



UNIFIED COUNCIL

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NATIONAL LEVEL SCIENCE TALENT SEARCH EXAMINATION (UPDATED)

CLASS - 9

Question Paper Code : UN465

KEY

1. D	2. D	3. B	4. A	5. C	6. B	7. C	8. A	9. B	10. B
11. A	12. A	13. C	14. B	15. A	16. B	17. C	18. D	19. A	20. D
21. A	22. C	23. C	24. B	25. C	26. A	27. C	28. C	29. D	30. A
31. D	32. C	33. B	34. A	35. B	36. D	37. D	38. B	39. A	40. C
41. A	42. D	43. B	44. C	45. C	46. B	47. D	48. A	49. B	50. D
51. A	52. A	53. A	54. C	55. D	56. B	57. C	58. Del	59. C	60. A

SOLUTIONS

MATHEMATICS

1: (D) Volume each small metallic cube = $a^3 = (2 \text{ cm})^3 = 8 \text{ cm}^3$

Let 'n' cubes dropped in the tank

\therefore Volume of 'n' cubes = Volume of risen water

$$n \times 8\text{cm}^3 = 8 \times 5 \times 4 \text{ cm}^3$$

$$n = \frac{8 \times 20 \text{ cm}^3}{8\text{cm}^3} = 20$$

2: (D) $\triangle AOX \cong \triangle COY$ [\therefore ASA congruency]

\therefore $OX = OY$ [\therefore CPCT]

\therefore $OX - OY = 0$

3: (B) Diameter is the biggest chord

Maximum distance between R & T = 4cm

4: (A) Let the original side of the given equilateral triangle be a units

$$\therefore \text{Original area} = \frac{\sqrt{3}}{4} a^2 \text{ units}^2$$

Given $A = 2a$

$$\Rightarrow \text{New area} = \frac{\sqrt{3}}{4} A^2 = \frac{\sqrt{3}}{4} \times (2a)^2$$

$$= 4 \times \frac{\sqrt{3}}{4} a^2 = 4 \text{ times original area}$$

5: (C) $s = \frac{a+b+c}{2} = \frac{6\text{cm}+17.5\text{cm}+18.5\text{cm}}{2} = \frac{42\text{cm}}{2} = 21\text{cm}$

Area of the triangle

$$= \sqrt{s(s-a)(s-b)(s-c)}$$

$$= \sqrt{21 \times 15 \times 3.5 \times 2.5} \text{ cm}^2$$

$$= \sqrt{21 \times 15 \times \frac{7}{2} \times \frac{5}{2}} \text{ cm}^2$$

$$= \frac{3 \times 5 \times 7}{2} \text{ cm}^2 = 52.5 \text{ cm}^2$$

6: (B) Given $(x + 1)$ is a factor of $f(x)$

$$\therefore f(-1) = 0$$

$$\therefore f(-1) = (-1)^n - 1 = 0 \text{ if 'n' is even}$$

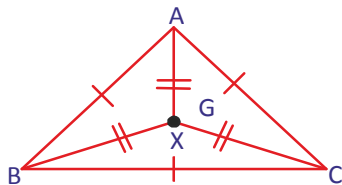
7: (C) Original volume = $\pi r^2 h$

$$\text{New volume} = \pi(2r)^2 \times \left(\frac{h}{2}\right) = 2\pi r^2 h$$

The ratio of new volume & original volume

$$= 2\pi r^2 h : \pi r^2 h = 2 : 1$$

8: (A) There is only 'one' point i.e. centroid makes the triangle into three triangles of equal area



9: (B) Let the original number be $10x + y$

Sum of the digit of the number = $(x + y)$

Given difference = $(10x + y) - (x + y)$

$$= 10x + y - x - y$$

= $9x$ which is always divisible by 9

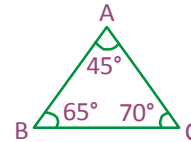
10: (B) Triangle ABC and parallelogram ABCF lie between the same parallel lines and having common base

\therefore Area of parallelogram ABCF = 2 Area of ΔABC

$$= 2 \times 30 \text{ cm}^2 = 60 \text{ cm}^2$$

11: (A) In ΔABC , $45^\circ + 65^\circ + \angle C = 180^\circ$

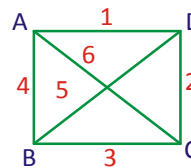
$$\angle C = 180^\circ - 110^\circ = 70^\circ$$



\therefore $\angle A$ is smallest angle $\Rightarrow BC$ is smallest side

$\angle C$ is greatest angle $\Rightarrow AB$ is greatest side

12: (A) Six line segments are formed with 4 points such that no three points are collinear



13: (C) Given $CD \parallel AB \Rightarrow \angle DCE = \angle B = 60^\circ$

In ΔABC , $55^\circ + 60^\circ + \angle ACB = 180^\circ$

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

14: (B) $\frac{de \times bc}{ab \times cd} = \frac{5 \times 2}{3 \times 4}$

$$\frac{e}{a} = \frac{5}{6}$$

15: (A) $\angle PRS = \angle PTS = 35^\circ$ [\because Angles in the same segment]

In ΔQRS , $\angle Q = 90^\circ \Rightarrow 35^\circ + 90^\circ + x = 180^\circ$

$$x = 180^\circ - 125^\circ = 55^\circ$$

16: (B) $\frac{7 - \sqrt{5+x}}{(x-44)} = \frac{7 - \sqrt{5+x}}{(x-44)} \times \frac{7 + \sqrt{5+x}}{7 + \sqrt{5+x}}$

$$= \frac{49 - (5+x)}{(x-44)(7 + \sqrt{5+x})}$$

$$= \frac{49 - 5 - x}{(x-44)(7 + \sqrt{5+x})}$$

$$= \frac{44 - x}{(x-44)(7 + \sqrt{5+x})}$$

$$= \frac{-x + 44}{(x - 44)(7 + \sqrt{5 + x})}$$

$$= \frac{-(\cancel{x - 44})1}{(\cancel{x - 44})(7 + \sqrt{5 + x})}$$

17: (C) LHS = $\sqrt{64 \times 3} - \sqrt{121 \times 3} - \sqrt{225 \times 3} + \sqrt{289 \times 3}$
 $= 8\sqrt{3} - 11\sqrt{3} - 15\sqrt{3} + 17\sqrt{3}$
 $= -\sqrt{3}$

18: (D) Given $3(x + 2)^2 + 2(x + 2)^2 = 48 + 32$
 $5(x + 2)^2 = 80$
 $(x + 2)^2 = \frac{80}{5} = 16$

$$x + 2 = \pm\sqrt{16} = \pm 4$$

$$x + 2 = 4$$

$$x = 4 - 2$$

$$x = 2$$

(or)

$$x + 2 = -4$$

$$x = -4 - 2$$

$$x = -6$$

19: (A) Given $2\pi r = 220$ cm

$$2 \times \frac{22}{7} \times r = 220 \text{ cm}$$

$$r = \frac{220}{2} \times \frac{7}{22} \times \frac{1}{1} \text{ cm}$$

$$r = 35 \text{ cm}$$

$$\text{Volume of cylinder} = \pi r^2 h$$

$$= \frac{22}{7} \times 35^2 \times 35 \times 63 \text{ cm}^3$$

$$= 2, 42, 550 \text{ cm}^3$$

20: (D) Given $4\pi r^2 = 1018 \frac{2}{7} \text{ cm}^2$

$$4 \times \frac{22}{7} \times r^2 = \frac{7128}{7} \text{ cm}^2$$

$$\therefore r^2 = \frac{7128}{4} \times \frac{7}{22} \times \frac{1}{4}$$

$$r^2 = (9 \text{ cm})^2$$

$$r = 9 \text{ cm}$$

$$\text{Volume of sphere} = \frac{4}{3} \pi r^3$$

$$= \frac{4}{3} \times \frac{22}{7} \times 9^3 \times 9 \text{ cm}^3$$

$$= 3054.85 \text{ cm}^3$$

$$= 3054.9 \text{ cm}^3$$

21: (A) from options $(3a + 2b - c)^2 = 9a^2 + 4b^2 + (-c)^2 + 2(3a)(2b) + 2(2b)(-c) + 2(-c)(3a)$
 $= 9a^2 + 4b^2 + c^2 + 12ab - 4bc - 6ca$

22: (C) Number of students who read only mathematics = $70 - 40 = 30$

Number of students who read only English = $60 - 40 = 20$

\therefore Number of students in the class = $30 + 20 + 40 = 90$

23: (C) Let $x = \overline{0.621} = 0.621 621 621 \dots$

$$\therefore 1000x = 1000 \times 0.621 621 621 \dots$$

$$1000x = 621.621 621 621 \dots$$

$$x = \underline{0.621 621 621 \dots}$$

$$\therefore 999x = 621$$

$$x = \frac{621}{999} = \frac{23}{37}$$

$$\therefore \overline{0.621} = \frac{23}{37}$$

24: (B) Let x & y are supplementary angles

Given $y = 3x$

But $x + y = 180^\circ$

$$x + 3x = 180^\circ$$

$$4x = 180^\circ$$

$$x = \frac{180^\circ}{4} = 45^\circ$$

$$y = 3x = 3 \times 45^\circ = 135^\circ$$

$$25: (C) \quad s = \frac{a+b+c}{2} = \frac{9\text{cm}+40\text{cm}+41\text{cm}}{2} = \frac{90\text{cm}}{2} = 45\text{cm}$$

$$\text{Area of } \triangle ABC = \sqrt{s(s-a)(s-b)(s-c)}$$

$$= \sqrt{45\text{cm} \times 36\text{cm} \times 5\text{cm} \times 4\text{cm}}$$

$$= \sqrt{9 \times 5 \times 9 \times 4 \times 5 \times 4 \text{cm}^4}$$

$$= 9 \times 5 \times 4 \text{ cm}^2 = 180 \text{ cm}^2$$

$$\therefore \frac{1}{2} \times 9\text{cm} \times h = 180\text{cm}^2$$

[\therefore Shortest side altitude is longest]

$$h = 180 \text{ cm}^2 \times \frac{2}{9\text{cm}} = 40\text{cm}$$

PHYSICS

26: (A) In the figure shown, at point P_1 the kinetic energy of the planet is maximum as it is nearer to the sun. Nearer the planet is to the sun, lesser its PE and greater its KE.

27: (C) Mass and velocity of the bullet is

$$M_b = 25 \text{ g} = 0.025 \text{ kg}, v_b = 500 \text{ m s}^{-1}$$

$$\text{Mass of machine gun, } M_g = 12 \text{ kg. } V_g = ?$$

$$\text{Magnitude of momentum of gun } M_g v_b = -mv$$

$$(\text{Law of conservation of momentum}) = 0.025 \times 500 = 12.5 \text{ kg m s}^{-1}$$

As initial momentum of the gun is zero, the change in the momentum of the gun after it has fired one bullet in $1/4$ second = $m_b v_b - 0 = 12.5 \text{ kg m s}^{-1}$

$$\therefore \text{Impulse} = F \times t = 12.5, F = \frac{12.5}{(1/4)} = 50 \text{ N}$$

28: (C) Plants use solar radiations in a chemical reaction called photosynthesis to live and grow. Energy from the Sun is stored in plants as food in the form of chemical energy. Growing grasses in the field increases chemical energy. This energy is then transferred from plants to animals and humans through food chains and food webs.

$$29: (D) \quad a = \frac{v-u}{t} = \frac{2200-1500}{8} = 87.5 \text{ m/s}^2$$

$$30: (A) \quad a = F/m$$

$$\text{New acceleration} = \frac{F}{3 \text{ m}} = \frac{1}{3} \left(\frac{F}{m} \right) = \frac{1}{3} a$$

31: (D) Work done against gravity in lifting water.

$$W = m \times g \times h$$

$$\text{Mass of water (m)} = 200 \text{ kg}, g = 10 \text{ m / s}^2, h = 6 \text{ m}$$

$$W = m \times g \times h = 200 \times 10 \times 6 = 12000 \text{ J}$$

\therefore The work done in lifting 200 kg of water to 6 m height is 12000 joules.

32: (C) As distances travelled by a body in successive seconds differ by 2 m each, therefore, acceleration is constant or uniform = 2 m / s^2 .

33: (B) Mass is a measure of inertia of a body. Object Q has more inertia than object P.

34: (A) When a car accelerates, its speed and kinetic energy increases.

The rate of rubbing of the tyres with the road as well as the air resistance increases due to stronger wind blowing against the car. As a result, heat produced increases.

The acceleration of the car results in higher consumption of fuel. Car's fuel has the chemical energy used to convert it into kinetic energy of the car along with the production of heat. Chemical potential energy is the energy stored in the fuel which on use for accelerating a car decreases.

35: (B) Initial velocity of the ball $u = 49 \text{ m/s}$

Final velocity of the ball $v = 0 \text{ m/s}$ (it stops)

Acceleration due to gravity $g = -9.8 \text{ m/s}^2$ (ball is thrown vertically upwards)

Maximum height reached by the ball $h = ?$

For a freely falling body $v^2 = u^2 + 2gh$

$$(0)^2 = (49 \text{ m/s})^2 + 2 (-9.8 \text{ m/s}^2) h$$

$$\text{or } 0 - (49 \text{ m/s})^2 = -2 \times 9.8 \text{ m/s}^2 (h)$$

$$h = \frac{49 \text{ m/s} \times 49 \text{ m/s}}{2 \times 9.8 \text{ m/s}^2} = 122.5 \text{ m}$$

So, the maximum height reached by the ball is 122.5 m

CHEMISTRY

- 36: (D) Empirical formula is C_4H_9 . As molecular formula is required, it will be $(C_4H_9)_n$ and n is an integer. In this case, $n = 2$.

	C	H
% Mass	84.2	15.8
A_t	12	1
%Mass/ A_t	7	15.8
Divide by smallest ratio	1	2.25
Multiply by 4	4	9

- 37: (D) A mixture is a combination of two or more different substances not bound or bonded chemically.

Adding of milk to water results in the formation of a mixture.

Crushing of a marble tile into small particles, breaking of ice cubes into small pieces and powdering of rock salt crystals involve a change of same solid into smaller particles, pieces or powder to which there is no addition of another substance. Hence, they are not mixtures.

- 38: (B) 1 mole of Mg = 24 g
0.8 moles of Mg = $24 \times 0.8 = 19.2$ g

- 39: (A) Oil is immiscible in water.
Fractional distillation is a method used for separating homogeneous mixture of two liquids with different boiling points. All pure substances are homo-geneous in nature.

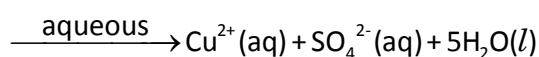
The constituent elements of a compound can be separated by only chemical methods.

- 40: (C) Conversion factor: $1^\circ\text{C} = 1 + 273 \text{ K}$.
Hence, $100^\circ\text{C} = 100 + 273 = 373 \text{ K}$.

- 41: (A) From the formula of chromic acid H_2CrO_4 , the valency of chromate ion is two and the formula of divalent metal chromate is $MCrO_4$.

- 42: (D) A mixture of chalk and water cannot be separated by chromatography but it can be separated by filtration. Chromatography is a method used for separation and identification of the constituents of a mixture based on the difference in absorption of constituents by a surface of an appropriate adsorbent material or solid medium.

- 43: (B) $CuSO_4 \cdot 5H_2O(s)$



1 mole of the solid contains 2 moles of ions

i.e. Cu^{2+} and SO_4^{2-}

- 44: (C) Two miscible liquids having different boiling points can be separated by fractional distillation.
45: (C) Ozone (O_3) has 3 atoms in its molecule, so the atomicity of ozone is 3.

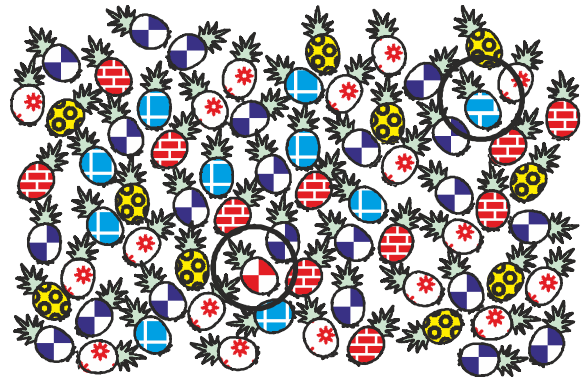
BIOLOGY

- 46: (B) X is the xylem vessel with the thick, lignified cell walls. Y is the red blood cell as it has a flattened bi-concave shape. Z is the root hair cell as it contains a long extension called the root hair, which helps to increase its surface area.
47: (D) The HIV virus is carried in body fluids such as blood, semen, vaginal secretions and breast milk.
48: (A) Rearing, care and management of honey bees for obtaining products like honey and beeswax etc are called apiculture.
49: (B) Pollen grains contain male gametes, which can only be formed via meiosis. Ova are female gametes, which are also formed via meiosis. The zygote forms via fertilisation, the fusion of a male with a female gamete. No cell division is involved during this process (ii). The formation of new potato plants from a tuber involves asexual reproduction, where all daughter plants from the same tuber will be genetically identical to the parent plant (iv).

50. (D) Ligaments are tough connective tissue, connects bones to one another, they are made of collagen fibres and they are found in skeletal system
51. (A) The given structure (shape) of virus is identified to be of a retrovirus (Human immuno deficiency virus– HIV), a causative agent of AIDS.
52. (A) The biconcave shape of red blood cells is important for enhancing their surface area to volume ratio. This maximises the rate of exchange of gases with their environment, i.e., the uptake and release of oxygen and carbon dioxide.
53. (A) Energy decreases as it moves up trophic levels because energy lost as heat during respiration.
54. (C) Excessive enrichment of nutrients in the water in rivers and lakes frequently due to run off from the land which causes a dense growth of plant life. It results in a decrease in water clarity, dissolved oxygen and aquatic life.
55. (D) A pulse crop grown in an time interval between two cereal crops is to compensate for the loss of nitrogen.

CRITICAL THINKING

- 56: (B) 2 pineapple appears only once



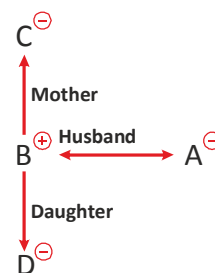
- 57: (C)



- 58: (Deleted)

- 59: (C) In case of a leap year, the calendar of March moves ahead by 2 days as compared to previous year. Using both information, the only possibility of a two day difference arises if it was a Tuesday on 31st March of previous year and it is Thursday on this year. Hence, question can be answered using both information.

- 60: (A) $A \% B \# C * D$



Clearly, D is the daughter of A.