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# NATIONAL LEVEL SCIENCE TALENT SEARCH EXAMINATION

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

## KEY

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 1. D | 2. C | 3. D | 4. C | 5. A | 6. C | 7. B | 8. B | 9. D | 10. C |
| 11. D | 12. A | 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. B | 32. C | 33. C | 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. A | 52. A | 53. B | 54. A | 55. D | 56. A | 57. D | 58. C | 59. A | 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.

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

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

$= x^2 + 3x - 10$ (OR) $2x^2 + 6x - 20$

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

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

$x = \sqrt{4 + x}$

$x^2 = 4 + x$

$x^2 - x - 4 = 0$

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

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

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

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

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

$n^2 + n = 2 \times \frac{\cancel{1998}^{666}}{\cancel{3}_1}$

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

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

$n = 36$ [$\because$ n = 37 rejected]

$n = -9$ (or) 8

04. (C) Given $\angle A = \angle CBD$

$\angle ABD = \angle C$ [$\because \angle D = 90°$]

$\therefore$ $\Delta ADB \sim \Delta BDC$ [$\because$ A.A similarity]

$\therefore$ $\frac{AB}{BC} = \frac{BD}{DC} \Rightarrow \frac{5.7\text{ cm}}{BC} = \frac{3.8\text{ cm}}{5.4\text{ cm}}$

$\therefore$ BC = 8.1 cm

05. (A) Given $a_5 = 10$

$a + 4d = 10$

$19 + 4d = 10$ [$\because$ 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 $ax^3 + bx^2 + cx + d$

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

$\Rightarrow a = 16$ & $b = -4$

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

$\Rightarrow c = -24$

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

$\therefore$ Required polynomial = $16x^3 - 4x^2 - 24x - 9$

08. (B) Given $2(l + b) = 34$ m $l + b = 17$ m

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

$l(17 - l) = 60$

$17l - l^2 = 60$

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

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

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

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

$l = l^2$ (or) 5

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

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

Diagonal = $\sqrt{l^2 + b^2} = \sqrt{l2^2 + 5^2}$

= 13

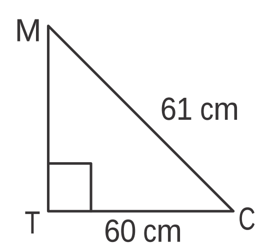
09. (D) In $\Delta MCT$, $\angle T = 90° \Rightarrow MC^2 = MT^2 + TC^2$

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

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

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

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



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

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

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

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

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

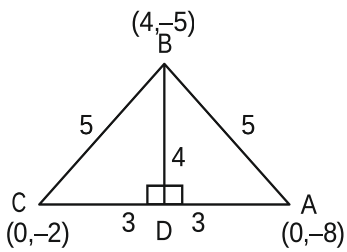
Area of $\Delta ABC = \sqrt{s(s-a)(s-b)(s-c)}$

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

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

= 4 × 3 sq units

= 12 sq. units (OR)




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

= 12 sq. units

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

$\frac{\not{12}^{\,6}}{\not{2}}[2a + 11d] = 156$

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

$$\begin{array}{rl} 2a + 11\,d = 26 & \longrightarrow \text{eq. (2)} \\ 2a + 6\,d = \ 16 & \longrightarrow \text{eq. (1)} \times 2 \\ (-)\quad (-) \quad\ (-) & \\ \hline 5d = \ 10 & \end{array}$$

d = 2

a + 3(2) = 8

a = 8 – 6 = 2

Given $a_p = 200$

2 + (p – 1) (2) = 200

$2[\not{1} + p - \not{1}] = 200$

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

12. (A) Let the quadratic polynomial be h($x$) = a$x^2$ + b$x$ + c

Given h(–1) = 7 & h(1) = –3

$\therefore$ h(–1) = a$(-1)^2$ + b(–1) + c = 7

a – b + c = 7 $\rightarrow$ 1

h(1) = a$(1)^2$ + b(1) + c = –3

a + b + c = –3 $\rightarrow$ 2

eq. ① – ② $\Rightarrow$ –2b = 7 + 3 = 10

$b = \frac{10}{-2} = -5$

substitute b = –5 in eq 1 $\Rightarrow$ a + 5 + c = 7

$\therefore$ a + c = 7 – 5 = 2

If a = c = 1 $\Rightarrow$ h($x$) = $x^2$ – 5$x$ + 1

$$\begin{array}{r|l|l} x^2-1 & \not{x^2} - 5x + 1 & 1 \\ & \not{x^2} \qquad\quad -1 & \\ & (-) \qquad\ \ (-) & \\ \cline{2-2} & \qquad -5x + 2 & \end{array}$$

If a = 2 & c = 0 then h($x$) = 2$x^2$ – 5$x$

$$\begin{array}{r|l|l} x^2-1 & \not{2x^2} - 5x & 2 \\ & \not{2x^2} \qquad -2 & \\ & (-) \qquad\ (+) & \\ \cline{2-2} & \qquad -5x + 2 & \end{array}$$

$\therefore$ The remainder = (–5$x$ + 2)

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

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

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

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

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

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

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

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

$= 1$

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

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

$81a^2 - 18a + 1 = 0$ 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 $n = 8x + 7$

$\therefore 2n + 4 = 2(8x + 7) + 4 = 16x + 14 + 4 = 16x + 18$

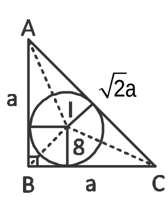
$= 16x + 16 + 2$

$= 8(2x + 2) + 2$

$= 8y + 2$

$\therefore$ 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 = $\sqrt{2}\,a$ ($\because$ pythagorus theorem)

Area of Δ ABC = Area of Δ AIB

+ Area of Δ BIC + Area of Δ AIC

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

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

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

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

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

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

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

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

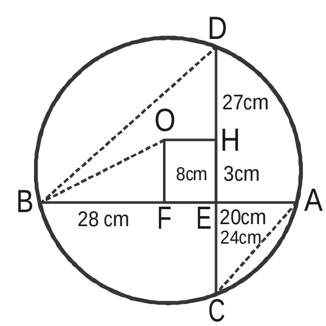
18. (C) Given $\frac{1}{\cancel{3}}\cancel{\pi}\times 4^2\times h = \frac{4}{\cancel{3}}\cancel{\pi}(5^3 - 3^3)$

$$h = \frac{\cancel{4}(125 - 27)}{\cancel{16}_4}$$

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

$= 24.5$ cm

19. (B) Const: Join AC & BD




ΔBED~ΔCEA [$\because$ A.A similarity]

$$\therefore \frac{BE}{CE} = \frac{ED}{EA} \Rightarrow \frac{\overset{3}{\cancel{36}}\text{cm}}{\underset{2}{\cancel{24}}\text{cm}} = \frac{ED}{20\text{cm}}$$

$$ED = \frac{\overset{10}{\cancel{20}}\times 3}{\underset{1}{\cancel{2}}}\text{cm} = 30\text{cm}$$

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

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

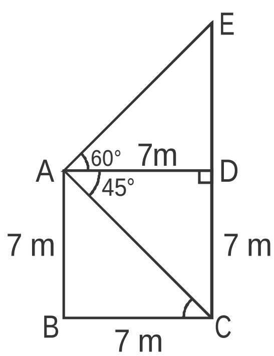
20. (A) In $\Delta ABC$, $\angle ACB = \angle CAD = 45°$

[Angle of the elevation = Angle of the depression]

In $\Delta ABC$, $\tan 45° = \frac{AB}{BC}$

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

BC = 7m




$\therefore$ AD = BC = 7m

In $\Delta ADE$, $\tan 60° = \frac{DE}{AD}$

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

$DE = 7\sqrt{3}$ m

Height of the power = CE = CD + DE

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

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

= 7 × 2.732 m

= 19.124 m

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

Given n + 2r = 90 cm

TSA of the toy = 2pr2 + 2prh + 2pr2

= 2pr (r + h + r)

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

= 132 cm × 90 cm

= 11880 cm$^2$

Total cost of painting = 11,880 cm$^2$ × $\frac{70\text{ p}}{1\text{ cm}^2}$

= Rs. 8,316.00 paisa

= Rs. 8316

22. (B) Factors of –3 are 3 (or) –3

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

$p(3) = 0$ $(x - 3)$ is a factor of $p(x)$

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

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

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

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

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

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

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

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

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

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

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

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

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

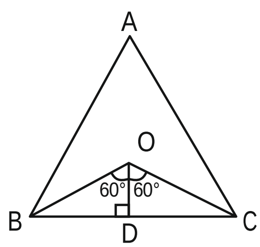
Now, $\angle BAC = 60° \Rightarrow \angle BOC = 2(\angle BAC) = 120°$.

Draw $OD \perp BC$. Then, $\angle BOD = \angle COD = 60°$.

From right $\Delta BDO$, we have

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

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




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

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

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

Area of the designed region

= (area of the circle with r = 42 cm)

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

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

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

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

$= 3255.21\text{ cm}^2$

24. (C) Given $a7 = a + 6d = -20$

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

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

$= 13 \times -20$

$= -260$

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 vremains positive (virtual and behind the mirror), while the object distance uis 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 uimplies 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 F2 (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 $|u| \to \infty$, v $\to$ 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 < 0so v < 0. Thus (u < 0, v < 0)— third quadrant (real image).

If $|u|<|f|$(object between pole and focus; U < F) then F – U > 0so 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. (B) Find the new near point.

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

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

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

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

Find required power to restore working distance to 25 cm.

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

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

So the required lens power is +3.5 D.

Correct option: (C)

32. (C) Observer is above water surface

Explanation (short): A rainbow is actually a full 360° circle, but from ground level only the upper arc is visible. When the observer is elevated above the water, they can see both: the upper part of the rainbow (direct arc), and the lower part reflected in the water, which together appear as a complete circle. This is only possible when the observer is above the water surface.

Why others are incorrect (short):

(A) Low sun helps enlarge the visible arc but does not make the full circle visible with reflection.

(B) "Below sunlight line" is not relevant to rainbow geometry.

(D) Sunlight being unpolarized is unrelated to seeing a full circular rainbow.

33. (C) 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 → right (→)

Magnetic field B: into the page (✘)

Use right-hand rule:

Point fingers in direction of current (→), curl them into the page (✘).

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 → brighter image.

But a larger pupil also increases spherical and chromatic aberrations, reducing the depth of field → 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

$$C_3H_8O,\ CH_3 - \underset{\underset{O}{\|}}{C} - CH_3$$

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 alk 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 secrets 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. (A) P refers to the thin film of moisture lining the alveolar wall. It allows oxygen gas to dissolve in it so that the oxygen will be able to diffuse through the alveolar walls and into the blood capillaries.

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) (i) and (iv) only

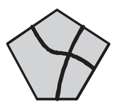
57. (D) Data inadequate

58. (C)

Bench I — [P] [T] (S)
Bench II — [U] (Q)
Bench III — [V] (R)

□ = Boy ○ = Girl

QRS are group of girls.

59. (A) 

60. (C) 4