

JNUEE PHD Computational Biology N Bioinformatic

1) Choose the odd one out[Question ID = 25232][Question Description = S1_TROH_903_PhD_Q001]

1. Polyester [Option ID = 172855]
2. Cotton [Option ID = 172856]
3. Terylene [Option ID = 172857]
4. Nylon [Option ID = 172858]

2) In an examination, the number scored by 5 candidates are 5 successive odd integers. If their total marks are 185, the highest score is,[Question ID = 25233][Question Description = S1_TROH_903_PhD_Q002]

1. 39 [Option ID = 172859]
2. 41 [Option ID = 172860]
3. 43 [Option ID = 172861]
4. 47 [Option ID = 172862]

3) In the following question, certain pairs of words are given, out of which all pairs except one bear a common relationship. Find out the differently related pair.[Question ID = 25234][Question Description = S1_TROH_903_PhD_Q003]

1. Death : Disease [Option ID = 172863]
2. Milk : Butter [Option ID = 172864]
3. Grape : Juice [Option ID = 172865]
4. Water : Oxygen [Option ID = 172866]

4) Today is Varun's birthday. One year from today he will be twice as old as he was 12 years ago. How old is Varun today?[Question ID = 25235][Question Description = S1_TROH_903_PhD_Q004]

1. 20 years [Option ID = 172867]
2. 22 years [Option ID = 172868]
3. 25 years [Option ID = 172869]
4. 27 years [Option ID = 172870]

5) In a single throw of a die, what is the probability of getting a number greater than 4?[Question ID = 25236][Question Description = S1_TROH_903_PhD_Q005]

1. $\frac{1}{2}$ [Option ID = 172871]
2. $\frac{1}{3}$ [Option ID = 172872]
3. $\frac{2}{3}$ [Option ID = 172873]
4. $\frac{1}{4}$ [Option ID = 172874]

6) Which letter can fill the blank?

A	D	H
F	I	M
?	N	R

[Question ID = 34453][Question Description = S1_TROH_903_PhD_Q006]

1. K [Option ID = 183823]
2. N [Option ID = 183824]
3. O [Option ID = 183825]
4. P [Option ID = 183826]

7) If

$$x = 3 + \sqrt{2},$$

find the value of

$$(\sqrt{x} - 1/\sqrt{x})$$

[Question ID = 25237][Question Description = S1_TROH_903_PhD_Q007]

1. 3 [Option ID = 172875]
2. 2 [Option ID = 172876]
3. $3\sqrt{2}$

[Option ID = 172877]

4. 4 [Option ID = 172878]

8) In the following figure, if the radius of each of the four outer circle is r, what is the radius of the inner circle?



[Question ID = 25238][Question Description = S1_TROH_903_PhD_Q008]

1. $\frac{2}{\sqrt{2}+1}r$

[Option ID = 172879]

2. $\frac{1}{\sqrt{2}}r$

[Option ID = 172880]

3. $(\sqrt{2} - 1)r$

[Option ID = 172881]

4. $\sqrt{2}r$

[Option ID = 172882]

9) In a class of 50 students, some students can speak only English and some can speak only Hindi. Ten students can speak both English and Hindi. If the number of students who can speak English is 21, how many students can speak Hindi, how many can speak only

[Question ID = 25239][Question Description = S1_TROH_903_PhD_Q009]

1. 39, 29 and 11 respectively [Option ID = 172883]
2. 37, 27 and 13 respectively [Option ID = 172884]
3. 28, 18 and 22 respectively [Option ID = 172885]
4. 21, 11 and 29 respectively [Option ID = 172886]

10) Which one of the following options is sufficient to predict the direction of village T with respect to village R?

- A) T is to the north of W which is to the west of S
- B) T is to the North-West of S
- C) W is to the North-West of R

[Question ID = 25240][Question Description = S1_TROH_903_PhD_Q010]

1. Any two of the three [Option ID = 172887]
2. Only A and B [Option ID = 172888]
3. Only B and C [Option ID = 172889]
4. Only A and C [Option ID = 172890]

11) Obtain a unit vector perpendicular to the surface given below

$$x^2 + y^2 + z^2 = 3$$

at the point (1, 1, 1). Lengths are in meters.

[Question ID = 34454][Question Description = S1_TROH_903_PhD_Q011]

1. $(\hat{x} + \hat{y} + \hat{z})/\sqrt{3}$

[Option ID = 183827]

2. $(\hat{x} + \hat{y} + \hat{z})/3$

[Option ID = 183828]

3. $(\hat{x} + \hat{y})/\sqrt{3}$

[Option ID = 183829]

4. $(\hat{y} + \hat{z})/\sqrt{3}$

[Option ID = 183830]

12) Consider a scalar potential given by $V(r) = r^p$. Compute $\text{div. grad}(V(r))$,

[Question ID = 34455][Question Description = S1_TROH_903_PhD_Q012]

1. r^p

[Option ID = 183831]

2. $p(p+1)r^{p-2}$

[Option ID = 183832]

3. pr^{p-1}

[Option ID = 183833]

4. $p(p+1)r^{p+2}$

[Option ID = 183834]

13) Evaluate the definite integral $\int_{-\infty}^{\infty} \frac{dy}{y^2+1}$

[Question ID = 34456][Question Description = S1_TROH_903_PhD_Q013]

1. 0 [Option ID = 183835]

2. π

[Option ID = 183836]

3. ∞

[Option ID = 183837]

4. 1 [Option ID = 183838]

14) Consider any two matrices A and B whose dimension is $N \times N$. What is the value of $\text{Trace}([A, B])$?

[Question ID = 34457][Question Description = S1_TROH_903_PhD_Q014]

1. AB

- [Option ID = 183839]
 2. 0 [Option ID = 183840]
 3. 1 [Option ID = 183841]
 4. $AB - BA$

[Option ID = 183842]

- 15) Let us consider the Green's function given by

$$G_0(\mathbf{r}, \mathbf{r}') = \frac{1}{4\pi|\mathbf{r} - \mathbf{r}'|}$$

If $\mathbf{R} = \mathbf{r} - \mathbf{r}'$ then what is the value of $G_0(\mathbf{R})$?

[Question ID = 34458][Question Description = S1_TROH_903_PhD_Q015]

1. 1
 [Option ID = 183843]

2. π
 [Option ID = 183844]

3. $\frac{1}{(4\pi R)}$
 [Option ID = 183845]

4. $\frac{1}{(2\pi R)}$
 [Option ID = 183846]

- 16) The Hamiltonian of a one-dimensional particle is given by $H(p) = \frac{1}{\alpha} p^\alpha$, where α is a constant. The corresponding Lagrangian is given by

[Question ID = 34459][Question Description = S1_TROH_903_PhD_Q016]

1. αq
 [Option ID = 183847]

2. $\frac{1}{\alpha} q^\alpha$
 [Option ID = 183848]

3. $\frac{\alpha}{q^\alpha}$
 [Option ID = 183849]

4. $\frac{\alpha}{q}$
 [Option ID = 183850]

- 17) Let us consider a light source at the rest at $x = 0$ in the reference frame S emitting two pulses of light P₁ at $t = 0$ and P₂ at $t = \tau$. A reference frame S' moves with a velocity $v\hat{x}$ with respect to S. Now an observer in reference frame S' receives the initial pulse P₁ at time $t' = 0$ at $x' = 0$. Calculate to first order in $\frac{v}{c}$ the Doppler shift of the H β emission ($\lambda = 4861.33 \text{ \AA}$) from the neutralization to H atoms of protons accelerated through a potential of 20 kV. Assuming that emission occurs after acceleration and while the protons drift with constant velocity. Also, assume that the optical axis of the spectrometer is parallel to the motion of the protons.

[Question ID = 34460][Question Description = S1_TROH_903_PhD_Q017]

1. $\Delta\lambda = 1.8 \text{ \AA}$
 [Option ID = 183851]

2. $\Delta\lambda = 31.8 \text{ \AA}$
 [Option ID = 183852]

3. $\Delta\lambda = 331.8 \text{ \AA}$
 [Option ID = 183853]

4. $\Delta\lambda = 3331.8 \text{ \AA}$
 [Option ID = 183854]

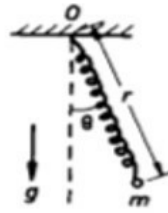
- 18) Let us consider two particles interaction by the way of a central force of potential $V(r)$ where r is the relative position vector. Which of the following is true?

[Question ID = 34461][Question Description = S1_TROH_903_PhD_Q018]

1. Motion is in a plane and $\mathbf{r}$ sweeps out equal areas in equal times
 [Option ID = 183855]
 2. Motion is not in a plane but $\mathbf{r}$ sweeps out equal areas in equal times
 [Option ID = 183856]
 3. Motion is not in a plane and $\mathbf{r}$ does not sweeps out equal areas in equal times
 [Option ID = 183857]

4. None of the above [Option ID = 183858]

- 19) Let us consider a massless spring of length l_0 (with no tension) has a point mass m connected one end and the other end fixed so the spring hangs in the gravitational field as shown in Figure below. Assume that the motion of the system is in one vertical plane.



The Lagrange's equation of motion in generalized coordinate θ is given by

[Question ID = 27510][Question Description = S1_TROH_903_PhD_Q019]

1. $mr^2\ddot{\theta} + 2mr\dot{\theta} + mgr\sin\theta = 0$

[Option ID = 183859]

2. $m\ddot{r} + 2m\dot{r} + mgr\sin\theta = 0$

[Option ID = 183860]

3. $mr^2\ddot{\theta} + mgr\sin\theta = 0$

[Option ID = 183861]

4. $2mr\dot{r}\dot{\theta} + mgr\sin\theta = 0$

[Option ID = 183862]

- 20) Consider a rigid body whose constraints are described by $(r_i - r_j)^2 - c_{ij}^2 = 0$. The type of the constraint is

[Question ID = 27511][Question Description = S1_TROH_903_PhD_Q020]

1. holonomic [Option ID = 183863]
2. Non-holonomic [Option ID = 183864]
3. Cyclic [Option ID = 183865]
4. Scleronomous [Option ID = 183866]

- 21) Consider the following coordinate transformation equations from q, p to Q, P given by

$$Q = \ln(1 + q^{\frac{1}{2}} \cos p)$$

$$P = 2(1 + q^{\frac{1}{2}} \cos p)q^{\frac{1}{2}} \sin p$$

Given below are two statements:

Statement I: If q, p are canonical then Q, P are also canonical.

Statement II: Q, P are canonical, no matter q, p canonical or not.

In the light of the above statements, choose the **most appropriate** answer from the options given below

[Question ID = 27512][Question Description = S1_TROH_903_PhD_Q021]

1. Both Statement I and Statement II are correct [Option ID = 183867]
2. Both Statement I and Statement II are incorrect [Option ID = 183868]
3. Statement I is correct but Statement II is incorrect [Option ID = 183869]
4. Statement I is incorrect but Statement II is correct [Option ID = 183870]

- 22) Consider a transmission line for which $V = 180 \sin(2\pi 60t)$ V and $I = 600 \sin(2\pi 60t + 24^\circ)$ mA. If the power is confined inside a long hollow perfectly conducting tube of 1 meter in diameter, the Poynting vector is

[Question ID = 27513][Question Description = S1_TROH_903_PhD_Q022]

1. 22.8 Wm^{-2} [Option ID = 183872]
2. 32.8 Wm^{-2} [Option ID = 183873]
3. 62.8 Wm^{-2} [Option ID = 183874]
4. 2.8 Wm^{-2} [Option ID = 183871]

- 23) Suppose a cylindrical soft iron rod of length L and diameter d is bend into a circular shape of radius R leaving a gap where the two ends of the rod almost meet. The gap spacing s is constant over the face of the ends of the rod. If one assumes $s \ll d$, $d \ll R$ and N turns of wire are wrapped tightly around the iron rod with a current I is passing through the wire (neglect fringing, relative permeability of the iron and permeability in free space are μ_r and μ_0 respectively), the Magnetic field B in the gap is

[Question ID = 27514][Question Description = S1_TROH_903_PhD_Q023]

1. $\frac{\mu_r \mu_0 NI}{2\pi R + (\mu_r - 1)s}$

[Option ID = 183875]

2. $\frac{\mu_r \mu_0 NI}{(\mu_r - 1)s}$

[Option ID = 183876]

3.
$$\frac{\mu_r \mu_0 NI}{2\pi R}$$

[Option ID = 183877]

4.
$$\frac{\mu_r \mu_0}{2\pi R + (\mu_r - 1)s}$$

[Option ID = 183878]

- 24) **Assertion A:** The velocity of light (c), Permittivity in free space (ϵ_0), and permeability in free space (μ_0) are related by $c = \sqrt{\frac{1}{\epsilon_0 \mu_0}}$

Reason R: Light is an electromagnetic wave.

In the light of the above statements, choose the *most appropriate* answer from the options given below

[Question ID = 27515][Question Description = S1_TROH_903_PhD_Q024]

1. Both A and R are correct and R is the correct explanation of A

[Option ID = 183879]

2. Both A and R are correct but R is NOT the correct explanation of A

[Option ID = 183880]

3. A is correct but R is not correct

[Option ID = 183881]

4. A is not correct but R is correct

[Option ID = 183882]

- 25) Match List I with List II

List I	List II
A. $W = \frac{1}{2} QV$	I. Faraday's law
B. $\oint \mathbf{D} \cdot d\mathbf{s} = Q$	II. Ampere's law
C. $\oint \mathbf{E} \cdot d\mathbf{l} = V$	III. Capacitor energy
D. $I = \iint \mathbf{J} \cdot d\mathbf{s}$	IV. Gauss's law

Choose the correct answer from the options given below:

[Question ID = 27516][Question Description = S1_TROH_903_PhD_Q025]

1. A-IV, B-III, C-II, D-I [Option ID = 183883]
 2. A-III, B-IV, C-I, D-II [Option ID = 183884]
 3. A-III, B-IV, C-II, D-I [Option ID = 183885]
 4. A-III, B-I, C-IV, D-II [Option ID = 183886]

- 26) The expectation value of anti-Hermitian operator is [Question ID = 27517][Question Description = S1_TROH_903_PhD_Q026]

1. Purely real [Option ID = 183887]
 2. Purely imaginary [Option ID = 183888]
 3. Complex with nonzero real and imaginary parts [Option ID = 183889]
 4. None of the above [Option ID = 183890]

- 27) Let us consider a Gaussian wave packet whose x-space wave function is given by

$$\langle x|a\rangle = \frac{1}{\pi^{1/4}\sqrt{d}} e^{ikx - \frac{x^2}{2d^2}}$$

where d is the width of the Gaussian wave packet and k is the wave vector. The value of momentum dispersion $\langle (\Delta p)^2 \rangle$ is

[Question ID = 27518][Question Description = S1_TROH_903_PhD_Q027]

1.
$$\frac{\hbar^2}{4}$$

[Option ID = 183891]

2.
$$\frac{\hbar^2}{2d^2}$$

[Option ID = 183892]

3.
$$\frac{\hbar^2}{d}$$

[Option ID = 183893]

4.
$$\frac{\hbar^2}{d^2}$$

[Option ID = 183894]

28) Given below are two statements:

Statement I: A measurement on a certain eigenstate does not change the state.

Statement II: The probability of jumping into some particular state $|a\rangle$ is given by,

$$Prob. = |\langle a|\alpha\rangle|^2.$$

In the light of the above statements, choose the **Correct** answer from the options given below

[Question ID = 27519][Question Description = S1_TROH_903_PhD_Q028]

1. Both Statement I and Statement II are true [Option ID = 183895]
2. Both Statement I and Statement II are false [Option ID = 183896]
3. Statement I is correct but Statement II is false [Option ID = 183897]
4. Statement I is incorrect but Statement II is true [Option ID = 183898]

29) The ground state $|0\rangle$ can be expressed as state $|n\rangle$ by

[Question ID = 27520][Question Description = S1_TROH_903_PhD_Q029]

1. $|n\rangle = \left[\frac{(a^\dagger)^n}{\sqrt{n!}} \right] |0\rangle$

[Option ID = 183899]

2. $|n\rangle = \left[\frac{(a)^n}{\sqrt{n!}} \right] |0\rangle$

[Option ID = 183900]

3. $|n\rangle = \left[(a^\dagger)^n \right] |0\rangle$

[Option ID = 183901]

4. $|n\rangle = [(a)^n] |0\rangle$

[Option ID = 183902]

30) The probability that a particle trapped in a 1-D box of width W can be found between $0.45W$ and $0.55W$ for the ground state is

[Question ID = 27521][Question Description = S1_TROH_903_PhD_Q030]

1. 0.198 [Option ID = 183903]
2. 0.398 [Option ID = 183904]
3. 0.598 [Option ID = 183905]
4. 0.798 [Option ID = 183906]

31) The wave function of a particle moving along x-axis is given by $\psi = ax$ if $0 \leq x \leq 1$ otherwise $\psi = 0$. The probability of finding the particle between $x = 0.45$ and $x = 0.55$ is

[Question ID = 27522][Question Description = S1_TROH_903_PhD_Q031]

1. 0.7525 [Option ID = 183907]
2. 0.07525 [Option ID = 183908]
3. 0.007525 [Option ID = 183909]
4. 0.0007525 [Option ID = 183910]

32) Let us consider a photon gas enclosed in a volume V and in equilibrium at temperature T . The photon is massless particle with energy $\epsilon = pc$ where p and c are photon's momentum and speed of light respectively. The dependence on average energy to the temperature T is

[Question ID = 27523][Question Description = S1_TROH_903_PhD_Q032]

1. $\bar{E} \propto T$

[Option ID = 183911]

2. $\bar{E} \propto T^2$

[Option ID = 183912]

3. $\bar{E} \propto T^3$

[Option ID = 183913]

4. $\bar{E} \propto T^4$

[Option ID = 183914]

33) Consider one mole of an ideal gas undergoes a reversible isothermal expansion from volume V to $2V$. The change in the entropy of the gas is

[Question ID = 27524][Question Description = S1_TROH_903_PhD_Q033]

1. $R \ln 2$

[Option ID = 183915]

2. R

[Option ID = 183916]

3. $\ln 2$

[Option ID = 183917]

4. 0 [Option ID = 183918]

34) Let us consider a system of N non-interacting particles, each fixed in position and carrying a magnetic moment μ , immersed in a magnetic field H . Treat the particles as distinguishable. If the number of possible microstates of the system when its energy is E , is given by $\Omega(E)$ then the entropy of the system is given by (k is Boltzmann constant)[Question ID = 27525][Question Description = S1_TROH_903_PhD_Q034]

1. $S = k\Omega$

[Option ID = 183919]

2. $S = k \ln \Omega$

[Option ID = 183920]

3. $S = \ln \Omega$

[Option ID = 183921]

4. $S = k/\Omega$

[Option ID = 183922]

35) Consider LS coupling of two atomic electrons whose orbital quantum numbers are $l_1 = 1$ and $l_2 = 2$. The possible values of the total angular momentum quantum number J are

[Question ID = 27526][Question Description = S1_TROH_903_PhD_Q035]

1. $J = 1, 2, 3, 4$

[Option ID = 183923]

2. $J = 0, 1, 2, 3, 4$

[Option ID = 183924]

3. $J = 0, 1, 2, 3$

[Option ID = 183925]

4. $J = 0, 1, 2$

[Option ID = 183926]

36) The fine structure of atomic spectral lines arises from[Question ID = 27527][Question Description = S1_TROH_903_PhD_Q036]

1. electron spin-orbit coupling [Option ID = 183927]

2. interaction between electron and nucleus [Option ID = 183928]

3. nuclear spin [Option ID = 183929]

4. none of the above [Option ID = 183930]

37) Photons of energy 3eV strike matter. Which interaction would you expect to be important

[Question ID = 27528][Question Description = S1_TROH_903_PhD_Q037]

1. Pair Production

[Option ID = 183931]

2. Raman Scattering (rotational and vibrational excitation)

[Option ID = 183932]

3. Atomic Ionization

[Option ID = 183933]

4. Rayleigh Scattering

[Option ID = 183934]

38) Let us consider coupling a p -state and s -state electron via j, j coupling. Possible resultant states with the appropriate quantum numbers are

[Question ID = 34147][Question Description = S1_TROH_903_PhD_Q038]

1. $\left(\frac{3}{2}, \frac{1}{2}\right)_2$, $\left(\frac{3}{2}, \frac{1}{2}\right)_1$, $\left(\frac{1}{2}, \frac{1}{2}\right)_1$, $\left(\frac{1}{2}, \frac{1}{2}\right)_0$

[Option ID = 183935]

2. $\left(\frac{3}{2}, \frac{1}{2}\right)_1$, $\left(\frac{1}{2}, \frac{1}{2}\right)_1$, $\left(\frac{1}{2}, \frac{1}{2}\right)_0$

[Option ID = 183936]

3. $\left(\frac{3}{2}, \frac{1}{2}\right)_2$, $\left(\frac{1}{2}, \frac{1}{2}\right)_1$, $\left(\frac{1}{2}, \frac{1}{2}\right)_0$

[Option ID = 183937]

4. $\left(\frac{3}{2}, \frac{1}{2}\right)_2$, $\left(\frac{3}{2}, \frac{1}{2}\right)_1$, $\left(\frac{1}{2}, \frac{1}{2}\right)_0$

[Option ID = 183938]

39) The Bohr radius of the hydrogen atom is compared to the electron Compton wavelength is approximately[Question ID = 34148][Question Description = S1_TROH_903_PhD_Q039]

1. 100 times larger [Option ID = 183939]
2. 1000 times larger [Option ID = 183940]
3. 10000 times larger [Option ID = 183941]
4. About the same [Option ID = 183942]

40) Given below are two statements: one is labelled as **Assertion A** and the other is labelled as **Reason R**

Assertion A:

Nuclear Magnetic Resonance (NMR) measurements in bulk samples are possible despite the small size of the nuclear moments.

Reason R:

The magnitude of net magnetic moment along z-direction per unit volume in bulk sample is approximated to

$$\mathcal{M}_z = \frac{|g_I| \mu_N N}{4k_B T} \hbar \omega_0$$

where g_I is Lande g-factor, μ_N is nuclear magneton, k_B is Boltzmann constant, ω_0 is resonant angular frequency within the states $M_I = \pm \frac{1}{2}$ and N is number of atoms per unit volume.

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

[Question ID = 34149][Question Description = S1_TROH_903_PhD_Q040]

1. Both A and R are true and R is the correct explanation of A
[Option ID = 183943]
2. Both A and R are true but R is NOT the correct explanation of A
[Option ID = 183944]
3. A is true but R is false
[Option ID = 183945]
4. A is false but R is true
[Option ID = 183946]

41) Name of the following reaction is

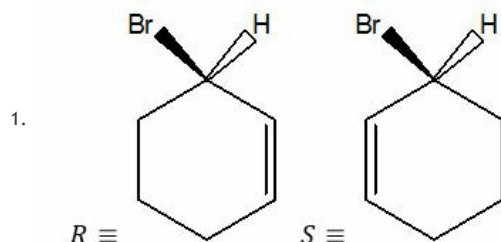


[Question ID = 34150][Question Description = S1_TROH_903_PhD_Q041]

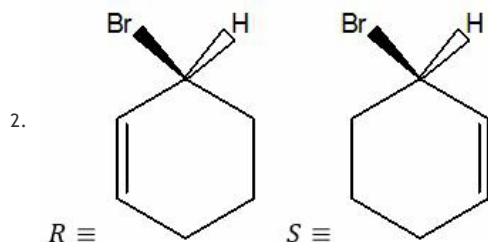
1. Claisen Condensation [Option ID = 183947]
2. Perkin Reaction [Option ID = 183948]
3. Mannich Reaction [Option ID = 183949]
4. Hoffmann Rearrangement [Option ID = 183950]

42) Which of the following are correct match for R and S configuration of 3-bromocyclohexene

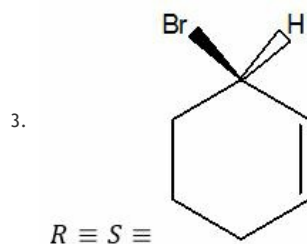
[Question ID = 34151][Question Description = S1_TROH_903_PhD_Q042]



[Option ID = 183951]



[Option ID = 183952]



[Option ID = 183953]

4. R and S configuration is not possible for this compound
[Option ID = 183954]

43) Among the given statement/s

A) C⁺ of a carbocation is a chiral center

B) Carbon radical is a chiral center

C) C of aldehyde is a chiral center

D) C of amine is a chiral center

Choose the correct answer from the options given below

[Question ID = 34152][Question Description = S1_TROH_903_PhD_Q043]

1. A only

[Option ID = 183955]

2. A and B only

[Option ID = 183956]

3. B and C only

[Option ID = 183957]

4. D only

[Option ID = 183958]

44) Given below Assertion and Reason

Assertion A: Enantiomers are also termed as optical isomers.

Reason R: Absolute configuration is a spatial arrangement of substituents attached to a chiral center.

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

[Question ID = 34153][Question Description = S1_TROH_903_PhD_Q044]

1. Both A and R are true and R is the correct explanation of A

[Option ID = 183959]

2. Both A and R are true but R is NOT the correct explanation of A

[Option ID = 183960]

3. A is true but R is false

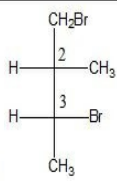
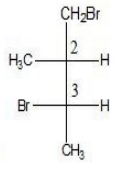
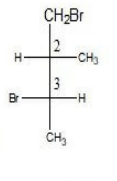
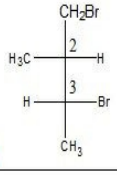
[Option ID = 183961]

4. A is false but R is true

[Option ID = 183962]

45)

Match List I with List II

List I	List II
A. 	I. 2R,3S
B. 	II. 2R,3R
C. 	III. 2S,3R
D. 	IV. 2S,3S

Choose the correct answer from the options given below:

[Question ID = 34154][Question Description = S1_TROH_903_PhD_Q045]

1. A-II, B-I, C-IV, D-III

[Option ID = 183963]

2. A-III, B-IV, C-I, D-II

[Option ID = 183964]

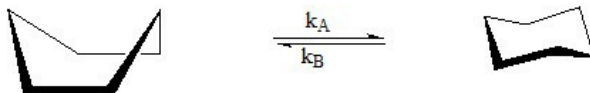
3. A-II, B-IV, C-I, D-III

[Option ID = 183965]

4. A-III, B-I, C-IV, D-II

[Option ID = 183966]

46) Consider the inter-conversion of the "boat" and "chair" conformations of cyclohexane



The reaction is first order in each direction, with an equilibrium constant of 10^4 . The activation energy for the conversion of the chair conformer to the boat conformer is 42 kJ/mol . Assuming an Arrhenius pre-exponential factor of 10^{12} s^{-1} , what is the value of k_A at 298K ?

[Question ID = 34155][Question Description = S1_TROH_903_PhD_Q046]

1. $4.34 \times 10^8 \text{ s}^{-1}$

[Option ID = 183967]

2. $4.34 \times 10^4 \text{ s}^{-1}$

[Option ID = 183968]

3. $4.34 \times 10^3 \text{ s}^{-1}$

[Option ID = 183969]

4. $4.34 \times 10^5 \text{ s}^{-1}$

[Option ID = 183970]

47) The compound β -pinene isomerizes at 650K to either 4-isopropenyl-1-methyl cyclohexane (IMC) with a rate constant of $k_1 = 0.022 \text{ s}^{-1}$, or to myrcene with a rate constant of $k_2 = 0.13 \text{ s}^{-1}$. If the reaction is carried out under kinetic control, what is the ratio of IMC to myrcene.

[Question ID = 34156][Question Description = S1_TROH_903_PhD_Q047]

1. 5.9 [Option ID = 183971]

2. 0.169 [Option ID = 183972]

3. 0.00286 [Option ID = 183973]

4. cannot predict [Option ID = 183974]

48) Match List I with List II

List I	List II
A. $\frac{0.693}{k}$	I. Half-life of zero order reaction
B. $\frac{a}{2k}$	II. Half-life of first order reaction
C. $\frac{1}{k}$	III. Average life of first order reaction
D. $\frac{1}{ak}$	IV. Half-life of second order reaction

Choose the correct answer from the options given below:

[Question ID = 34157][Question Description = S1_TROH_903_PhD_Q048]

1. A-II, B-I, C -III, D-IV

[Option ID = 183975]

2. A-II, B-I, C-IV, D-III

[Option ID = 183976]

3. A-I, B-II, C-IV, D-III

[Option ID = 183977]

4. A-I, B-II, C-III, D-IV

[Option ID = 183978]

49) Match List I with List II

List I	List II
A. XeF_2	I. Octahedral
B. SF_6	II. Linear
C. PCl_5	III. Bent
D. SnCl_2	IV. Trigonal bipyramidal

Choose the correct answer from the options given below:

[Question ID = 34158][Question Description = S1_TROH_903_PhD_Q049]

1. A-II, B-I, C-IV, D-III

[Option ID = 183979]

2. A-I, B -II, C-IV, D-III

[Option ID = 183980]

3. A- II, B-I, C-III, D-IV

[Option ID = 183981]

4. A- I, B-II, C-III, D-IV

[Option ID = 183982]

50) Given below Assertion and Reason

Assertion A: In the MO for NH_3 the s and p atomic orbitals of N atom are all symmetry adapted to combine with the three 1s group orbitals of H.

Reason R: Of the three 1s group orbitals of H, one has A_1 and two have E symmetry. Similarly for N atom, the s and p_z orbitals have A_1 symmetry and the pair p_x, p_y have E symmetry, the same as H 1s orbitals.

In the light of the above statements, choose the *most appropriate* answer from the options given below

[Question ID = 34159][Question Description = S1_TROH_903_PhD_Q050]

1. Both A and R are correct and R is the correct explanation of A

[Option ID = 183983]

2. Both A and R are correct but R is NOT the correct explanation of A

[Option ID = 183984]

3. A is correct but R is not correct

[Option ID = 183985]

4. A is not correct but R is correct

[Option ID = 183986]

51) Among the below statements

A. The Latimer diagram for oxygen in acidic medium is $O_2 \xrightarrow{0.695} H_2O_2 \xrightarrow{1.763} H_2O$

B. The Latimer diagram for oxygen in acidic medium is $O_2 \xrightarrow{-0.0649} HO_2 \xrightarrow{0.867} OH^-$

C. The Latimer diagram for oxygen in basic medium is $O_2 \xrightarrow{-0.0649} HO_2 \xrightarrow{0.867} OH^-$

D. The Latimer diagram for oxygen in basic medium is $O_2 \xrightarrow{0.695} H_2O_2 \xrightarrow{1.763} H_2O$

Choose the correct answer from the options given below:

[Question ID = 34160][Question Description = S1_TROH_903_PhD_Q051]

1. A and C Only [Option ID = 183987]

2. B and D Only [Option ID = 183988]

3. C and D Only [Option ID = 183989]

4. A and B Only [Option ID = 183990]

52) The function(s) of salt bridge in a cell is/are

A. It maintains standard electrode potential of cell constant which depends on several factors.

B. It completes the electric circuit.

C. It separates both the solutions from each other

D. It maintains the electrical neutrality of both electrolytic solutions.

Choose the correct answer from the options given below:[Question ID = 34161][Question Description = S1_TROH_903_PhD_Q052]

1. A, B, C, D only [Option ID = 183991]

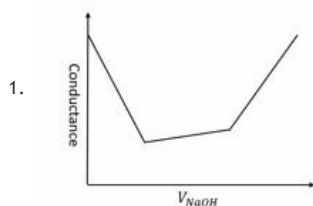
2. A, C, D only [Option ID = 183992]

3. A, B, C only [Option ID = 183993]

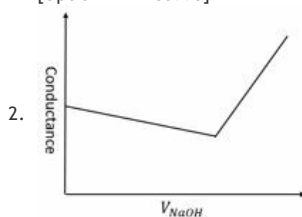
4. B, C, D only [Option ID = 183994]

53) Which of the following graph-truly represents the titration of a solution containing a mixture of HCl and CH_3COOH against NaOH solution?

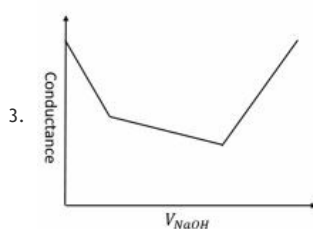
[Question ID = 34162][Question Description = S1_TROH_903_PhD_Q053]



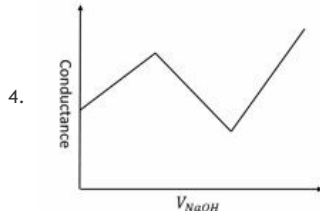
[Option ID = 183995]



[Option ID = 183996]



[Option ID = 183997]



[Option ID = 183998]

54)

The electron identified by quantum numbers n and l for the following, it can be placed in order of increasing energy from the lowest to highest for low atomic number atoms, as

- A. $n = 4, l = 1$
- B. $n = 4, l = 0$
- C. $n = 3, l = 2$
- D. $n = 3, l = 1$

[Question ID = 34163][Question Description = S1_TROH_903_PhD_Q054]

1. $D < B < C < A$

[Option ID = 183999]

2. $B < D < A < C$

[Option ID = 184000]

3. $A < C < B < D$

[Option ID = 184001]

4. $C < A < D < B$

[Option ID = 184002]

55) What is the value of $\langle x \rangle$ for any state of a particle confined in 1-D box?

[Question ID = 34164][Question Description = S1_TROH_903_PhD_Q055]

1. a [Option ID = 184003]

2. $\frac{a}{2}$

[Option ID = 184004]

3. 0 [Option ID = 184005]

4. $2a$

[Option ID = 184006]

56) Which of the following functions is/are acceptable as a wave function

- A. $\Psi(x) = e^{-x^2}$
- B. $\Psi(x) = e^x$
- C. $\Psi(x) = \sin\left(\frac{\pi x}{4}\right)$
- D. $\Psi(x) = x^2$

Choose the correct answer from the options given below:

[Question ID = 34165][Question Description = S1_TROH_903_PhD_Q056]

1. A, B only [Option ID = 184007]

2. B, C only [Option ID = 184008]

3. A, C only [Option ID = 184009]

4. B, D only [Option ID = 184010]

57) Given below Assertion and Reason

Assertion A: Entropy of system is related to thermodynamic probability of system and is given by $S = k_B \ln(W)$

Reason R: Residual entropy for a system is given by $S = x_i \sum_i x_i \ln(x_i)$

In the light of the above statements, choose the *most appropriate* answer from the options given below

[Question ID = 27529][Question Description = S1_TROH_903_PhD_Q057]

1. Both A and R are correct and R is the correct explanation of A [Option ID = 184011]

2. Both A and R are correct but R is NOT the correct explanation of A [Option ID = 184012]

3. A is correct but R is not correct [Option ID = 184013]

4. A is not correct but R is correct [Option ID = 184014]

58) Given below statements

A. Most atoms are in ground electronic state at room temperature.

B. $q_{elec} = \sum_i g_{e_i} e^{-\beta \epsilon_{e_i}}$

C. Ground state term symbol of H is $^2S_{1/2}$

D. Point group of H_2O is C_{2v}

Choose the correct answer from the options given below:

[Question ID = 27530][Question Description = S1_TROH_903_PhD_Q058]

1. A, B only

[Option ID = 184015]

2. B, C only

[Option ID = 184016]

3. A, C only

[Option ID = 184017]

4. A, B, C, D

[Option ID = 184018]

59) For an irreversible process:

A. $\Delta S_{system} + \Delta S_{Surr} < 0$

B. $\Delta S_{system} + \Delta S_{Surr} > 0$

C. $S_{system} = \Delta S_{Surr}$

D. $\Delta S_{system} + \Delta S_{Surr} = 0$

Choose the correct answer from the options given below:

[Question ID = 27531][Question Description = S1_TROH_903_PhD_Q059]

1. A only [Option ID = 184019]

2. B only [Option ID = 184020]

3. C only [Option ID = 184021]

4. D only [Option ID = 184022]

60) The mathematical relation $\frac{\Delta H_{vap}}{T_b} = 21 \text{ Cal K}^{-1} \text{ mol}^{-1}$ represents

[Question ID = 27532][Question Description = S1_TROH_903_PhD_Q060]

1. Fajan's rule [Option ID = 184023]

2. Trouton's rule [Option ID = 184024]

3. Phase rule [Option ID = 184025]

4. Walden's rule [Option ID = 184026]

61) Match List I with List II

List I	List II
A. $\left[\frac{\partial K_p}{\partial T} \right]$	I. $\frac{E_a}{RT^2}$
B. $\left[\frac{\partial K}{\partial T} \right]$	II. $\frac{\Delta H^\circ}{RT^2}$
C. $\left[\frac{\partial K}{\partial T} \right]$	III. $e^{-\frac{\Delta G^\circ}{RT}}$
D. K_p	IV. $\frac{\Delta U}{RT^2}$

Choose the correct answer from the options given below:

[Question ID = 27533][Question Description = S1_TROH_903_PhD_Q061]

1. A-II, B-I, C- IV, D-III

[Option ID = 184027]

2. A-II, B- IV, C- I, D-III

[Option ID = 184028]

3. A-IV, B-II, C-I, D-III

[Option ID = 184029]

4. A-IV, B-II, C-III, D-I

[Option ID = 184030]

62) Match List I with List II

List I	List II
A. Boyle's Law	I. $\left(\frac{\partial V}{\partial T} \right)_p = \frac{V}{T}$
B. Charle's Law	II. $\left(\frac{\partial p}{\partial V} \right)_T = -\frac{p}{V}$
C. Avogadro's law	III. $-\frac{dp}{dt} = \frac{K}{\sqrt{d}}$
D. Graham's law	IV. $\left(\frac{\partial V}{\partial n} \right)_{p,T} = \frac{RT}{p}$

Choose the correct answer from the options given below:

[Question ID = 27534][Question Description = S1_TROH_903_PhD_Q062]

1. A-I, B-II, C-III, D-IV

[Option ID = 184031]

2. A-IV, B-III, C-II, D-I

[Option ID = 184032]

3. A-II, B-IV, C-I, D-III

[Option ID = 184033]

4. A-II, B-I, C-IV, D-III

[Option ID = 184034]

63) Assertion A: Critical temperature is the temperature at which the intermolecular attraction in gas molecules vanish.

Reason R: At critical point, the density of substance in gaseous and liquid states become same.

In the light of the above statements, choose the most appropriate answer from the options given below

[Question ID = 27535][Question Description = S1_TROH_903_PhD_Q063]

1. Both A and R are correct and R is the correct explanation of A [Option ID = 184035]

2. Both A and R are correct but R is NOT the correct explanation of A [Option ID = 184036]

3. A is correct but R is not correct [Option ID = 184037]

4. A is not correct but R is correct [Option ID = 184038]

64) Which of the following expressions is/are correct, relating molecular weight (M) of an ideal gas with density ρ

A. $M = \left(\frac{\rho}{P}\right)RT$

B. $M = \left(\frac{P}{\rho}\right)RT$

C. $M = \left(\frac{1}{\rho}\right)RT$

D. $M = PRT$

Choose the correct answer from the options given below:

[Question ID = 27536][Question Description = S1_TROH_903_PhD_Q064]

1. A only [Option ID = 184039]

2. B only [Option ID = 184040]

3. C only [Option ID = 184041]

4. D only [Option ID = 184042]

65) The sum of orbital energies of the occupied Hückel MO energy level for ethylene

[Question ID = 27537][Question Description = S1_TROH_903_PhD_Q065]

1. $2\alpha - 2\beta$

[Option ID = 184043]

2. $2\alpha + 2\beta$

[Option ID = 184044]

3. 2α

[Option ID = 184045]

4. 2β

[Option ID = 184046]

66) Assertion A: The equilibrium shape of LiH_2 is linear.

Reason R: It has three electron system.

In the light of the above statements, choose the *most appropriate* answer from the options given below

[Question ID = 27538][Question Description = S1_TROH_903_PhD_Q066]

1. Both A and R are correct and R is the correct explanation of A [Option ID = 184047]

2. Both A and R are correct but R is NOT the correct explanation of A [Option ID = 184048]

3. A is correct but R is not correct [Option ID = 184049]

4. A is not correct but R is correct [Option ID = 184050]

67) Match List I with List II

List I	List II
A. Total number of degree of freedom for HCl	I. 12
B. Total number of degree of freedom for H_2O	II. 15
C. Total number of degree of freedom for NH_3	III. 9
D. Total number of degree of freedom for CH_4	IV. 6

Choose the correct answer from the options given below:

[Question ID = 27539][Question Description = S1_TROH_903_PhD_Q067]

1. A- I, B-II, C -III, D-IV

[Option ID = 184051]

2. A- IV, B-III, C-II, D-I

[Option ID = 184052]

3. A- IV, B-III, C-I, D-II

[Option ID = 184053]

4. A- I, B-III, C-II, D-IV

[Option ID = 184054]

68) Identify prolate symmetric top molecules:

A. CH_3I

B. NH_3

C. C_6H_6

D. XeF_4

Choose the correct answer from the options given below:

[Question ID = 27540][Question Description = S1_TROH_903_PhD_Q068]

1. A, B only [Option ID = 184055]

2. B, C only [Option ID = 184056]

3. C, D only [Option ID = 184057]

4. A, D only [Option ID = 184058]

69) What is the relationship between Absorbance (A) and Transmittance (T)?[Question ID = 27541][Question Description = S1_TROH_903_PhD_Q069]

1. $A = -\log_{10} T$

[Option ID = 184059]

2. $A = \log_{10} T$

[Option ID = 184060]

3. $A = \frac{1}{\log_{10} T}$

[Option ID = 184061]

4. $A = T$

[Option ID = 184062]

70) For CO_2 molecule which normal mode(s) is/are IR inactive?[Question ID = 27542][Question Description = S1_TROH_903_PhD_Q070]

1. Symmetric stretching [Option ID = 184063]

2. Asymmetric stretching [Option ID = 184064]

3. Bending [Option ID = 184065]

4. Asymmetric stretching and bending [Option ID = 184066]

71) For two matrices A and B, $(A + B)^2 = A^2 + B^2 + 2AB$ if

[Question ID = 27543][Question Description = S1_TROH_903_PhD_Q071]

1. A and B are orthogonal [Option ID = 184067]

2. A and B commute [Option ID = 184068]

3. One of A and B is unit matrix [Option ID = 184069]

4. For any A and B [Option ID = 184070]

72) Assertion: The eigenvalues of a Hermitian matrix are real

Reason: The eigenvectors corresponding to distinct eigenvalues of a Hermitian matrix are orthogonal.

In the light of the above statements, choose the *most appropriate* answer from the options given below[Question ID = 27544][Question Description = S1_TROH_903_PhD_Q072]

1. Both A and R are correct and R is the correct explanation of A [Option ID = 184071]

2. Both A and R are correct but R is NOT the correct explanation of A [Option ID = 184072]

3. A is correct but R is not correct [Option ID = 184073]

4. A is not correct but R is correct [Option ID = 184074]

73)

The eigenvalues of $A = \begin{bmatrix} 1 & 0 & -1 \\ 1 & 2 & 1 \\ 2 & 2 & 3 \end{bmatrix}$ are

[Question ID = 27545][Question Description = S1_TROH_903_PhD_Q073]

1. 1, 3, 4 [Option ID = 184075]

2. 2, 4, 7 [Option ID = 184076]

3. 1, 2, 3 [Option ID = 184077]

4. 1, 4, 7 [Option ID = 184078]

74) Let, $A = \begin{pmatrix} 1 & -2 \\ 4 & 5 \end{pmatrix}$ and $f(t) = t^2 - 3t + 7$, then $f(A)$ is

A. $\begin{pmatrix} 3 & -6 \\ 12 & 9 \end{pmatrix}$

B. $\begin{pmatrix} -3 & -6 \\ 12 & 9 \end{pmatrix}$

C. $\begin{pmatrix} -3 & 6 \\ -12 & 9 \end{pmatrix}$

D. $\begin{pmatrix} -3 & -6 \\ -12 & 9 \end{pmatrix}$

21. $\begin{pmatrix} -12 & 9 \end{pmatrix}$
Choose the correct answer from the options given below:

[Question ID = 27546][Question Description = S1_TROH_903_PhD_Q074]

1. D only [Option ID = 184079]
2. C only [Option ID = 184080]
3. A only [Option ID = 184081]
4. B only [Option ID = 184082]

75) Find $\det_{\mathbb{R}}(T)$, where T is the operator on $\mathbb{R}^3$ defined by [Question ID = 27547][Question Description = S1_TROH_903_PhD_Q075]

1. -11 [Option ID = 184083]
2. 11 [Option ID = 184084]
3. 10 [Option ID = 184085]
4. -10 [Option ID = 184086]

76) **Statement I:** A matrix $A \in M_n(I)$ is invertible iff $\det(A) \neq 0$.

Statement II: In that case, $\det(A^{-1}) = (\det A)^{-1}$

In the light of the above statements, choose the *most appropriate* answer from the options given below

[Question ID = 27548][Question Description = S1_TROH_903_PhD_Q076]

1. Both Statement I and Statement II are correct
[Option ID = 184087]
2. Both Statement I and Statement II are incorrect
[Option ID = 184088]
3. Statement I is correct but Statement II is incorrect
[Option ID = 184089]
4. Statement I is incorrect but Statement II is correct
[Option ID = 184090]

77) Among the given statements regarding Bernoulli's equation in fluid dynamics, true statements are

- A. It is valid for ideal, steady, incompressible, continuous flow.
- B. It is valid for ideal, steady, compressible, continuous flow
- C. It is valid for steady, incompressible, continuous, rotational flow.
- D. It is valid for ideal, incompressible, rotational, unsteady flow.
- E. It is valid for ideal, steady, continuous, rotational flow.

Choose the correct answer from the options given below: [Question ID = 27549][Question Description = S1_TROH_903_PhD_Q077]

1. A only [Option ID = 184091]
2. B only [Option ID = 184092]
3. C & E only [Option ID = 184093]
4. D only [Option ID = 184094]

78) **Statement I:** "In a steady, ideal flow of an incompressible fluid, total energy at any point of the fluid is always constant" is the statement of Euler's theorem

Statement II: While considering fluid dynamics, only viscous force, pressure force and turbulent force are considered

In the light of the above statements, choose the *most appropriate* answer from the options given below [Question ID = 27550][Question Description = S1_TROH_903_PhD_Q078]

1. Both Statement I and Statement II are correct [Option ID = 184095]
2. Both Statement I and Statement II are incorrect [Option ID = 184096]
3. Statement I is correct but Statement II is incorrect [Option ID = 184097]
4. Statement I is incorrect but Statement II is correct [Option ID = 184098]

79) **Statement I:** A connected graph with n vertices and $(n-1)$ edges is a tree.

Statement II: In a connected graph, every pair of vertices has a path, then the graph is not a tree.

In the light of the above statements, choose the *Correct* answer from the options given below [Question ID = 27551][Question Description = S1_TROH_903_PhD_Q079]

1. Both Statement I and Statement II are true [Option ID = 184099]
2. Both Statement I and Statement II are false [Option ID = 184100]
3. Statement I is correct but Statement II is false [Option ID = 184101]
4. Statement I is incorrect but Statement II is true [Option ID = 184102]

80) A connected planar graph with n vertices, r regions and $m-1$ edges satisfies [Question ID = 27552][Question Description = S1_TROH_903_PhD_Q080]

1. $n-m+r=2$ [Option ID = 184103]
2. $n-m+r=1$ [Option ID = 184104]
3. $n-m+r=0$ [Option ID = 184105]
4. $n+m-r=1$ [Option ID = 184106]

81) Choose correct statements from the following statements

- A. Degree of each vertex of an Eulerian graph is even.
- B. A bipartite graph is 2-colorable.
- C. Degree of a vertex is the number of vertices which are connected with the vertex.
- D. In a connected graph with a cycle, removing any edge will make the graph disconnected.

[Question ID = 27553][Question Description = S1_TROH_903_PhD_Q081]

1. C and D Only
[Option ID = 184107]
2. A and C Only

[Option ID = 184108]

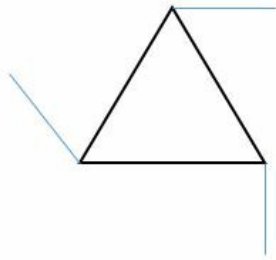
3. B and D Only

[Option ID = 184109]

4. A and B Only

[Option ID = 184110]

82) Among the given statements about the graph



- A. The graph is not a tree
- B. The graph is acyclic and planar
- C. The graph is Hamiltonian not Eulerian.
- D. Not more than one edges can be removed so that the remaining graph is connected

Choose the correct answer from the options given below:

[Question ID = 27554][Question Description = S1_TROH_903_PhD_Q082]

- 1. A only [Option ID = 184111]
- 2. B only [Option ID = 184112]
- 3. C only [Option ID = 184113]
- 4. D only [Option ID = 184114]

83) Match List I with List II

List I	List II
A. Places	I. Petri net
B. Assigning tokens	II. Class of vertices
C. Bipartite graph	III. At least one token
D. Enabled	IV. Marking

Choose the correct answer from the options given below:

[Question ID = 27555][Question Description = S1_TROH_903_PhD_Q083]

- 1. A-IV, B-II, C-I, D-III [Option ID = 184115]
- 2. A-II, B-IV, C-I, D-III [Option ID = 184116]
- 3. A-III, B-IV, C-I, D-II [Option ID = 184117]
- 4. A-II, B-I, C-IV, D-III [Option ID = 184118]

84) Given below are two statements

Statement I: The region $y \leq x^2 - 5$ is a convex region (set).

Statement II: If a linear programming problem has an unbounded solution, then its dual also has an unbounded solution.

In the light of the above statements, choose the **Correct** answer from the options given below

[Question ID = 27556][Question Description = S1_TROH_903_PhD_Q084]

- 1. Both Statement I and Statement II are true [Option ID = 184119]
- 2. Both Statement I and Statement II are false [Option ID = 184120]
- 3. Statement I is correct but Statement II is false [Option ID = 184121]
- 4. Statement I is incorrect but Statement II is true [Option ID = 184122]

85) General solution of $y(2xy + e^x)dx - e^x dy = 0$ is

[Question ID = 27557][Question Description = S1_TROH_903_PhD_Q085]

- 1. $e^x = y(c - x^2)$

[Option ID = 184123]

- 2. $e^x = y(c - x)$

[Option ID = 184124]

- 3. $e^y = x(c - y^2)$

[Option ID = 184125]

4. $e^y = x(c - y)$

[Option ID = 184126]

86) The complementary function of $\frac{d^2y}{dx^2} - 4\frac{dy}{dx} = x^2$ is

[Question ID = 27558][Question Description = S1_TROH_903_PhD_Q086]

1. $C_1x + C_2e^{4x}$

[Option ID = 184127]

2. $C_1 + C_2e^{4x}$

[Option ID = 184128]

3. $C_1 + 4C_2e^x$

[Option ID = 184129]

4. $C_1x + C_2e^x$

[Option ID = 184130]

87) The adjoint equation of $t^2 \frac{d^2x}{dt^2} + 3t \frac{dx}{dt} + 3x = 0$ is

[Question ID = 27559][Question Description = S1_TROH_903_PhD_Q087]

1. $t^2 \frac{d^2x}{dt^2} + 3t \frac{dx}{dt} + 3x = 0$

[Option ID = 184131]

2. $t^2 \frac{d^2x}{dt^2} + t \frac{dx}{dt} + 2x = 0$

[Option ID = 184132]

3. $t^2 \frac{d^2x}{dt^2} + 3t \frac{dx}{dt} + x = 0$

[Option ID = 184133]

4. $2t \frac{d^2x}{dt^2} + 3 \frac{dx}{dt} + 3x = 0$

[Option ID = 184134]

88) The characteristic root of the system

$$\frac{dx}{dt} = 4x - y \text{ and } \frac{dy}{dt} = x + 2y, \text{ is}$$

[Question ID = 27560][Question Description = S1_TROH_903_PhD_Q088]

1. 3, 3 [Option ID = 184135]

2. -3, -3 [Option ID = 184136]

3. -2, -4 [Option ID = 184137]

4. 2, 4 [Option ID = 184138]

89) **Statement 1:** In the following linear system

$$\frac{dx}{dt} = 2x + 4y \text{ and } \frac{dy}{dt} = -2x + 6y \dots\dots\dots(0,0) \text{ is a critical point.}$$

Statement 2: In the above system, the critical point is a node.

In the light of the above statements, choose the **Correct** answer from the options given below

[Question ID = 27561][Question Description = S1_TROH_903_PhD_Q089]

1. Both Statement I and Statement II are true [Option ID = 184139]

2. Both Statement I and Statement II are false [Option ID = 184140]

3. Statement I is correct but Statement II is false [Option ID = 184141]

4. Statement I is incorrect but Statement II is true [Option ID = 184142]

90) The Wronskian of the solutions $\sin x$ and $\cos x$ of $\frac{d^2y}{dx^2} + y = 0$ is

A. 0

B. -1

C. Linearly independent

D. Linearly dependent

Choose the correct answer from the options given below:

[Question ID = 27562][Question Description = S1_TROH_903_PhD_Q090]

1. A only

[Option ID = 184143]

2. B only

[Option ID = 184144]

3. A and D only

[Option ID = 184145]

4. B and C only

[Option ID = 184146]

91) **Statement I:** For Hermite polynomials, $H_{n+1}(x) = 2xH_n(x) + 2nH_{n-1}(x)$

Statement II: $H_0(x) = 1, H_1(x) = x$ and $H_2(x) = 2x^2 + 2$ are Hermite polynomials.

In the light of the above statements, choose the **Correct** answer from the options given below

[Question ID = 27563][Question Description = S1_TROH_903_PhD_Q091]

1. Both Statement I and Statement II are true [Option ID = 184147]
2. Both Statement I and Statement II are false [Option ID = 184148]
3. Statement I is correct but Statement II is false [Option ID = 184149]
4. Statement I is incorrect but Statement II is true [Option ID = 184150]

92) For Bessel functions $J_n(x)$,

[Question ID = 27564][Question Description = S1_TROH_903_PhD_Q092]

1. $|J_0(x)| \leq 1, |J_n(x)| \leq \frac{1}{\sqrt{2}}; n > 1$

[Option ID = 184151]

2. $|J_0(x)| \geq 1, |J_n(x)| \geq \frac{1}{\sqrt{2}}; n > 1$

[Option ID = 184152]

3. $|J_0(x)| \leq 1, |J_n(x)| \geq \frac{1}{\sqrt{2}}; n > 1$

[Option ID = 184153]

4. $|J_0(x)| \geq 1, |J_n(x)| \leq \frac{1}{\sqrt{2}}; n > 1$

[Option ID = 184154]

93)

Q-93) Match List I with List II

List I	List II
A. Legendre polynomial	I. $(-1)^n e^{x^2} \frac{d^n}{dx^n} (e^{-x^2})$
B. Hermite polynomial	II. $\frac{1}{2^n n!} \frac{d^n}{dx^n} (x^2 - 1)^n$
C. Laguerre polynomial	III. $\frac{e^x x^{-a}}{n!} \frac{d^n}{dx^n} (e^{-x} x^{n+a})$
D. Bessel function	IV. $\sum_{m=0}^{\infty} \frac{(-1)^m}{m! \Gamma(m+1+a)} \left(\frac{x}{2}\right)^{2m+a}$

Choose the correct answer from the options given below:

[Question ID = 27572][Question Description = S1_TROH_903_PhD_Q093]

1. A-I, B-II, C-III, D-IV [Option ID = 184183]
2. A-II, B-I, C-IV, D-III [Option ID = 184184]
3. A-II, B-I, C-III, D-IV [Option ID = 184185]
4. A-III, B-I, C-II, D-IV [Option ID = 184186]

94) Which of the followings is/are not property of Bessel functions

- A. $xJ'_n(x) = nJ_n(x) - xJ_{n+1}(x)$
- B. $xJ'_n(x) = -nJ_n(x) - xJ_{n-1}(x)$
- C. $2J'_n(x) = J_{n-1}(x) + J_{n+1}(x)$
- D. $2nJ_n(x) = xJ_{n-1}(x) + xJ_{n+1}(x)$
- E. $\frac{d}{dx}(x^n J_n(x)) = x^n J_{n-1}(x)$

[Question ID = 27565][Question Description = S1_TROH_903_PhD_Q094]

1. A and B Only

[Option ID = 184155]

2. B and C Only

[Option ID = 184156]

3. C and D Only

[Option ID = 184157]

4. D and E Only

[Option ID = 184158]

95) For a random variable x with true value μ what is the first moment of $x - \mu$ ($E[x - \mu]$)

[Question ID = 27566][Question Description = S1_TROH_903_PhD_Q095]

1. 0 [Option ID = 184159]
2. ∞ [Option ID = 184160]
3. $-\infty$ [Option ID = 184161]
4. 1 [Option ID = 184162]

96) The distribution of the speed of the molecules of a gas in 3D is given by $f(c)dc = \left(\frac{m}{2\pi k_B T}\right)^{3/2} e^{-mc^2/2k_B T} c^2$, where m is the mass of the molecule, k_B is the Boltzmann constant and T is the kelvin temperature. Determine average of speed $[c]$?

[Question ID = 27567][Question Description = S1_TROH_903_PhD_Q096]

1. $\sqrt{\frac{8k_B T}{\pi m}}$

[Option ID = 184163]

2. $\left(\frac{8k_B T}{\pi m}\right)^{3/2}$

[Option ID = 184164]

3. $\left(\frac{3k_B T}{m}\right)$

[Option ID = 184165]

4. $\left(\frac{6k_B T}{\pi m}\right)$

[Option ID = 184166]

97) The melting point, X , of a solid is a continuous random variable which is uniformly distributed between $100^\circ C$ to $150^\circ C$. What is the probability that the solid melts in the range $115^\circ C - 130^\circ C$?

[Question ID = 27568][Question Description = S1_TROH_903_PhD_Q097]

1. $7/10$
[Option ID = 184167]
2. $1/2$
[Option ID = 184168]
3. $3/10$
[Option ID = 184169]
4. $2/5$
[Option ID = 184170]

98) Among the given statements for the data 5,7,29,53,12,14,17,19,14,10, true statements are

- A. standard deviation=5
- B. median=10
- C. mode=14
- D. mean=18
- E. var=10

Choose the correct answer from the options given below:

[Question ID = 27569][Question Description = S1_TROH_903_PhD_Q098]

1. A and B Only
[Option ID = 184171]
2. A and E Only
[Option ID = 184172]
3. C and D Only
[Option ID = 184173]
4. D and E Only
[Option ID = 184174]

99) Given below are two statements:

Statement I: Let X be a random variable with probability distribution function $f(x) = kx^2, 0 \leq x \leq 1$. Then $E(X) = 1/4$.

Statement II: Let X be a random variable with probability distribution function $f(x) = \frac{x}{5} + a, 0 \leq x \leq 3$. Then $a =$

In the light of the above statements, choose the **Correct** answer from the options given below

[Question ID = 27570][Question Description = S1_TROH_903_PhD_Q099]

1. Both Statement I and Statement II are true [Option ID = 184175]
2. Both Statement I and Statement II are false [Option ID = 184176]
3. Statement I is correct but Statement II is false [Option ID = 184177]
4. Statement I is incorrect but Statement II is true [Option ID = 184178]

100) Given below are two statements:

Statement I: Probability of getting one queen and one king in two draws from a pack of cards without replacement is $\frac{1}{169}$.

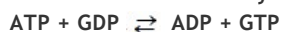
Statement II: If 50% people have vehicles, 60% drive. 15% people have vehicles and drive if 25% people don't have vehicles and don't drive.

In the light of the above statements, choose the **Correct** answer from the options given below

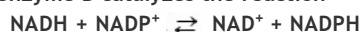
[Question ID = 27571][Question Description = S1_TROH_903_PhD_Q100]

1. Both Statement I and Statement II are true
[Option ID = 184179]
2. Both Statement I and Statement II are false
[Option ID = 184180]
3. Statement I is correct but Statement II is false
[Option ID = 184181]
4. Statement I is incorrect but Statement II is true
[Option ID = 184182]

101) Consider the effects of two enzymes. Enzyme A catalyzes the reaction



whereas enzyme B catalyzes the reaction



Which is the correct option?

[Question ID = 27573][Question Description = S1_TROH_903_PhD_Q101]

1. Both enzymes A and B are beneficial
[Option ID = 184187]
2. Enzyme A is beneficial and enzyme B is detrimental
[Option ID = 184188]
3. Enzyme B is beneficial and enzyme A is detrimental
[Option ID = 184189]
4. Both enzymes A and B are detrimental
[Option ID = 184190]

102) The melting point of the DNA strand depends upon [Question ID = 27574][Question Description = S1_TROH_903_PhD_Q102]

1. AT Bases [Option ID = 184191]
2. GC Bases [Option ID = 184192]
3. AT/GC ratio [Option ID = 184193]
4. All of the above [Option ID = 184194]

103) Which antibody crosses the placenta? [Question ID = 27575][Question Description = S1_TROH_903_PhD_Q103]

1. Ig A [Option ID = 184195]
2. IgG [Option ID = 184196]
3. IgE [Option ID = 184197]
4. IgM [Option ID = 184198]

104) The plant samples are containing protein molecules of different sizes 110 KDa, 55 KDa, 173KDa respectively. To separate all three of them gel filtration chromatography has been performed. What would be the order of protein elution through column?

[Question ID = 27576][Question Description = S1_TROH_903_PhD_Q104]

1. 110, 55, 173
[Option ID = 184199]
2. 55, 110, 173
[Option ID = 184200]
3. 173, 110, 55
[Option ID = 184201]
4. 173, 55, 110
[Option ID = 184202]

105) Statement I: The regulation of cyclin-Cdk complexes depends entirely on phosphorylation and dephosphorylation.

Statement II: In order for proliferating cells to maintain a relatively constant size, the length of the cell cycle must match the time it takes for the cell to double in size.

In the light of the above statements, choose the most appropriate answer from the options given below

[Question ID = 27577][Question Description = S1_TROH_903_PhD_Q105]

- Both Statement I and Statement II are correct
[Option ID = 184203]
- Both Statement I and Statement II are incorrect
[Option ID = 184204]
- Statement I is correct but Statement II is incorrect
[Option ID = 184205]
- Statement I is incorrect but Statement II is correct
[Option ID = 184206]

106) If the concentration of a transcription repressor is 100 molecules per E. coli, and it has a single binding site in the bacterial genome, what must the equilibrium constant be for the binding site to be 99% occupied? (Volume of E-coli is $1.5 \mu\text{M}^3$)[Question ID = 27578][Question Description = S1_TROH_903_PhD_Q106]

- $9.9 \times 10^7 \text{ M}^{-1}$ [Option ID = 184207]
- $99 \times 10^5 \text{ M}^{-1}$ [Option ID = 184208]
- $9.9 \times 10^8 \text{ M}^{-1}$ [Option ID = 184209]
- $9.9 \times 10^9 \text{ M}^{-1}$ [Option ID = 184210]

107) Li - Fraumeni syndrome, a rare inherited condition, is associated with

[Question ID = 27579][Question Description = S1_TROH_903_PhD_Q107]

- Mutation in p53 gene
[Option ID = 184211]
- Mutation in cdk2
[Option ID = 184212]
- Mutation in mdm2
[Option ID = 184213]
- Mutation in pRb
[Option ID = 184214]

108) If a murine cell that does not express the human CD4 is successfully transfected with the human CD4 DNA, will it make it susceptible to HIV infection and why?

[Question ID = 27580][Question Description = S1_TROH_903_PhD_Q108]

- No, because it lacks the human chemokine co-receptor.
[Option ID = 184215]
- No, because it indicates absence of antigen in CD4^+ T cells.
[Option ID = 184216]
- Yes, because it alters concentration of IgG1 and IgG4.
[Option ID = 184217]
- Yes, because it causes mutation in transcription factors that regulate MHC class II expression.
[Option ID = 184218]

109) Occurrence of disease has been seen in 25-35 years of individual where females are more likely to get affected than their male counterparts. The affected individuals are characterized with arthritis, weakness and kidney disfunction. The individuals are probably suffering with the disease.

[Question ID = 27581][Question Description = S1_TROH_903_PhD_Q109]

- Rheumatoid Arthritis
[Option ID = 184219]
- Multiple Sclerosis
[Option ID = 184220]
- Myasthenia gravis
[Option ID = 184221]
- Systemic lupus erythematosus
[Option ID = 184222]

110)

Q-110) Match the following disease and which organ got affected due to the disease.

List I	List II
A. Hashimoto thyroiditis	I. Kidney
B. Crohn disease	II. Thyroid
C. <u>Insulin dependent diabetes mellitus (IDDM)</u>	III. Pancreas
D. Good Pasture's <u>Syndrom</u>	IV. Gut

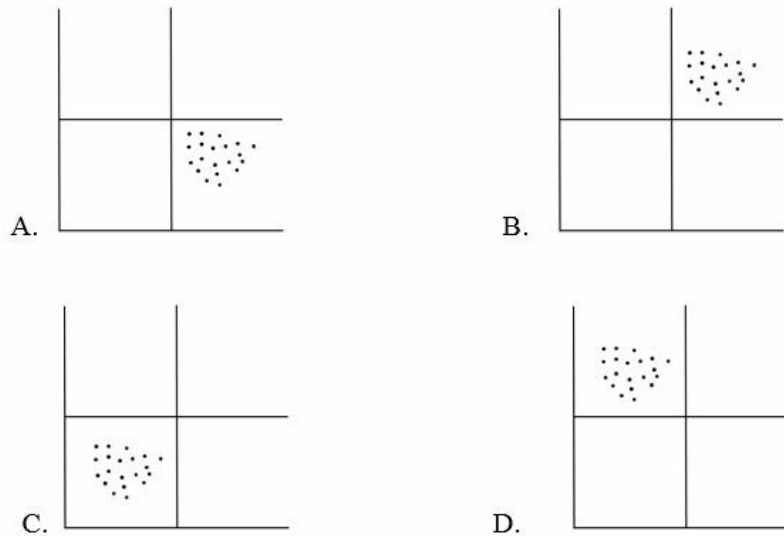
Choose the correct option:

[Question ID = 27582][Question Description = S1_TROH_903_PhD_Q110]

- A-II, B-IV, C-III, D-I [Option ID = 184223]

2. A-IV, B-I, C-III, D-II [Option ID = 184224]
3. A-I, B-II, C-III, D-IV [Option ID = 184225]
4. A-II, B-I, C-III, D-IV [Option ID = 184226]

111) A researcher has been asked to perform an experiment where he has to measure the number of the apoptotic cells. He has performed flow cytometry and got four different graphs. Among all which graph is/are having apoptotic cells:



Choose the correct answer from the options given below:

[Question ID = 27583][Question Description = S1_TROH_903_PhD_Q111]

1. Only A

[Option ID = 184227]

2. A and B

[Option ID = 184228]

3. C and A

[Option ID = 184229]

4. B and D

[Option ID = 184230]

112) In Plant cells, Krebs cycle takes place in which organelle[Question ID = 27584][Question Description = S1_TROH_903_PhD_Q112]

1. Mitochondria [Option ID = 184231]
2. Cytoplasm [Option ID = 184232]
3. Plastid [Option ID = 184233]
4. Peroxisome [Option ID = 184234]

113) Gradient Centrifugation separates samples on the basis of?[Question ID = 34224][Question Description = S1_TROH_903_PhD_Q113]

1. Charge [Option ID = 184235]
2. Weight [Option ID = 184236]
3. Density [Option ID = 184237]
4. Size [Option ID = 184238]

114) Which statement is FALSE for Transmission electron microscope :[Question ID = 34225][Question Description = S1_TROH_903_PhD_Q114]

1. Electron passes through specimen [Option ID = 184239]
2. Sectioning of the specimen is required before viewing [Option ID = 184240]
3. Internal structure of the specimen can be viewed [Option ID = 184241]
4. Staining of the specimen is not required [Option ID = 184242]

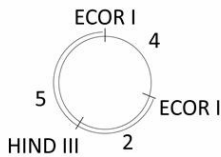
115) A researcher has been given a DNA molecule and has to digest with ECoR I, HIND III separately and in combination. After performing the digestion, gel electrophoresis has been done.

DNA molecule	ECoR I	HIND III	ECO R I & HIND III

	4 kb		4 kb
			2 kb

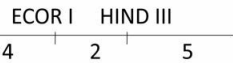
[Question ID = 34226][Question Description = S1_TROH_903_PhD_Q115]

1.



[Option ID = 184243]

2.



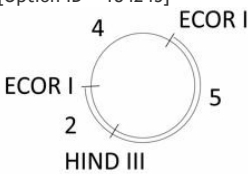
[Option ID = 184244]

3.



[Option ID = 184245]

4.



[Option ID = 184246]

116) On the basis of the gel which map will be appropriate? Which statement is false for plasmid[Question ID = 34227][Question Description = S1_TROH_903_PhD_Q116]

1. It has its own origin of replication. [Option ID = 184247]
2. Plasmids are circular and linear DNA molecules. [Option ID = 184248]
3. Plasmids does not contain cos site. [Option ID = 184249]
4. Stringent plasmids are present at multiple copies per cell. [Option ID = 184250]

117) _____ is an inhibitor of enzyme 5-enolpyruvyl shikimate-3phosphate (EPSP) synthase, which is responsible for the synthesis of aromatic amino acids in plants.[Question ID = 34228][Question Description = S1_TROH_903_PhD_Q117]

1. tosyl-lysine chloro-methyl ketone (TLCK) [Option ID = 184251]
2. glyphosate [Option ID = 184252]
3. iodoacetate [Option ID = 184253]
4. None of them [Option ID = 184254]

118) Lysozymes are present among all except[Question ID = 34229][Question Description = S1_TROH_903_PhD_Q118]

1. sweat [Option ID = 184255]
2. saliva [Option ID = 184256]
3. tears [Option ID = 184257]
4. egg white [Option ID = 184258]

119) A researcher has to separate DNA molecule, protein, RNA from the cell extract. To achieve this objective, he has performed ion exchange chromatography and he has placed resin in glass column then he has applied gradual increased salt concentration to elute out all three. What would be the order of elution for all three?[Question ID = 34230][Question Description = S1_TROH_903_PhD_Q119]

1. DNA-1, RNA-2, protein-3 [Option ID = 184259]
2. protein-1, RNA-2, DNA-3 [Option ID = 184260]
3. RNA-1, protein-2, DNA-3 [Option ID = 184261]
4. protein-1, DNA-2, RNA-3 [Option ID = 184262]

120) Among all which is the stop codon?[Question ID = 34231][Question Description = S1_TROH_903_PhD_Q120]

1. AUA [Option ID = 184263]
2. UUG [Option ID = 184264]
3. UGG [Option ID = 184265]
4. None of these [Option ID = 184266]

121) Northern blotting involves _____ of RNA from a gel.[Question ID = 34232][Question Description = S1_TROH_903_PhD_Q121]

1. transfer [Option ID = 184267]
2. transcribe [Option ID = 184268]
3. detection [Option ID = 184269]
4. none of the above [Option ID = 184270]

122) Method can be used to label DNA with radioactive markers is/are

[Question ID = 34233][Question Description = S1_TROH_903_PhD_Q122]

1. nick translation

[Option ID = 184271]

2. end filling

[Option ID = 184272]

3. Both, nick translation and end filling

[Option ID = 184273]

4. None

[Option ID = 184274]

123) In prokaryotic transcription, _____ subunit/s play important role in promoter recognition

A. σ subunit

B. α subunit

C. ω subunit

D. β subunit

Choose the correct option

[Question ID = 34234][Question Description = S1_TROH_903_PhD_Q123]

1. A only [Option ID = 184275]

2. A and C only [Option ID = 184276]

3. A and B only [Option ID = 184277]

4. A and D only [Option ID = 184278]

124) Gene cloning is useful for[Question ID = 34235][Question Description = S1_TROH_903_PhD_Q124]

1. amplification [Option ID = 184279]

2. replication [Option ID = 184280]

3. saponification [Option ID = 184281]

4. none of the above [Option ID = 184282]

125) Metabolic co-operation between different prokaryotic species are called? [Question ID = 34236][Question Description = S1_TROH_903_PhD_Q125]

1. biofilms [Option ID = 184283]

2. biochannels [Option ID = 184284]

3. metagenomics [Option ID = 184285]

4. none of the above [Option ID = 184286]

126) The genetic code was deciphered in part by experiments in which polynucleotides of repeating sequences were used as mRNAs to direct protein synthesis in cell-free extracts. In the test tube, artificial conditions were used that allowed ribosomes to start protein synthesis anywhere on an RNA molecule, without the need for a translation start codon, as required in a living cell. What polypeptides would you expect to be synthesized if the following polynucleotides were used as templates in such a cell-free extract?

AUCAUCAUC...

[Question ID = 34237][Question Description = S1_TROH_903_PhD_Q126]

1. Codes for a polymer of phenylalanine

[Option ID = 184287]

2. Codes for a polymer of alternating Isoleucines and Tyrosines

[Option ID = 184288]

3. Codes for a mixture of three different polymers

[Option ID = 184289]

4. Codes for a mixture of alternating Histidine and Serine

[Option ID = 184290]

127) Which is the correct order in any monocot species.[Question ID = 34238][Question Description = S1_TROH_903_PhD_Q127]

1. One cotyledon, parallel veins, scattered tissue, fibrous root system. [Option ID = 184291]

2. One cotyledon, net-like veins, scattered tissue, fibrous root system. [Option ID = 184292]

3. One cotyledon, parallel veins, scattered tissue, taproot system. [Option ID = 184293]

4. One cotyledon, parallel veins, ring tissue, fibrous root system. [Option ID = 184294]

128) The diploid human genome comprises 6.4×10^9 bp and fits into a nucleus that is $6 \mu\text{m}$ in diameter. If the diameter of the DNA helix is 2.4 nm, what fraction of the volume of the nucleus is occupied by DNA? [Volume of a sphere is $(4/3 \pi r^3)$ and volume of a cylinder is $\pi r^2 h$.][Question ID = 34239][Question Description = S1_TROH_903_PhD_Q128]

1. 8% of the nuclear volume [Option ID = 184295]

2. 9% of the nuclear volume [Option ID = 184296]

3. 10% of the nuclear volume [Option ID = 184297]

4. 11% of the nuclear volume [Option ID = 184298]

129) Apoptotic cell can be recognized through a specific signal in their outer leaflet which are also known as “eat me signals”. These are[Question ID = 34240][Question Description = S1_TROH_903_PhD_Q129]

1. Phosphatidylserine [Option ID = 184299]

2. Phosphatidylcholine [Option ID = 184300]

3. Phosphatidylinositol [Option ID = 184301]

4. Sphingolipid [Option ID = 184302]

130) Match Table I with Table II

A. The orderly sequence of events by which a cell duplicates its contents and divides into two	I. Homolog
B. Complex of DNA, histones, and non-histone proteins found in the nucleus of a eukaryotic cell.	II. Nucleosome
C. Sequence of amino acids in a protein	III. Cell cycle

C. One of the two copies of a particular chromosome in a diploid cell, each copy being derived from a different parent.	III. Cell Cycle
D. Beadlike structure in eukaryotic chromatin, composed of a short length of DNA wrapped around a core of histone proteins	IV. Chromatin

[Question ID = 34241][Question Description = S1_TROH_903_PhD_Q130]

1. A-III, B-IV, C-I, D-II [Option ID = 184303]
2. A-III, B-I, C-IV, D-II [Option ID = 184304]
3. A-II, B-IV, C-I, D-III [Option ID = 184305]
4. A-II, B-I, C-IV, D-III [Option ID = 184306]

131) What is the sequence identity between the following pair of sequences?

MLIPLAIWKA
MVASLDIFRA

[Question ID = 34242][Question Description = S1_TROH_903_PhD_Q131]

1. 60%
[Option ID = 184307]
2. 40%
[Option ID = 184308]
3. 50%
[Option ID = 184309]
4. 30%
[Option ID = 184310]

132) Discontiguous MegaBLAST attains efficiency in detecting distant homologs due to use of [Question ID = 34243][Question Description = S1_TROH_903_PhD_Q132]

1. spaced seed [Option ID = 184311]
2. higher seed length [Option ID = 184312]
3. lower T value [Option ID = 184313]
4. lower X-dropoff value [Option ID = 184314]

133) The following are the primary biological databases:

- A. NCBI, EMBL, DDBJ
- B. PubMed, EMBL, DDBJ
- C. NCBI, FTP, DDBJ
- D. NCBI, SCOP, EMBL
- E. All of the above

Choose the correct answer from the options given below:

[Question ID = 27585][Question Description = S1_TROH_903_PhD_Q133]

1. A Only
[Option ID = 184315]
2. A and C Only
[Option ID = 184316]
3. B and D Only
[Option ID = 184317]
4. E Only
[Option ID = 184318]

134) Q-134) Dynamic programming (DP) as it is used in Needleman-Wunch method is for pair-wise alignments and therefore can be referred to as two-dimensional DP. Is it feasible to apply DP for aligning more than 2 sequences (say 10 sequences) simultaneously by way of multi-dimensional DP?

Select the most appropriate answer.

[Question ID = 27586][Question Description = S1_TROH_903_PhD_Q134]

1. Yes, but it is computationally very demanding both in terms of memory and time
[Option ID = 184319]
2. Yes, it is easily implementable but surprisingly it is not used as widely as the heuristic multiple sequence alignment methods
[Option ID = 184320]
3. Needs multidimensional substitution scoring matrix
[Option ID = 184321]
4. It is very challenging to write a computer code
[Option ID = 184322]

135) Match List I with List II

List I	List II
A. KEGG	I. Protein Structure Database

A. <u>KEGG</u>	I. Protein Structure Database
B. PDB	II. Pathway Database
C. <u>GenBank</u>	III. Secondary Protein Database
D. CATH	IV. Primary Sequence Database

Choose the correct answer from the options given below:

[Question ID = 27587][Question Description = S1_TROH_903_PhD_Q135]

1. A-II, B-III, C-I, D-IV [Option ID = 184323]
2. A-II, B-I, C-III, D-IV [Option ID = 184324]
3. A-II, B-I, C-IV, D-III [Option ID = 184325]
4. A-II, B-IV, C-I, D-III [Option ID = 184326]

136) Which of the following is used to evaluate the significance of phylogenetic tree topologies? [Question ID = 27588][Question Description = S1_TROH_903_PhD_Q136]

1. bootstrapping [Option ID = 184327]
2. random walk [Option ID = 184328]
3. ROC analysis [Option ID = 184329]
4. Branch length [Option ID = 184330]

137) Which of the following is a character based method of phylogenetic tree construction?

[Question ID = 27589][Question Description = S1_TROH_903_PhD_Q137]

1. Neighbour-joining Method
[Option ID = 184331]
2. Unweighted Pair Group Method Using Arithmetic Average
[Option ID = 184332]
3. Jukes-Cantor Model
[Option ID = 184333]
4. Maximum Parsimony Method
[Option ID = 184334]

138) Which of the following is a database of protein models generated by homology modelling methods?

[Question ID = 27590][Question Description = S1_TROH_903_PhD_Q138]

1. NDB
[Option ID = 184335]
2. PDB
[Option ID = 184336]
3. CAS
[Option ID = 184337]
4. Modbase
[Option ID = 184338]

139) Which of the following is a third generation algorithm that uses MSA for secondary structure prediction?

[Question ID = 27591][Question Description = S1_TROH_903_PhD_Q139]

1. GOR
[Option ID = 184339]
2. Chou Fasman
[Option ID = 184340]
3. HMM
[Option ID = 184341]
4. Neural Network Model
[Option ID = 184342]

140) Given below are two statements:

Statement I: In phylogenetic tree construction the maximum parsimony method is slower than the distance based methods.

Statement II: Maximum parsimony method is insensitive to the order in which sequences are added during phylogenetic tree construction.

In the light of the above statements, choose the most appropriate answer from the options given below

[Question ID = 27592][Question Description = S1_TROH_903_PhD_Q140]

1. Both Statement I and Statement II are correct
[Option ID = 184343]
2. Both Statement I and Statement II are incorrect
[Option ID = 184344]
3. Statement I is correct but Statement II is incorrect
[Option ID = 184345]
4. Statement I is incorrect but Statement II is correct
[Option ID = 184346]

141) Human genome approximately consists of

[Question ID = 27593][Question Description = S1_TROH_903_PhD_Q141]

1. <5000 genes

[Option ID = 184347]

2. <10000 genes

[Option ID = 184348]

3. <20000 genes

[Option ID = 184349]

4. More than 20000 genes

[Option ID = 184350]

142) Metagenomic sequencing is NOT used for[Question ID = 27594][Question Description = S1_TROH_903_PhD_Q142]

1. Sequencing of viral DNA/RNA from blood sample [Option ID = 184351]

2. Sequencing of bacterial DNA from soil sample [Option ID = 184352]

3. Sequencing of bacterial DNA from fecal sample [Option ID = 184353]

4. Sequencing of sample from microbial communities of marine environments [Option ID = 184354]

143) Chip sequencing method is used for the identification of[Question ID = 27595][Question Description = S1_TROH_903_PhD_Q143]

1. Protein-DNA interactions [Option ID = 184355]

2. Protein-Protein interactions [Option ID = 184356]

3. DNA-DNA interactions [Option ID = 184357]

4. Protein-Drug interactions [Option ID = 184358]

144) RNA sequencing methodology uses Next generation sequencing to sequence[Question ID = 27596][Question Description = S1_TROH_903_PhD_Q144]

1. cDNAs generated from DNA [Option ID = 184359]

2. RNA generated from cDNAs [Option ID = 184360]

3. cDNAs generated from RNA [Option ID = 184361]

4. All of the above [Option ID = 184362]

145) FASTQ format is mainly used for sequence read storage from the gene sequencing. The data contains the following information: [Question ID = 27597][Question Description = S1_TROH_903_PhD_Q145]

1. Sequence identifier [Option ID = 184363]

2. Nucleotide sequence [Option ID = 184364]

3. sequence quality score [Option ID = 184365]

4. All of the above [Option ID = 184366]

146) What would be approximate length of a protein chain having molecular weight of 16.5kDa?[Question ID = 27598][Question Description = S1_TROH_903_PhD_Q146]

1. 150 amino acids [Option ID = 184367]

2. 100 amino acids [Option ID = 184368]

3. 50 amino acids [Option ID = 184369]

4. 200 amino acids [Option ID = 184370]

147) A protein structure is simulated at room temperature. The initial structure of the protein is adopted from its PDB file. How to ensure that the simulation starts at room temperature?[Question ID = 27599][Question Description = S1_TROH_903_PhD_Q147]

1. By using a thermostat [Option ID = 184371]

2. By adding a random force [Option ID = 184372]

3. By assigning random velocities to the atoms from Maxwell velocity distribution at corresponding temperature [Option ID = 184373]

4. By using simulated annealing [Option ID = 184374]

148) Match List I with List II

List I	List II
A. Residues per turn in an Alpha helix	I. 3.6
B. Hydrogen bonding in an Alpha helix	II. $i \rightarrow i+5$
C. Residues per turn in a pi-helix	III. $i \rightarrow i+4$
D. Hydrogen bonding in a pi-helix	IV. 4.1

Choose the correct answer from the options given below:

[Question ID = 27600][Question Description = S1_TROH_903_PhD_Q148]

1. A-I, B-III, C-IV, D-II [Option ID = 184375]

2. A-II, B-I, C-IV, D-III [Option ID = 184376]

3. A-IV, B-II, C-I, D-III [Option ID = 184377]

4. A-III, B-I, C-II, D-IV [Option ID = 184378]

149) The correct order of absolute entropy of the following oligopeptide sequences at physiological temperature is

a) Val-Asp-Pro-Ser-Pro

b) Val-Gly-Ala-Gly-Gln

c) Ala-Ser-Ala-Phe-Asn

[Question ID = 27601][Question Description = S1_TROH_903_PhD_Q149]

1. S(b) > S(c) > S(a)
[Option ID = 184379]
2. S(a) > S(b) > S(c)
[Option ID = 184380]
3. S(a) > S(c) > S(b)
[Option ID = 184381]
4. S(c) > S(b) > S(a)
[Option ID = 184382]

150) At melting temperature, DNA

[Question ID = 27602][Question Description = S1_TROH_903_PhD_Q150]

1. is single stranded
[Option ID = 184383]
2. forms hairpin structure
[Option ID = 184384]
3. is in supercoiled state
[Option ID = 184385]
4. unzips half of its base pairs
[Option ID = 184386]

151) Given below are two statements:

Statement I: GOR V method of secondary structure prediction for proteins is based on Bayesian Statistics.

Statement II: GOR V method of secondary structure prediction for proteins is based on Evolutionary Information.

In the light of the above statements, choose the most appropriate answer from the options given below

[Question ID = 34303][Question Description = S1_TROH_903_PhD_Q151]

1. Both Statement I and Statement II are correct
[Option ID = 184387]
2. Both Statement I and Statement II are incorrect
[Option ID = 184388]
3. Statement I is correct but Statement II is incorrect
[Option ID = 184389]
4. Statement I is incorrect but Statement II is correct
[Option ID = 184390]

152) Which of the following protein motif is the most used secondary structure for specific DNA recognition?

[Question ID = 34304][Question Description = S1_TROH_903_PhD_Q152]

1. Beta-Helix-Beta
[Option ID = 184391]
2. Helix-Beta-Helix
[Option ID = 184392]
3. ZINC Finger
[Option ID = 184393]
4. Ca Finger
[Option ID = 184394]

153) The scoring systems derived from statistical analysis of residue substitution data from sets of reliable alignments of highly related sequences is termed as:

[Question ID = 34305][Question Description = S1_TROH_903_PhD_Q153]

1. Dynamic matrix
[Option ID = 184395]
2. Substitution matrix
[Option ID = 184396]
3. Sequence identity matrix
[Option ID = 184397]
4. Sequence homology
[Option ID = 184398]

154) Suppose in a sequence alignment if a set of globin sequences are added to set of protein kinase sequences then the probable alignment output will be[Question ID = 34306][Question Description = S1_TROH_903_PhD_Q154]

1. False Positive [Option ID = 184399]
2. True Positive [Option ID = 184400]
3. False Negative [Option ID = 184401]

4. True Negative [Option ID = 184402]

155) Given below are two statements:

Statement I: Unrooted tree can be used to study the phylogenetic relationship among taxonomic units but it does not show the evolutionary path.

Statement II: In phylogenetic analysis we cannot assign a root in an unrooted tree by using an outgroup.

In the light of the above statements, choose the most appropriate answer from the options given below

[Question ID = 34307][Question Description = S1_TROH_903_PhD_Q155]

1. Both Statement I and Statement II are correct

[Option ID = 184403]

2. Both Statement I and Statement II are incorrect

[Option ID = 184404]

3. Statement I is correct but Statement II is incorrect

[Option ID = 184405]

4. Statement I is incorrect but Statement II is correct

[Option ID = 184406]

156) In mammals DNA methylation is characterized by:[Question ID = 34308][Question Description = S1_TROH_903_PhD_Q156]

1. Addition of methyl group to adenine [Option ID = 184407]

2. Addition of methyl group to cytosine [Option ID = 184408]

3. Addition of methyl group to guanine [Option ID = 184409]

4. Addition of methyl group to thymine [Option ID = 184410]

157) Histone can be post-translationally modified by:[Question ID = 34309][Question Description = S1_TROH_903_PhD_Q157]

1. Methylation of Arginine [Option ID = 184411]

2. Acetylation of Lysine [Option ID = 184412]

3. Phosphorylation of Serine [Option ID = 184413]

4. All of the above [Option ID = 184414]

158) Given below are two statements:

Statement I: Alteration in the structural organization of the chromosome is called chromosomal aberration.

Statement II: Gene mutation is also a chromosomal aberration.

In the light of the above statements, choose the most appropriate answer from the options given below

[Question ID = 34310][Question Description = S1_TROH_903_PhD_Q158]

1. Both Statement I and Statement II are correct

[Option ID = 184415]

2. Both Statement I and Statement II are incorrect

[Option ID = 184416]

3. Statement I is correct but Statement II is incorrect

[Option ID = 184417]

4. Statement I is incorrect but Statement II is correct

[Option ID = 184418]

159) A. The amino acid sequence of a typical collagen polypeptide consists of monotonously repeating triplets of sequence GL-X-Y over a segment of ~ 1000 residues, where X and Y are respectively Alanine and Leucine

B. The amino acid sequence of a typical collagen polypeptide consists of monotonously repeating triplets of sequence GL-X-Y over a segment of ~ 1000 residues, where X and Y are respectively Alanine and Proline

C. The amino acid sequence of a typical collagen polypeptide consists of monotonously repeating triplets of sequence GL-X-Y over a segment of ~ 1000 residues, where X and Y are respectively Alanine and 4-Hydroxyprolyl

D. The amino acid sequence of a typical collagen polypeptide consists of monotonously repeating triplets of sequence GL-X-Y over a segment of ~ 1000 residues, where X and Y are respectively Proline and 4-Hydroxyprolyl

Choose the correct answer from the options given below:

[Question ID = 34311][Question Description = S1_TROH_903_PhD_Q159]

1. A Only

[Option ID = 184419]

2. B Only

[Option ID = 184420]

3. C Only

[Option ID = 184421]

4. D Only

[Option ID = 184422]

160) Given below are two statements:

Statement I: Alteration of methylation level within the GG Islands is one of the best characterised epigenetic alterations in tumour.

Statement II: NGS experiments showed that in general between 5-10% of normally unmethylated GG ptomotor islands adopt abnormal methylation level in the genomes of patients with various tumours.

In the light of above statements, choose the most appropriate answer from the options given below

[Question ID = 34312][Question Description = S1_TROH_903_PhD_Q160]

- Both Statement I and Statement II are correct
[Option ID = 184423]
- Both Statement I and Statement II are incorrect
[Option ID = 184424]
- Statement I is correct but Statement II is incorrect
[Option ID = 184425]
- Statement I is incorrect but Statement II is correct
[Option ID = 184426]

161) The system function $H(s) = \frac{2(s-2)}{(s-3)(s-1)(s-5)}$ has

[Question ID = 34313][Question Description = S1_TROH_903_PhD_Q161]

- One zero and three poles [Option ID = 184427]
- Two zeroes and one poles [Option ID = 184428]
- Two zeroes and two poles [Option ID = 184429]
- One zero and one pole [Option ID = 184430]

162) The response of a network to an arbitrary input in terms of the impulse response of the network can be determined through [Question ID = 34314][Question Description = S1_TROH_903_PhD_Q162]

- Waveform synthesis [Option ID = 184431]
- Fourier transform [Option ID = 184432]
- Convolution [Option ID = 184433]
- Final Value Theorem [Option ID = 184434]

163) “A photograph can be obtained from its negative and by using an identical procedure the negative can be obtained from the photograph”

This statement justifies the _____

[Question ID = 34315][Question Description = S1_TROH_903_PhD_Q163]

- Superposition Theorem [Option ID = 184435]
- Convolution Theorem [Option ID = 184436]
- Duality Theorem [Option ID = 184437]
- Final Value Theorem [Option ID = 184438]

164) Find the solution for $x''(t) + 3x'(t) + 2x(t) = 0$, given the initial conditions $x(0^+) = 2$, and $x'(0^+) = -1$

[Question ID = 34316][Question Description = S1_TROH_903_PhD_Q164]

- $x(t) = 3e^{-t} \cdot e^{-2t}$
[Option ID = 184439]
- $x(t) = -3e^{-t} + e^{-2t}$
[Option ID = 184440]
- $x(t) = -e^{-t} + 2e^{-t}$
[Option ID = 184441]
- $x(t) = 3e^{-t} + e^{-2t}$
[Option ID = 184442]

165) Avalanche photo diode is operated under a [Question ID = 34317][Question Description = S1_TROH_903_PhD_Q165]

- Small reverse bias condition [Option ID = 184443]
- Large reverse bias condition [Option ID = 184444]
- No bias condition [Option ID = 184445]
- Forward bias condition [Option ID = 184446]

166) The relationship between the large signal current gain of a common emitter transistor (β) and the large signal current gain of a common base transistor (α) is given as

[Question ID = 34318][Question Description = S1_TROH_903_PhD_Q166]

- $\beta = \frac{\alpha}{1-\alpha}$
[Option ID = 184447]
- $\alpha = \frac{\beta}{1-\beta}$
[Option ID = 184448]
- $\beta = \alpha(1-\alpha)$
[Option ID = 184449]
- $\alpha = \beta(1-\beta)$
[Option ID = 184450]

167) Tunneling happens in _____ doped p-n diode under _____ bias conditions. Fill the respective blanks [Question ID = 34319][Question Description = S1_TROH_903_PhD_Q167]

- Highly, reversed [Option ID = 184451]

2. Highly, forward [Option ID = 184452]
3. Lightly, reversed [Option ID = 184453]
4. Lightly, forward [Option ID = 184454]

168) A silicon transistor with $\beta=50$, $V_{cc}=10V$, $R_e=1.4K\Omega$, $R_b=2.96K\Omega$ and $V_{BE}=0.6V$. For self-bias configuration the stability factor S is

[Question ID = 34320][Question Description = S1_TROH_903_PhD_Q168]

1. 3
[Option ID = 184455]
2. 5
[Option ID = 184456]
3. 4
[Option ID = 184457]
4. 10
[Option ID = 184458]

169) Determine the current draw a dual power supply of $\pm 10V$, if the IC dissipates 500mW.

[Question ID = 34321][Question Description = S1_TROH_903_PhD_Q169]

1. 15.0 mA
[Option ID = 184459]
2. 24.0 mA
[Option ID = 184460]
3. 26.0 mA
[Option ID = 184461]
4. 25.0 mA
[Option ID = 184462]

170) The variation of DC output voltage as a function of DC load current is called regulation. For an ideal power supply percentage regulation is [Question ID = 34322][Question Description = S1_TROH_903_PhD_Q170]

1. 100 [Option ID = 184463]
2. 0 (zero) [Option ID = 184464]
3. 1 [Option ID = 184465]
4. 50 [Option ID = 184466]

171) Hexadecimal of decimal number 229 is[Question ID = 27603][Question Description = S1_TROH_903_PhD_Q171]

1. F5 [Option ID = 184467]
2. E4 [Option ID = 184468]
3. F3 [Option ID = 184469]
4. E5 [Option ID = 184470]

172) _____can be used for sampling of an analog signal[Question ID = 27604][Question Description = S1_TROH_903_PhD_Q172]

1. 4-bit parallel adder [Option ID = 184471]
2. 8085 microprocessor [Option ID = 184472]
3. Sample and hold circuit [Option ID = 184473]
4. BJT in CB configuration [Option ID = 184474]

173) Find out the false statement out of the following:[Question ID = 27605][Question Description = S1_TROH_903_PhD_Q173]

1. Latches can't be used for multiplexing data on to a bus [Option ID = 184475]
2. Latch is a type of temporary storage device [Option ID = 184476]
3. Latch is a type of multivibrator [Option ID = 184477]
4. Latch is a type of bistable logic device [Option ID = 184478]

174) The minimum SOP expression of

$$X\bar{Y}Z + \bar{X}YZ + \bar{X}\bar{Y}Z + \bar{X}\bar{Y}\bar{Z} + X\bar{Y}\bar{Z}$$

[Question ID = 27606][Question Description = S1_TROH_903_PhD_Q174]

1. $X+YZ$ [Option ID = 184479]
2. $\bar{Y} + \bar{X}Z$
[Option ID = 184480]
3. $\bar{X} + YZ$
[Option ID = 184481]
4. $\bar{Y} + XZ$
[Option ID = 184482]

175) Output of shift keying (ASK, PSK, FSK) will be_____in nature[Question ID = 27607][Question Description = S1_TROH_903_PhD_Q175]

1. Digital [Option ID = 184483]
2. Analog [Option ID = 184484]
3. Unit impulse [Option ID = 184485]
4. Analog and digital both [Option ID = 184486]

176) The average information per message of a source is referred as[Question ID = 27608][Question Description =

S1_TROH_903_PhD_Q176]

1. Channel Capacity [Option ID = 184487]
2. Entropy [Option ID = 184488]
3. Baud rate [Option ID = 184489]
4. Mean Square Error [Option ID = 184490]

177) In frequency modulation, modulating signal $m(t)$ is $A_m \cos(\omega_m t)$, frequency deviation is 10KHz and $f_m=4$ KHz. The transmission bandwidth of this FM signal is

[Question ID = 27609][Question Description = S1_TROH_903_PhD_Q177]

1. BT=38 KHz
[Option ID = 184491]
2. BT=18 KHz
[Option ID = 184492]
3. BT=28 KHz
[Option ID = 184493]
4. BT=24 KHz
[Option ID = 184494]

178) Determine the Nyquist sampling rate for the signal $\text{Sinc}(100\pi t) + \text{Sinc}(50\pi t)$

[Question ID = 27610][Question Description = S1_TROH_903_PhD_Q178]

1. 50 Hz
[Option ID = 184495]
2. 100 Hz
[Option ID = 184496]
3. 150 Hz
[Option ID = 184497]
4. 200 Hz
[Option ID = 184498]

179) Satellite is a type of _____[Question ID = 27611][Question Description = S1_TROH_903_PhD_Q179]

1. Modulator [Option ID = 184499]
2. Amplifier [Option ID = 184500]
3. Repeater [Option ID = 184501]
4. Circulator [Option ID = 184502]

180) For direct to home (DTH) TV, Ku band is used. Find the wavelength range for Ku band.

[Question ID = 27612][Question Description = S1_TROH_903_PhD_Q180]

1. 15 mm to 25 mm
[Option ID = 184503]
2. 7 mm to 28 mm
[Option ID = 184504]
3. 10 mm to 30 mm
[Option ID = 184505]
4. 16.67 mm to 25 mm
[Option ID = 184506]

181) An Electromagnetic wave is propagating in a medium having relative permittivity and relative permeability as 16.0 and 1.0, respectively. How much intrinsic impedance will be offered by this medium to the EM wave, if it is propagating in TEM mode?

[Question ID = 27613][Question Description = S1_TROH_903_PhD_Q181]

1. 377Ω
[Option ID = 184507]
2. 0.25Ω
[Option ID = 184508]
3. 94.25Ω
[Option ID = 184509]
4. 4.0Ω
[Option ID = 184510]

182) The elliptically polarized wave is traveling in the positive direction with X and Y directions electric field components

$$E_x = E_1 \sin(\omega t - \beta z)$$

$$E_y = E_2 \sin(\omega t - \beta z + \delta)$$

Elliptically polarized wave becomes circularly polarized wave when

[Question ID = 27614][Question Description = S1_TROH_903_PhD_Q182]

1. $E_1 = E_2$ and $\delta = \frac{\pi}{4}$
[Option ID = 184511]
2. $E_1 \neq E_2$ and $\delta = \pi$
[Option ID = 184512]

3. $E_1 = E_2$ and $\delta = \frac{\pi}{2}$

[Option ID = 184513]

4. $E_1 = E_2$ and $\delta = 2\pi$

[Option ID = 184514]

183) A rectangular air filled waveguide has a cross-section of $40 \times 90 \text{ mm}^2$. Find the cutoff wavelength for the dominant mode.

[Question ID = 27615][Question Description = S1_TROH_903_PhD_Q183]

1. 150 mm

[Option ID = 184515]

2. 180 mm

[Option ID = 184516]

3. 160 mm

[Option ID = 184517]

4. 170 mm

[Option ID = 184518]

184) Dominant mode of rectangular waveguide is _____ in which cut-off will be _____. Fill the respective blanks:

[Question ID = 27616][Question Description = S1_TROH_903_PhD_Q184]

1. TM_{10} , minimum

[Option ID = 184519]

2. TE_{10} , maximum

[Option ID = 184520]

3. TE_{10} , minimum

[Option ID = 184521]

4. TM_{10} , maximum

[Option ID = 184522]

185) The far field of the antenna of size 'L' is

[Question ID = 27617][Question Description = S1_TROH_903_PhD_Q185]

1. More than $\frac{2L^2}{\lambda}$

[Option ID = 184523]

2. Less than $\frac{2L^2}{\lambda}$

[Option ID = 184524]

3. Equal to $\frac{2L^2}{\lambda}$

[Option ID = 184525]

4. More than $\frac{2L}{\lambda}$

[Option ID = 184526]

186) A dipole antenna is placed in a medium, whose relative permittivity is 4.0 and relative permeability is 1.0. What should be the length of this dipole antenna to transmit a signal of 3.0 GHz frequency in the same medium, considering negligible fringing length?

[Question ID = 27618][Question Description = S1_TROH_903_PhD_Q186]

1. 50 mm

[Option ID = 184527]

2. 100 mm

[Option ID = 184528]

3. 75 mm

[Option ID = 184529]

4. 25 mm

[Option ID = 184530]

187) A monopole antenna is working on 6 GHz frequency. Its length will be _____

[Question ID = 27619][Question Description = S1_TROH_903_PhD_Q187]

1. 12.5 mm

[Option ID = 184531]

2. 25 mm

[Option ID = 184532]

3. 50 mm

[Option ID = 184533]

4. 6.25 mm

[Option ID = 184534]

188) Directivity 'D' of an antenna that radiates over only half a sphere is[Question ID = 27620][Question Description = S1_TROH_903_PhD_Q188]

1. $D=3$ [Option ID = 184535]
2. $D=4$ [Option ID = 184536]
3. $D=2$ [Option ID = 184537]
4. $D=1$ [Option ID = 184538]

189) Find out the correct statement[Question ID = 34343][Question Description = S1_TROH_903_PhD_Q189]

1. Proxy server increases the internet browsing speed [Option ID = 184539]
2. Proxy server decreases the internet browsing speed [Option ID = 184540]
3. Proxy server is essential for every LAN [Option ID = 184541]
4. Proxy server don't effect the internet browsing speed. [Option ID = 184542]

190) Bluetooth is _____ technology that connects devices in small area

[Question ID = 34344][Question Description = S1_TROH_903_PhD_Q190]

1. WLAN
[Option ID = 184543]
2. Wireless LAN
[Option ID = 184544]
3. Wired LAN
[Option ID = 184545]
4. MAN
[Option ID = 184546]

191) A processor has 16 integer registers (R0, R1, ..., R15) and 64 floating point registers (F0,F1,...,F63). It uses a 2-byte instruction format. There are four categories of instructions: Type-1, Type-2, Type-3, and Type-4. Type-1 category consists of four instructions, each with 3 integer register operands (3Rs). Type-2 category consists of eight instructions, each with 2 floating point register operands (2Fs). Type-3 category consists of fourteen instructions, each with one integer register operand and one floating point register operand (1R+1F). Type-4 category consists of N instructions, each with a floating point register operand (1F). N can be at most :[Question ID = 34345][Question Description = S1_TROH_903_PhD_Q191]

1. 16 [Option ID = 184547]
2. 32 [Option ID = 184548]
3. 64 [Option ID = 184549]
4. 2048 [Option ID = 184550]

192) A particular parallel program computation requires 100sec when executed on a single processor, if 40% of this computation is inherently sequential (i.e. will not benefit from additional processors), then theoretically best possible elapsed times of this program running with 2 and 4 processors, respectively, are:

[Question ID = 34346][Question Description = S1_TROH_903_PhD_Q192]

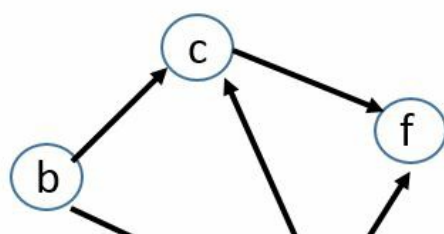
1. 20 sec and 10 sec
[Option ID = 184551]
2. 30 sec and 15 sec
[Option ID = 184552]
3. 50 sec and 25 sec
[Option ID = 184553]
4. 70 sec and 55 sec
[Option ID = 184554]

193) Consider the functions $f_1(n)=10^n$, $f_2(n)=n^{1/3}$, $f_3(n)=n^n$, and $f_4(n)=\log_2(n)$, that we want to arrange in ascending order of growth rate. That is, if a function $g(n)$ immediately follows function $f(n)$ then it should be the case that $f(n)$ is $O(g(n))$. Which one of the following arrangement is correct?

[Question ID = 34347][Question Description = S1_TROH_903_PhD_Q193]

1. f_4, f_2, f_1, f_3
[Option ID = 184555]
2. f_4, f_2, f_3, f_1
[Option ID = 184556]
3. f_4, f_1, f_2, f_3
[Option ID = 184557]
4. None of the above
[Option ID = 184558]

194) Consider the directed acyclic graph G as given below.





How many topological orderings does it have?

[Question ID = 34348][Question Description = S1_TROH_903_PhD_Q194]

1. 0 [Option ID = 184559]
2. 1 [Option ID = 184560]
3. 4! [Option ID = 184561]
4. None of the above [Option ID = 184562]

195) Suppose you are given an array A having heights information of individuals and each height value is distinct. Further you are told that the sequence of values $A[1], A[2], \dots, A[n]$ are arranged in unimodal fashion, for some p in A's indexes, $1 \leq p \leq n$, the values in the array entries increase up to position p in A, then decrease the remainder of the way until n . You would like to find the peak p . How many operations at minimum you would require to find p ?

[Question ID = 34349][Question Description = S1_TROH_903_PhD_Q195]

1. $n^{1/2}$
[Option ID = 184563]
2. $\log_2(n)$
[Option ID = 184564]
3. 1
[Option ID = 184565]
4. None of the above
[Option ID = 184566]

196) An algorithm to find the length of the longest monotonically increasing sequence of numbers in the array $A[0, n-1]$ is as follows:

Let L_i denotes the length of the longest monotonically increasing sequence starting at index i in the array.

Initialize $L_{n-1} = 1$

For all i such that $0 \leq i \leq n-2$ set

$L_i = 1 + L_{i+1}$ if $A[i] < A[i+1]$

$L_i = 1$ otherwise

Finally the length of the longest monotonically increasing sequence is $\max(L_0, L_1, \dots, L_{n-1})$.

Which of the following statements is True?

[Question ID = 34350][Question Description = S1_TROH_903_PhD_Q196]

1. The algorithm uses dynamic programming paradigm.
[Option ID = 184567]
2. The algorithm has a linear complexity and uses branch and bound strategy.
[Option ID = 184568]
3. The algorithm has a non-linear complexity and uses branch and bound strategy.
[Option ID = 184569]
4. The algorithm uses divide and conquer paradigm.
[Option ID = 184570]

197) Consider the following C function definition.

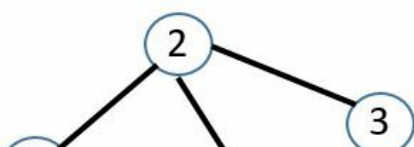
```
int T (int a, int b, int c){
if ( (a >= b && (c < b)) return b;
else if (a >= b) return T(a,c,b);
else return T(b,a,c); }
```

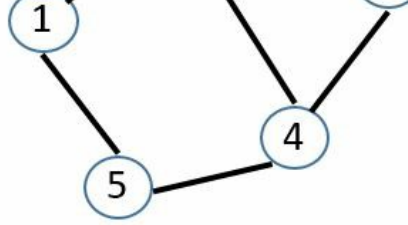
The function T

[Question ID = 34351][Question Description = S1_TROH_903_PhD_Q197]

1. Finds the maximum of a, b and c.
[Option ID = 184571]
2. Find the minimum of a, b, c.
[Option ID = 184572]
3. Finds the middle element of a, b, c
[Option ID = 184573]
4. None of the above.
[Option ID = 184574]

198) Consider the graph G given below.





Let us start the DFS traversal on G starting from vertex 2. Which out of the below given traversals are not possible?

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

Choose the correct answer from options given below:

[Question ID = 34352][Question Description = S1_TROH_903_PhD_Q198]

1. A and C

[Option ID = 184575]

2. A and B

[Option ID = 184576]

3. B and C

[Option ID = 184577]

4. A and B

[Option ID = 184578]

199) Consider the following C program that attempts to locate an element x in an array Y[] using binary search. The program is erroneous logically.

```
f(int Y[10], int x) {
    int i , j , k ;
    i = 0; j =9;
    do {
        k = (i + j )/ 2;
        if (Y[k] < x) i=k;
        else j = k;
    } while (Y[k] != x && i < j );
    if ( Y [k] == x) printf ("x is in the array");
    else printf ("x is not in the array");
}
```

On which of the following inputs of Y and x does the function fail?

[Question ID = 34353][Question Description = S1_TROH_903_PhD_Q199]

1. Y is [1,2,3,4,5,6,7,8,9,10] and X < 10

[Option ID = 184579]

2. Y is [1,3,5,7,9,11,13,15,17,19] and X < 1

[Option ID = 184580]

3. Y is [2,2,2,2,2,2,2,2,2,2] and X > 2

[Option ID = 184581]

4. Y is [2,4,6,8,10,12,14,16,18,20] and $2 < x < 20$ and x is even.

[Option ID = 184582]

200) Given a set of 'n' elements, we want to organize them to find all the elements that are smaller than an input 'x'. We use the following methods to organize our elements.

- A. Binary Search Tree of 'n' elements
- B. Min-heap of 'n' elements
- C. A sorted array of elements
- D. A linked list of sorted elements

Which of the below statements are correct?

[Question ID = 34354][Question Description = S1_TROH_903_PhD_Q200]

- 1. A would be the best and B would be the worst data structures out of four given. [Option ID = 184583]
- 2. C and D, both, would be the best data structures to do the task [Option ID = 184584]
- 3. A, C and D are the best data structures and would take equal time for retrieving the elements. [Option ID = 184585]
- 4. None of the above. [Option ID = 184586]

201) Let R be a regular expression matching a language L. For which conditions below can we construct a regular expression for matching L^* [Question ID = 34355][Question Description = S1_TROH_903_PhD_Q201]

- 1. When L is finite [Option ID = 184587]
- 2. When L is infinite [Option ID = 184588]

3. When L is not a subset of a non-regular language [Option ID = 184589]
4. All of the above [Option ID = 184590]

202) Which of the following are valid ways to prove that a language L is regular?

- A. Take a string w in L longer than its pumping length and then show that pumping up w gives a string not in L.
- B. Take a string w in L longer than its pumping length and then show that pumping up w gives a string in L.
- C. Take a string w in L longer than its pumping length and then show that pumping up w gives a string in L.
- D. Construct a DFA that goes to some final state if and only if its input does not belong to L.

Choose the correct answer

[Question ID = 34356][Question Description = S1_TROH_903_PhD_Q202]

1. A,B,C [Option ID = 184591]
2. D [Option ID = 184592]
3. A,B [Option ID = 184593]
4. A,D [Option ID = 184594]

203) Match the following:

Let L be the language $\{w : w \in \{0,1\}^* \text{ such that reverse of } w \text{ is identical to } w\}$. $A \setminus B$ denotes the set A minus the set B.

A.	$\{0,1\}^* \setminus L$	I.	CFL
B.	L	II.	Decidable
C.	Set of Turing Machines that accept L	III.	Regular
D.	$L \setminus \{0,1\}^*$	IV.	Undecidable

[Question ID = 34357][Question Description = S1_TROH_903_PhD_Q203]

1. A-I, B-III, C-IV, D-II [Option ID = 184595]
2. A-II, B-IV, C-I, D-III [Option ID = 184596]
3. A-II, B-I, C-IV, D-III [Option ID = 184597]
4. A-I, B-III, C-II, D-IV [Option ID = 184598]

204) Suppose a Turing machine is designed whose accepting state is the same as its starting state. What can be said about this Turing machine?[Question ID = 34358][Question Description = S1_TROH_903_PhD_Q204]

1. This is not a valid TM. [Option ID = 184599]
2. The Turing machine accepts the empty string but no other string. [Option ID = 184600]
3. The Turing machine accepts all non-empty strings but not the empty string. [Option ID = 184601]
4. The Turing machine accepts all strings. [Option ID = 184602]

205) Which of these is NOT an advantage of using shared, dynamically linked libraries as opposed to using statically linked libraries?

[Question ID = 34359][Question Description = S1_TROH_903_PhD_Q205]

1. Lesser overall page fault rate in the system [Option ID = 184603]
2. Faster program startup [Option ID = 184604]
3. Existing programs need not be relinked to take advantage of newer versions of libraries [Option ID = 184605]
4. Smaller size of executable files [Option ID = 184606]

206) Consider the following grammar about arithmetic expressions.

$E \rightarrow T \mid T + E \mid T - E$

$T \rightarrow P \mid P * T \mid P / T$

$P \rightarrow \text{identifier} \mid (E)$

What can be said about the grammar?

[Question ID = 34360][Question Description = S1_TROH_903_PhD_Q206]

1. It gives multiplication precedence over division.

[Option ID = 184607]

2. It gives division precedence over multiplication.

[Option ID = 184608]

3. It gives the same precedence to multiplication and division.

[Option ID = 184609]

4. The question of precedence between multiplication and division is meaningless.

[Option ID = 184610]

207) Assume that an integer variable takes 32 bits and a character variable takes 8 bits. During the compilation of a C program, we observed the following intermediate code generated for accessing $X[i][j][k]$.

$t0 = i * 1024$

$t1 = j * 32$

$t2 = k * 4$

$t3 = t1 + t0$

$t4 = t3 + t2$

$t5 = X[t4]$

What can be said about the declaration of X in the C program?

[Question ID = 34361][Question Description = S1_TROH_903_PhD_Q207]

1. int X[32][32][8] [Option ID = 184611]
2. int X[4][1024][32] [Option ID = 184612]
3. char X[4][32][8] [Option ID = 184613]
4. char X[32][16][2] [Option ID = 184614]

208) Consider the following code segment.

```
x = u - t;  
y = x * v;  
x = y + w;  
y = t - z;  
y = x * y;
```

The minimum number of total variables required to convert the above code segment to static single assignment form is:

[Question ID = 34362][Question Description = S1_TROH_903_PhD_Q208]

1. 6
[Option ID = 184615]
2. 8
[Option ID = 184616]
3. 9
[Option ID = 184617]
4. 10
[Option ID = 184618]

209) Which one of the following is the deadlock avoidance algorithm?[Question ID = 27621][Question Description = S1_TROH_903_PhD_Q209]

1. Round Robin algorithm [Option ID = 184619]
2. Elevator algorithm [Option ID = 184620]
3. Karn's algorithm [Option ID = 184621]
4. Banker's algorithm [Option ID = 184622]

210) What is compaction in operating system?[Question ID = 27622][Question Description = S1_TROH_903_PhD_Q210]

1. A paging technique [Option ID = 184623]
2. A technique for overcoming external fragmentation [Option ID = 184624]
3. A technique for overcoming internal fragmentation [Option ID = 184625]
4. A technique for overcoming fatal errors [Option ID = 184626]

211) The wait operation of the semaphore usually works on the _____ system call.[Question ID = 27623][Question Description = S1_TROH_903_PhD_Q211]

1. stop () [Option ID = 184627]
2. hold() [Option ID = 184628]
3. block() [Option ID = 184629]
4. wait() [Option ID = 184630]

212) In a paged segmented system a virtual address consist of 32 bits of which 12 bits are displacement, 11 bits are segment number and a bits are page number. What will be the maximum number of pages and maximum number of segment?[Question ID = 27624]
[Question Description = S1_TROH_903_PhD_Q212]

1. 2^{23} and 2^{20} [Option ID = 184631]
2. 2^{20} and 2^{23} [Option ID = 184632]
3. 2^{22} and 2^{20} [Option ID = 184633]
4. 2^{20} and 2^{22} [Option ID = 184634]

213) Consider a relation with schema R(A,B,C,D) and FDs $AB \rightarrow x$, $C \rightarrow D$, and $D \rightarrow A$. Which of the following FDs follow from the given FDs?

[Question ID = 27625][Question Description = S1_TROH_903_PhD_Q213]

1. $B \rightarrow A$
[Option ID = 184635]
2. $A \rightarrow B$
[Option ID = 184636]
3. $C \rightarrow B$
[Option ID = 184637]
4. None of the above
[Option ID = 184638]

214) Consider the following schedules for transactions T1, T2 and T3 having their read and write operations. $R_j(x)$ denotes a read operation by transaction j on data item x, whereas $W_j(x)$ denotes a write operation by transaction j on data item x.

$R_1(A)$, $R_2(A)$, $R_3(B)$, $W_1(A)$, $R_2(C)$, $R_2(B)$, $W_2(B)$, $W_1(C)$

Which of the following serial schedules are conflict equivalent to the above schedule?

[Question ID = 27626][Question Description = S1_TROH_903_PhD_Q214]

1. T2, T3, T1 [Option ID = 184639]
2. T1, T2, T3 [Option ID = 184640]
3. T3, T1, T2 [Option ID = 184641]
4. T3, T2, T1 [Option ID = 184642]

215) Suppose relation R has n tuples. What would be the maximum number of tuples produced for the relational algebraic expression

$\pi_L(R) \times R$ for some list of attributes L.[Question ID = 27627][Question Description = S1_TROH_903_PhD_Q215]

1. $n \log n$ [Option ID = 184643]
2. n [Option ID = 184644]
3. n^2 [Option ID = 184645]
4. None of the above [Option ID = 184646]

216) Consider a relation Supplier (sid, sname, pid, pname) having information of the products supplied by suppliers. Which of the following SQL queries find the suppliers who supply at least two products?

- A. Select sid From Supplier group by sid Having count(*) >= 2
- B. Select sid From Supplier S1 Where EXISTS (Select sid From Supplier Where S1.sid = sid)
- C. Select sid From Supplier S1 Where EXISTS (Select sid from Supplier Where pid != S1.pid)
- D. Select sid From Supplier S1 Where S1.sid IN (Select Sid from Supplier Where sid = S1.sid and pid > S1.pid)

Choose the correct option:

[Question ID = 27628][Question Description = S1_TROH_903_PhD_Q216]

1. A and B
[Option ID = 184647]
2. B and C
[Option ID = 184648]
3. C and D
[Option ID = 184649]
4. A and D
[Option ID = 184650]

217) The address size of IPv6 protocol is _____.[Question ID = 27629][Question Description = S1_TROH_903_PhD_Q217]

1. 32 bit [Option ID = 184651]
2. 64 bit [Option ID = 184652]
3. 128 bit [Option ID = 184653]
4. 256 bit [Option ID = 184654]

218) What is the meaning of Bandwidth in computer network?[Question ID = 27630][Question Description = S1_TROH_903_PhD_Q218]

1. Transmission capacity of a communication channel. [Option ID = 184655]
2. Class of internet protocol used in computer network [Option ID = 184656]
3. Computers connected in a single network [Option ID = 184657]
4. None of the following [Option ID = 184658]

219) In blowfish algorithm usually key expansion converts a key at most 448 bits into several sub key arrays totalling _____ bytes.[Question ID = 27631][Question Description = S1_TROH_903_PhD_Q219]

1. 4096 [Option ID = 184659]
2. 4168 [Option ID = 184660]
3. 4608 [Option ID = 184661]
4. 4864 [Option ID = 184662]

220) What is the requirement of Bridge in Computer Network?

[Question ID = 27632][Question Description = S1_TROH_903_PhD_Q220]

1. To separate LANs
[Option ID = 184663]
2. To Connect LANs
[Option ID = 184664]
3. To control network speed
[Option ID = 184665]
4. All of the above
[Option ID = 184666]