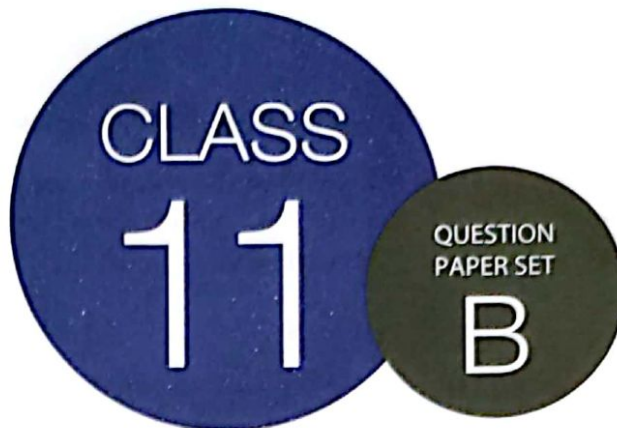




SOF NATIONAL SCIENCE
OLYMPIAD 2022-23



DO NOT OPEN THIS BOOKLET UNTIL ASKED TO DO SO

Total Questions: 50 | Time: 1 hr.

Guidelines for the Candidate

1. You will get additional ten minutes to fill up information about yourself on the OMR Sheet, before the start of the exam.
2. Write your **Name, School Code, Class, 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.
3. 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)
4. **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 one mark each.
5. All questions are compulsory. There is no negative marking. Use of calculator is not permitted.
6. There is only ONE correct answer. Choose only ONE option for an answer.
7. 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: In the water cycle, condensation is the process of
A. Water vapour cooling down and turning into a liquid B. Ice warming up and turning into a liquid
C. Liquid cooling down and turning into ice D. Liquid warming up and turning into water vapour
As the correct answer is option A, you must darken the circle corresponding to option A on the OMR Sheet.

16.	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
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8. Rough work should be done in the blank space provided in the booklet.
9. Return the OMR Sheet to the invigilator at the end of the exam.
10. Please fill in your personal details in the space provided on this page before attempting the paper.

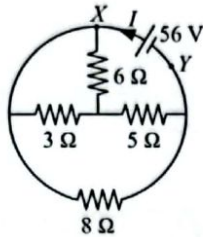


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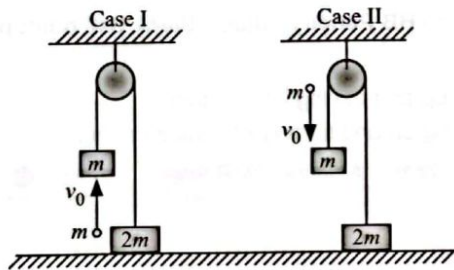
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SECTION-1
PHYSICS

1. Different resistors and a cell of emf 56 V are connected between two points X and Y as shown in the circuit diagram. The value of current I is

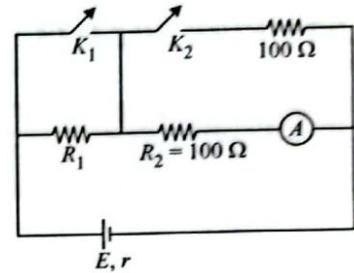


- A. $\frac{56}{15}$ A B. $\frac{15}{56}$ A
C. $\frac{1}{4}$ A D. 15 A
2. Consider two small blocks of masses $2m$ and m , which are connected by an in-extensible light string as shown in the given figure. The string is passing over a light frictionless pulley. The block of mass $2m$ is resting on a surface and the block of mass m is hanging in air. A particle having mass m strikes the block of mass m from below in case I with a velocity v_0 and in case II it strikes the block of mass m with a velocity v_0 from the top and sticks to it.

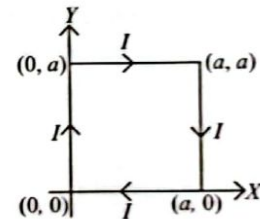


- Which of the following statements is correct?
- A. The conservation of linear momentum can be applied in both the cases, just before and just after collision.
B. The conservation of linear momentum can be applied in case I but cannot be applied in case II, just before and just after collision.
C. The ratio of velocities of mass m , just after collision in first and second case is $\frac{1}{2}$.
D. The ratio of velocities of mass m , just after collision in first and second case is 4.

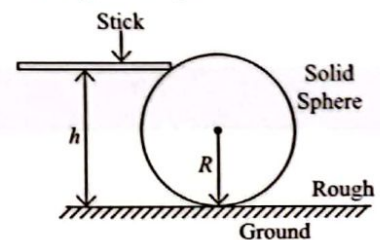
3. Consider the circuit shown, when key K_1 is closed, then the ammeter reads 10 A whether K_2 is open or closed. But when K_1 is open the ammeter reads 5 A. When K_2 is closed, the values of r and R_1 are respectively
(Assuming that ammeter resistance is much less than R_2).



- A. 100 Ω, 50 Ω B. 50 Ω, 100 Ω
C. 0 Ω, 100 Ω D. 0 Ω, 50 Ω
4. A square shaped current carrying loop as shown in the given figure is placed in a magnetic field which is given by $\vec{B} = \frac{B_0 z}{a} \hat{j}$, where B_0 is a positive constant. Which of the following statements is correct?



- A. Force on side (0, 0) to (0, a) is $\left(\frac{B_0 I a}{8}\right) \hat{i}$.
B. Force on side (0, a) to (a, a) is $-4B_0 I a \hat{j}$.
C. Net magnetic force on the loop is zero.
D. Force on side (a, 0) to (0, 0) is $\frac{B_0 I a}{16} \hat{k}$.
5. Consider a solid sphere having mass M and radius R . This sphere is placed on a rough horizontal surface, having coefficient of friction μ . Now, this sphere is struck by a horizontal stick at height h ($R < h < 2R$), as shown in the given figure.



The value of h , so that the sphere performs pure rolling motion immediately after it has been struck is

- A. $\frac{R}{5}$ B. $\frac{2R}{3}$
 C. $\frac{7R}{5}$ D. $\frac{3R}{5}$

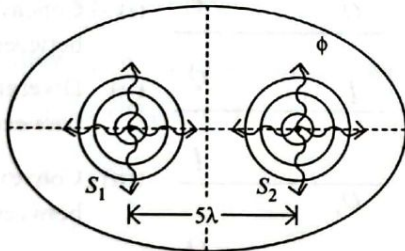
6. Read the given statements and select the correct option.

Statement 1 : A parallel beam of light travelling in air, when it is incident on a parallel slab, it can be displaced laterally by the parallel transparent slab through a distance more than the thickness of the slab.

Statement 2 : The lateral displacement of light travelling in the slab increases with the increase in its refractive index of slab.

- A. Both statements 1 and 2 are true and statement 2 is the correct explanation of statement 1.
 B. Both statements 1 and 2 are true but statement 2 is not the correct explanation of statement 1.
 C. Statement 1 is true but statement 2 is false.
 D. Statement 1 is false but statement 2 is true.

7. S_1 and S_2 are two coherent sound sources situated along major axis of an elliptical boundary ϕ , as shown in the given figure.



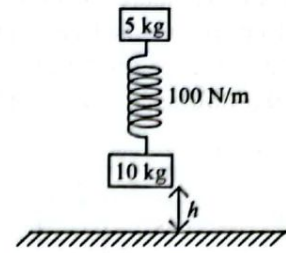
Separation between these sources is 5λ , where λ is wavelength of sound, emitted by S_1 and S_2 . Consider the following statements.

- I. Number of maxima located along the boundary ϕ is twenty.
 II. Number of maxima located along the boundary ϕ is four.
 III. Number of minima located along the boundary ϕ is sixteen.
 IV. Number of minima located along the boundary ϕ is twenty.

Which of the given statements are correct?

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

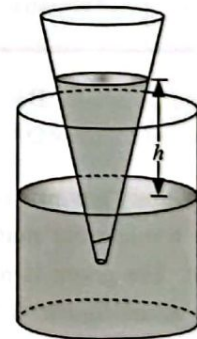
8. Two blocks are connected through a spring as shown in the given figure.



When the system is released, the spring was in its natural length. Find the possible value of h such that after perfectly inelastic collision with the ground, the larger block may be lifted off the ground.

- A. 1 m B. 1.5 m
 C. 3 m D. 1.75 m

9. A capillary tube is made up of glass. Radius of its two ends are r_1 and r_2 and the tube is in the shape of a truncated cone. Now, the capillary tube is dipped in a liquid vertically, such that the liquid rises in it to a height h as shown in the given figure, where the radius of its cross section is r . If surface tension of the liquid is T , its density is ρ , and its contact angle with glass is θ , and apex angle of the cone is α , then consider the following statements (g is the acceleration due to gravity).

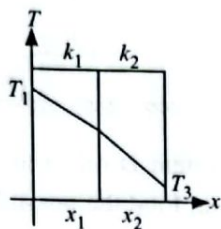


- I. The value of h is $\frac{2T}{r\rho g} \sin\left(\theta + \frac{\alpha}{2}\right)$.
 II. If $\theta \gg \alpha$, then h is approximately $\frac{T\alpha}{r\rho g}$.
 III. The value of h is $\frac{2T}{r\rho g} \cos\left(\theta + \frac{\alpha}{2}\right)$.

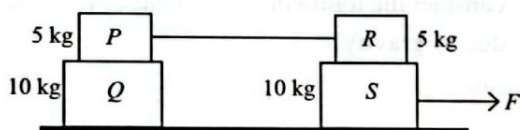
Which of the given statements is/are incorrect?

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

10. The variation of temperature (T) and distance (x) through each layer of a double layer furnace wall is shown in the given figure. Let the external temperatures T_1 and T_3 are maintained constant, and $T_1 > T_3$. If the thickness of both the layers x_1 and x_2 are same, which of the following is correct?

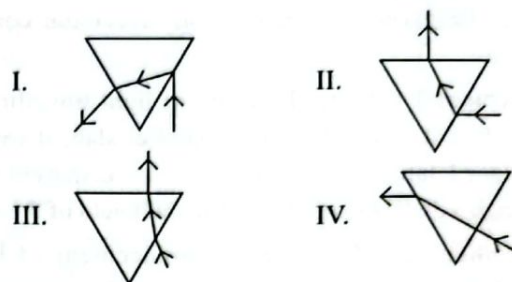
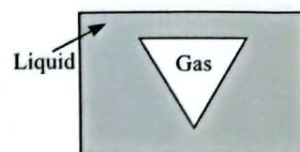


- A. $k_1 > k_2$
 B. $k_1 < k_2$
 C. $k_1 = k_2$, but rate of heat flowing through first layer is larger than through second layer
 D. $k_1 = k_2$, but rate of heat flowing through first layer is lesser than through second layer
11. Four blocks arrangement, connected through a light string is as shown in the given figure. If the coefficient of static friction between the top and the bottom blocks is 0.2, then the maximum value of the horizontal force F , applied to one of the bottom blocks that makes all the four blocks move with the same acceleration, is



- A. 15 N B. 10 N
 C. 25 N D. 30 N
12. Consider a hollow "gas prism" which is made with walls of thin transparent material and is sealed to be liquid tight. The prism is immersed in a liquid as shown in the given figure. A ray of light enters the prism from the liquid on the right. The following diagrams represent possible paths of the ray entering the prism, passing through it and emerging back in the liquid. Here, the walls of the prism have to be

treated as having negligible thickness and playing no significant role in the path of refraction.



Which of the given ray diagrams is/are correct?

- A. I only B. II and IV only
 C. III only D. III and IV only
13. Given diagram shows O as object and I as image. The responsible optical system can be, a spherical mirror, plane mirror or a thin lens. In the cases of the lens and spherical mirror, the straight line shows the principal axis. Match column I and column II and select the correct option from the given codes:
- | | Column I | Column II |
|----|---------------|---|
| P. | $\frac{O}{I}$ | (i) Concave mirror between O and I |
| Q. | $\frac{I}{Q}$ | (ii) Diverging lens between O and I |
| R. | $\frac{I}{O}$ | (iii) Convex mirror between O and I |
| S. | $\frac{I}{Q}$ | (iv) Converging lens between O and I |
| | | (v) Inclined plane mirror somewhere between |
- A. P-(i), (ii); Q-(ii), (iii); R-(iii), (iv); S-(iv), (v)
 B. P-(iv), (v); Q-(iii), (iv); R-(ii), (iii); S-(i)
 C. P-(v); Q-(i); R-(ii), (iii); S-(iv)
 D. P-(iii), (v); Q-(iii), (v); R-(iv), (v); S-(iv), (v)

CHEMISTRY

14. Select the incorrect order :
- A. Atomic radius : $\text{Li} > \text{Be} > \text{C} > \text{N} > \text{O}$
 B. Electronegativity : $\text{F} > \text{O} > \text{N} > \text{B}$
 C. Metallic Character : $\text{Na} > \text{K} > \text{Rb} > \text{Cs}$
 D. Basic Character of Oxides : $\text{Sr} > \text{Ca} > \text{Mg} > \text{Be}$
15. The correct order of boiling points of 2,2-dimethylpropane, 2-methylbutane and n -pentane is
- A. n -pentane $>$ 2,2-dimethylpropane $>$ 2-methylbutane
 B. n -pentane $>$ 2-methylbutane $>$ 2,2-dimethylpropane
 C. 2,2-dimethylpropane $>$ 2-methylbutane $>$ n -pentane
 D. 2-methylbutane $>$ n -pentane $>$ 2,2-dimethylpropane.

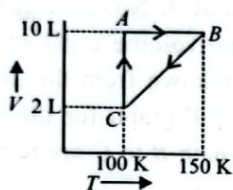
16. B has a smaller first ionization enthalpy than Be. Which among the following could not be the reason for this fact?

- I. It is difficult to remove 2s electron than 2p electron.
- II. 2p electron of B is more shielded from the nucleus by the inner core electrons than the 2s electrons of Be.
- III. 2s electron has more penetration power than 2p electron.
- IV. Atomic radius of B is less than Be.

(Atomic number B = 5, Be = 4)

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

17. Consider the given diagram for 1 mole of a gas X and answer the following question.



The process A → B represents

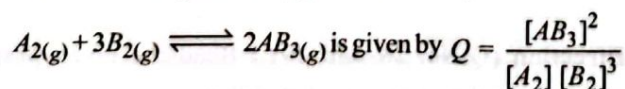
- A. Isobaric change
- B. Isothermal change
- C. Adiabatic change
- D. Isochoric change.

18. Arrange the following in decreasing order of stability.

1. $(\text{CH}_3)_2 - \overset{+}{\text{C}} - \text{CH}_2 - \text{CH}_3$
2. $(\text{CH}_3)_3 - \overset{+}{\text{C}}$
3. $(\text{CH}_3)_2 - \overset{+}{\text{C}}\text{H}$
4. $\text{CH}_3 - \overset{+}{\text{C}}\text{H}_2$
5. $\overset{+}{\text{C}}\text{H}_3$

- A. 2 > 3 > 5 > 1 > 4
- B. 2 > 1 > 3 > 4 > 5
- C. 5 > 3 > 1 > 2 > 4
- D. 4 > 2 > 1 > 3 > 5

19. The reaction quotient (Q) for reaction,



The reaction will proceed from left to right if

- A. $Q = K_c$
- B. $Q < K_c$
- C. $Q > K_c$
- D. Any of these.

20. pH of different solutions are given in the table below.

Solution	pH
W	11.4 - 12.2
X	1.2 - 2.4
Y	9.0 - 10.0
Z	5.6 - 6.2

Arrange these solutions in the increasing order of H^+ ion concentration.

- A. $W < Z < X < Y$ B. $X < Y < W < Z$
C. $X < Z < Y < W$ D. $W < Y < Z < X$

21. Three students Neha, Priya and Abhishek performed the experiment to study the reactivity of various metals in ZnSO_4 solution. They tabulated their observations in the following table :

here * - Reaction will not take place

✓ - Reaction will take place

	Set 1	Set 2	Set 3	Set 4
Metals	Fe	Mg	Cu	Al
Neha	*	✓	*	✓
Priya	✓	✓	*	*
Abhishek	*	✓	✓	*

The incorrect observation(s) was/were made by

- A. Neha only
- B. Priya only
- C. Both Priya and Abhishek
- D. Both Neha and Priya.

22. The density of a 2 M sodium sulphite (Na_2SO_3) solution is 2.63 g/mL. Calculate the percent by mass of sodium sulphite.

- A. 12.64%
- B. 9.58%
- C. 0.87%
- D. 8.21%

23. Read the given statements and select the correct option.

Statement 1 : As the molecular mass increases in any homologous series, no gradation in physical properties is observed.

Statement 2 : This is because the functional group changes as one moves across a given homologous series.

- A. Both statement 1 and statement 2 are true and statement 2 is the correct explanation of statement 1.
- B. Both statement 1 and statement 2 are true but statement 2 is not the correct explanation of statement 1.
- C. Statement 1 is true but statement 2 is false.
- D. Both statement 1 and statement 2 are false.

24. Select the incorrect match(es).
- Heating the mixture of hydrogen and copper (II) oxide- Redox reaction
 - Heating of ferrous sulphate - Double displacement reaction
 - Exposure of silver chloride to sunlight- Combination reaction
 - Burning of coal - Combination reaction
- A. I and II only
B. III only

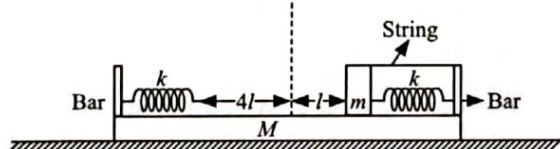
- C. II and III only
D. I and IV only

25. Mn^{3+} ions are unstable in solution and undergo disproportionation to give Mn^{2+} , MnO_2 and H^+ ions. What will be the balanced ionic equation for this reaction?
- $3Mn^{3+} + 4H_2O \rightarrow MnO_2 + Mn^{2+} + 8H^+$
 - $Mn^{3+} + 4H_2O \rightarrow MnO_2 + Mn^{2+} + 4H^+$
 - $Mn^{3+} + 2H_2O \rightarrow MnO_2 + Mn^{2+} + 4H^+$
 - $2Mn^{3+} + 2H_2O \rightarrow MnO_2 + Mn^{2+} + 4H^+$

SECTION-2

ACHIEVERS SECTION

26. Consider a plank of mass M which is placed on a smooth horizontal surface. Two identical light springs of spring constant k are rigidly connected to bars, at the ends of the plank as shown in the given figure. When the springs are in their unextended position the distance between their free ends is $4l$. A block of mass m is placed on the plank and pressed against one of the springs, so that it is compressed by l . To keep the block at rest it is connected to the right bar by means of a light string, initially the system is at rest. Now if the string is burnt, then time period of oscillations of the block is

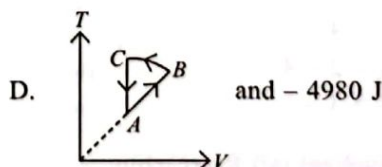
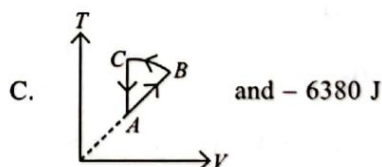
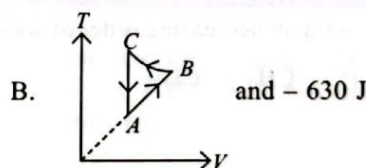
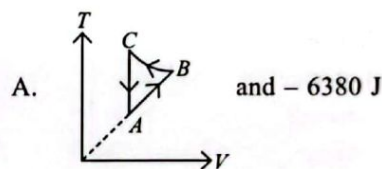


- $(2\pi + 4) \sqrt{\frac{2Mm}{k(M+m)}}$
- $(\pi + 8) \sqrt{\frac{2Mm}{k(M+m)}}$
- $(\pi + 4) \sqrt{\frac{Mm}{k(M+m)}}$
- $2(\pi + 4) \sqrt{\frac{Mm}{k(M+m)}}$

27. Three moles of an ideal gas is initially in state A , having pressure $1.01 \times 10^5 \text{ N/m}^2$ and temperature 400 K . Keeping pressure constant, the gas is taken to state B . Temperature at B is 600 K . The gas is then taken to state C in such a way that its temperature increases and volume decreases. Also from B to C the magnitude of $\frac{dT}{dV}$ increases. The volume of gas at C is equal to

volume of gas at A . Now, the gas is taken to initial state A keeping volume constant. A total of 1400 J of heat is withdrawn from the sample in the cyclic process. The T - V graph for the cyclic process and work done in path B to C are respectively.

(Take $R = 8.3 \text{ J/k mol}$.)



Direction (Q.No. 28 and 29) : Read the given passage and answer the questions that follow :

Atomic orbitals are precisely distinguished by what are known as quantum numbers. Each orbital is distinguished by three quantum numbers. The fourth quantum number is called electron spin quantum number which helps in distinguishing the two orientations of the electron.

28. Read the following statements and select the option that correctly identifies them as true (T) or false (F) ones.

- I. 'n' is also known as subsidiary quantum number and it defines the three-dimensional shape of the orbital.
- II. A value of 'l' equal to 3 corresponds to f subshell.
- III. For any subshell (defined by 'l' value), 2l-1 values of m_l are possible.
- IV. The values of n, l and m_l for a 4p orbital are 4, 2 and -1, 0, +1 respectively.

	I	II	III	IV
A.	T	T	F	F
B.	F	T	F	T
C.	T	F	F	F
D.	F	T	F	F

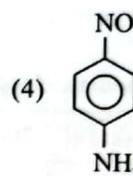
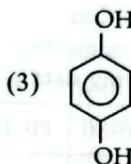
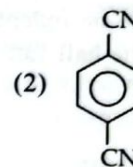
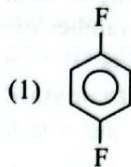
29. The correct quantum numbers n, l, m_l , m_s for the unpaired electron of fluorine atom respectively are

- A. 3, 0, 0, $+\frac{1}{2}$
- B. 3, 0, 0, $-\frac{1}{2}$

C. 2, 1, -2, $+\frac{1}{2}$

D. 2, 1, 1, $+\frac{1}{2}$

30. Which of the following molecule(s) has/have significant value of dipole moment?



- A. (3) and (4) only
- B. (1) and (3) only
- C. (1) and (2) only
- D. (3) only

SECTION-3

MATHEMATICS

31. If A.M. between two positive numbers a and b is 15 and G.M. between a and b is 9, then the numbers are

- A. 3, 27
- B. 2, 27
- C. 3, 26
- D. -3, -27

32. The equation $\frac{x^2}{14-a} + \frac{y^2}{9-a} = 1$ represents a/an

- A. Ellipse, if $a > 9$
- B. Hyperbola, if $9 < a < 14$
- C. Hyperbola, if $a > 14$
- D. Ellipse, if $9 < a < 14$

33. If $\frac{1}{3}$ is a root of the equation $x^2 + kx - \frac{5}{9} = 0$, then find the value of k.

- A. $\frac{3}{4}$
- B. $\frac{4}{3}$
- C. $\frac{2}{3}$
- D. $\frac{3}{2}$

34. The value of k such that the quadratic polynomial $x^2 - (k+6)x + 2(2k+1)$ has sum of the zeroes as half of their product, is

- A. 2
- B. 3
- C. -5
- D. 5

35. Solve for x : $-(x-3) + 4 > -2x + 5$

- A. $(-2, \infty)$
- B. $(-\infty, 2]$
- C. (2, 4)
- D. (0, ∞)

36. The number of spherical bullets that can be made out of a solid cube of lead whose edge measures 88 cm, each bullet being 4 cm in diameter, is

- A. 25000
- B. 25440
- C. 20328
- D. 25140

37. The modulus of $\frac{1+2i}{1-(1-i)^2}$ is

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

38. Find the derivative of $f(x) = 1 + x + x^2 + x^3 + \dots + x^{50}$ at $x = 1$.

- A. 1275
- B. 1200
- C. 1326
- D. 1542

39. There are 8 lamps in a hall. Each one of them can be switched on independently. The number of ways in which the hall can be illuminated is

- A. 8!
- B. 16
- C. 255
- D. 2^8

40. Find the median class for the following data.

Class interval	20-40	40-60	60-80	80-100
Frequency	10	12	20	22

- A. 20-40
- B. 40-60
- C. 60-80
- D. 80-100

41. 6 boys and 6 girls sit in a row at random. Find the probability that all the girls sit together.

- A. $\frac{1}{40}$
- B. $\frac{1}{68}$
- C. $\frac{1}{132}$
- D. None of these

42. Find the length of an arc of a circle of radius 3 cm, if the angle subtended at the centre is 30° . (Use : $\pi = 3.14$)

- A. 1.50 cm
- B. 1.35 cm
- C. 1.57 cm
- D. 1.20 cm

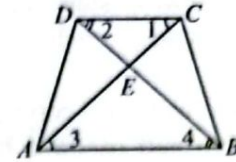
43. Find a relation between x and y such that the point (x, y) is equidistant from the points $(9, 3)$ and $(5, 7)$.

- A. $x - y = 2$
- B. $x + y = 3$
- C. $x - y = 4$
- D. $x + y = -2$

44. If $\cos \theta = -\frac{1}{2}$ and $\pi < \theta < \frac{3\pi}{2}$, then find the value of $4 \tan^2 \theta - 3 \operatorname{cosec}^2 \theta$.

- A. 0
- B. $\frac{1}{4}$
- C. 8
- D. None of these

45. In the given figure, $\angle 1 = \angle 3$, $\angle 2 = \angle 4$, $DE = 4$ units, $CE = (x + 1)$ units, $AE = (2x + 4)$ units and $BE = (4x - 2)$ units. Find the value of x .



- A. 2
- B. 3
- C. 4
- D. 5

46. If $A = \{1, 2, 4\}$, $B = \{2, 4, 5\}$, $C = \{2, 5\}$, then $(A - B) \times (B - C) =$

- A. $\{(1, 2), (1, 5), (2, 5)\}$
- B. $\{(1, 4)\}$
- C. $\{(1, 5)\}$
- D. None of these

47. The total number of terms in the expansion of $(x + a)^{51} - (x - a)^{51}$ after simplification is

- A. 102
- B. 25
- C. 26
- D. 23

48. Evaluate : $\lim_{x \rightarrow 2} \left(\frac{x^2 - 3x + 2}{x^2 + x - 6} \right)$

- A. $\frac{1}{5}$
- B. $\frac{2}{5}$
- C. $\frac{3}{5}$
- D. 1

49. If the numerator of a fraction is increased by 2 and the denominator is decreased by 4, then it becomes 2. If the numerator is decreased by 1 and the denominator is increased by 2, then it becomes $\frac{1}{3}$. Find the fraction.

- A. $\frac{3}{4}$
- B. $\frac{4}{7}$
- C. $\frac{5}{3}$
- D. $\frac{3}{8}$

50. Find the angle between the x -axis and the line joining the points $(3, -1)$ and $(4, -2)$.

- A. 130°
- B. 135°
- C. 150°
- D. None of these

31. In a dihybrid cross where two parents differ in two pairs of contrasting traits like seed colour yellow (YY) and seed colour green (yy) with seed shape round (RR) and seed shape wrinkled (rr), the number of green coloured seeds (yy) among sixteen products of F_2 generation will be
- A. 2 B. 4
C. 6 D. 8.
-
32. The correct sequence of reproductive stages seen in flowering plants is
- A. Gametes, Zygote, Embryo, Seedling
B. Zygote, Gametes, Embryo, Seedling
C. Seedling, Embryo, Zygote, Gametes
D. Gametes, Embryo, Zygote, Seedling.
-
33. Which of the following statement(s) is/are true about heart?
- (i) Left atrium receives oxygenated blood from different parts of body while right atrium receives deoxygenated blood from lungs.
(ii) Left ventricle pumps oxygenated blood to different body parts except lungs while right ventricle pumps deoxygenated blood to lungs.
(iii) Left atrium transfers oxygenated blood to right ventricle which sends it to different body parts.
(iv) Right atrium receives deoxygenated blood from different body parts except lungs while left ventricle pumps oxygenated blood to different body parts except lungs.
- A. (i) only B. (ii) only
C. (ii) and (iv) only D. (i) and (iii) only
-
34. Which of the following is most appropriate for aerobic respiration?
- A. $\text{Glucose} \xrightarrow{\text{Mitochondria}} \text{Pyruvate}$
 $\downarrow \text{Cytoplasm}$
 $\text{CO}_2 + \text{H}_2\text{O} + \text{Energy}$
- B. $\text{Glucose} \xrightarrow{\text{Cytoplasm}} \text{Pyruvate}$
 $\downarrow \text{Mitochondria}$
 $\text{CO}_2 + \text{H}_2\text{O} + \text{Energy}$
- C. $\text{Glucose} \xrightarrow{\text{Cytoplasm}} \text{Pyruvate} + \text{Energy}$
 $\downarrow \text{Mitochondria}$
 $\text{CO}_2 + \text{H}_2\text{O}$
- D. $\text{Glucose} \xrightarrow{\text{Cytoplasm}} \text{Pyruvate} + \text{Energy}$
 $\downarrow \text{Mitochondria}$
 $\text{CO}_2 + \text{H}_2\text{O} + \text{Energy}$
-
35. Read the given statements and select the correct option.
- Statement 1 :** *Sphagnum* is slowly carbonised, compressed and fossilised over thousands of years to produce a dark spongy mass called peat.
- Statement 2 :** Peat helps to keep soil porous and it also improves water holding capacity of the soil.
- A. Both statement 1 and statement 2 are true and statement 2 is the correct explanation of statement 1.
B. Both statement 1 and statement 2 are true but statement 2 is not the correct explanation of statement 1.
C. Statement 1 is true but statement 2 is false.
D. Both statement 1 and statement 2 are false.
-
36. Select the characters which are not applicable to the anatomy of dicot roots.
- (a) Presence of conjunctive tissue
(b) Presence of protein compounds in the Casparian strips
(c) Presence of polyarch xylem bundles
(d) Presence of pericycle
- A. (a) and (b) only B. (b) and (d) only
C. (c) and (d) only D. (b) and (c) only
-
37. Arrange the following events of meiosis in correct sequence.
- (i) Crossing over
(ii) Synapsis
(iii) Terminalisation of chiasmata
(iv) Disappearance of nucleolus
- A. (i), (ii), (iii), (iv) B. (ii), (iii), (iv), (i)
C. (ii), (i), (iv), (iii) D. (ii), (i), (iii), (iv)
-
38. Consider the following statements regarding photosynthesis and select the correct ones.
- (a) The first carbon dioxide acceptor in C_4 cycle is PGA.
(b) In C_3 plants, the first stable product of photosynthesis during dark reaction is RuBP.
(c) Cyclic photophosphorylation results in the formation of ATP.
(d) Oxygen which is liberated during photosynthesis comes from water.
- A. (a) and (b) only B. (a) and (c) only
C. (c) and (d) only D. (b) and (c) only

39. Read the following statements (i-iv) regarding "ethephon" and answer the question which follows them.

- (i) It is sprayed in aqueous solution and is readily absorbed and transported within the plant.
- (ii) It hastens fruit ripening in tomatoes and apples.
- (iii) It can be used to induce fruit thinning in cotton, cherry and walnut.
- (iv) It is used to promote female sex expression in cucumber and increase yield.

How many of the above statement(s) is/are correct?

- A. One
- B. Two
- C. Three
- D. All of these

40. Which one of the following biomolecules is correctly characterised?

- A. Lecithin - a phosphorylated glyceride found in cell membrane.
- B. Palmitic acid - an unsaturated fatty acid with 18 carbon atoms.
- C. Adenylic acid - adenosine with a glucose phosphate molecule.
- D. Alanine amino acid - contains an amino group and an acidic group anywhere in the molecule.

41. Match column I (taxonomical hierarchy) with column II (taxonomic category for dog classification) and select the correct option from the given codes.

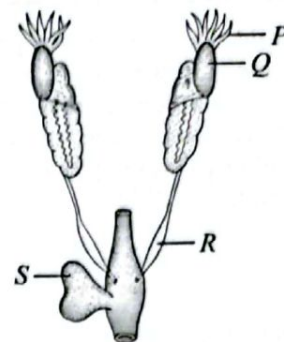
Column I	Column II
(i) Class	(a) Chordata
(ii) Phylum	(b) Canidae
(iii) Family	(c) Carnivora
(iv) Order	(d) Mammalia

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

42. Which of the following statements is incorrect with respect to Phylum Echinodermata?

- A. Exclusively marine, body is bilaterally symmetrical in larval forms and adults are pentamerous radial.
- B. Ambulacral system present, tube feet help in locomotion, capture of food and respiration.
- C. Specialised excretory organs present; urea is the chief nitrogenous waste.
- D. Development is indirect and includes ciliated larva that undergoes metamorphosis to change into adult.

43. Refer to the given figure of urinogenital system of a frog. Identify the labelled parts P-S and select the incorrect statement regarding them.



- A. P stores food material for hibernation period and increases in size during summer.
- B. Q is composed of a large number of seminiferous tubules that help in formation of sperms.
- C. R stores sperms and may be absent in some frogs.
- D. S is a common chamber for receiving faecal matter, urine and sperms.

44. Select the option that correctly fills up the blanks in the given paragraph.

The movement of air into and out of the lungs is carried out by creating a (i) between the lungs and the atmosphere. Inspiration can occur if intra-pulmonary pressure is (ii) than the atmospheric pressure. Expiration takes place when the intra-pulmonary pressure is (iii) than the atmospheric pressure. Inspiration is initiated by the (iv) of diaphragm which (v) the volume of thoracic chamber in the antero-posterior axis.

	(i)	(ii)	(iii)	(iv)	(v)
A.	Concentration gradient	Lower	Higher	Relaxation	Increases
B.	Concentration gradient	Higher	Lower	Contraction	Decreases
C.	Pressure gradient	Higher	Lower	Relaxation	Decreases
D.	Pressure gradient	Lower	Higher	Contraction	Increases

45. Phenomenon that involves progressive increase in concentration of harmful non-biodegradable chemicals at different trophic level is called

- A. Eutrophication
- B. Biomagnification
- C. Degradation
- D. Transformation.

46. Select the incorrect match.

	Endocrine gland	Hormone	Function
A.	Thyroid gland	Thyroxine	Regulates metabolic rate of the body
B.	Corpus luteum	Progesterone	Maintenance of pregnancy
C.	Anterior pituitary	Adrenocortico-tropic hormone	Stimulates cortex of adrenal gland to produce its hormones
D.	Thymus	Thymosin	Regulates blood calcium levels

47. Which of the following is not a function of testis?

- A. Formation of sperms
- B. Secretion of sex hormone, testosterone
- C. Production of fructose to provide energy to the sperms
- D. None of these

48. Given are few events occurring during photosynthesis.

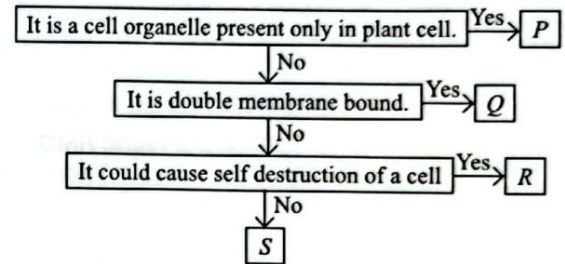
- I. Photolysis of water
 - II. Reduction of NADPH to NADP⁺
 - III. Evolution of molecular oxygen
 - IV. Synthesis of assimilatory power
 - V. Conversion of carbon dioxide to carbohydrates
- Select the option that correctly segregates them on the basis of their occurrence during light and dark reactions.

	Light reaction	Dark reaction
A.	I, III, IV	II, V
B.	I, IV	II, III, V
C.	II, IV	I, III, V
D.	II, III, IV	I, V

49. Select the incorrect match regarding the traits by Mendel in garden pea.

Character	Dominant trait
A. Pod shape	- Full
B. Seed colour	- Yellow
C. Flower colour	- Violet
D. Pod colour	- Yellow

50. Refer to the given flow chart and select the correct option.



	P	Q	R	S
A.	Vacuole	Chloroplast	Golgi complex	Endoplasmic reticulum
B.	Leucoplast	Mitochondria	Lysosome	Golgi complex
C.	Chromoplast	Chloroplast	Nucleolus	Vacuole
D.	Peroxisome	Golgi complex	Endoplasmic reticulum	Vacuole

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