

**PAPER : IIT-JAM 2007**  
**BIOTECHNOLOGY-BT**

**INSTRUCTIONS:**

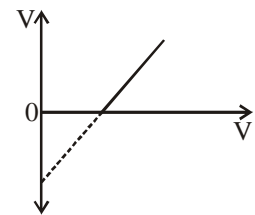
- (i) This test paper has a total of 100 questions.
- (ii) Each question has **4 choices** for its answer : (a), (b), (c) and (d). Only **one** of them is the correct answer.
- (iii) For each correct answer, you will be awarded **3 (three)** marks.
- (iv) For each wrong answer, you will be awarded **-1 (Negative one)** mark.
- (v) Multiple answers to a question will be treated as a wrong answer.
- (vi) For each un-attempted question, you will be awarded **0 (zero)** mark.

1. Let  $1 < x < \infty$  and  $f(x) = \log\left(\frac{x+1}{x-1}\right)$ . Then  $f\left(\frac{x^3+3x}{1+3x^2}\right)$  equals  
(a)  $f(x+3)$                       (b)  $f(x^2+3)$                       (c)  $2f(x)$                       (d)  $3f(x)$
2. Let  $P(x)$  be the polynomial of least degree with rational coefficients and  $1+\sqrt{5}$  is a root of  $P(x)=0$ . Then  $P(x)$  is  
(a)  $x^2-2x+4$                       (b)  $x^2+2x+4$                       (c)  $x^2+2x-4$                       (d)  $x^2-2x-4$
3. Let  $C$  be the circle passing through the origin with its centre lying on the straight lines  $3x-2y=0$  and  $x+y-5=0$ . Then the equation of  $C$  is  
(a)  $x^2+y^2+4x+6y=0$                       (b)  $x^2+y^2+4x-6y=0$   
(c)  $x^2+y^2-4x-6y=0$                       (d)  $x^2+y^2-4x+6y=0$
4. The range of a random variable  $X$  is  $\{0, 1, 2, 3, \dots\}$  and the probabilities of  $X$  are given by  $P(X=0) = \frac{1}{e}, P(X=k) = \frac{c^k}{k!e}, k=1, 2, 3, \dots$ , where  $c$  is a constant. Then  $P(0 < X < 2)$  is  
(a)  $1/e$                       (b)  $4/e$                       (c)  $2/e$                       (d)  $3/e$
5. Let  $x, y$  be real numbers,  $\vec{a} = \hat{i} + \hat{j} - \hat{k}$ ,  $\vec{b} = \hat{i} - \hat{j} + \hat{k}$  and  $\vec{c} = x\hat{i} + y\hat{j} - \hat{k}$ . If  $\vec{c}$  is perpendicular to  $\vec{a}$  and  $\vec{c} \cdot \vec{b} = -4$ , then which one of the following is TRUE?  
(a)  $x=2, y=1$                       (b)  $x=-2, y=-1$                       (c)  $x=2, y=-1$                       (d)  $x=-2, y=1$
6. The value of  $\lim_{x \rightarrow 2} \frac{2^{x+1} + 2^{4-x} - 12}{2^{6-x} - 2^{3+x} + 16}$  is  
(a)  $-1/12$                       (b)  $1/12$                       (c)  $-1/6$                       (d)  $1/6$
7. A wire of length 50 cm is to be cut into two pieces for making a square and a circle. For their combined area to be a minimum, one of the pieces must have a length (in cm) of  
(a)  $\frac{200\pi}{\pi+4}$                       (b)  $\frac{100\pi}{\pi+4}$                       (c)  $\frac{200}{\pi+4}$                       (d)  $\frac{100}{\pi+4}$

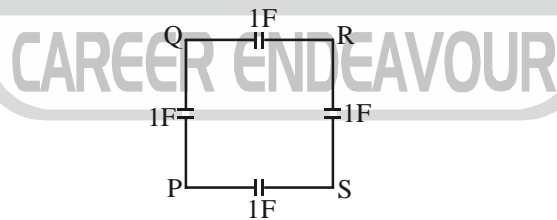


8. The solution of the differential equation  $x \frac{dy}{dx} - y = 2x \ln x, x > 0$  subject to the condition  $y(1) = 0$  is
- (a)  $x^2 \ln x$  (b)  $x(\ln x)^2$  (c)  $x^2(\ln x)^2$  (d)  $x \ln x$
9. A force of magnitude 50N acts in a direction making an angle of  $30^\circ$  with the positive  $x$ -axis. Then the components (in N) along the coordinate axes OX and OY are
- (a) 25, 25 (b)  $25\sqrt{3}, 25$  (c) 25,  $25/2$  (d)  $25\sqrt{3}/2, 25/2$
10. Let  $z = x + iy$  and  $|z - i| = |z + 1|$ . Then  $x$  and  $y$  satisfy the equation
- (a)  $x - y = 1$  (b)  $x + y = 1$  (c)  $x + y = 0$  (d)  $x - y = 0$
11. The values of  $\cos^4\left(\frac{\pi}{8}\right) + \cos^4\left(\frac{3\pi}{8}\right)$  is
- (a)  $1/4$  (b)  $1/2$  (c)  $3/4$  (d) 1
12. If  $n \geq 2$  and  $(1+x)^n = a_0 + a_1x + a_2x^2 + \dots + a_nx^n$ , then the value of the expression  $a_0 + 2a_1 + 3a_2 + 4a_3 + \dots + (n+1)a_n$  equals
- (a)  $2^{n-1}(n+2)$  (b)  $2^n n$  (c)  $2^{n-1}(n+1)$  (d)  $2^{n-2}(n+7)$
13. The distance of the point (1, 2, 1) from the plane  $3x - 6y + 2z + 7 = 0$  is
- (a) 1 (b) 0 (c)  $1/7$  (d)  $2/7$
14. The value of the determinant  $\begin{vmatrix} 1+xy & 1 & 1 \\ 1 & 1+yx & 1 \\ 1 & 1 & 1+zx \end{vmatrix}$  equals
- (a)  $(x+y+z)(x+y+z+xyz)$  (b)  $xyz(x+y+z+xyz)$   
 (c)  $xyz(x+y+z)$  (d)  $xyz(xy+yz+zx)$
15. The value of the derivative of  $y = \tan^{-1}\left[\frac{\sqrt{1+x^2}-1}{x}\right], x \neq 0$  at  $x=1$  is
- (a)  $\frac{1}{4-2\sqrt{2}}$  (b)  $\frac{1}{4+2\sqrt{2}}$  (c)  $1/2$  (d)  $1/4$
16. The value of the definite integral  $\int_0^{2\pi} x |\sin x| dx$  is
- (a)  $2\pi$  (b)  $3\pi$  (c)  $4\pi$  (d)  $\pi$
17. A particle is projected at an angle of elevation  $45^\circ$  with a velocity of 1 unit. Then the horizontal distance covered is ( $g$  denotes the acceleration due to gravity)
- (a)  $g$  (b)  $2/g$  (c)  $g/2$  (d)  $1/g$

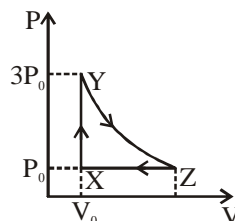
18. The maximum value of  $7x+10y$  subject to the constraints  $x+3y \geq 3$ ,  $x+y \leq 2$  and  $x \geq 0$ ,  $y \geq 0$  is  
 (a) 20 (b) 10 (c) 14 (d) 15.5
19. A simple pendulum of mass  $m$  and length  $l$  is given a horizontal velocity  $v$  when it is at rest in the equilibrium position. Let  $v^2 = gl$ , where  $g$  is the acceleration due to gravity. The angle from the vertical at the turning point is  
 (a)  $\pi/3$  (b)  $\pi/4$  (c)  $\pi/6$  (d)  $\pi/2$
20. Figure below shows the variation of stopping potential ( $V$ ) as a function of frequency ( $\nu$ ) of the incident radiation in a photoelectric experiment. If the intensity of the incident radiation is increased, then in the graph




- (a) the slope alone changes  
 (b) the V-intercept alone changes  
 (c) both the slope and V-intercept remain the same  
 (d) both the slope and V-intercept change
21. A hydrogen atom in the 3<sup>rd</sup> excited state can have  
 (a) 3 Lyman, 2 Balmer and 1 Paschen transitions  
 (b) 2 Balmer and 1 Paschen transitions  
 (c) 2 Lyman and 1 Paschen transitions  
 (d) 2 Lyman, 3 Balmer and 1 Paschen transitions
22. Four capacitors (each of 1F) are connected as shown in the figure. If the capacitor assembly is charged to  $V$  volts by connecting to the points P and R, the total energy stored in the assembly is



- (a)  $2V^2$  (b)  $\frac{1}{2}V^2$  (c)  $4V^2$  (d)  $V^2$
23. Figure shows the P-V diagram for an ideal gas. If the system has a temperature  $T_0$  at X, the temperature at Y is



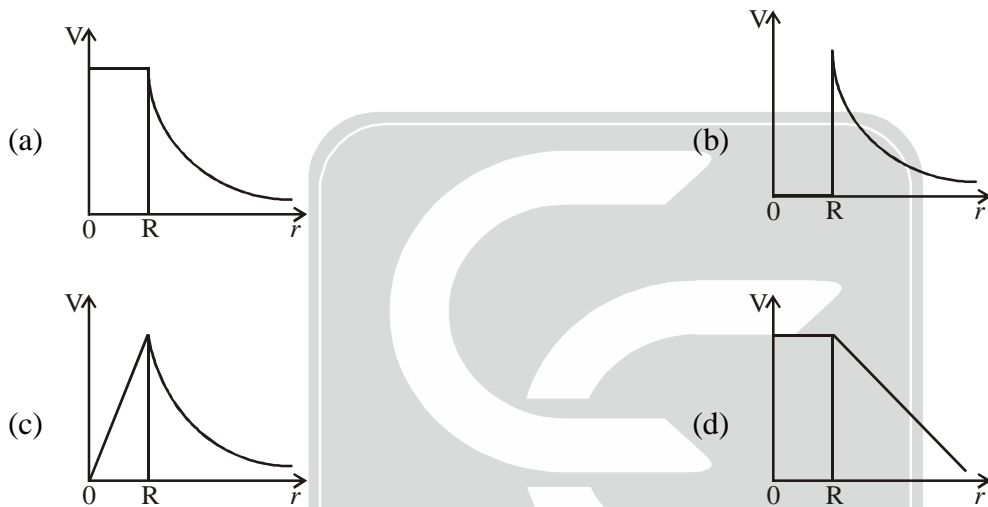
- (a)  $T_0$  (b)  $2T_0$  (c)  $3T_0$  (d)  $4T_0$

24. The first overtone of an open organ pipe of length  $l$  was found to be the same as that of the fundamental frequency of a closed organ pipe when the pipe was immersed in water upto a certain level. Then, the water fills the tube upto a level of
- (a)  $\frac{1}{4}l$                       (b)  $\frac{3}{4}l$                       (c)  $\frac{1}{2}l$                       (d)  $\frac{2}{3}l$
25. For obtaining a REAL image using a biconvex lens of focal length  $f$ , the distance  $d$  between the object and the image must satisfy the condition
- (a)  $d = \infty$  only                      (b)  $2f < d < 4f$                       (c)  $0 < d < 2f$                       (d)  $d \geq 4f$
26. An electron having initial velocity  $v_0$  and momentum  $p_0$  is accelerated in a constant electric field  $\vec{E}$ . After a time  $t$ , it acquires velocity  $v$  and momentum  $p$ . The change in the wavelength of the electron is
- (a)  $\frac{h|v-v_0|}{p_0}$                       (b)  $\frac{h}{p}$                       (c)  $\frac{h|v-v_0|}{p_0v}$                       (d)  $\frac{h}{p_0}$
27. If the biasing is changed from forward to reverse across a semiconductor  $p$ - $n$  junction, the width of the depletion layer
- (a) decreases                      (b) does not change                      (c) vanishes                      (d) increases
28. A force  $\vec{F}$  is applied to a block of mass  $M$  resting on a surface, as shown in the figure. The coefficient of static friction between  $M$  and the surface is  $\mu_s$ . If the mass DOES NOT move, then
- 
- (a)  $F > \mu_s Mg$                       (b)  $F < \mu_s Mg$                       (c)  $F = Mg$                       (d)  $F < Mg$
29. When an ideal gas is compressed adiabatically to one-fourth of its original volume, the pressure increases by 8 times. The ratio of the molar heat capacities ( $C_p/C_v$ ) of the gas can be
- (a) 1.4                      (b) 1.67                      (c) 1.45                      (d) 1.5
30. Consider two simple harmonic motions represented by  $x_1 = A_0 \cos(\omega t + \delta)$  and  $x_2 = A_0 \cos(\omega t)$ . At  $t = 0$ ,  $x_1 = -A_0$ . If these two simple harmonic motions are combined, the amplitude of the resultant motion is
- (a) zero                      (b)  $2A_0$                       (c)  $\frac{A_0}{2}$                       (d)  $\sqrt{2}A_0$
31. When the resistance  $R$  in an LCR circuit is increased, the resonance frequency of the circuit
- (a) increases, but the resonance becomes broader  
 (b) decreases, but the resonance become sharper  
 (c) remains the same, but the resonance becomes sharper  
 (d) remains the same, but the resonance becomes broader
32. When the temperature of water is increased from  $0^\circ\text{C}$ , its
- (a) volume decreases and then increases                      (b) volume increases and then decreases  
 (c) volume increases                      (d) volume remains constant

33. A projectile is launched at an angle  $\theta$  with respect to the horizontal with an initial velocity  $u$ . The coordinates of the moving projectile at the highest point are

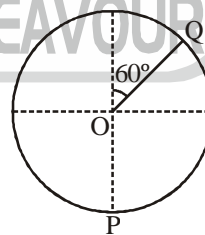
(a)  $\left(\frac{u^2 \sin 2\theta}{g}, \frac{u^2 \sin^2 \theta}{2g}\right)$                       (b)  $\left(\frac{u^2 \sin 2\theta}{2g}, \frac{u^2 \sin^2 \theta}{g}\right)$   
 (c)  $\left(\frac{u^2 \sin 2\theta}{2g}, \frac{u^2 \sin^2 \theta}{2g}\right)$                       (d)  $\left(\frac{u^2 \sin 2\theta}{g}, \frac{u^2 \sin^2 \theta}{g}\right)$

34. If a conducting sphere of radius  $R$  is given a charge  $Q$ , which one of the following graphs represents the variation of potential ( $V$ ) as a function of distance ( $r$ ) from the centre of the sphere



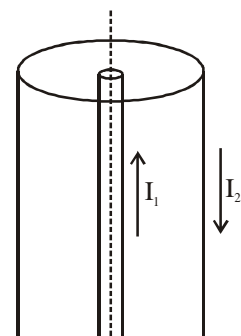
35. A particle of mass  $m$  tied to a string is made to move in circular path of radius  $R$  in a VERTICAL plane. Neglect the air friction and mass of the string. Total work done on the particle when the particle moves from  $P$  to  $Q$  is

(a)  $mgR$                       (b)  $\frac{3}{2}mgR$   
 (c)  $\left(1 + \frac{\sqrt{3}}{2}\right)mgR$                       (d) Zero



36. Currents  $I_1$  and  $I_2$  flow in opposite directions along two long coaxial tubes as shown in the figure. The magnetic field at any point in the annular region depends on

(a)  $I_2$  only                      (b)  $I_1$  only  
 (c)  $I_1 - I_2$                       (d)  $I_1 + I_2$





37. Which one of the following is considered to be the first biological catalyst when life originated on earth?
- (a) RNA (b) DNA  
(c) Protein (d) Lipid
38. "Portuguese man-of-war" belongs to the phylum
- (a) Porifera (b) Cnidaria  
(c) Annelida (d) Arthropoda
39. If an animal has biradial symmetry, then it has
- (a) only one plane of symmetry  
(b) two axes of rotational symmetry  
(c) two planes of symmetry, these two planes have no specific relationship to each other  
(d) two planes of symmetry, these two planes are at right angles to each other
40. A population is isolated by a geographical barrier. The resulting speciation known as
- (a) parapatric (b) allopatric  
(c) sympatric (d) pseudopatric
41. Consider the following Groups:
- Group I** : Class of compounds  
**Group II** : Typical examples for **Group I**  
**Group III** : Organism / cell associated with the production of these compounds
- | <b>Group I</b>                  | <b>Group II</b>          | <b>Group III</b>         |
|---------------------------------|--------------------------|--------------------------|
| <b>P1.</b> Primary metabolite   | <b>Q1.</b> Antibiotic    | <b>R1.</b> Bacteria      |
| <b>P2.</b> Secondary metabolite | <b>Q2.</b> Amino acid    | <b>R2.</b> Yeast         |
| <b>P3.</b> Enzyme               | <b>Q3.</b> Cellulose     | <b>R3.</b> Fungus        |
| <b>P4.</b> Polysaccharide       | <b>Q4.</b> Lignin        | <b>R4.</b> B Lymphocytes |
| <b>P5.</b> Recombinant protein  | <b>Q5.</b> Lipase        | <b>R5.</b> Plant Cells   |
| <b>P6.</b> Immunoglobulins      | <b>Q6.</b> Human insulin |                          |
|                                 | <b>Q7.</b> IgG           |                          |
- Choose the correct match
- (a) P1-Q2-R2, P2-Q1-R1, P3-Q5-R3, P4-Q4-R5, P5-Q3-R3, P6-Q7-R4  
 (b) P1-Q1-R1, P2-Q2-R2, P3-Q3-R3, P4-Q4-R5, P5-Q5-R1, P6-Q6-R4  
 (c) P1-Q2-R1, P2-Q1-R3, P3-Q6-R4, P4-Q3-R5, P5-Q7-R5, P6-Q1-R4  
 (d) P1-Q2-R1, P2-Q1-R3, P3-Q5-R2, P4-Q3-R5, P5-Q6-R1, P6-Q7-R4
42. Which one of the following modifications targets the proteins selectively to lysosomes?
- (a) Addition of N-acetylgalactosamine to a serine residue of the protein  
 (b) Addition to a precise number of mannose residues to the protein  
 (c) Phosphorylation of a specific mannose residue to mannose-6-phosphate  
 (d) Addition of a peptide signal sequence to the N-terminus of the protein
43. Consider the following three groups:
- Group I** : Viruses  
**Group II** : Associated diseases  
**Group III** : Nature of genetic material - single stranded (ss) or double stranded (ds) DNA/RNA

Group I	Group II	Group III
<b>P1.</b> HIV	<b>Q1.</b> Common cold	<b>R1.</b> ssRNA
<b>P2.</b> Herpes virus	<b>Q2.</b> Cancer	<b>R2.</b> ssDNA
<b>P3.</b> Rhinovirus	<b>Q3.</b> Diarrhea	<b>R3.</b> dsRNA
<b>P4.</b> Rotavirus	<b>Q4.</b> AIDS	<b>R4.</b> dsDNA
<b>P5.</b> Human papilloma virus	<b>Q5.</b>	Chickenpox

Choose the correct match

- (a) P1-Q2-R1, P2-Q3-R2, P3-Q1-R3, P4-Q5-R4, P5-Q4-R4  
 (b) P1-Q4-R1, P2-Q5-R4, P3-Q1-R1, P4-Q3-R3, P5-Q2-R4  
 (c) P1-Q4-R1, P2-Q5-R2, P3-Q1-R3, P4-Q3-R4, P5-Q2-R2  
 (d) P1-Q2-R3, P2-Q3-R1, P3-Q4-R2, P4-Q1-R1, P5-Q5-R4
44. A class of spermicides (used for contraception) inhibits the flagellar motion of the sperm thereby preventing it from swimming towards the egg. This is achieved by  
 (a) inhibiting the motor protein dyneine (b) inhibiting the motor protein kinesin  
 (c) disrupting the microfilaments (d) depolymerizing microtubules
45. Which one of the following signaling pathways is CORRECT?  
 (a) Signal → GPCR → G-Protein → Adenyl cyclase → eAMP → Protein kinase A → Cellular response  
 (b) Signal → G-Protein → GPCR → Phospholipase C → Inositol triphosphate (IP3) → IP3-gated calcium channel → Release of Ca<sup>2+</sup> ions  
 (c) Hormone diffusion → Hormone receptor (HR) complex → Nuclear transport of HR complex → G-protein modification of HR complex (Transcription Factor) → Binding of Transcription Factor to DNA → Transcription of a gene  
 (d) Signal → GPCR → G-Protein → Tyrosine kinase → Protein phosphorylation → cAMP → Cellular response
46. Which one of the following can be used to transfect DNA into mammalian cells?  
**P.** Liposomes  
**Q.** Cholesterol  
**R.** CaCl<sub>2</sub> + HEPES buffer (calcium phosphate)  
**S.** Magnesium chloride  
 (a) Only **P** (b) **P** and **Q** (c) **P** and **R** (d) **P** and **S**
47. Choose the correct set of matches between **Groups I** and **II**.
- | Group I                                   | Group II                       |
|---|--------------------------------|
| <b>P.</b> One extra copy of chromosome 13 | <b>1.</b> Edwards syndrome     |
| <b>Q.</b> XO                              | <b>2.</b> Klinefelter syndrome |
| <b>R.</b> XXY                             | <b>3.</b> Patau syndrome       |
| <b>S.</b> One extra copy of chromosome 21 | <b>4.</b> Down syndrome        |
|   | <b>5.</b> Turner syndrome      |
- (a) **P-1, Q-5, R-3, S-2** (b) **P-3, Q-5, R-2, S-4**  
 (c) **P-2, Q-1, R-3, S-4** (d) **P-1, Q-1, R-2, S-5**





54. In the pentose phosphate pathway, glucose is first converted to ribulose-5-phosphate by oxidative decarboxylation. Then, ribulose-5-phosphate undergoes
- (a) further oxidation (b) reduction  
(c) further decarboxylation (d) only rearrangements of carbon skeleton
55. Which one of the following statements is TRUE?
- (a) All microarrays are DNA microarrays  
(b) Complete genome sequence should be known to make a microarray  
(c) All the microarrays use radioisotopes  
(d) Microarrays can be used to measure mRNA levels
56. The metabolite that is NOT used by brain as a source of energy under conditions of prolonged low blood-glucose levels is



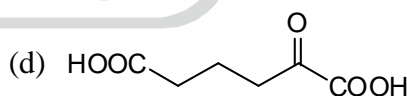
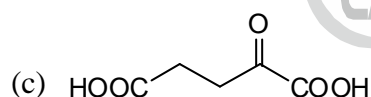
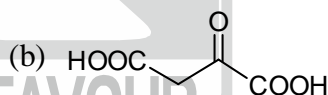
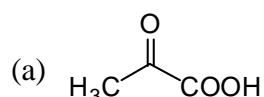
57. Which one of the following protects membrane lipids against damage by reactive oxygen species produced in the chloroplast?
- (a) Carotenoids (b) Chlorophyll *a*  
(c) Chlorophyll *b* (d) Phycocyanin
58. A DNA sequencing reaction was performed with the fragment 5'-XXXXGCGATCGYYYY-3' as the template, dideoxy GTP, all the four dNTPs, and the required primers and enzyme. XXXX and YYYY in the given DNA fragment represent primer binding sites. The set of fragments obtained during the reaction will be (the primers are not shown in the amplified fragments).
- (a) 5'-CGATCGC-3' only  
(b) 5'-CG-3', 5'-CGCTAG-3', 5'-CGCTAGC-3'  
(c) 5'-CG-3', 5'-CGATCG-3', 5'-CGATCGC-3'  
(d) 5'-G-3', 5'-GCG-3', 5'-GCGATCG-3'
59. According to the Linnean system of biological classification, the term "Hominidae" indicates
- (a) class (b) order (c) family (d) genus
60. The endosperm in an angiosperm plant is
- (a) haploid (b) diploid (c) triploid (d) tetraploid
61. The technique appropriate for sterilizing animal tissue culture media is
- (a) filtering through a 0.45  $\mu$ m filter (b) autoclaving at 120°C  
(c) boiling at atmospheric pressure (d) using chemical agents
62. Which two of the following statements are TRUE in relation to human pregnancy?
- P:** The blastocyst consists of trophoblast, an inner cell mass and a central cavity  
**Q:** The morula becomes embedded in the endometrium during implantation  
**R:** The placenta acts as an exchange mechanism between the mother and the fetus  
**S:** Maternal and fetal blood are mixed while passing through the placenta
- (a) **P** and **Q** (b) **R** and **S** (c) **Q** and **S** (d) **P** and **R**

63. In *Drosophila melanogaster*, cherub wings (ch), black body (b) and cinnabar eyes (cn) are recessive to their corresponding alleles (represented as ch<sup>+</sup>, b<sup>+</sup> and cn<sup>+</sup>, respectively) and are all located on chromosome 2. Homozygous wild type flies were mated with cherub, black and cinnabar flies and the resulting F1 females were test crossed with cherub, black and cinnabar males. The following progeny were produced from the test cross.

ch b <sup>+</sup> cn	110
ch <sup>+</sup> b <sup>+</sup> cn <sup>+</sup>	780
ch <sup>+</sup> b cn	70
ch <sup>+</sup> b <sup>+</sup> cn	6
ch b cn	769
ch b <sup>+</sup> cn <sup>+</sup>	60
ch <sup>+</sup> b cn <sup>+</sup>	111
ch b cn <sup>+</sup>	9
Total	1915

Of these three genes, which one is in the middle?

- (a) The locus that determines cherub wings      (b) The locus that determines cinnabar eyes  
 (c) The locus that determines black body      (d) Cannot be determined from the given data
64. The enzyme that is used to make the first strand cDNA from mRNA is  
 (a) Reverse transcriptase      (b) Restriction endonuclease  
 (c) DNA polymerase      (d) T4 DNA ligase
65. Which one of the following compounds, on transamination, DOES NOT result in one of the genetically coded 20 amino acids?



66. Choose the correct set of words denoted by (P), (Q), (R), (S) and (T) to fill in the blanks.

(P) use (Q) for antigen presentation. These antigen-displaying MHC molecules are recognized by (R), which express a unique co-receptor on their cell surface called as (S). On interaction with the antigen presenting cells, T cells respond by producing cytokines such as (T).

- (a) P. All nucleated cells, Q. MHC I, R. Cytotoxic T Cells, S. CD4, T. Perforina  
 (b) P. Macrophages, Q. MHC II, R. Cytotoxic T Cells, S. CD4, T.  $\gamma$ -Interferon  
 (c) P. B Lymphocytes, Q. MHC II, R. Helper T Cells (TH2), S. CD4, T. Interleukin-4  
 (d) P. Dendritic Cells, Q. MHC I, R. Helper T Cells (TH1), S. CD8, T. GMCSF

67. **Group I** lists relationships that can exist between two organisms. Their descriptions are given in **Group II**. Find the correct set of matches between **Groups I** and **II**.

**Group I**

- P. Ammensalism
- Q. Commensalisms
- R. Symbiosis
- S. Parasitism

**Group II**

- 1. One population is benefited and the other is harmed
- 2. Two dissimilar species living together in close association
- 3. Heterotrophic organisms that ingest other organisms
- 4. One population is inhibited but the other is not affected
- 5. One population is benefited but the other is not affected

- (a) P-4, Q-1, R-2, S-3
- (c) P-5, Q-4, R-3, S-5

- (b) P-3, Q-5, R-4, S-1
- (d) P-4, Q-5, R-2, S-1

68. Choose the correct set of matches between **Groups I** and **II**.

**Group I**

- P. Embryoid
- Q. Callus
- R. Meristem
- S. Scutellum

**Group II**

- 1. An unorganized growth of plant cells in a culture medium
- 2. A localized group of actively dividing cells from which permanent tissue systems such as root, shoot, leaf, and flower are derived
- 3. A process whereby specialized, non-dividing cells begin to proliferate by mitotic division, presumed to involve regression to an undifferentiated state
- 4. Mass of cells which has an external morphology resembling a proembryo
- 5. The embryonic cotyledon of monocot plants

- (a) P-4, Q-2, R-3, S-5
- (c) P-3, Q-4, R-2, S-1

- (b) P-4, Q-1, R-2, S-5
- (d) P-2, Q-1, R-3, S-4

69. Match the hormones (**Group I**) to the glands producing them (**Group II**).

**Group I**

- P1. Oxytocin
- P2. Insulin
- P3. Calcitonin
- P4. Estrogen
- P5. Epinephrine
- P6. Testosterone

**Group II**

- R1. Ovary
- R2. Pituitary
- R3. Testis
- R4. Pancreas
- R5. Thyroid
- R6. Pineal
- R7. Adrenal

- (a) P1-R5, P2-R4, P3-R2, P4-R1, P5-R6, P6-R3
- (b) P1-R4, P2-R6, P3-R5, P4-R3, P5-R7, P6-R1
- (c) P1-R2, P2-R4, P3-R5, P4-R1, P5-R7, P6-R3
- (d) P1-R1, P2-R4, P3-R7, P4-R1, P5-R6, P6-R5

70. The  $G_0$  phase of the animal cell cycle can occur

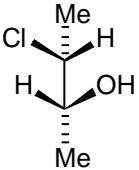
- (a) just before the  $G_1$  phase
- (c) during the  $G_2$  phase

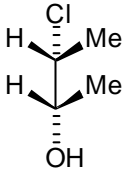
- (b) just before the mitotic (M) phase
- (d) late in the  $G_1$  phase



71. Which one of the following options correctly describes the import of  $P_i$  and ADP into the mitochondria?
- By ADP –  $H^+$  antiport and  $P_i$  –  $H^+$  antiport
  - By ADP – ATP antiport and  $P_i$  –  $OH^-$  antiport
  - By ADP –  $OH^-$  antiport and  $P_i$  –  $OH^-$  antiport
  - By ADP – ATP antiport and  $P_i$  –  $H^+$  antiport
72. If the genotypes Aa Bb Cc dd Ee and Aa bb Cc Dd Ee are crossed, what will be the proportion of AABBCCDDEE genotype among the progeny?
- 1/32
  - 1/64
  - 1/256
  - Zero
73. An enzymatic reaction following Michaelis-Menton kinetics ( $K_{CC} = 50 \mu M$ ) converts 10% of the substrate (initial concentration  $S_0 = 1 mM$ ) to the product in 5 minute. If the enzyme concentration is doubled and the substrate concentration is brought down to 0.1 mM in the initial reaction mixture, the time (in minutes) taken for 50% conversion will be approximately
- 1
  - 2
  - 2.5
  - 12.5
74. Which one of the following statements regarding mitochondria is FALSE?
- Oxidation of NADH present in the mitochondrial matrix is coupled to proton transport out of the matrix
  - Hydrolysis of ATP present in the mitochondrial matrix is coupled to proton transport out of the matrix
  - Cytochrome *c* mediates electron transfer from cytochrome  $bc_1$  complex to cytochrome *aas* complex
  - Cytosolic NADH is delivered to the mitochondrial NADH dehydrogenase complex by the glycerol-3-phosphate shuttle pathway.
75. The shape of cholesterol is
- planar
  - globular
  - cylindrical
  - helical
76. The vitamin, whose derivative is NOT a coenzyme of *E. coli* pyruvate dehydrogenase complex is
- pyridoxal
  - thiamine
  - niacin
  - riboflavin
77. For a given unicellular organism, which one of the following needs to be characterized only once?
- Genome
  - Transcriptome
  - Protcome
  - Metabolome
78. A certain purified DNA sample was cut with two restriction endonucleases E1 and E2. The following results were obtained from agarose gel electrophoresis
- Sample cut with E1 alone: two bands of size 35 kb and 15 kb
- Sample cut with E2 alone two bands of size 40 kb and 10 kb
- Sample cut simultaneously with E1 and E2: three bands of size 35 kb, 10 kb and 5 kb. From these data, it can be inferred that the DNA has
- two sites for E1 and one site for E2
  - one site for E1 and two sites for E2
  - one site each for E1 and E2
  - three sites for E1 and one site for E2
79. Which one of the following elements NEED NOT be present in an expression vector?
- Selection marker to select for host cells containing the vector
  - Two different origins of replication
  - Promoter sequence upstream of the cloned gene
  - Unique restriction enzyme sites for insertional cloning

80.  $\Delta G^{ac}$  for the hydrolysis of ATP to ADP and  $P_i$  is  $-32$  kJ/mol. This means that when ATP is hydrolyzed to ADP and  $P_i$  in a cell.
- $-32$  kJ/mol of free energy becomes available to the cell for utilization
  - free energy available to the cell cannot be more than  $-32$  kJ/mol
  - at least  $-32$  kJ/mol of free energy becomes available to the cell for utilization
  - free energy available to cell cannot be determined solely by the value of  $\Delta G^{ac}$
81. The product obtained by heating an equimolar mixture of adipic acid and hexamethylenediamine is
- Nylon 6
  - Nylon 66
  - Polyurethane
  - Terylene
82. A mixture of  $CH_3 - CH_2 - CH = CH_2$  and HBr (slight excess) in ether DOES NOT show optical activity because
- an achiral product is formed
  - a single chiral product is formed
  - the product formed is a racemic mixture
  - $CH_3 - CH_2 - CH = CH_2$  and HBr do not react in ether
83. The correct match between the items of **Group I** and **Group II** is
- | <b>Group I</b>       | <b>Group II</b> |
|----------------------|-----------------|
| P. Phosphatidic acid | 1. Zwitterionic |
| Q. Triacylglycerol   | 2. Hydrophilic  |
| R. Glycogen          | 3. Hydrophobic  |
|                      | 4. Amphiphatic  |
- P-4, Q-2, R-3
  - P-4, Q-3, R-2
  - P-1, Q-4, R-2
  - P-2, Q-3, R-1
84. The correct match between the items of **Group I** and **Group II** is
- | <b>Group I</b>                  | <b>Group II</b>              |
|---------------------------------|------------------------------|
| P. McLafferty rearrangement     | 1. UV-Vis spectroscopy       |
| Q. Chemical shift               | 2. IR spectroscopy           |
| R. Molar extinction coefficient | 3. NMR spectroscopy          |
| S. Revalues                     | 4. Mass spectroscopy         |
|                                 | 5. Thin layer chromatography |
|                                 | 6. Gel electrophoresis       |
- P-1, Q-3, R-6, S-4
  - P-3, Q-4, R-2, S-6
  - P-4, Q-2, R-3, S-5
  - P-4, Q-3, R-1, S-5
85. Which one of the following is paramagnetic?
- CO
  - $N_2$
  - NO
  - $[NO]^+$
86. Which one of the following molecules has zero dipole moment?
- $BF_3$
  - $H_2O$
  - $CHCl_3$
  - HP
87. Which one of the following complex ions has a square planar geometry?
- $[PtCl_4]^{2-}$
  - $[NiCl_4]^{2-}$
  - $[Zn(CN)_4]^{2-}$
  - $[Cd(CN)_4]^{2-}$

88. The set of quantum numbers,  $n = 2, l = 2, m = 0$
- is forbidden
  - describes an electron in a  $2d$  orbital
  - describes an electron in a  $2p$  orbital
  - describes one of the five orbitals of similar type
89. The rate equation for the reaction  $2X + 3Y \rightarrow Z$  is  $rate = k[X][Y]$ . Consider the following statements
- P:** The unit of  $k$  is  $\text{mol L}^{-1}\text{s}^{-1}$
- Q:** The value of  $k$  is independent of the initial concentrations of  $X$  and  $Y$
- R:** By doubling the concentrations of both  $X$  and  $Y$ , the rate is doubled
- Then, which one of the following is CORRECT?
- P** is true, **Q** is false, **R** is false
  - P** is true, **Q** is true, **R** is false
  - P** is false, **Q** is true, **R** is true
  - P** is false, **Q** is true, **R** is false
90. Consider the equilibrium reaction  $\text{N}_2\text{O}_4(\text{g}) \rightleftharpoons 2\text{NO}_2(\text{g})$ . If the total pressure of the equilibrium mixture is  $p$  and the degree of dissociation of  $\text{N}_2\text{O}_4(\text{g})$  is  $x$  at 300K, the partial pressure of  $\text{NO}_2(\text{g})$  is
- $\left(\frac{2x}{1+x}\right)p$
  - $\left(\frac{2x}{1-x}\right)p$
  - $\frac{2}{3}xp$
  - $2xp$
91. The correct match between the items of **Group I** and **Group II** is
- | <b>Group I</b>              | <b>Group II</b>                  |
|-----------------------------|----------------------------------|
| P. Fehling's solution       | 1. Detection of aldehyde         |
| Q. Ferric chloride solution | 2. Detection of glucose          |
| R. Schiff's base formation  | 3. Detection of phenol           |
| S. Iodoform test            | 4. Detection of $-\text{COCH}_3$ |
- P-2, Q-1, R-3, S-4
  - P-4, Q-3, R-1, S-2
  - P-3, Q-2, R-4, S-4
  - P-2, Q-3, R-1, S-4
92. The two compounds given below are
- 


- identical
  - enantiomeric
  - diastereomeric
  - meso compounds
93. The correct match between the items of **Group I** and **Group II** is
- | <b>Group I</b>  | <b>Group II</b>         |
|---|-------------------------|
| P. Preparation of alkanes   | 1. Reimer-Tiemann       |
| Q. $\text{C}_2\text{H}_6 + \text{C}_2\text{H}_5\text{Cl} + \text{AlCl}_3$ | 2. Elimination reaction |
| R. $\text{C}_2\text{H}_5\text{OH} + \text{CHCl}_3 + \text{NaOH}$          | 3. Friedel-Crafts       |
| S. $\text{C}_2\text{H}_5\text{Br} + \text{KOH}$ (alcoholic)               | 4. Wurtz                |
- P-3, Q-2, R-1, S-4
  - P-4, Q-3, R-1, S-2
  - P-1, Q-3, R-2, S-4
  - P-4, Q-2, R-1, S-3

