



SciQuest

Class XII

by Zaariya



16 November, 2019.

TIME ALLOTTED: 2 HOURS

INSTRUCTIONS TO CANDIDATES

1. The Answer Sheet is kept inside this Test Booklet. When you are directed to open the Test Booklet, take out the Answer Sheet and fill in the particulars carefully.
2. This examination paper contains **EIGHTY(80)** questions and comprises **TWENTY EIGHT(28)** printed pages.
3. There are **FOUR(4)** parts in this question paper A, B, and C and D having 20 questions each.
4. Part A and Part B are common for all students, where as those who have opted for PCM and, for PCB are to attempt Part C and, Part D respectively.
5. The **last 5 questions** of each part are worth **+FOUR(4)** marks each and a wrong answer will result in deduction of **ONE(1)** mark.
6. The remaining questions are worth **+TWO(2)** marks and a wrong answer will result in deduction of **HALF(1/2)** mark from the total score.
7. Unattempted questions will not affect your score.
8. There is only one correct response to each question. Filling up more than one response in any question will be treated as a wrong response.
9. No candidate is allowed to carry any textual material, printed or written, bits of papers, pager, mobile phone, any electronic device, etc. inside the examination room/hall.

Personal Details

Name of the Candidate

Registration Number

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Centre Code

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Part A- PHYSICS

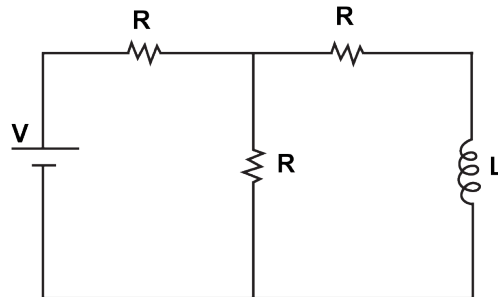
1. Suppose a new radioactive substance is discovered at NISER this year and its half-life is found to be 2 hours. But its intensity of radiation is 64 times the safe level. The minimum time after which work can be done safely with this source is
 - (a) 6 hours
 - (b) 12 hours
 - (c) 24 hours
 - (d) 48 hours
2. Which of the following is true?
 - (a) Electric field exists as closed-loop but induced electric field is not closed
 - (b) Induced electric field is a conservative field force
 - (c) Tangent at any point on the magnetic field lines does not always point to the direction of magnetic force
 - (d) Magnetic force is always an action-reaction force
3. Calculate the excess pressure in a charged liquid drop with radius R , surface tension T , and σ as the surface charge density
 - (a) zero
 - (b) $\frac{2T}{R} + \frac{\sigma^2}{2\epsilon}$
 - (c) $\frac{2T}{R} - \frac{\sigma^2}{2\epsilon}$
 - (d) $\frac{\sigma^2}{2\epsilon} - \frac{2T}{R}$
4. Which of the following is true about EM waves?
 - (a) Its propagation obeys the inverse square law
 - (b) It cannot be reflected or refracted
 - (c) The \vec{E} and \vec{B} fields are not always in phase
 - (d) SI unit of Poynting vector is $\frac{\text{watt}}{\text{m}}$

Space for rough work

5. Calculate the de broglie wavelength of an alpha particle which is accelerated by 0.01020 volts

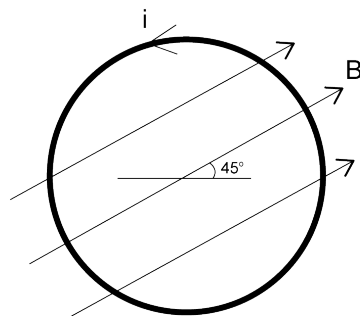
- (a) 3\AA (b) 7\AA (c) 1\AA (d) 4\AA

6. In the given circuit calculate the amount of current flowing through the inductor in time $t = 2L$.
Given, $R = 1\text{ ohm}$, $V = 3\text{ volts}$ (Take: $e^{-1} = 0.36$, $e^{-2} = 0.13$, $e^{-3} = 0.049$)



- (a) 0.86A (b) 1.67A (c) 1.13A (d) 0.95A

7. Following is the ring with current 6A flowing in anticlockwise direction kept in a magnetic field 3 tesla as shown in the figure. Find the angular acceleration of its rotation in SI units



- (a) 32π (b) 36π (c) 16π (d) 3π

Space for rough work

8. In a series CR and LR circuit with AC power source, what happens to the voltage drop across the capacitor(V_C) and the inductor(V_L) with increase in frequency?
- (a) V_C increases, V_L decreases (b) Both increase
(c) Both decrease (d) V_C decreases, V_L increases
9. C.J. Davisson and L.H. Germer won the Nobel Prize in 1937 for their experimental discovery. The experiment is now known as the famous Davisson–Germer experiment. What had they found?
- (a) Diffraction of Electrons (b) Polarization of Electrons
(c) Particle Nature of Light (d) Existence of Ether
10. The density of the nucleus of an atom _____
- (a) increases with Atomic Number (b) decreases with Atomic Number
(c) follows no known trend (d) is independent of Atomic Number
11. What is the charge on p-type and n-type semiconductors?
- (a) positive and negative respectively (b) negative and positive respectively
(c) Both are Neutral (d) Both are Negative
12. In some materials, an increase in temperature leads to an increase in the energy of electrons, which increases the number of carriers in the material. But such an increase in electron density decreases the average time between two collisions. Considering these two factors, what happens to the resistivity of the material with increase in temperature:
- (a) Decreases for Semiconductors (b) Decreases for Metals
(c) Decreases for all materials (d) Increases for all materials

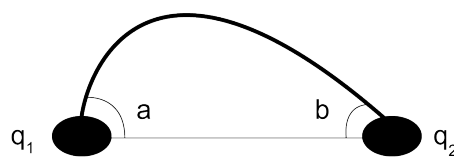
Space for rough work

13. Consider the following two statements:

- (A) Changing magnetic field always gives rise to electric field
(B) Changing electric field always gives rise to magnetic field

Now choose the correct option:

- (a) A is incorrect (b) B is incorrect
(c) Both A and B are incorrect (d) Both A and B are correct
14. The speed of light in any material depends on the permittivity and permeability of the material. In your lab, you discover a diamagnetic material whose permittivity is exactly the same as that of free space. What will be the speed of light in this material?
- (a) Less than the speed of light in vacuum (b) More than the speed of light in vacuum
(c) Same as the speed of light of vacuum (d) It depends on the intensity of light
15. A small water bubble is trapped in a solution whose refractive index is close to that of air. A solute is continuously added in the solution such that its refractive index keeps increasing till it reaches the value 2. How will the focal length of the bubble vary?
- (a) It will remain constant throughout the experiment
(b) It will decrease from a positive value to zero
(c) It will decrease from positive to a negative value
(d) It will increase throughout the experiment
16. An electric line of flux originates from positive charge q_1 at an angle 'a' and ends on a negative charge q_2 at an angle 'b'. Find the ratio of q_1 to q_2 :



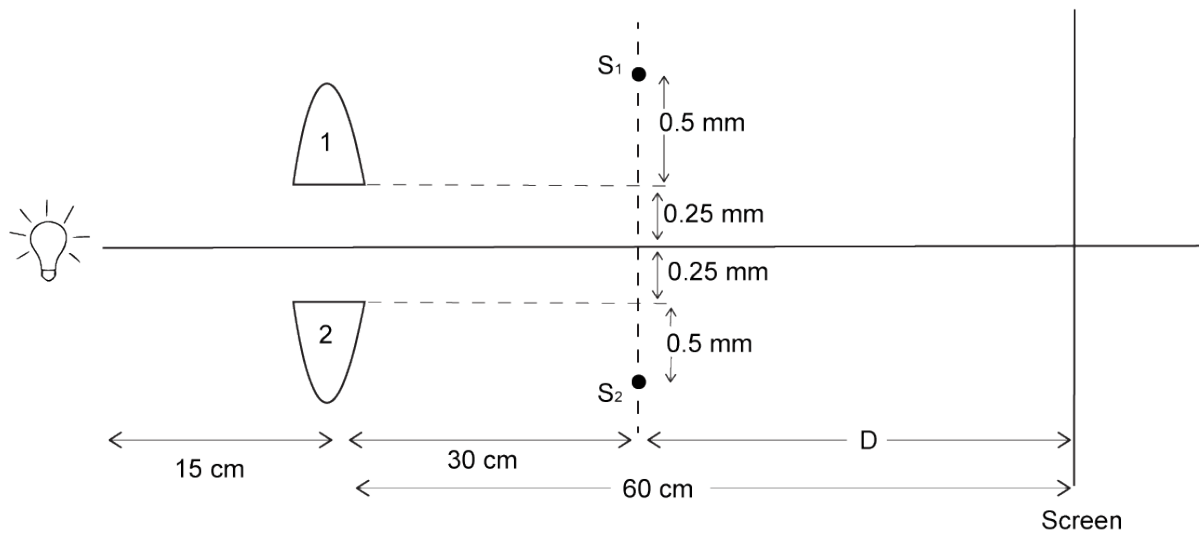
- (a) $\frac{\cos a}{\cos b}$ (b) $\frac{\cos b}{\cos a}$ (c) $\frac{1 - \cos b}{1 - \cos a}$ (d) None of the above

Space for rough work

17. There are two polarizers A and B mutually perpendicular to each other, hence when light of intensity I falls on A, the output from B has zero intensity. Now two polarizers M and N are placed between A and B, and are oriented such that the output intensity from B is maximum. What is the output intensity of light?

(a) $\frac{I}{8}$ (b) $\frac{9I}{64}$ (c) $\frac{27I}{128}$ (d) $\frac{27I}{64}$

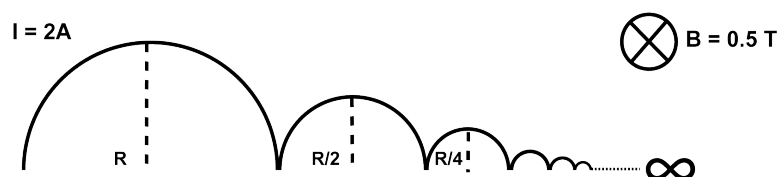
18. A convex lens of focal length 10 cm is cut into two halves which are moved apart to a separation of 0.5 mm. A point source of monochromatic light of wavelength λ is 5000\AA is placed in front of the lens at a distance of $r = 15\text{ cm}$ from it. Find the fringe width on the screen at a distance of 60 cm behind the lens



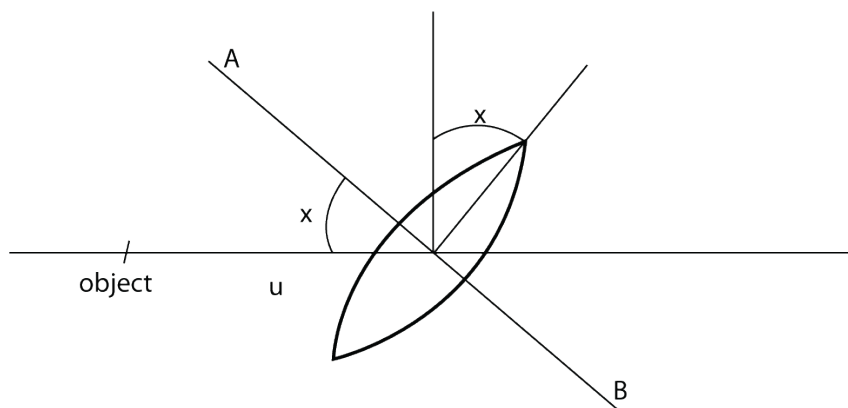
(a) 0.1 mm (b) 0.2 mm (c) 0.3 mm (d) 0.4 mm

Space for rough work

19. A uniform bent wire is placed in a magnetic field as shown. What is the value of $\frac{mass}{length}$ (mass per unit length of the wire) so that the wire is in equilibrium?



- (a) $\frac{2}{\pi g}$ (b) $\frac{2R}{\pi g}$ (c) $\frac{\pi g}{2}$ (d) $\frac{2}{g}$
20. An object is placed at a distance u from the center of a convex lens of focal length f . The image formed is at a distance v from the center of the lens. If the lens is rotated by an angle x , then according to the given figure, what is the length of the projection of the line joining the new image and the center of the lens on the line AB?

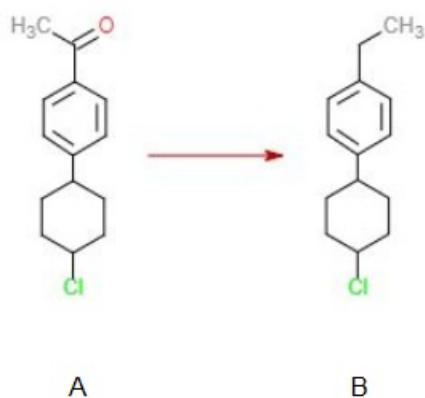


- (a) $\frac{fv \cos x}{f + v(\cos x - 1)}$ (b) $\frac{fv \cos x}{f - v(\cos x - 1)}$ (c) $\frac{fv \cos x}{f + v(\cos x + 1)}$ (d) $\frac{fv \cos x}{f - v(\cos x + 1)}$

Space for rough work

Part B- CHEMISTRY

21. Which of the following statements is true?
- (a) Pb^{4+} is a weaker oxidizing agent than Sn^{4+}
 - (b) Tl^{3+} is more stable than Tl^{1+}
 - (c) Pb^{2+} is a stronger reducing agent than Sn^{2+}
 - (d) PbSO_4 decomposes on strong heating giving off SO_2 gas
22. A slightly acidic solution contains the following ions:- Fe^{3+} , Cu^{2+} , Zn^{2+} . Which of the following can you add to the solution in excess to get direct identification of only Fe^{3+}
- (a) Conc.HCl
 - (b) Conc. NaOH
 - (c) Conc. NH_3
 - (d) H_2S gas
23. Suppose you are to reduce an organic compound, A to B.

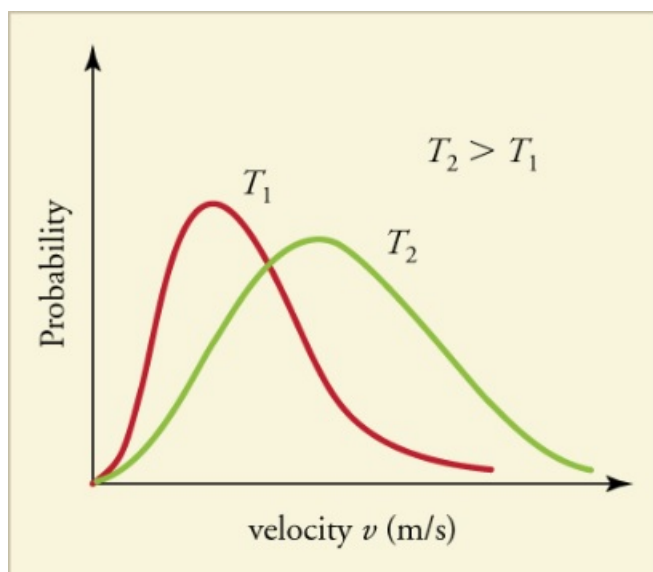


Which reagent among the following is most appropriate for this transformation?

- (a) NH_2-NH_2
- (b) $\text{Zn}-\text{Hg}/\text{conc.HCl}$, heat
- (c) Both A and B
- (d) None of these

Space for rough work

24. The maxwell distribution curve for an ideal gas at temperature T_1 and temperature T_2 is shown below-

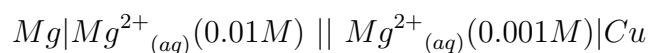


Choose the correct statement

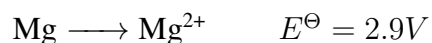
- (a) The total area under the curves is independent of the moles of the gases
 - (b) $T_1 > T_2$; Higher the temperature, sharper is the curve
 - (c) U_{mps} decreases as temperature increases
 - (d) The equilibrium constant K of the reaction at temperatures T_1 and T_2 are related as $K_{T_1} > K_{T_2}$
25. Choose the incorrect statement with respect to $[\text{Pt}(\text{NH}_3)_4][\text{PtCl}_4]$
- (a) It is a polymerisation isomer of $[\text{Pt}(\text{NH}_3)_3\text{Cl}_3]$
 - (b) EAN of cationic part is equal to that of anionic part
 - (c) It is the coordination isomer of $[\text{Pt}(\text{NH}_3)_3\text{Cl}][\text{Pt}(\text{NH}_3)\text{Cl}_3]$
 - (d) It does not involve coordinate bonding

Space for rough work

26. Lyophobic sols are stable in the presence of lyophilic sols, what is the cause for this?
- Adsorption of lyophilic sols on lyophobic sols
 - Lyophobic sols are self stabilized, there is no link to lyophilic sol
 - Lyophilic sols separate out the flocculating ions causing lyophobic sols to stabilize
 - Lyophilic sols maintain the critical micelle concentration for Lyophobic sols
27. When NaCl and $K_2Cr_2O_7$ are stirred in a beaker and warmed with H_2SO_4
- A deep blue colored gas is formed
 - The gas evolved on passing through NaOH forms a purple coloured solution
 - Deep green vapours are evolved
 - CrO_2Cl_2 is formed
28. What will be the EMF of the following cell:



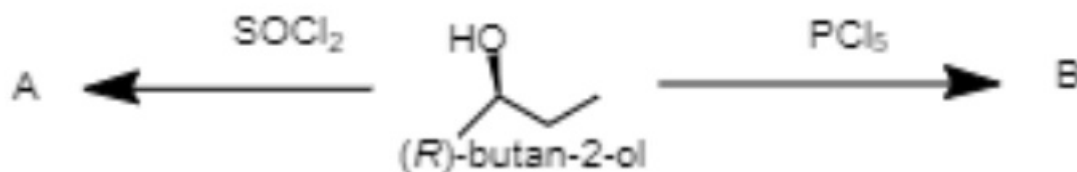
The standard electrode potentials are:



- (a) 2.53 V (b) 2.37 V (c) 2.67 V (d) 2.34 V

Space for rough work

29. Consider the following two reactions in which R-Butan-2-ol gives 'A' on reaction with SOCl_2 , and 'B' on reaction with PCl_5 respectively.



The Stereochemical configuration of the chiral centres of A and B respectively are:-

- (a) R and S (b) S and R
- (c) S and S (d) R and R
30. The **incorrect** order for the properties mentioned below is:
- (a) Solubility in water: $\text{BeSO}_4 > \text{MgSO}_4 > \text{CaSO}_4 > \text{SrSO}_4 > \text{BaSO}_4$
- (b) Thermal Stability: $\text{LiOH} < \text{NaOH} < \text{KOH} < \text{RbOH} < \text{CsOH}$
- (c) Acidic Character: $\text{N}_2\text{O} > \text{NO} > \text{N}_2\text{O}_3 > \text{NO}_2 > \text{N}_2\text{O}_5$
- (d) Bond dissociation energy: $\text{F}_2 < \text{Cl}_2 < \text{Br}_2 > \text{I}_2$
31. In Synergic bonding between a metal and carbonyl, if the number of unpaired electrons in the valence shell of the metal increases, the strength of C-O bond
- (a) Increases (b) Decreases
- (c) Cannot be predicted (d) Bond breaks down

Space for rough work

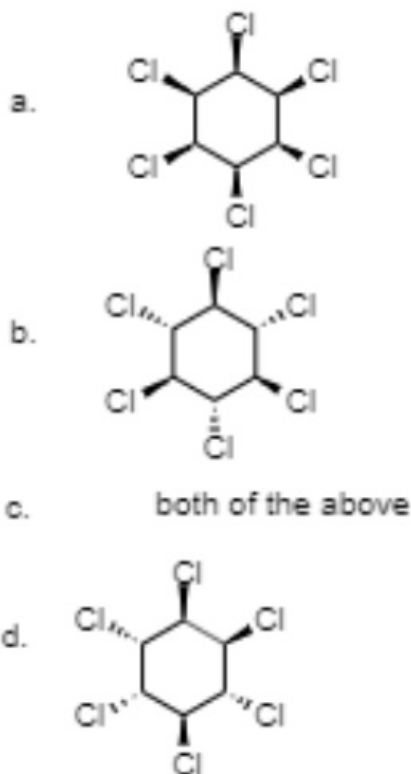
32. The reaction given below is used in extraction of aluminium from its ore, however, there is a limitation to this process. From where can you get the ore to subject it to this process?



- (a) From an area with lots of sand and rocky structures
(b) From an area with an iron ore nearby
(c) From an area with a copper ore nearby
(d) From an area with a tin ore nearby.
33. Shivam was performing an experiment with Methyl alcohol, when 50 ml of water fell into a beaker containing 100 ml pure Methyl alcohol. What will be the resultant volume and will he be able to separate the mixture completely using distillation?
- (a) Less than 150 ml, Yes
(b) More than 150 ml, No
(c) Less than 150 ml, No
(d) More than 150 ml, Yes
34. On reacting anisole with sodium in liquid ammonia, the product is
- (a) 1-methoxycyclohex-1,3-diene
(b) Hex-2,3-diene
(c) 2-methoxycyclohex-1,4-diene
(d) 1-methoxycyclohex-1,4-diene
35. In a solid, the anions are arranged in fcc lattice and the cations occupy all octahedral voids. The $\frac{r}{R}$ ratio is 0.5. What is the packing fraction of the unit cell?
- (a) 0.698
(b) 0.833
(c) 0.659
(d) None of these
36. While considering Bohr's atomic model, we assume that the nucleus is rigid at the centre of the atom. However, the nucleus also revolves in tandem with the electron. This makes a difference in the resultant mass that we finally see in the results. What should be the correct value for the mass of nucleus in the result after considering this? (M is the mass of nucleus and m is the mass of an electron)
- (a) $\frac{m}{1 + m/M}$
(b) $\frac{mM}{M - m}$
(c) $M \frac{m(1 + M)}{M - m}$
(d) $\frac{M}{1 + m/M}$

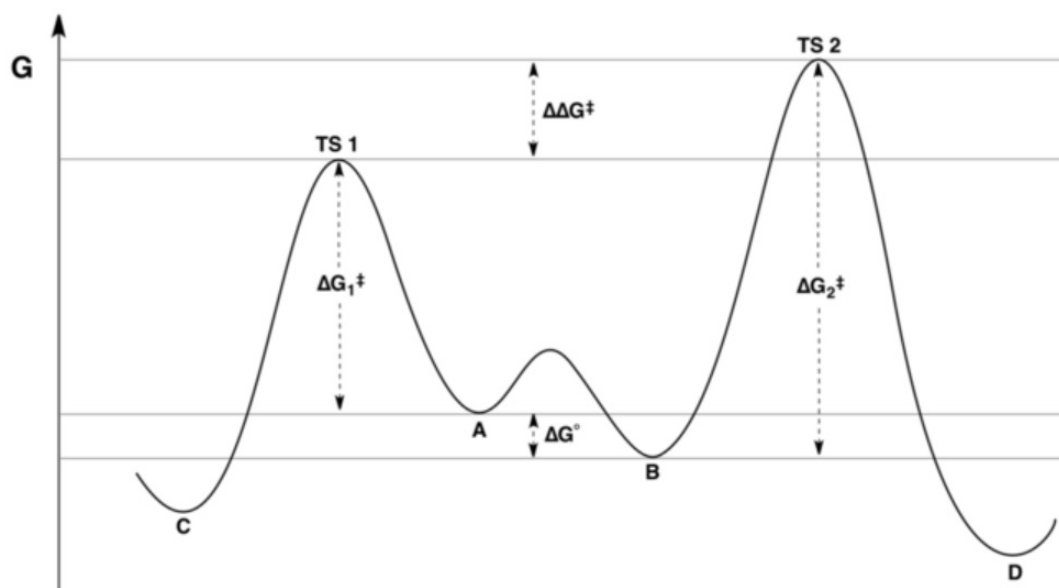
Space for rough work

37. Carbenes are an important intermediate in various organic reactions. The Riemer Tiemann reaction is one of the most well known reaction of Organic chemistry. It is used in the synthesis of salicylaldehyde. However, the reaction has some side products as well. When pyrrole is reacted with chloroform in basic medium, the product formed is
- (a) Meta-chloropyridine (b) 2-dichloromethylpyrrole
(c) Piperazine (d) 2-Chloro-3-nitro benzene
38. Reductive Ozonolysis of 2-methyl-but-2-ene gives two products X and Y. X and Y on treatment with base in the same beaker will give how many products?
- (a) 1 (b) 2 (c) 3 (d) 4
39. Which of the following cyclohexane derivatives cannot undergo E_2 elimination at all on treatment with alc. KOH?



Space for rough work

40. Consider the potential energy diagram below in which A and B are two rapidly inter-converting conformers of a reactant. Suppose under a reaction condition, conformation A of reactant gives C and conformation B gives D as the product. Provided the Products C and D are not inter-convertible amongst themselves, What will be the major product formed in the reaction?



- (a) C
(b) D
(c) Both get formed equally
(d) None of these

Space for rough work

Part C- MATHEMATICS

41. $A + B = 2B'$

$6A + 5B = I.$

Where I is the 3×3 matrix identity matrix and B' is the transpose of B . Then $A = ?$

(a) $\frac{5I}{11}$

(b) $\frac{I}{11}$

(c) $\frac{6I}{11}$

(d) None of the above

42. If $ax^2 + bx + c$ has no roots on the real line, then the nature of the function $f(x) = x^3 + 3bx^2 + 6acx + d$ is

(a) Strictly increasing

(b) Strictly decreasing

(c) Increasing but not strictly

(d) Decreasing but not strictly

43. $\int_{-k}^k 1 - 2 \sin^2 \frac{x}{2} - 2 \tan\left(\frac{\pi}{4} - x\right) \frac{\sin x}{\sin 2x} dx =$

(a) 0

(b) $\left(\frac{1}{k+1}\right) k^2$

(c) $k^2 - 1 \left(\frac{1}{k^2 + 1}\right)$

(d) None of the above

44. $f(x) = \begin{bmatrix} x & \dots & x^n \\ \vdots & \ddots & \vdots \\ (x+n) & & (x+n)^n \end{bmatrix}$

Then, $\det(f''(x)) =$

(a) $\det(f(x))$

(b) $(n+1) \det(f(x))$

(c) $n(n+1) \det(f(x))$

(d) None of the above

Space for rough work

45. x, y and z form an A.P. Under some function f , $f(x), f(y)$ and $f(z)$ form a GP. If $a = f(x)$, then which differential equation does $f(x)$ satisfy ?

(a) $\frac{d^2a}{dx^2} = \frac{1}{a} \left(\frac{da}{dx} \right)^2$ (b) $\frac{d^2a}{dx^2} = \frac{1}{x} \left(\frac{da}{dx} \right)^2$ (c) $\frac{d^2a}{dx^2} = \frac{1}{a} \left(\frac{da}{dx} \right)$ (d) $\frac{d^2a}{dx^2} = \frac{1}{x} \left(\frac{da}{dx} \right)$

46. $f_1(x) = e^{\frac{1}{x}}$ and $f_n(x) = e^{f_{n-1}(x)}$ when $n \geq 2$. Then what is a possible expression for

$$\int f_1(x) f_2(x) \dots f_n(x) \frac{dx}{2x^2} ?$$

(a) $-\frac{f_n(x)}{2} + c$ (b) $-n \frac{f_n(x)}{2} + c$ (c) $-n^2 \frac{f_n(x)}{2} + c$ (d) $-\frac{f_n(x)}{4} + c$

47. If A is the area between $y^2 = 8x$ and $x^2 = y$, what is $3e^{\frac{i\pi}{2}} A$

(a) $8i$ (b) $\frac{8}{3}$ (c) $\frac{32i}{3}$ (d) $-8i$

48. $f(x) = ax^3 + bx^2 + cx + d, d > 0$

Given: i) $a + b + c + d = -4$ ii) $3a + 2b + c = 0$,

What conclusion can we draw about $f(x)$?

(a) No root in $[0, 1]$ (b) Exactly one root in $[0, 1]$ (c) All three roots in $[0, 1]$ (d) No conclusion

49. Find the roots of the equation

$$a(b-2c)x^2 + b(c-2a)x + c(a-2b) = 0$$

if $ab + bc + ca = 0$

(a) $1, \frac{c(a-2b)}{a(b-2a)}$ (b) $\frac{c}{a}, \frac{(a-2b)}{(b-2c)}$
(c) $\frac{(a-2b)}{(b-2c)}, \frac{(a-2b)}{(b-2c)}$ (d) None of the above

Space for rough work

50. The smallest positive root of the equation $\tan x - x = 0$ lies in

- (a) $\left(0, \frac{\pi}{2}\right)$ (b) $\left(\frac{\pi}{2}, \pi\right)$ (c) $\left(\pi, \frac{3\pi}{2}\right)$ (d) $\left(\frac{3\pi}{2}, 2\pi\right)$

51. If

$$(1 + x + x^2)^{25} = a_0 + a_1x + \dots + a_{50}x^{50}$$

Then, $a_0 + a_2 + \dots + a_{50}$ is

- (a) Odd, of the form $3k + 1$ (b) Odd, of the form $3k$
(c) Odd, of the form $3k + 2$ (d) Even

52. If

$$f(x) = \left(\frac{\sin \alpha}{\sin x}\right)^{\frac{1}{x - \alpha}}, x \neq \alpha$$

is continuous at $x = \alpha$, then $f(\alpha) =$

- (a) $e^{\tan \alpha}$ (b) $e^{2 \tan \alpha}$ (c) $e^{\cot \alpha}$ (d) $e^{2 \cot \alpha}$

53. Equation of lines drawn through $(1, 1)$ and perpendicular to $3x^2 - 5xy - 2y^2 = 0$ is

- (a) $2(x - 1)^2 - 5(x - 1)(y - 1) - 3(y - 1)^2 = 0$
(b) $2(x - 1)^2 + 5(x - 1)(y - 1) - 3(y - 1)^2 = 0$
(c) $2(x - 1)^2 - 5(x - 1)(y - 1) + 3(y - 1)^2 = 0$
(d) None of the above

Space for rough work

54. $\int_{-\pi}^{\pi} \frac{2x(1 + \sin x)}{1 + \cos x} dx$ is

- (a) $\frac{\pi^2}{4}$ (b) π^2 (c) Zero (d) $\frac{\pi}{2}$

55. If 'a' is a real number and

$$-3(x - [x])^2 + 2(x - [x]) + a^2 = 0 \text{ (where } [] \text{ is the greatest integer function)}$$

has no integral solutions, Then all possible values of 'a' remain the interval

- (a) $(-2, -1)$ (b) $(-\infty, -2) \cup (2, \infty)$
(c) $(-1, 0) \cup (0, 1)$ (d) $(1, 2)$

56. Solving the inequality $\sin(\sin^{-1}(5)) > x^2 - 4x$, we get

$$x \in \left(\alpha - \sqrt{\beta - \gamma\pi}, \alpha + \sqrt{\beta - \gamma\pi} \right)$$

Then, $\alpha + \beta + \gamma$ is

- (a) 7 (b) 6 (c) 11 (d) 13

57. The solution of $\frac{xy dy}{dx} + y^3 = x \cos x$ is $y^3 = f(x) + g(x) \cos x + \frac{k}{x^3}$, where k is a real number. Then,

- (a) $f(x) = 3 - \frac{18}{x^2}, g(x) = \frac{9}{x} - \frac{18}{x^3}$
(b) $f(x) = \frac{9}{x} - \frac{18}{x^3}, g(x) = 3 - \frac{18}{x^3}$
(c) $f(x) = 3 - \frac{15}{x^3}, g(x) = 3 - \frac{18}{x^2}$
(d) $f(x) = \frac{3}{x} - \frac{18}{x^3}, g(x) = 3 - \frac{18}{x^3}$

Space for rough work

58. $\int \frac{\ln(et^{t-1})}{t^2 e^{-t+2019}} dt = F(t) + c$

Then, $F(1) = n$

(a) n is a even number

(b) n is a odd number

(c) n is rational but not an integer

(d) n is irrational

59. The points $(0, -1, -1)$, $(-4, 4, 4)$, $(4, 5, -1)$ and $(3, 4, 4)$ are

(a) Collinear

(b) Coplanar

(c) Form a square

(d) None of these

60. $\int 3x^2 + 6x + 5\tan^{-1}(x) dx = f(x)\tan^{-1}(x) + g(x) + n \ln(\ln(x)) + C$

Then, $f(1) + g(1) + h(1) + n$ equals

(a) 6.5

(b) 7.5

(c) 8.5

(d) 9.5

Space for rough work

Part D- BIOLOGY

61. Why does convergent evolution happen?

- (a) Because the two species live in dissimilar habitats. Eg. Darwin's finches
- (b) Because the two species live in similar habitats. Eg. The origin of domestic dog and modern wolf
- (c) Because the two species live in similar habitats. Eg. Eyes of cephalopods, vertebrates, and cnidarians.
- (d) Because the two species live in dissimilar habitats. Eg. Wings of insects, birds, bats, and Pterosaurs.

62. A colorblind man marries a woman whose father was a colorblind and mother was normal. Then what will be the probability that the first child of the couple is colorblind?

- (a) $\frac{1}{2}$
- (b) $\frac{1}{4}$
- (c) $\frac{3}{4}$
- (d) 1

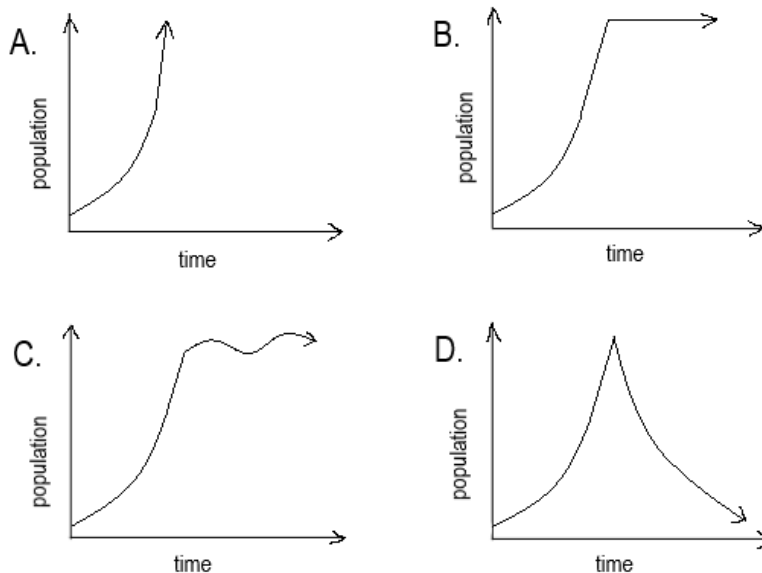
63. Identify the correct functions of RNA

- (i) It carries amino acids to ribosomes
- (ii) It is a constituent of ribosomes
- (iii) It carries genetic information from DNA for protein synthesis
- (iv) It plays a catalytic role during protein synthesis

- (a) Only (i)
- (b) Only (i) & (ii)
- (c) Only (ii) & (iii)
- (d) All (i), (ii), (iii) & (iv)

Space for rough work

64. A few rabbits are introduced in an uninhabited island with plenty of food. If these rabbits breed in absence of any predation, disease and natural calamity, which of the following graph best represents their population growth?



- (a) A (b) B (c) C (d) D
65. Two bottles were half-filled with water from Ganga ('G') and Mahanadi ('M'), and are kept under identical airtight conditions for 5 days. The oxygen content determined in the bottle-G was 3% and in the bottle-M was 10%. What could be the cause of this difference?
- (a) Ganga is more polluted than Mahanadi
(b) Mahanadi is more polluted than Ganga
(c) Both are equally polluted
(d) Ganga has fewer minerals than Mahanadi

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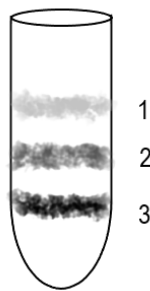
71. Over fifty percent of swallows living on cliffs in Nebraska were killed when a cold spell hit the area in 1996. Scientists collected nearly 2000 dead swallows from the base of the cliffs and captured about 1000 live ones. By measuring the body mass of these birds, they found that birds with larger than average body mass survived the cold spell better than the ones with smaller than average body mass. The data collected suggests that:

- (i) The population is undergoing natural selection.
- (ii) The population is undergoing disruptive selection.
- (iii) There is directional selection acting on the population.
- (iv) Stabilizing selection is acting on the population.

Which of the above inference(s) drawn from the data is/are correct?

- (a) (i), (iii) only (b) All except (ii) (c) (iii) only (d) (iv) only

72. In the experiment that Meselson and Stahl conducted to demonstrate that DNA replication was semi-conservative, they utilized two isotopes of nitrogen: the lighter ^{14}N and the heavier ^{15}N . In the diagram below, 1, 2 and 3 represents which of the following:



- (a) 1: ^{14}N - ^{14}N , 2: ^{15}N - ^{15}N , 3: ^{14}N - ^{15}N (b) 1: ^{14}N - ^{15}N , 2: ^{14}N - ^{14}N , 3: ^{15}N - ^{15}N
(c) 1: ^{14}N - ^{14}N , 2: ^{14}N - ^{15}N , 3: ^{15}N - ^{15}N (d) 1: ^{15}N - ^{15}N , 2: ^{14}N - ^{15}N , 3: ^{14}N - ^{14}N

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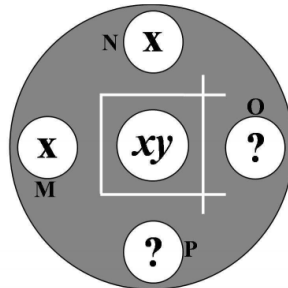
73. Which of the following property of a normal cell is lost when it transitions to a cancerous cell?
- (a) Membrane fluidity
 - (b) Contact Inhibition
 - (c) Dividing capacity
 - (d) Glucose utilization
74. Which one of the following is true with respect to human ovary?
- (a) Estrogen is secreted by Graafian follicles and progesterone by corpus luteum
 - (b) Estrogen is secreted by corpus luteum and progesterone by Graafian follicles
 - (c) Both estrogen and progesterone are secreted by Graafian follicles
 - (d) None of the above
75. Bt toxin produced by *Bacillus thuringiensis* does not kill the producer because the toxin is
- (a) in an inactive protoxin form
 - (b) rapidly secreted outside
 - (c) Inactivated by an antitoxin
 - (d) in unfolded form
76. Mimikyu is a Pokemon species who is very lonely. So it starts mimicking Pikachu, by wearing a Pikachu-like costume, without any harm to Pikachu. The costume helps in saving Mimikyu from potential predators because many predators are afraid of Pikachu's electric shock. Raichu, another Pokemon species, mimics Pikachu, they have similar warnings, and thus, survive in the forest by becoming each other's aid. Due to human activity, the population of Pikachu became extremely low. How would that affect the population of Mimikyu and Raichu? (Hint: Predators learn to avoid preys from the number of bad encounters)
- (a) Negative effects on Mimikyu and Raichu
 - (b) Positive effects on Mimikyu and Raichu
 - (c) Negative effect on Mimikyu but positive effect on Raichu
 - (d) Positive effect on Mimikyu but negative effect on Raichu

Space for rough work

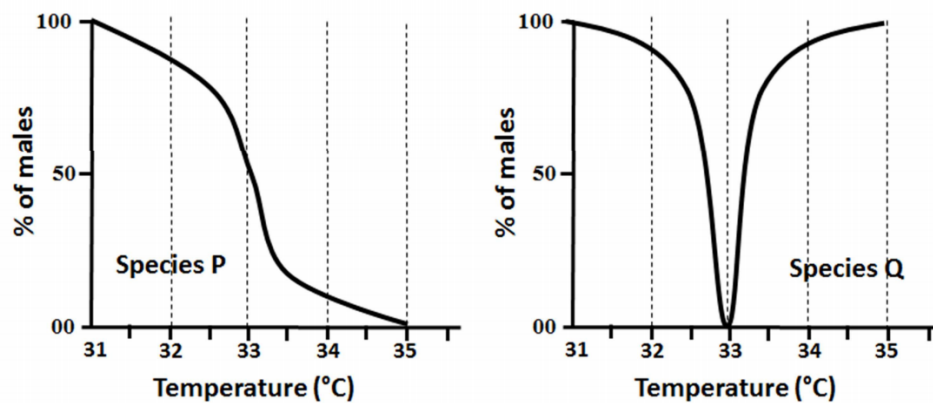
77. You have two dogs, a male, and a female. Both of them are of the same breed. The female is more cute with a denser fur and male is aggressive and have thinner fur. The gene CUTE causes the dog to become cute and the gene AGGR makes the dog aggressive. The gene LN causes the fur to become denser and gene SN causes the fur to become thinner. CUTE and AGGR are on the same locus on a chromosome and CUTE suppresses the function of AGGR. Also, LN and SN are present on the same locus of chromosome and LN suppresses the activity of SN. Now, if these two dogs mate what is the probability of the puppy to be like his father?
- (a) 0.0625
 - (b) 0.0000
 - (c) 0.2500
 - (d) can be both b and c
78. You are analyzing the Lac-operon system in E.coli. Your colleague in the biochemistry department has synthesized a novel compound Blablucose, that can be broken down by the enzyme β -Galactosidase to produce Blublucose (β -Galactosidase is an enzyme encoded by one of the genes under the Lac operon control). E.coli that make Blublucose turn blue. You add Blablucose to E.coli in the following growth conditions:
- 1. No Glucose, No Lactose
 - 2. No Glucose, Lactose
 - 3. Glucose, No Lactose
 - 4. Glucose, Lactose
- Which of the following combinations of colour and growth medium is correct?
- (a) 1. White, 2. Blue, 3. Blue, 4. White
 - (b) 1. White, 2. White, 3. White, 4. White
 - (c) 1. Blue, 2. Blue, 3. White, 4. White
 - (d) 1. White, 2. Blue, 3. White, 4. White

Space for rough work

79. A glass plate is coated with a layer of agarose gel. A central well and four surrounding wells (M, N, O, P) are cut on the agarose as shown in the figure below. A mixture of x and y antibodies is added in the central well that react specifically with antigens X and Y, respectively. Wells M and N contain the antigen X. Wells P and O contain antigens of unknown identity.



- (a) antigen Y in both O and P (b) antigen X in both O and P
- (c) antigen X in O and Y in P (d) antigen Y in O and X in P
80. Two unique reptilian species (P and Q) reproduce in an ambient temperature range (31°C to 35°C only). A group of scientists found a strange observation regarding the “male to female ratio” as obtained from fertilized eggs artificially hatched within laboratory incubators, as shown in the figure below.



The maximum life span of these reptiles is 5 years. 50 male and 50 female adults each of species P and Q were used to start a 10 year-long study. The eggs were always hatched in incubators during this study. Now consider the following statements:

- I. If the temperature of the incubator is strictly maintained at 33°C for 10 consecutive years, the species P is expected to have more males than in species Q.
- II. If the temperature of the incubator is strictly maintained at 31°C for 10 consecutive years, there will be more males in species P than in species Q.
- III. If the temperature of the incubator is strictly maintained at 31°C for 10 consecutive years, then both P and Q will not survive in the lab.

IV. If the temperature of the incubator is strictly maintained at 31°C and 35°C for every alternate year (for a total of 10 years), there will be more males in species P than species Q.

In the absence of any other factors, which of the above are the possible outcome(s)?

- | | |
|--------------------|-------------------|
| (a) All except III | (b) All except II |
| (c) I, II only | (d) III, IV only |

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END OF QUESTIONS
