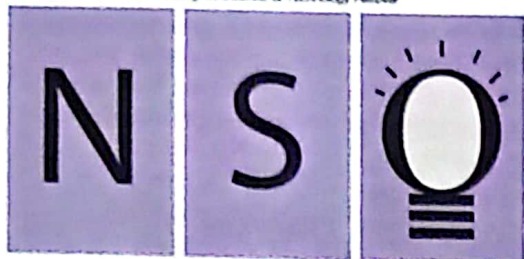




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**SOF NATIONAL SCIENCE
OLYMPIAD 2024-25**

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CLASS **11**
SET-B

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, 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.
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: 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.
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 before attempting the paper.
11. **Participate in SOF-Techfest IIT Bombay Innovation Challenge. Open for class 8, 9 & 10. For details, please visit : www.sofworld.org**

16. ● (A) (B) (C) (D)

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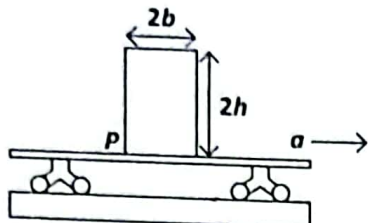
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SECTION-1

PHYSICS

1. A block of mass m , height $2h$ and width $2b$ rests on a flat car which moves horizontally with constant acceleration a , as shown in the given figure. What will be the value of acceleration at which the block topples about P ?

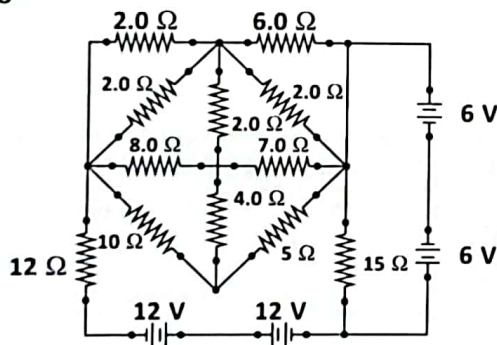


(Consider sufficient friction to prevent slipping and take $b = 1.2 \text{ m}$, $h = 2.7 \text{ m}$, $\mu = 0.5$ and $g = 10 \text{ ms}^{-2}$)

- A. $20/9 \text{ m s}^{-2}$
 B. $70/3 \text{ m s}^{-2}$
 C. $20/3 \text{ m s}^{-2}$
 D. $40/9 \text{ m s}^{-2}$
2. A satellite of mass m orbits the Earth in an elliptical orbit having aphelion distance r_a and perihelion distance r_p . The period of orbit is T . The semi-major and semi-minor axes of the ellipse are $\frac{r_a + r_p}{2}$ and $\sqrt{r_p r_a}$ respectively. What will be the value of angular momentum of the satellite?

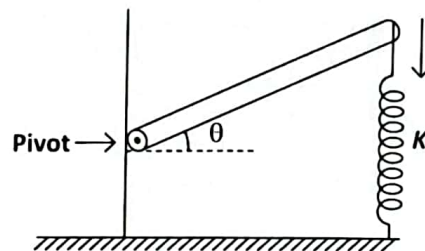
- A. $\frac{2m\pi(r_a + r_p)\sqrt{r_a r_p}}{T}$
 B. $\frac{m\pi(r_a + r_p)\sqrt{r_a r_p}}{T}$
 C. $\frac{m\pi(r_a + r_p)\sqrt{r_a r_p}}{3T}$
 D. $\frac{4m\pi(r_a + r_p)\sqrt{r_a r_p}}{T}$

3. Which of the following statements are incorrect with respect to the electrical circuit shown in the given figure?



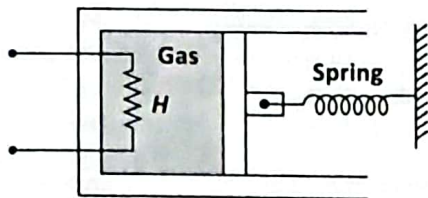
- (i) The amount of current passing through 8Ω resistance lies in the range of 2 A to 4 A .
 (ii) The amount of heat generated across 6Ω resistance is less than the heat generated across 8Ω resistance.
 (iii) The current flowing across 12Ω resistance is greater than the value of current across 2Ω resistance.
- A. (ii) and (iii) only
 B. (i) and (iii) only
 C. (i) and (ii) only
 D. (i), (ii) and (iii)

4. A horizontal rod of mass m and length L is pivoted at one end. The rod's other end is supported by a spring of force constant K . The rod is displaced by a small angle θ from its horizontal equilibrium position and released. What will be the value of angular frequency of simple harmonic motions of the rod?



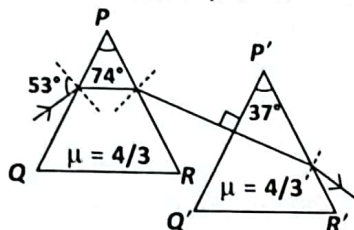
- A. $\sqrt{\frac{3K}{m}}$
 B. $\sqrt{\frac{K}{3m}}$
 C. $\sqrt{\frac{3K}{m} + \frac{3g}{2L}}$
 D. $\sqrt{\frac{K}{m}}$

5. An ideal monoatomic gas is confined in a cylinder by a spring-loaded piston of cross-section $7 \times 10^{-3} \text{ m}^2$. Initially the gas is at 310 K and occupies a volume of $3.2 \times 10^{-3} \text{ m}^3$ and the spring is in a relaxed state. The gas is heated by a small heater H . The force constant of the spring is 7500 N/m and the atmospheric pressure is $1.0 \times 10^5 \text{ Pa}$. The cylinder and piston are thermally insulated. The piston and the spring are massless and there is no friction between piston and cylinder. There is no heat loss through heater coil wire leads and thermal capacity of heater coil is negligible. What will be the final temperature of gas, if it is being heated until the piston moves out slowly by 0.2 m ?



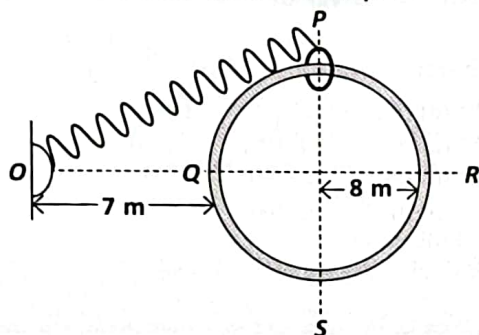
- A. 800 K
B. 1400 K
C. 1200 K
D. 310 K

6. A light ray is incident on face PQ of prism PQR as shown in the given figure. The second prism is kept in such a way that the emergent ray from prism PQR is falling normally on face $P'Q'$ of prism $P'Q'R'$. What will be the net value of deviation produced by combination of these prisms?



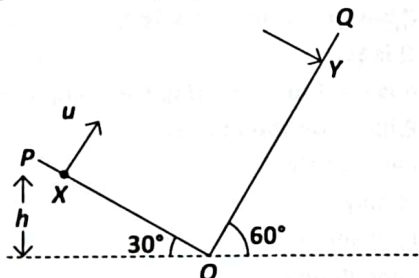
- A. 48°
B. 112°
C. 32°
D. 18°

7. A collar P of mass 5 kg is constrained to move along a horizontal smooth and fixed circular track of radius 8 m. The spring lying in the plane of the circular track and having spring constant 300 Nm^{-1} is undeformed when the collar is at Q . If the collar starts from rest at P , what will be the value of normal reaction exerted by the track on the collar when it passes through Q ?



- A. 3440 N
B. 3360 N
C. 3750 N
D. 2880 N

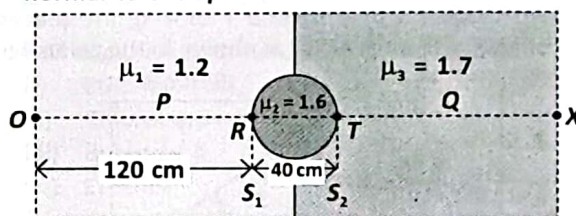
8. Two inclined planes OP and OQ having inclination (with horizontal) 30° and 60° respectively, intersect each other at point O as shown in the given figure. A particle is projected from point X with velocity $u = 10\sqrt{3} \text{ ms}^{-1}$ along a direction perpendicular to plane OP .



Match column I with column II for the particle striking plane OQ perpendicularly at Y .

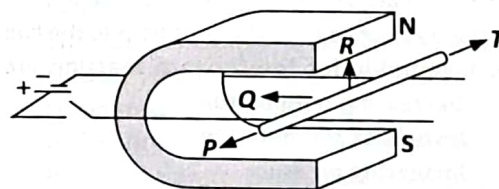
Column I	Column II
(p) The velocity with which particle strikes the plane OQ	(i) 2 SI Units
(q) Time of flight of the particle	(ii) 5 SI Units
(r) Vertical height h of X from a horizontal line passing through the point O	(iii) 10 SI Units
(s) Value of distance XY	(iv) 20 SI Units
A. (p)-(iii), (q)-(i), (r)-(iv), (s)-(ii)	
B. (p)-(iii), (q)-(ii), (r)-(i), (s)-(iv)	
C. (p)-(iv), (q)-(iii), (r)-(ii), (s)-(i)	
D. (p)-(iii), (q)-(i), (r)-(ii), (s)-(iv)	

9. A transparent sphere of radius 20 cm and refractive index 1.6 is fixed in a hole of the partition separating the two media : P (refractive index, $\mu_1 = 1.2$) and Q (refractive index $\mu_3 = 1.7$) as shown in the given figure. A luminous point object, O is placed 120 cm from the surface of the sphere in medium P . It is viewed from point X in medium Q in a direction normal to the sphere.



Which of the following characteristics correctly represent the final image so formed?

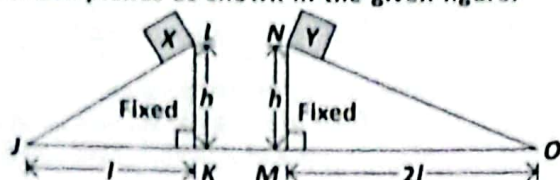
- A. Image will form at 204 cm from vertex (R) and on the left side.
B. Image will form at 204 cm from vertex (T) and on the right side.
C. Image will form at 160 cm from vertex (R) and on the left side.
D. Image will form at 160 cm from vertex (T) and on the right side.
10. A brass rod rests on two horizontal wires in between the poles of a horse shoe magnet as shown in the given figure.



Which one of the following correctly represents the direction in which the rod moves when the switch is closed and a current flows through the rod?

- A. The direction of P
B. The direction of Q
C. The direction of R
D. The direction of T

11. Two identical blocks X and Y are placed on two fixed inclined planes as shown in the given figure.



Read the given statements and select the correct option. Neglect resistance and other friction.

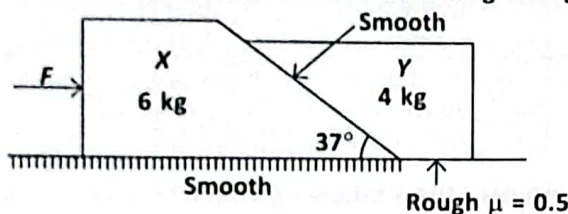
Statement I : The kinetic energy of X on sliding to J will be greater than the kinetic energy of Y on sliding to O.

Statement II : The acceleration of X will be greater than the acceleration of Y when both the blocks are released on the inclined planes.

Statement III : The work done by an external agent to move the block Y slowly from position N to O is negative.

- A. Only statement I is true.
B. Only statement II is true.
C. Only statement I and statement III are true.
D. Only statement II and statement III are true.

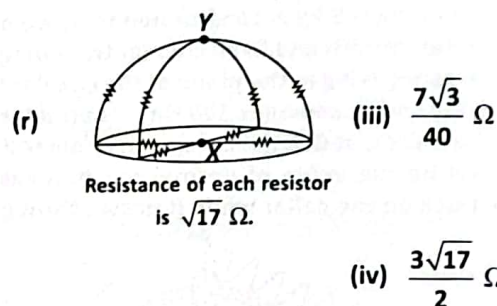
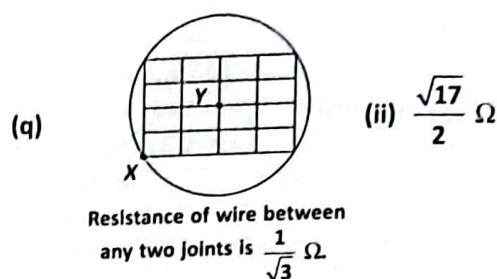
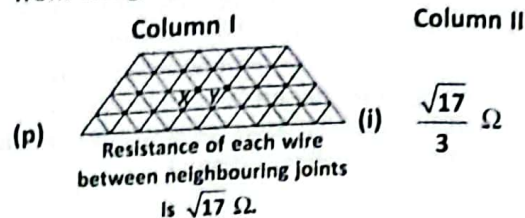
12. Two blocks, X of 6 kg and Y of 4 kg are placed in contact with each other as shown in the given figure.



There is no friction between X and the ground and between the blocks. The coefficient of friction between Y and ground is 0.5. A horizontal force F is applied on X. What will be the minimum and maximum value of F , which can be applied so that both the blocks can move combinedly without any relative motion between them?

- A. 10 N, 50 N
B. 12 N, 50 N
C. 12 N, 75 N
D. 10 N, 75 N

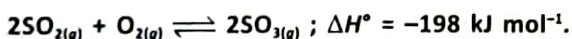
13. Calculate the equivalent resistance between end points X and Y in all circuits given below and match column I with column II and select the correct option from the given codes.



- A. (p)-(ii), (q)-(iii), (r)-(i)
B. (p)-(i), (q)-(iii), (r)-(ii)
C. (p)-(ii), (q)-(iv), (r)-(i)
D. (p)-(i), (q)-(iv), (r)-(ii)

CHEMISTRY

14. Consider the given reaction at equilibrium :



On the basis of Le Chatelier's principle, the conditions not favourable for the forward reaction are

- I. Decreasing temperature
II. Increasing temperature
III. Increasing pressure
IV. Decreasing pressure.
A. II and III only
B. I and IV only
C. I and III only
D. II and IV only

15. Compound P combines with oxygen in the cells of our body and provides energy. P when reacts with

oxygen produces compound Q along with water vapour. A metal hydroxide R reacts with Q to give a chemical compound S (which has the same formula as marble) and water.

Which of the following statements is/are correct regarding P, Q and R?

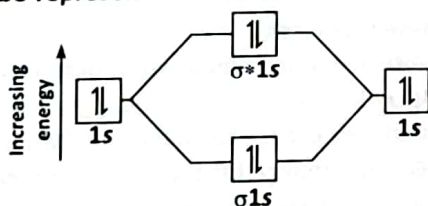
- I. P has molecular mass 180 u.
II. Q is SO_2 .
III. R is used for preparing bleaching powder.
IV. P has 5 carbon atoms.
A. I and II only
B. III only
C. II, III and IV only
D. I and III only

16. KClO_4 can be prepared from Cl_2 and KOH by the following sequence of reactions :



Which of the following statements regarding formation of KClO_4 is/are correct?

- The overall balanced equation of formation of KClO_4 from Cl_2 and KOH can be represented as $3\text{Cl}_2 + 4\text{KOH} \rightarrow \text{KClO}_4 + 3\text{KCl} + 2\text{H}_2\text{O}$
 - 568 g of Cl_2 gas is required to prepare 138.5 g of KClO_4 .
 - For preparing 1 mol of KClO_4 , 179.2 L of KOH is required at STP.
- A. I and II only
B. III only
C. II and III only
D. I and III only
17. 22.44 kJ energy is required to convert 8 g of gaseous atom of metal M to $M^+_{(g)}$. If I.E.₁ of metal $M = 374$ kJ/mol, select the incorrect statement for the metal M .
- A. 0.06 mol of gaseous ion (M^+) is formed.
B. Different amount of energy is required to convert all $M^+_{(g)}$ to $M^{2+}_{(g)}$.
C. Atomic mass of metal $M = 133.33$ u.
D. 3.613×10^{21} atoms of M are converted to $M^+_{(g)}$.
18. Read the given statements and select the correct option.
- Statement 1 :** Dilution of a concentrated acid is always done by taking sufficient amount of concentrated acid in a beaker and adding water into it slowly with stirring.
- Statement 2 :** Dilution of a concentrated acid is a highly endothermic reaction.
- 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.
19. The molecular orbital electronic configuration of X_2 can be represented as follows :



Which of the given statements are not the correct conclusions about molecule X_2 ?

- It is the electronic configuration of He_2 .
 - Bond order of X_2 is one.
 - X_2 molecule exists but it is not stable.
 - Bond order of X_2 is higher than that of X_2^+ .
- A. I and II only
B. II and IV only
C. II, III and IV only
D. I, III and IV only
20. Which of the following reactions is/are not exothermic in nature?
- Combustion of natural gas
 - Dissolution of ammonium chloride in water
 - Dilution of concentrated hydrochloric acid
 - Decomposition of vegetable matter
 - Evaporation of water
- A. (i) only
B. (i), (iii) and (iv) only
C. (ii) and (v) only
D. (ii), (iv) and (v) only
21. Few organic compounds are listed below.
- Ethanoic acid
 - Chloropropane
 - Butanal
 - Ethanol
 - Propanoic acid
- Select the correct statement about these compounds from the following.
- A. Compounds (ii) and (iv) contain the same functional group.
B. Compounds (i) and (iv) consist of multiple (double/triple) bonds.
C. Compounds (iii) and (iv) belong to the same homologous series.
D. Compounds (i) and (v) can undergo esterification reaction to give sweet-smelling substances.
22. Which of the following is/are correct statement(s)?
- Carbocations, carbonyl compounds and alkyl halides can act as electrophiles.
 - The resonance hybrid has higher energy and greater stability than any of the contributing structures.
 - In $-E$ effect, the π -electrons of the multiple bond are transferred to that atom to which the attacking reagent gets attached.
 - NO_2^+ , H_3O^+ and NH_4^+ being positively charged species can act as electrophile.
- A. I and II only
B. I only
C. III and IV only
D. II and III only

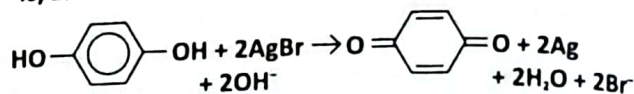
23. *P* burns in air on heating to form a protective layer of its oxide on surface. *Q* reacts violently with cold water and can be extracted by the electrolysis of its fused or molten chloride. *R* is a metal that reacts with very dilute nitric acid to evolve hydrogen gas. Metal *S*, a constituent of bronze, is a highly unreactive metal that does not even react with steam. Metals *P*, *Q*, *R* and *S* are respectively

- Al, Na, Mg, Cu
- Zn, K, Mn, Fe
- Al, K, Zn, Cu
- Zn, Na, Mg, Ag.

24. Name the series for the emission transition of H-atom if it starts from the orbit having radius 1.3225 nm and ends at 0.4761 nm.

- Lyman series
- Balmer series
- Paschen series
- Brackett series

25. For the given reaction, the incorrect statement(s) is/are

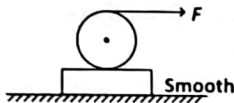
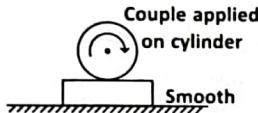
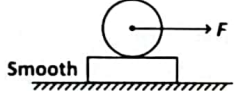
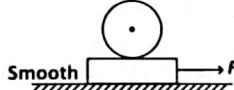


- Hydroquinone acts as reductant.
 - Ag^+ is reduced.
 - It is an intramolecular redox change.
- I only
 - II and III only
 - I and II only
 - III only

SECTION-2

ACHIEVERS SECTION

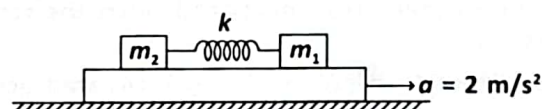
26. Column I represents a cylinder kept on a rough plank in different situations. Column II represents the direction of friction and acceleration. Match column I with column II and select the correct option from the given codes. (Assume mass of cylinder is equal to that of the plank.)

Column I	Column II
(p) 	(i) Plank accelerates to the left
(q) 	(ii) Friction on cylinder is towards right
(r) 	(iii) Friction on cylinder is in direction opposite to its acceleration.
(s) 	(iv) The acceleration of cylinder is greater in magnitude than that of the plank.
	(v) Acceleration of cylinder is towards right.

- (p) – (i, ii, iii, v); (q) – (i, iii, v); (r) – (i, iii); (s) – (iv)
- (p) – (i, ii, iv, v); (q) – (i, ii, v); (r) – (iii, iv, v); (s) – (ii, v)
- (p) – (i, ii, iv); (q) – (i, ii, v); (r) – (i, iii, iv, v); (s) – (iii, v)
- (p) – (i, iii, iv, v); (q) – (iii, v); (r) – (i, ii, iii); (s) – (ii, iv)

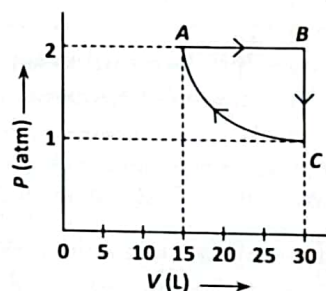
27. Two blocks of masses $m_1 = 2 \text{ kg}$ and $m_2 = 4 \text{ kg}$ are connected by a spring of constant $k = 200 \text{ N/m}$ and

placed over a plank as shown in the given figure. The coefficient of friction between m_2 and plank is 0.5 and there is no friction between m_1 and plank. Initially the whole system is at rest. The plank is now pulled to the right with constant acceleration $a = 2 \text{ m/s}^2$. What will be the amplitude of oscillations of block m_1 relative to the plank?



- 4 cm
- 2 cm
- 3 cm
- 6 cm

28. Two moles of an ideal gas undergo following reversible process :



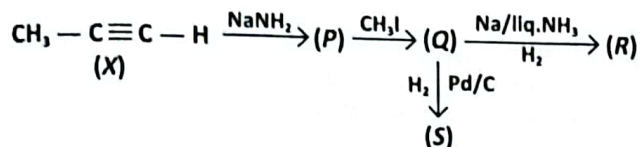
For these processes,

- Total work done involved in the overall process is $x \text{ J}$.
 - Enthalpy change for the overall process is $y \text{ J}$.
 - Entropy change for the overall process is $z \text{ J}$.
- Then x , y and z are respectively

	x	y	z
A.	-931.96	0	0
B.	+601.57	0	+2.815
C.	+601.57	-601.57	0
D.	-931.96	+931.96	+2.815

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

Consider the following reaction sequence,



29. The incorrect statement(s) about R and S is/are
- Both (R) and (S) give same product on reductive ozonolysis.
 - (R) has lesser dipole moment than (S).

- Chain isomer of (R) gives propan-2-one on reaction with KMnO_4 in acidic medium.
 - Position isomer of (S) gives 2-bromobutane as a major product on reaction with HBr in presence of peroxide.
 - (R) has higher boiling point than (S).
- I and II only
 - IV and V only
 - I, II and III only
 - IV only

30. Identify the correct statement about (X) and (Q).
- (Q) and (X) are position isomers.
 - (Q) on reaction with $\text{Hg}^{2+}/\text{H}^+$ at 333 K gives propanone.
 - (X) and (Q) can be distinguished by reaction with sodium metal.
 - (Q) is more acidic than 1-butyne.

SECTION-3

MATHEMATICS

31. If $\frac{5z_2}{11z_1}$ is purely imaginary, then the value of

$$\left| \frac{2z_1 + 3z_2}{2z_1 - 3z_2} \right| \text{ is}$$

- $\frac{37}{33}$
 - 2
 - 1
 - None of these
32. If α and β are the zeroes of the quadratic polynomial $f(x) = 3x^2 - 4x + 1$, then the quadratic polynomial whose zeroes are α^2/β and β^2/α , is
- $9x^2 - 28x + 3$
 - $9x^2 + 28x - 3$
 - $9x^2 - 28x - 3$
 - None of these

33. Let x be the arithmetic mean and y, z be the two geometric means between any two positive numbers.

The value of $\frac{y^3 + z^3}{xyz}$ is

- 1
 - 2
 - 3
 - 4
34. Find the coefficient of x^5 in the expansion of the product $(1 + 2x)^6(1 - x)^7$.
- 151
 - 171

- 165
- 179

35. The production of TV in a factory increases uniformly by a fixed number every year. It produced 8000 TVs in 6th year and 11300 in 9th year, then find the production of TVs in 8th year.

- 10500
- 9800
- 9700
- 10200

36. The number of natural numbers smaller than 10^4 of which all the digits are distinct are

- 5000
- 5200
- 5300
- 5274

37. Find the equation of the ellipse with centre at the origin, major-axis on the y -axis and passing through the points (3, 2) and (1, 6).

- $\frac{x^2}{40} + \frac{y^2}{10} = 1$
- $\frac{x^2}{30} + \frac{y^2}{50} = 1$
- $\frac{x^2}{10} + \frac{y^2}{40} = 1$
- $\frac{x^2}{50} + \frac{y^2}{30} = 2$

38. If AD , BE and CF are the altitudes of $\triangle ABC$ whose vertex A is the point $(-4, 5)$. Also, the coordinates of the points E and F are $(4, 1)$ and $(-1, -4)$ respectively. Then, equation of BC is

A. $3x - 4y + 28 = 0$
 B. $4x + 3y + 28 = 0$
 C. $3x - 4y - 28 = 0$
 D. $x + 2y + 7 = 0$

39. Find the values of x in the given equation.
 $3^{2x+1} - 730(3^x - 1) = 703$.

A. 3, 4
 B. 3, -4
 C. -3, 4
 D. 3, -3

40. P is a variable point and the co-ordinates of two points A and B are $(-2, 2, 3)$ and $(13, -3, 13)$ respectively. The locus of P if $3PA = 2PB$, is

A. $x^2 + y^2 + z^2 - 28x - 12y + 10z - 347 = 0$
 B. $x^2 + y^2 + z^2 + 28x - 10y + 12y = 0$
 C. $x^2 + y^2 + z^2 = 0$
 D. $x^2 + y^2 + z^2 + 28x - 12y + 10z - 247 = 0$

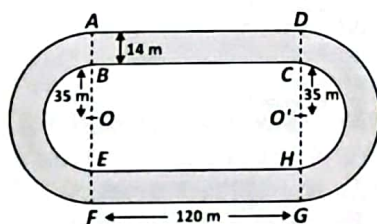
41. A man on a cliff observes a boat at an angle of depression of 30° which is approaching the shore to the point immediately beneath the observer with a uniform speed. Six minutes later, the angle of depression of the boat is found to be 60° . Find the total time taken by the boat to reach the shore.

A. 6 mins
 B. 5 mins
 C. 9 mins
 D. 3 mins

42. The value of $\lim_{x \rightarrow 2} \frac{x^2 - 4}{\sqrt{3x-2} - \sqrt{x+2}}$ is

A. 8
 B. -8
 C. 7
 D. 5

43. A athlete track 14 m wide consists of two straight sections 120 m long joining semi-circular ends whose inner radius is 35 m. Calculate the area of the shaded region.



A. 6056 m^2
 B. 7056 m^2

C. 7766 m^2
 D. 8126 m^2

44. The mean of five observations is 4 and their variance is 5.2. If three of them are 1, 2 and 6, then the other two observations are

A. 2 and 9
 B. 4 and 7
 C. 5 and 6
 D. 2 and 10.

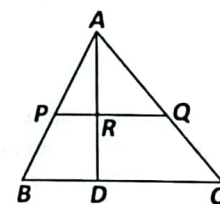
45. Mr. Sharma and Mr. Arora are family friends and they decided to go for a trip. For the trip they reserved their rail tickets. Mr. Arora has not taken a half ticket for his child who is 6 years old whereas Mr. Sharma has taken half tickets for his two children who are 6.5 years and 8 years old. A railway half ticket costs half of the full fare but the reservation charges are the same as on a full ticket. Mr. and Mrs. Arora paid ₹ 1700, while Mr. and Mrs. Sharma paid ₹ 2700. Find the full fare of one ticket.

A. ₹ 700
 B. ₹ 722
 C. ₹ 730
 D. ₹ 740

46. Two cards are drawn at random from a well-shuffled pack of 52 cards. What is the probability that either both are red or both are kings?

A. $\frac{56}{217}$
 B. $\frac{55}{221}$
 C. $\frac{49}{223}$
 D. $\frac{54}{219}$

47. In the given figure, $AP = 3 \text{ cm}$, $AR = 4.5 \text{ cm}$, $AQ = 6 \text{ cm}$, $AB = 5 \text{ cm}$ and $AC = 10 \text{ cm}$, then find AD .



A. 4.5 cm
 B. 5.5 cm
 C. 6.5 cm
 D. 7.5 cm

48. If $\frac{|x+3|+x}{x+2} > 1$, then $x \in$

A. $(-5, -2)$
 B. $(-1, \infty)$

- C. $(-5, -2) \cup (-1, \infty)$
D. None of these

49. Two brands of chocolates are available in packs of 24 and 15 respectively. If I need to buy an equal number of chocolates of both kinds, then what is the least number of boxes of each kind I would need to buy?
- A. 7, 10
B. 5, 8

- C. 6, 4
D. 3, 9

50. Find the least $x (> 0)$ for which
 $\tan(x^\circ + 100^\circ) = \tan(x^\circ + 50^\circ) \tan x^\circ \tan(x^\circ - 50^\circ)$.
- A. 60
B. 45
C. 30
D. 90

OR

BIOLOGY

31. Refer to the given table of differences between Kingdom Monera and Kingdom Protista. Identify the incorrect set of differences and select the correct option.

	Kingdom Monera	Kingdom Protista
(i)	It includes unicellular prokaryotes.	It includes multicellular eukaryotes.
(ii)	Membrane bound cell organelles are absent.	Membrane bound cell organelles are present.
(iii)	Cell wall, if present, made up of peptidoglycans.	Cell wall, if present, contains cellulose.
(iv)	Flagella, when present, made up of protein tubulin.	Flagella or cilia, when present, made up of protein flagellin.

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

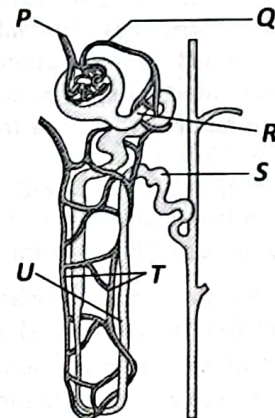
32. Match column I with column II and select the correct option.

Column I (Terms)	Column II (Meaning)
(i) Genotype	(p) An organism with contrasting alleles of a character
(ii) Recessive	(q) Observable characteristics of an organism
(iii) Heterozygote	(r) The trait that remains hidden in a heterozygote
(iv) Phenotype	(s) Genetic constitution of an organism

- A. (i) - (s), (ii) - (r), (iii) - (p), (iv) - (q)
B. (i) - (s), (ii) - (r), (iii) - (q), (iv) - (p)

- C. (i) - (s), (ii) - (q), (iii) - (r), (iv) - (p)
D. (i) - (q), (ii) - (r), (iii) - (s), (iv) - (p)

33. Refer to the given figure and select the incorrect statement regarding P-U.



- A. About 70-80 % of electrolytes and water are normally reabsorbed in R.
B. In S, filtrate becomes hypotonic to blood plasma while in U, it becomes hypertonic.
C. The flow of blood in the two limbs of T is in opposite direction therefore forms a counter current.
D. P is afferent arteriole whereas Q is efferent arteriole.

34. Refer to the given table and select the correct matches.

	Blood cell	Nucleus	Feature
(i)	Neutrophil	Bilobed	Phagocytic
(ii)	Monocyte	Bean shaped	Agranulocyte, phagocytic
(iii)	Eosinophil	Bilobed	Associated with allergic reactions
(iv)	Blood platelet	Rounded	Blood clotting

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

35. The given Punnett's square represents the pattern of inheritance in a dihybrid cross where yellow (Y) and round (R) seed condition is dominant over white (y) and wrinkled (r) seed condition.

	YR	Yr	yR	yr
YR	F	J	N	R
Yr	G	K	O	S
yR	H	L	P	T
yr	I	M	Q	U

A plant of type 'H' will produce seeds with the genotype identical to seeds produced by the plants of

- A. Type M B. Type J
C. Type P D. Type N.
36. Read the given statements about frog's morphology and anatomy and select the option that correctly fills any two of the given blanks.

- (i) Eyes are covered by a _____ that protects them while in water.
(ii) The circulatory system of frog has a triangular structure called _____ that joins the right atrium.
(iii) The urinary bladder is thin-walled and present _____ to the rectum which opens into the cloaca.
(iv) In male reproductive system, vasa efferentia are _____ in number that arise from the testes.

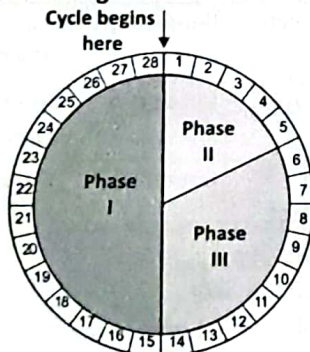
- A. (i)-Eyelids, (iii) - Dorsal
B. (ii)-Conus arteriosus, (iv) - 6-8
C. (i)-Nictating membrane, (iv) - 4-5
D. (ii)-Sinus venosus, (iii) - Ventral

37. Read the given statements and select the option that correctly identifies them as true (T) and false (F) ones.

- (i) The small intestine is usually longer in carnivores.
(ii) The enzyme sucrase converts sucrose into glucose and galactose.
(iii) Three pairs of salivary glands are present in human beings.
(iv) Ileum is the longest part of small intestine.

- | | | | | |
|----|-----|------|-------|------|
| | (i) | (ii) | (iii) | (iv) |
| A. | F | T | T | F |
| B. | T | F | T | T |
| C. | F | F | T | T |
| D. | T | T | F | F |

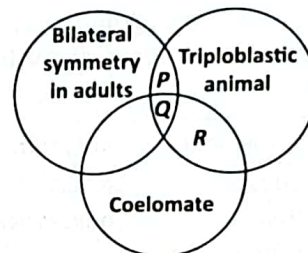
38. Refer to the given schematic representation of menstrual cycle showing three phases I, II and III. Select the option that correctly matches these phases with the following events.



- (i) FSH secreted by the anterior pituitary stimulates the ovarian follicle to secrete estrogen which stimulates the proliferation of the endometrium.
(ii) LH secreted by the anterior pituitary stimulates the development of corpus luteum which secretes progesterone.
(iii) Reduced production of LH from anterior pituitary causes degeneration of corpus luteum, thereby progesterone production is reduced.

	Phase I	Phase II	Phase III
A.	(i)	(ii)	(iii)
B.	(iii)	(i)	(ii)
C.	(ii)	(iii)	(i)
D.	(iii)	(ii)	(i)

39. Refer to the given Venn diagram and select the incorrect statement regarding P, Q and R.



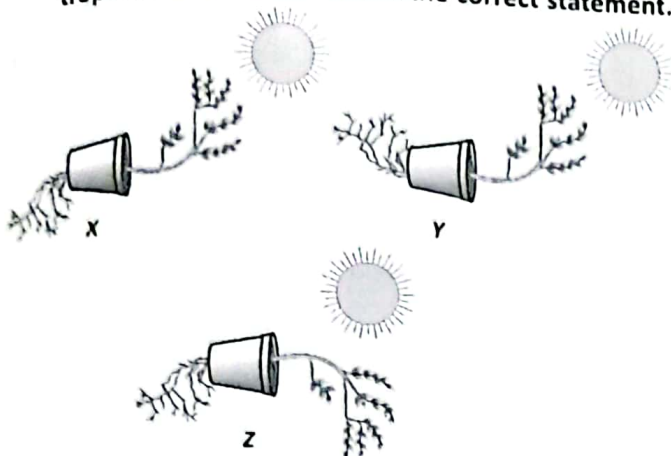
- A. P could be *Taenia solium* which possesses hooks and suckers whereas R could be *Echinus* which moves with the help of tube feet.
B. Q could be *Macropus* that has brood pouch for rearing young ones whereas P could be *Planaria* that shows regeneration.
C. R could be *Asterias* which possesses dermal branchiae that act as respiratory and excretory organs whereas Q could be *Exocoetus* which possesses air bladder to regulate buoyancy.
D. None of these

40. Identify the correct pair of differences between grazing food chain and detritus food chain in the given table and select the correct option.

S. No.	Grazing food chain	Detritus food chain
(i)	This food chain begins with producers as the first trophic level.	This food chain begins with detritivores and decomposers as the first trophic level.
(ii)	Energy source is the Sun.	Energy source is organic remains or detritus.
(iii)	This food chain adds energy into the ecosystem.	It retrieves food energy from detritus and prevents its wastage.
(iv)	It helps in releasing inorganic nutrients to the cycling pool.	It binds the inorganic nutrients.

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

41. Refer to the given figures of pots X, Y and Z showing tropic movements and select the correct statement.



- A. The growth in pot Z appears more accurate, because both root and shoot shows negative growth towards light.
 B. The growth in pot Y appears more accurate, because both shoot and root shows positive growth towards light.
 C. The growth in pot X appears more accurate, because shoot is negatively geotropic while root is positively geotropic.
 D. The growth in pot Y appears more accurate, because both root and shoots are positive geotropic.

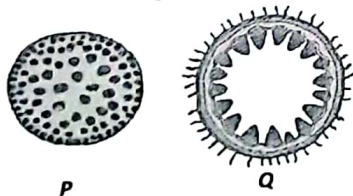
42. Refer to the steps of catalytic cycle of an enzyme action.

- P. The substrate binds to the active site of the enzyme, fitting into the active site.
 Q. The active site of the enzyme, now in close proximity of the substrate breaks the chemical bonds of the substrate and the new enzyme-product complex is formed.
 R. The enzyme releases the products of the reaction and the free enzyme is ready to bind to another molecule of the substrate.
 S. The binding of the substrate causes the enzyme to alter its shape, fitting more tightly around the substrate.

Select the option that correctly arranges the given steps.

- A. $P \rightarrow S \rightarrow Q \rightarrow R$
 B. $P \rightarrow Q \rightarrow R \rightarrow S$
 C. $P \rightarrow R \rightarrow Q \rightarrow S$
 D. $S \rightarrow Q \rightarrow R \rightarrow P$

43. Identify the given figures P and Q and select the correct statement regarding them.



- A. Figure P shows T.S. of dicot stem as it has scattered vascular bundles, while figure Q shows T.S. of monocot stem as it has ring arrangement of vascular bundles.
 B. Figure P shows T.S. of monocot stem as it has scattered vascular bundles while figure Q shows T.S. of dicot stem as it has ring arrangement of vascular bundles.
 C. Figure Q shows T.S. of maize stem as it has ring arrangement of vascular bundles.
 D. Figure P shows T.S. of sunflower stem as it has scattered vascular bundles.

44. Match the column I with column II and select the correct option.

Column I	Column II
(P) Gibberellins	(i) Kinetin
(Q) Cytokinins	(ii) Dormin
(R) Ethylene	(iii) Promotes apical dominance
(S) Auxins	(iv) <i>Gibberella fujikuroi</i>
(T) Absciscic acid	(v) Ethephon
	(vi) IBA
	(vii) Promotes nutrient mobilisation
	(viii) Stress hormone
	(ix) Promotes bolting
	(x) Climacteric ripening of fruit

- | | | | | |
|-------------|-----------|---------|-----------|-------------|
| (P) | (Q) | (R) | (S) | (T) |
| A. (iv, ix) | (i, vii) | (v, x) | (ii, vi) | (iii, viii) |
| B. (iv, ix) | (i, vii) | (v, x) | (iii, vi) | (ii, viii) |
| C. (iv, x) | (ii, vii) | (v, i) | (iii, vi) | (ix, viii) |
| D. (iv, ix) | (i, vii) | (v, ii) | (iii, vi) | (x, viii) |

45. Photosynthesis in C_4 plant takes place in two types of cells namely mesophyll and bundle sheath cells. Select the correct option regarding these cells.

	Mesophyll	Bundle sheath
A.	PEPcase	C_4 -Cycle
B.	PEPcase	Calvin cycle
C.	RuBisCO	C_4 -Cycle
D.	RuBisCO	C_2 -Cycle

46. Transpiration has many significances for plants. Select the correct option regarding the significance of transpiration.

- (i) Create pressure in xylem vessels for upward movement of water and minerals.
 (ii) Regulate temperature of plant.
 (iii) It supplies oxygen for photosynthesis.
 (iv) Maintains the shape and structure of plant parts by keeping cells turgid.
- A. Only (i), (ii) and (iii) are correct.
 B. Only (i), (ii) and (iv) are correct.
 C. Only (i) and (iii) are correct.
 D. Only (iii) and (iv) are correct.

47. Read the given statements where few words have been underlined with marking (I)-(IV) and select the correct option regarding them.

- I. In photophosphorylation, the energy of oxidation and reduction (i) is used to generate proton gradient required for phosphorylation.
 - II. Oxidation of one molecule of FADH_2 yields three (ii) ATP molecules.
 - III. The net gain of energy in glycolysis is six (iii).
 - IV. In ETS, proton gradient is generated by reductive phosphorylation (iv).
- A. (i)-C-C bond energy, (ii)-four, (iii)-eight
 - B. (ii)-four, (iii)-eight
 - C. (ii)-six, (iv)-oxidative phosphorylation
 - D. (i)-light, (iii)-eight, (iv)-oxidative phosphorylation

48. Arrange the following in the order of increasing volume.

- I. Tidal volume
 - II. Residual volume
 - III. Expiratory reserve volume
 - IV. Vital capacity
- A. $I < II < III < IV$
 - B. $I < IV < III < II$
 - C. $I < III < II < IV$
 - D. $I < IV < II < III$

49. Consider the following statements (I)-(IV) and select the option that correctly identifies the true (T) and false (F) ones.

- (I) Trophic level represent specific species.
- (II) An organism may occupy more than one trophic level at a time.

- (III) Food web is a complex branched food chain.
- (IV) A food chain is the sequence of steps through which the process of energy transfer occurs in an ecosystem.

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

50. Given below are the diagrammatic representation of position of floral parts on thalamus, condition of ovary and example. Select the correctly matched option.

	Position of floral parts on thalamus	Condition of ovary	Example
A.		$\underline{G}$	Mustard
B.		$\underline{G}$	Brinjal
C.		$\overline{G}$	Cucumber
D.		$\overline{G}$	Rose

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