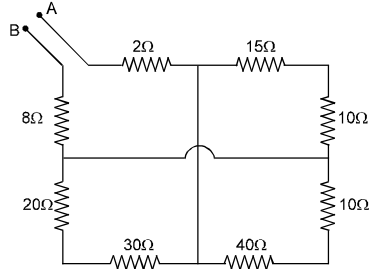


INSTRUCTIONS

1. Immediately fill in the particulars on this page of the Test Booklet with Blue/Black Ball Point Pen. Use of pencil is strictly prohibited.
2. Test duration is TWO HOUR(120MINUTES)
3. For Medical stream the test booklet consists of 60 Questions, For Non-Medical stream the test booklet consists of 45 Questions.
4. There are four sections in the question paper.
The distribution of question, subject wise in each part is mentioned below.

PHYSICS	– 15 Questions
CHEMISTRY	– 15 Questions
BIOLOGY	– 30 Questions
MATHEMATICS	– 15 Questions
5. Candidates will be awarded Four marks (+4) each for indicated correct response of each Question& One mark (-1) deduct for indicated incorrect response. No deduction from the total score will be made if no response is indicated.
6. No candidate is allowed to carry any textual material, printed or written, bits of papers, mobile phone, any electronic device etc.
7. After the completion of the test, the candidate must hand over the Answer Sheet to the Invigilator on duty in the Room/Hall. However, the candidates are allowed to take away this Test Booklet with them.
8. Do not fold or make any stray marks on the Answer sheet.

PHYSICS

1. A solid sphere of radius R has a volume charge density $\rho = \rho_0 r^2$ (Where ρ_0 is a constant and r is the distance from centre). At a distance x from its centre (for $x < R$), the electric field is directly proportional to :
 (a) $1/x^2$ (b) $1/x$ (c) x^3 (d) x^2
2. A parallel plate capacitor of capacitance 90 pF is connected to a battery of emf 20V. If a dielectric material of dielectric constant $K = \frac{5}{3}$ is inserted between the plates, the magnitude of the induced charge will be :
 (a) 2.4 n C (b) 0.9 n C (c) **1.2 n C** (d) 0.3 n C
3. The equivalent resistance between points A and B is :


 (a) $\frac{65}{2} \Omega$ (b) $\frac{45}{2} \Omega$ (c) $\frac{5}{2} \Omega$ (d) $\frac{91}{2} \Omega$
4. An arc lamp requires a direct current of 10 A at 80 V to function. if it is connected to a 220 V(rms), 50 Hz AC supply, the series inductor needed for it to work is close to :
 (a) 0.08 H (b) 0.044 H (c) **0.065 H** (d) 80 H

SPACE FOR ROUGH WORK (You can check your Answer-key & Result on www.careeracademy.in)

5. A plane electromagnetic wave travelling along the X-direction has a wavelength of 3mm. The variation in the electric field occurs in the Y-direction with an amplitude 66 Vm^{-1} . The equation for the electric and magnetic fields as a function of x and t are respectively.

(a) $E_y = 33 \cos \pi \times 10^{11} \left(t - \frac{x}{c} \right), B_z = 1.1 \times 10^{-7} \cos \pi \times 10^{11} \left(t - \frac{x}{c} \right)$

(b) $E_y = 11 \cos 2\pi \times 10^{11} \left(t - \frac{x}{c} \right), B_y = 11 \times 10^{-7} \cos 2\pi \times 10^{11} \left(t - \frac{x}{c} \right)$

(c) $E_x = 33 \cos \pi \times 10^{11} \left(t - \frac{x}{c} \right), B_x = 11 \times 10^{-7} \cos \pi \times 10^{11} \left(t - \frac{x}{c} \right)$

(d) $E_y = 66 \cos 2\pi \times 10^{11} \left(t - \frac{x}{c} \right), B_z = 2.2 \times 10^{-7} \cos 2\pi \times 10^{11} \left(t - \frac{x}{c} \right)$

6. Yellow light of 557 nm wavelength is incident on a cesium surface. It is found that no photo electrons flow in the circuit when the cathode-anode voltage drops below 0.25V. Then the threshold wavelength for photo electric effect from cesium is

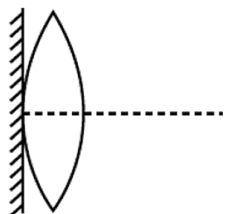
- (a) 577 nm **(b) 653 nm** (c) 734 nm (d) 191 nm

7. Imagine an atom made up of a proton and a hypothetical particle of double the mass of the electron but having the same charge as the electron. Apply the Bohr atom model and consider all possible transitions of this hypothetical particle to the first excited level. The longest wavelength photon that will be emitted has wavelength λ (given in terms of the Rydberg constant R for the hydrogen atom) equal to

- (a) $9/(5R)$ (b) $36/(5R)$ **(c) $18/(5R)$** (d) $4/R$

8. A thin convex lens of focal length f is put on a plane mirror as shown in the figure. When an object is kept at a distance a from the lens- mirror combination, its image is formed at a distance $\frac{a}{3}$ in front of the combination. The value of a is

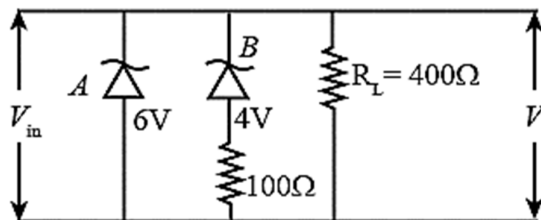
- (a) f
(b) $2f$
(c) $3f$
(d) $\frac{3}{2}f$



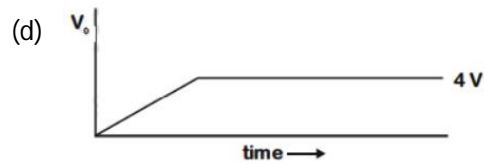
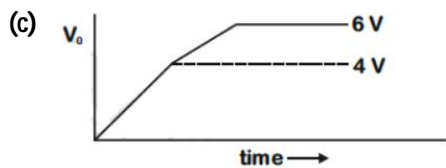
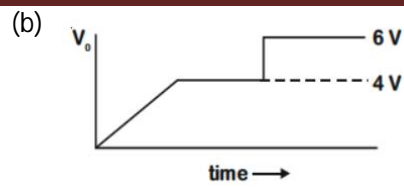
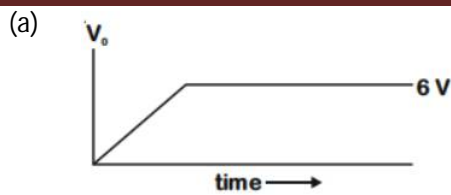
9. A polarizer – analyser set is adjusted such that the intensity of light coming out of the analyser is just 10% of the original intensity. Assuming that the polarizer – analyser set does not absorb any light, the angle by which the analyser need to be rotated further to reduce the output intensity to zero, is

- (a) 71.6° (b) 90° **(c) 18.4°** (d) 45°

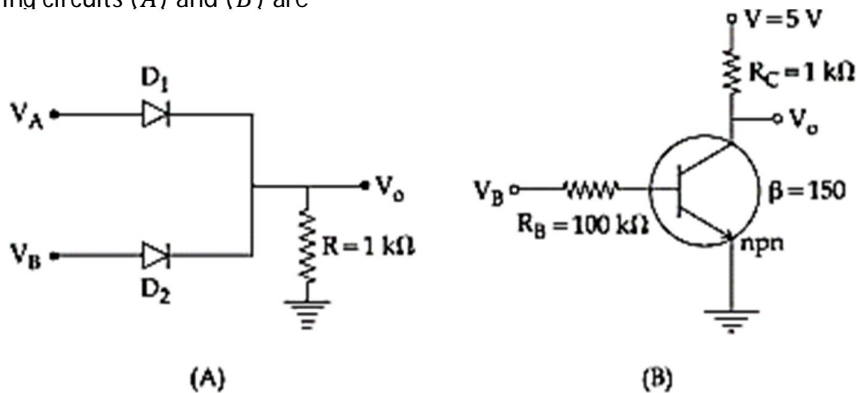
10. Two Zener diodes (A and B) having breakdown voltages of 6 V and 4 V respectively, are connected as shown in the circuit. The output voltages V_o variation with input voltage linearly increasing with time, is given by $V_{input} = 0 \text{ V}$ at $t = 0$ (figures are qualitative)



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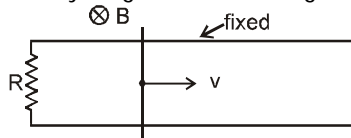


11. If V_A and V_B are the input voltages (either 5 V or 0 V) and V_o is the output voltage then the two gates represented in the following circuits (A) and (B) are



- (a) OR and NOT gate (b) AND and NOT gate (c) AND and OR gate (d) NAND and NOR gate

12. **STATEMENT-1** : A resistance R is connected between the two ends of the parallel smooth conducting rails. A conducting rod lies on these fixed horizontal rails and a uniform constant magnetic field B exists perpendicular to the plane of the rails as shown in the figure. If the rod is given a velocity v and released as shown in figure, it will stop after some time. The total work done by magnetic field is negative .



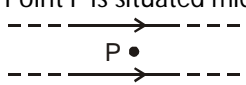
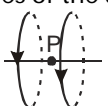


STATEMENT-2 : If force acts opposite to direction of velocity its work done is negative.

- (a) Statement-1 is True, Statement-2 is True; Statement-2 is a correct explanation for Statement-1.
 (b) Statement-1 is True, Statement-2 is True; Statement-2 is NOT a correct explanation for Statement-1
 (c) Statement-1 is True, Statement-2 is False
(d) Statement-1 is False, Statement-2 is True
13. **STATEMENT-1** : Q- value of a reaction : $A + B \rightarrow C + Q$ is $- 30$ MeV. The minimum kinetic energy of bombarding nucleus to initiate the nuclear reaction is 30 MeV.
STATEMENT-2 : Momentum will conserve in the endoergic reaction also.
 (a) Statement-1 is True, Statement-2 is True; Statement-2 is a correct explanation for Statement-1
 (b) Statement-1 is True, Statement-2 is True; Statement-2 is NOT a correct explanation for Statement-1

SPACE FOR ROUGH WORK (You can check your Answer-key & Result on www.careeracademy.in)

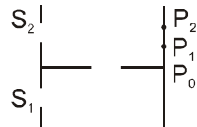
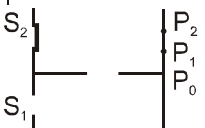
- (c) Statement-1 is True, Statement-2 is False
(d) Statement-1 is False, Statement-2 is True.

14. Two wires each carrying a steady current I are shown in four configurations in Column I. Some of the resulting effects are described in Column II. Match the statements in Column I with the statements in Column II and indicate your answer by darkening appropriate bubbles in the 4×4 matrix given in the ORS.

	Column-I		Column-II
(A)	Point P is situated midway between the wires. 	(p)	The magnetic fields (B) at P due to the currents in the wires are in the same direction.
(B)	Point P is situated at the mid-point of the line joining the centres of the circular wires, which have same radii. 	(q)	The magnetic field B at P due to the currents in the wires are in opposite directions.
(c)	Point P is situated at the mid-point of the line joining the centers of the circular wires, which have same radii. 	(r)	There is no magnetic field at P.
(D)	Point P is situated at the common center of the wires. 	(s)	The wires repel each other.

- (a) (A) → (q), (r) ; (B) → (p); (C) → (q), (r) ; (D) → (q,s) (b) (A) → (q), (s) ; (B) → (p); (C) → (q), (r) ; (D) → (q,r)
(c) (A) → (q), (r) ; (B) → (q); (C) → (p), (r) ; (D) → (q,s) (d) (A) → (q), (s) ; (B) → (p); (C) → (q), (s) ; (D) → (q,r)

15. Column I shows four situations of standard Young's double slit arrangement with the screen placed far away from the slits S_1 and S_2 . In each of these cases $S_1P_0 = S_2P_0$, $S_1P_1 - S_2P_1 = \lambda/4$ and $S_1P_2 - S_2P_2 = \lambda/3$, where λ is the wavelength of the light used. In the cases B, C and D, a transparent sheet of refractive index μ and thickness t is pasted on slit S_2 . The thicknesses of the sheets are different in different cases. The phase difference between the light waves reaching a point P on the screen from the two slits is denoted by $\delta(P)$ and the intensity by $I(P)$. Match each situation given in Column-I with the statement(s) in Column-II valid for that situation.

	Column-I		Column-II
(A)		(p)	$\delta(P_0) = 0$
(B)	$(\mu - 1)t = \lambda/4$ 	(q)	$\delta(P_1) = 0$

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(C) $(\mu - 1)t = \lambda/2$

(r) $I(P_1) = 0$

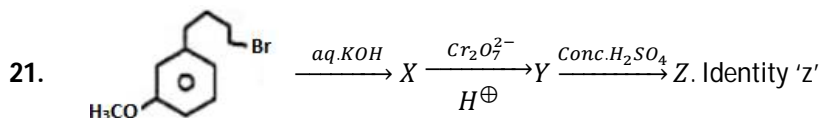
(D) $(\mu - 1)t = 3\lambda/4$

(s) $I(P_0) > I(P_1)$

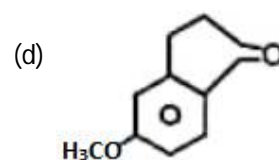
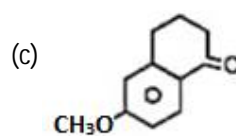
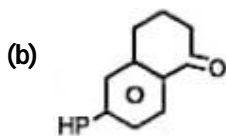
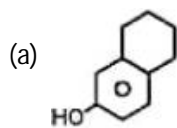
- (t) $I(P_2) > I(P_1)$
- (a) (A) → p, s; (B) → q; (C) → t; (D) → r, s, t
 (b) (A) → q, s; (B) → p; (C) → t; (D) → r, s, t
- (c) (A) → p, q; (B) → s; (C) → t; (D) → r, s, t
 (d) (A) → p, s; (B) → q; (C) → s; (D) → r, t, t

CHEMISTRY

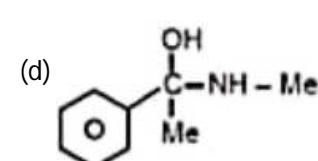
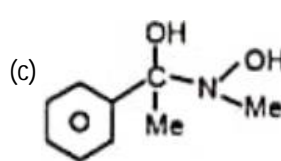
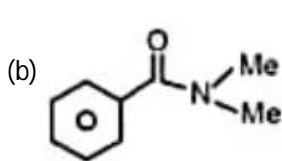
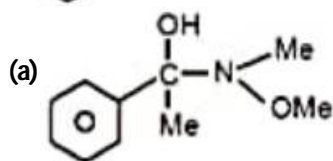
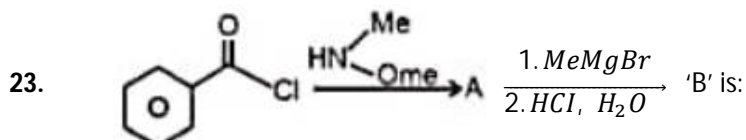
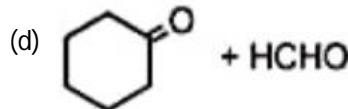
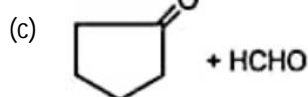
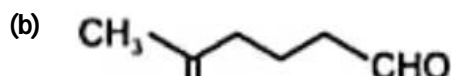
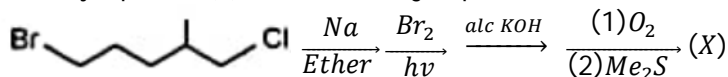
16. Find the incorrect trend for 1st IP.
 (a) $C > Si > Ge > Pb > Sn$ (b) $B > Tl > Ga > Al > In$ (c) $Be > Li > B > C$ (d) $Zn > Fe > Ni > Mn$
17. The pK_a values of the following glutamic acid are indicated below. The isoelectronic point for the amino acid is
- $$\begin{array}{c}
 HO_2C - (CH_2)_2 - CH - CO_2H \\
 4.3 \qquad \qquad \qquad | \qquad \qquad 2.2 \\
 \qquad \qquad \qquad NH_3 \\
 \qquad \qquad \qquad + \\
 \qquad \qquad \qquad 9.7
 \end{array}$$
- (a) 7 (b) 3.25 (c) 4.95 (d) 5.95
18. A reaction is carried out in rigid wall container and contains a mixture of N_2 , H_2 and NH_3 in equilibrium ($K_p = 3.75 \text{ atm}^{-2}$). If sufficient He is introduced into the reaction to double the total pressure under isothermal conditions, then the value of K_p at the new equilibrium would be
 (a) 0.9 atm^{-2} (b) 7.50 atm^{-2} (c) 15.00 atm^{-1} (d) 3.75 atm^{-2}
19. Given below are two statements:
Statement-I: In all the conformation of ethane, the bond angles are different.
Statement-II: In all the conformations of ethane, the bond lengths remain the same.
 In the light of above statements, choose the correct answer from the options given below:
 (a) Statement-I is incorrect but statement-II is correct (b) Both statement-I and statement-II are correct
 (c) Both statement-I and statement-II are incorrect (d) Statement-I is correct but statement-II is incorrect.
20. The magnitude of potential energy of electron in n^{th} excited state of He^+ ion is $\frac{8}{81}$ times the kinetic energy of electron in the first excited state of Li^{2+} ion. Hence the value of 'n' is
 (a) 2 (b) 3 (c) 5 (d) 6



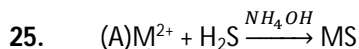
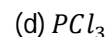
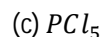
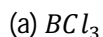
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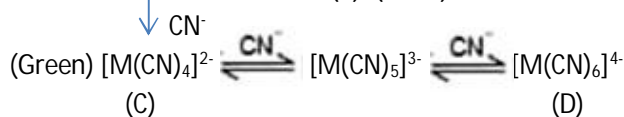
22. The major product(X) of the following sequence of reaction is



24. Which of the following does not hydrolyse in room conditions?



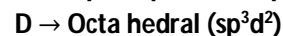
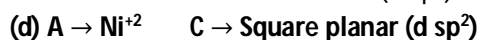
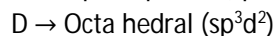
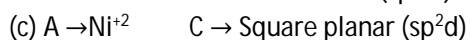
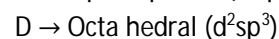
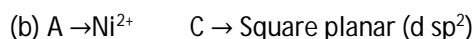
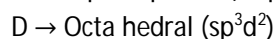
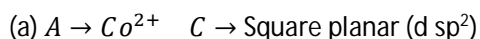
(B) (Black)



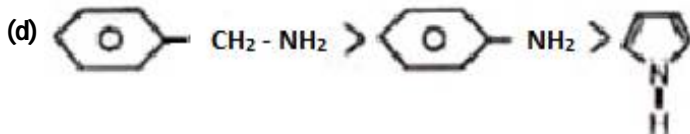
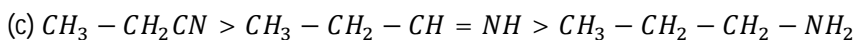
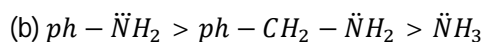
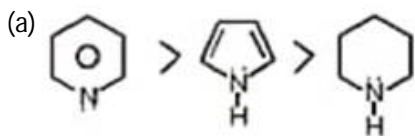
(C)

(D)

Choose the correct statement

SPACE FOR ROUGH WORK (You can check your Answer-key & Result on www.careeracademy.in)

26. Which one is correct order of basic strength?



27. Consider the cell

$Ag(S) | AgBr(S) | Br^-(aq) || Cl^-(aq) | AgCl(S) | Ag(S)$ at 25°C. The solubility product constants of $AgBr$ and $AgCl$ are 5×10^{-13} and 1×10^{-10} respectively. For what ratio of the concentrations of Br^- and Cl^- ions would be, emf of the cell be zero?

- (a) 1: 200 (b) 1: 100 (c) 1: 500 (d) 200: 1

28. The energy of an electron in Bohr's orbit of hydrogen atom is -13.6 eV. The total electronic energy of a hypothetical He atom in which there is no electron-electron repulsion is

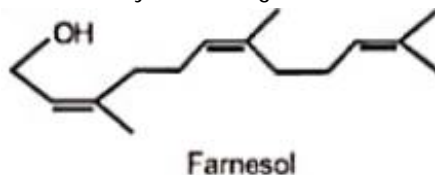
- (a) 27.2 eV (b) -27.2 eV (c) -108.8 eV (d) 108 eV

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

- (A) The dipole moment of PF_3Cl_2 is non-zero
 (B) The colour of the X_2 molecules (halogens) of group 17 elements changes gradually from yellow to violet down the group due to increase in HOMO-LUMO gap down the group
 (C) $HClO_4$ is more acidic than $HClO$ because of the resonance stabilization of its anion
 (D) The sum of the number of lone pairs of electron on each central atom in the following species $[BrF_2]^+$, $[SnF_3]$ and $[XeF_3]^+$ is 6.

- (a) C and D only (b) A and C only (c) A, B and C only (d) B, C and D only

30. Farnesol (structure given) is an organic substance used in perfumery to emphasise the odours of floral fragrances, and is a natural pesticide for mites. How many different geometric isomers of Farnesol are possible?



- (a) 2 (b) 8 (c) 6 (d) 4

BIOLOGY

31. Hind II always cuts DNA molecules at a particular point called recognition sequence and it consists of:
(a) 8 bp **(b) 6 bp** (c) 4 bp (d) 10 bp.
32. List of endangered species was released by
(a) GEAC (b) WWF (c) FOAM **(d) IUCN.**
33. The type of conservation in which the threatened species are taken out from their natural habitat and placed in special setting where they can be protected and given special care is called
(a) in-situ conservation **(b) Biodiversity conservation**
(c) Semi-conservative method (d) Sustainable development.
34. The lactose present in the growth medium of bacteria is transported to the cell by the action of
(a) Beta-galactosidase (b) Acetylase **(c) Permease** (d) Polymerase.
35. Given below are two statements:
Statement I : Bt toxins are insect group specific and coded by a gene cry IAc.
Statement II : Bt toxin exists as inactive protoxin in *B. thuringiensis*. However, after ingestion by the insect the inactive protoxin gets converted into active form due to acidic pH of the insect gut.
In the light of the above statements, choose the correct answer from the options given below:
(a) Both Statement I and Statement II are true
(b) Both Statement I and Statement II are false
(c) Statement I is true but Statement II is false
(d) Statement I is false but Statement II is true.
36. A pink flowered Snapdragon plant was crossed with a red flowered Snapdragon plant. What type of phenotype/s is/are expected in the progeny?
(a) Only red flowered plants **(b) Red flowered as well as pink flowered plants**
(c) Only pink flowered plants (d) Red, Pink as well as white flowered plants.

37. Match List I with List II.

	List-I		List-II
A.	Robert May	I.	Species-Area relationship
B.	Alexander von Humboldt	II.	Long term ecosystem experiment using out door plots
C.	Paul Ehrlich	III.	Global species diversity at about 7 million
D.	David Tilman	IV.	Rivet popper hypothesis

Choose the correct answer from the options given below:

- (a) A-II, B-III, C-I, D-IV **(b) A-III, B-I, C-IV, D-II** (c) A-I, B-III, C-II, D-IV (d) A-III, B-IV, C-II, D-I.
38. Match List I with List II.

	List-I		List-II
A.	Frederick Griffith	I.	Genetic code
B.	Francois Jacob & Jacque Monod	II.	Semi-conservative mode of DNA replication
C.	Har Gobind Khorana	III.	Transformation
D.	Meselson & Stahl	IV.	Lac operon

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Choose the correct answer from the options given below:

(a) A-III, B-II, C-I, D-IV **(b) A-III, B-IV, C-I, D-II** (c) A-II, B-III, C-IV, D-I (d) A-IV, B-I, C-II, D-III.

39. In an ecosystem if the Net Primary Productivity (NPP) of first trophic level is $100x \text{ (kcal m}^{-2}\text{) yr}^{-1}$, what would be the GPP (Gross Primary Productivity) of the third trophic level of the same ecosystem?

(a) $\frac{x}{10} \text{ (kcal m}^{-2}\text{) yr}^{-1}$

(b) $x \text{ (kcal m}^{-2}\text{) yr}^{-1}$

(c) $10x \text{ (kcal m}^{-2}\text{) yr}^{-1}$

(d) $\frac{100x}{3x} \text{ (kcal m}^{-2}\text{) yr}^{-1}$.

40. Which of the following statements is incorrect?

(a) A bio-reactor provides optimal growth conditions for achieving the desired product

(b) Most commonly used bio-reactors are of stirring type

(c) Bio-reactors are used to produce small scale bacterial cultures

(d) Bio-reactors have an agitator system, an oxygen delivery system and foam control system

41. Which one is the correct product of DNA dependent RNA polymerase to the given template?

3'TACATGGCAAATATCCATTCA5'

(a) 5'AUGUACCGUUUUAUAGGUAAGU3'

(b) 5'AUGUAAAAGUUUUAUAGGUAAGU3'

(c) 5'AUGUACCGUUUUAUAGGGAAGU3'

(d) 5'ATGTACCGTTTATAGGTAAGT3'

42. Given below are two statements : one is labelled as Assertion A and the other is labelled as Reason R :

Assertion A : FSH acts upon ovarian follicles in female and Leydig cells in male.

Reason R : Growing ovarian follicles secrete estrogen in female while interstitial cells secrete androgen in male human being.

In the light of the above statements, choose the correct answer from the options given below :

(a) Both A and R are true and R is the correct explanation of A

(b) Both A and R are true but R is NOT the correct explanation of A

(c) A is true but R is false

(d) A is false but R is true

43. Match List I with List II :

	List I		List II
A.	Typhoid	I.	Fungus
B.	Leishmaniasis	II.	Nematode
C.	Ringworm	III.	Protozoa
D.	Filariasis	IV.	Bacteria

Choose the correct answer from the options given below:

(a) A-I, B-III, C-II, D-IV

(b) A-IV, B-III, C-I, D-II

(c) A-III, B-I, C-IV, D-II

(d) A-II, B-IV, C-III,

44. Given below are some stages of human evolution. Arrange them in correct sequence. (Past to Recent)

A. Homo habilis

B. Homo sapiens

C. Homo neanderthalensis

D. Homo erectus

Choose the correct sequence of human evolution from the options given below:

(a) D-A-C-B

(b) B-A-D-C

(c) C-B-D-A

(d) A-D-C-B

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45. Match List I with List II :

List I

- A. α -I antitrypsin
 B. Cry IAb
 C. Cry IAa
 D. Enzyme replacement therapy

List II

- I. Cotton bollworm
 II. ADA deficiency
 III. Emphysema
 IV. Corn borer

Choose the correct answer from the options given below:

- (a) A-II, B-I, C-IV, D-III (b) A-III, B-I, C-II, D-IV (c) **A-III, B-IV, C-I, D-II** (d) A-II, B-IV, C-I, D-III

46. The "Ti plasmid" of *Agrobacterium tumefaciens* stands for

- (a) Tumour inhibiting plasmid

- (b) Tumor independent plasmid

(c) Tumor inducing plasmid

- (d) Temperature independent plasmid

47. Which one of the following factors will not affect the Hardy-Weinberg equilibrium?

- (a) Genetic recombination

- (b) Genetic drift

- (c) Gene migration

(d) Constant gene pool

48. Match List I with List II :

	List I		List II
A.	Down's syndrome	I.	11 th chromosome
B.	α -Thalassemia	II.	'X' chromosome
C.	β -Thalassemia	III.	21 st chromosome
D.	Klinefelter's syndrome	IV.	16th chromosome

Choose the correct answer from the options given below :

- (a) A-I, B-II, C-III, D-IV

- (b) A-II, B-III, C-IV, D-I

(c) A-III, B-IV, C-I, D-II

- (d) A-IV, B-I, C-II, D-III

49. Match List I with List II :

List I

- A. Common cold
 B. Haemozoin
 C. Widal test
 D. Allergy

List II

- I. Plasmodium
 II. Typhoid
 III. Rhinoviruses
 IV. Dust mites

Choose the correct answer from the options given below :

- (a) A-II, B-IV, C-III, D-I

- (b) A-I, B-III, C-II, D-IV

(c) A-III, B-I, C-II, D-IV

- (d) A-IV, B-II, C-III, D-I

50. Match List I with List II:

	List I		List II
A.	RNA polymerase III	I.	snRNPs
B.	Termination of transcription	II.	Promotor
C.	Splicing of Exons	III.	Rho factor
D.	TATA box	IV.	SnRNAs, tRNA

Choose the correct answer from the options given below :

- (a) A-II, B-IV, C-I, D-III

- (b) A-III, B-II, C-IV, D-I

(c) A-III, B-IV, C-I, D-II

(d) A-IV, B-III, C-I, D-II

51. Given below are two statements:
Statement I: Cleistogamous flowers are invariably autogamous.
Statement II: Cleistogamy is disadvantageous as there is no chance for cross pollination.
In the light of the above statements, choose the correct answer from the options given below.
(a) Statement I is incorrect but Statement II is correct
(b) Both Statement I and Statement II are correct
(c) Both Statement I and Statement II are incorrect
(d) Statement I is correct but Statement II is incorrect.
52. XO type of sex determination can be found in:
(a) Monkeys (b) *Drosophila* (c) Birds **(d) Grasshoppers.**
53. The process of translation of mRNA to proteins begins as soon as:
(a) The tRNA is activated and the larger subunit of ribosome encounters mRNA
(b) The small subunit of ribosome encounters mRNA
(c) The larger subunit of ribosome encounters mRNA
(d) Both the subunits join together to bind with mRNA.
54. Which one of the following statements cannot be connected to Predation?
(a) It is necessitated by nature to maintain the ecological balance
(b) It helps in maintaining species diversity in a community
(c) It might lead to extinction of a species
(d) Both the interacting species are negatively impacted.
55. Which of the following is not a method of ex situ conservation?
(a) Cryopreservation (b) In vitro fertilization **(c) National Parks** (d) Micropropagation.
56. If the length of a DNA molecule is 1.1 metres, what will be the approximate number of base pairs?
(a) 6.6×10^6 bp **(b) 3.3×10^9 bp** (c) 6.6×10^9 bp (d) 3.3×10^6 bp.
57. If a colour blind female marries a man whose mother was also colour blind, what are the chances of her progeny having colour blindness?
(a) 100% (b) 25% (c) 50% (d) 75%
58. Ten *E. coli* with ¹⁵N-dsDNA are incubated in medium containing ¹⁴N nucleotide. After 60 minutes, how many *E. coli* cells will have DNA totally free from ¹⁵N?
(a) 80 cells (b) 20 cells (c) 40 cells **(d) 60 cells.**
59. Which of the following statements is not true?
(a) Flippers of penguins and dolphins are a pair of homologous organs
(b) Analogous structures are a result of convergent evolution
(c) Sweet potato and potato is an example of analogy (d) Homology indicates common ancestry.
60. Which of the following is not a desirable feature of a cloning vector?
(a) Presence of two or more recognition sites (b) Presence of origin of replication
(c) Presence of a marker gene (d) Presence of single restriction enzyme site.

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MATHEMATICS

31. Let f be a function satisfying $2f(xy) = (f(x))^y + (f(y))^x$ and $f(1) = k \neq 1$, then $\sum_{r=1}^n f(r)$ is equal to
 (a) $k^n - 1$ (b) k^n (c) $k^n + 1$ (d) none
32. Let $\max_{0 \leq x \leq 2} \left\{ \frac{9-x^2}{5-x} \right\} = \alpha$ and $\min_{0 \leq x \leq 2} \left\{ \frac{9-x^2}{5-x} \right\} = \beta$ if $\int_{\beta-8/3}^{2\alpha-1} \max. \left\{ \frac{9-x^2}{5-x}, x \right\} dx = \alpha_1 + \alpha_2 \log_e \left(\frac{8}{15} \right)$, then $\alpha_1 + \alpha_2$ is equal to
 (a) 30 (b) 34 (c) 38 (d) none
33. If the area of the bounded region $R = \{(x, y) : \max\{0, \log_e x\} \leq y \leq 2^x, \frac{1}{2} \leq x \leq 2\}$ is $\alpha(\log_e 2)^{-1} + \beta(\log_e 2) + \gamma$, then the value of $(\alpha + \beta + 2\gamma)^2$ is equal to
 (a) 8 (b) 2 (c) 4 (d) 1
34. Let $A = \begin{bmatrix} 2 & -1 \\ 0 & 2 \end{bmatrix}$. If $I - {}^5C_1(\text{adj } A) + {}^5C_2(\text{adj } A)^2 - \dots - {}^5C_5(\text{adj } A)^5$, then the sum of all elements of the matrix B is
 (a) -5 (b) -6 (c) -7 (d) -8
35. If \vec{a} & \vec{b} are vectors such that $|\vec{a} + \vec{b}| = \sqrt{29}$ and $\vec{a} \times (2\hat{i} + 3\hat{j} + 4\hat{k}) = (2\hat{i} + 3\hat{j} + 4\hat{k}) \times \vec{b}$. Then a possible value of $(\vec{a} + \vec{b}) \cdot (-7\hat{i} + 2\hat{j} + 3\hat{k})$ is
 (a) 0 (b) 3 (c) 4 (d) 8
36. If $g(x) = \lim_{m \rightarrow \infty} \frac{x^m f(1) + h(x) + 1}{2x^m + 3x + 3}$ is continuous at $x = 1$ and $g(1) = \lim_{x \rightarrow 1} \{\log_e(ex)\}^{2/\log_e x}$, then the value of $2g(1) + 2f(1) - h(1)$, when $f(x)$, $g(x)$ and $h(x)$ are continuous at $x = 1$ is
 (a) 0 (b) 1 (c) 2 (d) 3
37. A bag contains 8 balls, whose colors are either white or black, 4 balls are drawn at random without replacement and it was found that 2 balls are white and other two balls are black. The probability that the bag contains equal number of white and black balls is
 (a) $\frac{2}{5}$ (b) $\frac{2}{7}$ (c) $\frac{1}{7}$ (d) $\frac{1}{5}$
38. The domain of the function $f(x) = \sin^{-1} \left(\frac{2-|x|}{4} \right) + \cos^{-1} \left(\frac{2-|x|}{4} \right) + \tan^{-1} \left(\frac{2-|x|}{4} \right)$ is
 (a) [0,3] (b) [-6,6] (c) [-1,1] (d) [-3,3]
39. A curve $y = f(x)$ satisfies the differential equation $(2xy^2 - y)dx + x dy = 0$, and it passes through the point of intersection of line $2x - 3y = 1$ and $3x + 2y = 8$. Then the value of $|y(1)|$ will be
 (a) 1 (b) 0 (c) 2 (d) none

40. If the system of linear equations $x + y + 3z = 0, x + 3y + k^2z = 0; 3x + y + 3z = 0$ has a non zero solution (x, y, z) for some $k \in R$, then $(x + y/z)$ is equal to
 (a) -3 (b) 9 (c) 3 (d) -9
41. If $f(x + y) = f(x) + f(y) + |x|y + xy^2, \forall x, y \in R$ and $f'(0)$, then
 (a) f need not be differentiable at every non-zero x (b) f is differentiable for all $x \in R$
 (c) f is twice differentiable at $x = 0$ (d) none of these
42. Let f, g and h are real valued function defined on the interval $[0,1]$ by $f(x) = e^{x^2} + e^{-x^2}, g(x) = xe^{x^2} + e^{-x^2}$ and $h(x) = x^2e^{x^2}e^{-x^2}$. If a, b and c denotes, respectively, the absolute maximum of f, g and h on $[0,1]$, then
 (a) $a = b$ and $c \neq b$ (b) $a = c$ and $a \neq b$ (c) $a \neq b$ and $c \neq b$ (d) $a = b = c$
43. The function $f(x) = x^3 - 6x^2 + ax + b$ is such that $f(2) = f(4) = 0$. Consider two statements.
 (S_1) there exists $x_1, x_2 \in (2,4), x_1 < x_2$, such that $f'(x_1) = -1$ and $f'(x_2) = 0$.
 (S_2) there exists $x_3, x_4 \in (2,4), x_3 < x_4$, such that f is decreasing in $(2, x_4)$, increasing in $(x_4, 4)$ and $2f'(x_3) = \sqrt{3}f(x_4)$ increasing in $(x_4, 4)$ and $2f'(x_3) = \sqrt{3}f(x_4)$. Then
 (a) (S_1) is true and (S_2) is false (b) both (S_1) and (S_2) are false
 (c) both (S_1) and (S_2) are true (d) (S_1) is false and (S_2) is true
44. Match the following.

	List-I	List-II
P.	The number of polynomials $f(x)$ with non-negative integer coefficients of degree ≤ 2 , satisfying $f(0) = 0$ and $\int_0^1 f(x)dx = 1$, is	1.8
Q.	The number of point in the interval $(-\sqrt{13}, \sqrt{13})$ at which $f(x) = \sin(x^2) + \cos(x^2)$ attains its maximum value, is	2.2
R.	$\int_{-2}^2 \frac{3x^2}{(1+e^x)} dx$ equals	3.4
S.	$\frac{(\int_{-1/2}^{1/2} \cos 2x \log(\frac{1+x}{1-x}) dx)}{(\int_0^{1/2} \cos 2x \log(\frac{1+x}{1-x}) dx)}$ equals	4.0

	P	Q	R	S
(a)	3	2	4	1
(b)	2	3	4	1
(c)	3	2	1	4
(d)	2	3	1	4

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45. Let $\gamma \in \mathbb{R}$ be such that the lines $L_1: \frac{x+11}{1} = \frac{y+21}{2} = \frac{z+29}{3}$ and $L_2: \frac{x+16}{3} = \frac{y+11}{2} = \frac{z+4}{\gamma}$ intersect. Let R_1 be the point of intersection of L_1 and L_2 . Let $O = (0, 0, 0)$, and \hat{n} denotes a unit normal vector to the plane containing both the lines L_1 and L_2 .

Match each entry in List-I to the correct entry in List-II.

List-I		List-II	
(P)	γ equals	(1)	$-\hat{i} - \hat{j} + \hat{k}$
(Q)	A possible choice for \hat{n} is	(2)	$\sqrt{\frac{3}{2}}$
(R)	$\overrightarrow{OR_1}$ equals	(3)	1
(S)	A possible value of $\overrightarrow{OR_1} \cdot \hat{n}$ is	(4)	$\frac{1}{\sqrt{6}}\hat{i} - \frac{2}{\sqrt{6}}\hat{j} + \frac{1}{\sqrt{6}}\hat{k}$
		(5)	$\sqrt{\frac{2}{3}}$

The correct option is

- (a) (P) \rightarrow (3)(Q) \rightarrow (4)(R) \rightarrow (1)(S) \rightarrow (2) (b) (P) \rightarrow (5)(Q) \rightarrow (4)(R) \rightarrow (1)(S) \rightarrow (2)
 (c) (P) \rightarrow (3)(Q) \rightarrow (4)(R) \rightarrow (1)(S) \rightarrow (5) (d) (P) \rightarrow (3)(Q) \rightarrow (1)(R) \rightarrow (4)(S) \rightarrow (5)