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NATIONAL LEVEL SCIENCE TALENT SEARCH EXAMINATION - 2013

SOLUTIONS FOR CLASS : 7

Mathematics

1. (A) If product of 3 integers is odd, each of them is odd and hence their sum is odd.

2. (C) $\Delta AEC \cong \Delta ABD$

3. (B) $I = \dfrac{PTR}{100}$

$\dfrac{P}{9} = \dfrac{PR^2}{100}$

$\Rightarrow R = \dfrac{10}{3} = 3\dfrac{1}{3}\%$

4. (D) $(1-2) + (3-4) +$ --------- $(2009-2010) + (2011-2012)$

$(-1) + (-1) +$ ------ (1006) terms $= 1006$

5. (B) Length of the side of the square $= 2 + 1 + 2 = 5$ cm

$\therefore$ Area of square $= 5 \times 5 = 25$ cm^2

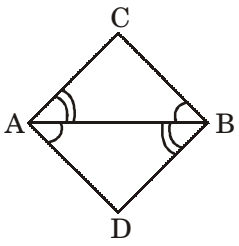
6. (D) $\dfrac{x-4}{3} - \dfrac{2x+1}{6} = \dfrac{5x+1}{2}$

$\Rightarrow \dfrac{-9}{6} = \dfrac{5x+1}{2}$

or $-3 = 5x + 1$

or $x = \dfrac{-4}{5}$

7. (B)



Given $\angle ABC = \angle BAD$

and $\angle CAB = \angle DBA$

Also AB is the common side

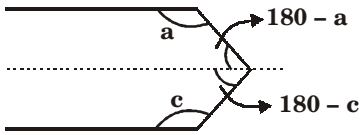
Hence, $\Delta ACB \cong \Delta BDA$ (ASA)

8. (A) $\boxed{\dfrac{1}{5}} < \dfrac{3}{5} < \dfrac{7}{5} < \boxed{\dfrac{9}{5}}$

$\dfrac{9}{5} \times \dfrac{x}{100} = \dfrac{1}{5}$

$\Rightarrow x = \dfrac{100}{9} = 11\dfrac{1}{9}\%$

9. (C)



$a + b + c = a + 180 - a + 180 - c + c = 360^o$

10. (D) $\dfrac{-24 \div 3}{15 \div 3} = \dfrac{-8}{5} \equiv \dfrac{8}{-5}$.

11. (A) $1 - \dfrac{2}{3} = \dfrac{1}{3}$

$\dfrac{1}{3} - \dfrac{1}{5} = \dfrac{5-1}{15} = \dfrac{+4}{15}$

$1 - \dfrac{4}{15} = \dfrac{11}{15}$

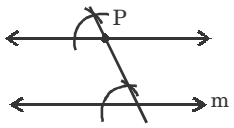
12. (D) Percentage of pure gold $= \dfrac{22}{24} \times 100$

$= \dfrac{275}{3}\%$

$= 91\dfrac{2}{3}\%$

13. (A) Average $= \dfrac{2+6+12+12+16+0}{7} = \dfrac{52}{7}$

14. (B)



15. (A) $\dfrac{100-5}{100} \times \dfrac{100-10}{100} \times$ original sum $= 171$

$\therefore$ original sum $= 171 \times \dfrac{100}{95} \times \dfrac{100}{90} =$ ₹ 200

16. (C) Let the consecutive numbers be $2x - 2$, $2x$ $2x + 2$

$6(2x - 2) - 4(2x + 2) = 2x$

$\Rightarrow 2x = 20$

17. (C) $14 \div 2 = 7$ cm

$7 \times 7 = 49$ cm .....(1)

$35 - 7 = 28$ cm .....(2)

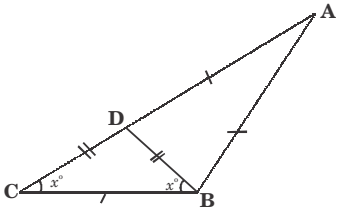
$\dfrac{1}{2} \times \dfrac{22}{7} \times 14 = 22$ cm .....(3)

$35 + 49 + 28 + 22 = 134$ cm

18. (D) Number of marbles Pankaj has = 96
Number of marbles Arun has = 63
Let the number of marbles that Arun should give Pankaj be x.
then, $(96 + x) = 2\,(63 - x)$
$\Rightarrow 96 + x = 126 - 2x$
or $x = 10$

19. (B) $\frac{(30\%\text{ of }60)+x}{60+x} = \frac{50}{100}$ [where x = number of games won in a row]
$\Rightarrow 36 + 2x = 60 + x$
or $x = 24$

20. (C) $\angle DCB = \angle DBC = x^o$ [since, DC = DB]
$\angle ADB = \angle DCB + \angle DBC = x + x = 2x^o$
$\angle ADB = \angle ABD = 2x^o$ [since, AD = AB]

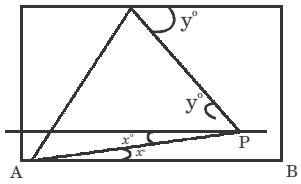


In ΔABC,
$\angle A + \angle B + \angle C = 180^o$
$x^o + (x^o + 2x^o) + x^o = 180^o \Rightarrow 5x = 180^o$ or $x = 36^o$.

21. (C) $\frac{1}{2}\left(\frac{3}{4}+\frac{9}{11}\right)=\frac{1}{2}\left(\frac{33+36}{44}\right)$
$= \frac{1}{2}\left(\frac{69}{44}\right)=\frac{69}{88}$

22. (D) The average of all the marks = $\frac{96}{8} = 12$
The only two marks having an average of 12 are 10 and 14.
[Note: Marks with the same average must be removed.]

23. (C) Draw a line parallel to AB passing through P.
Given that the triangle is equilaterial i.e., each angle measure of the triangle is 60^o



$x + y = 60^o$

24. (A) Option (A) has the largest area.

25. (D) $55^o + 35^o + 90^o = 180^o$

Physics

26. (C) Among the given choices, a falcon flies the fastest with a speed of 320 km/h
Speed of cheetah = 112 km/h
Speed of rabbit = 56 km/h
Speed of squirrel = 19 km/h

27. (B) In the "OFF" position of the switch, the two terminals are disconnected.

28. (B) When soap bubbles are blown into the air, they appear colourful because white light is dispersed into seven colours. This phenomenon is called dispersion of light.

29. (B) A fuse is a safety device which prevents damages to electrical circuits and possible fires.

30. (A) When water is heated in a pot, the temperature of the water increases upto 100 °C. Hence, it starts boiling.

31. (D) In clinical thermometer, mercury is used as thermometric liquid which is a toxic substance and it is very difficult to dispose off if a thermometer breaks. Secondly, in digital thermometers, the value of the reading is comparatively easier to read than in mercury thermometers. It does not contain mercury.

32. (A) An odometer fixed in the vehicles gives the starting time/distance of travel and the distance covered in km at every interval or instant of time.

33. (D) No image is formed on the screen because a concave lens is a diverging lens. The light rays get diverged when they pass through a concave lens.

34. (C) The transfer of heat by radiation does not require any medium.

35. (C) Soft iron is used as a core of an electromagnet and the given illustration is of an electromagnet. Soft iron can act as a temporary magnet.

36. (A) Speed = $\frac{\text{Distance}}{\text{Time}}$
Diameter of the track = 300 m
Distance = Length of the track = $2\pi r \times 2$
$= \pi \times D \times 2$
$= 3.14 \times 300 \times 2$ m
Time taken = 60×2 s = 120 s
Speed = $\frac{3.14\times300\times2}{120}$ = 15.7 m s^{-1}

37. (D) Electromagnets are used in the functioning of cranes, maglev trains and electric bells.

38. (A)

	Subhash	Anil	Sunil	Savant
After 1st minute	20	40	25	30
After 5th minute	65	75	60	70
In between 1st and 5th minute	45	35	35	40

Hence, Subhash runs the fastest between the first and the fifth minute.

39. (B) (i) Concave mirrors act as reflectors in head lights of vehicles like cars, scooters, buses, lorries etc.
(ii) It is used in shaving mirrors.
(iii) It is used by dentists and E.N.T. doctors to see the large images of teeth, internal parts of ears, nose and throat.

40. (D) A nano second is one billionth (1/1,000,000,000) of a second. It is used in space travel.

41. (D) An electromagnet can be made stronger by:
(i) increasing the strength of current in the coil.
(ii) increasing the number of turns of wire in the coil.
(iii) by winding the coil around a soft iron core.

42. (D) A convex mirror has a wider field of vision. So, its reflecting surface can be used to view the vehicles coming from behind.

43. (C) The chemical energy stored in the cell gets converted into electrical energy, which heats up the filament of the bulb to glow and give out light.

44. (D) Following precautions must be taken while using a clinical thermometer.
(i) Avoid keeping the thermometer in the mouth of infants.
(ii) Avoid keeping the thermometer in boiling water.
(iii) Avoid keeping the thermometer near a flame.

45. (A) Tungsten element when heated up to a very high temperature starts glowing.
Hence, it is used in electric bulbs.

46. (B) The seven coloured disc shown in figure (i) proves that white light consists of seven colours. (ii) When the coloured disc is rotated by using a pencil at its centre, it appears to be white due to the mixing of seven colours together. It is known as Newton's disc.

47. (D) Due to the rise in the level of mercury when the thermometer was placed in the liquid, it can be inferred that the liquid is at a higher temperature than the surrounding temperature. Heat is gained by mercury on placing it in the liquid. Since, heat is gained by the mercury, it expanded as matter expands on heating.

48. (B) Speed is given by the slope of the graph which is equal to distance / time.
$\therefore$ Speed of the body from C to D is
$= \frac{20-6}{12-8} = \frac{14}{4} = 3.5 \text{ m s}^{-1}$

49. (C) Time period = time taken for one oscillation
$\frac{\text{No. of oscillations}}{\text{Time taken}} = \frac{40}{120} = \frac{1}{3} = 0.33 \text{ s}$

50. (D) Following factors are necessary for making elements in electric room heaters to produce heat.
(i) Length, thickness and material of the wire.
(ii) Amount and duration of current passing through it.

Chemistry

51. (D) Hydrofluoric acid (HF) is the only liquid in which glass is soluble.

52. (D) Following are the precautions to be taken during a storm:
(i) Do not take shelter under a tree.
(ii) Do not lie down on the floor or ground.
(iii) Close all the doors and windows in the house.

53. (A) Basic solution turns the colourless phenolpthalein indicator pink.

54. (B) Salt and water can be obtained back from the salt water solution by evaporation. As the change is temporary and reversible, it is a physical change.

55. (D) Due to difference in air pressure, the soft drink from the bottle is pushed into the straw to enable us to drink.

56. (D) Sodium metal 'X' reacts with water to form sodium hydroxide and it liberates hydrogen gas.
$2Na(s) + 2H_2O(l) \rightarrow 2NaOH(aq) + H_2(g)$
Sodium Water Sodium hydroxide Hydrogen
Water is neutral and does not change the colour of china rose indicator. But sodium hydroxide 'Y' is basic in nature. Hence, it changes china rose indicator to green colour.

57. (D) Option (D) is false. The correct statement is that the ground water varies from place to place.

58. (D) In summer near the equator, the land warms up faster and most of the time, the temperature of the land is higher than that of water in the oceans. The air over the land gets heated up and rises. This causes the winds to blow from the oceans towards land. These are called monsoon winds. In winter the direction of the wind flow gets reversed, it flows from the land towards the oceans.

59. (A) When the ant bit Anita, it injected formic acid, a weak acid into her skin. Acids cause a burning sensation when they come in contact with our skin. Calamine solution is applied on the skin when an ant bites. which is basic in nature. It neutralizes the acid and gives relief from pain.
Calamine solution contains zinc carbonate. The swollen area can also be rubbed with moist baking soda (sodium hydrogen carbonate) which is also basic in nature.

60. (D) The reaction between an acid and a base is known as neutralisation. Salt and water are produced in this process with the evolution of heat.
$HCl + NaOH \rightarrow NaCl + \text{Water}$

61. (C) Warmer air expands, has less weight. It rises up to a greater height than the cold air.

62. (B) The blue litmus paper turning red indicates that the soil is acidic. The soil should be made basic so that its pH increases and improves its nature. Slaked lime is a basic substance. Hence, this should be added to the soil to get a better plant growth.

63. (C) The air pressure of the moving air over the roof of the hutment drops whereas the air pressure inside the hutments under the roof remains high. Air from a zone of higher pressure gushes towards the zone of lower air pressure taking away everything which comes its way. This is how the roofs get blown off during a storm.

64. (C) Magnesium hydroxide is present in an antacid.

65. (D) All the three statements: a chemical change is permanent, energy changes occur during a chemical change and heat energy is evolved or absorbed during a physical change are correct.

66. (B) Before cloud formation, water takes up heat from the atmosphere to change it into vapour. When water vapour changes back to liquid form as raindrops, this heat is released into the atmosphere. The heat released into the atmosphere warms the air around it. This warm air tends to rise up and causes a drop in the pressure. More air rushes to the centre of the storm. This cycle is repeated. The chain of events ends with the formation of a very low-pressure system with very high - speed winds revolving around it. This weather condition is called a cyclone.

67. (C) The groundwater which seeps deep into the soil is collected over the impervious (solid) rocks to form an aquifer.

68. (A) When an iron nail is put in a dilute solution of $CuSO_4$, after about an hour or so, the nails were found to be coated with copper.

If we leave the nails in the solution for a long time, the colour of the solution is also found to have changed from bright blue to greenish black.

This change is due to the chemical reaction and transfer of iron from the nails to replace copper from $CuSO_4$ in solution, thus forming Iron sulphate ($FeSO_4$), with the change in colour. Copper released from copper sulphate forms a coating of copper on iron nails.

69. (D) Option (D) is not true because during a hurricane, whirling wind and water with cyclonic winds over the sea may go upto 120 km or more per hour.

70. (D) Global warming is not caused due to depletion of water table.

Biology

71. (C) The following sequence is followed in the process of nutrition in animals.

Ingestion → Digestion → Absorption → Assimilation → Egestion.

72. (D) In the given figure arrows labelled as R and Q represent cross pollination.

73. (D) Bacteria breakdown the sugars present in the left over food and release acids.

74. (C) Heart is the pumping organ in circulatory system. Stomach is a sac like structure that stores food for some time is a part of digestive system. Lungs are called ventilators of our body, where exchange of gases takes place.

75. (D) The direction of arrow S is wrong. Heart pumps oxygenated blood to all parts of the body and receives carbon dioxide from all parts of the body.

76. (B) Photosynthesis is the process in which energy from the sunlight is used to combine water with carbon dioxide in the presence of chlorophyll pigment to form glucose and liberate oxygen into the air. In the given equation X - Carbon dioxide and Y is Oxygen.

77. (C) Earthworms do not have special organs on its body to help respiration. They breathe through their entire moist skin. They come out in the open since they are unable to breathe in water logged soil.

78. (C) The given plants nepenthes, sundew and utricularia are autotrophs and they grow in nitrogen deficient marshy places. To overcome this, they feed on insects hence the name insectivorous plants.

79. (A) A swollen part in the upper region of the trunk above the girdle is due to the removal of phloem tissue at the girdle and due to the accumulation of food in the cortical cells.

i-r, ii-p, iii-q, iv-s

80. (B) Symbiotic relationship – Lichens

Parasitic plant	–	Viscum
Ruminant	–	Cow
Saprophyte	–	Mould

81. (B) The pollen grain germinates on the stigma of style and develops pollen tube. The pollen tube grows down through the style. The pollen tube reaches the ovany and the male gamete move into the ovule to fuse with the egg.

82. (D) Pulmonary artery carries deoxygenated blood from the heart to the lung for purification. Among the four blood samples bar graph labelled as 'S' represents the blood sample taken from pulmonary artery.

83. (C) Monkey is an arboreal animal. It has long arms and legs and usually walk on four. It has prehensile tail to grasp branches and show their teeth that gives grin like appearance.

84. (D) Plants take in carbon dioxide during photosynthesis to synthesis their food and give out oxygen. Animals take in oxygen and give out carbon dioxide during respiration.

85. (B) Loamy soil is a mixture of sand, clay and humus. It is also called garden soil. Loam is full of air, holds good amount of water and has nutrients required for plants.

86. (B) Pseudopodia or false feet are the structures that are developed by amoeba to procure its food and for locomotion.

87. (C) In the given figure X represents vascular bundles. Xylem in the vascular bundle transports water and mineral salts and phloem part of vascular bundle transports sugar.

88. (D) During the process of exchange of gases, a carbon dioxide molecule that enters the alveolus is carried to bronchiole, bronchus and trachea. From trachea it is exhaled out through nostrils.

89. (D) Chemical reactions in the cells of our body produce waste products. The process of removing these waste products from the body is called excretion. The removal of undigested food from the large intestine is not excretion it is called defecation. This is because the undigested food has not entered the body cells.

90. (C) Decomposers are bacteria and fungi which break down dead plants and animals into mineral substances.