



UNIFIED COUNCIL

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NATIONAL LEVEL SCIENCE TALENT SEARCH EXAMINATION - 2011

SOLUTIONS FOR CLASS : 9

Mathematics

1. (A) $\angle AME = 80^\circ = \angle BMN$

$$\angle MND = 180^\circ - 80^\circ = 100^\circ$$

$$\text{In } \triangle MNQ, \angle MNQ + \angle NMP + \angle MQN = 180^\circ$$

$$(\text{or}) \frac{1}{2} \times 100^\circ + \frac{1}{2} \times 80^\circ + \angle MQN = 180$$

$$\Rightarrow \angle MQN = 180^\circ - 90^\circ = 90^\circ$$

2. (D) $y = a + \frac{b}{x}$

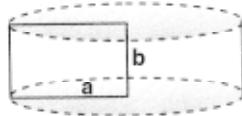
$$1 = a - b \text{ and } 5 = a - \frac{1}{5}b$$

$$\Rightarrow a = 6 \text{ and } b = 5$$

$$\therefore a + b = 6 + 5 = 11$$

3. (B) $V = \pi r^2 h$

$$= \pi a^2 b$$



4. (D) Sum of 'n' of observations = mn

of O & m are added the

$$\text{sum} = mn + 0 + m$$

$$= m(n+1)$$

$$\text{No. of observations} = n+2$$

$$\therefore \text{New mean} = \frac{m(n+1)}{n+2}$$

5. (B) In a leap year, there are 366 days, i.e., 52 weeks and 2 days.

To have 53 sundays in the year, the extra day must be saturday, sunday or sunday, monday.

$$\text{so, required probability} = \frac{2}{7}$$

6. (D) $\frac{x(x^3 - 3x^2 + 2x)}{x}$

$$\therefore \text{remainder} = 0$$

$$\text{Quotient : } x^3 - 3x^2 + 2x$$

7. (D) $\frac{xy}{x+y} = a \Rightarrow \frac{1}{a} = \frac{1}{x} + \frac{1}{y}$

$$\frac{1}{b} = \frac{1}{x} + \frac{1}{z}, \quad \frac{1}{c} = \frac{1}{y} + \frac{1}{z}$$

$$\text{adding } \frac{1}{a} + \frac{1}{b} = \frac{2}{x} + \left(\frac{1}{y} + \frac{1}{z} \right) = \frac{2}{x} + \frac{1}{c}$$

$$\Rightarrow \frac{2}{x} = \frac{1}{a} + \frac{1}{b} - \frac{1}{c} = \frac{bc + ac - ab}{abc}$$

$$\Rightarrow x = \frac{2abc}{bc + ac - ab}$$

8. (C) $\begin{array}{|c|c|c|c|} \hline X & 2 & U & 8 & Z & 5 & Y \\ \hline \end{array}$

$$x \cdot y = 2 + 8 + 5 = 15$$

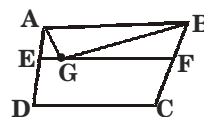
$$\therefore X - U - Z - Y$$

9. (C) $\triangle ABC \approx \triangle DBE, \triangle DEF, \triangle ADF, \triangle ECF$

10. (C) $AB \parallel CD \parallel EF$

$$\Rightarrow \text{ar} \triangle AGB = \frac{1}{2} \parallel \text{gm AEFB}$$

$$[\because \triangle AGB \text{ and } \parallel \text{gm AEFB}]$$



are on the same base and between same parallel lines AB and EF]

$$\therefore \text{ar} \triangle AGB = \frac{1}{4} \parallel \text{gm ABCD} = \frac{S}{4}$$

11. (B) $\angle AQP = \frac{1}{2} \angle AOP$

$$= \frac{1}{2} \times 75^\circ = 37.5^\circ$$

$$12. (A) \frac{a^3}{a_1^3} = \frac{27}{1}$$

$$\frac{a}{a_1} = \sqrt[3]{\frac{27}{1}} = \frac{3}{1}$$

$$13. (C) \text{ Chicken} = x$$

$$\text{goat} = y$$

$$x + y = 30 \quad (1)$$

$$2x + 4y = 84 \quad (2)$$

Sol. (1) & (2) we get

$$\text{chicken} = 18, \text{ goat} = 12$$

$$\text{Ratio} = 18 : 12 = 3 : 2$$

$$14. (C) 2^3 - 4 \cdot 2^2 + 2a + b = 2^3 - a \cdot 2^2 + 2b + 8 = 0$$

$$2a + b = 8 \quad (1) \quad 8 - 4a + 2b + 8 = 0$$

$$4a - 2b = 16 \quad (2)$$

$$\text{or } 2a - b = 8 \quad (3)$$

Sol. (1) & (2),

$$a = 4, b = 0$$

$$15. (A) a^b = 5^3$$

$$(a-b)^{a+b-4} \Rightarrow (5-3)^{5+3-4} = (2)^4 = 16$$

$$16. (C) S = \frac{13+12+5}{2} = 15 \text{ cm}$$

$$\text{Area} = \sqrt{15 \times 2 \times 3 \times 10}$$

$$= \sqrt{5^2 \times 2^2 \times 3^2}$$

$$= 5 \times 2 \times 3$$

$$= 30 \text{ cm}^2 = 0.003 \text{ m}^2$$

$$17. (B) \angle ABC = \frac{180 - 68}{2} = \frac{112}{2} = 56^\circ$$

$$18. (A) \begin{array}{|c|} \hline 2 \\ \hline \end{array}$$

$$\begin{array}{|c|} \hline 3 \\ \hline \end{array}$$

$$\text{Area} = \frac{1}{2} \times 3 \times 2 = 3 \text{ sq. units}$$

$$19. (D) 37a = 37b = 5661$$

$$a = b = 153$$

$$\text{Average of } a \text{ and } b = 153$$

$$20. (B) r^3 - \frac{2}{3}r^3 = \frac{2}{3}R^3$$

$$\frac{1}{3}r^3 = \frac{2}{3}R^3$$

$$\frac{r}{R} = \frac{2^{1/3}}{1}$$

$$21. (B) 4x \times 3x = 120$$

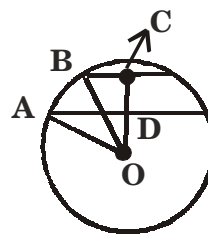
$$12x^2 = 120$$

$$x^2 = 10$$

4 : 3 is not the ratio of dimensions of the rectangle.

$$22. (C) OA = OB = \frac{13}{2} = 6.5 \text{ cm}$$

$$AD = \frac{12}{2} = 6 \text{ cm}, BC = \frac{5}{2} = 2.5 \text{ cm}$$



$$\text{In } \triangle ADO, DO = 2.5 \text{ cm}$$

$$\text{In } \triangle BCO, CO = 6 \text{ cm}$$

Distance between the two chords

$$CD = CO - OD = 6 - 2.5 = 3.5 \text{ cm.}$$

$$23. (B) Q = 5 - 2\sqrt{6}$$

$$(5 + 2\sqrt{6})^2 + (5 - 2\sqrt{6})^2$$

$$2[25 + 24]$$

$$2[49] = 98$$

$$24. (B) \text{ All the three points satisfy the eq. } x + y = 0.$$

$$25. (C)$$

Physics

$$26. (A) \text{ The dishes are at rest, while table cloth is under motion. Hence, inertia of rest of dishes due to the table cloth can be pulled from a table without dislodging the dishes.}$$

$$27. (C) \text{ The fuel consumed by a crane is equal to the power of the crane.}$$

$$\frac{\text{Power}_P}{\text{Power}_Q} = \frac{\frac{m \times g \times h}{t_1}}{\frac{mgh}{t_2}} = \frac{t_2}{t_1} = \frac{2}{1}$$

$$\therefore \text{Power } P = 2 \text{ Power } Q$$

So, crane P consumes more fuel than crane Q.

$$28. (D) \text{ The speed of the car is the slope of the distance-time graph.}$$

In the given graph, car 4 has the least value of slope. Hence, car 4 travels the slowest.

$$29. (C) \text{ The graph in option (C) has the highest pitch because it has highest frequency i.e. more number of waves are covered in a given time.}$$

$$30. (B) \text{ A cork floating on the surface of water has net force zero as the upthrust acting is equal to buoyant force. Similarly, the case of an object floating in air.}$$

31. (C)

Given: $m_1 = 2 \text{ kg}$
 $m_2 = 4 \text{ kg}$; $h_1 = 60 \text{ ft}$; $h_2 = 30 \text{ ft}$
 According to law of conservation of energy,
 $\Delta KE = \Delta PE$

$$\therefore \frac{KE_1}{KE_2} = \frac{m_1 g (h_1 - h_2)}{m_2 g (h_1 - h_2)}$$

$$\frac{KE_1}{KE_2} = \frac{2}{4} = 1:2$$

32. (A) In case of a rubber ball the change in momentum is 2 mV. In the case of metal ball the change of momentum in mV.

33. (D) Let mass and radius of heavenly body be M_h and R_h respectively.

Given,

$$M_h = 2 M_e$$

$$R_h = 3 R_e$$

$$\therefore W_h = mg_h = m \frac{GM_h}{R_h^2} = \frac{mG(2M_e)}{3R_e^2}$$

$$= (m) \left(\frac{2 GM_e}{9 R_e^2} \right)$$

$$= \frac{2}{9} mg_e = \frac{2}{9} \times 900$$

$$\text{Since, } mg_e = 900 \text{ N (given)}$$

$$= 200 \text{ N}$$

34. (C) A vibrating particle creates a disturbance in a medium, resulting in waves. The kinds of wave motion depends on the direction of wave motion w.r.t. to the direction of a vibrating particle i.e. either longitudinal (parallel) or transverse (perpendicular).

35. (B) A spring balance is graduated on sea level. If a body is weighed at consecutively increasing heights from the earth's surface, the weight indicated by the balance will go on decreasing continuously. This is because value of g decreases with height.

36. (A) Initial velocity of the car = 40 m s^{-1}

final velocity of the car = 0

Time ' t ' = 0.2 s

$$\text{Acceleration} = \frac{v - u}{t} = \frac{0 - 40}{0.2} = -200 \text{ m s}^{-2}$$

$$\therefore \text{Deceleration} = 200 \text{ m s}^{-2}$$

37. (C) The graph of distance versus time indicates a parabola, hence the particle have uniform accelerated motion.

38. (A) KE with any reference must be positive as in its expression velocity appears as a square i.e., with power 2 and mass is never

negative.

39. (D) The bag with wide strap enables the total weight of the bag to spread over a greater area, thus reducing the pressure on the shoulder. Hence, this bag is more comfortable.

40. (B) When the force retards the motion of a body, the work done is negative.

41. (B) According to the given situation,

$$S = \frac{1}{2} at^2$$

$$a \propto \frac{1}{t^2} \text{ (as } S = 100 \text{ m)}$$

since Ramesh wins the race he takes less time so his acceleration is more than Suresh.

42. (B) When the magnitude remains constant in magnitude but not in direction, the particle moves in a circular path. So 'X' executes a circular path.

43. (B) Quality of sound is that characteristic which enables us to distinguish one sound from another having the same pitch (same frequency) and loudness (amplitude). Hence, the trace given in option (B) has same pitch and loudness but differs in quality.

44. (B) Energy required = mgh . In both cases, h and m is the same. Hence, energy spent by both is same.

Note: The powers of Rahul and Rohan is different as same energy is used in different times.

45. (C) Let the velocities of the two ends of the train be u and v and the velocity of the middle point be v_1 .

\therefore Acceleration of mid-point of the train

$$= a = \frac{v_1^2 - u^2}{2s} = \frac{v^2 - v_1^2}{2s}$$

$$v_1^2 - u^2 = v^2 - v_1^2;$$

$$2v_1^2 = v^2 + u^2$$

$$v_1 = \sqrt{\frac{v^2 + u^2}{2}}$$

$$= \sqrt{\frac{6^2 + 8^2}{2}}$$

$$= \sqrt{\frac{100}{2}}$$

$$= 5\sqrt{2} \text{ kmph}$$

46. (D) $R^1 = \frac{R}{2}$
 $M = \text{constant}$ $W^1 \propto g^1$
 $g^1 = g \left(\frac{R}{R^1} \right)^2$
 $g^1 = g(4)$
 $\frac{g^1 - g}{g} \times 100 = \frac{4g - g}{g} \times 100 = 300 \%$

47. (D) Time taken for first echo (t_1) = $\frac{2x}{V} = \frac{2x}{344}$
Time taken for second echo (t_2)
 $= \frac{(2 \times 60)}{V} = \frac{120}{344}$
 $t_2 - t_1 = 0.25$
 $\frac{120}{344} - \frac{2x}{344} = 0.25$
 $120 - 2x = 0.25 \times 344$
 $2x = 120 - 86$
 $x = \frac{34}{2} = 17 \text{ m}$

48. (B) $F = 70 \text{ N} = \frac{Gm_1m_2}{d^2}$
 $d^1 = 2d$
 $\therefore F^1 = \frac{Gm_1m_2}{(d^1)^2} = \frac{Gm_1m_2}{4d^2} = \frac{1}{4} F$
Percentage change in force
 $= \frac{F^1 - F}{F} \times 100 = \frac{\frac{1}{4}F - F}{F} \times 100$
 $= \frac{-3}{4} \times 100 = -75\%$

49. (D) When both the trolleys collide with each other, they undergo inelastic collision due to this, both the trolleys experience a change in momentum as well as velocity.

50. (B) $u = 0$; $v = 2 \text{ m s}^{-1}$; $t = 10 \text{ s}$
 $a = \frac{v - u}{t} = \frac{2 - 0}{10} = 0.2 \text{ m s}^{-2}$

Chemistry

51. (B) A temperatures greater than -2°C but less than 59°C bromine is a liquid. A liquid has a definite volume but no definite shape, it only takes the shape of the container. Hence, temperature is 36°C (in this case)

52. (D) 1 g of O atoms = $\frac{1}{16} \times 6.022 \times 10^{23}$ atoms
1 g of O_2 molecule has
 $= \frac{1}{32} \times 2 \times 6.022 \times 10^{23}$ atoms
1 g of ozone has
 $= \frac{1}{48} \times 3 \times 6.022 \times 10^{23}$ atoms

\therefore All have the same number of atoms.

53. (C) Given, $Z = 2$; $A = 3$
 $Z = \text{number of protons}$
 $= \text{number of electrons} = 2$

Number of neutrons = $A - Z = 3 - 2 = 1$

54. (B) A colloidal solution can scatter a beam of light when passed through that solution. This solution also do not leave any residue when passed through the filter paper.

55. (C) Salt of binary acid is M_2S_3 . This implies valency of M is 3.

56. (A) When a solid melts, the heat supplied is used up in changing the state. During the change of state, the molecules move farther apart by overcoming the forces of attraction among them.

57. (B) A compound is formed by the combination of different elements in constant proportions by weight.

58. (A) After the gold foil, most of the alpha-particle travel in straight lines because most of the atom is hollow and empty in space.

59. (A) Water can evaporate at any temperature between its M.P. (0°C) and its B.P. (100°C) as it remains in liquid within this range of temperature. Water on evaporation rises to the sky and condenses to form clouds. Evaporation leads to cooling.

60. (D) Gunpowder is a heterogeneous mixture of nitre, charcoal and sulphur.

61. (A) According to J.J. Thomson's atomic model, the negative charges of an atom are distributed uniformly in a lump of positive charge.

62. (D) Mole wt of:
 $\text{H}_2\text{O} = 2 + 16 = 18$
 $\text{NO} = 14 + 16 = 30$
 $\text{CO}_2 = 12 + 32 = 44$
 $\text{SO}_2 = 32 + 32 = 64$
 $\text{H}_2\text{O} < \text{NO} < \text{CO}_2 < \text{SO}_2$

63. (C) Isotopes have same atomic number i.e. number of protons or electrons is same. Hence, same chemical properties. But,

- mass number of isotopes is different and have different number of nucleons or neutrons.
64. (C) The equation in option (C) is balanced
65. (D) Four coloured dyes were used to colour the four sweets.
66. (C) Reddish brown precipitate of ferric hydroxide formed can be separated by filtration.
67. (B) $_{10}\text{X}^{20}$ has $Z = 10$; EC 2, 8 has stable octet configuration and is less reactive.
68. (B) Dissolution of carbon dioxide in water is a chemical change.
 $\text{CO}_2 + \text{H}_2\text{O} \rightarrow \text{H}_2\text{CO}_3$
 But, dissolution of oxygen in water and dissolution of salt in water are physical changes.
69. (A) 32 g of $\text{O}_2 = 1$ mole
 1 mole of O_2 containing $= 6.022 \times 10^{23}$ molecules of O_2
 (or) $2 \times 6.022 \times 10^{23}$ atoms of O_2
 To have 6.022×10^{23} atoms of O_2 we need 0.5 mole of O_2 i.e. 16 g of

$$\text{O}_2 = 0.5 \text{ mole} = \frac{6.022}{2} \times 2 \times 10^{23} \text{ atoms of } \text{O}_2$$

$$= 6.022 \times 10^{23} \text{ atoms of } \text{O}_2$$
70. (C) Particles in a gas move about freely and randomly in all directions spreading out as far as they can to fill the container or space that they can occupy. Because gases have no definite volume.
- Biology**
71. (A) A group of cells together form a tissue. Similar tissue together form an organ. Organs with definite function are included in an organ system.
72. (C) Fungi are saprophytes.
73. (D) Connective tissues like blood and muscles supports, defends and stores food.
74. (A) In the given pie chart 80% denotes proteins.
75. (D) Biomass is not a fossil fuel.
76. (C) Cell membrane, nucleus and cytoplasm are common to both plants and animals.
77. (B) A morning glory plant is a climber. It coils around the stems of other plants to get support and to get sufficient sunlight.
78. (D) P and R have chloroplasts and can make their own food Q and S feed on other organisms or heterotrophs.
79. (C) AID and hepatitis B are transmitted through body fluids.
80. (B) The given figure is carbon cycle arrows I represent combustion II, Photosynthesis and III respiration.
81. (C) In the given figure arrow labelled R represents cross pollination.
82. (D) The given plant is potato. It is a stem tuber. It reproduces from stem tubers.
83. (C) New varieties of crops are produced by the process called hybridisation.
84. (B) Exocytosis is the reverse process, endocytosis ridding a cell of material by discharging it from vesicles at the cell surface.
85. (A) Diatoms belongs to the phylum chlorophyta.
86. (A) The above characteristics are exhibited by monocots. Paddy and maize belongs to monocots.
87. (A) In the given options load is a cold blooded animals. Option B, C and D are warm blooded animals.
88. (C) Dengue fever is caused by dengue virus.
89. (D) Osmosis is the passage of water from a region of high water concentration through a semi-permeable membrane to a region of low water concentration.
90. (D) Animals get their nitrogen by eating plants and other animals.