



UNIFIED COUNCIL

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NATIONAL LEVEL SCIENCE TALENT SEARCH EXAMINATION (UPDATED)

CLASS - 9

Question Paper Code : UN460

KEY

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SOLUTIONS

MATHEMATICS

1: (D) Given $g(1) = f(1)$

$$2(1)^3 + a(1)^2 + 3(1) - 5 = 1^3 + 1^2 - 4(1) - a$$

$$2 + a - 2 = 2 - 4 - a$$

$$2a = -2$$

$$a = \frac{-2}{2} = -1$$

2: (B) $s = \frac{a+b+c}{2} = \frac{25m+39m+56m}{2} = \frac{120m}{2} = 60m$

Area of the triangle

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

$$= \sqrt{60 \times 35 \times 21 \times 4 \text{ m}^4}$$

$$= \sqrt{3 \times 4 \times 5 \times 5 \times 7 \times 7 \times 3 \times 4 \text{ m}^4}$$

$$= 3 \times 4 \times 5 \times 7 \text{ m}^2$$

$$= 420 \text{ m}^2$$

$$\therefore \frac{1}{2} \times 25m \times h = 420 \text{ m}^2$$

[\therefore Shortest side of a triangle longest altitude]

$$h = 420 \text{ m}^2 \times 2 \times \frac{1}{25 \text{ m}}$$

$$= 33.6 \text{ m}$$

3: (D) Given $AB : BC = 1 : 2$ and $BC : CD = 5 : 8$

$$\therefore AB : BC : CD = 5 : 10 : 16 = 5x : 10x : 16x$$

$$\therefore AB : BD = 5x : (10x + 16x) =$$

$$5x : 26x = 5 : 26$$

4: (A) In a triangle difference of two sides is lesser than third side

5: (C) Base area = 10 are = $10 \times 100 \text{ sqm} = 1,000 \text{ sq m}$

Height

$$= \frac{\text{Volume}}{\text{Base area}} = \frac{10 \text{ m}^3}{1000 \text{ sq m}} = \frac{10 \times 1000 \text{ m}^3}{10000 \text{ m}^2}$$

$$= \frac{1}{10} \text{ m}$$

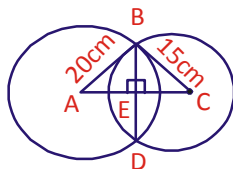
$$= \frac{100 \text{ cm}}{10}$$

$$= 10 \text{ cm}$$

6: (C) In a triangle sum of two sides is greater than third side

$$\therefore \text{Each diagonal length is less than } (7 + 5) \text{ cm}$$

7: (C) Given $AB = 20 \text{ cm}$ & $BC = 15 \text{ cm}$



$AC = 25 \text{ cm}$ and $BD \perp AC$

In $\triangle ABE$, Let $AE = x \text{ cm} \Rightarrow EC = (25 - x) \text{ cm}$

$$BE^2 = AB^2 - AE^2 = (20)^2 - x^2 = 400 - x^2 \rightarrow (1)$$

In $\triangle BCE$, $BE^2 = BC^2 - EC^2 = (15)^2 - (25 - x)^2$

$$= 225 - (625 - 50x + x^2)$$

$$= 225 - 625 + 50x - x^2$$

$$= 50x - x^2 - 400 \rightarrow (2)$$

But eq (1) = eq (2)

$$400 - x^2 = 50x - x^2 - 400$$

$$400 + 400 = 50x$$

$$x = \frac{800}{50} = 16$$

$$\therefore BE^2 = 400 - x^2 = 400 - 16^2 = 400 - 256 = 144$$

$$\therefore BE = \sqrt{144} \text{ cm} = 12 \text{ cm}$$

$$\therefore BD = 2BE = 2 \times 12 \text{ cm} = 24 \text{ cm}$$

8: (B) Given $\frac{1}{2} h (a + b) = 30 \text{ cm}^2$

$$\Rightarrow \frac{1}{2} \times 7 \text{ cm} (7 \text{ cm} + b) = 30 \text{ cm}^2$$

$$7 \text{ cm} + b = \frac{30 \text{ cm}^2}{7 \text{ cm}} = 15 \text{ cm}$$

$$b = 15 \text{ cm} - 7 \text{ cm} = 8 \text{ cm}$$

9: (C) Let the original radius be $r \text{ cm}$

$$\therefore \text{Original surface area} = 4\pi r^2$$

$$\text{New radius } (R) = r + 100\% r = r + r = 2r$$

$$\text{New are surface} = 4\pi R^2 = 4\pi (2r)^2$$

$$= 4(4\pi r^2)$$

$$\text{Increased area} = 4(4\pi r^2) - 4\pi r^2$$

$$= 3(4\pi r^2)$$

Increased area percentage

$$= \frac{3(4\pi r^2)}{4\pi r^2} \times 100$$

$$= 300 \%$$

10: (D) Sum of other two angles = $180^\circ - 73^\circ = 107^\circ$

$$11: (B) \sqrt{3 - 2\sqrt{2}} = \sqrt{2 + 1 - 2\sqrt{2} \times 1}$$

$$= \sqrt{(\sqrt{2})^2 + 1^2 - 2\sqrt{2} \times 1}$$

$$= \sqrt{(\sqrt{2} - 1)^2}$$

$$= (\sqrt{2} - 1)$$

12: (B) In $\triangle ABC$, given $\angle ABC = 50^\circ$ & $AB = AC \Rightarrow \angle ACB = \angle ABC = 50^\circ$

$$\text{In } \triangle ABC \quad 50^\circ + 50^\circ + \angle A = 180^\circ$$

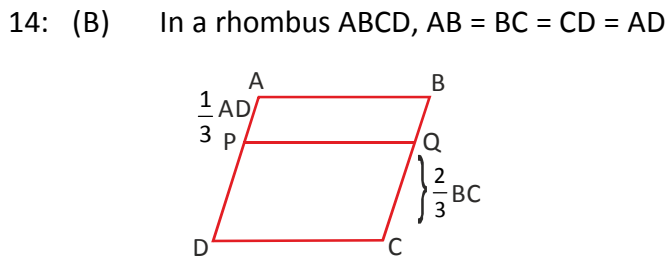
$$\angle A = 180^\circ - 100^\circ = 80^\circ$$

$$\therefore \angle BEC + \angle BDC + \angle BAC = 100 + 80 + 80$$

$$[\because \angle BAC + \angle BEC = 180^\circ \text{ \& \ } \angle BDC = \angle BAC]$$

$$= 260^\circ$$

13: (C) Given $\angle APB = \angle ACQ$
 $180^\circ - \angle ABC = 180^\circ - \angle ACB$
 $\angle ACB = \angle ABC = x$ (say)
 In $\triangle ABC$, $76^\circ + x + x = 180^\circ$
 $2x = 180^\circ - 76^\circ = 104^\circ$
 $x = \frac{104^\circ}{2} = 52^\circ$



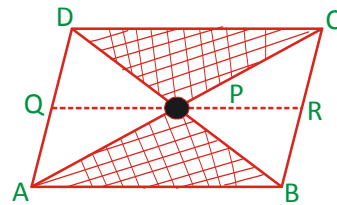
$\therefore AD = BC$
 $\frac{1}{3} AD = AP = \frac{1}{3} BC \rightarrow (1)$

Given $CQ = \frac{2}{3} BC \Rightarrow BQ = BC - CQ$
 $= BC - \frac{2}{3} BC$
 $= \frac{3BC - 2BC}{3}$
 $= \frac{1}{3} BC \rightarrow (2)$

from (1) & (2) $AP = BQ$ & $AP \parallel BQ$
 APQB is a parallelogram

15: (B) Given the angles ratio of quadrilateral = $5 : 6 : 7 : 6$
 $= 5x : 6x : 7x : 6x$
 $\therefore 5x + 6x + 7x + 6x = 360^\circ$
 $24x = 360^\circ$
 $x = \frac{360^\circ}{24} = 15^\circ$
 $\therefore 7x - 5x = 2x = 2 \times 15^\circ = 30^\circ$

16: (A) Construction : $QR \parallel AB$ through 'P'



\therefore Area of $\triangle APB = \frac{1}{2}$ ar (ABRQ) $\rightarrow (1)$

Area of $\triangle CPD = \frac{1}{2}$ ar (CRQD) $\rightarrow (2)$

eq (1) + (2) \Rightarrow Area of $(\triangle APB + \triangle CPD) = \frac{1}{2}$
 [area (ABRQ) + ar (CRQD)]
 $= \frac{1}{2}$ ar ABCD

17: (A) $\frac{7^{84}}{343} = \frac{7^{84}}{7^3} = \frac{7^{84}}{7^3} = 7^{84-3} = 7^{81}$

$\therefore 7^3$ divides 7^{84} exactly

\therefore Remainder = zero

18: (C) Given ABDE is a parallelogram

$\angle E = \angle DBA = 36^\circ$

Given ABCD is a rhombus

$AB = AD \Rightarrow \angle ABD = \angle ADB = 36^\circ$

$36^\circ + 36^\circ + \angle DAB = 180^\circ$

$\angle DAB = 180^\circ - 72^\circ = 108^\circ$

19: (C) $x^2 + x - 2 = x^2 + 2x - x - 2$
 $= x(x + 2) - 1(x + 2) = (x + 2)(x - 1)$
 $x^2 - x - 6 = x^2 - 3x + 2x - 6$
 $= x(x - 3) + 2(x - 3) = (x - 3)(x + 2)$
 $x^2 - 4x + 3 = x^2 - 3x - x + 3$
 $= x(x - 3) - 1(x - 3) = (x - 3)(x - 1)$
 $\therefore \sqrt{(x^2 + x - 2)(x^2 - x - 6)(x^2 - 4x + 3)}$
 $= \sqrt{(x + 2)(x - 1)(x - 3)(x + 2)(x - 3)(x - 1)}$
 $= \sqrt{(x + 2)^2 (x - 1)^2 (x - 3)^2}$
 $= (x - 1)(x + 2)(x - 3)$

PHYSICS

20: (B) Given $3\pi r^2 = 11,550 \text{ cm}^2$

$$3 \times \frac{22}{7} \times r^2 = 11,550 \text{ cm}^2$$

$$r^2 = 11,550 \times \frac{7}{22} \times \frac{1}{3}$$

$$= 25 \times 7 \times 7 \text{ cm}^2$$

$$r^2 = (5 \times 7 \text{ cm})^2$$

∴ Radius (r) = 35 cm

21: (D) $\sqrt{448} - \sqrt{1008} - \sqrt{567} + \sqrt{700}$

$$= \sqrt{64 \times 7} - \sqrt{144 \times 7} - \sqrt{81 \times 7} + \sqrt{100 \times 7}$$

$$= 8\sqrt{7} - 12\sqrt{7} - 9\sqrt{7} + 10\sqrt{7}$$

$$= -3\sqrt{7}$$

$$= -\sqrt{3 \times 3 \times 7}$$

$$= -\sqrt{63}$$

22: (C) $h = \sqrt{l^2 - r^2} = \sqrt{35^2 - 21^2} = \sqrt{1225 - 441} = \sqrt{784} = 28$

Volume of cone

$$= \frac{1}{3} \pi r^2 h = \frac{1}{3} \times \frac{22}{7} \times 21^2 \times 28 \text{ cm}^3$$

$$= 12936 \text{ cm}^3$$

23: (B) $S = \frac{a+b+c}{2} = \frac{17\text{cm} + 25\text{cm} + 28\text{cm}}{2} = 35\text{cm}$

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

$$= \sqrt{35 \times 18 \times 10 \times 7} \text{ cm}^2$$

$$= \sqrt{7 \times 5 \times 18 \times 2 \times 5 \times 7}$$

$$= 7 \times 5 \times 6 \text{ cm}^2 = 210 \text{ cm}^2$$

24: (A) Volume = $a^3 = (75 \text{ cm})^3 = 421875 \text{ cm}^3$

$$= \frac{421875}{1000} \text{ litres} = 421.875 \text{ litres}$$

25: (C) $x^2 + x(c-b) + (c-a)(a-b) = x^2 + x(c-a+a-b) + (c-a)(a-b)$

$$= x^2 + x[(c-a) + (a-b)] + (c-a)(c-b)$$

$$= x^2 + x(c-a) + x(a-b) + (c-a)(a-b)$$

$$= x(x+c-a) + (a-b)(x+c-a)$$

$$= (x+c-a)(x+a-b)$$

26: (C) As G is universal gravitational constant. So, it remains constant everywhere.

27: (C) $m = 2 \text{ kg}; u = 0; t = 4 \text{ seconds}; a = 1.5 \text{ m s}^{-2}$.

$$v = u + at = 0 + 1.5 \times 4 = 6 \text{ m s}^{-1}$$

$$\text{Gain in momentum} = mv - mu$$

$$= m(v - u) = 2(6 - 0) = 12 \text{ kg m s}^{-1}$$

28: (A) $W = F S \cos \theta$

$$\cos \theta = \frac{W}{F \times S} = \frac{1}{10 \times 0.2} = \frac{1}{2}$$

$$\cos \theta = \frac{1}{2} \Rightarrow \theta = 60^\circ$$

The angle between the force and displacement is 60°

29: (C) $v - u = 80 - 45 = 35 \text{ km/h}$

$$35 \text{ km/h} = 9.722 \text{ m/s}$$

$$a = \frac{v-u}{t} = \frac{9.722}{4} = 2.43 \text{ m/s}^2$$

30: (B) A force can accelerate a lighter vehicle with less mass more easily than a heavier vehicle with more mass which

are moving. As $a = \frac{F}{m}$, a heavier mass vehicle has less acceleration.

31: (B) Mass of the body (m) = 10 kg, Velocity of the body (v) = 2 m s⁻¹, Kinetic energy (K.E) = ?

$$\text{K.E} = \frac{1}{2} mv^2 = \frac{1}{2} \times 10 \times (2)^2 = \frac{1}{2} \times 10 \times 4 = 20 \text{ joule}$$

∴ The K.E of the body = 20 joule

32: (C) The distance between the dots represents the speed of the car. The speed is first constant and then decreases as the dots are read from left to right.

33: (B) The velocity of an object may be zero but acceleration is not zero.

34: (C) Electricity produced in a hydroelectric power station is similar to electricity produced in thermal power station.

35: (D) m_1 and $m_2 = 60 \text{ kg}$
 Distance between them $d = 2 \text{ m}$
 Gravitational constant $G = 6.67 \times 10^{-11} \text{ N m}^2 \text{ kg}^{-2}$

Force $F = ?$

From the formula $F = G \frac{m_1 m_2}{d^2}$

Putting the values, we get $F = 6.67 \times 10^{-11}$
 $\times \frac{60 \times 60}{2 \times 2}$

$$F = 6.67 \times 10^{-11} \times \frac{3600}{4}$$

$$F = 6.67 \times 10^{-11} \times 900 = 6.67 \times 9 \times 10^{-9} = 60.03 \times 10^{-9} \text{ N}$$

CHEMISTRY

36: (B) $n = 0.25 \text{ moles} = \frac{1}{4} \text{ mole}$

Mass of element (m) = 6 g

Molecular weight of element (M) = $\frac{m}{n}$

$$= \frac{6}{(1/4)} = \frac{6}{0.25} = 24 \text{ g}$$

24 g is the molecular weight of magnetism.

37: (B) P is ammonium chloride that is used in dry cells. Q is common salt obtained by evaporation of sea water. R is iron bridge which corrodes to form rust when it comes in contact with atmospheric water vapour and oxygen. S is sand that is mixed with cement for plastering the walls.

38: (B) 40 g of calcium constitutes one gram atom.

10 g of calcium accounts for gram atom

$$= \text{Gram atoms} = \frac{\text{Mass of the element in grams}}{\text{Atomic mass of the element}}$$

$$\frac{10}{40} = 0.25 \text{ gram atoms}$$

According to Avogadro's number, the number of atoms in 1 g of calcium = 6.023×10^{23}

The number of atoms in 0.25 gram atom = $0.25 \times 6.023 \times 10^{23} = 1.50 \times 10^{23} \text{ atoms}$.

39: (B) The correct sequence of collection of distillates based on their boiling points is 2, 3, 4, 6, 1, 5 with the lowest boiling point that distils first.

	Liquid	Boiling point (°C)	Sequence
1	Acetic acid	118	5 th
2	Chloroform	62	1 st
3	Carbon tetrachloride	77	2 nd
4	1-propanol	88	3 rd
5	Ethylene glycol	195	6 th
6	Heptane	98	4 th

40: (D) $C = K - 273.15 = 475 - 273.15 = 201.85 \text{ }^\circ\text{C}$

41: (B) All pure samples of water contain hydrogen and oxygen in fixed mass ratio of 1 : 8.

This is in agreement with the law of constant or definite proportion.

42: (C) Iron sulphide is a compound of Iron and sulphur. Stainless steel and brass are alloys. Diamond is an element.

43: (C) M_r of $\text{H}_2\text{O} = 2 \times 1 + 16 = 18$

$$\text{Amount of } \text{H}_2\text{O in } 72 \text{ g} = \frac{72}{18} = 4 \text{ mole}$$

Therefore, there are 4 moles of oxygen atoms in 72 g of pure water.

$$\text{Mass of oxygen} = 4 \times 16 = 64 \text{ g.}$$

44: (C) Melting of aluminium metal to make utensils is a change of state and shape. Bending of a brass strip and making wire with a lump of copper both involves change in shape. Rusting of iron articles is a chemical change.

45: (A) 24 g of carbon (12) has maximum number of atoms as it has 2 moles while others have 1 mole.

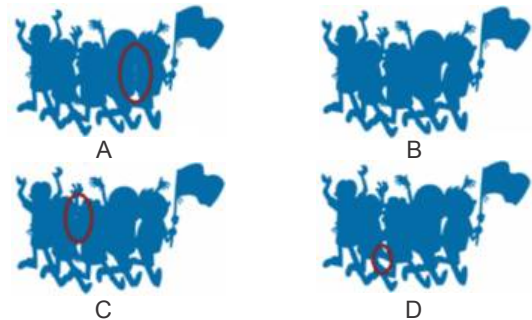
BIOLOGY

46. (B) Organelle IV is the chloroplast and it contains photosynthetic pigments to absorb light and carry out photosynthesis.
47. (B) The drawing shows a plant cell, as seen by the presence of the cell wall, cell membrane and tonoplast. The long cytoplasmic extension is the root hair.
48. (A) (I) is the sieve tube cell as it does not contain a nucleus but it possess crosswalls.
(II) is the companion cell as it contains a sap vacuole and nucleus.
(III) is the xylem vessels as it is continuous and hollow, without any crosswalls.
49. (D) The spongy nature of the stems and roots of some aquatic plants is due to the presence of a specialized tissue known as aerenchyma.
50. (A) $3 \rightarrow 1 \rightarrow 4 \rightarrow 5 \rightarrow 2$
51. (C) Y is lymphocyte. Lymphocyte produces antibodies to fight pathogen.
52. (A) Food chain is a linked system of organisms. Each organisms is important for the next to maintain continuity of life.
53. (D) Food poisoning caused by bacteria is called Botulism.
54. (D) The lignified walls of the cell wall provide greater structural support to prevent the xylem vessels from collapsing. Mature xylem vessels also lack protoplasm and cross walls between cells to minimise obstruction to the flow of water up the stem. Statement 1 is not a specific adaptation of the xylem because all plant cells have cellulose cell walls.
55. (A) The red blood cell or erythrocyte transports oxygen as oxyhaemoglobin and carbon dioxide as carbamino haemoglobin.

CRITICAL THINKING

- 56: (D) Do not assume that the proportion of white:black sheep is uniform across rams and ewes. We know from (I) that there are 40 ewes but we do not know that 40% of ewes are black. Hence the right answer is D.

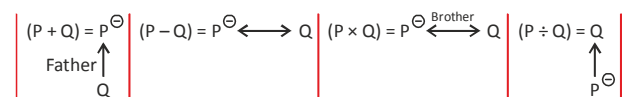
- 57: (B)



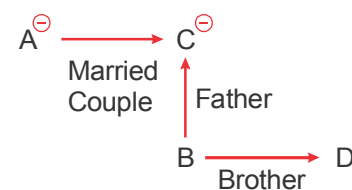
- 58: (C)

- 59: (A) Gear C is 4 times the diameter of gear A. Since the gears are all connected by a chain, the tip velocity of all the gears must be the same; otherwise, the chain would come off the gears. Therefore, if the tip velocity is to be the same for all gears and gear C is 4 times larger than gear A, then gear C must be turning 4 times slower than gear A. Twenty RPM divided by 4 equals 5 RPM.

- 60: (C) By decoding given information with symbols of family diagram, we get



- (ii) (C) From the given information, following family diagram can be drawn



Now, it is clear that A is the mother of B.