



JEE ADVANCED



Sri Chaitanya IIT Academy.,India.

★ A.P ★ T.S ★ KARNATAKA ★ TAMILNADU ★ MAHARASHTRA ★ DELHI ★ RANCHI

A right Choice for the Real Aspirant
ICON Central Office - Madhapur - Hyderabad

SEC: Sr.Super60(Incoming)_STERLING BT

Time: 09:00AM to 12:00PM

WTA-30

JEE-ADV_(2021-P1)

Date: 27-04-2025

Max. Marks: 180

27-04-2025_Sr.Super60(Incoming)_STERLING BT_ Jee-Adv(2021-P1)_WTA-30_Syllabus

PHYSICS

: Capacitor with a conducting slab between the plates: Charging, Sharing of charge, Force between dielectric and capacitorRC CircuitsElectromagnetism: MOVING CHARGES AND MAGNETISM: Magnetic force on moving point charges and current elements, Qualitative study, Magnetic Lorentz force, Definition of magnetic fieldMotion of a charge in uniform electric and magnetic fields, velocity selector arrangement, Cyclotron (Deleted pertaining to JEE Main but still in JEE ADV Syllabus)Force on a current-carrying conductor in a magnetic field, Magnetic dipoles moment of a current carrying coil, Torque, P.E and interaction of magnetic dipoles.

CHEMISTRY

:

CHEMICAL KINETICS: Rates of chemical reactions; Order, Molecularity and Rate constant,Zero and First Order Reactions,Differential & Integrated rate law, Arrhenius equation, Collision theory,Parallel order

MATHEMATICS

: Integration by parts, Integration-Reduction formulae

Name of the Student: _____

H.T. NO:

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JEE-ADVANCE-2021-P1-Model

Time:3Hr's

IMPORTANT INSTRUCTIONS

Max Marks: 180

PHYSICS:

Section	Question Type	+Ve Mark	- Ve Mark	No.of Qs	Total marks
Sec – I(Q.N : 1 – 4)	Questions with Single Correct Choice!	+3	-1	4	12
Sec – II(Q.N : 5 – 10)	Paragraph Questions with Numerical Value Answer Type	+2	0	6	12
Sec – III(Q.N : 11 – 16)	Questions with Multiple Correct Choice with partial mark	+4	-2	6	24
Sec – IV(Q.N : 17 – 19)	Questions with Non-negative Integer Value Type	+4	0	3	12
Total				19	60

CHEMISTRY:

Section	Question Type	+Ve Marks	- Ve Marks	No.of Qs	Total marks
Sec – I(Q.N : 20 – 23)	Questions with Single Correct Choice	+3	-1	4	12
Sec – II(Q.N : 24 – 29)	Paragraph Questions with Numerical Value Answer Type	+2	0	6	12
Sec – III(Q.N : 30 – 35)	Questions with Multiple Correct Choice with partial mark	+4	-2	6	24
Sec – IV(Q.N : 36– 38)	Questions with Non-negative Integer Value Type	+4	0	3	12
Total				19	60

MATHEMATICS:

Section	Question Type	+Ve Marks	- Ve Marks	No.of Qs	Total marks
Sec – I(Q.N : 39 – 42)	Questions with Single Correct Choice	+3	-1	4	12
Sec – II(Q.N : 43 – 48)	Paragraph Questions with Numerical Value Answer Type	+2	0	6	12
Sec – III(Q.N : 49 – 54)	Questions with Multiple Correct Choice with partial mark	+4	-2	6	24
Sec – IV(Q.N : 55 – 57)	Questions with Non-negative Integer Value Type	+4	0	3	12
Total				19	60

**PHYSICS****Max Marks: 60**

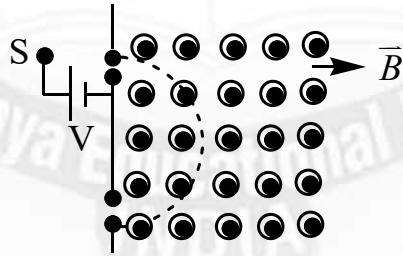
SECTION – I
(SINGLE CORRECT ANSWER TYPE)

This section contains 4 multiple choice questions. Each question has 4 options (A), (B), (C) and (D) for its answer, out of which ONLY ONE option can be correct.

Marking scheme: +3 for correct answer, 0 if not attempted and -1 in all other cases. Section 1 (Max Marks: 12)

- Section 1 contains Four questions
- Each Question has Four Options and Only One of these four will be the correct answer.
- For each question, choose the option corresponding to the correct answer
- The Marking scheme to evaluate Answer to each question will be :
- Full Marks: +3 (If the answer is correct)
- Zero Marks: 0 (If the question is unanswered)
- Negative Marks: -1 (In all other cases)

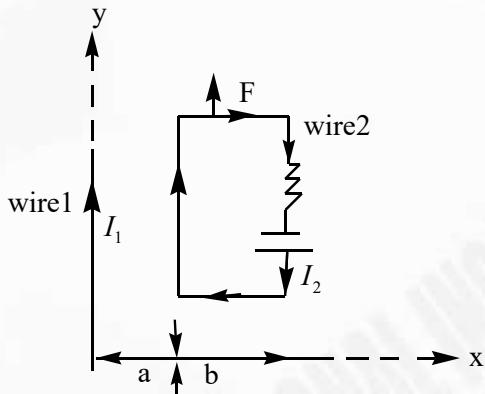
1. An electron moves with speed $2 \times 10^5 \text{ ms}^{-1}$ along the positive x-direction in the presence of magnetic induction $\vec{B} = \hat{i} + 4\hat{j} - 3\hat{k}$ tesla. The magnitude of the force experienced by the electron in newton is (charge on the electron = $1.6 \times 10^{-19} \text{ C}$)
 A) 1.18×10^{-13} B) 1.28×10^{-13} C) 1.6×10^{-13} D) 1.72×10^{-13}
2. A mass spectrometer is a device which select particle of equal mass. An ion with electric charge $q > 0$ and mass m starts at rest from a source S and is accelerated through a potential difference V. It passes through a hole into a region of constant magnetic field \vec{B} perpendicular to the plane of the paper as shown in the figure. The particle is deflected by the magnetic field and emerges through the bottom hole at a distance d from the top hole. The mass of the particle is



- A) $\frac{qBd}{8V}$
- B) $\frac{qB^2d^2}{4V}$
- C) $\frac{qB^2d^2}{8V}$
- D) $\frac{qBd}{2V}$



3. Wire-1 in fig is oriented along the Y-axis and carries a steady current I_1 A rectangular circuit located to the right of the wire carries a current I_2 . Find the force experienced by the top of the horizontal wire (wire-2) of the rectangular circuit.



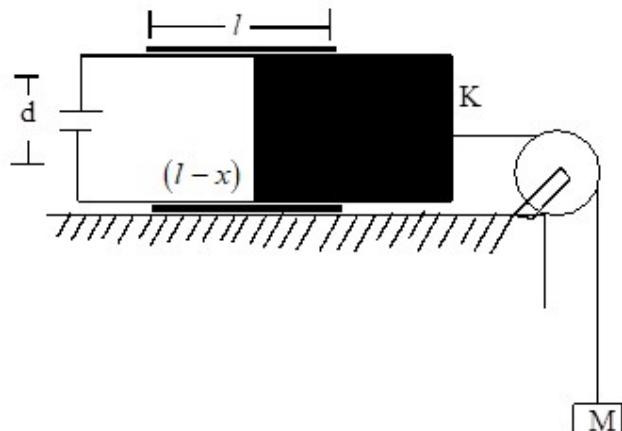
A) $\left[\frac{\mu_0 I_1 I_2}{2\pi} \ln\left(1 + \frac{b}{a}\right) \hat{j} \right]$

B) $\left[\frac{\mu_0 I_1 I_2}{2\pi} \ln\left(1 + \frac{b}{a}\right) (-\hat{j}) \right]$

C) $\left[\frac{\mu_0 I_1 I_2}{2\pi} \ln\left(1 + \frac{b}{a}\right) (-\hat{i}) \right]$

D) $\left[\frac{\mu_0 I_1 I_2}{2\pi} \ln\left(1 + \frac{b}{a}\right) (\hat{i}) \right]$

4. Consider the situation shown in figure. The width of each plate is b and distance between the plates is d . The capacitor plates are rigidly clamped in the laboratory and connected to a battery of emf E . All surfaces are frictionless. Calculate the value of M for which the dielectric slab will stay in equilibrium.



A) $\frac{\epsilon_0 b E^2 (K-1)}{2dg}$

B) $\frac{\epsilon_0 b E^2 (K-1)}{dg}$

C) $\frac{2\epsilon_0 b E^2 (K-1)}{dg}$

D) $\frac{\epsilon_0 b E^2 (K+1)}{dg}$



SECTION-II

(PARAGRAPH WITH NUMERICAL VALUE TYPE)

- This section contains **THREE (03)** questions stems.
- There are **TWO (02)** questions corresponding to each question stem.
- The answer to each question is a **NUMERICAL VALUE**.
- For each question, enter the correct numerical value corresponding to the answer in the designated place using the mouse and the on-screen virtual numeric keypad.
- If the numerical value has more than two decimal places, **truncate/round-off** the value to **TWO** decimal places.
- Answer to each question will be evaluated according to the following marking scheme:
- **Full Marks: +2** If ONLY the correct numerical value is entered at the designated place;
- **Zero Marks:0** in all other cases

Question Stem for Question Nos. 5 and 6

Question Stem

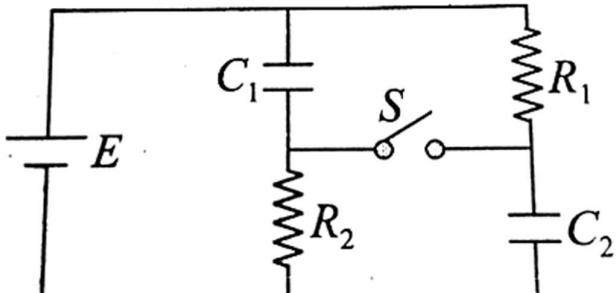
A charged particle of mass 2g and charge 1mC is allowed to enter in a region of space in which uniform electric and magnetic field can be created. The subsequent path of the particle in the region will depend upon initial value of velocity and direction of the field

5. If $E=0$, $B=1.\hat{k}$ and $V=\frac{10}{\sqrt{2}}\hat{i}+\frac{10}{\sqrt{2}}\hat{j}$ then the radius of the path of the particle is _____ m.
6. If $B=2.\hat{k}$ T and $V=\frac{5}{\pi}\text{m/s}$ then the pitch of the helix will be _____ m.

Question Stem for Question Nos. 7 and 8

Question Stem

The switch S has been closed for long time and the electric circuit shown carries a steady current. Let $C_1 = 3.0\mu\text{F}$, $C_2 = 6.0\mu\text{F}$, $R_1 = 4.0\text{k}\Omega$ and $R_2 = 7.0\text{k}\Omega$. The Power dissipated in R_2 is 2.8 W.



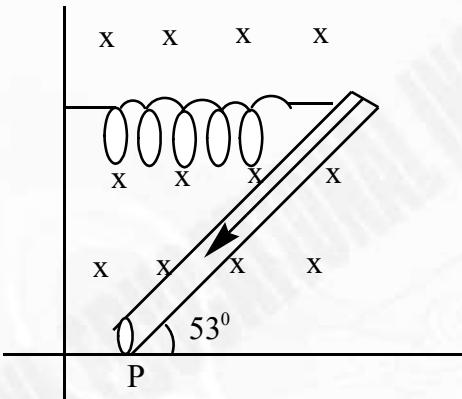
7. The power dissipated to the resistor R_1 is _____ W.
8. The charge on capacitor C_1 is _____ μC .



Question Stem for Question Nos. 9 and 10

Question Stem

A thin uniform rod with negligible mass & length 0.2 m is attached to the floor by a friction less hinge at point P. A horizontal spring with force constant $K=4.80\text{N/m}$ connects the other end of the rod to a vertical wall. The rod is in a uniform magnetic field $B=0.34\text{T}$ directed into the plane of figure. There is current $I=6.50\text{ A}$ in the rod.

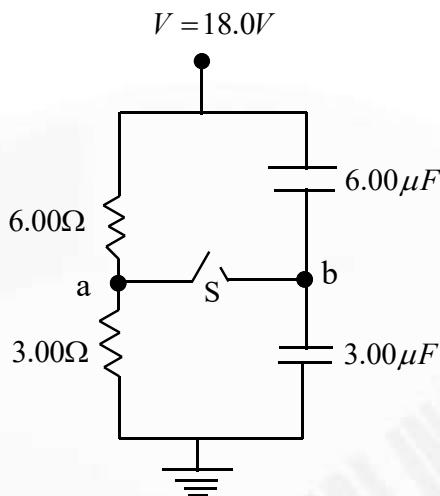


9. Calculate the torque due to the magnetic force on the rod, for an axis at P _____ $\times 10^{-3}\text{ N-m}$
10. When the rod is in equilibrium & make an angle of 53° with the floor. Is the spring stretched compressed _____ mm.

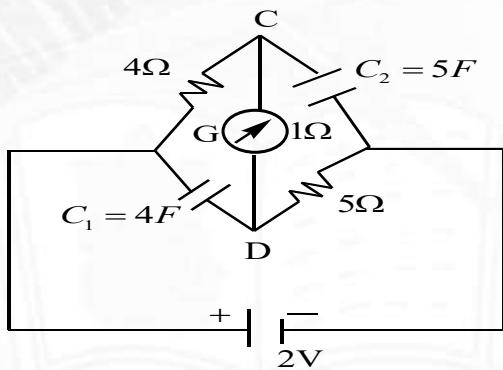
SECTION-III (ONE OR MORE CORRECT ANSWER TYPE)

- This section contains **SIX (06)** questions.
- Each question has **FOUR** options (A), (B), (C) and (D). **ONE OR MORE THAN ONE** of these four option(s) is (are) correct answer(s).
- For each question, choose the option(s) corresponding to (all) the correct answer(s).
- Answer to each question will be evaluated according to the following marking scheme:
- **Full Marks: +4** If only (all) the correct option(s) is (are) chosen;
- **Partial Marks: +3** If all the four options are correct but **ONLY** three options are chosen,
- **Partial Marks: +2** If three or more options are correct but **ONLY** two options are chosen, both of which are correct;
- **Partial Marks: +1** If two or more options are correct but **ONLY** one option is chosen and it is a correct option;
- **Zero Marks: 0** If unanswered;
- **Negative Marks: -2** In all other cases.
- For example, in a question, if (A), (B) and (D) are the **ONLY** three options corresponding to the correct answer, then Choosing ONLY (A), (B) and (D) will get +4 marks;
Choosing ONLY (A), will get +1 mark;
Choosing ONLY (B), will get +1 mark;
Choosing ONLY (D), will get +1 mark;
Choosing no option(s) (i.e. the question is unanswered) will get 0 marks and
Choosing any other option(s) will get -2 marks.

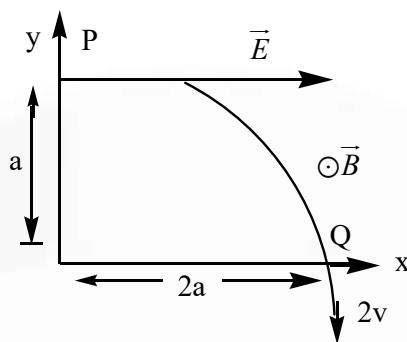
11. Study the following circuit diagram and mark the correct options.



- A) The potential of point a with respect to point b in figure when switch S is open is -6V.
 B) The points a and b are at the same potential, when S is opened.
 C) The charge flown through the switch S when it is closed is $54 \mu C$.
 D) The final potential of b with respect to ground when switch S is closed is 8 V.
12. In the circuit shown in Fig., the cell is ideal with e.m.f=2V. The resistance of the coil of the galvanometer G is 1Ω . Then



- A) initially no current flows in G B) in steady state 0.2 A current flows in G
 C) potential difference across C_1 is 1V D) potential difference across C_2 is 1.2V
13. A particle of charge $+q$ and mass m moving under the influence of a uniform electric field $E\hat{i}$ and uniform magnetic field $B\hat{k}$ follows a trajectory from P to Q as shown in figure. The velocities at P and Q are $v\hat{i}$ and $-2v\hat{j}$. Which of the following statement(s) is/are correct?



- A) $E = \frac{3}{4} \left(\frac{mv^2}{qa} \right)$
- B) Rate of work done by electric field at P = $\frac{3}{4} \left(\frac{mv^3}{a} \right)$
- C) Rate of work done by electric field at P is zero
- D) Rate of work done by both the fields at Q is zero
14. A beam of protons with a velocity of $4 \times 10^5 \text{ ms}^{-1}$ enters a uniform magnetic field of 0.3T. The velocity makes an angle of 60° with the magnetic field.
- A) The radius of the helical path taken by the proton is 1.2cm
- B) The radius of the helical path taken by the proton is 12cm
- C) The pitch of the helix is 4.4 mm
- D) The pitch of the helix is 4.4 cm
15. Two identical charged particles enter a uniform magnetic field with same speed but at angles 30° and 60° with field. Let a, b and c be the ratio of their periods, radii and pitches of the helical paths then
- A) abc=1 B) abc>1 C) abc<1 D) a=bc
16. A charged particle is projected in a plane perpendicular to a uniform magnetic field. The areal velocity (area swept per unit time by the position vector of the particle relative to the centre) of the particle is :



- A) directly proportional to kinetic energy of particle
- B) directly proportional to momentum of the particle
- C) inversely proportional to magnetic field strength
- D) inversely proportional to charge on particle

SECTION-IV (INTEGER ANSWER TYPE)

- This section contains **THREE (03)** question.
- The answer to each question is a **NON-NEGATIVE INTEGER**.
- For each question, enter the correct integer corresponding to the answer the using the mouse and the on-screen virtual numeric keypad in the place designated to enter the answer.
- Answer to each question will be evaluated according to the following marking scheme:
- **Full Marks** : +4 If ONLY the correct integer is entered;
- **Zero Marks** : 0 In all other cases.

17. A charged particle of charge $4mc$ enters a uniform magnetic field of induction

$\bar{B} = 4\bar{i} + y\bar{j} + z\bar{k}$ Tesla with a velocity $\bar{v} = 2\bar{i} + 3\bar{j} + 6\bar{k}$. If the particle continues to move undeviated, then the strength of the magnetic field induction (B) is ____ Tesla

18. A beam of α -particle of energy 30 Mev is to be obtained from a cyclotron of radius 50cm. The strength of magnetic field required to be applied will be (in T)

$$m_\alpha = 6.64 \times 10^{-27} \text{ Kg} \text{ (Round off nearest integer)}$$

19. A clycotron is used to obtain 2 Mev protons, if the frequency is 5MHz and the potential is 20kV. The magnetic field necessary for resonance is (in T) (Round off nearest integer)

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IN JEE MAIN 2023 JEE ADVANCED 2023 AND NEET 2023**

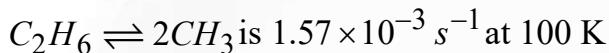
JEE MAIN 2023 SINGARAJU VENKAT KOUNDINYA SRI CHAITANYA EDUCATIONAL INSTITUTIONS 300 300 RANK 1	JEE Advanced 2023 VARILALA CHIRANJILAS REDDY SRI CHAITANYA EDUCATIONAL INSTITUTIONS 341 360 RANK 1	NEET 2023 BORA VARUN BHAGYA SETHI SRI CHAITANYA EDUCATIONAL INSTITUTIONS 720 720 RANK 1
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**CHEMISTRY****Max. Marks: 60**

**SECTION-I
(SINGLE CORRECT ANSWER TYPE)**

- This section contains **Four (04)** questions.
- Each question has **FOUR** options (A), (B), (C) and (D). **ONLY ONE** of these four options is the correct answer.
- For each question, choose the option corresponding to the correct answer.
- Answer to each question will be evaluated according to the following marking scheme:
- Full Marks : +3 If ONLY the correct option is chosen;
- Zero Marks : 0 If the none of the options is chosen (i.e. the question is unanswered);
- Negative Marks : -1 In all other cases.

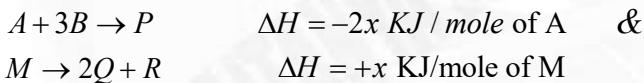
20. The forward rate constant for the elementary reversible gaseous reaction



What is the rate constant for the backward reaction at this temperature if 10^{-4} moles of CH_3 and 10 moles of C_2H_6 are present in a 10 litre vessel at equilibrium.

- A) $1.57 \times 10^9 L \text{ mol}^{-1} s^{-1}$ B) $1.57 \times 10^{10} L \text{ mol}^{-1} s^{-1}$
 C) $1.57 \times 10^{11} L \text{ mol}^{-1} s^{-1}$ D) $1.57 \times 10^7 L \text{ mol}^{-1} s^{-1}$

21. For a hypothetical reaction,



These reactions are carried simultaneously in a reactor such that temperature is not changing if rate of disappearance of B is $y \text{ M sec}^{-1}$ then rate of formation (in M sec^{-1}) of Q is:

- A) $\frac{2}{3}y$ B) $\frac{3}{2}y$ C) $\frac{4}{3}y$ D) $\frac{3}{4}y$

22. The kinetic data for the given reaction $A(g) + 2B(g) \xrightarrow{k} C(g)$ is provided in the following table for three experiments at 300 K

Ex. No.	[A/M]	[B/M]	Initial rate (M sec^{-1})
1.	0.01	0.01	6.930×10^{-6}
2.	0.02	0.01	1.386×10^{-5}
3.	0.02	0.02	1.386×10^{-5}

In another experiment starting with initial concentration of 0.5 and 1 M respectively for A and B at 300 K, find the rate of reaction after 50 minutes from the starting of experiment (in M/sec).

- A) 6.93×10^{-4} B) 0.25×10^{-7} C) 4.33×10^{-5} D) 3.46×10^{-4}



23. In an elementary reaction $A(g) + 2B(g) \rightarrow C(g)$ the initial pressure of A and B are

$P_A = 0.40$ atm and $P_B = 0.60$ atm respectively. After time T, if pressure of C is observed 0.1

atm, then find the value of $\frac{r_1(\text{initial rate of reaction})}{r_1(\text{rate of reaction after time t})}$.

- A) 30 B) 300 C) 3 D) 0.3

SECTION-II (PARAGRAPH WITH NUMERICAL VALUE TYPE)

- This section contains **THREE (03)** questions stems.
- There are **TWO (02)** questions corresponding to each question stem.
- The answer to each question is a **NUMERICAL VALUE**.
- For each question, enter the correct numerical value corresponding to the answer in the designated place using the mouse and the on-screen virtual numeric keypad.
- If the numerical value has more than two decimal places, **truncate/round-off** the value to **TWO** decimal places.
- Answer to each question will be evaluated according to the following marking scheme:
- **Full Marks** : +2 If ONLY the correct numerical value is entered at the designated place;
- **Zero Marks** : 0 In all other cases.

Question Stem for Question Nos. 24 and 25

Question Stem

Arrhenius studied the effect of temperature on the rate of a reaction and postulated that rate constant varies with temperature exponentially as $k = Ae^{-Ea/RT}$. This method is generally used for finding the activation energy of a reaction. Keeping temperature constant, the effect of catalyst on the activation energy has also been studied.

24. The pre-exponential factor in the Arrhenius equation of a first order reaction has the unit is $Mole^x \text{ Litre}^y \text{ Sec}^{-z}$. z is ____
25. If the rate of reaction doubles for 10^0C rise of temperature from 290K to 300K, the activation energy of the reaction will be approximately ____ (in kcal mole⁻¹)

Question Stem for Question Nos. 26 and 27

Question Stem

An important parameter of a photochemical reaction is the quantum efficiency or quantum yield (ϕ) which is defined as

$$\phi = \frac{\text{moles of the substance reacted}}{\text{moles of photons absorbed}}$$

Absorption of UV radiation decompose acetone according to the reaction

$$(CH_3)_2CO \xrightarrow{h\nu} C_2H_6 + CO$$

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**JEE MAIN
2023**
SINGARAJU
VENKAT KOUNDINYA
SRI CHAITANYA
CLASS
300
300

RANK 1

**JEE Advanced
2023**
VARVILALA
CHIRANJEEVI REDDY
SRI CHAITANYA
CLASS
341
360

RANK 1

**NEET
2023**
BORA VARUN
SRI CHAITANYA
CLASS
720
720

RANK 1



26. The quantum yield of a reaction at $\lambda = 330 \text{ nm}$ is 0.4. A sample of acetone absorbs

monochromatic radiation at $\lambda = 330 \text{ nm}$ at the rate of $7.2 \times 10^{-3} \text{ Js}^{-1}$ (Given :

$N_A = 6 \times 10^{23}; h = 6.6 \times 10^{-34}$ in S.I. unit). The rate of formation of CO(mol/s) is

$8 \times 10^{-x} \cdot x$ is _____

27. If quantum yield is 0.8 then rate of formation of C_2H_6 (mol/s) is $x \times 10^{-9}$. Then 'x' is _____

Question Stem for Question Nos. 28 and 29

Question Stem

Radioactive disintegration is a first order reaction and its rate depends only upon the nature of nucleus and does not depend upon external factors like temperature and pressure. The rate of radioactive disintegration (Activity) is represented as $-\frac{dN}{dt} = \lambda N$

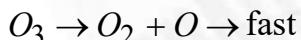
Where λ = decay constant ; N = number of nuclei at time t; N_0 = initial no. of nuclei

The above equation after integration can be represented as $\lambda = \frac{2.303}{t} \log\left(\frac{N_0}{N}\right)$

28. Calculate the half-life period (in years) of a first order reaction $\text{A} \rightarrow \text{products}$, If the reactant 'A' remains only 1/16 of its original amount in 4740 years :

29. Consider a reaction $2\text{O}_3 \rightarrow 3\text{O}_2$

Mechanism:



Order of reaction is x.

SECTION-III (ONE OR MORE CORRECT ANSWER TYPE)

- This section contains **SIX (06)** questions.
- Each question has **FOUR** options (A), (B), (C) and (D). **ONE OR MORE THAN ONE** of these four option(s) is (are) correct answer(s).
- For each question, choose the option(s) corresponding to (all) the correct answer(s).
- Answer to each question will be evaluated according to the following marking scheme:
- **Full Marks: +4** If only (all) the correct option(s) is (are) chosen;
- **Partial Marks: +3** If all the four options are correct but **ONLY** three options are chosen,
- **Partial Marks: +2** If three or more options are correct but **ONLY** two options are chosen, both of which are correct;
- **Partial Marks: +1** If two or more options are correct but **ONLY** one option is chosen and it is a correct option;
- **Zero Marks: 0** If unanswered;
- **Negative Marks: -2** In all other cases.
- For example, in a question, if (A), (B) and (D) are the **ONLY** three options corresponding to the correct answer, then Choosing ONLY (A), (B) and (D) will get +4 marks;
Choosing ONLY (A), will get +1 mark;
Choosing ONLY (B), will get +1 mark;
Choosing ONLY (D), will get +1 mark;
Choosing no option(s) (i.e. the question is unanswered) will get 0 marks and
Choosing any other option(s) will get -2 marks.



30. Select the correct statement (s) :
- A) Rate constants are never negative
 - B) Partial orders are never negative
 - C) Molecularity and order of reaction both are equal for elementary reactions
 - D) Order of reaction may be change with change in practical conditions (temp. and pressure)
31. Select the correct statement (s) :
- A) The rate of reaction decreases with decrease in temperature
 - B) The rate of reaction is uniform in zero order reaction
 - C) The rate of reaction depends upon the surface area of the solid reactants
 - D) Average and instantaneous rate of reaction defined for micro and macroscopic interval respectively
32. Select the correct statement (s) :
- A) The rate law of the elementary reaction; $2A \rightarrow B + C$, must be $r = k[A]^2$
 - B) The rate law for the complex reaction $A + B \rightarrow C$, might not be $r = k[A][B]$
 - C) If the partial orders differ from the stoichiometric coefficients in the balanced reaction, the reaction must be complex
 - D) If the partial orders are equal to corresponding coefficients in the balanced reaction, the reaction must be elementary
33. Select the correct statement (s) :
- A) Every substance that appears in the rate law of reaction must be a reactant or product in that reaction
 - B) If we know the rate law of a reaction; we can always deduce its mechanism
 - C) If the reaction has rate $r = k[A][B]^{3/2}$ then reaction may be elementary
 - D) A zero order reaction must be a complex reaction
34. Select the correct statement (s):
- A) When $T \rightarrow \infty$ or $E_a \rightarrow 0$ then $k=A$
 - B) A positive catalyst can change ΔH of the reaction
 - C) A mixture of reactants may be thermodynamically unstable but kinetically stable
 - D) A negative catalyst increases the activation energy of the reaction
35. Consider a reaction $A + B \rightarrow C$, in which both reactants are in the same phase, may be
- A) unimolecular elementary reaction
 - B) Exothermic
 - C) Heterogeneous
 - D) Photochemical

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IN JEE MAIN 2023 JEE ADVANCED 2023 AND NEET 2023**



SECTION-IV (INTEGER ANSWER TYPE)

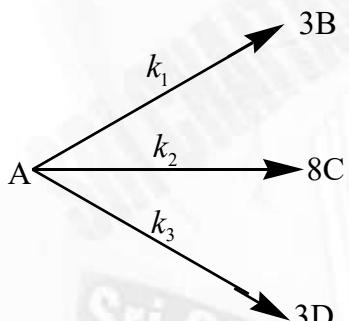
- This section contains **THREE (03)** question.
- The answer to each question is a **NON-NEGATIVE INTEGER**.
- For each question, enter the correct integer corresponding to the answer using the mouse and the on-screen virtual numeric keypad in the place designated to enter the answer.
- Answer to each question will be evaluated according to the following marking scheme:
- **Full Marks : +4** If ONLY the correct integer is entered;
- **Zero Marks : 0** In all other cases.

36. The rate of decomposition of $\text{NH}_3(\text{g})$ at 10 atm on platinum surface is zero order. What is rate of formation (in M min^{-1}) of $\text{H}_2(\text{g})$, if rate constant of reaction $2\text{NH}_{3(\text{g})} \rightarrow \text{N}_2(\text{g}) + 3\text{H}_2(\text{g})$ is 2.0M min^{-1} ?

37. 5A \longrightarrow Product

In above reaction, half-life period is directly proportional to initial concentration of reactant. The initial rate of reaction is $400 \text{ mol lit}^{-1} \text{ min}^{-1}$.

Calculate the half-life period (in sec) when initial concentration of reactant is 200 mol lit^{-1} .



38. ; At time $t=0$, initial mole of A is 1.

Overall half life of the reaction is 15 days. Then calculate the number of mole of C after 45days if the ratio of $k_1 : k_2 : k_3$ is 4:2:1

**MATHEMATICS****Max. Marks: 60**

SECTION-I
(SINGLE CORRECT ANSWER TYPE)

- This section contains **Four (04)** questions.
- Each question has **FOUR** options (A), (B), (C) and (D). **ONLY ONE** of these four options is the correct answer.
- For each question, choose the option corresponding to the correct answer.
- Answer to each question will be evaluated according to the following marking scheme:
- Full Marks : +3 If ONLY the correct option is chosen;
- Zero Marks : 0 If the none of the options is chosen (i.e. the question is unanswered);
- Negative Marks : -1 In all other cases.

39. The value of $\int e^x \left(\frac{x^4 + 2}{(1+x^2)^{5/2}} \right) dx$, is equal to

- A) $\frac{e^x(x+1)}{(1+x^2)^{3/2}} + C$ B) $\frac{e^x(1-x+x^2)}{(1+x^2)^{3/2}} + C$ C) $\frac{e^x(1+x)}{(1+x^2)^{3/2}} + C$ D) None of these

40. the value of $\int e^{(x \sin x + \cos x)} \cdot \left(\frac{x^4 \cos^3 x - x \sin x + \cos x}{x^2 \cos^2 x} \right) dx$, is equal to

- A) $e^{(x \sin x + \cos x)} \cdot \left(x + \frac{1}{x \cos x} \right) + C$ B) $e^{(x \sin x + \cos x)} \cdot \left(x \cos x + \frac{1}{x} \right) + C$
 C) $e^{(x \sin x + \cos x)} \cdot \left(x - \frac{1}{x \cos x} \right) + C$ D) None of the above

41. $\int \frac{e^{\tan^{-1} x}}{(1+x^2)} \left[\left(\sec^{-1} \sqrt{1+x^2} \right)^2 + \cos^{-1} \left(\frac{1-x^2}{1+x^2} \right) \right] dx$, ($x > 0$) is equal to

- A) $e^{\tan^{-1} x} (\tan^{-1} x) + C$ B) $\frac{e^{\tan^{-1} x} (\tan^{-1} x)^2}{2} + C$
 C) $e^{\tan^{-1} x} \left(\sec^{-1} \left(\sqrt{1+x^2} \right) \right)^2 + C$ D) $e^{\tan^{-1} x} \left(\csc^{-1} \left(\sqrt{1+x^2} \right) \right)^2 + C$

42. $\int \frac{1-7\cos^2 x}{\sin^7 x \cos^2 x} dx = \frac{f(x)}{(\sin x)^7} + C$, then $f(x)$ is equal to

- A) $\sin x$ B) $\cos x$ C) $\tan x$ D) $\cot x$



SECTION-II

(PARAGRAPH WITH NUMERICAL VALUE TYPE)

- This section contains **THREE (03)** questions stems.
- There are **TWO (02)** questions corresponding to each question stem.
- The answer to each question is a **NUMERICAL VALUE**.
- For each question, enter the correct numerical value corresponding to the answer in the designated place using the mouse and the on-screen virtual numeric keypad.
- If the numerical value has more than two decimal places, **truncate/round-off** the value to **TWO** decimal places.
- Answer to each question will be evaluated according to the following marking scheme:
- **Full Marks: +2** If ONLY the correct numerical value is entered at the designated place;
- **Zero Marks: 0** In all other cases.

Question Stem for Question Nos. 43 and 44

Question Stem

We can derive reduction formulas for the integral of the form

$\int \sin^n x dx, \int \cos^n x dx, \int \tan^n x dx, \int \cot^n x dx$, and other integrals of these form using integration by parts. In turn these reduction formulas can be used to compute integrals of higher power of etc.

43. If $\int \sin^5 x dx = -\frac{1}{5} \sin^4 x \cos x + A \sin^2 x \cos x - \frac{8}{15} \cos x + C$ then $|4A|$ is equal to
44. If $\int \tan^6 x dx = \frac{1}{5} \tan^5 x + A \tan^3 x + \tan x - x + C$ then $|A|$ is equal to

Question Stem for Question Nos. 45 and 46

Question Stem

Question Stem

Let $f : R \rightarrow R$ be a function as

$f(x) = (x-1)(x+2)(x-3)(x-6) - 100$. If $g(x)$ is a polynomial of degree ≤ 3 such that $\int \frac{g(x)}{f(x)} dx$ does not contain any logarithm function and $g(-2) = 10$ Then

45. Number of imaginary roots of $f(x) = 0$ is
46. The minimum value of $f(x)$ is k then $|k|$

Question Stem for Question Nos. 47 and 48

Question Stem

If $f : R \rightarrow (0, \infty)$ be a differentiable function $f(x)$ satisfying

$$f(x+y) - f(x-y) = f(x) \cdot \{f(y) - y\}, \forall x, y \in R,$$

$$(f(y) \neq f(-y) \text{ for all } y \in R) \text{ and } f'(0) = 2010.$$

Now, answer the following questions.



47. Given 4 statements

Statement-1: $f(x)$ is one-one and into

Statement-2: $\{f(x)\}$ is non-periodic, where $\{\cdot\}$ denotes fractional part of x .

Statement-3: $f(x) = 4$ has only two solutions.

Statement-4: $f(x) = f^{-1}(x)$ has only one solution.

then how many number of statements are true ?

48. Let $g(x) = \log_e(\sin x)$, and $\int f(g(x)) \cos x dx = h(x) + c$, (Where c is constant of integration), then $h\left(\frac{\pi}{2}\right)$ is equal to k then $\frac{1}{k} =$

SECTION-III (ONE OR MORE CORRECT ANSWER TYPE)

- This section contains **SIX (06)** questions.
- Each question has **FOUR** options (A), (B), (C) and (D). **ONE OR MORE THAN ONE** of these four option(s) is (are) correct answer(s).
- For each question, choose the option(s) corresponding to (all) the correct answer(s).
- Answer to each question will be evaluated according to the following marking scheme:
- **Full Marks : +4** If only (all) the correct option(s) is (are) chosen;
- **Partial Marks : +3** If all the four options are correct but **ONLY** three options are chosen,
- **Partial Marks : +2** If three or more options are correct but **ONLY** two options are chosen, both of which are correct;
- **Partial Marks : +1** If two or more options are correct but **ONLY** one option is chosen and it is a correct option;
- **Zero Marks : 0** If unanswered;
- **Negative Marks: -2** In all other cases.
- For example, in a question, if (A), (B) and (D) are the **ONLY** three options corresponding to the correct answer, then Choosing **ONLY** (A), (B) and (D) will get +4 marks;
Choosing **ONLY** (A), will get +1 mark;
Choosing **ONLY** (B), will get +1 mark;
Choosing **ONLY** (D), will get +1 mark;
Choosing no option(s) (i.e. the question is unanswered) will get 0 marks and
Choosing any other option(s) will get -2 marks.

49. If $\int e^x \left(\frac{x^2 - x + 1}{(x^2 + 1)^{3/2}} \right) dx = e^x f(x) + c$ then

- A) $f(x)$ is an even function B) $f(x)$ is an odd function
 C) $f(x)$ is a bounded function D) The range of $f(x)$ is $(0,1]$

50. If $\int (\sin 3\theta + \sin \theta) \cos \theta e^{\sin \theta} d\theta = (A \sin^3 \theta + B \cos^2 \theta + C \sin \theta + D \cos \theta + E) e^{\sin \theta} + F$

then

- A) $B=12$ B) $D=0$ C) $B= -12$ D) $A= -4$



51. $\int \frac{1}{(x^{5/6} + 5x^{7/6})\sqrt{1+4x^{1/3}}} dx$ is equal to
 A) $-6\tan^{-1}(x^{-1/3} + 4)^{1/2} + C$ B) $-6\cot^{-1}(x^{-1/3} + 4)^{1/2} + C$
 C) $6\tan^{-1}(x^{1/3} + 4)^{1/2} + C$ D) $6\cot^{-1}(x^{-1/3} + 4)^{1/2} + C$
52. $\int \cosec^5 x dx = -\frac{\cosec^P x \cot x}{4} - \frac{P \cosec x \cot x}{Q} + \frac{3}{Q} \log |\cosec x - \cot x| + K$
 A) P=3 B) Q=8 C) P=2 D) P+Q=11
53. $\int \frac{\cos x(1+4\cos 2x)}{\sin x + 4\sin x \cos^2 x} dx = P \log |\sin x| + Q \log |\sin^2 x + R \cos^2 x| + c$, then
 A) P=1 B) Q= $\frac{1}{2}$ C) R=5 D) P+Q+R=6.5
54. If $\int \sin^{-1} x \cos^{-1} x dx = f^{-1}(x) \left[Ax - xf^{-1}(x) - 2\sqrt{1-x^2} \right] + \frac{\pi}{2} \sqrt{1-x^2} + 2x + C$, then
 A) $f(x) = \sin x$ B) $f(x) = \cos x$ C) $A = \frac{\pi}{4}$ D) $A = \frac{\pi}{2}$

SECTION-IV (INTEGER ANSWER TYPE)

- This section contains THREE (03) question.
- The answer to each question is a NON-NEGATIVE INTEGER.
- For each question, enter the correct integer corresponding to the answer the using the mouse and the on-screen virtual numeric keypad in the place designated to enter the answer.
- Answer to each question will be evaluated according to the following marking scheme:
- **Full Marks : +4** If ONLY the correct integer is entered;
- **Zero Marks : 0** In all other cases.

55. If $f(x) = \int 2e^x \cos^2 x (-\tan^2 x + \tan x + 1) dx$ and $f(x)$ passes through $(\pi, 0)$ then
 $[f(0) + f'(0)]$ is equal to (where [] is G.I.F).
56. If $\int \frac{dx}{(x^2+1)^2} = \frac{A}{148} \tan^{-1} x + \frac{1}{2} \frac{x}{x^2+1} + C$ then A is equal to
57. If $\int e^{x^3+x^2-1} (3x^4 + 2x^3 + 2x) dx = f(x) + C$, then the value of $f(1) \times f(-1)$ is _____.



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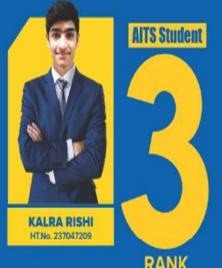
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