly when weak electrolytes are used Alcohol is a non-electrolyte as it has no ions to conduct electricity.
47. (C) Since, surface 3 needed the greatest force to move the object, this surface is the roughest.
48. (B) The loudness of a note on the guitar can be increased by increasing the amplitude of the vibration of the guitar spring.
 Options (A) (C) and (D): Changes in tension, thickness and length of the guitar string affect the pitch or frequency of the sound, not its loudness.
49. (D) When a force acts on small contact area, the pressure is high. Sharp things are able to penetrate because of the small contact area. Knife, scissor, hole punch, thumb tack, saw and many other tools make use of the small contact area to penetrate due to high pressure. Hammer transmits force and energy but it is not normally used to create high pressure to penetrate through things.
50. (B) The electrons on the underside of the lightning cloud induce a positive charge on the earth's surface. When the electric field is strong, the electrons are being attracted to the earth. Lightning is caused by large amount of fast moving electrons moving at high speed through the air from the cloud to the ground.

Chemistry

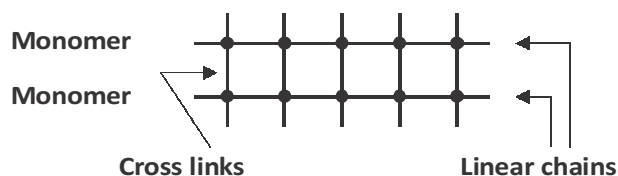
51. (B) According to the bar chart, people of cities I and IV should wear masks when they go outside as the amount of pollutants in particle and gaseous form is very high. Inhaling polluted air by human beings and animals leads to many respiratory problems.
52. (A) The given figure shows the deposits of petroleum and natural gas. These deposits are present in the impervious rock situated deep in the earth. They are formed based on their densities. Natural gas being lighter occupies the top most layer followed by petroleum (crude oil). Water being denser than gas and oil occupies the bottom of the fossil fuel deposits. 'P' is petroleum below the natural gas 'Q'.
53. (D) Potassium and sodium are very reactive metals. Zinc and iron are less reactive than potassium and sodium. Lead is less reactive than zinc, iron and tin. As we come down in the series, the chemical reactivity of metals decreases. So, the descending order of reactivity of metals is sodium, zinc and lead.
54. (B) Since, the mass of material Q does not change much when it is soaked in water, it is the least absorbent. A swim suit should be made of the least absorbent material so that water does not add much to the mass of the swim suit.
55. (A) Sulphur is an impurity in coal. When coal is burnt in power plants, sulphur dioxide gas is released along with other gases. Sulphur dioxide gas reacts with the water vapour in the atmosphere to form sulphuric acid. This acid falls down along with rain and makes it acidic as given below.
Sulphur dioxide + water → sulphurous acid
Sulphur trioxide + water → sulphuric acid
Burning of paper releases carbon dioxide. Use of CFC products damages the ozone layer of the atmosphere but it is not the cause are source of acid rain.
56. (B) Rust or iron(III) oxide can be removed by reaction with acids. Concentrated sulphuric acid does not have strong acidic properties, unlike lemon juice (contains citric acid), as there is incomplete dissociation of the acid due to lack of water. Dilute sulphuric acid not concentrated is more effective to remove the rust on the steel object before painting. Use of water and aqueous sodium hydroxide (a base) cannot clean a rusty steel object thoroughly.
57. (A) When organic wastes are decomposed in the absence of oxygen, biogas is released. Biogas consists mainly 65% of methane and 35% of other gases like carbon dioxide,

hydrogen and hydrogen sulphide. When methane gas is released into the atmosphere, it causes air pollution.

58. (D) Carbon monoxide which binds to the haemoglobin prevents oxygen from binding. This causes reduction in the amount of oxygen circulated in the blood which in turn causes inadequate amount of oxygen distributed to the body. Carbon monoxide is poisonous. However it is difficult for us to detect due to its colourless, odourless and tasteless property.
59. (A) As per the given figures and statements, only statement (A) is true. City 'R' recycles 85% of its plastic wastes.
60. (B) Polypropene is used for making transparent containers, water pipes, pipe fittings, bodies of automobile batteries and toys. Polyethylene terephthalate (PET) is used for making microwave ovenware.
61. (A) Non-luminous flame has more heat than light because the fuel is completely burnt. It is not safe to leave a non-luminous flame burning because it is not visible. Lack of visibility may cause burns accidentally.
62. (C) Fuels burn in the presence of oxygen to form carbon dioxide and water vapour.
(i) Magnesium burns in the presence of oxygen to form magnesium oxide.
$$2\text{Mg} + \text{O}_2 \rightarrow 2\text{MgO}$$

(ii) Water combines with oxygen to form hydrogen peroxide.
$$2\text{H}_2\text{O} + \text{O}_2 \rightarrow 2\text{H}_2\text{O}_2$$

(iii) Camphor when burnt undergoes sublimation and changes directly from solid to gas.
63. (B) Melamine is a type of thermoset plastic. It cannot be remoulded because it has cross links between the monomers as shown below.



64. (C) Copper and silver, both being lower down than hydrogen in the reactivity series are easily displaced out of a solution of their ions by reactive metals higher up in the reactivity series. Iron, however, cannot displace Mg^{2+} and Ca^{2+} as it is below Mg and Ca in the reactivity series.
$$\text{Fe} + \text{Cu}^{2+} \rightarrow \text{Fe}^{2+} + \text{Cu}$$

$$\text{Fe} + 2\text{Ag}^+ \rightarrow \text{Fe}^{2+} + 2\text{Ag}$$

65. (D) Biodegradable rubbish buried in the ground decomposes to become nutrients that do not pollute the environment. Burning of trees in the forests produces carbon dioxide, ash and smoke that pollute the environment. Using treated waste from sewage plants to fertilise roadside trees is not a form of pollution, as harmful substances have been removed from the waste. Turning waste water into drinkable water is not a form of pollution.
66. (B) Statements (A), (C) and (D) are true of sodium. Sodium reacts vigorously with water at room temperature to form sodium hydroxide and hydrogen gas is released.

$$2\text{Na} + 2\text{H}_2\text{O} \rightarrow 2\text{NaOH} + \text{H}_2$$
Sodium hydroxide is a base. Bases change the colour of red litmus paper to blue.
67. (D) Carbon dioxide is the fourth most abundant gas found in air. It can react with water to form a weak acid, carbonic acid. This in turn causes the slight acidic property of rain water. Carbon dioxide is a non-pollutant gas that helps plants to carry out photosynthesis. During lightning, the free nitrogen reacts with oxygen in the atmosphere to form NO_2 (nitrite) and NO_3 (nitrate) respectively. These salts ultimately reach the earth/soil which helps in the growth of plants. Excess of nitrate in the soil mixes with ground water and causes water pollution.
68. (A) Nylon is used for making a wide range of products like fine sarees, thread, ropes, fishing nets, carpets, seat belts, umbrella covers, parachutes etc.
Polyethene is used for wrapping films.
Polystyrene is used to make disposable foam cups.
PVC is used for making floor tiles.
69. (D) Fire extinguishers are filled with liquid carbon dioxide under high pressure. It does not support burning. This gas must be sprayed on the top of the fire to put out the fire gradually. Spraying the CO_2 gas at the bottom of the fire does not extinguish it but supports burning as it has more oxygen than carbon.
70. (B) Statements (A), (C) and (D) are true of diamond. Diamond is a bad conductor of heat and electricity.
- Biology**
71. (B) Harmful bacteria called mycobacterium tuberculosis causes tuberculosis.
72. (B) Figures labelled (i) and (iv) are plant cells. They have a rigid cell wall.
73. (C) Exchange of gases and transpiration of water vapour takes place through stomata.
74. (C) To conserve natural resources anyone who chops down a tree to replant a new tree within the same.
75. (A) Farmer mixes fertiliser with water to enable the roots to easily absorb it.
76. (C) The quantity and quality of food production can be increased by using modern technology and carrying out research and development.
77. (D) All microorganisms are the organisms that cannot be seen with the naked eye.
78. (D) Menstruation does not take place during pregnancy.
79. (A) In the given figure the part labelled N is nucleus. Nucleus controls activities in cell.
80. (B) Butterfly undergoes 4 stage life cycle and a bird undergoes 3 stage life cycle and the mother provides food for the young.
81. (A) The sex chromosomes of parents X and X fertilise to form a girl child.
82. (A) Yeast releases carbon dioxide gas and makes bread dough rise.
83. (A) The picture shown is a Euglena. It is a fresh water free living unicellular organism. The long whiplike flagellum is used for swimming and it reproduces by splitting. It is bright green in colour as it contains chloroplast which allows Euglena to conduct photosynthesis.
84. (A) A virus is a microscopic organism. It causes diseases in plant cells and animal cells. It can reproduce only inside a living cell.
85. (C) Cells in reproductive organs undergo meiotic division to produce haploid cells or gametes.
86. (D) Sex of a child is determined by father, as the gametes have either X or Y chromosomes. X chromosome of father determines as a girl child & Y as a boy child.
87. (C) As the woman attains menopause stage, the ovaries cannot produce any more eggs hence, she cannot become pregnant.
88. (A) Paramecium is a protozoan. It is a microorganism.
89. (D) Presence of cell wall indicates that it is a plant cell.
90. (A) Ecologically fungi are important because they act as decomposers and aid in nutrient cycling.

