



UNIFIED COUNCIL

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NATIONAL LEVEL SCIENCE TALENT SEARCH EXAMINATION (UPDATED)

CLASS - 10

Question Paper Code : UN444

KEY

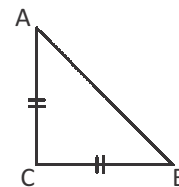
1. B	2. B	3. C	4. A	5. D	6. C	7. B	8. C	9. B	10. A
11. C	12. A	13. B	14. B	15. D	16. B	17. C	18. C	19. D	20. B
21. C	22. A	23. A	24. C	25. B	26. D	27. B	28. A	29. A	30. B
31. C	32. C	33. D	34. A	35. C	36. D	37. B	38. A	39. C	40. C
41. B	42. B	43. B	44. A	45. C	46. B	47. B	48. C	49. A	50. C
51. C	52.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

SOLUTIONS

MATHEMATICS

1. (B) Given $\alpha\beta\gamma = -\frac{d}{a} = -(-30) = 30$
 But given $\alpha\beta = -6$ then $(-6)\gamma = 30$
 $\gamma = -5$
2. (B) Given $a = 45, d = 41 - 45 = -4$
 $\therefore a_{12} = a + 11d = 45 - 44 = 1$
 $\therefore a_{13} = a + 12d = 45 - 48 = -3$
 $\therefore 13^{\text{th}}$ term is the first negative term.

3. (C) Given $AB^2 = 2AC^2$
 $\Rightarrow AB^2 = AC^2 + AC^2$
 $AB^2 = AC^2 + BC^2$ [Q $AC = BC$]
 $\therefore \angle C = 90^\circ$
 [\therefore converse of pythagorus theorem]



4. (A) Given $a + b = 33$

$$\therefore \frac{1}{a} + \frac{1}{b} = \frac{a+b}{ab} = \frac{33}{3 \times 90} = \frac{11}{90}$$

5. (D) Given $\alpha\beta = 1 = \frac{c}{a}$

$$\therefore \frac{6m}{m^2+9} = 1$$

$$m^2 - 6m + 9 = 0$$

$$(m - 3)^2 = 0$$

$$m = 3.$$

6. (C) Given $(3 \text{ cm})^3 + (4 \text{ cm})^3 + (x \text{ cm})^3 = (6 \text{ cm})^3$

$$x^3 = 216 \text{ cm}^3 - 64 \text{ cm}^3 - 27 \text{ cm}^3$$

$$x^3 = 125 \text{ cm}^3$$

$$\therefore x = 5 \text{ cm}$$

$$\therefore \text{TSA of the cube whose edge is } x \text{ cm} = 6a^2$$

$$= 6 \times 25 \text{ cm}^2 = 150 \text{ cm}^2$$

7. (B) $\frac{2}{a+b+1} = \frac{3}{a+2b+1} = \frac{7}{4a+4b+1}$

$$\therefore 2a + 4b + 2 = 3a + 3b + 3$$

$$a - b = -1 \quad \rightarrow (1)$$

$$\text{But } 12a + 12b + 3 = 7a + 14b + 7$$

$$5a - 2b = 4 \quad \rightarrow (2)$$

$$\text{Solving (1) \& (2) } a = 2 \text{ \& } b = 3$$

8. (C) Let $\left(\frac{1}{2}, 6\right)$ divides the join of $(3, 5)$ & $(-7, 9)$ in the ratio $m_1 : m_2$

$$\therefore \left(\frac{1}{2}, 6\right) = \left(\frac{-7m_1 + 3m_2}{m_1 + m_2}, \frac{9m_1 + 5m_2}{m_1 + m_2}\right)$$

$$\therefore 6 = \frac{9m_1 + 5m_2}{m_1 + m_2}$$

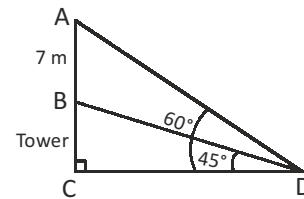
$$\Rightarrow 6m_1 + 6m_2 = 9m_1 + 5m_2$$

$$3m_1 = m_2$$

$$\frac{m_1}{m_2} = \frac{1}{3}$$

9. (B) Given :- $AB = 7 \text{ m}$,

$$\angle ADC = 60^\circ, \angle BDC = 45^\circ, \angle C = 90^\circ$$



$$\text{In } \triangle BCD, \tan 45^\circ = \frac{BC}{CD}$$

$$BC = CD \quad \rightarrow (1)$$

$$\text{In } \triangle ACD, \tan 60^\circ = \frac{AC}{CD}$$

$$\sqrt{3} = \frac{BC + 7 \text{ m}}{BC} \quad [\because CD = BC]$$

$$\sqrt{3} BC - BC = 7 \text{ m}$$

$$BC = \frac{7}{(\sqrt{3}-1)} \times \frac{(\sqrt{3}+1)}{(\sqrt{3}+1)} = \frac{7(\sqrt{3}+1)}{2}$$

$$= \frac{7(1.732+1)}{2} = 9.56 \text{ m}$$

10. (A) $\text{LHS} = 2 \left[\frac{\cos^2(90^\circ - 70^\circ) + \cos^2 70^\circ}{\sin^2 25^\circ + \sin^2(90^\circ - 25^\circ)} \right] - (1) + \frac{(1)}{\sqrt{3}}$

$$= 2 - 1 + \frac{1}{\sqrt{3}}$$

$$= \frac{\sqrt{3}+1}{\sqrt{3}} \times \frac{\sqrt{3}}{\sqrt{3}}$$

$$= \frac{3+\sqrt{3}}{3}$$

11. (C) $\text{LHS} = 4\left(\frac{1}{\sqrt{3}}\right)^2 + \frac{1}{8}\left(\frac{1}{\sqrt{3}}\right)^2 + \left(\frac{1}{2}\right)^2$

$$\times \left(\frac{1}{\sqrt{2}}\right)^2 + \frac{1}{2} \times 1^2$$

$$= \frac{4}{3} + \frac{1}{24} + \frac{1}{8} + \frac{1}{2}$$

$$= \frac{32 + 1 + 3 + 12}{24}$$

$$= \frac{48}{24}$$

$$= 2$$

12. (A) Volumes ratio of sphere, cone & cylinder

$$= \frac{4}{3} \pi r^3 : \frac{1}{3} \pi r^2 h : \pi r^2 h$$

$$= \frac{4}{3} : \frac{2}{3} : 2$$

$$= \frac{2}{3} : \frac{1}{3} : 1$$

$$= 2 : 1 : 3$$

13. (B) Let $\frac{2x-1}{x+3} = a \Rightarrow 2a - \frac{3}{a} = 5$

$$2a^2 - 5a - 3 = 0$$

$$2a^2 - 6a + a - 3 = 0$$

$$2a(a-3) + 1(a-3) = 0$$

$$(a-3)(2a+1) = 0$$

$$\therefore a = 3 \quad \text{or} \quad a = -\frac{1}{2}$$

$$\frac{2x-1}{x+3} = 3 \quad \text{or} \quad \frac{2x-1}{x+3} = -\frac{1}{2}$$

$$2x-1 = 3x+9 \quad \text{or} \quad 4x-2 = -x-3$$

$$-x = 10 \quad \text{or} \quad 5x = -3+2$$

$$x = -10 \quad \text{or} \quad x = -\frac{1}{5}$$

14. (B) Given $(\alpha - \beta)^2 = 144$

$$\alpha - \beta = 12 \quad \rightarrow (1)$$

$$\text{But } \alpha + \beta = -22 \quad \rightarrow (2)$$

$$\text{Solving (1) \& (2) } \alpha = -5 \text{ \& } \beta = -17$$

$$\text{But } \alpha\beta = k$$

$$\therefore k = -5 \times -17 = 85$$

15. (D) Given In $\triangle ABC$, $DE \parallel BC$

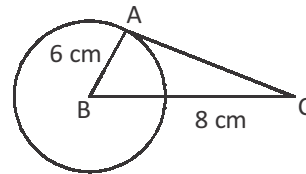
$$\therefore \triangle ADE : \triangle ABC \{ \because \text{A.A.A Similarity} \}$$

$$\therefore \frac{AD}{AB} = \frac{DE}{BC}$$

$$\Rightarrow \frac{2 \text{ cm}}{4.5 \text{ cm}} = \frac{4 \text{ cm}}{BC}$$

$$BC = 9 \text{ cm.}$$

16. (B)



Given : In $\triangle ABC$, $AB = 6 \text{ cm}$, $BC = 8 \text{ cm}$

$$\angle A = 90^\circ$$

$$\therefore BC^2 = AB^2 + AC^2$$

$$(8 \text{ cm})^2 = (6 \text{ cm})^2 + AC^2$$

$$64 \text{ cm}^2 - 36 \text{ cm}^2 = AC^2$$

$$AC = \sqrt{28} \text{ cm} = 2\sqrt{7} \text{ cm}$$

17. (C) Let $c \left(\frac{3}{5}, \frac{11}{5} \right)$ divides the join of A (3, 5)

and B (-3, -2) in the ratio $m_1 : m_2$

$$\therefore c \left(\frac{3}{5}, \frac{11}{5} \right) = \left(\frac{-3m_1 + 3m_2}{m_1 + m_2}, \frac{-2m_1 + 5m_2}{m_1 + m_2} \right)$$

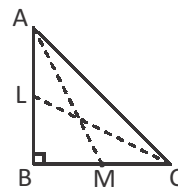
$$= \frac{11}{5} = \frac{-2m_1 + 5m_2}{m_1 + m_2}$$

$$11 m_1 + 11 m_2 = -2 m_1 + 5 m_2$$

$$21 m_1 = 4 m_2$$

$$\frac{m_1}{m_2} = \frac{4}{21} \Rightarrow m_1 : m_2 = 4 : 21$$

18. (C)



$$\text{Given } BL = \frac{AB}{2} \text{ \& } BM = \frac{BC}{2}$$

In $\triangle BLC$, $\angle B = 90^\circ$

$$CL^2 = BL^2 + BC^2$$

$$CL^2 = \left(\frac{AB}{2} \right)^2 + BC^2$$

$$= \frac{AB^2}{4} + BC^2$$

$$CL^2 = \frac{AB^2 + 4BC^2}{4}$$

$$4 CL^2 = AB^2 + 4BC^2$$

19. (D) Given $a = 64, d = 60 - 64 = -4$

But $S_n = \frac{n}{2} [2a + (n-1)d]$

$544 = \frac{n}{2} [128 + (n-1)(-4)]$

$1088 = n[128 - 4n + 4]$

$1088 = n[132 - 4n]$

$1088 = 4n [33 - n]$

$272 = 33n - n^2$

$n^2 - 33n + 272 = 0$

$n^2 - 16n^2 - 17n + 272 = 0$

$n = 16$ (or) 17 .

20. (B) $\angle POQ = 180^\circ - \angle POR = 180^\circ - 130^\circ = 50^\circ$

In $\triangle POQ, \angle PQO = 90^\circ$ & $\angle POQ = 50^\circ$

$\therefore \angle OPQ = 40^\circ$

21. (C) Given volume of $y = \frac{1}{2}$ of volume of X

$\frac{1}{3} \pi r^2 h = \frac{1}{2} \times \frac{1}{3} \pi R^2 h_2$

$r^2 h_1 = \frac{1}{2} \times (3r)^2 \times h_2$

$\frac{h_1}{h_2} = \frac{9}{2}$

$\therefore \frac{h_1}{h_2} = \frac{9}{2}$

22. (A) Given $mx - ny = m^2 + n^2 \rightarrow (1)$

& $x + y = 2m$

$\therefore mx + my = 2m^2 \rightarrow (2)$

eq (2) & (1) $\Rightarrow my + ny = 2m^2 - m^2 - n^2$

$(m + n) y = m^2 - n^2$

$y = (m - n)$

$x + m - n = 2m$

$x = 2m - m + n$

$x = m + n$

23. (A) $\triangle OPD : \triangle OQB$ [Q.A.A Similarity]

$\therefore \frac{OP}{OQ} = \frac{PD}{QB}$

$\left(\frac{\frac{h}{2}}{h} \right) = \frac{PD}{QB}$

$\frac{1}{2} = \frac{PD}{R}$

\therefore Volumes ratio of upper part and frustum

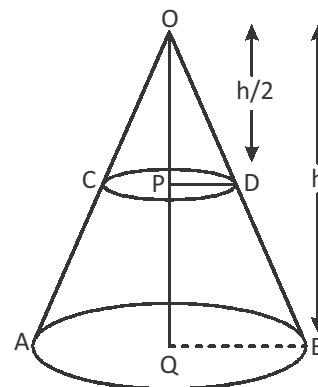
= Upper cone volume : Total cone volume - upper cone volume

= $\frac{1}{3} \pi \left(\frac{R}{2} \right)^2 \left(\frac{h}{2} \right) : \frac{1}{3} \pi R^2 h - \frac{1}{3} \pi \left(\frac{R}{2} \right)^2 \left(\frac{h}{2} \right)$

= $\frac{1}{3} \pi \frac{R^2 h}{8} : \frac{1}{3} \pi R^2 H \left[1 - \frac{1}{8} \right]$

= $\frac{1}{8} : \frac{7}{8}$

= $1 : 7$



24. (C) Let $\sqrt{x} = a$ & $\sqrt{y} = b$

$\therefore 2a + 3b = 17 \rightarrow (1)$

$3a - 2b = 6 \rightarrow (2)$

$4a + 6b = 34 \rightarrow (1) \times 2$

$9a - 6b = 18 \rightarrow (2) \times 3$

$13a = 52$

$a = 4$ then $b = 3$

$\therefore \sqrt{y} = 3$

Squaring on both sides

$y = 9$.

25. (B) Equidistant chords are equal

\therefore All tangents are same length.

PHYSICS

26. (D) Power dissipated from the lamp = VI
= 240 V × 0.5 A = 120 W
Energy dissipated in 5 minutes = Pt
= 120 W × 5 × 60 s
= 36 000 J

27. (B) $m = \frac{I}{O} = \frac{v}{u} = \frac{3}{1}$

$$\therefore v = 3u$$

$$\text{or } \frac{v}{u} = \frac{3}{1}$$

When the position of the object and the image is interchanged then, $u' = v$ and $v' = u$

$$\therefore m = \frac{v'}{u'} = \frac{u}{v}$$

$$\therefore m = \frac{1}{3}$$

Magnification is 1 / 3

28. (A) Placement of another identical prism in an inverted position with respect to the first and allowing the colours of spectrum to pass through it will change the spectrum into white light.

29. (A) The strength of the magnetic field at a distance r from a long, straight wire carrying a current I is proportional to I/r , that is, B is inversely proportional to r . So, at $1/2$ the distance from the wire, the magnetic field will be twice as strong.

30. (B) When magnification is + 2.

$$u = -x$$

$$v = -2x$$

$$f = +20$$

Using $\frac{1}{v} - \frac{1}{u} = \frac{1}{f}$ we get

$$\frac{1}{-2x} + \frac{1}{x} = \frac{1}{20}$$

$$\text{or } x = 10 \text{ cm}$$

To get a magnification of -2

$$u = -y$$

$$v = +2y$$

$$\text{and } f = +20$$

$$\therefore \frac{1}{2y} + \frac{1}{y} = \frac{1}{20}$$

$$\text{or } y = 30 \text{ cm}$$

$$\therefore y - x = 20 \text{ cm}$$

31. (C) Resistance, $R = \frac{\rho l}{A}$

If r be the resistance of one cut part,

$$\text{then } r = \frac{\rho(l/n)}{A} = \frac{R}{n}$$

The resistance R' of the parallel combination is given by

$$\frac{1}{R'} = \frac{1}{r} + \frac{1}{r} + \dots = \frac{n}{r}$$

$$\text{So, } R' = \frac{r}{n} = \frac{R/n}{n} = \frac{R}{n^2}$$

$$\text{Hence, } \frac{R}{R'} = \frac{n^2}{1}$$

32. (C) The actual sunrise takes place when the sun is just above the horizon. But due to refraction of sunlight caused by the atmosphere, we can see the rising sun about 2 minutes before it is actually above the horizon. When the sun is slightly below the horizon, then the sun's light coming from less dense air to more dense air is refracted downwards as it passes through the atmosphere. Because of this atmospheric refraction, the sun appears to be raised above the horizon when actually it is slightly below the horizon. So, the time from sunrise to sunset is lengthened by about $2 + 2 = 4$ minutes because of atmospheric refraction.

33. (D) Concave lens forms the virtual image of a real object. So let

$$u = -4x \text{ and } v = -x \text{ then } 3x = 10 \text{ cm}$$

$$\text{or } x = \frac{10}{3} \text{ cm}$$

$$\therefore u = -\frac{40}{3} \text{ cm}$$

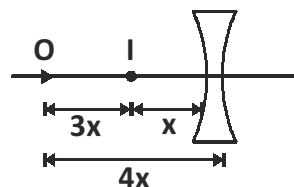
$$\text{and } v = -\frac{10}{3} \text{ cm}$$

$$\text{Substituting in } \frac{1}{f} = \frac{1}{v} - \frac{1}{u}$$

$$\text{We get } \frac{1}{f} = \frac{-3}{10} + \frac{3}{40}$$

$$\text{or } f = -\frac{40}{9}$$

$$\text{or } f = -4.4 \text{ cm}$$



34. (A) We know the relation between power (P), resistance (R) and voltage (V) is

$$P = \frac{V^2}{R}$$

$$\Rightarrow P \propto \frac{1}{R} \Rightarrow R \propto \frac{1}{P}$$

$$\text{As } R \propto \frac{1}{P}$$

$$R = \frac{1}{P} = \frac{1}{40 \text{ W}} = 0.025 \Omega$$

$$R \propto \frac{1}{P} = \frac{1}{60 \text{ W}} = 0.016 \Omega$$

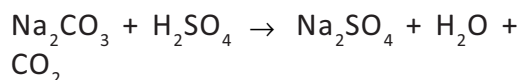
$$R \propto \frac{1}{P} = \frac{1}{100 \text{ W}} = 0.01 \Omega$$

Hence, 100 W bulb has maximum power and minimum resistance.

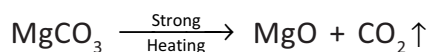
35. (C) Magnetic field lines emerge from the north pole and enter at the south pole. Therefore, as the north pole is moved upward through the loop, the upward magnetic flux increases. To oppose an increasing upward flux, the direction of the induced current will be clockwise (as seen from above) to generate some downward magnetic flux. Now, as the south pole moves away from the centre of the loop, there is a decreasing upward magnetic flux, so the direction of the induced current will be counterclockwise.

CHEMISTRY

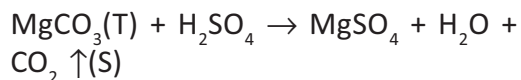
36. (D) The most abundant metal in the earth's crust is aluminium which makes up 7% of earth's crust followed by 4% of iron. The trivalent metal extracted by electrolysis is "Aluminium".
37. (B) Reaction of H_2SO_4 with BaCl_2 is a precipitation reaction whereby two solutions are mixed to form an insoluble precipitate, BaSO_4 . H^+ is not involved in the reaction:
- $$\text{Ba}^{2+} (\text{aq}) + \text{SO}_4^{-2} (\text{aq}) \rightarrow \text{BaSO}_4 (\downarrow)$$
38. (A) Ammonia being a base reacts with sulphuric acid to form ammonium sulphate (salt). It is an acid-base reaction as given below.
- $$2\text{NH}_3(\text{aq}) + \text{H}_2\text{SO}_4(\text{aq}) \rightarrow (\text{NH}_4)_2\text{SO}_4(\text{aq})$$
39. (C) Isomers have same molecular formula, molecular weight and molecular composition but different chemical properties and structural formulae because the properties are based on the position of atoms.
40. (C) CO_2 is produced in the given chemical reaction. Hence, Y is a carbonate. In general, an acid reacts with a carbonate to give a salt, H_2O and CO_2 as given below.



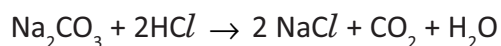
41. (B) (T) is MgCO_3 as it is insoluble in water. On strong heating of MgCO_3 , it forms MgO and CO_2 gas(S) is evolved.



When MgCO_3 reacts with dil. H_2SO_4 acid, the following are formed.



42. (B) The given formula $\text{C}_{17}\text{H}_{35}\text{COO}^-\text{Na}^+$ is of sodium stearate, a soap salt of sodium.
43. (B) In the given equation, the value of x is 2 as given below:



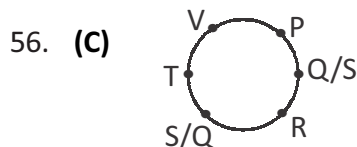
44. (A) Both P and Q solutions have pH of 2 and 6 respectively. These solutions are mixed to produce an acidic mixture.
45. (C) The IUPAC name of the given structure is Butanoic acid ($\text{C}_3\text{H}_7\text{COOH}$).

BIOLOGY

46. (B) The structural unit of chloroplast is grana.
47. (B) In the earthworms, exchange of gases takes place through skin.
48. (C) Tadpole respire by gills.
49. (A) Egg-producing animals are called oviparous.
50. (C) The excretory organs of grasshopper are Malpighian tubules.
51. (C) "Loop of Henle" is the part of nephron.
52. (B) The hormones which activate cell division in plants are cytokinins.
53. (C) Pituitary gland is called the master gland of human body.

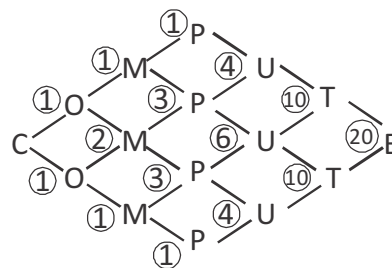
54. (D) The centre for memory and intelligence is cerebrum.
55. (C) If pancreas cannot produce enough insulin it leads to diabetes.

CRITICAL THINKING



57. (A) In fig. (X), one of the dots lies in the region common to the square and the triangle only, another dot lies in the region common to the circle and the triangle only and the third dot lies in the region common to the triangle and the rectangle only. In fig. (2), there is no region common to the square and the triangle only. In fig. (3), there is no region common to the circle and the triangle only. In fig. (4) there is no region common to the triangle and the rectangle only. Only fig. (1) consists of all the three types of regions.

58. (A)
59. (A)



There are 20 different ways to form the word "COMPUTE".

60. (B) Total number of students in the class = 61.

THE END