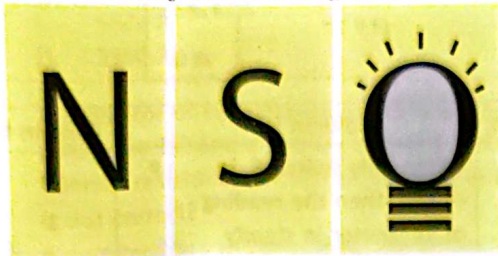




Techfest™
Asia's Largest Science & Technology Festival



SOF NATIONAL SCIENCE
OLYMPIAD 2025-26

QUESTION
PAPER SET

C

CLASS

12

Total Questions : 50

Time : 1 hr.

Guidelines for the Candidate

- You will get additional ten minutes to fill up information about yourself on the OMR Sheet, before the start of the exam.
- Write your **Name, School Code, Class, Section, Roll No.** and **Mobile Number** clearly on the **OMR Sheet** and do not forget to sign it. We will share your marks / result and other information related to SOF exams on your mobile number.
- The Question Paper comprises three sections:
Section - 1 : **Physics & Chemistry** (25 Questions)
Section - 2 : **Achievers Section** (5 Questions)
Section - 3 : **Mathematics** (20 Questions) or **Biology** (20 Questions)
- Section-1 and 2 are compulsory for all.** In Section-3 opt for Mathematics OR Biology and mark the same on the OMR Sheet. Each question in Achievers Section carries 3 marks, whereas all other questions carry 1 mark each.
- All questions are compulsory. There is no negative marking. Use of calculator is not permitted.
- There is only ONE correct answer. Choose only ONE option for an answer.
- To mark your choice of answers by darkening the circles on the OMR Sheet, use **HB Pencil** or **Blue / Black ball point pen** only. E.g.
Q.16: If a mixture can be separated by magnetic separation, one of the constituents must be
A. Ferrous B. Non-ferrous C. Precious D. Non-metallic.
As the correct answer is option A, you must darken the circle corresponding to option A on the OMR Sheet.
- Rough work should be done in the blank space provided in the booklet.
- Return the OMR Sheet to the invigilator at the end of the exam.
- Please fill in your personal details in the space provided before attempting the paper.
- SOF-Techfest IIT Bombay Innovation Challenge - Open for class 8, 9 and 10. For more details, please visit : www.sofworld.org**

16. ● (B) (C) (D)



Name:.....

SOF Olympiad Roll No.:..... Contact No.:.....

DO NOT OPEN THIS BOOKLET UNTIL ASKED TO DO SO

THE WORLD'S
BIGGEST
OLYMPIADS

27 Years
of Trust

99,499+
Schools

72
Countries

8.1+ Crores
Assessments

8
Olympiads

SECTION-1
PHYSICS

1. White coherent light ($4000 \text{ \AA} - 7000 \text{ \AA}$) is sent through the slits of a YDSE. The separation between the slits is 0.5 mm and screen is 50 cm away from the slits. There is a small hole in the screen at a point 1.0 mm away (along the width of the fringe) from the central line. Which of the following options is incorrect?

- A. 400 nm wavelength is missing in the light coming from the hole.
- B. 500 nm wavelength will have strong intensity.
- C. 667 nm wavelength is missing in the light coming from the hole.
- D. 400 nm wavelength will have strong intensity.

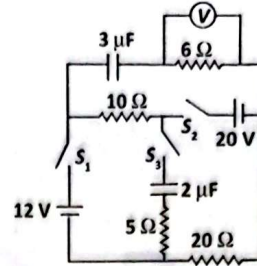
2. A sphere of radius 0.1 m and mass $8\pi \text{ kg}$ is attached to the lower end of a steel wire of length 5.0 m and diameter 10^{-3} m . The wire is suspended from 5.22 m high ceiling of a room. When the sphere is made to swing as a simple pendulum, it just grazes the floor at its lowest point. Calculate the approximate velocity of the sphere at the lowest position. Young's modulus of steel is $1.994 \times 10^{11} \text{ N/m}^2$.

- A. 4.5 m/s
- B. 8.8 m/s
- C. 6.4 m/s
- D. 3.2 m/s

3. A positive charge Q is uniformly distributed throughout the volume of dielectric sphere of radius R . A point mass m , having charge $+q$ is fired towards the center of the sphere with velocity v from a point at a distance $r (> R)$ from the center of the sphere. What will be the minimum velocity (v) so that it can penetrate $R/2$ distance of the sphere (Charge on the small mass remains constant throughout the motion)?

- A. $\sqrt{\frac{qQ}{2m\pi\epsilon_0 R} \left[\frac{11}{7} - \frac{R}{r} \right]}$
- B. $\sqrt{\frac{qQ}{2m\pi\epsilon_0 R} \left[\frac{11}{8} - \frac{2R}{r} \right]}$
- C. $\sqrt{\frac{qQ}{2m\pi\epsilon_0 R} \left[\frac{11}{4} - \frac{R}{2r} \right]}$
- D. $\sqrt{\frac{qQ}{2m\pi\epsilon_0 R} \left[\frac{11}{8} - \frac{R}{r} \right]}$

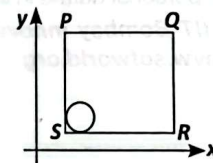
4. Match column I with column II based on the given circuit diagram.



S. No.	Column I	Column II
(i)	When only switch S_1 is closed, then the reading of voltmeter in steady state is (in V)	P. $\frac{88}{3}$
(ii)	When only switch S_1 is closed, then the charge on $3\mu\text{F}$ capacitor is (in μC)	Q. Zero
(iii)	After closing all the switches, the charge on $2\mu\text{F}$ capacitor in steady state is (in μC)	R. 3.2
(iv)	After closing all the switches, power supplied by 12 V in steady state is (in W)	S. 36

- A. (i) - (S), (ii) - (Q), (iii) - (R), (iv) - (P)
- B. (i) - (Q), (ii) - (S), (iii) - (R), (iv) - (P)
- C. (i) - (Q), (ii) - (S), (iii) - (P), (iv) - (R)
- D. (i) - (S), (ii) - (Q), (iii) - (P), (iv) - (R)

5. A solid sphere of mass 2 kg is resting inside a cube as shown in the given figure. The cube is moving with a velocity $\vec{v} = (5t\hat{i} + 2t\hat{j}) \text{ ms}^{-1}$. Here t is time in seconds. All the surfaces are smooth. The sphere is at rest with respect to the cube. What is the total force exerted by the sphere on the cube?



- A. 28 N
- B. 25 N
- C. 24 N
- D. 26 N

6. The path of photoelectrons emitted due to electromagnetic radiation incident on a sample of a material is found to have a maximum bending radius of 0.1 m in a magnetic field of $\frac{\sqrt{2}}{3} \times 10^{-4} \text{ T}$. When the radiation is incident normally on a double slit

having a slit separation of 0.1 mm, it is observed that there are 10 fringes in a width of 3.1 cm on a screen placed at a distance of 1 m from the double slit. What should be the approximate wavelength of the incident light so that the bending radius is one half of what it was before?

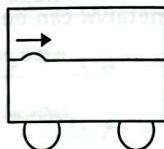
(Mass of electron = $0.5 \text{ MeV}/c^2$ and $hc = 12400 \text{ eV}\text{\AA}$)

- A. 5200 Å
- B. 4960 Å
- C. 5620 Å
- D. 2350 Å

7. A capacitor of capacitance $10 \mu\text{F}$ is connected to a resistance 2Ω and a battery of emf 5 V of negligible internal resistance. Which of the following options is not correct?

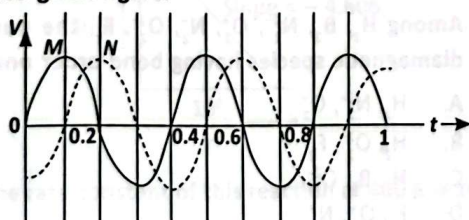
- A. After $20 \mu\text{s}$ of completing the circuit, the power delivered by the battery is $\frac{25}{2e} \text{ W}$.
- B. After $20 \mu\text{s}$ of completing the circuit, the power dissipated by heat is $\frac{25}{2e^2} \text{ W}$.
- C. After $20 \mu\text{s}$ of completing the circuit, the rate of energy stored in the capacitor is $\left(\frac{25}{2e} - \frac{25}{2e^2}\right) \text{ W}$.
- D. After $20 \mu\text{s}$ of completing the circuit, the power dissipated by heat is $\frac{15}{2e^2} \text{ W}$.

8. A taut string having tension 100 N and linear mass density 0.25 kg/m is used inside a cart to generate a wave pulse starting at the left end as shown in the given figure. Which of the following options is correct regarding motion of the cart so that the pulse remains stationary with respect to ground?



- A. The cart should move in the opposite direction of pulse with speed of 20 m/s .
- B. The cart should move in the same direction of pulse with speed of 20 m/s .
- C. The cart should move in the opposite direction of pulse with speed of 40 m/s .
- D. The cart should move in the same direction of pulse with speed of 40 m/s .

9. Two sinusoidal voltages of same frequency are shown in the given figure.



What is the frequency and the phase relationship between the voltages?

	Frequency (Hz)	Phase lead of N over M (in radian)
A.	0.4	$-\frac{\pi}{4}$
B.	2.5	$-\frac{\pi}{2}$
C.	2.5	$+\frac{\pi}{2}$
D.	2.5	$-\frac{\pi}{4}$

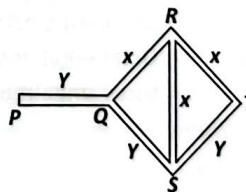
10. A satellite is revolving in a circular equatorial orbit of radius $R = 2 \times 10^4 \text{ km}$ from East to West. Calculate the interval after which it will appear at the same equatorial town. Given that the radius of the Earth = 6400 km and g (acceleration due to gravity) = 10 ms^{-2} .

- A. 5 hr 48 min
- B. 6 hr 30 min
- C. 5 hr 30 min
- D. 4 hr 36 min

11. An isolated plate, initially free from charge, is charged by repeated contacts with a conductor, which after each contact has a charge Q due to some mechanism. If q is the charge on the plate after the first operation, the maximum charge that can be given to the plate in this way is

- A. $Qq/(Q + q)$
- B. $Qq/(Q - q)$
- C. $2Qq/(Q - q)$
- D. $(Q - q)q/Q$

12. Three rods of material X and three rods of material Y are connected as shown in the given figure. All the rods are of identical lengths and cross-sectional areas. If the rod end P is maintained at 60°C and the junction T at 10°C , calculate the temperature of junctions Q, R and S. The thermal conductivity of X is $9.2 \times 10^{-2} \text{ kcal/m/s}^\circ\text{C}$ and that of Y is $4.6 \times 10^{-2} \text{ kcal/m/s}^\circ\text{C}$.



Which of the following options is incorrect?

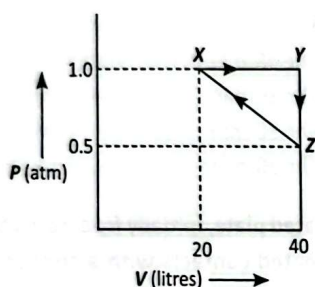
- A. Temperature at Q is 10°C greater than temperature at S.
- B. Temperature at R is 20°C .
- C. Temperature at Q is 25°C .
- D. Temperature at S is 20°C .

13. Read the following passage and identify the correct statement.

One mole of an organic compound (*P*) having molecular formula C_3H_8O reacts completely with two moles of HI to produce (*Q*) and (*R*). When (*Q*) is boiled with aqueous alkali it produces (*S*) which gives positive iodoform test.

- P* is a symmetrical ether.
- P* and (*S*) are functional group isomers.
- (*R*) on treatment with alcoholic KOH gives ethene.
- When vapours of (*S*) are passed over heated copper at 573 K, ethanal is produced.

14. One mole of an ideal gas undergoes the following processes ($X \rightarrow Y \rightarrow Z \rightarrow X$) as shown in the diagram below:



In the above processes

- The total work done is -6.14 L-atm and internal energy change is $+6.14$ L-atm
- The total heat change involved is -2.25 L-atm and internal energy change is zero
- The total entropy change is zero and total heat change involved is $+2.25$ L-atm
- The total work done is -6.14 L-atm and total entropy change is zero.

15. Which of the following are correctly matched?

- $[Cu(NH_3)_4]^{2+}$ - Square planar geometry with two unpaired electrons
- $[NiCl_4]^{2-}$ - Tetrahedral geometry with two unpaired electrons
- $[CoF_6]^{3-}$ - Octahedral geometry with two unpaired electrons
- $[Cr(H_2O)_6]^{3+}$ - Octahedral geometry with three unpaired electrons

- I, III and IV only
- II and IV only
- I and III only
- I, II and IV only

16. A compound *P* decolourises Br_2 water. *P* reacts with HBr to form *Q*. *Q* reacts with NaOH to form *R*. On oxidation *R* gives hexan-3-one. Identify *P*, *Q* and *R*.

- P* : $CH_3CH_2CH_2CH=CHCH_3$,
Q : $CH_3CH_2CH_2CH_2CH_2CH_2Br$,
R : $CH_3CH_2CH_2CH_2OH$
- P* : $CH_3CH=CHCH_3$,
Q : $CH_3CH(Br)CH(Br)CH_3$,
R : $CH_3CH_2CH(OH)CH_2CH_2CH_3$
- P* : $CH_3CH_2CH=CHCH_2CH_3$,
Q : $CH_3CH_2CH(Br)CH_2CH_2CH_3$,
R : $CH_3CH_2CH_2CH(OH)CH_2CH_3$
- P* : $CH_3CH_2CH=CHCH_2CH_3$,
Q : $CH_3CH_2CH(Br)CH(Br)CH_2CH_3$,
R : $CH_3CH_2CH_2CH(OH)CH_2CH_3$

17. Match column-I with column-II and select the correct option.

Column-I (Reaction)	Column-II (Amount of product formed)
P. $H_2 + O_2 \rightarrow H_2O$ 1 g 1 g	I. 1.21 g
Q. $H_2 + N_2 \rightarrow NH_3$ 1 g 1 g	II. 1.03 g
R. $C + H_2 \rightarrow CH_4$ 1 g 1 g	III. 1.125 g
S. $H_2 + Cl_2 \rightarrow HCl$ 1 g 1 g	IV. 1.33 g

- $P \rightarrow III, Q \rightarrow I, R \rightarrow II, S \rightarrow IV$
- $P \rightarrow III, Q \rightarrow I, R \rightarrow IV, S \rightarrow II$
- $P \rightarrow II, Q \rightarrow IV, R \rightarrow III, S \rightarrow I$
- $P \rightarrow II, Q \rightarrow IV, R \rightarrow I, S \rightarrow III$

18. When 10 coulombs of electricity is passed through a salt solution of MCl_2 , 2.1×10^{-3} g of metal *M* is deposited. The metal *M* can be

- Mg
- Ca
- Cu
- Zn

19. Which of the following statements is/are correct?

- Sc^{3+} and V^{3+} exhibit paramagnetism.
 - Ti^{2+} and Cr^{2+} are strong reducing agents.
 - V_2O_3 and Cr_2O_3 are basic oxides.
- I and II only
 - III only
 - II only
 - I and III only

20. Among $H_2, B_2, N_2^-, O_2^+, N_2^+, O_2^-, F_2$, the number of diamagnetic species having bond order one are

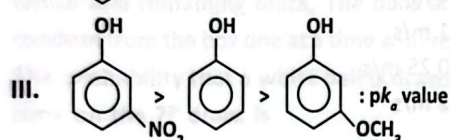
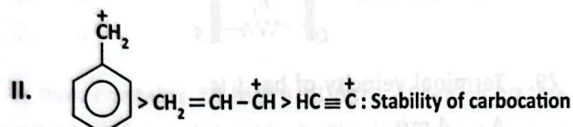
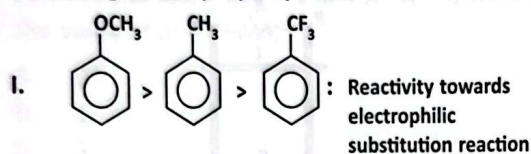
- H_2, N_2^-, O_2^+
- H_2, O_2^-, F_2
- H_2, B_2, O_2^-
- F_2, O_2^+, N_2^+

21. Read the given statements and select the correct option.
Statement-I : The depression in freezing point of solution observed for the same mole of acetic acid, trichloroacetic acid and trifluoroacetic acid dissolved separately in a fixed quantity of water increases in the order, trifluoroacetic acid < trichloroacetic acid < acetic acid.

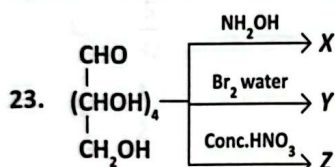
Statement-II : If 5 g each of the solutes P and Q (molar mass $P > Q$) are dissolved separately in 10 g of the same solvent, then Q will show greater lowering in vapour pressure.

- A. Statement I is false but statement II is true.
B. Both statement I and statement II are false.
C. Statement I is true but statement II is false.
D. Both statement I and statement II are true.

22. Which of the following orders is/are not correct according to the property mentioned?

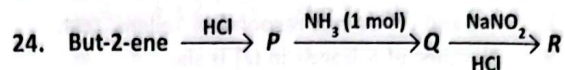


- A. I and II only
B. II only
C. III only
D. II and III only



Number of hydrogen atoms in compounds X, Y and Z are respectively

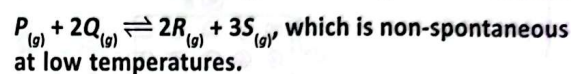
- A. 12, 12, 10
B. 13, 10, 12
C. 12, 10, 12
D. 13, 12, 10



The correct statement regarding P, Q and R is

- A. Q and R are optically active but P is optically inactive
B. Q is a secondary amine
C. On oxidation with acidified $\text{K}_2\text{Cr}_2\text{O}_7$, R gives an aldehyde
D. On heating with chloroform and ethanolic potassium hydroxide, Q gives foul smelling compound.

25. Consider the following reversible gaseous reaction:



Identify the correct statement(s) among the following regarding the given reaction.

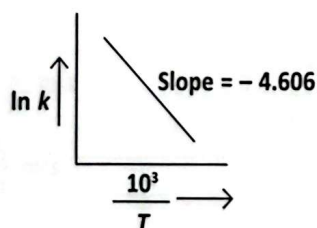
- I. It will be non-spontaneous even at higher temperatures.
II. Increase in temperature favours the forward reaction.
III. If volume of the container is increased without changing temperature then concentration of R and S will decrease.
IV. If inert gas is added at constant pressure at same temperature then concentration of P and Q will increase.

- A. II, III and IV only
B. II only
C. I and IV only
D. I, II, III and IV

SECTION-2

ACHIEVERS SECTION

26. For a reaction $R \rightarrow P$, the plot of $\ln k$ vs $\frac{10^3}{T}$ is given in the figure.

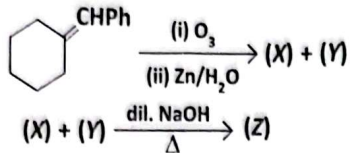


The rate constant of this reaction at 400 K is 10^{-4} s^{-1} .

Which of the following is/are correct for the given reaction?

- I. Activation energy for the reaction is 88 kJ mol^{-1} .
II. On increasing temperature, the slope of the curve decreases.
III. The rate constant for the reaction at 500 K is 10^{-3} s^{-1} .
IV. Activation energy for the reaction is $21.21 \text{ kcal mol}^{-1}$.
A. III only
B. I only
C. I and III only
D. I, II and IV only

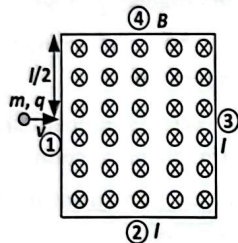
27. Consider the following sequence of reactions.



Identify the correct statement(s) among the following.

- I. (X) and (Y) do not respond to Tollens' test.
 - II. Number of π -bonds in (Z) is six.
 - III. On treatment with zinc-amalgam and concentrated hydrochloric acid (X) and (Y) are converted to hydrocarbons.
- A. I and III only
 B. II only
 C. I and II only
 D. III only

28. The magnetic field is confined in a square region. A positive charged particle of charge q and mass m is projected as shown in the given figure.



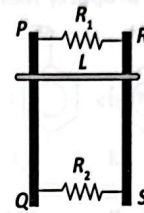
Read the given statements and select the correct option.

- I. If the velocity is less than $\frac{qBl}{4m}$, the charge particle comes out from face 1.
- II. If the velocity is $\frac{qBl}{4m} < v < \frac{5qBl}{4m}$, the charge particle comes out from face 4.
- III. If the velocity is more than $\frac{5qBl}{4m}$, the charge particle comes out from face 3.
- IV. The particle will never come out from face 2 irrespective of the velocity.

- A. I, II only
 B. I, II, III only
 C. II, III, IV only
 D. I, II, III and IV

Directions (Q. No.- 29 and 30): Refer to the given passage and answer the following questions.

Two parallel vertical metallic rails PQ and RS are separated by 1 m. They are connected at two ends by resistances R_1 and R_2 as shown in given figure. A horizontal metallic bar L of mass 0.2 kg slides without friction vertically down the rails under the action of gravity. There is a uniform horizontal magnetic field of 0.6 T perpendicular to the plane of the rails. It is observed that when the terminal velocity is attained, the power dissipated in R_1 and R_2 are 0.76 W and 1.2 W, respectively.



29. Terminal velocity of bar L is

- A. 4 m/s
 B. 1 m/s
 C. 0.25 m/s
 D. 2 m/s

30. The ratio of resistances R_1 and R_2 is

- A. $\frac{30}{19}$
 B. $\frac{1}{4}$
 C. $\frac{4}{9}$
 D. $\frac{190}{27}$

SECTION-3

MATHEMATICS

31. Let $X = \{0, 1, 2, 3\}$ and $Y = \{-1, 0, 1, 4, 9\}$ and a function $f: X \rightarrow Y$ defined by $y = x^2$, is

- A. One-one onto
 B. One-one into
 C. Many-one onto
 D. Many-one into

32. The value of $\int_0^{\pi/2} \frac{dx}{(\sqrt{\cos x} + \sqrt{\sin x})^4}$ is

- A. $\frac{1}{2}$
 B. $\frac{1}{3}$
 C. $\frac{2}{3}$
 D. $\frac{1}{6}$

33. $\lim_{x \rightarrow \frac{\pi}{3}} \frac{\sin\left(\frac{\pi}{3} - x\right)}{2\cos x - 1}$ is equal to

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

34. If matrix $A = \begin{bmatrix} a & b & c \\ b & c & a \\ c & a & b \end{bmatrix}$, where a, b and c are real

positive numbers, $abc = 1$ and $A^T \cdot A = I$, then find the value of $a^3 + b^3 + c^3$.

- A. 0
- B. 1
- C. 3
- D. 4

35. A box contains 24 identical balls of which 12 are white and remaining black. The balls are drawn at random from the box one at a time with replacement. The probability that a white ball is drawn for the 4th time on the 7th draw, is

- A. $\frac{5}{64}$
- B. $\frac{27}{32}$
- C. $\frac{5}{32}$
- D. $\frac{1}{2}$

36. A lamp of negligible height is placed on the ground l_1 m away from a wall. A man l_2 m tall is walking at a speed of $\frac{l_1}{10}$ m/s from the lamp to the nearest point on the wall. When he is midway between the lamp and the wall, the rate of change in the length of his shadow on the wall is

- A. $-\frac{5l_2}{2}$ m/s
- B. $-\frac{2l_2}{5}$ m/s
- C. $-\frac{l_2}{2}$ m/s
- D. $-\frac{l_2}{5}$ m/s

37. Let μ be the mean and σ be the standard deviation of the distribution, where $\sum f_i = 62$. If $[x]$ denotes the greatest integer $\leq x$, then $[\mu^2 + \sigma^2]$ is equal to

x_i	0	1	2	3	4	5
f_i	$k+2$	$2k$	k^2-1	k^2-1	k^2+1	$k-3$

- A. 8
- B. 6
- C. 9
- D. 7

38. Find the cosine of the angle between the vectors \vec{p} and \vec{q} such that $2\vec{p} + \vec{q} = \hat{i} + \hat{j}$ and $\vec{p} + 2\vec{q} = \hat{i} - \hat{j}$.

- A. $-\frac{4}{5}$
- B. $\frac{4}{5}$
- C. $-\frac{3}{5}$
- D. $\frac{3}{5}$

39. If a is the A.M. of b & c and the two geometric means are G_1 & G_2 , then $G_1^3 + G_2^3$ is equal to

- A. $\frac{abc}{2}$
- B. abc
- C. $2abc$
- D. $\frac{3}{2}abc$

40. Let f be twice differentiable such that $f''(x) = -f(x)$ and $f'(x) = g(x)$. If $h(x) = \{f(x)\}^2 + \{g(x)\}^2$, where $h(5) = 11$, then $h(10) =$

- A. 11
- B. 10
- C. 9
- D. 8

41. If $x \frac{dy}{dx} + 2y = \ln x$, then $e^2 y(e) - y(1) =$

- A. $\frac{e^2 + 1}{2}$
- B. $\frac{e^2 + 1}{3}$
- C. $\frac{e^2 + 1}{4}$
- D. $e^2 + 1$

42. The value of $\tan^{-1}\left(\tan\frac{5\pi}{6}\right) + \cos^{-1}\left(\cos\frac{13\pi}{6}\right)$ is

- A. 2
- B. 1
- C. 0
- D. -1

43. If the letters of the word KRISNA are arranged in all possible ways and these words are written out as in a dictionary, then the rank of the word KRISNA is

- A. 324
- B. 341
- C. 359
- D. None of these

44. If $f(x) = \frac{x-1}{x+1}$, then $f(2x) =$

- A. $\frac{f(x)+1}{f(x)+3}$
- B. $\frac{3f(x)+1}{f(x)+3}$
- C. $\frac{f(x)+3}{f(x)+1}$
- D. $\frac{f(x)+3}{3f(x)+1}$

45. The area bounded by the curve $y = \sin^2x$ and lines

$x = \frac{\pi}{2}$, $x = \pi$ and X-axis is

- A. $\frac{\pi}{2}$ sq. unit
- B. $\frac{\pi}{4}$ sq. unit
- C. $\frac{\pi}{8}$ sq. unit
- D. None of these

46. The minimum value of $z = x - 5y$ subject to $x - y \geq 0$, $-x + 2y \geq 2$, $x \geq 3$, $y \leq 4$ and $x, y \geq 0$ is

- A. -11

C. -12

D. $-\frac{19}{2}$

47. If $\sin x + \sin^2x + \sin^3x = 1$, then

$\cos^6x - 4\cos^4x + 8\cos^2x =$

- A. 2
- B. 1
- C. 3
- D. 4

48. If the foot of the perpendicular from point $(4, 3, 8)$

on the line $L_1: \frac{x-a}{l} = \frac{y-2}{3} = \frac{z-b}{4}$, $l \neq 0$ is $(3, 5, 7)$,

then the shortest distance between the line L_1 and

line $L_2: \frac{x-2}{3} = \frac{y-4}{4} = \frac{z-5}{5}$, is equal to

- A. $\frac{1}{\sqrt{3}}$
- B. $\frac{1}{2}$
- C. $\frac{1}{\sqrt{6}}$
- D. $\sqrt{\frac{2}{3}}$

49. The radius of a circle passing through the foci of the

ellipse $\frac{x^2}{25} + \frac{y^2}{16} = 1$ and centred at $(0, 4)$ is

- A. 5
- B. 4
- C. 3
- D. None of these

50. If $iz^3 + z^2 - z + i = 0$, then $|z|$ equals

- A. 2
- B. 1
- C. 0
- D. None of these

OR

BIOLOGY

31. Read the given statements about embryonic development in human beings and select the correct ones.

- (i) After one week of pregnancy, the embryo's heart is formed.
- (ii) By the end of second month of pregnancy, the foetus develops limbs and digits.

(iii) By the end of 12 weeks of pregnancy, most of the major organ systems are formed.

(iv) The first movements of the foetus and appearance of hair on head are usually observed during the third month of pregnancy.

(v) By the end of about 24 weeks of pregnancy, the body is covered with fine hair, eye-lids separate and eyelashes are formed.

- A. (i), (ii) and (iii) only
- B. (ii), (iii) and (v) only
- C. (ii), (iii) and (iv) only
- D. (i), (iv) and (v) only

32. Read the given statements (a-c) each with two blanks. Select the option that correctly fills the blanks in any two statements.

- (a) Analogy is based on (i) evolution whereas homology is based on (ii) evolution.
- (b) The thorns and tendrils of *Bougainvillea* and *Cucurbita* respectively represent (i) whereas the eye of the octopus and of mammals represent (ii).
- (c) (i) is a connecting link between plants and animals whereas (ii) is a connecting link between non-chordates and chordates.

- A. (a) - (i) Convergent, (ii) Divergent
(c) - (i) *Chlamydomonas*, (ii) Lung fish
- B. (a) - (i) Convergent, (ii) Divergent
(c) - (i) *Euglena*, (ii) *Balanoglossus*
- C. (a) - (i) Divergent, (ii) Convergent
(b) - (i) Homology, (ii) Analogy
- D. (b) - (i) Analogy, (ii) Homology
(c) - (i) Poriferans, (ii) Duck-billed platypus

33. Refer to the given statements (I to IV) and select the option that correctly fill in the blanks in any two of them.

- I. (i) bacterium lives in genital tubes and causes (ii) sensation during urination. It may lead to eye infection in children of infected mothers.
- II. Symptoms of genital herpes is more severe in (i). It is caused by (ii) and is transmitted sexually.
- III. *Chlamydia* is (i) pathogen that causes urethritis epididymitis in males and inflammation of (ii) in females.
- IV. *Sarcoptes scabiei* is an (i) that causes intense itching and patches on (ii).

- A. I-(i)-*Neisseria gonorrhoeae* (ii)-Burning
II-(i)-Males (ii)-Protozoa
- B. I-(i)-*Neisseria gonorrhoeae* (ii)-Burning
IV-(i)-Ectoparasite (ii)-Skin
- C. III-(i)-Obligate intracellular (ii)-Fallopian tube
IV-(i)-Endoparasite (ii)-Anus
- D. II-(i)-Males (ii)-Bacteria
III-(i)-Facultative intracellular (ii)-Uterus

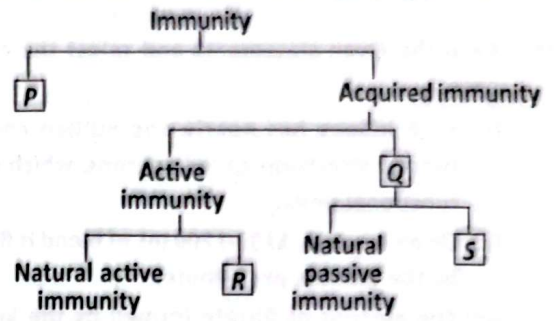
34. Read the given statements and select the correct ones.

- (i) Biogas is produced by aerobic breakdown or digestion of biomass with the help of methanogenic bacteria.

- (ii) Biogas is a mixture of 50-70% carbon dioxide and 30-40% methane, with smaller amounts of other gases like hydrogen and oxygen.
- (iii) Biogas generation is a three-stage anaerobic digestion of animal and other organic wastes.
- (iv) Biogas is a storable form of energy which can be used more efficiently and economically.

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

35. Identify P-S from the given classification chart and select the correct statement regarding them.



- A. R develops when a person has recovered from an attack of small pox whereas S is the resistance passively transferred from the mother to the foetus through placenta.
- B. P consists of specialised cells like T-cells and B-cells whereas Q consists of various types of barriers.
- C. P is inherited by an organism from its parents and it provide protection since birth whereas Q develops in a recipient by the administration of antibodies.
- D. In Q, person's own cells produce antibodies in response to infection or vaccination whereas a person develops R by receiving ready-made antibodies.

36. Which of the following statements are correct regarding biodiversity losses?

- (i) Passenger pigeon and Steller's sea cow have become extinct in the last 500 years due to over exploitation by humans.
- (ii) The introduction of Cichlid fish into lake Victoria of South Africa, killed the unique assemblage of more than 200 species of Nile Perch.
- (iii) When a species become extinct, the plant and animal species associated with it in an obligatory way also become extinct.

- A. (i), (ii) and (iii)
- B. (i) and (iii) only
- C. (i) and (ii) only
- D. (ii) and (iii) only

37. Read the given steps that occur during expiration in humans.

- (i) Relaxation of the diaphragm.
- (ii) Reduction in the thoracic volume and consequently the pulmonary volume.
- (iii) The intrapulmonary pressure becomes higher than the atmospheric pressure.
- (iv) Foul air flows out from the alveolar cavities.

Now, select the option that identifies the correct sequential arrangement of these steps.

- A. (i) → (ii) → (iii) → (iv)
- B. (iii) → (iv) → (i) → (ii)
- C. (iv) → (iii) → (ii) → (i)
- D. (i) → (iii) → (ii) → (iv)

38. Read the given statements and select the correct ones.

- (i) Each kidney has nearly one million complex tubular structures called nephrons, which are its functional units.
- (ii) On an average, 1100-1200 mL of blood is filtered by the kidneys per minute.
- (iii) The amount of filtrate formed by the kidneys per minute is called glomerular filtration rate.
- (iv) Glomerular filtration rate in a healthy individual is approximately 125 mL per minute.
- (v) In humans, the excretory system consists of a pair of kidneys, a ureter and a urethra only.

- A. (ii), (iii) and (iv) only
- B. (iii), (iv) and (v) only
- C. (i), (ii) and (iii) only
- D. (i), (iii) and (v) only

39. Select the correct matches.

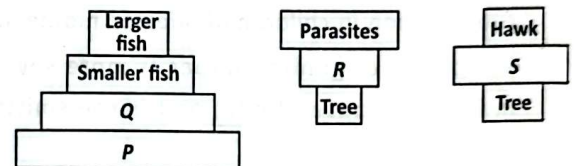
- (i) **Myasthenia gravis** – Progressive degeneration of skeletal muscle mostly due to genetic disorder
- (ii) **Tetany** – Rapid spasm in muscle due to high Ca^{2+} level in body fluid
- (iii) **Arthritis** – Inflammation of the joints
- (iv) **Muscular dystrophy** – Autoimmune disorder that affects neuromuscular junction
- (v) **Gout** – Inflammation of joints due to accumulation of uric acid crystals

- A. (ii) and (iii) only
- B. (iii) and (iv) only
- C. (iii) and (v) only
- D. (iv) and (v) only

40. In which of the following options the genus name, its two characters and its phylum are correctly matched?

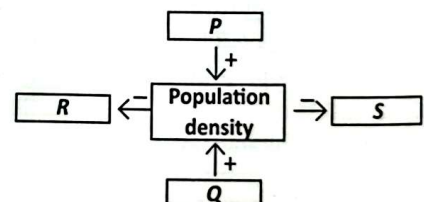
Genus	Characters	Phylum
A. <i>Pheretima</i>	(i) Monoecious (ii) Exhibit organ-system level of body organisation	Annelida
B. <i>Pleurobrachia</i>	(i) Fertilisation is external with indirect development (ii) Reproduction takes place only by asexual means	Cnidaria
C. <i>Limulus</i>	(i) Bilaterally symmetrical, triploblastic and coelomate (ii) Usually dioecious and oviparous	Mollusca
D. <i>Sycon</i>	(i) Digestion is extracellular (ii) Sexes are separate	Porifera

41. Study the given ecological pyramids and select the option that correctly identifies P, Q, R and S.



- | | | | | |
|----|----------------|----------------|--------------|---------|
| | P | Q | R | S |
| A. | Zooplanktons | Phytoplanktons | Birds | Rabbits |
| B. | Phytoplanktons | Birds | Zooplanktons | Frogs |
| C. | Phytoplanktons | Zooplanktons | Birds | Birds |
| D. | Zooplanktons | Phytoplanktons | Birds | Birds |

42. Refer to the given diagram and select the correct statements regarding it.



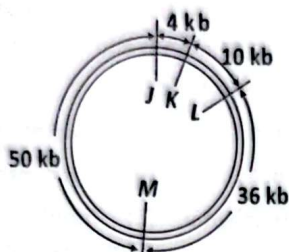
- (i) R could be the number of births during a given period.
- (ii) Q could be the number of individuals who left the habitat.

(iii) P could be the number of individuals of the same species that have come into the habitat.

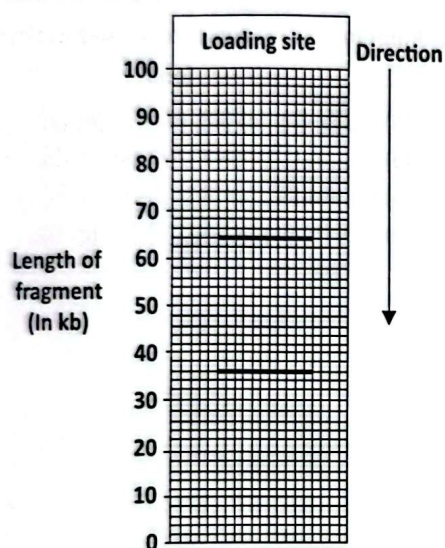
(iv) S could be the number of deaths in a population during a given period.

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

3. The diagram below shows the position of four recognition sites J, K, L and M for four different restriction enzymes in a single plasmid.



The plasmid was cut using only two restriction enzymes and the resulting fragments were separated by gel electrophoresis. The position of the fragments is shown as follows.



At which of these recognition sites, restriction enzymes must have acted?

- A. L and M
- B. J and K
- C. J and M
- D. L and K

44. Read the given statements and select the correct ones.

- (i) Genetic modifications have made crops more tolerant to abiotic stresses.
- (ii) Genetic modifications have enhanced reliance on chemical pesticides.
- (iii) Genetic modifications have reduced nutritional values of food.

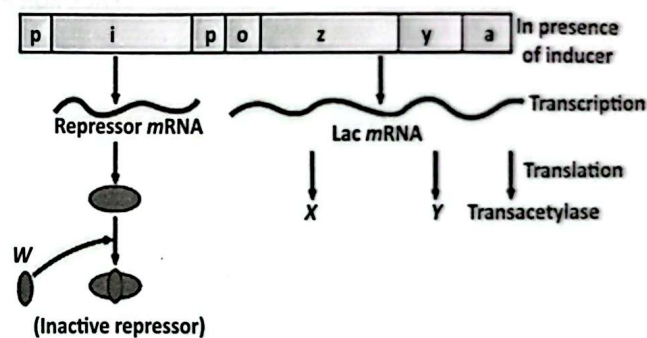
(iv) Genetic modifications have helped to reduce post harvest losses.

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

45. In which one of the following options, genetic disorder, its characteristics and its type are incorrectly matched?

Genetic disorder	Characteristics	Type
A. Haemophilia	Sex-linked recessive	Mendelian disorder
B. Phenylketonuria	Sex-linked recessive	Mendelian disorder
C. Down's syndrome	Due to presence of additional copy of the chromosome number 21	Chromosomal disorder
D. Klinefelter's syndrome	An additional copy of X-chromosome is present and individuals are sterile	Chromosomal disorder

46. Refer to the given figure of lac operon and select the correct statements about W, X and Y.

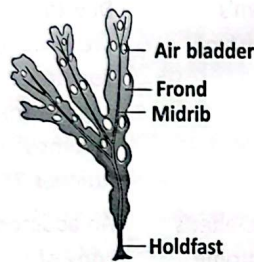


- (i) W could be glucose that regulates switching on and off of the operon.
- (ii) X is primarily responsible for the hydrolysis of disaccharide, lactose into galactose and glucose.
- (iii) Y increases the permeability of the cell to β -galactosides.
- (iv) W could be lactose that acts as an inducer.

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

47. Select the correctly matched pairs.
- (i) Leptotene – Chromosomes become visible
 - (ii) Diplotene – Pairing of homologous chromosomes
 - (iii) Pachytene – Exchange of genetic material between homologous chromosomes
 - (iv) Zygotene – Dissolution of the synaptonemal complex
 - (v) Diakinesis – Terminalisation of chiasmata
- A. (i), (ii) and (iv) only
 B. (ii), (iii) and (iv) only
 C. (ii), (iv) and (v) only
 D. (i), (iii) and (v) only

48. Refer to the given figure.



Now, select the option that correctly identifies its name, class and flagellar number respectively.

- A. *Laminaria*, Phaeophyceae, 2
 B. *Dictyota*, Phaeophyceae, 2-8
 C. *Fucus*, Phaeophyceae, 2
 D. *Ulothrix*, Chlorophyceae, 2-8

49. Refer to the given sequence of taxonomical categories and select the correct one(s).

- (i) Species → Class → Order → Phylum
- (ii) Genus → Species → Order → Kingdom
- (iii) Species → Genus → Order → Phylum
- (iv) Genus → Order → Family → Phylum

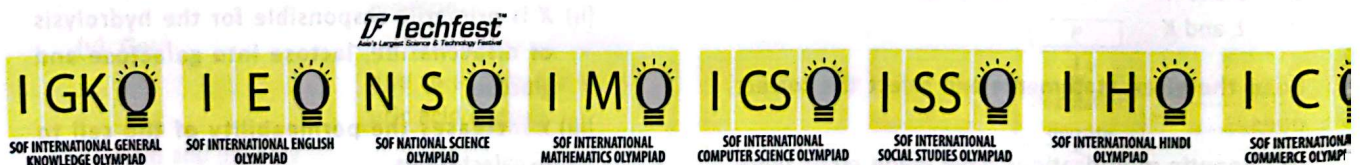
- A. (iii) only
 B. (ii) and (iii) only
 C. (i) and (iv) only
 D. (i) and (ii) only

50. Match the plant tissues in column I with their functions in column II and select the correct option from the given codes.

Column I	Column II
(a) Parenchyma	(i) Transports food materials
(b) Sclerenchyma	(ii) Transports water and minerals
(c) Collenchyma	(iii) Provides mechanical support and elasticity
(d) Xylem	(iv) Provides mechanical strength and rigidity
(e) Phloem	(v) Stores and assimilates food

- A. (a)-(i), (b)-(ii), (c)-(iii), (d)-(iv), (e)-(v)
 B. (a)-(v), (b)-(iv), (c)-(iii), (d)-(ii), (e)-(i)
 C. (a)-(v), (b)-(iv), (c)-(iii), (d)-(i), (e)-(ii)
 D. (a)-(iii), (b)-(iv), (c)-(v), (d)-(ii), (e)-(i)

SPACE FOR ROUGH WORK



For latest updates & information, please like our Facebook page (www.facebook.com/sofworld) or register www.sofworld.org/subscribe-updates.html

For Level 1 and Level 2 preparation material / free sample papers, please log on to www.mtg.in



Head Office: Plot 99, Sector 44 Institutional area, Gurugram -122 003 (HR), India
 Email: info@sofworld.org | Website: www.sofworld.org