

MATHEMATICS

1. If $a_1, a_2, a_3, \dots, a_n$ be an A.P. of non-zero terms, then find the sum:

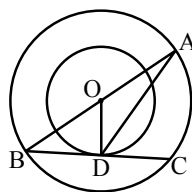
$$\frac{1}{a_1 a_2} + \frac{1}{a_2 a_3} + \dots + \frac{1}{a_{n-1} a_n}$$

- (A) $\frac{n-1}{a_1 a_n}$ (B) $\frac{n}{a_1 a_n}$ (C) $\frac{(n-1)}{a_1 a_{n-1}}$ (D) $\frac{n}{a_2 a_{n-1}}$

2. If the sum of the roots of the quadratic equation $ax^2 + bx + c = 0$ is equal to the sum of the squares of their reciprocals, then

- (A) ab^2, bc^2, ca^2 , are in A.P. (B) bc^2, ab^2, ca^2 are in A.P.
 (C) ab^2, ca^2, bc^2 are in A.P. (D) ca^2, bc^2, ab^2 are in A.P.

3. The radii of two concentric circles are 13 cm and 8 cm respectively. AB is a diameter of the bigger circle. BD is a tangent to the smaller circle touching it at D. The length of AD is



- (A) 19 cm (B) 17 cm (C) 16 cm (D) 14 cm

4. If $\frac{x^3 + ax^2 + bx + 6}{x^2 - x - 2}$ is a polynomial of degree 1 in x , then value of $a + b$ is:

- (A) -5 (B) -4 (C) -2 (D) -3

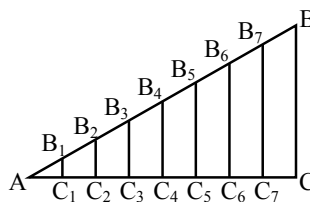
5. If the zeroes of the polynomial $x^3 - ax^2 + bx - c$ are three consecutive integers then, what is the smallest possible value of b ?

- (A) $-\frac{1}{\sqrt{3}}$ (B) -1 (C) -2 (D) 1

6. For what value of k will the roots of the quadratic equation $kx^2 - 5x + 6 = 0$ be in the ratio 2 : 3 ?

- (A) 0 (B) -1 (C) 1 (D) 2

7. Side AC of a right triangle ACB, right angled at C, is divided into 8 equal parts. Seven line segments parallel to BC are drawn to AB from the points of division. If $BC = 10$ cm, then the sum of the lengths of the seven line segments is

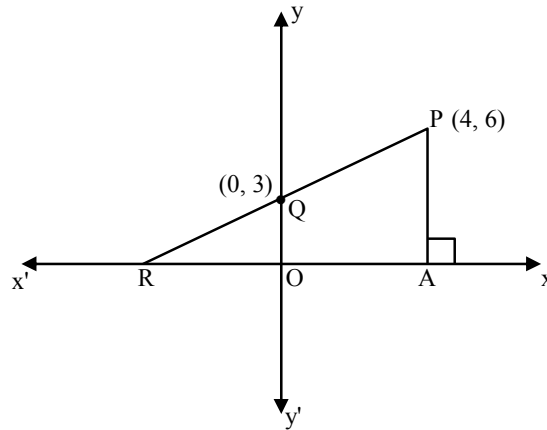


- (A) 35 cm (B) 34 cm (C) 33 cm (D) 45 cm

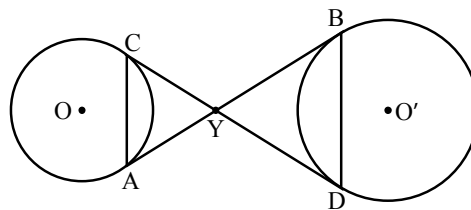
8. If $\sin^4 x + \sin^2 x = 1$, then the value of $\frac{1}{\cot^4 x + \cot^2 x}$ is

- (A) 1 (B) $\cos^2 x$ (C) $\sin^2 x$ (D) $\tan^2 x$

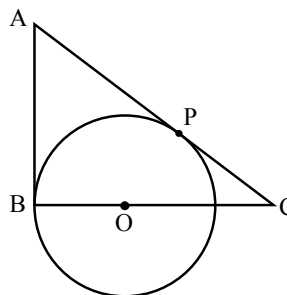
9. If $\tan^2 y \operatorname{cosec}^2 x - 1 = \tan^2 y$, then which one of the following is correct?
 (A) $x = 2y$ (B) $y = 2x$ (C) $x - y = 0$ (D) $x - y = 1$
10. In the adjoining figure, P and Q have coordinates (4, 6) and (0, 3) respectively. Area of ΔRAP is



- (A) 16 sq. units (B) 18 sq. units (C) 20 sq. units (D) 24 sq. units
11. Two poles, one is double in length of other, are standing opposite to each other at a distance of y meter. If angle of elevation of their top from mid point of the line joining their feet are complementary, then height of the shorter pole (in meters) is:
 (A) $\frac{y}{\sqrt{2}}$ (B) $\frac{y}{2\sqrt{2}}$ (C) $\frac{y}{2}$ (D) $y\sqrt{2}$
12. The given figure shows two circles with centre O and O'. AB and CD are tangents to the circles. Also $AC = 4.2$ cm, $AY = 4$ cm and $BY = 6$ cm.

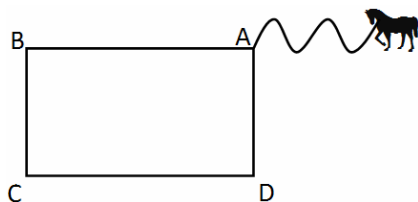


- What is the sum of the length of the chords AC and BD?
 (A) 6.2 cm (B) 9.8 cm (C) 10.5 cm (D) 12.9 cm
13. The given figure shows a circle with centre O and radius 6 cm. AB and AC are tangents to the circle. It is also given that $BC = 16$ cm



- Area of ΔABC is:
 (A) 50 cm^2 (B) 96 cm^2 (C) 128 cm^2 (D) 144 cm^2

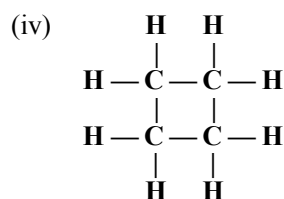
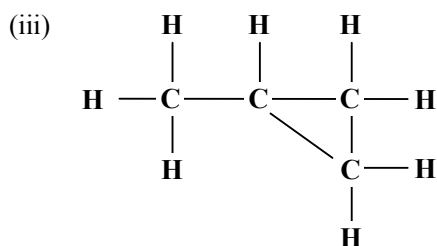
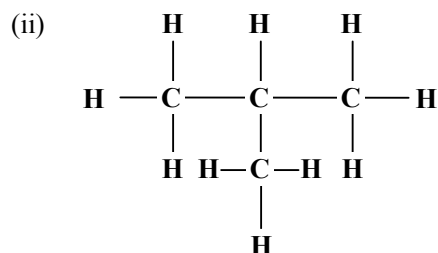
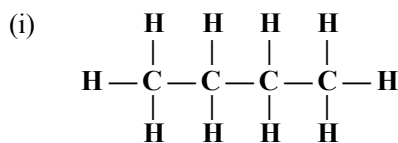
14. If $(n^2 + 9n + 20)$ is the product of two prime numbers, where n is some integer, then value of $n^4 - n^3 + n^2 - n$ is
 (A) 120 (B) 60 (C) 10 (D) 30
15. A horse is tied at corner A of a rectangular field ABCD by a rope. Neither the horse nor the rope is allowed to enter the rectangle ABCD. $AB = r$ units and $AD = \frac{r}{2}\sqrt{3}$ units. What is the maximum possible area that can be grazed by the horse if the length of the rope is r units?



- (A) $\frac{5\pi r^2}{6}$ sq. units (B) $\frac{6\pi r^2}{5}$ sq. units
 (C) $\frac{5\pi r^2}{6} - \frac{r^2\sqrt{3}}{8}$ sq. units (D) $\frac{6\pi r^2}{5} + \frac{r^2\sqrt{3}}{8}$ sq. units

CHEMISTRY

16. A substance X, which is an oxide of a group 2 element, is used intensively in the cement industry. This element is present in bones also. On treatment with water it forms a solution which turns red litmus blue. Identify X.
 (A) BeO (B) MgO (C) CaO (D) All of the above
17. 10 mL of a solution of NaOH is found to be completely neutralized by 8 mL of a given solution of HCl. If we take 20 mL of the same solution of NaOH, the amount of HCl solution (the same solution as before) required to neutralize it will be:
 (A) 4 mL (B) 8 mL (C) 12 mL (D) 16 mL
18. Which of the following methods is most suitable for preventing an iron frying pan from rusting?
 (A) applying grease (B) applying paint
 (C) applying a coating of zinc (D) all of the above
19. Which of the following are correct structural isomers of butane?



- (A) (i) and (iii) (B) (ii) and (iv) (C) (i) and (ii) (D) (iii) and (iv)

20. Match the reactions given in Column (A) with the names given in Column (B).

Sr. No.	Column (A)	Column (B)
a.	$\text{CH}_3\text{OH} + \text{CH}_3\text{COOH} \xrightarrow{\text{H}^+} \text{CH}_3\text{COOCH}_3 + \text{H}_2\text{O}$	i. Addition reaction
b.	$\text{CH}_2 = \text{CH}_2 + \text{H}_2 \xrightarrow{\text{Ni}} \text{CH}_3 - \text{CH}_3$	ii. Substitution reaction
c.	$\text{CH}_4 + \text{Cl}_2 \xrightarrow{\text{Sunlight}} \text{CH}_3\text{Cl} + \text{HCl}$	iii. Neutralisation reaction
d.	$\text{CH}_3\text{COOH} + \text{NaOH} \longrightarrow \text{CH}_3\text{COONa} + \text{H}_2\text{O}$	iv. Esterification reaction

(A) a-iii; b-i; c-iv, d-ii

(B) a-iii; b-ii; c-i, d-iv

(C) a-i; b-ii; c-iii, d-iv

(D) a-iv; b-i; c-ii, d-iii

21. Generally metals react with acids to give salt and hydrogen gas. Which of the following acids does not give hydrogen gas on reacting with metals (except Mn and Mg)?

(A) H_2SO_4

(B) HCl

(C) HNO_3

(D) All of these

22. Which of the following are not ionic compounds?

(i) KCl

(ii) HCl

(iii) CCl_4

(iv) NaCl

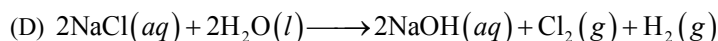
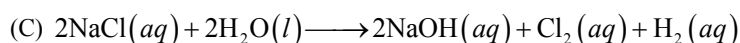
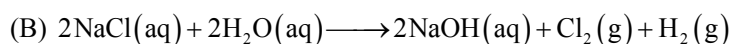
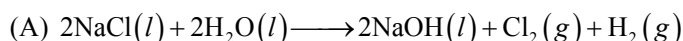
(A) (i) and (ii)

(B) (ii) and (iii)

(C) (iii) and (iv)

(D) (i) and (iii)

23. Identify the correct representation of reaction occurring during chlor-alkali process :



24. If a few drops of a concentrated acid accidentally spill over the hand of a student, what should be done?

(A) Wash the hand with plenty of saline solution.

(B) Wash the hand immediately with plenty of water and apply a paste of sodium hydrogen carbonate.

(C) After washing hand with plenty of water apply solution of sodium hydroxide on the hand.

(D) Neutralise the acid with a strong alkali by washing hand with conc. KOH.

25. Solid calcium oxide reacts vigorously with water to form calcium hydroxide accompanied by liberation of heat. This process is called slaking of lime. Calcium hydroxide dissolves in water to form its solution called lime water. Which among the following (s) is (are) true about slaking of lime and the solution formed?

(i) It is an endothermic reaction

(ii) It is an exothermic reaction

(iii) The pH of the resulting solution will be more than seven

(iv) The pH of the resulting solution will be less than seven

(A) (i) and (ii)

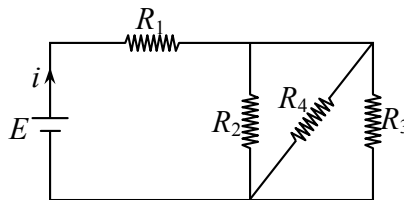
(B) (ii) and (iii)

(C) (i) and (iv)

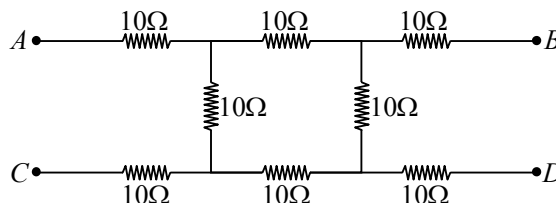
(D) (iii) and (iv)

PHYSICS

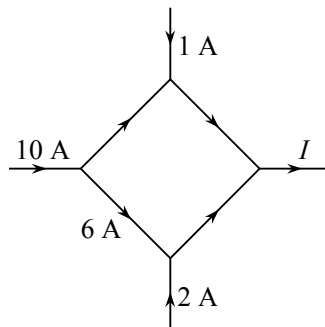
26. A material 'B' has twice the specific resistance of 'A'. A circular wire made of 'B' has twice the diameter of a wire made of 'A'. Then for the two wires to have the same resistance, the ratio $\frac{l_B}{l_A}$ of their respective lengths must be
- (A) $\frac{1}{2}$ (B) $\frac{1}{4}$ (C) 2 (D) 1
27. The length of a given cylindrical wire is increased by 100%. Due to the consequent decrease in diameter the change in the resistance of the wire will be
- (A) 300% (B) 200% (C) 100% (D) 50%
28. The resistance of an incandescent lamp is
- (A) Greater when switched off (B) Smaller when switched on
(C) Greater when switched on (D) The same whether it is switched off or switched on
29. In the circuit given $E = 6.0 V$, $R_1 = 100 \text{ ohm}$, $R_2 = R_3 = 50 \text{ ohm}$, $R_4 = 75 \text{ ohm}$. The equivalent resistance of the circuit, in ohm, is



- (A) 11.875 (B) 26.31 (C) 118.75 (D) None of these
30. What will be the equivalent resistance between the two points A and D

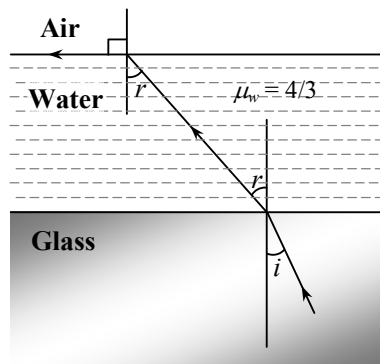


- (A) 10Ω (B) 20Ω (C) 30Ω (D) 40Ω
31. An electron is moving in the north direction. It experiences a force in vertically upward direction. The magnetic field at the position of the electron is in the direction of
- (A) East (B) West (C) North (D) South
32. The figure shows a network of currents. The magnitude of currents is shown here. The current I will be



- (A) 3 A (B) 9 A (C) 13 A (D) 19 A

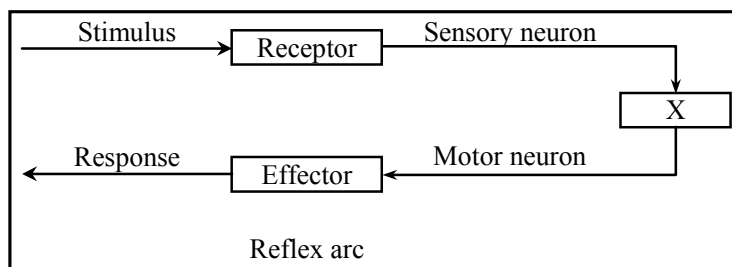
33. Two mirrors are inclined at an angle of 90° . The number of images formed for an object placed in between the mirrors is
 (A) 5 (B) 6 (C) 3 (D) 8
34. Colour of the sky is blue due to
 (A) Scattering of light (B) Total internal reflection
 (C) Total emission (D) None of the above
35. A ray of light is incident at the glass-water interface at an angle i , it emerges finally parallel to the surface of water, then the value of μ_g would be



- (A) $(4/3)\sin i$ (B) $1/\sin i$ (C) $4/3$ (D) 1

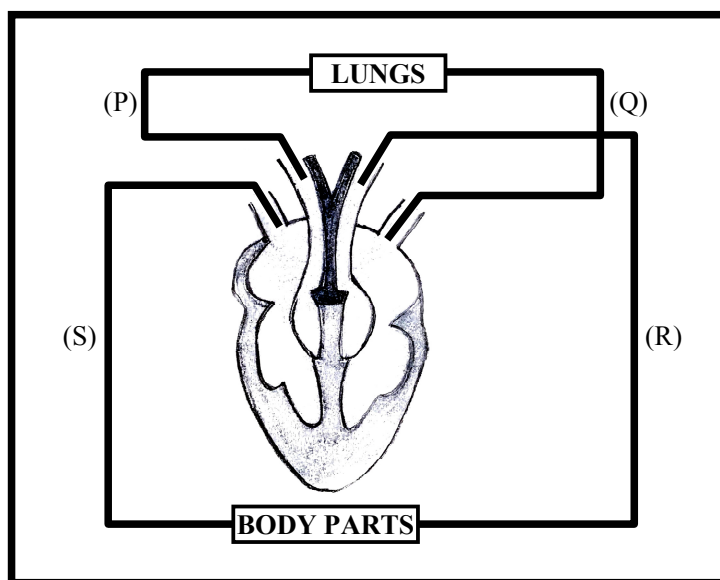
BIOLOGY

36. In peas, a pure tall plant (TT) is crossed with a pure short plant (tt). The ratio of pure tall plants to pure short plants in F_2 generation will be:
 (A) 1 : 3 (B) 3 : 1 (C) 1 : 1 (D) 2 : 1
37. A pregnant woman has an equal chance of her baby being blood group A or blood group AB. Which one of the following shows the possible genotypes of the woman and the father of her child?
 (A) $I^A I^A$ and $I^B I^O$ (B) $I^A I^B$ and $I^B I^O$ (C) $I^A I^O$ and $I^B I^O$ (D) $I^O I^B$ and $I^A I^O$
38. Observe the flow chart and identify 'X'.



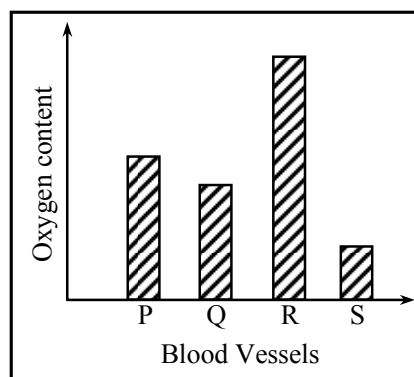
- (A) Spinal cord (B) Brain (C) Cranial nerves (D) Neuromuscular junction
39. Along the path of the vas deferens the secretion of which gland provide nutrition to the sperms?
 (A) Testes (B) Seminal vesicles (C) Scrotum (D) Urinary bladder
40. Which of the following statements about transmission of nerve impulse is incorrect?
 (A) Nerve impulse travels from dendritic end towards axonal end.
 (B) At the dendritic end electrical impulses bring about the release of some chemicals which generate an electrical impulse at the axonal end of another neuron.
 (C) The chemicals released from the axonal end of one neuron cross the synapse and generate a similar electrical impulse in a dendrite of another neuron.
 (D) A neuron transmits electrical impulses not only to another neuron but also to muscle and gland cells.

41. A patient was advised by the doctor to take an injection of insulin because his–
 (A) blood pressure was low (B) heart was beating slowly
 (C) sugar level in blood was low (D) sugar level in blood was high
42. Some dinosaurs had feathers although they could not fly but birds have feathers that help them to fly. In the context of evolution this means that
 (A) Reptiles have evolved from birds.
 (B) There is no evolutionary connection between reptiles and birds.
 (C) Feathers are homologous structures in both the organisms.
 (D) Birds have evolved from reptiles.
43. Pure-bred pea plant (P) is crossed with pure-bred pea plant (Q). It is found that the plants which look like (P) do not appear in F_1 generation but reappear in F_2 generation. Which of the plants (P) and (Q) are tall and dwarf?
 (A) P are tall and Q are dwarf (B) P are tall and Q are also tall
 (C) P are dwarf and Q are also dwarf (D) P are dwarf and Q are tall
44. Which of the following is true about the amount of oxygen and the direction of blood flow in blood vessels P, Q, R and S?



	Oxygen content		Direction of blood flow	
	Highest	Lowest	To the heart	From the heart
(A)	Q	P	S	R
(B)	S	R	P	Q
(C)	R	Q	S	P
(D)	S	Q	P	R

45. The chart given below shows the oxygen content in four samples of blood taken from four different blood vessels of the body.



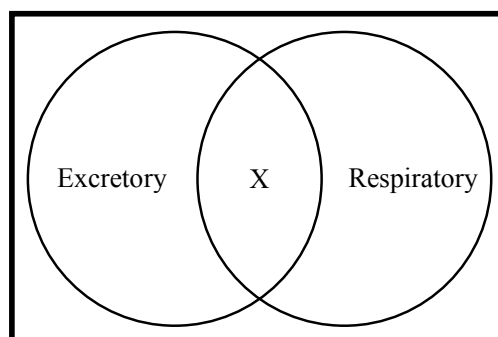
Which sample is most probably taken from a pulmonary artery?

- (A) P (B) Q (C) R (D) S
46. The following statements describe how the transport system in a plant works.

- P → Xylem tubes carry water and mineral salts to other parts of the plant.
 Q → The leaves make food in the presence of sunlight.
 R → The leaves receive water and mineral salts.
 S → Phloem tubes transport food to other parts of the plant.
 T → Root hairs absorb water and mineral salts from the soil.

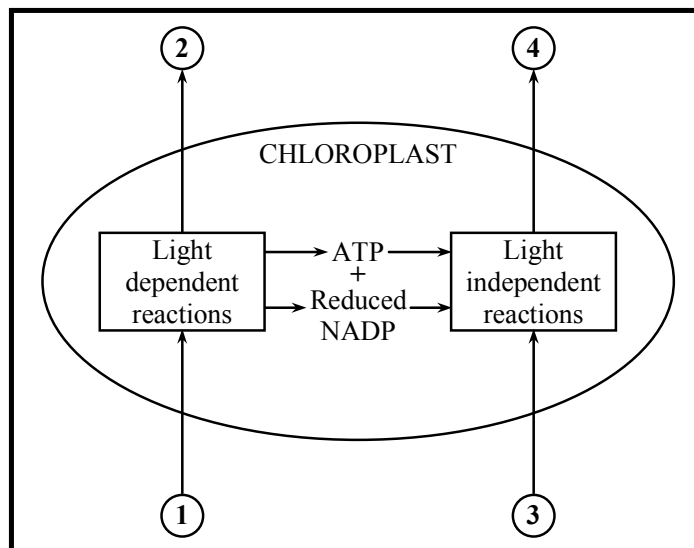
Which of these is a correct sequence?

- (A) P → T → Q → R → S (B) T → P → R → Q → S
 (C) P → R → Q → S → T (D) R → Q → T → P → S
47. Which organ is represented by 'X' in the human body?



- (A) Buccal cavity (B) Heart (C) Lungs (D) Kidneys

48. The given diagram indicates the movement of substances into in and out of a chloroplast.



What do labels 1 to 4 represent?

	(1)	(2)	(3)	(4)
(A)	Sugar	H ₂ O	ATP	O ₂
(B)	H ₂ O	O ₂	CO ₂	Sugar
(C)	CO ₂	H ₂ O	Sugar	O ₂
(D)	CO ₂	ATP	H ₂ O	Starch

49. Trypsin is a digestive enzyme which occurs in mammals and digests:
- (A) Starch in buccal cavity in an alkaline medium.
 (B) Protein in stomach in an acidic medium.
 (C) Protein in duodenum in an acidic medium.
 (D) Protein in duodenum in an alkaline medium.
50. Blood pressure is measured with an instrument called
- (A) Sphygmomamometer (B) Sphygnomanometer
 (C) Sphygnomamometer (D) Sphygmomanometer

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CLASS 10th MOVING TO CLASS 11th**ANSWER KEY****SET A**

MATHEMATICS	13. (B)	PHYSICS	38. (A)
1. (A)	14. (D)	26. (C)	39. (B)
2. (C)	15. (C)	27. (A)	40. (B)
3. (A)	CHEMISTRY	28. (C)	41. (D)
4. (D)	16. (C)	29. (C)	42. (D)
5. (B)	17. (D)	30. (C)	43. (D)
6. (C)	18. (C)	31. (A)	44. (A)
7. (A)	19. (C)	32. (C)	45. (D)
8. (A)	20. (D)	33. (C)	46. (B)
9. (C)	21. (C)	34. (A)	47. (C)
10. (D)	22. (B)	35. (B)	48. (B)
11. (B)	23. (D)	BIOLOGY	49. (D)
12. (C)	24. (B)	36. (C)	50. (D)
	25. (B)	37. (A)	

SOLUTION

MATHEMATICS

1. (A)

Let $a_2 - a_1 = a_3 - a_2 = \dots = a_n - a_{n-1} = d$ (common difference)

$$\begin{aligned}
 \text{Then } \frac{1}{a_1 a_2} + \frac{1}{a_2 a_3} + \dots + \frac{1}{a_{n-1} a_n} &= \frac{1}{d} \left[\frac{d}{a_1 a_2} + \frac{d}{a_2 a_3} + \dots + \frac{d}{a_{n-1} a_n} \right] \\
 &= \frac{1}{d} \left[\frac{a_2 - a_1}{a_1 a_2} + \frac{a_3 - a_2}{a_2 a_3} + \dots + \frac{a_n - a_{n-1}}{a_{n-1} a_n} \right] \\
 &= \frac{1}{d} \left[\frac{1}{a_1} - \frac{1}{a_2} + \frac{1}{a_2} - \frac{1}{a_3} + \dots + \frac{1}{a_{n-1}} - \frac{1}{a_n} \right] \\
 &= \frac{1}{d} \left[\frac{1}{a_1} - \frac{1}{a_n} \right] \\
 &= \frac{1}{d} \left[\frac{a_n - a_1}{a_1 a_n} \right] \\
 &= \frac{1}{d} \left[\frac{a_1 + (n-1)d - a_1}{a_1 a_n} \right] && [\because a_n = a_1 + (n-1)d] \\
 &= \frac{n-1}{a_1 a_n}
 \end{aligned}$$

2. (C)

Let α, β be the roots of the equation $ax^2 + bx + c = 0$

$$\text{then } \alpha + \beta = -\frac{b}{a}, \alpha\beta = \frac{c}{a}$$

$$\alpha + \beta = \frac{1}{\alpha^2} + \frac{1}{\beta^2} \quad (\text{Given})$$

$$\Rightarrow \alpha + \beta = \frac{\alpha^2 + \beta^2}{(\alpha\beta)^2} = \frac{(\alpha + \beta)^2 - 2\alpha\beta}{(\alpha\beta)^2}$$

$$\Rightarrow -\frac{b}{a} = \frac{\left(-\frac{b}{a}\right)^2 - \frac{2c}{a}}{\left(\frac{c}{a}\right)^2} = \frac{b^2 - 2ca}{c^2}$$

$$\Rightarrow -bc^2 = ab^2 - 2ca^2$$

$$\Rightarrow 2ca^2 = ab^2 + bc^2$$

$$\Rightarrow ab^2, ca^2, bc^2 \text{ are in A.P.}$$

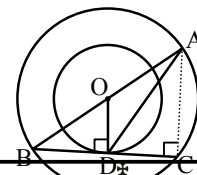
3. (A)

Join AC.

OD \perp BD (radius \perp tangent at the point of contact) \Rightarrow BD = DC (perpendicular from the centre bisects the chord) \Rightarrow D is mid-point of BC

Also O is mid-point of AB.

$$\therefore OD = \frac{1}{2} AC \text{ and } OD \parallel AC \quad (\text{mid-point theorem})$$



$$\Rightarrow AC = 2 OD \text{ and } \angle ACD = 90^\circ$$

$$\Rightarrow AC = 2 \times 8 = 16 \text{ cm}$$

In $\triangle ODB$,

$$OB^2 = OD^2 + BD^2$$

$$\Rightarrow 13^2 = 8^2 + BD^2$$

$$\Rightarrow BD^2 = 169 - 64 = 105$$

$$\Rightarrow BD = DC = \sqrt{105} \text{ cm}$$

In $\triangle ACD$,

$$AD^2 = AC^2 + DC^2 = 16^2 + (\sqrt{105})^2 = 361$$

$$\Rightarrow AD = \sqrt{361} = 19 \text{ cm}$$

4. (D)

$$\begin{array}{r} x^2 - x - 2 \overline{) x^3 + ax^2 + bx + 6} \\ \underline{-x^3 \quad +x^2 \quad -2x} \\ (a+1)x^2 + (b+2)x + 6 \\ \underline{-(a+1)x^2 \quad + (a+1)x \quad -2(a+1)} \\ (a+b+3)x + (2a+8) \end{array}$$

As $\frac{x^3 + ax^2 + bx + 6}{x^2 - x - 2}$ is a polynomial of degree 1, then

$$a + b + 3 = 0 \text{ and } 2a + 8 = 0 \Rightarrow a = -4$$

$$\therefore -4 + b + 3 = 0 \Rightarrow b = 1$$

$$\therefore a + b = -4 + 1 = -3$$

5. (B)

Let the zeroes be $(\alpha - 1)$, α , $(\alpha + 1)$

$$\therefore \text{sum of product of zeroes taken two at a time} = \frac{b}{1}$$

$$\Rightarrow (\alpha - 1)\alpha + \alpha(\alpha + 1) + (\alpha + 1)(\alpha - 1) = b$$

$$\Rightarrow \alpha^2 - \alpha + \alpha^2 + \alpha + \alpha^2 - 1 = b$$

$$\Rightarrow 3\alpha^2 - 1 = b$$

$$\therefore \text{minimum value of } b = -1, \text{ when } \alpha = 0$$

6. (C)

$$\text{Let the roots be } \alpha \text{ and } \beta \text{ then, } \alpha + \beta = \frac{5}{k} \quad \dots\dots\dots(i)$$

$$\alpha\beta = \frac{6}{k} \quad \dots\dots\dots(ii)$$

$$\text{Given } \frac{\alpha}{\beta} = \frac{2}{3} \quad \Rightarrow \alpha = \frac{2}{3}\beta$$

\therefore from (i) and (ii)

$$\frac{2}{3}\beta + \beta = \frac{5}{k} \text{ and } \frac{2}{3}\beta \times \beta = \frac{6}{k}$$

$$\Rightarrow \frac{5\beta}{3} = \frac{5}{k} \text{ and } \frac{2}{3}\beta^2 = \frac{6}{k}$$

$$\Rightarrow \beta = \frac{3}{k} \text{ and } \beta^2 = \frac{9}{k}$$

$$\Rightarrow \frac{9}{k^2} = \frac{9}{k} \Rightarrow k^2 - k = 0$$

$$\Rightarrow k(k-1) = 0 \Rightarrow k = 0 \text{ or } k = 1$$

But for $k = 0$, $kx^2 - 5x + 6 = 0$ will not be a quadratic equation.

$$\therefore k = 1$$

7. (A)

$$\Delta AB_1C_1 \sim \Delta ABC \quad (\text{AAA})$$

$$\Rightarrow \frac{AC_1}{AC} = \frac{B_1C_1}{BC}$$

$$\Rightarrow \frac{1}{8} = \frac{B_1C_1}{10} \Rightarrow B_1C_1 = \frac{10}{8} \text{ cm}$$

$$\Delta AB_2C_2 \sim \Delta ABC \quad (\text{AAA})$$

$$\Rightarrow \frac{AC_2}{AC} = \frac{B_2C_2}{BC}$$

$$\Rightarrow \frac{2}{8} = \frac{B_2C_2}{10} \Rightarrow B_2C_2 = \frac{10 \times 2}{8} \text{ cm}$$

$$\text{Similarly, } B_3C_3 = \frac{10 \times 3}{8} \text{ cm, } B_4C_4 = \frac{10 \times 4}{8} \text{ cm, } B_5C_5 = \frac{10 \times 5}{8} \text{ cm, } B_6C_6 = \frac{10 \times 6}{8} \text{ cm, } B_7C_7 = \frac{10 \times 7}{8} \text{ cm}$$

$$\begin{aligned} \therefore \text{ Required sum} &= B_1C_1 + B_2C_2 + \dots + B_7C_7 \\ &= \frac{10}{8} + \frac{10 \times 2}{8} + \frac{10 \times 3}{8} + \dots + \frac{10 \times 7}{8} \\ &= \frac{10}{8}(1 + 2 + \dots + 7) \\ &= \frac{10}{8} \times 28 = 35 \text{ cm} \end{aligned}$$

8. (A)

$$\sin^4 x + \sin^2 x = 1$$

$$\Rightarrow \sin^4 x = 1 - \sin^2 x$$

$$\Rightarrow \sin^4 x = \cos^2 x \quad \dots \dots \dots (i)$$

$$\text{Now, } \cot^4 x + \cot^2 x = \cot^2 x (\cot^2 x + 1)$$

$$= \cot^2 x \times \operatorname{cosec}^2 x$$

$$= \frac{\cos^2 x}{\sin^2 x} \times \frac{1}{\sin^2 x}$$

$$= \frac{\cos^2 x}{\sin^4 x}$$

$$= \frac{\cos^2 x}{\cos^2 x} \quad [\text{From (i)}]$$

$$= 1$$

$$\therefore \frac{1}{\cot^4 x + \cot^2 x} = \frac{1}{1} = 1$$

9. (C)

$$\tan^2 y \operatorname{cosec}^2 x - 1 = \tan^2 y$$

$$\begin{aligned} \Rightarrow \tan^2 y \operatorname{cosec}^2 x - \tan^2 y &= 1 \\ \Rightarrow \tan^2 y (\operatorname{cosec}^2 x - 1) &= 1 \\ \Rightarrow \tan^2 y \cot^2 x &= 1 \\ \Rightarrow \tan^2 y &= \frac{1}{\cot^2 x} = \tan^2 x \\ \Rightarrow y = x &\quad \Rightarrow x - y = 0 \end{aligned}$$

10. (D)

Let OR = x units

 $\Delta ROQ \sim \Delta RAP$ (AAA similarity)

$$\Rightarrow \frac{RO}{RA} = \frac{OQ}{AP}$$

$$\Rightarrow \frac{x}{x+4} = \frac{3}{6}$$

$$\Rightarrow \frac{x}{x+4} = \frac{1}{2}$$

$$\Rightarrow 2x = x + 4 \quad \Rightarrow x = 4$$

$$\therefore RA = x + 4 = 4 + 4 = 8 \text{ units}$$

$$\begin{aligned} \therefore \text{Area of } \Delta RAP &= \frac{1}{2} \times RA \times PA \\ &= \frac{1}{2} \times 8 \times 6 \\ &= 24 \text{ sq. units} \end{aligned}$$

11. (B)

$$\tan \theta = \frac{h}{\frac{y}{2}} = \frac{2h}{y} \quad \dots(i)$$

$$\tan(90^\circ - \theta) = \frac{2h}{\frac{y}{2}} = \frac{4h}{y}$$

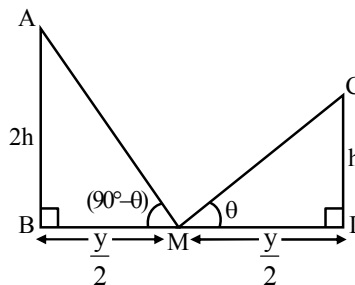
$$\Rightarrow \cot \theta = \frac{4h}{y} \quad \dots(ii)$$

From (i) and (ii)

$$\tan \theta \times \cot \theta = \frac{2h}{y} \times \frac{4h}{y}$$

$$\Rightarrow 1 = \frac{8h^2}{y^2}$$

$$\Rightarrow h^2 = \frac{y^2}{8} \quad \Rightarrow h = \frac{y}{2\sqrt{2}}$$



12. (C)

AY = CY = 4 cm (tangents from an external point are equal)

Similarly BY = DY = 6 cm

In ΔAYC and ΔBYD

$$\frac{AY}{BY} = \frac{CY}{DY} = \frac{4}{6} = \frac{2}{3}$$

and $\angle AYC = \angle BYD$ (vertically opposite angles)

$$\therefore \triangle AYC \sim \triangle BYD \quad (\text{S.A.S. similarity})$$

$$\Rightarrow \frac{AY}{BY} = \frac{AC}{BD}$$

$$\Rightarrow \frac{2}{3} = \frac{4.2}{BD} \Rightarrow BD = 6.3 \text{ cm}$$

$$\therefore AC + BD = 4.2 + 6.3 = 10.5 \text{ cm}$$

13. (B)

Join OP

$$OP = OB = 6 \text{ cm} \quad (\text{radius})$$

$$OC = BC - OB = 16 - 6 = 10 \text{ cm.}$$

$OB \perp AB$ and $OP \perp AP$ (radius \perp tangent at the point of contact)

In $\triangle OPC$,

$$OC^2 = OP^2 + PC^2$$

$$\Rightarrow PC^2 = OC^2 - OP^2 = 10^2 - 6^2$$

$$\Rightarrow PC = 8 \text{ cm}$$

$AB = AP$ (tangents from an external point are equal)

In $\triangle ABC$,

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

$$\Rightarrow AB^2 + 16^2 = (AP + PC)^2$$

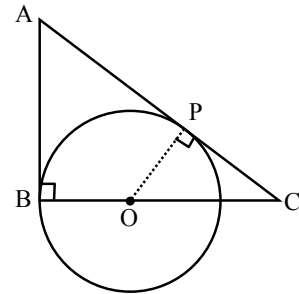
$$\Rightarrow AB^2 + 16^2 = (AB + 8)^2 \quad (\because AP = AB)$$

$$\Rightarrow AB^2 + 256 = AB^2 + 64 + 16AB$$

$$\Rightarrow 16AB = 192$$

$$\Rightarrow AB = 12 \text{ cm}$$

$$\begin{aligned} \therefore \text{Ar}(\triangle ABC) &= \frac{1}{2} \times AB \times BC \\ &= \frac{1}{2} \times 12 \times 16 = 96 \text{ cm}^2 \end{aligned}$$



14. (D)

$$n^2 + 9n + 20 = (n + 4)(n + 5)$$

where $(n + 4)$ and $(n + 5)$ are consecutive integers as n is some integer. There is only one pair of prime numbers which are consecutive. They are 2 and 3.

$$\therefore n + 4 = 2 \text{ and } n + 5 = 3$$

$$\Rightarrow n = -2$$

$$\text{So, } n^4 - n^3 + n^2 - n = 16 + 8 + 4 + 2 = 30$$

15. (C)

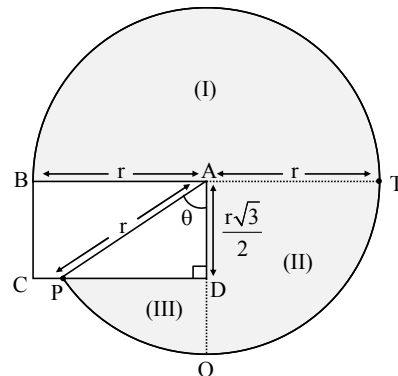
$$\cos \theta = \frac{AD}{AP} = \frac{\frac{r\sqrt{3}}{2}}{\frac{r}{2}} = \frac{\sqrt{3}}{2}$$

$$\Rightarrow \theta = 30^\circ$$

$$\sin \theta = \frac{PD}{AP} \Rightarrow \sin 30^\circ = \frac{PD}{r}$$

$$\Rightarrow \frac{1}{2} = \frac{PD}{r} \Rightarrow PD = \frac{r}{2}$$

$$\text{Area (region III)} = \text{ar}(\text{sector APQ}) - \text{ar}(\triangle APD)$$



$$\begin{aligned}
 &= \frac{30^\circ}{360^\circ} \times \pi r^2 - \frac{1}{2} \times PD \times AD \\
 &= \frac{\pi r^2}{12} - \frac{1}{2} \times \frac{r}{2} \times \frac{r\sqrt{3}}{2} \\
 &= \frac{\pi r^2}{12} - \frac{r^2\sqrt{3}}{8}
 \end{aligned}$$

$$\text{Area (region I)} = \frac{\pi r^2}{2}$$

$$\text{Area (region II)} = \frac{\pi r^2}{4}$$

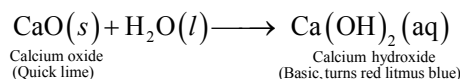
Required area = ar (region I) + ar (region II) + ar (region III)

$$\begin{aligned}
 &= \frac{\pi r^2}{2} + \frac{\pi r^2}{4} + \frac{\pi r^2}{12} - \frac{r^2\sqrt{3}}{8} \\
 &= \frac{6\pi r^2 + 3\pi r^2 + \pi r^2}{12} - \frac{r^2\sqrt{3}}{8} \\
 &= \frac{10\pi r^2}{12} - \frac{r^2\sqrt{3}}{8} \\
 &= \frac{5\pi r^2}{6} - \frac{r^2\sqrt{3}}{8} \text{ sq. units}
 \end{aligned}$$

CHEMISTRY

16. (C)

X = CaO (used in cement industry). The element Ca is present in bones.



17. (D)

If we take double the amount of same NaOH solution, the amount of the same HCl solution required to neutralize it is also double. Hence, the correct option is (D).

18. (C)

Although, in principle, all three methods can be used to protect iron from rusting, yet the first two methods cannot be used to protect a frying pan because both grease and paints (usually but not always) are organic matter which burn on heating, Therefore (C) is usually used. The reason being that zinc is more reactive than iron and hence, does not allow rusting to occur. Zinc although has lower melting point therefore, does not melt at the temperature at which the frying pan is mostly used. Thus, option (C) is correct.

19. (C)

Only (i) and (ii) has the same molecular formula (C_4H_{10}) while (ii) and (iv) have C_4H_8 as the molecular formula.

20. (D)

21. (C)

HNO_3 is a strong oxidizing agent. It oxidizes metal to metal oxide which further dissolves in HNO_3 to form metal nitrate and HNO_3 itself is reduced to NO_2 (nitrogen dioxide) or NO (nitric oxide) or N_2O (nitrous oxide) depending

upon the nature of the metal and concentration of the acid. Mn and Mg are the only metals which react with dilute HNO_3 to produce H_2 gas.

22. (B)

HCl and CCl_4 are covalent compounds.

23. (D)

It is correct because physical states of the reactants and products are correctly represented.

24. (B)

Washing the hand with plenty of water washes away most of the acid and gives partial relief from burning sensation. A paste of sodium hydrogen carbonate completely neutralize the effect of the acid.

25. (B)

Slaking of lime is an exothermic reaction. Lime (CaO) combines with water to form slaked lime, $\text{Ca}(\text{OH})_2$. Since, it is a base the resulting solution is basic and hence, has pH greater than 7.

PHYSICS

26. (C)

$$R = \rho \frac{l}{\pi r^2} \Rightarrow l \propto \frac{r^2}{\rho} \Rightarrow \frac{l_B}{l_A} = \left(\frac{r_B}{r_A} \right)^2 \times \frac{\rho_A}{\rho_B}$$

$$\Rightarrow \frac{l_B}{l_A} = \left(\frac{2}{1} \right)^2 \times \left(\frac{1}{2} \right) = \frac{2}{1}$$

27. (A)

If suppose length $l_1 = 100$ then $l_2 = 100 + 100 = 200$

$$\frac{R_1}{R_2} = \left(\frac{l_1}{l_2} \right)^2 = \left(\frac{100}{200} \right)^2 \Rightarrow R_2 = 4R_1$$

$$\frac{\Delta R}{R} \times 100 = \frac{R_2 - R_1}{R_1} \times 100 = \frac{4R_1 - R_1}{R_1} \times 100 = 300\%$$

28. (C)

When lamp is switched on, temperature of filament increases, hence R increases.

29. (C)

In given circuit three resistance R_2, R_4 and R_3 are parallel.

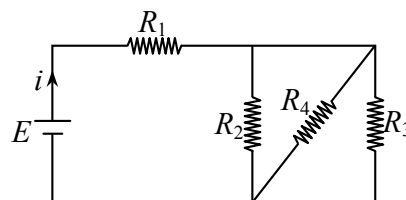
$$\frac{1}{R} = \frac{1}{R_2} + \frac{1}{R_4} + \frac{1}{R_3}$$

$$= \frac{1}{50} + \frac{1}{50} + \frac{1}{75}$$

$$= \frac{75 + 75 + 50}{50 \times 75}$$

$$R = \frac{50 \times 75}{75 + 75 + 50} = \frac{50 \times 75}{200} = \frac{75}{4} \Omega = 18.75 \Omega$$

This resistance is in series with R_1



$$\therefore R_{\text{resultant}} = R_1 + R = 100 + 18.75 = 118.75\Omega$$

30. (C)

Resistances at C and B are not in the circuit. Use laws of resistances in series and parallel excluding the two resistance.

31. (A)

By Fleming's left hand rule.

32. (C)

Since $10 + 1 + 2 = 13$ Ampere current is coming therefore same current will leave therefore $i = 13$ A.

33. (C)

If $\frac{360}{\theta} = 4$ (even) then number of images formed (n)

$$n = \left(\frac{360}{\theta} - 1 \right) \quad \therefore n = 4 - 1 = 3$$

34. (A)

Intensity of scattered light $I \propto \frac{1}{\lambda^4}$, since λ_{blue} is least that's why sky looks blue.

35. (B)

$$\text{For glass-water interface } {}_g\mu_w = \frac{\sin i}{\sin r} \quad \dots \text{ (i)}$$

$$\text{For water-air interface } {}_w\mu_a = \frac{\sin r}{\sin 90^\circ} \quad \dots \text{ (ii)}$$

$$\Rightarrow {}_g\mu_w \times {}_w\mu_a = \frac{\sin i}{\sin r} \times \frac{\sin r}{\sin 90^\circ} = \sin i$$

$$\Rightarrow \frac{\mu_w}{\mu_g} \times \frac{\mu_a}{\mu_w} = \sin i \Rightarrow \mu_g = \frac{1}{\sin i}$$

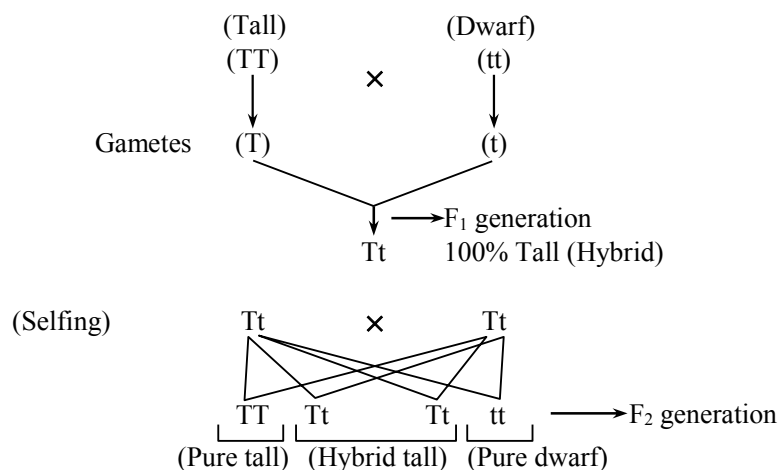
BIOLOGY

36. (C)

Mendel crossed pure tall (TT) and pure dwarf (tt) plants. The plants belonged to F_1 generation were all tall (Hybrid).

Plants of F_1 generation were self pollinated.

The plants of F_2 generation were both tall and dwarf, in approximate 3 : 1 ratio phenotypically and 1 : 2 : 1 genotypically.

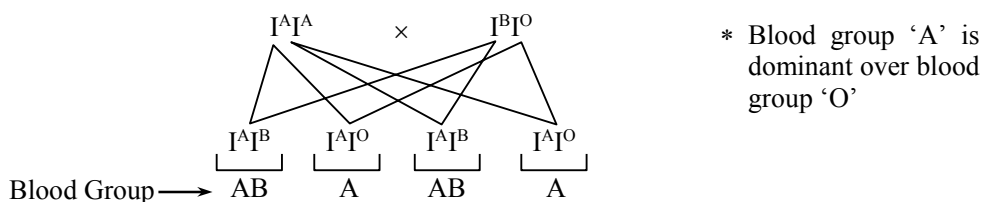


Phenotypic ratio = 3 : 1

Genotypic ratio = 1 : 2 : 1

Ratio of Pure tall to pure dwarf in F₂ generation is 1 : 1.

37. (A)



38. (A)

Reflex action is a rapid automatic response of the body to a stimulus without involving the brain. The pathway of nerve involved in a reflex action is called reflex arc.

Reflex actions are controlled by spinal cord.

39. (B)

Along the path of the vasdeferens the secretion of seminal vesicles provide nutrition to the sperms.

40. (B)

Transmission of nerve impulse:

- ❖ There is always more than one neuron involved in the transmission of nerve impulse.
- ❖ The space or junction between axon of one neuron and dendrites of another is called synapse.
- ❖ A chemical reaction occurs at the receptor tip to create electrical impulses which are tiny electrical charges. This travels from the dendrites to the cell body and then along the axon to its end. At the end of the axon, the electrical impulse releases some chemicals (like acetylcholine). These chemicals cross the synapse and start a similar electric impulse in the dendrites of next neuron and because of this, these chemicals are called neurotransmitters.

41. (D)

Insulin plays a major role in regulating blood glucose level.

- ❖ Injection of insulin is given to those patients whose blood glucose/sugar level in blood is high.

42. (D)

- ❖ Birds have evolved from reptiles.
- ❖ Archaeopteryx is considered as connecting link between birds and reptiles.

43. (D)

- ❖ P are dwarf and Q are tall.
 - ❖ In a cross between tall and dwarf plant, tall is dominant while dwarf is recessive.
 - ❖ Recessive traits do not appear in F_1 generation but they reappear in F_2 generation.
So, plant P is recessive plant i.e., they are dwarf plant.
44. (A)
- (P) → It is pulmonary artery which carry deoxygenated blood from right ventricle of the heart to the lungs.
- (Q) → It is pulmonary vein which carry oxygenated blood from lungs to the left auricle of the heart.
- (R) → It is Aorta which carry oxygenated blood from left ventricle of the heart to the body parts.
- (S) → It is vein (superior and inferior vena cava) which carry deoxygenated blood from body parts to the right auricle of the heart.
45. (D)
- S represents pulmonary artery, which carries deoxygenated blood from right ventricle to the lungs.
46. (B)
- Transport system in a plant:
- Root (Root hair) → Xylem tubes → Leaves → Photosynthesis in leaves → Transport of food by phloem.
47. (C)
- ❖ Lungs helps in excretion and respiration both.
- Lungs, in the process of respiration receives oxygen and excrete some wastes such as, carbondioxide and water.
48. (B)
- ❖ In light dependent reaction of photosynthesis, splitting of water molecule into hydrogen and oxygen takes place.
 - ❖ In light independent reaction of photosynthesis, reduction of carbon dioxide to sugar (glucose) takes place.
49. (D)
- ❖ Pancreas secrete pancreatic juice which contains enzyme trypsin.
 - ❖ Trypsin helps in digestion of protein in duodenum (a part of small intestine), in an alkaline medium.
50. (D)
- Blood pressure is measured with an instrument called **sphygmomanometer**.

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