

# Talent Search Exam. 2017

TEST CODE **1212**

for class XII

BOOKLET **D**

**Duration : 2 Hours** **Max. Marks : 360**

Please read the instructions carefully. You are allotted 5 minutes specifically for this purpose.

## INSTRUCTIONS

### A. General :





1. This booklet is your question paper containing **120 Questions**. Attempt any one of the **Biology OR Mathematics**. The booklet has **22 Pages**.
2. The question paper contains blank space for your rough work. No additional sheets will be provided for rough work.
3. It is mandatory to use **Blue or Black Ball Point Pen** to darken to appropriate circle in the answer sheet.
4. Blank papers, clipboards, log tables, slide rules, calculators, cellular phones, pagers and electronic gadgets in any form are not allowed to be carried inside the examination hall.
5. Fill in the boxes provided below on this page and also write your Name and Roll Number in the space provided.
6. Do not use white-fluid or any other rubbing material on answer sheet. Before handing over the answer sheet to the invigilator, candidate should check that **Roll No, Test code and Book Code** have been filled and marked correctly. Immediately after the prescribed examination time is over, the **Answer sheet is to be returned to the invigilator**.

### B. Filling the Answer Sheet :





7. On **Side-1** of Answer Sheet write your name, Enrollment Number and Name of the centre in the respective boxes. **Do not write anything on Side-2.**
8. Put your signature space provided on the Answer Sheet affirming that you have verified this.
9. All question carry **+4 Marks** for Right Answer and **-1** for Wrong Answer.

## PROCEDURE OF FILLING UP THE ANSWERS IN ANSWER SHEET

### Wrong Filling

-  A B C D Tick mark
-  A B C D Cross mark
-  A B C D Half filled or semi dark
-  A B C D Light filled

### Right Filling

-  B C D Fully darken with Pen
-  B C D Fully darken with Pen
-  B C D Fully darken with Pen
-  B C D Fully darken with Pen

**Name of the candidate (In Capital Letters)**

**Enrollment Number**

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**I have read all the instruction and shall abide by them.**

.....  
**(Signature of the candidate)**

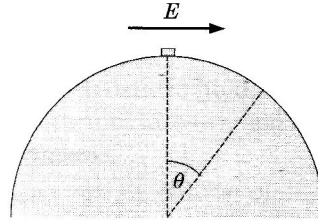
**I have verified all the information filled in by the candidate.**

.....  
**(Signature of the Invigilator)**

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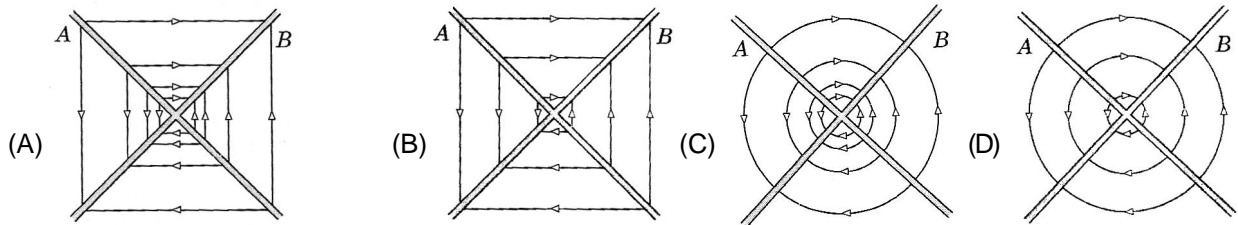
# PHYSICS

1. In a horizontal uniform electric field, a small charged disk is gently released on the top of a fixed spherical dome. The disk slides down the dome without friction and breaks away from the surface of the dome at angular position  $\theta = \sin^{-1}(3/5)$  from the vertical. Determine the ratio of the force of gravity acting on the disk to the force of its interaction with the field.

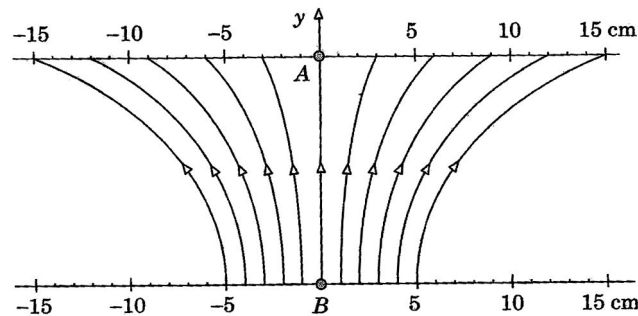


- (A)  $\frac{4}{3}$                       (B)  $\frac{3}{4}$                       (C)  $\frac{9}{2}$                       (D)  $\frac{12}{1}$

2. Two infinitely large planes A and B intersect each other at right angles and carry uniform surface charge densities  $+\sigma$  and  $-\sigma$ . In which of the following figures, electric field lines are correctly represented?

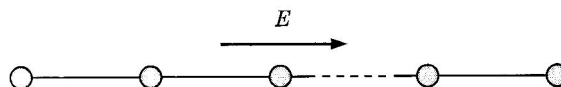


3. A charge particle is in equilibrium at point A under combined action of a uniform gravitational field and a non-uniform electric field. The electric field is symmetric with respect to rotation about the y-axis and the lines of the electric field in a plane are shown in the fig. The charge modulus on the particle is changed gradually till it shifts to another equilibrium position B. With the help of the fig. estimate fractional change in the charge modulus.



- (A)  $\frac{1}{3}$                       (B)  $\frac{2}{3}$                       (C)  $\frac{1}{9}$                       (D)  $\frac{8}{9}$

4. A straight chain consisting of  $n$  identical metal balls is at rest in a region of free space as shown. In the chain, each ball is connected with adjacent ball by identical conducting wires. Length  $l$  of a connecting wire is much larger than the radius  $r$  of the balls.



A uniform electric field  $E$  pointing along the chain is switched on in the region. Find the magnitude of the induced charges at one of the end ball.

- (A)  $q = 2\pi\epsilon_0 r n l E$                       (B)  $q = 2\pi\epsilon_0 r (n-1) l E$                       (C)  $q = 4\pi\epsilon_0 r (n-1) l E$                       (D)  $q = 4\pi\epsilon_0 r (n-1)^2 l E$

5. Flat air capacitor  $C$  consists of two large plates, located close to each other. Initially, one of the plates was not charged, while the other had charge  $Q$ . Now a slab of electrical resistance  $R$  and thickness equal to distance

between the plates is inserted in the capacitor. Estimate the amount of heat lost in the form of heat within the slab over a long period of time till steady state condition is established.

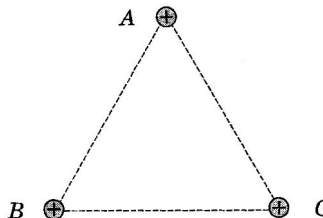
(A)  $\frac{Q^2}{2C}$

(B)  $\frac{Q^2}{8C}$

(C)  $\frac{3Q^2}{8C}$

(D)  $\frac{7Q^2}{8C}$

6. Three identical point charges are placed on the vertices of an equilateral triangle as shown in the fig. At how many places within the triangle ABC electric field vanishes.



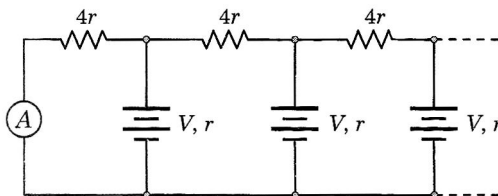
(A) One

(B) Two

(C) Three

(D) Four

7. The circuit shown in the diagram extends to the right into infinity. Each battery has the electromotive force  $V$  (unknown) and the internal resistance  $r$  (known). Each resistor has the resistance  $4r$ . The reading of the ideal ammeter shown in the diagram is  $I$ . Find the value of  $V$  in terms of  $I$  and  $r$ .



(A)  $V = (2 - 2\sqrt{2})Ir$

(B)  $V = (2 + 2\sqrt{2})Ir$

(C)  $V = 4.5Ir$

(D)  $V = 3.0Ir$

8. In the circuit are shown two parallel plate capacitors of capacitances  $C$  and  $2C$  consisting of plates of identical dimensions. They are connected with an ideal battery of terminal voltage  $V$  as shown in the fig. I. Now the capacitor smaller in volume is completely inserted into the other capacitor larger in volume and kept in symmetric position and then connection polarities of the plates are reversed as shown in the fig. II. Identify correct statements?

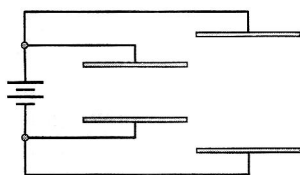


Figure-I

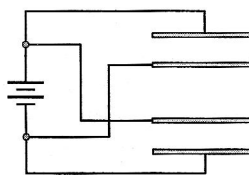
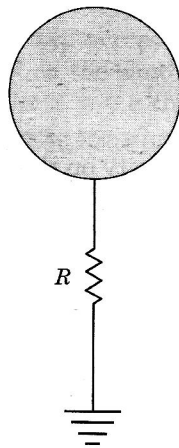


Figure-II

- (A) Charge flown through the battery is  $10CV$  and the battery absorbs energy  
 (B) Charge flown through the battery is  $10CV$  and the battery delivers energy  
 (C) Charge flown through the battery is  $7CV$  and the battery absorbs energy  
 (D) Charge flown through the battery is  $7CV$  and the battery delivers energy

### Paragraph Based Questions (9 to 10)

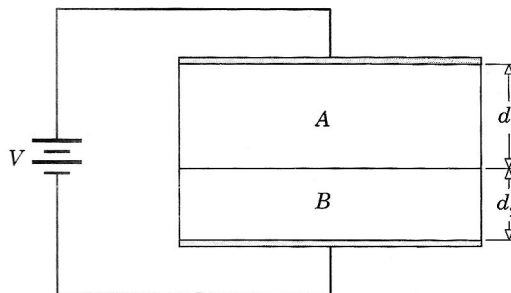
A conducting balloon of radius 'a' is charged to a potential  $V_0$  and held at a large height above the earth surface. The large height of the balloon from the earth ensures that charge distribution on the surface of the balloon remains unaffected by the presence of the earth. It is connected to the earth through a resistance  $R$  and a valve in the balloon is opened. The gas inside the balloon escapes from the valve and the size of the balloon decreases. The rate of decrease in radius of the balloon is controlled in such a manner that potential of the balloon remains constant. Assume the electric permittivity of the surrounding air equals to that of free space ( $\epsilon_0$ ) and charge cannot leak to the surrounding air.



9. Rate at which radius  $r$  of the balloon changes with time is best represented by the equation
- (A)  $\frac{dr}{dt} = \frac{1}{4\pi\epsilon_0 R}$       (B)  $\frac{dr}{dt} = -\frac{1}{4\pi\epsilon_0 R}$       (C)  $\frac{dr}{dt} = \frac{r}{4\pi\epsilon_0 aR}$       (D)  $\frac{dr}{dt} = -\frac{r}{4\pi\epsilon_0 aR}$
10. How much heat is dissipated in the resistance  $R$  till the moment radius of the balloon becomes half?
- (A)  $0.5\pi\epsilon_0 aV_0^2$       (B)  $\pi\epsilon_0 aV_0^2$   
 (C)  $2\pi\epsilon_0 aV_0^2$       (D)  $4\pi\epsilon_0 aV_0^2$

### Paragraph Based Questions (11 to 12)

A parallel plate capacitor is filled with two layers of different materials A and B as shown in the fig. The material A has dielectric constant  $\epsilon_1$  and conductivity  $\sigma_1$  and the material B has dielectric constant  $\epsilon_2$  and conductivity  $\sigma_2$  respectively. The capacitor is connected across a battery of terminal voltage  $V$ .



11. Electric fields in material A is
- (A)  $\frac{V\sigma_1}{d_1\sigma_1 + d_2\sigma_2}$       (B)  $\frac{V\sigma_2}{d_1\sigma_1 + d_2\sigma_2}$   
 (C)  $\frac{V\sigma_1}{d_1\sigma_2 + d_2\sigma_1}$       (D)  $\frac{V\sigma_2}{d_1\sigma_2 + d_2\sigma_1}$
12. What is the total surface charge density on the interface of the two medium?
- (A)  $\frac{\epsilon_0 V(\epsilon_1 - \epsilon_2)}{d_1\epsilon_2 + d_2\epsilon_1}$       (B)  $\frac{\epsilon_0 V(\sigma_1 - \sigma_2)}{d_1\sigma_2 + d_2\sigma_1}$   
 (C)  $\frac{\epsilon_0 V(\sigma_1\epsilon_2 - \sigma_2\epsilon_1)}{d_1\sigma_2 + d_2\sigma_1}$       (D)  $\frac{V}{\epsilon_0 d_1 d_2} \left[ \frac{d_1}{d_1 + d_2} - \frac{d_2}{d_1 + d_2} \right]$
13. Current  $I$  flowing along edges of one face of a cube as shown in the fig. I, produces magnetic field  $\vec{B} = B_0 \hat{j}$  at the centre of the cube. Consider another identical cube, where the current  $I$  flows along the path shown in the fig. II. What magnetic field exists at the centre of the second cube?

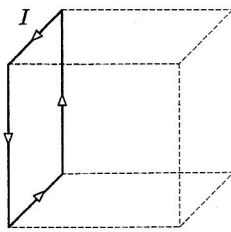
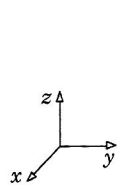


Figure-I

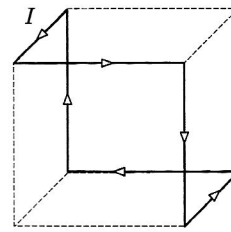
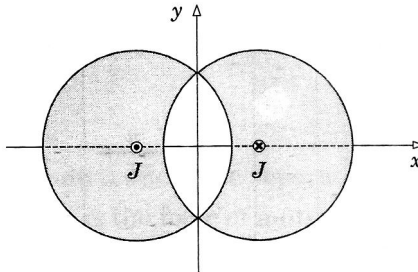


Figure-II

14. (A) Zero (B)  $B_0(\hat{i} + \hat{j} + \hat{k})$  (C)  $B_0(-\hat{i} + \hat{j} + \hat{k})$  (D)  $B_0(-\hat{i} + \hat{j} - \hat{k})$
14. A parallel plate capacitor consists of square plates of edge length  $a$  separated by distance  $d$  that is much smaller than the edge length. It is charged to potential  $V$  and made to move with constant velocity  $v$  directed along one of its edges. How much magnetic field exists inside the capacitor?
- (A)  $\frac{\mu_0 \epsilon_0 VV}{d}$  (B)  $\frac{\mu_0 \epsilon_0 aV}{vd}$  (C)  $\frac{\mu_0 \epsilon_0 a^2 V}{vd}$  (D)  $\frac{\mu_0 \epsilon_0 a^2 Vv}{d}$
15. A long straight conductor has uniform cross-section having shape of two identical overlapped circles with their center-to-center spacing  $a$ . The material from overlapped section has been removed from entire length of the conductor as shown in the fig. Now the portions on either sides of the  $y$ - $z$  plane are split and restacked after coating their surface by a very thin layer of insulating paint.



The portions of composite conductor to the left and the right side of the  $y$ - $z$  plane carry uniform currents of current density  $J$  in the positive  $z$  and the negative  $z$ -directions respectively. The permeability of both the conductors is the same as that of vacuum.

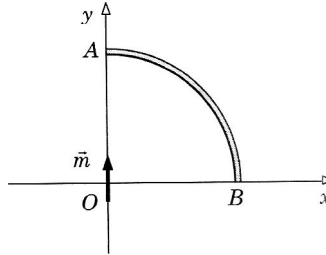
Which one of the following statements best describes the magnetic field in the empty space inside the composite conductor.

- (A) It is non-uniform and points in the positive  $y$ -direction everywhere on the  $y$ -axis
- (B) It is non-uniform and points in the positive  $y$ -direction everywhere on the  $x$  and  $y$ -axis
- (C) It is uniform, points everywhere in the positive  $y$ -direction and has magnitude  $\frac{1}{2}\mu_0 J a$
- (D) It has different directions at different points but the same magnitude  $\frac{1}{2}\mu_0 J a$
16. Two coaxial circular coils of radii  $a$  and  $b$  are separated by a large distance  $x$  and carry equal currents  $I$ . If  $a \gg b$ , what is the force of mutual interaction between them.
- (A)  $F = \frac{\mu_0 I^2 a^2 b}{(a^2 + x^2)^{1.5}}$  (B)  $F = \frac{3\pi\mu_0 I^2 a b x}{(a^2 + x^2)^{1.5}}$  (C)  $F = \frac{\pi\mu_0 I^2 a^3 b}{(a^2 + x^2)^2}$  (D)  $F = \frac{3\pi\mu_0 I^2 a^3 b x}{2(a^2 + x^2)^{2.5}}$
17. A plane with a wingspan of 18 m flies horizontally at a speed of 360 km/h. The vertical component of the Earth's magnetic field strength is about 40 A/m. An electric bulb is connected between the two extreme ends of the wings
- (A) Voltage is induced between the extreme ends and the bulb will glow
- (B) Voltage is not induced between the extreme ends and the bulb will not glow
- (C) Voltage is not induced between the extreme ends but the bulb will glow
- (D) Voltage is induced between the extreme ends but the bulb will not glow

18. A wire of uniform cross-section is drawn from a piece of mass  $m$  of a metal of density  $d$  and resistivity  $\rho$ . Now the ends of the wire are joined to make a planar closed loop. The loop is placed in a uniform magnetic field whose induction  $B$  varies with time  $t$  according to law  $B = \beta t$ , where  $\beta$  is a constant. What is the maximum current you can obtain in the loop by properly selecting shape and dimensions of the loop?

- (A)  $\frac{\beta m}{\pi \rho d}$                       (B)  $\frac{\beta m}{2\pi \rho d}$                       (C)  $\frac{\beta m}{4\pi \rho d}$                       (D)  $\frac{\beta m}{8\pi \rho d}$

19. Consider a quarter circular conducting ring of large radius  $r$  with its center at the origin, where a magnetic dipole of moment  $\vec{m}$  is placed as shown in the fig. When the ring rotates at constant angular velocity  $\omega$  about the  $y$ -axis, electromotive force induces between its ends is

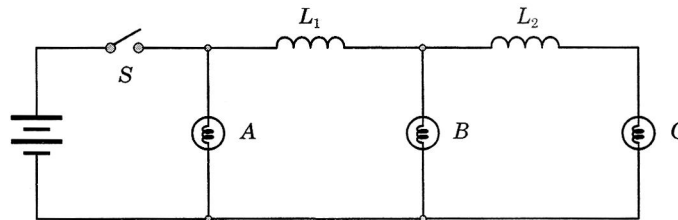


- (A) Zero                      (B)  $V = \frac{\mu_0 m \omega}{2\pi r}$                       (C)  $V = \frac{\mu_0 m \omega}{4\pi r}$                       (D)  $V = \frac{\mu_0 m \omega}{8\pi r}$

20. A superconducting rigid planar loop of area  $A$  and self-inductance  $L$  carrying a current is held fixed in a region of free space. Now a uniform magnetic field of induction  $B$  pointing everywhere parallel to the magnetic moment  $\vec{m}$  of the loop is switched on. Current in the loop after the magnetic field is switched on is given by

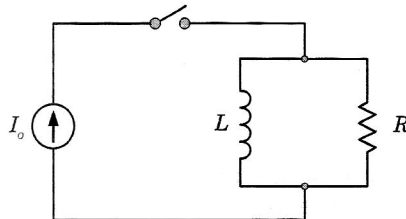
- (A)  $I = \frac{AB}{L}$                       (B)  $I = \frac{m}{A} - ALB$                       (C)  $I = \frac{m}{A} - \frac{AB}{L}$                       (D)  $I = \frac{m}{A} + \frac{AB}{L}$

21. Three identical lamps A, B and C and two identical inductive coils  $L_1$  and  $L_2$  are connected to a DC power supply through a switch  $S$  as shown in the fig. Initially the switch is closed for a long time and steady state is reached. Now the switch  $S$  is opened. Which of the following statements correctly describes order of brightness of the bulbs immediately after the switch is opened?



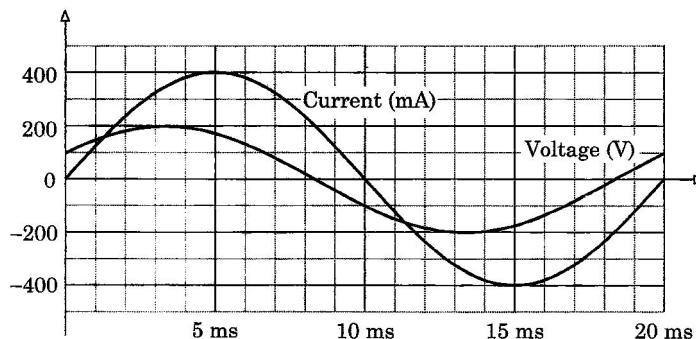
- (A) Brightness of A suddenly increases but that of B and C remains unchanged  
 (B) Brightness of B suddenly increases but that of A and C remains unchanged  
 (C) Brightness of C suddenly increases but that of A and B remains unchanged  
 (D) Brightness of all the bulbs suddenly increases equally

22. The circuit shown consists of a coil of inductance  $L$ , an unknown resistance  $R$ , a switch and an ideal current source of current  $I_0$ . Find total heat dissipated in the resistance after the switch is closed.



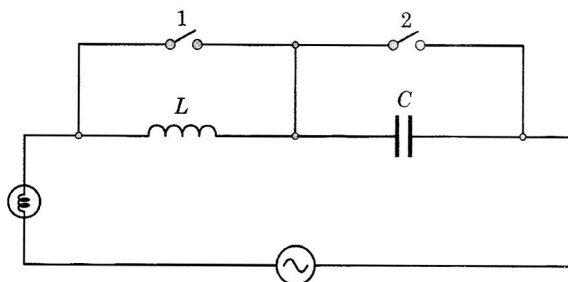
- (A) Zero                      (B)  $\frac{1}{4} LI_0^2$                       (C)  $\frac{1}{2} LI_0^2$                       (D)  $LI_0^2$

23. The given graph shows variation with time in the source voltage and steady state current drawn by a series RLC circuit.



Which of the following statements is incorrect?

- (A) Current lags the voltage  
 (B) Resistance in the circuit is  $250\sqrt{3}\Omega$   
 (C) If capacitive resistance is  $74\Omega$ , inductance in the circuit is approximately 560 mH  
 (D) Average power dissipation in the circuit is  $20\sqrt{3}W$
24. In the circuit shown, a series combination of an incandescent lamp, an inductance  $L$  and capacitance  $C$  is connected across a alternating voltage source. Two switches 1 and 2 are provided to short circuit the inductor or the capacitor or both.

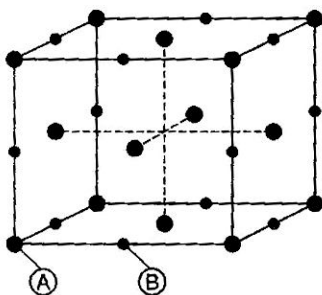


Initially both the switches are open and the lamp glows with certain brightness. When switch 1 is closed keeping switch 2 open, brightness of the lamp remains unchanged. How does the brightness of the lamp change when switch 1 is opened and 2 is closed?

- (A) Decreases (B) Increases (C) Remain unchanged (D) Insufficient information
25. An ac ammeter, an ac voltmeter and a resistor are connected in series and the combination is connected across a sinusoidal voltage source. The ac ammeter and the ac voltmeter are purely resistive in nature. The readings are  $A$  and  $V$  respectively. If a capacitor is now connected across the voltmeter
- (A) Both  $A$  and  $V$  will increase (B) Both  $A$  and  $V$  will decrease  
 (C)  $A$  will decrease,  $V$  will increase (D)  $A$  will increase,  $V$  will decrease

## CHEMISTRY

26. For a solid with the following structure, the co-ordination number of the point B is:



(A) 3

(B) 4

(C) 5

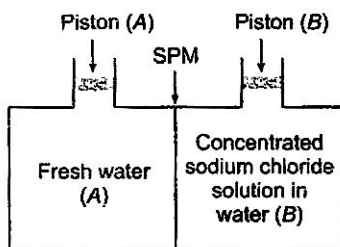
(D) 6

**Paragraph Based Questions (27 to 28)**

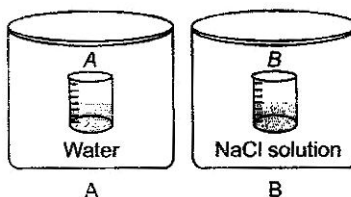
In crystalline solids atoms or molecules are arranged in a regular and long range order fashion in a three dimensional pattern. These have sharp melting point, flat faces, sharp edges, bounded by well defined planes. A large number of unit cells, each of which possess a definite geometry bounded by plane faces give rise to the formation of a crystal. A point at the corner of unit cell contributes for  $1/8$  of each such point to unit cell. A point along an edge contribute for  $1/4$  of each such point to unit cell. A body centred point contributes for 1 each such points to unit cell. Co-ordination number is the number of nearest neighbours that each ion is surrounded by an

oppositely charged ions. Radius of unit cell in sc, fcc and bcc is  $\frac{a}{2}$ ,  $\frac{a}{2\sqrt{2}}$  and  $\frac{\sqrt{3}a}{4}$ , where  $a$  is edge length of cell.

27. A mineral having the formula  $AB_2$  crystallizes in the cubic closed packed lattice, with  $A^{2+}$  atoms occupying the lattice points and  $B^-$  tetrahedral voids. The co-ordination number of A, B and fraction of the tetrahedral sites occupied by B atom respectively are:  
 (A) 8, 4, 100% (B) 4, 8, 100% (C) 8, 6, 57% (D) 6, 8, 57%
28. An alloy of Cu and gold crystallizes in a cubic lattice in which the gold atoms occupy the lattice points at the corners of cube and copper atoms occupy the centre of each face. The formula of this compound is:  
 (A)  $AuCu_3$  (B)  $AuCu$  (C)  $AuCu_2$  (D)  $CuAu_3$
29. Consider the fig. and mark the correct option.



- (A) Water will move from side (A) to side (B) if a pressure lower than osmotic pressure is applied on piston (B)  
 (B) Water will move from side (B) to side (A) if a pressure greater than osmotic pressure is applied on piston (B)  
 (C) Water will move from side (B) to side (A) if a pressure equal to osmotic pressure is applied on piston (B)  
 (D) Water will move from side (A) to side (B) if a pressure equal to osmotic pressure is applied on piston (A)
30. Two beakers of capacity 500 mL were taken. One of these beakers, labelled as 'A', was filled with 400 mL water whereas the beaker labelled 'B' was filled with 400 mL of 2 M solution of NaCl. At the same temperature both the beakers were placed in closed containers of same material and same capacity as shown in fig.



At a given temperature, which of the following statements is correct about the vapour pressure of pure water and that of NaCl solution?

- (A) Vapour pressure in container (A) is more than that in container (B)  
 (B) Vapour pressure in container (A) is less than that in container (B)  
 (C) Vapour pressure is equal in both the containers  
 (D) Vapour pressure in container (B) is twice the vapour pressure in container (A)



31. Select the incorrect statement.

- (A) Higher is the value of Henry's law constant (in mol litre<sup>-1</sup> atm<sup>-1</sup>), lower is solubility of gas  
 (B) Henry's law in mol litre<sup>-1</sup> atm<sup>-1</sup> constant for N<sub>2</sub> is higher than O<sub>2</sub> at 298 K  
 (C) O<sub>2</sub> has lower solubility in water than N<sub>2</sub> at 298 K  
 (D) Aquatic species are more comfortable in cold water than hot water

32. Match the following and select the correct option given below:

**List-A**

- I. Th(NO<sub>3</sub>)<sub>4</sub>  
 II. Benzoic acid in benzene  
 III. Al<sub>2</sub>(SO<sub>4</sub>)<sub>3</sub>

IV. S<sub>8</sub>

**List B**

(P)  $i > 1$

(Q)  $i < 1$

(R)  $i = 5$

(S)  $1 - \alpha + \frac{\alpha}{8}$

(A) I → PR, II → PS, III → Q, IV → P

(C) I → PR, II → PR, III → Q, IV → QS

(B) I → PQ, II → PR, III → S, IV → P

(D) I → QR, II → PQ, III → PS, IV → S

33. In the electrolysis of aqueous sodium chloride solution which of the half cell reaction will occur at anode?

(A)  $\text{Na}_{(\text{aq})}^+ + e^- \longrightarrow \text{Na}_{(\text{s})}$ ;

$$E_{\text{cell}}^{\circ} = -2.71 \text{ V}$$

(B)  $2\text{H}_2\text{O}_{(\text{l})} \longrightarrow \text{O}_{2(\text{s})} + 4\text{H}_{(\text{aq})}^+ + e^-$ ;

$$E_{\text{cell}}^{\circ} = -1.23 \text{ V}$$

(C)  $\text{H}_{(\text{aq})}^+ + e^- \longrightarrow \frac{1}{2}\text{H}_{2(\text{g})}$ ;

$$E_{\text{cell}}^{\circ} = -0.00 \text{ V}$$

(D)  $\text{Cl}_{(\text{aq})}^- \longrightarrow \frac{1}{2}\text{Cl}_{2(\text{g})} + e^-$ ;

$$E_{\text{cell}}^{\circ} = -1.36 \text{ V}$$

34. Calorimetric determination of  $\Delta H$  for the reaction at 0°C :  $2\text{Ag} + \text{ZnCl}_2 \longrightarrow \text{Zn} + 2\text{AgCl} + \text{AgCl}$  is +52.05 kcal. If the emf of the cell for

$\text{Zn} + 2\text{AgCl} \longrightarrow 2\text{Ag} + \text{ZnCl}_2$  is 1.015 volt, what is the temperature coefficient of cell?

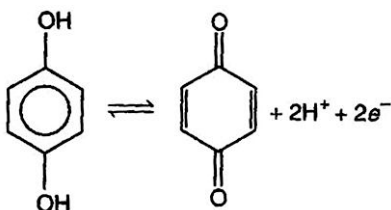
(A)  $-4.311 \times 10^{-4}$  V/degree

(B)  $+4.311 \times 10^{+4}$  V/degree

(C)  $7.86 \times 10^{-3}$  V/degree

(D)  $2.73 \times 10^{-3}$  V/degree

35. At pH = 2,  $E_{\text{Quinhydrone}}^{\circ} = 1.30$ ,  $E_{\text{Quinhydrone}}$  will be:



(A) 1.36 V

(B) 1.30 V

(C) 1.42 V

(D) 1.20 V

36. Match the following and select the correct option given below:

**List-A**

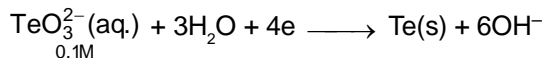
- I. Vapour pressure of solution  
 II. Lowering in vapour pressure of solution  
 III. Acetone-CHCl<sub>3</sub> solution  
 IV. Hexane-ethanol solution  
 V. van't Hoff factor for C<sub>6</sub>H<sub>5</sub>COOH in C<sub>6</sub>H<sub>6</sub>  
 VI. van't Hoff factor for glucose-H<sub>2</sub>O  
 VII. van't Hoff factor for NaCl-H<sub>2</sub>O

**List B**

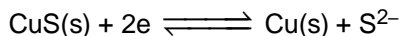
- (1) Mole fraction of solute  
 (2) Mole fraction of solvent  
 (3)  $\Delta H_{\text{mixing}} = +ve$   
 (4)  $\Delta H_{\text{mixing}} = -ve$   
 (5) Greater than unity  
 (6) Equal to unity  
 (7) Lesser than unity

- (A) I → 2, II → 1, III → 4, IV → 3, V → 7, VI → 6, VII → 5  
 (B) I → 1, II → 2, III → 3, IV → 4, V → 5, VI → 6, VII → 7  
 (C) I → 2, II → 3, III → 4, IV → 7, V → 6, VI → 1, VII → 5  
 (D) I → 3, II → 2, III → 1, IV → 5, V → 7, VI → 6, VII → 4

37. The standard electrode potential of the given reaction is  $-0.57$  V. What will be electrode potential at  $\text{pH} = 10$ ?



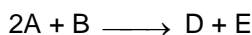
- (A)  $-0.116$  V (B)  $-0.161$  V  
 (C)  $-0.924$  V (D)  $-0.222$  V
38. What is standard reduction potential for the half cells  $\text{S}^{2-}|\text{CuS}|\text{Cu}$  involving the reaction:



$$\text{Given } K_{\text{sp}}\text{CuS} = 10^{-35}, E_{\text{Cu}^+/\text{Cu}^{2+}}^{\circ} = -0.34 \text{ V}$$

- (A)  $0.693$  V (B)  $-0.693$  V  
 (C)  $1.37$  V (D)  $-1.37$  V
39. Two reactions,  $\text{A} \longrightarrow \text{products}$  and  $\text{B} \longrightarrow \text{products}$ , have rate constants  $K_a$  and  $K_b$  at temperature  $T$  and activation energies  $E_a$  and  $E_b$  respectively. If  $K_a > K_b$  and  $E_a < E_b$  and assuming that  $A$  for both the reactions is same then:
- (A) At high temperature  $K_a$  will be greater than  $K_b$   
 (B) At lower temperature  $K_a$  and  $K_b$  will differ more and  $K_a > K_b$   
 (C) As temperature rises  $K_a$  and  $K_b$  will be close to each other in magnitude  
 (D) All of the above

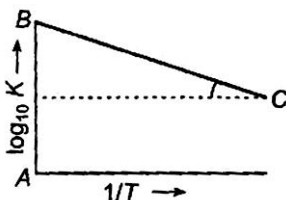
40. Following mechanism has been proposed for a reaction,



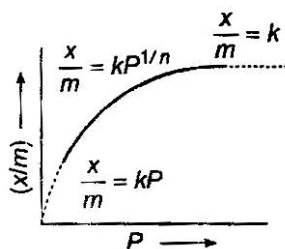
The rate law expression for the reaction is:

- (A)  $r = K[\text{A}^2][\text{B}]$   
 (B)  $r = K[\text{A}][\text{B}]$   
 (C)  $r = K[\text{A}]^2$   
 (D)  $r = K[\text{A}][\text{C}]$
41. Fig. shows a graph in  $\log_{10}K$  vs.  $\frac{1}{T}$  where,  $K$  is rate constant and  $T$  is temperature. The straight line BC has

slope,  $\tan\theta = -\frac{1}{2.303}$  and an intercept of 5 on y-axis. Thus  $E_a$ , the energy of activation is:



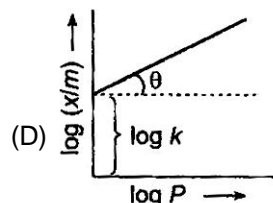
- (A)  $2.303 \times 2$  cal (B)  $\frac{2}{2.303}$  cal  
 (C)  $2$  cal (D) None of these
42. Which one is not correct about Freundlich isotherm if?



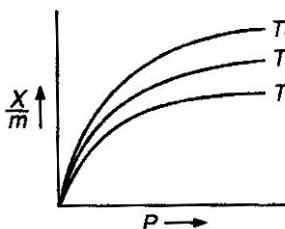
(A)  $n = \frac{1}{\tan \theta}$  at average pressure

(B)  $\theta = 45^\circ$  at low pressure

(C)  $\theta = 45^\circ$  at high pressure



43. Variation of  $x/m$  vs.  $P$  are plotted for a gas at different temperatures as shown below. The correct order of temperature is:



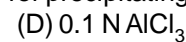
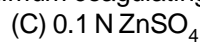
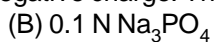
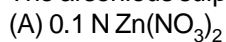
(A)  $T_1 > T_2 > T_3$

(B)  $T_3 > T_2 > T_1$

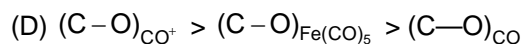
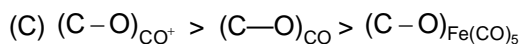
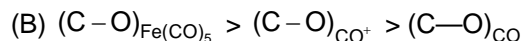
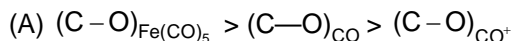
(C)  $T_2 > T_1 > T_3$

(D)  $T_2 > T_3 > T_1$

44. The arsenious sulphide sol has negative charge. The maximum coagulating power for precipitating it is of:



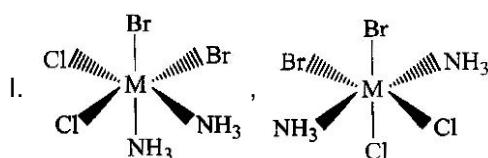
45. What is the correct order of C—O bond length?



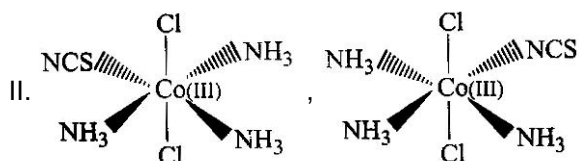
46. Match the following and select the correct option given below:

**Column-I**

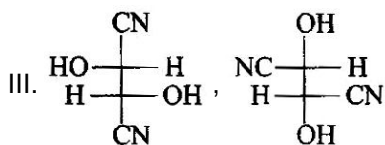
**Column-II**



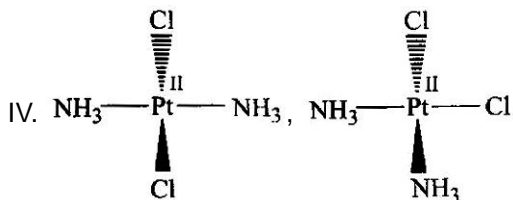
(P) Enantiomeric pair



(Q) Geometrical isomers



(R) Plane of symmetry present in both

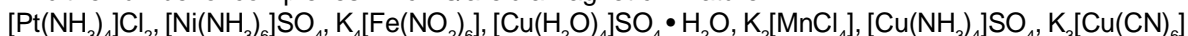


(S) Structural isomers

(T) Both have axis of symmetry

(A) I  $\rightarrow$  R, II  $\rightarrow$  PST, III  $\rightarrow$  QT, IV  $\rightarrow$  PRS(B) I  $\rightarrow$  P, II  $\rightarrow$  RST, III  $\rightarrow$  PS, IV  $\rightarrow$  QRT(C) I  $\rightarrow$  S, II  $\rightarrow$  RS, III  $\rightarrow$  PT, IV  $\rightarrow$  ST(D) I  $\rightarrow$  Q, II  $\rightarrow$  RST, III  $\rightarrow$  PT, IV  $\rightarrow$  QRT

47. Find the number of complexes which is/are diamagnetic in nature:



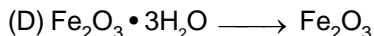
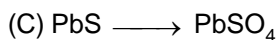
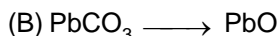
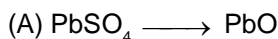
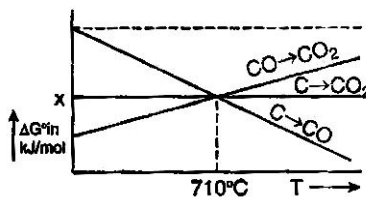
(A) 3

(B) 5

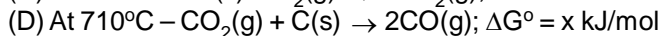
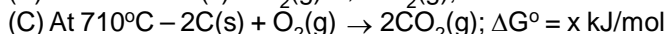
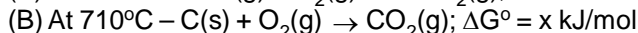
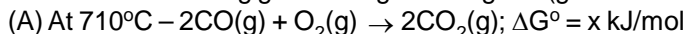
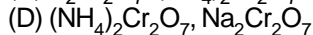
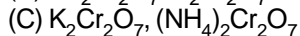
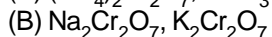
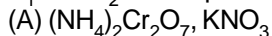
(C) 1

(D) 2

48. Which of the following changes is not observed when ore is heated for calcination?

49. For reactions of metals to form their oxide one gram mole  $\text{O}_2$  molecule is used may be plotted graphically against temperature:

Select incorrect using given Ellingham diagram (given above).

50. Orange solid ( $\text{S}_1$ )  $\xrightarrow{\Delta}$  diamagnetic gas + only green residueOrange solid ( $\text{S}_2$ )  $\xrightarrow{\Delta}$  paramagnetic gas + green solid + yellow solid $\text{S}_1$  and  $\text{S}_2$  are respectively:

# REASONING

**Directions for Questions 51 to 55** Answer the questions on the basis of the information given below.

In a coding language, the digits 0 to 9 are represented by letters A to J. not necessarily in the same order and  $IABD \times BDI$  is expressed as:

$$\begin{array}{r}
 \begin{array}{cccc}
 I & A & B & D \\
 \times & B & D & I \\
 \hline
 I & A & B & D \\
 E & I & E & D & x \\
 A & B & H & D & x & x \\
 \hline
 D & H & B & G & C & D
 \end{array}
 \end{array}$$

51. If 5 is represented by D, find the value of  $H \times B \times G$ .
- (A) 18  
(B) 21  
(C) 24  
(D) 0
52. Find the value of  $(HBG) \times A \rightarrow$
- (A) IAA  
(B) HGE  
(C) ABC  
(D) 246
53. Find the value of  $(A+B+C+D+E+F+G+H+I+J)$
- (A) 45  
(B) 44  
(C) 55  
(D) 54
54. Letter F is represented by which letter?
- (A) 2  
(B) 9  
(C) 0  
(D) Can't be determined
55. Find the value of  $(IH+I)^3$
- (A) IBGH  
(B) IBBI  
(C) IABI  
(D) IGHA
56. Reversing the digits of 102 increases the number by 99. How many other three-digit numbers increase by 99 when their digits are reversed?
- (A) 71  
(B) 79  
(C) 69  
(D) 80
57. The number of people in an auditorium is a perfect square not greater than 400. Which of the following cannot be the ratio of males to females in the auditorium?
- (A) 71 : 73  
(B) 149 : 251  
(C) 101 : 61  
(D) 137 : 61
58. A and B run a km race and A wins by 60 seconds. A and C run a km race and A wins by 375 metres. B and C run a km race and B wins by 30 seconds. Find the time each takes to run a km.
- (A)  $2\frac{1}{2}$  min,  $3\frac{1}{2}$  min, 4 min  
(B) 3 min, 4 min,  $4\frac{1}{2}$  min  
(C)  $3\frac{1}{2}$  min.,  $4\frac{1}{2}$  min, 5 min  
(D)  $4\frac{1}{2}$  min.,  $5\frac{1}{2}$  min, 6 min.
59.  $A @ B \Rightarrow B$  is the father of A  
 $A \$ B \Rightarrow A$  is the uncle of B  
 $A ? B \Rightarrow B$  is the sister-in-law of A  
 $A ! B \Rightarrow A$  is the mother of B  
 $A \# B \Rightarrow B$  is the daughter of A
- Using the above information find the possible nature of the relationship between P and T if :
- $R \$ P, P @ Q, P ? S, S ! T, U \# T$
- (A)  $P \# T$   
(B)  $T \$ P$   
(C)  $P \$ T$   
(D)  $P ! T$
60. Complete the series 41, 44, 71, 77, 104, \_\_\_\_\_
- (Hint : All numbers are related in some manner to different numbers formed by using digits 2, 4 and 6)
- (A) 113  
(B) 107  
(C) 116  
(D) Can't be determined

**IMPORTANT INSTRUCTION :-**

Attempt any one in Biology OR Mathematics by following the same question number given in test booklet. Leave blank circle against non-attempting subject. You are not allowed to change any question number.

**BIOLOGY**

61. The most-vital event of sexual reproduction is perhaps the fusion of gametes, called  
 (A) Insemination (B) Syngamy  
 (C) Embryogenesis (D) Viviparous
62. Each testis has about 250 compartments called-  
 (A) Seminiferous tubules  
 (B) Epididymis  
 (C) Testicular lobules  
 (D) Rete testis
63. Which of the following gland is not associated with male reproductive organs:  
 (A) Bulbourethral (B) Seminal vesicle  
 (C) Bartholins (D) Prostate
64. Placenta also acts as an endocrine tissue and produces several hormones like all except  
 (A) hCG (B) hPL  
 (C) Progesteron (D) Somatostatin
65. Saheli - a new oral contraceptive for females - was developed by-  
 (A) MMR (B) IMR  
 (C) CDRI (D) ZIFT
66. You could be free of STDS infections if you follow the simple principles given below-except:-  
 (A) Avoid sex with unknown partners  
 (B) Always use condoms during coitus  
 (C) Get incomplete treatment if diagnosed with disease  
 (D) Avoid public toilets and contaminated garments
67. Which one is not the part of ART?  
 (A) ICSI (B) ZIFT  
 (C) IUT (D) MTP
68. Which conditions/factor was not used by miller in his simulation experiment:  
 (A) Glycine, alanine, Aspartic acid  
 (B) CH<sub>4</sub>, NH<sub>3</sub>, H<sub>2</sub>, water vapour  
 (C) Temperature 800°C  
 (D) Anaerobic/Reducing environment
69. Evolution for darwin, was gradual while devries believed mutation caused speciation and hence called-  
 (A) Saltation (B) Directional  
 (C) Branching descent (D) Phyllogeny
70. Disturbance in genetic equilibrium a hardy-weinberg equilibrium resulting in evolution the factor which is not involved in it is-  
 (A) Selection (B) Genetic drift  
 (C) Mutation (D) Panmictic condition
71. Find out the incorrect match  
 (A) Pneumonia-*Haemophilus influenzae*  
 (B) Malaria- *Plasmodium falciparum*  
 (C) Filaria - *Epidermophyton*  
 (D) Dysentery - *E. histolytica*
72. Which of the following protect non-infected cells from further viral infection?  
 (A) Macrophages (B) IgE  
 (C) Interferons (D) Pyrogens
73. Colostrum is-  
 (A) Natural active immunity  
 (B) Artificial active immunity  
 (C) Natural passive immunity  
 (D) Artificial passive immunity
74. In plant which is not with hallucinogenic properties is?  
 (A) *Atropa balladona* (B) *Datura*  
 (C) *Cannabis sativus* (D) *Papaver*
75. Which method can not involved in improvement of animal breeds-  
 (A) Cross breeding (B) Out breeding  
 (C) Out crossing (D) Inbreeding
76. If experimentally, generative cell of a pollen grain is killed with a laser beam, the pollen grain of a flowering plant germinates and produces normal pollen tube because:-  
 (A) Laser beam stimulates pollen germination and pollen tube  
 (B) Laser beam does not damage the region from which pollen tube emerged  
 (C) The contents of the killed germinative cell

permit germination and pollen growth

(D) The vegetative cell has not been damaged

77. Study the diagram given below and find out incorrect statement about this:



- (A) Here thalamus contributes in fruit formation  
 (B) Its pollen remains viable for months  
 (C) Here ovary is epigynous  
 (D) PGR  $GA_3$  is used for improving fruit shape

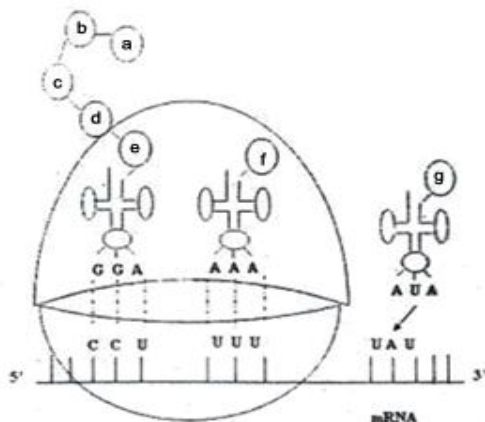
78. Which of the following options is incorrect?

- (A) Pollination does not give the guarantee of the promotion of post-pollination events that lead to fertilization  
 (B) The events – “from pollen deposition on stigma until pollen tubes enter the ovule” are together referred to as pre reproductive interaction  
 (C) Pollen-pistil interaction is a dynamic process involving pollen recognition followed by promotion or rejection of the pollen  
 (D) Pistil has ability to recognise the pollen, whether right or wrong type

79. If t-RNA isolated from E.coli, and m-RNA as well as ribosomes isolated from mouse liver cell are incubated with ATP and free amino acids, what may happen?

- (A) Protein specific to mouse will be synthesised  
 (B) Protein specific to E.coli will be synthesised  
 (C) Protein synthesis will not occur  
 (D) A hybrid protein will be synthesised

80. The figure illustrates the process of translation in protein synthesis. If the triplet UAU is modified to UAG what will be the consequence?



(A) Amino acid 'f' will be omitted from resultant polypeptide chain

(B) The amino acid 'g' will be replaced by some other amino acid in the resultant polypeptide

(C) The polypeptide with a, b, c, d, e and f will be released

(D) The polypeptide will not be produced at all

81. In modern times plant breeding is mainly carried out by?

- (A) Tissue culture  
 (B) Molecular genetic tools  
 (C) Conventional breeding  
 (D) Pure line selection

82. How many of the following statements are correct?

- I. In India agriculture accounts for 33% of GDP and 62% of population is dependent upon it.  
 II. Between 1960–2000, wheat production increased from 11–75 million ton and rice from 35–89.5 million tons.  
 III. Semi-dwarf variety of wheat is developed at international center for wheat and maize improvement.

IV. Jaya and Ratna are semi-dwarf variety of rice.

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

83. Out of the following four statements how many of them are correct?

(I) Two nucleotides are joined by 3'–5' phosphodiester linkage.

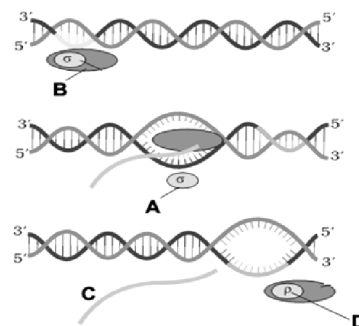
(II) Chromatin which is a beads-on string structure, where beads represents histone protein.

(III) Euchromatin is transcriptionally active whereas heterochromatin is inactive.

(IV) Histone proteins has amino acids with positive charge on side chains.

- (A) 4  
 (B) 3  
 (C) 2  
 (D) 1

84. Study the diagram given below



A, B, C and D is marked, which correspond to certain functions which of the following is not matched correctly

- (A) A - Initiation  
(B) B - Elongation  
(C) C - Expression  
(D) D - Termination

85. Read the following four statements (A–D)

- A. The characters blend in heterozygous condition.  
B. Change in a single base pair of DNA does not cause mutation.  
C. Cancer cells commonly show chromosomal aberrations.  
D. In insect, sex chromosomes in male are ZZ and in females are ZW.

How many of the above statement is/are right?

- (A) Two  
(B) Three  
(C) Four  
(D) One

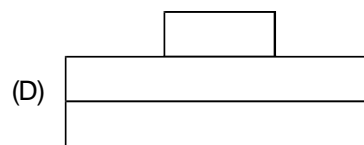
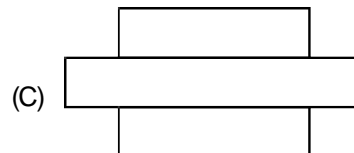
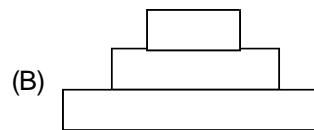
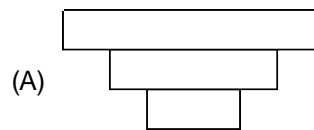
86. a. Experimental removal of *Pisaster* resulted in extinction of more than ten species of invertebrates in that area.  
b. Cactus population in Australia decreased tremendously by introduction of Moths.  
c. Predators help to maintain species diversity.

- (A) All are correct  
(B) b is correct but c is incorrect  
(C) a is correct but b is incorrect  
(D) Only c is correct

87. The rate of decomposition of detritus is accelerated-

- (A) If the detritus contains lignin chitin, tannins and cellulose  
(B) If the detritus is present in acidic soil  
(C) If the moisture and aeration are at optimum  
(D) If the temperature is below 10°C

88. Which one of the following shows pyramid of numbers in a single tree ecosystem?



89. How many of the following statements are correct?

- Primary productivity of an ecosystem depends upon plant species of that area and not on environmental factors.
- During decomposition oxygen is required; the rate is controlled by chemical composition of detritus and climatic factors.
- In aquatic ecosystem GFC is major conduit of energy flow, whereas in terrestrial ecosystem it is DFC.
- In most ecosystems, all the pyramids are upright.

- (A) 4 (B) 3  
(C) 2 (D) 1

90. Ecosystem requires constant supply of energy to synthesise the molecules they require for:

- (A) Storage, as when needed can be utilized  
(B) To counteract the universal tendency towards increasing disorderliness  
(C) As per first law of thermodynamics  
(D) None is correct

## MATHEMATICS

91. The period of  $f(x) = \sin\left(\frac{\pi x}{n-1}\right) + \cos\left(\frac{\pi x}{n}\right)$ ,  $n \in \mathbb{Z}$ ,  $n > 2$  is

- (A)  $2\pi n(n-1)$  (B)  $4n(n-1)$  (C)  $2n(n-1)$  (D) None of these



92. Let  $g(x) = 1 + x - [x]$  and  $f(x) = \begin{cases} -1, & x < 0 \\ 0, & x = 0 \\ 1, & x > 0 \end{cases}$ , then for all  $x$ ,  $f(g(x))$  is equal to  
 (A)  $x$  (B) 1 (C)  $f(x)$  (D)  $g(x)$
93. If  $f : [1, \infty) \rightarrow [1, \infty)$  is defined as  $f(x) = 2^{x(x-1)}$  then  $f^{-1}(x)$  is equal to  
 (A)  $\left(\frac{1}{2}\right)^{x(x-1)}$  (B)  $\frac{1}{2}\left(1 + \sqrt{1 + 4 \log_2 x}\right)$  (C)  $\frac{1}{2}\left(1 - \sqrt{1 + 4 \log_2 x}\right)$  (D) Not defined
94. If  $f(x) = \sin^3 x + \lambda \sin^2 x$ ;  $-\pi/2 < x < \pi/2$ , then the interval in which  $\lambda$  should lie in order that  $f(x)$  has exactly one minima and one maxima  
 (A)  $(-3/2, 3/2) - \{0\}$  (B)  $(-2/3, 2/3) - \{0\}$  (C)  $\mathbb{R}$  (D)  $\left[-\frac{3}{2}, 0\right)$
95. STATEMENT-1 :  $e^\pi$  is bigger than  $\pi^e$ .  
 STATEMENT-2 :  $f(x) = x^{1/x}$  is a increasing function when  $x \in [e, \infty)$ .  
 (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
96. The radius of a right circular cylinder of greatest curved surface which can be inscribed in a given right circular cone is  
 (A) one third that of the cone (B)  $1/\sqrt{2}$  times that of the cone  
 (C)  $2/3$  that of the cone (D)  $1/2$  that of the cone
97. The dimensions of the rectangle of maximum area that can be inscribed in the ellipse  $(x/4)^2 + (y/3)^2 = 1$  are  
 (A)  $\sqrt{8}, \sqrt{2}$  (B) 4, 3 (C)  $2\sqrt{8}, 3\sqrt{2}$  (D)  $\sqrt{2}, \sqrt{6}$
98. Let  $h$  be a twice differentiable positive function on an open interval  $J$ . Let  
 $g(x) = \ln(h(x)) \forall x \in J$   
 Suppose  $(h'(x))^2 > h''(x)h(x)$  for each  $x \in J$ . Then  
 (A)  $g$  is increasing on  $J$  (B)  $g$  is decreasing on  $J$   
 (C)  $g$  is concave upward on  $J$  (D)  $g$  is concave downward on  $J$
99. The value of  $\int \sqrt{\frac{x-1}{x+1}} \cdot \frac{1}{x^2} dx$  is equal to  
 (A)  $\sin^{-1} \frac{1}{x} + \frac{\sqrt{x^2-1}}{x} + C$  (B)  $\frac{\sqrt{x^2-1}}{x} + \cos^{-1} \frac{1}{x} + C$   
 (C)  $\sec^{-1} x - \frac{\sqrt{x^2-1}}{x} + C$  (D)  $\tan^{-1} \sqrt{x^2+1} - \frac{\sqrt{x^2-1}}{x} + C$
100. The value of  $\int \frac{1}{[(x-1)^3(x+2)^5]^{1/4}} dx$  is equal to  
 (A)  $\frac{4}{3} \left(\frac{x-1}{x+2}\right)^{1/4} + C$  (B)  $\frac{4}{3} \left(\frac{x+2}{x-1}\right)^{1/4} + C$  (C)  $\frac{1}{3} \left(\frac{x-1}{x+2}\right)^{1/4} + C$  (D)  $\frac{1}{3} \left(\frac{x+1}{x-1}\right)^{1/4} + C$

101.  $\int \sin^{-1} \sqrt{\frac{x}{a+x}} dx$
- (A)  $(a+x) \arcsin \sqrt{\frac{x}{a+x}} - \sqrt{ax} + C$  (B)  $(a+x) \arcsin \sqrt{\frac{x}{a+x}} + \sqrt{ax} + C$   
 (C)  $(a-x) \arcsin \sqrt{\frac{x}{a+x}} - \sqrt{ax} + C$  (D)  $(a+x) \arccot \sqrt{\frac{x}{a+x}} - \sqrt{ax} + C$
102.  $\lim_{t \rightarrow \left(\frac{\pi}{2}\right)^-} \int_0^t \tan \theta \sqrt{\cos \theta} \ln(\cos \theta) d\theta$  is equal to
- (A) -4 (B) 4 (C) -2 (D) Does not exist
103. If  $f(x) = \begin{cases} 0 & , \text{ where } x = \frac{n}{n+1}, n = 1, 2, 3, \dots \\ 1 & , \text{ else where} \end{cases}$ , then the value of  $\int_0^2 f(x) dx$ .
- (A) 1 (B) 0 (C) 2 (D)  $\infty$
104. The tangent to the graph of the function  $y = f(x)$  at the point with abscissa  $x = 1$  form an angle of  $\pi/6$  and at the point  $x = 2$ , an angle of  $\pi/3$  and at the point  $x = 3$ , an angle of  $\pi/4$  with positive x-axis. The value of  $\int_1^3 f'(x)f''(x)dx + \int_2^3 f''(x)dx$  ( $f''(x)$  is supposed to be continuous) is :
- (A)  $\frac{4\sqrt{3}-1}{3\sqrt{3}}$  (B)  $\frac{3\sqrt{3}-1}{2}$  (C)  $\frac{4-\sqrt{3}}{3}$  (D)  $\frac{4}{3} - \sqrt{3}$
105. Let  $I_n = \int_0^1 x^n (\tan^{-1} x) dx, n \in \mathbb{N}$ , then
- (A)  $(n+1)I_n + (n-1)I_{n-2} = \frac{\pi}{4} + \frac{1}{n} \forall n \geq 3$  (B)  $(n+1)I_n + (n-1)I_{n-2} = \frac{\pi}{2} - \frac{1}{n} \forall n \geq 3$   
 (C)  $(n+1)I_n - (n-1)I_{n-2} = \frac{\pi}{4} + \frac{1}{n} \forall n \geq 3$  (D)  $(n+1)I_n - (n-1)I_{n-2} = \frac{\pi}{2} - \frac{1}{n} \forall n \geq 3$
106.  $\lim_{x \rightarrow 0} (\sin x)^{\frac{1}{x}} + \left(\frac{1}{x}\right)^{\sin x}$  is equal to
- (A) 0 (B) -1 (C) 1 (D) 2
107. A function  $f(x)$  is defined in the interval  $[1, 4]$  as follows :
- $$f(x) = \begin{cases} \log_e [x], & 1 \leq x < 3 \\ |\log_e x|, & 3 \leq x < 4 \end{cases}$$
- the graph of the function  $f(x)$  ( $[.]$  represents greatest integer function)
- (A) Is broken at two points  
 (B) Is broken at exactly one point  
 (C) Does not have a definite tangent at more than two points  
 (D) None of these

108. If  $A = \begin{bmatrix} \cos\theta & -\sin\theta & 0 \\ \sin\theta & \cos\theta & 0 \\ 0 & 0 & 1 \end{bmatrix}$ , then  $\text{adj } A =$

- (A)  $A'$  (B)  $I$  (C)  $O$  (D)  $A^2$

109. If  $B$  is a non-singular matrix and  $A$  is a square matrix, then  $\det(B^{-1}AB)$  is equal to

- (A)  $\det(A^{-1})$  (B)  $\det(B^{-1})$  (C)  $\det(A)$  (D)  $\det(B)$

110. Let  $A = \begin{bmatrix} -1 & 2 & -3 \\ -2 & 0 & 3 \\ 3 & -3 & 1 \end{bmatrix}$  be a matrix, then  $(\det A) \times (\text{adj } A^{-1})$  is equal to

- (A)  $O_{3 \times 3}$  (B)  $I_3$  (C)  $\begin{bmatrix} -1 & 2 & -3 \\ -2 & 0 & 3 \\ 3 & -3 & 1 \end{bmatrix}$  (D)  $\begin{bmatrix} 3 & -3 & 1 \\ 3 & 0 & -2 \\ -1 & 2 & -3 \end{bmatrix}$

111. Let  $\lambda$  and  $\alpha$  be real. Find the set of all values of  $\lambda$  for which the system of linear equations have infinite solution  $\forall$  real values of  $\alpha$ .

$$\lambda x + (\sin \alpha)y + (\cos \alpha) z = 0$$

$$x + (\cos \alpha) y + (\sin \alpha) z = 0$$

$$-x + (\sin \alpha) y + (\cos \alpha) z = 0$$

- (A)  $(-\infty, \sqrt{2}) \cup (\sqrt{2}, \infty)$  (B)  $-1$  (C)  $(-5, -\sqrt{2})$  (D) None of these

112. Let  $A = \begin{bmatrix} a & o & b \\ 1 & e & 1 \\ c & o & d \end{bmatrix} \begin{bmatrix} x \\ y \\ z \end{bmatrix} = \begin{bmatrix} 0 \\ 0 \\ 0 \end{bmatrix}$  where  $a, b, c, d, e \in \{0, 1\}$ , then number of such matrix  $A$  for which system of equation  $AX = 0$  have unique solution.

- (A) 16 (B) 6 (C) 5 (D) None of these

113. The equation of the curve which is such that the portion of the axis of  $x$  cut off between the origin and tangent at any point is proportional to the ordinate of that point is

- (A)  $x = y(b - a \log y)$  (B)  $\log x = by^2 + a$   
 (C)  $x^2 = y(a - b \log y)$  (D)  $y = x(b - a \log x)$   
 (a is constant of proportionality)

114. The solution of  $y dx - x dy + 3x^2 y^2 e^{x^3} dx = 0$  is

- (A)  $\frac{x}{y} + e^{x^3} = C$  (B)  $\frac{x}{y} - e^{x^3} = 0$  (C)  $-\frac{x}{y} + e^{x^3} = C$  (D)  $\frac{y}{x} + e^{x^3} = c$

115. The differential equation of all parabola having their axis of symmetry coinciding with the  $x$ -axis is

- (A)  $y \frac{d^2 y}{dx^2} + \left(\frac{dy}{dx}\right)^2 = 0$  (B)  $y \frac{d^2 x}{dy^2} + \left(\frac{dx}{dy}\right)^2 = 0$  (C)  $y \frac{d^2 y}{dx^2} + \frac{dy}{dx} = 0$  (D) None of these

116. If ' $\alpha$ ' is the only real root of the equation  $x^3 + bx^2 + cx + 1 = 0$  ( $b < c$ ), then the value of  $\tan^{-1} \alpha + \tan^{-1}(\alpha^{-1})$  is equal to
- (A)  $-\frac{\pi}{2}$                       (B)  $\frac{\pi}{2}$                       (C) 0                      (D) Can't be determined
117. If  $f(x) = \sin^{-1}(\cos \operatorname{cosec}(\sin^{-1} x) + \cos^{-1}(\sec(\cos^{-1} x)))$  has
- (A) Exactly two values    (B) One value                      (C) Undefined                      (D) Infinite values
118. The minimum value of  $\sec^{-1} x^2 \operatorname{cosec}^{-1} x^2$  is
- (A)  $\frac{\pi}{4}$                       (B)  $\frac{\pi}{8}$                       (C)  $\frac{\pi}{16}$                       (D)  $\frac{2\pi}{3}$
119. The function  $f : R \rightarrow R$  defined by  $f(x) = (x-1)(x-2)(x-3)$  is
- (A) One-one but not onto                      (B) Onto but not one-one  
(C) Both one-one and onto                      (D) Neither one-one nor onto
120. If  $A = \{a, b, c\}$ , then total number of one-one onto functions which can be defined from A to A is
- (A) 3                      (B) 4                      (C) 9                      (D) 6

