



**NATIONAL LEVEL SCIENCE TALENT SEARCH EXAMINATION (UPDATED)**

**CLASS - 10**  
**Question Paper Code : 1P114**

**KEY**

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

**SOLUTIONS**

**MATHEMATICS**

01. (D) Required polynomial =  $k[x^2 - x(\alpha + \beta) + \alpha\beta]$  where k is any real number other than zero.

$$= k[x^2 - x(-3) - 10]$$

$$= k(x^2 + 3x - 10)$$

$$= x^2 + 3x - 10 \text{ (OR) } 2x^2 + 6x - 20$$

$$3x^2 + 9x - 30 \text{ (OR) } \left( \frac{x^2}{2} + \frac{3x}{2} - 5 \right)$$

02. (C) Let  $x = \sqrt{4 + \sqrt{4 + \sqrt{4 + \dots \infty}}}$

$$x = \sqrt{4 + x}$$

$$x^2 = 4 + x$$

$$x^2 - x - 4 = 0$$

$$x = \frac{-(-1) \pm \sqrt{1 + 16}}{2} = \frac{\sqrt{17} + 1}{2} \text{ (or) } \frac{1 - \sqrt{17}}{2}$$

03. (D) Given  $[3 + 6 + 9 + 12 + \dots] = 1998$

$$\frac{n}{2} [2 \times 3 + (n - 1)(3)] = 1998$$

$$[6 + 3n - 3] = 1998 \times 2$$

$$3n^2 + 3n = 1998 \times 2$$

$$n^2 + n = 2 \times \frac{1998 \times 666}{3}$$

$$n^2 + 37n - 36n - 1332 = 0$$

$$(n + 37)(n - 36) = 0$$

$$n = 36 \quad [\because n = 37 \text{ rejected}]$$

$$n = -9 \text{ (or) } 8$$

04. Delete

05. (A) Given  $a_5 = 10$

$$a + 4d = 10$$

$$19 + 4d = 10 \quad [\because a = 19]$$

$$4d = 10 - 19$$

$$d = -\frac{9}{4}$$

$$a_4 = a + 3d$$

$$= 19 + 3\left(-\frac{9}{4}\right)$$

$$= 19 - \frac{27}{4}$$

$$= 19 - 6.75$$

$$\therefore c = a_4 = 12.25$$

06. (C)  $\frac{2}{k} = \frac{-8}{4} \neq \frac{3}{10}$

$$\therefore \frac{2}{k} = \frac{-8}{4}$$

$$\therefore k = \frac{8}{-8} = -1$$

07. (B) Let  $\alpha, \beta, \gamma$  are the zeros of  $ax^3 + bx^2 + cx + d$

$$\text{Given } \alpha + \beta + \gamma = -\frac{b}{a} = \frac{1}{4} = \frac{4}{16}$$

$$\Rightarrow a = 16 \text{ \& } b = -4$$

$$\alpha\beta + \beta\gamma + \gamma\alpha = \frac{c}{a} = -\frac{3}{2} = \frac{24}{16}$$

$$\Rightarrow c = -24$$

$$\alpha\beta\gamma = -\frac{d}{a} = \frac{9}{16} \Rightarrow d = -9$$

$\therefore$  Required polynomial

$$= 16x^3 - 4x^2 - 24x - 9$$

08. (C) Let the quadratic polynomial in  $x$  be  $ax^2 + bx + c$

when divided by  $(x - 1)$

$$\text{remainder} = f(1) = a(1)^2 + b(1) + c = a + b + c$$

It is given to be 11

$$\therefore a + b + c = 11 \quad \dots\dots\dots (1)$$

When divided by  $(x - 2)$

$$\text{remainder} = f(2) = a(2)^2 + b(2) + c = 4a + 2b + c$$

$$\therefore 4a + 2b + c = 22 \quad \dots\dots\dots (2)$$

When divided by  $x - 3$

$$\text{remainder} = f(3) = a(3)^2 + b(3) + c = 9a + 3b + c$$

$$\therefore 9a + 3b + c = 37 \quad \dots\dots\dots (3)$$

Solving (1), (2) and (3) we get

$$a = 2, b = 5 \text{ and } c = 4$$

$$\text{required polynomial} = 2x^2 + 5x + 4$$

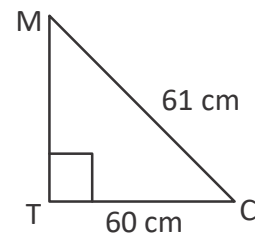
09. (D) In  $\triangle MCT$ ,  $\angle T = 90^\circ \Rightarrow MC^2 = MT^2 + TC^2$

$$\Rightarrow (61 \text{ cm})^2 = MT^2 + (60 \text{ cm})^2$$

$$3721 \text{ cm}^2 - 3600 \text{ cm}^2 = MT^2$$

$$\therefore MT = \sqrt{121 \text{ cm}^2} = 11 \text{ cm}$$

$$\therefore \sin C = \frac{MT}{MC} = \frac{11 \text{ cm}}{61 \text{ cm}} = \frac{11}{61}$$



10. (C)  $AB = \sqrt{(4-0)^2 + (-5+8)^2}$

$$= \sqrt{16 + 9} = 5 = 0$$

$$BC = \sqrt{(0-4)^2 + (-2+5)^2} = 5 = a$$

$$CA = \sqrt{(0-0)^2 + (-2+8)^2} = 6 = b$$

$$s = \frac{a+b+c}{2} = \frac{(5+5+6) \text{ units}}{2} = 8 \text{ units}$$

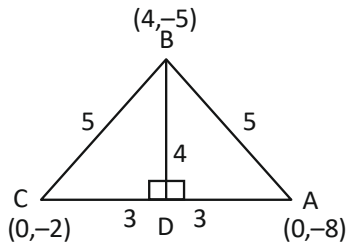
$$\text{Area of } \triangle ABC = \sqrt{s(s-a)(s-b)(s-c)}$$

$$= \sqrt{8 \times (8-5)(8-6)(8-5)}$$

$$= \sqrt{8 \times 3 \times 2 \times 3}$$

$$= 4 \times 3 \text{ sq units}$$

$$= 12 \text{ sq. units (OR)}$$



$$\text{Area of } \triangle ABC = \frac{1}{2} AC \times BD = \frac{1}{2} \times 6 \times 4$$

$$= 12 \text{ sq. units}$$

11. (D) Given  $a + 3d = 8 \rightarrow \text{eq. (1)}$

$$\frac{12^6}{2} [2a + 11d] = 156$$

$$2a + 11d = \frac{156}{6} = 26 \rightarrow \text{eq. (2)}$$

$$2a + 11d = 26 \rightarrow \text{eq. (2)}$$

$$2a + 6d = 16 \rightarrow \text{eq. (1)} \times 2$$

$$\begin{array}{r} (-) \quad (-) \quad (-) \\ \hline \end{array}$$

$$5d = 10$$

$$d = 2$$

$$a + 3(2) = 8$$

$$a = 8 - 6 = 2$$

$$\text{Given } a_p = 200$$

$$2 + (p-1)(2) = 200$$

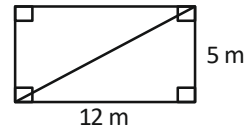
$$2[\cancel{x} + p - \cancel{x}] = 200$$

$$p = \frac{200}{2} = 100$$

12. (B) Given  $2(l+b) = 34 \text{ m} \Rightarrow l+b = 17 \text{ m}$

$$b = 17 - l$$

$$\text{Given } lb = 60 \text{ m}^2$$



$$l(17-l) = 60$$

$$17l - l^2 = 60$$

$$0 = l^2 - 17l + 60$$

$$l^2 - 12l - 5l + 60 = 0$$

$$l(l-12) - 5(l-12) = 0$$

$$(l-12)(l-5) = 0$$

$$\therefore l = 12 \text{ or } 5$$

$$l = 12 [\because 12 > 5]$$

$$\therefore b = 17 - l = 17 - 12 = 5$$

$$\text{Diagonal} = \sqrt{l^2 + b^2} = \sqrt{12^2 + 5^2}$$

$$= 13$$

13. (B) Given  $a = \frac{1}{\sin\theta} - \sin\theta$

$$= \frac{1 - \sin^2\theta}{\sin\theta} = \frac{\cos^2\theta}{\sin\theta} = \cos\theta \times \cot\theta$$

$$b = \frac{1}{\cos\theta} - \cos\theta = \frac{1 - \cos^2\theta}{\cos\theta} = \frac{\sin^2\theta}{\cos\theta} = \tan\theta \times \sin\theta$$

$$\therefore a^2 b^2 (a^2 + b^2 + 3) = \cot^2\theta \cos^2\theta \times \tan^2\theta \sin^2\theta (\cot^2\theta \cos^2\theta + \tan^2\theta \sin^2\theta + 3)$$

$$= \sin^2\theta \cos^2\theta \left( \frac{\cos^2\theta}{\sin^2\theta} \times \cos^2\theta + \frac{\sin^2\theta}{\cos^2\theta} \times \sin^2\theta + 3 \right)$$

$$= \cancel{\sin^2\theta \cos^2\theta} \left( \frac{\cos^6\theta + \sin^6\theta + 3\sin^2\theta \cos^2\theta}{\cancel{\sin^2\theta \cos^2\theta}} \right)$$

$$= (\cos^2\theta)^3 + (\sin^2\theta)^3 + 3\sin^2\theta \cos^2\theta (\sin^2\theta + \cos^2\theta)$$

$$= (\sin^2\theta + \cos^2\theta)^3 = 1$$

14. (A)  $(3^2)^{x+2} - 6 \times 3^{x+1} + 1 = 0$

$$(3^x)^2 \times 3^4 - 6 \times 3 \times 3^x + 1 = 0$$

$$81a^2 - 18a + 1 = 0 \text{ where } 3^x = a$$

$$(9a - 1)^2 = 0$$

$$\therefore 9a - 1 = 0$$

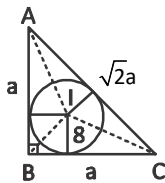
$$a = \frac{1}{9} = 3^x$$

$$3^{-2} = 3^x$$

$$x = -2$$

15. (D) Given  $n = 8x + 7$   
 $\therefore 2n + 4 = 2(8x + 7) + 4 = 16x + 14 + 4 = 16x + 18$   
 $= 16x + 16 + 2$   
 $= 8(2x + 2) + 2$   
 $= 8y + 2$   
 $\therefore$  It leaves remainder 2 if  $(2n + 4)$  is a divided by 8

16. (C) If 'I' is the centre of the circle and  $AB = BC = a$  cm then



$$AC = \sqrt{2} a \quad (\because \text{pythagorus theorem})$$

$$\text{Area of } \triangle ABC = \text{Area of } \triangle AIB$$

$$+ \text{Area of } \triangle BIC + \text{Area of } \triangle AIC$$

$$\frac{1}{2} a^2 = \frac{1}{2} \times a \times 8 \text{ cm} + \frac{1}{2} \times a \times 8 \text{ cm}$$

$$+ \frac{1}{2} \times \sqrt{2} a \times 8 \text{ cm}$$

$$\frac{1}{2} a \times a = \frac{1}{2} a(8 + 8 + 8\sqrt{2}) \text{ cm}$$

$$a = (16 + 8\sqrt{2}) \text{ cm}$$

$$\text{Perimeter} = 2a + \sqrt{2} a$$

$$= [2(16 + 8\sqrt{2}) + \sqrt{2}(16 + 8\sqrt{2})] \text{ cm}$$

$$= (32 + 16\sqrt{2} + 16\sqrt{2} + 16) \text{ cm}$$

$$= (48 + 32\sqrt{2}) \text{ cm}$$

17. (C) In option 'C':  $\frac{a_1}{a_2} = \frac{b_1}{b_2} = \frac{c_1}{c_2} = -\frac{1}{4}$

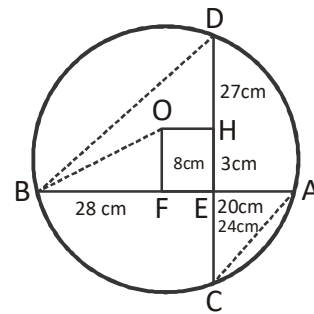
18. (C) Given  $\frac{1}{3} \pi \times 4^2 \times h = \frac{4}{3} \pi (5^3 - 3^3)$

$$h = \frac{4(125 - 27)}{16}$$

$$= \frac{98}{4}$$

$$= 24.5 \text{ cm}$$

19. (B) Const: Join AC & BD



$$\triangle BED \sim \triangle CEA \quad [\because \text{A.A similarity}]$$

$$\therefore \frac{BE}{CE} = \frac{ED}{EA} \Rightarrow \frac{36 \text{ cm}}{74 \text{ cm}} = \frac{ED}{20 \text{ cm}}$$

$$ED = \frac{20 \times 3}{74} \text{ cm} = 30 \text{ cm}$$

$$HE = OF = ED - DH$$

$$= 30 \text{ cm} - \frac{CD}{2} = 3 \text{ cm}$$

$$OB^2 = BF^2 + FO^2 = 28^2 + 3^2$$

$$= 784 + 9 = 793$$

$$\text{Area of the circle} = \pi r^2 = 793 \pi \text{ cm}^2$$

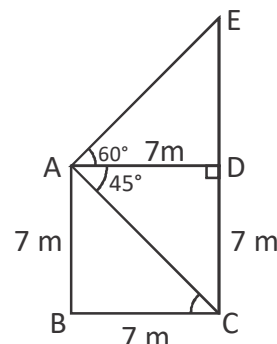
20. (A) In  $\triangle ABC$ ,  $\angle ACB = \angle CAD = 45^\circ$

[Angle of the elevation = Angle of the depression]

$$\text{In } \triangle ABC, \tan 45^\circ = \frac{AB}{BC}$$

$$1 = \frac{7 \text{ m}}{BC}$$

$$BC = 7 \text{ m}$$



$$\therefore AD = BC = 7\text{m}$$

$$\text{In } \triangle ADE, \tan 60^\circ = \frac{DE}{AD}$$

$$\sqrt{3} = \frac{DE}{7\text{m}}$$

$$DE = 7\sqrt{3}\text{ m}$$

$$\text{Height of the power} = CE = CD + DE$$

$$= 7\text{m} + 7\sqrt{3}\text{ m}$$

$$= 7(1 + \sqrt{3})\text{ m}$$

$$= 7 \times 2.732\text{ m}$$

$$= 19.124\text{ m}$$

21. (B) Given  $r = \frac{d}{2} = \frac{42}{2} = 21\text{ cm}$

$$\text{Given } n + 2r = 90\text{ cm}$$

$$\text{TSA of the toy} = 2\pi r^2 + 2\pi rh + 2\pi r^2$$

$$= 2\pi r(r + h + r)$$

$$= 2 \times \frac{22}{7} \times 21^3\text{ cm}(h + 2r)$$

$$= 132\text{ cm} \times 90\text{ cm}$$

$$= 11880\text{ cm}^2$$

$$\text{Total cost of painting}$$

$$= 11,880 \cancel{\text{ cm}^2} \times \frac{70\text{ p}}{1\cancel{\text{ cm}^2}}$$

$$= \text{Rs. } 8,316.00\text{ paisa}$$

$$= \text{Rs. } 8316$$

22. (B) Factors of  $-3$  are  $3$  (or)  $-3$

$$\text{Given } p(x) = x^3 - 17x^2 + 43x - 3$$

$$p(3) = 3^3 - 17(3)^2 + 43(3) - 3$$

$$= 27 - 153 + 129 - 3$$

$$= 156 - 156$$

$$p(3) = 0 \text{ (} x - 3 \text{) is a factor of } p(x)$$

$$x^3 - 17x^2 + 43x - 3 = x^3 - 3x^2 - 14x^2 + 42x + x - 3$$

$$= x^2(x - 3) - 14x(x - 3) + 1(x - 3)$$

$$= (x - 3)(x^2 - 14x + 1)$$

$$x^2 - 14x + 1 = 0$$

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

$$= \frac{-(-14) \pm \sqrt{(-14)^2 - 4 \times 1 \times 1}}{2 \times 1}$$

$$= \frac{14 \pm \sqrt{196 - 4}}{2}$$

$$= \frac{14 \pm \sqrt{192}}{2}$$

$$= \frac{14 \pm \sqrt{64 \times 3}}{2}$$

$$= \frac{14 \pm 8\sqrt{3}}{2}$$

$$= \frac{2(7 \pm 4\sqrt{3})}{2}$$

$$= 7 \pm 4\sqrt{3}$$

23. (D) Let  $o$  be the centre of the circle. Join  $BO$  and  $CO$ .

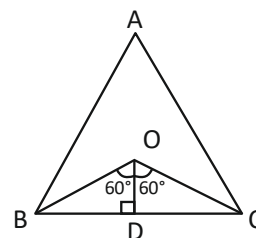
$$\text{Now, } \angle BAC = 60^\circ \Rightarrow \angle BOC = 2(\angle BAC) = 120^\circ$$

$$\text{Draw } OD \perp BC. \text{ Then, } \angle BOD = \angle COD = 60^\circ.$$

From right  $\triangle BDO$ , we have

$$\frac{OD}{OB} = \cos 60^\circ = \frac{1}{2} \Rightarrow \frac{OD}{42\text{ cm}} = \frac{1}{2}$$

$$\Rightarrow OD = \left(42 \times \frac{1}{2}\right)\text{ cm} = 21\text{ cm,}$$



$$\text{and } \frac{BD}{OB} = \sin 60^\circ = \frac{\sqrt{3}}{2} \Rightarrow \frac{BD}{42 \text{ cm}} = \frac{\sqrt{3}}{2}$$

$$\Rightarrow BD = \left( 42 \times \frac{\sqrt{3}}{2} \right) \text{ cm} = 21\sqrt{3} \text{ cm.}$$

$$\therefore BC = 2 \times BD = (2 \times 21\sqrt{3}) \text{ cm} = (42\sqrt{3}) \text{ cm}$$

Area of the designed region

= (area of the circle with  $r = 42 \text{ cm}$ )

– (area of equilateral  $\triangle ABC$  with  $a = 42\sqrt{3} \text{ cm}$ )

$$= \left( \pi r^2 - \frac{\sqrt{3}}{4} a^2 \right) = \left\{ \left( \frac{22}{7} \times 42 \times 42 \right) - \left( \frac{1.73}{4} \times (42\sqrt{3})^2 \right) \right\} \text{ cm}^2$$

$$\left\{ 5544 - \left( \frac{1.73}{4} \times 1764 \times 3 \right) \right\} \text{ cm}^2$$

$$= (5544 - 2288.79) \text{ cm}^2$$

$$= 3255.21 \text{ cm}^2$$

24. (C) Given  $a_7 = a + 6d = -20$

$$s_{13} = \frac{13}{2} [2a + 12d]$$

$$= \frac{13}{2} \times [a + 6d]$$

$$= 13 \times -20$$

$$= -260$$

25. (A) Given  $\cos \theta = 1 - \cos^2 \theta = \sin^2 \theta$

$$\therefore \sin^{12} \theta + 3\sin^{10} \theta + 3\sin^8 \theta + \sin^6 \theta = (\sin^4 \theta)^3$$

$$+ 3\sin^8 \theta \sin^2 \theta + 3\sin^4 \theta \sin^4 \theta + (\sin^2 \theta)^3$$

$$= (\sin^4 \theta + \sin^2 \theta)^3$$

$$= (\cos^2 \theta + \cos \theta)^3$$

$$= 1^3 = 1$$

## PHYSICS

26. (B) The image distance remains positive (virtual and behind the mirror), while the object distance is negative (in front of the mirror).

Substituting into the mirror formula

$$\frac{1}{f} = \frac{1}{v} + \frac{1}{u},$$

the small change in  $v$  for a large change in  $u$  implies the mirror has a large radius of curvature, typical of a convex mirror with  $f \approx 10 \text{ m}$ .

This also explains why convex mirrors are used in vehicles – they give a wider field of view but show distant objects as smaller and closer.

27. (C) Deflection remains same.

Explanation : The deflection of the magnetic compass is caused by the magnetic field generated by the electric current flowing through the wire. This scenario is a conceptual homework problem, and the solution relies on the formula for the magnetic field produced by a long, straight current-carrying wire.

The magnitude of the magnetic field ( $B$ ) at a perpendicular distance ( $r$ ) from an infinitely long straight wire carrying a current ( $I$ ) is given by the formula:

$$B = \frac{\mu_0 I}{2\pi r}$$

28. (C) I, II and III.

Reason: (I) is a ray through the optical centre – it goes straight through undeviated (correct).

(II) is a ray parallel to the principal axis – it is refracted through the far focal point  $F_2$  (correct).

(III) is a ray aimed at the near focal point  $F_1$  – it emerges parallel to the principal axis (correct).

(IV) does not follow any of the standard ray-tracing rules (its refracted direction is wrong), so it is incorrect.

29. (A) At high altitudes, the atmosphere becomes thinner, meaning fewer air molecules are available for Rayleigh scattering.

Since scattering intensity is proportional

to  $\frac{1}{\lambda^4}$ , the small amount of scattered light that reaches the eye consists mainly of shorter wavelengths (blue/violet).

The reduced total scattering also means less diffused light, so the sky appears darker and deeper blue – approaching black at near-space altitudes.

30. (B) Mirror formula (normal sign convention):

$$\frac{1}{v} + \frac{1}{u} = \frac{1}{f}$$

For a concave mirror  $f < 0$ . Put  $f = -F$  with  $F > 0$ . Solve for  $v$ :

$$v = \frac{uf}{u-f} = \frac{u(-F)}{u+F} = -\frac{uF}{u+F}$$

Write  $u = U$  (object to left, so  $U > 0$ ). Then

$$v = \frac{UF}{F-U}$$

Key features (corrected): Vertical asymptote: occurs when denominator of

$v(u)$  for the form  $-\frac{uF}{u+F}$  is zero  $\Rightarrow u + F = 0$ , i.e.  $u = -f$ . So vertical asymptote at  $u = -f$  (a negative value).

Horizontal asymptote: as  $|u| \rightarrow \infty$ ,  $v \rightarrow f$ . So horizontal asymptote at  $v = f$ . (Both asymptotes lie on the negative axes because  $f < 0$ .)

Branch locations: If  $|u| > |f|$  (object beyond the focus; equivalently  $U > F$ ) then  $F - U < 0$  so  $v < 0$ . Thus ( $u < 0$ ,  $v < 0$ )— third quadrant (real image).

If  $|u| < |f|$  (object between pole and focus;  $U < F$ ) then  $F - U > 0$  so  $v > 0$ . Thus ( $u < 0$ ,  $v > 0$ )— second quadrant (virtual image).

Therefore the curve has two branches in quadrants II and III, with asymptotes at  $u = -f$  (vertical) and  $v = f$  (horizontal). That is exactly the shape shown in option (B).

A useful checkpoint: when  $u = v = 2f$  (both are negative for a concave mirror),

the mirror equation holds ( $\frac{1}{2f} + \frac{1}{2f} = \frac{1}{f}$ ), so the point ( $u = 2f$ ,  $v = 2f$ ) (third quadrant) lies on the curve – not the origin.

31. (C) Find the new near point.

Using +2.0 D ( $f = +0.50$  m), he now sees clearly at 40 cm.

$$\text{Lens formula: } \frac{1}{f} = \frac{1}{v} - \frac{1}{u}$$

$$2 = \frac{1}{-N_{\text{new}}} - \frac{1}{-0.40}$$

$$2 = -\frac{1}{N_{\text{new}}} + 2.5 \Rightarrow N_{\text{new}} = 2 \text{ m}$$

Find required power to restore working distance to 25 cm.

Now, object at  $u = -0.25$  m must form a virtual image at the near point  $v = -2$  m.

$$\frac{1}{f} = \frac{1}{-2} - \frac{1}{-0.25} = -0.5 + 4 = 3.5$$

So the required lens power is +3.5 D.

Correct option: (C)

32. (A) The formation of a circle by a rainbow and its reflection on a water surface indicates that the Sun is near the horizon. When the Sun is low, the antisolar point rises, allowing the direct rainbow in the sky and its reflected image in water to together appear as a complete circle. Hence, the correct answer is Option (A).

33. (A) To find the direction of force on a current-carrying wire in a magnetic field, use the rule:  $\vec{F} = I(\vec{L} \times \vec{B})$

Current  $I$ : left  $\rightarrow$  right ( $\rightarrow$ )

Magnetic field  $B$ : into the page ( $\otimes$ )

Use right-hand rule:

Point fingers in direction of current ( $\rightarrow$ ), curl them into the page (8).

Your thumb points upward.

Correct Answer: (A) Upward

34. (A) Image appears brighter but more blurred.

Explanation (short and clear): When the pupil becomes larger, more light enters the eye  $\rightarrow$  brighter image.

But a larger pupil also increases spherical and chromatic aberrations, reducing the depth of field  $\rightarrow$  blurrier image.

So the vision becomes brighter but less sharp.

35. (B) Lenz's law

Explanation (short and clear): Lenz's law tells us the direction of induced current in a coil by stating that the induced current always opposes the change that produces it.

So, when the magnet moves toward coil B, Lenz's law helps determine which ends of coils A and B (Q and R) become north or south poles.

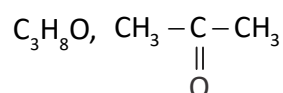
Therefore, polarity determination is based on Lenz's law.

### CHEMISTRY

36. (A) Calcium gives away two electrons, being in Group II of the periodic Table. Zinc will give away two electrons to form the  $Zn^{2+}$  ion. Nitrogen, being in Group V, will gain three electrons to form  $N^{3-}$  ion. Iodine, being in Group VII, will gain one electron.

37. (D) In a redox reaction, one substance is oxidised while the other substance is reduced.

38. (D) Propanone structure has three carbon chains with a central carbon atom double-bonded to an oxygen atom and the single bonded to two methyl ( $CH_3$ ) groups. It is the simplest ketone and has the molecular formula



39. (C) To change colour of an universal indicator from yellow to red, pH need to be increased by 4 times i.e.,  $[H^+]$  increases by  $10^4$  times.

40. (B) In the given reactions, metal oxides are reduced to metal.

41. (C) Decomposition of calcium carbonate is balanced.

42. (D) Carbon does not show semi metallic properties.

43. (C) Sodium hydroxide is a base that dissolves in water to form a solution of pH greater than 7.

44. (D)  $Na_2SO_4 + BaCl_2 \rightarrow BaSO_4 + 2NaCl$ . The given reaction is a double displacement reaction as there is mutual exchange of radicals between two compounds.

45. (B) Aluminium is a metal which forms an invisible protective layer and prevents further oxidation. Aluminium oxide is the covering of film formed with its chemical formula,  $Al_2O_3$ .

### BIOLOGY

46. (C) He can use the Benedict's test to test the presence of reducing sugars, and the iodine test for the presence of starch. The Biuret test is used to indicate the presence of proteins while the ethanol-emulsion test is used to indicate the presence of fats.

47. (B) With his bile duct blocked, the patient will be unable to secrete bile into his duodenum. Bile emulsifies fats and this increases the surface area of the fat globules for lipase to act on. Without bile, fat digestion would be reduced and thus a low-fat diet should be recommended. Red meat, fried chicken, ice cream, sausages and cheese contain large amounts of fat and should not be recommended. Baked beans are rich in protein, rice is rich in starch and watermelon is rich in sugar. They do not have particularly a high fat content.



48. (B) The most direct factors that are necessary for photosynthesis to proceed are carbon dioxide, water, light and chlorophyll.
49. (A) The biconcave shape of red blood cells is important for enhancing their surface area to volume area ratio. This maximises the rate of exchange of gases with their environment, i.e., the uptake and release of oxygen and carbon dioxide.
50. (C) Structures P and Q form a vascular bundle. The xylem is closer to the upper surface of the leaf (which lacks stomata in this diagram) and the phloem is closer to the lower surface (which contains stomata).
51. (D) P refers to the alveolus. It increase surface area for gaseous exchange.
52. (A) New plants develop from buds produced in the notches along the leaf margin.  
In Bryophyllum, small buds grow in the notches of its leaves. When these buds fall on soil, they develop into new plants, showing asexual reproduction.
53. (B) Dimple character is dominant over the character not having dimples. In the given cross there is a 50% of chance of getting dimples
54. (A) Reproduction is the act or process that produces young living things. Living things reproduce to ensure the continuity of their own kind.  
The fusion of a sperm and an egg is called fertilization.
55. (D) P - iii; Q - iv; R - i; S - ii

### CRITICAL THINKING

56. (A) Marble X is traveling at a higher speed (98 km/h) than Marble Y (65 km/h) in the same direction. Therefore, Marble X will eventually collide with Marble Y.
- According to the principle of conservation of momentum, during a collision between two objects, momentum is transferred from the faster object to the slower object.
  - After the collision, Marble Y will gain momentum and speed, causing it to roll at a faster rate, which makes statement (iv) correct.
  - Marble X will lose some momentum and speed but will continue to roll in the same direction because it was initially moving faster and the collision is head-on, which makes statement (i) correct.
  - Statements (ii), (iii), and (v) are incorrect because Marble X will not roll in the opposite direction or stop (unless specific extreme conditions not mentioned are met), and Marble Y's speed will change.
  - Therefore, the events described in (i) and (iv) will happen.

Based on the information provided, the conclusion that ball X will stop after the collision is not necessarily correct if we consider only conservation of momentum.

Statement (iii) : "Marble X will stop rolling once it hits marble Y"

This happens only in a perfectly elastic collision.

If the collision is:

- partially elastic or inelastic (very common in real marbles),
- then X will slow down, but will not stop completely.

Since the question does not specify elastic collision, we cannot assume (iii).

So Option B depends on an extra assumption → not valid.

57. (D) Data inadequate

58. (C) Bench I     P    T    S

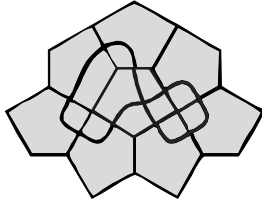
Bench II     U    Q

Bench III    V    R

= Boy     = Girl

QRS are group of girls.

59. (A,C)



60. (C) 4