FIITJEE INTERNAL TEST

RANK IMPROVEMENT TEST – VIII

Batches: 1921

IIT- JEE 2021

QP CODE:

Time: *3 hours* **Maximum Marks: 264**

- ***Please read the instructions carefully. You are allotted 5 minutes specially for this purpose.***
- ***You are not allowed to leave the examination hall before end of the test.***
- ***Use Blue/Black Ball Point Pen only*** *for writing particulars on* ***Side–1 and Side–2*** *of the Answer Sheet.* ***Use to Pencil is strictly prohibited.***

Instructions

Note:

1. The question paper contains 3 sections (Sec-1, Chemistry, Sec-II, Physics & Sec-III, Mathematics.)

2. Each section is divided into two parts, **Part-A & C**.

3. **Part – A** contains 16 questions which are further divided as follows:

❖ **PART – A** (**01 – 10)** contains 10 Multiple Choice Questions which have **One or More Correct** answer.

For each question in the group **Q. 1 – 10** of **PART – A** you will be awarded
Full Marks: **+4** If only the bubble(s) corresponding to all the correct options(s) is (are) darkened.
Partial Marks: **+1** For darkening a bubble corresponding **to each correct option,** provided NO incorrect option is darkened.
Zero Marks: **0** If none of the bubbles is darkened.
Negative Marks: **–1** In all other cases.

For example, if **(A), (C) and (D)** are all the correct options for a question, darkening all these three will result in **+4 marks**; darkening only **(A) and (D)** will result in **+2 marks**; and darkening **(A) and (B)** will result in **–1** marks, as a wrong option is also darkened.

❖ **PART – A** (**11 – 16)** contains 2 Paragraphs. Based upon each paragraph, 3 Multiple Choice Questions. Each question has four choices (A), (B), (C) and (D), out of which **only one is correct**. Each question carries **+4 marks** for correct answer and zero marks if no bubble is darkened. In all other cases, **minus one(–1) mark will be awarded.**

4. **PART-B (1 – 6)** contains 6 Numerical Based questions the answer of which maybe positive or negative numbers or decimals (e.g. 6.25, 7.00, -0.33, -.30, 30.27, -127.30) answer and each question carries **+4 marks** for correct answer and zero marks if no bubble is darkened. In all other cases, **minus one (–1) mark will be awarded.**

Filling of OMR Sheet

1. Ensure matching of OMR sheet with the Question paper before you start marking your answers on OMR sheet.
2. On the OMR sheet, darken the appropriate bubble with ***Blue/Black Ball Point Pen*** for each character of your Enrolment No. and write in ink your Name, Test Centre and other details at the designated places.
3. OMR sheet contains alphabets, numerals & special characters for marking answers.
4. Rough spaces are provided for rough work inside the question paper. No additional sheets will be provided for rough work.
5. Blank Papers, clip boards, log tables, slide rule, calculator, cellular phones, pagers and electronic devices, in any form, are not allowed.

Name of the Candidate **:** ☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐

Enrolment Number **:** ☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐

Section – I (Chemistry)

PART – A

(Multiple Correct Choice Type)

This section contains 10 **multiple choice questions.** Each question has four choices (A), (B), (C) and (D) out of which **ONE OR MORE** may be correct.

1. In aqueous medium, cuprous ion undergoes disproportionation as
$2Cu^{+}(aq) \rightarrow Cu^{2+}(aq) + Cu$
The reaction is spontaneous in forward direction because
(A) $Cu^{+}(aq)$ is stronger oxidising agent than $Cu^{2+}(aq)$
(B) $Cu^{+}(aq)$ is weaker oxidising agent than $Cu^{2+}(aq)$
(C) The high value of hydration energy of Cu^{2+} ion than Cu^{+} ion due to favourable hard-hard interaction
(D) In the gaseous phase, the reverse reaction is favourable

1. ACD

2. Which of the following metal ion(s) is/are precipitated by addition of $K_4[Fe(CN)_6]$ solution?
(A) Cu^{2+} (B) Cd^{2+}
(C) Fe^{3+} (D) Ag^{+}

2. ABCD

3. Which of the following ions can interfere in the detection of brown colour of $Fe(NO)^{2+}$ during the brown ring test?
(A) Cl^{-} (B) Br^{-}
(C) I^{-} (D) CrO_4^{2-}

3. BCD

4. Brown ring test is famous for the test of acid radical NO_3^{-} ion. Which of the following statement(s) is/are correct for brown ring test?
(A) The brown ring is formed at liquid junction having composition $[Fe(H_2O)_5(NO)]^{2+}$
(B) The brown ring is formed at liquid junction due to higher acid concentration at junction
(C) The magnetic moment of the complex is 3.9 B.M
(D) NO_2^{-} ion react similarly as NO_3^{-} ion and can be best separated by use of little sulphamic acid.

4. ABCD

5. In which of the following reactions, the gas(es) is/are evolved?
(A) $Cu^{2+} + \overline{C}N$ added slowly (B) $NO_2^{-} + H_2N - SO_3H \longrightarrow$
(C) $NO_2^{-} + N_3^{-} + H^{+} \longrightarrow$ (D) $Cu^{2+} + \overline{S}CN \xrightarrow[\text{time}]{\text{Long reaction}}$

5. ABCD

6. Which of the following reagent(s) can be used to distinguish between Hg^{2+} and Hg_2^{2+} ions?
(A) NH_3 (B) NaOH
(C) KCN (D) HCl

6. ABCD

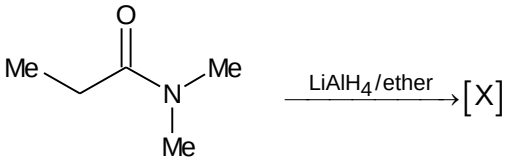
7. Which of the following reagent(s) can convert aqueous KI solution to violet colour?
(A) Chlorine water
(B) KNO_2 in presence of dil. H_2SO_4
(C) Conc.H_2SO_4
(D) Zn/CH_3COOH

7. ABC

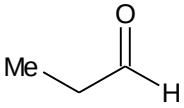
8. Which of the following statement(s) is/are correct for proteins?
(A) Primary structure of protein is the sequence of amino acid residue.
(B) α-helix and β-pleated sheet represents secondary structure.
(C) Fibrous proteins consist linear chain that are bounded together.
(D) A small change in primary structure can result in a large change in function.

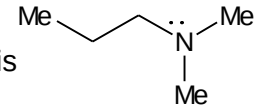
8. ABCD

9. For the following reduction



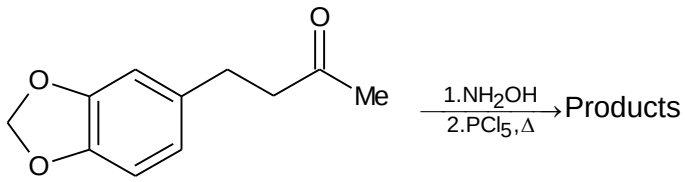
Select the correct statement(s)

(A) The reduction product[X] is 

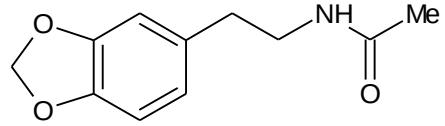
(B) The reduction product[X] is 

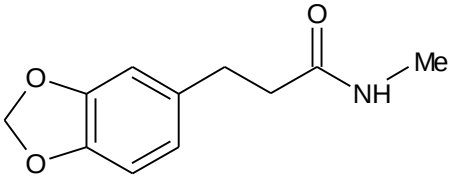
(C) The above amide reduced into 3° amine due to reduction of imminium ion
(D) The above amide is unaffected by $LiAlH_4$

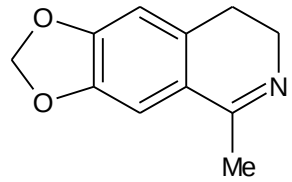
9. BC

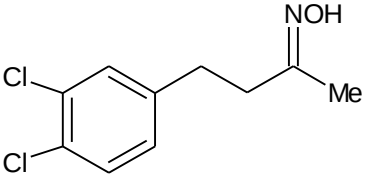
10. 

Which of the following compound(s) is/are likely to be formed in above reaction?

(A) 

(B) 

(C) 

(D) 

10. ABC

PART – A
(Single Correct Choice Type Q. No. 11 - 16)
Comprehension Type
Paragraph for question nos. 11 – 13

An aqueous solution may contain the following 12 anions:

CH_3COO^-, Br^-, CO_3^{2-}, Cl^-, CrO_4^{2-}, I^-, NO_3^-, $C_2O_4^{2-}$, PO_4^{3-}, SO_4^{2-}, S^{2-} and SO_3^{2-}

A colourless unknown solution is added to a mixture of $FeCl_3$, HCl and $K_3[Fe(CN)_6]$ and the solution turns deep blue.

11. The solution may contain
(A) Br^-, I^- and SO_3^{2-} ion
(B) Br^-, Cl^-, I^-, S^{2-} and SO_3^{2-} ions
(C) CrO_4^{2-} and NO_3^- ions
(D) I^-, S^{2-} and SO_3^{2-} ions

11. D

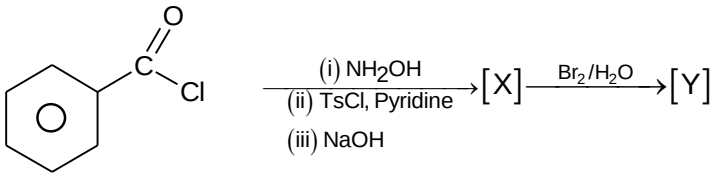
12. Furthermore, if the solution is treated first with H_2O_2 and then $BaCl_2$ solution a white precipitate is formed, which is not soluble by addition of HCl or HNO_3, the anion will be
(A) PO_4^{3-}
(B) S^{2-}
(C) I^-
(D) SO_3^{2-}

12. D

13. If the solution that is tested is initially acidic, then which of the anions are probably absent.
(A) NO_3^- and CrO_4^{2-}
(B) CO_3^{2-} and $C_2O_4^{2-}$
(C) PO_4^{3-} and SO_4^{2-}
(D) S^{2-} and SO_4^{2-}

13 A

Paragraph for question nos. 14 – 16



14. The organic compound [X] is
(A) Aniline
(B) Benzoic acid
(C) Cyanobenzene
(D) Benzamide

14. A

15. The formation of [X] does not involves an intermediate formed during the course of
(A) Hoffmann bromamide rearrangement
(B) Curtius rearrangement
(C) Lioshen rearrangement
(D) Arndt-Eistert synthesis

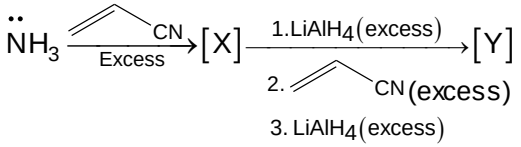
15. D

16. How many bromine atom(s) is/are in [Y]
(A) Zero
(B) One
(C) Two
(D) Three

16. D

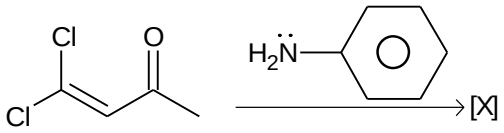
PART – C

This section contains 06 **numerical type questions**

1. 

The number of hetro-atom in [Y] is (Z). What is $\frac{Z}{2}$?

1. 5

2. 

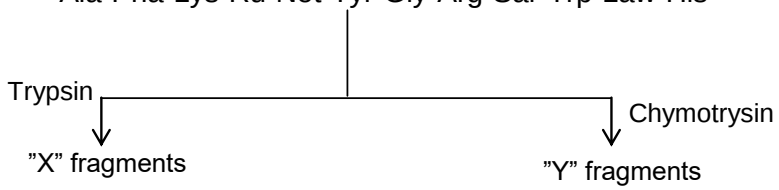
How many π-bonds are present in compound[X]?

2. 8

3. Glucose exists in aqueous solution in how many forms(major + minor).

3. 5

4. The peptide shown below is subjected to enzymatic cleavage as shown below



Value of xy/2?

4. 6

5. Among the following cations, how many may be present in water solution of chromate?
Ag^+, Pb^{2+}, Cu^{2+}, Ni^{2+}, Hg_2^{2+}, Na^+, K^+, NH_4^+, Mg^{2+}

5. 4

6. Among the following anions, how many will give colourless acid vapour/gas with conc. H_2SO_4?
Cl^-, Br^-, I^-, S^{2-}, SO_3^{2-}, $C_2O_4^{2-}$, NO_2^-, H_3COOO^-, BO_3^{3-}

6. 4

space for rough work

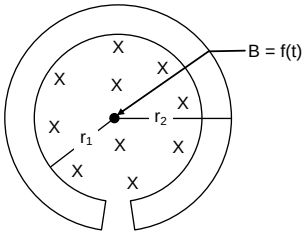
Section – II (Physics)

PART – A

(Multiple Correct Choice Type)

This section contains 10 **multiple choice questions.** Each question has four choices (A), (B), (C) and (D) out of which **ONE OR MORE** may be correct.

1. If the magnetic field B changes at a rate $\frac{dB}{dt}$, the induced current in the loop is

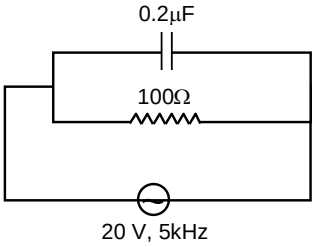


(A) $\propto \frac{dB}{dt}$ (B) $\left(\frac{r_1^2 - r_2^2}{2}\right)$

(C) zero (D) indeterminate

1. **C**

2. A single generator supplies a sine wave of 20V (V_{rms}), 5kHz to the circuit shown in the figure. Then choose the CORRECT alternative



(A) the rms current in the resistive branch is 0.2 A

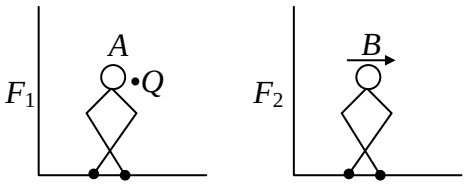
(B) the rms current in the capacitive branch is 0.1256 A

(C) the rms current through source is 0.2361 A

(D) current in both the branches is same

2. **ABC**

3. An observer A and a charge Q are fixed in a stationary frame F_1. An observer B is fixed in a frame F_2, which is moving with respect to F_1. Then choose the CORRECT Options



(A) A will observe electric field

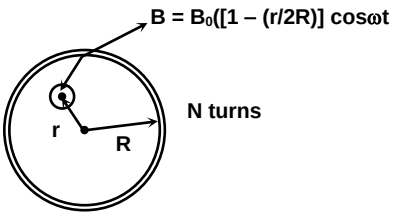
(B) B will observe magnetic field

(C) A will observe magnetic field

(D) B will observe electric field

3. **ABD**

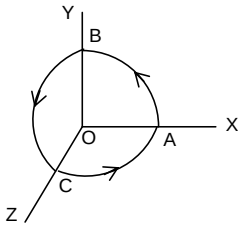
4. A circular loop with radius R consists of N tight turns of wire and is linked by external magnetic field directed perpendicular to the plane of the loop. The magnitude of the field perpendicular to the plane of the loop is B = $B_0\left(1-\frac{r}{2R}\right)$ cos ωt, where R is the radius of the loop and r is measured from the centre of the loop as shown in the figure. If resistance per unit length of the wire is λ then the induced current in the loop at any time can be



(A) $\frac{1}{6}\frac{R^2B_0\omega}{\lambda}$ (B) $\frac{2}{5}\frac{R^2B\omega}{\lambda}$ (C) $\frac{1}{4}\frac{R^2B_0\omega}{\lambda}$ (D) $\frac{RB_0\omega}{3\lambda}$

4. **ACD**

5. A wire is bent into three successive quadrants. The quadrant AB lies in the xy plane, BC in yz plane and CA in xz plane. Which of the following options has magnetic moments **lesser than or equal to** the magnetic moment of this system if a current I flows through it? Given : r = radius of each quadrant.

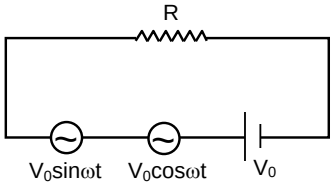


(A) $\frac{\sqrt{3}\pi r^2 I}{4}$ (B) $\frac{\sqrt{2}\pi r^2 I}{4}$

(C) $\frac{\pi r^2 I}{4}$ (D) $\frac{3\pi r^2 I}{4}$

5. **ABC**

6. Three sources of emf $V_0 \sin \omega t$, $V_0 \cos \omega t$ and V_0 are connected in series as shown. Find the options in which the value of current is **greater than or equal to** the value of rms current in the circuit.

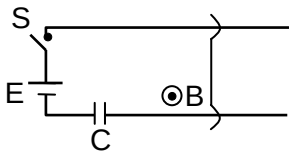


(A) $\frac{V_0}{R\sqrt{2}}$ (B) $\frac{V_0}{R}$

(C) $\frac{V_0\sqrt{2}}{R}$ (D) $\frac{2V_0}{R}$

6. **CD**

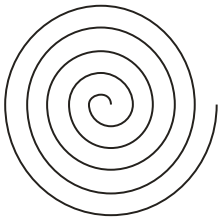
7. The circuit shown in the adjacent figure lies in a uniform magnetic field B coming out of the plane of paper. Initially, capacitor C is uncharged and the switch S is open. A conducting slider of mass m and length ℓ can move freely over parallel tracks. The velocity of the slider as soon as switch S is closed is (neglect effects of magnetic field due to the current in the shown circuit)



(A) $\frac{B\ell CE}{2m}$ (B) $\frac{B\ell CE}{m}$ (C) $\frac{CE^2}{2\ell m}$ (D) None of these

7. **D**

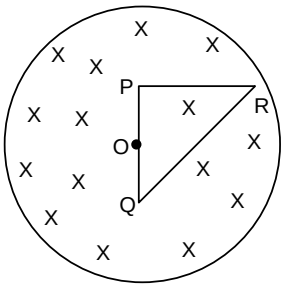
8. A charged particle enters a region which offers some resistance against its motion and a uniform magnetic field exists in the region. The particle traces a spiral path as shown. Then:



(A) angular velocity of particle increases
(B) speed of particle decreases continuously
(C) total mechanical energy of the particle remains conserved
(D) net force on the particle is always perpendicular to its direction of motion

8. **AB**

9. Consider a region of cylindrical magnetic field, changing with time at the rate α. Three conducting rods PQ, QR and RP are placed in the field such that the mid point of side PQ coincides with axis of the magnetic field region as shown in figure but their ends are not connected and joined with insulating material. PQ = 2ℓ, PR = 2ℓ,



(A) EMF induced between P and Q; $V_P - V_Q = 0$

(B) EMF induced between R and Q; $V_R - V_Q = \ell^2\alpha$

(C) EMF induced between P and R; $V_P - V_R = \ell^2\alpha$

(D) None of these

9. **ABC**

10. Choose the **incorrect** statements.

(A) A short magnet is moved along the axis of a conducting loop, the loop repels the magnet it the magnet is approaching the loop and attracts it if the magnet is moving away from the loop.

(B) An emf must be induced in a stationary conducting loop when it is placed in non-uniform transverse magnetic field, which changes with time at constant rate.

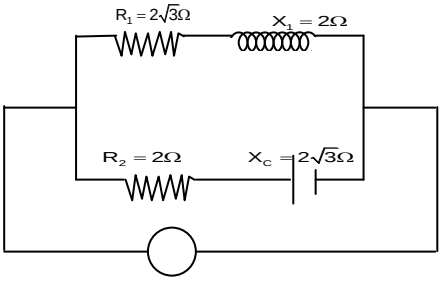
(C) An emf must be induced in a stationary conducting loop when it is placed in uniform transverse magnetic field, which changes with time at constant rate.

(D) Faraday's law is valid in time varying magnetic only

10. **BCD**

PART – A
(Single Correct Choice Type Q. No. 11 - 16)
Comprehension Type
Paragraph for question nos. 11 – 13

An alternating current source (AC)of 20 v (rms) is attached to the circuit shown



V= 20 Volts (rms)

11. The current (rms) flowing through R_2 (2Ω) resistance is

(A) 10 amp

(B) $10/\sqrt{3}$ amp

(C) 5 amp

(D) $5\left(\sqrt{3}-1\right)$amp

11. **C**

12. Net current (rms) flowing through the circuit

(A) $5\sqrt{2}$ amp (B) 5 amp

(C) 10 amp (D) 0 amp

12 **A**

13. Average power consumed by the circuit

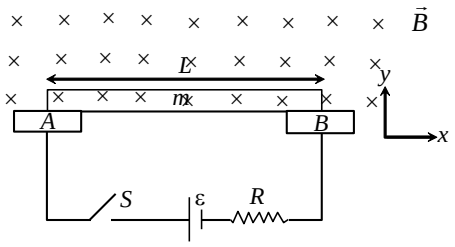
(A) 50 watt (B) $50\left(\sqrt{3}+1\right)$ watt

(C) 100 watt (D) $20\left(\sqrt{3}-1\right)$ watt

13. **B**

Paragraph for question nos. 14 – 16

In a vertical plane, a metal rod of length L and mass m is placed over two conducting platforms A and B. A region of magnetic field $\vec{B} = -B_0\hat{k}$ starting from line joining A and B and lying over it, is switched on. Now, at t = 0 switch S is closed such that the charge q is passes through the rod in time dt due to which magnetic field exert an impulsive force which causes the rod to jump with certain velocity and since the gravitational field is present the rod comes back to AB after some time and collides inelastically and the process is repeated.



14. The maximum height reached by the rod is

(A) $\frac{2q^2L^2B_0^2}{m^2g}$ (B) $\frac{q^2L^2B_0^2}{2m^2g}$ (C) $\frac{q^2L^2B_0^2}{m^2g}$ (D) $\frac{q^2L^2B_0^2}{4m^2g}$

14. **B**

15. The maximum emf induced in the rod is

(A) $\frac{B_0^2L^2q}{m}$ (B) $\frac{B_0^2L^2q}{2m}$ (C) $\frac{2B_0^2L^2q}{m}$ (D) $\frac{4B_0^2L^2q}{m}$

15. **A**

16. If time *dt* is assumed to be very small the time period of the motion is

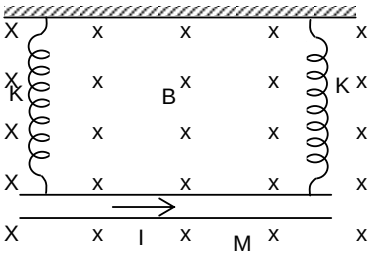
(A) $\frac{qLB_0}{2mg}$ (B) $\frac{qLB_0}{mg}$ (C) $\frac{2qLB_0}{mg}$ (D) $\frac{4qLB_0}{mg}$

16. **C**

PART – C

This section contains 06 **numerical type questions**

17. A metal rod of mass 10 gm and length 25 cm is suspended on two springs as shown in figure. The springs are extended by 4 cm. When a 20 ampere current passes through the rod it rises by 1 cm. The magnetic field is (in mT)

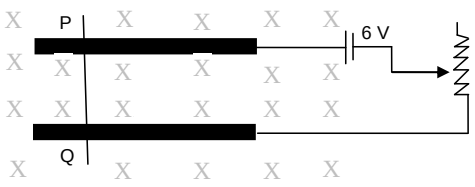


17. **15**

18. A square loop of side a = 6 cm carries a current I = 0.5 A. Calculate magnetic induction B (in μT) at point P, lying on the axis of loop and at a distance x = $\sqrt{7}$ cm from the centre of loop.

18. **4.5**

19. A metal wire PQ of mass 10 g lies at rest on two horizontal metal rails separated by 5 cm as shown in figure. A vertically downward magnetic field of magnitude 0.80 T exists in the space. The resistance of the circuit is slowly decreased and it is found that when the resistance goes below 20.0 Ω, the wire PQ starts sliding on the rails. The coefficient of friction between wires and rails is found to be μ, then 20μ is

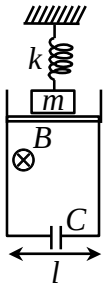


19. **2.4**

20. A uniform disc of radius R having charge Q distributed uniformly all over its surface is placed on a smooth horizontal surface. A magnetic field, $B = kxt^2$, where k is a constant, x is the distance (in metre) from the centre of the disc and t is the time (in second), is switched on perpendicular to the plane of the disc. Find the torque (in N-m) acting on the disc after 15 sec. (Take 4kQ = 1 S.I. unit and R = 1m)

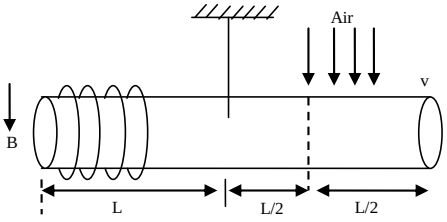
20. **1**

21. A block is attached to the ceiling by a spring that has a force constant k = 20 N/m. A conducting rod is rigidly attached to the block. The combined mass of the block and the rod is m = 0.3 kg. The rod can slide without friction along two vertical parallel rails, which are a distance l = 1 m apart. A capacitor of known capacitance C = 500 μF is attached to the rails by the wires. The entire system is placed in a uniform magnetic field B = 20 T directed as shown. Then calculate the angular frequency (in rad/sec) of the vertical oscillations of the block. Neglect the self-inductance and electrical resistance of the rod and all wires.



21. **6.32**

22. A non-conducting non-magnetic rod having circular cross section of radius R is suspended from a rigid support as shown in figure. A light and small coil of 300 turns is wrapped tightly at the left end of the rod where uniform magnetic field B exists in vertically downward direction. Air of density ρ hits the half of the right part of the rod with velocity V as shown in the figure. What should be current (in mA) in the clockwise direction (as seen from O) in the coil so that rod remains horizontal? Give answer in A. Given $\frac{2}{L\nu}\sqrt{\frac{\pi RB}{\rho}} = \frac{1}{\sqrt{5}}A^{-1/2}$.



22. **2**

space for rough work

Section – III (Mathematics)

PART – A

(Multiple Correct Choice Type)

This section contains 10 **multiple choice questions.** Each question has four choices (A), (B), (C) and (D) out of which **ONE OR MORE** may be correct.

1. Let $L=\int_0^1 \frac{t^a}{\left(t^2+1\right)\left[(2t)^a+\left(1-t^2\right)^a\right]}dt$, (where $a\in R$) is/are

(A) $L=\frac{\pi}{16}$, for $a=1$ (B) $L=\frac{\pi}{16}$, for $a=2$

(C) $L=\frac{\pi}{32}$, for $a=3$ (D) $L=\frac{\pi}{128}$, for $a=4$

1. **AD**

2. Let α, r be real numbers such that $r>1, r\neq 3, r\neq 4$, such that $\lim_{n\to\infty}\sum_{k=1}^{n}\frac{n^\alpha}{(n+k)^r}=\frac{r-3}{(r-1)(r-4)}$, then

(A) $\alpha=\frac{1}{2}$

(B) $r-\alpha=1$

(C) $r+\alpha=3$

(D) intersection point of $2^{-x}=\frac{1}{2-x}$ gives the solution for r.

2. **BC**

3. Define sequence $\{a_n\},\{b_n\}$ $a_n=\int_{-\frac{\pi}{6}}^{\frac{\pi}{6}} e^{n\sin\theta}\,d\theta$, $b_n=\int_{-\frac{\pi}{6}}^{\frac{\pi}{6}} e^{n\sin\theta}\cos\theta\,d\theta (n=1,2,3,.....)$ then

(A) $b_n=\frac{1}{n}\left(e^{\frac{n}{2}}-e^{-\frac{n}{2}}\right)$ (B) $b_n=\frac{1}{n}\left(e^{\frac{n}{2}}+e^{-\frac{n}{2}}\right)$

(C) $a_n\geq b_n$ (D) $a_n\leq\frac{2}{\sqrt{3}}b_n$

3. **ACD**

4. $\int\frac{dx}{\left(1+\sqrt{x}\right)^8}=\frac{-1}{3\left(1+\sqrt{x}\right)^{k_1}}+\frac{2}{7\left(1+\sqrt{x}\right)^{k_2}}+C$, then :

(A) $k_1=5$ (B) $k_1=6$

(C) $k_2=7$ (D) $k_2=8$

4. **BC**

5. For $a > 0$, if $I = \int \sqrt{\frac{x}{a^3 - x^3}}\, dx = A \sin^{-1}\left(\frac{x^{3/2}}{B}\right) + C$, where C is any arbitrary constant, then:

(A) $A = \frac{2}{3}$ (B) $B = a^{3/2}$

(C) $A = \frac{1}{3}$ (D) $B = a^{1/2}$

5. **AB**

6. Suppose $J = \int \frac{\sin^2 x + \sin x}{1 + \sin x + \cos x}\, dx$ and $K = \int \frac{\cos^2 x + \cos x}{1 + \sin x + \cos x}\, dx$. If C is an arbitrary constant of integration then which of the following is/are correct?

(A) $J = \frac{1}{2}(x - \sin x + \cos x) + C$ (B) $J = K - (\sin x + \cos x) + C$

(C) $J = x - K + C$ (D) $K = \frac{1}{2}(x - \sin x + \cos x) + C$

6. **BC**

7. If $\int \frac{3\cot 3x - \cot x}{\tan x - 3\tan 3x}\, dx = px + qg(x) + c$ where 'c' is a constant of integration, then:

(A) $p = 1;\ q = \frac{1}{\sqrt{3}};\ g(x) = \ln\left|\frac{\sqrt{3} - \tan x}{\sqrt{3} + \tan x}\right|$

(B) $p = 1;\ q = -\frac{1}{\sqrt{3}};\ g(x) = \ln\left|\frac{\sqrt{3} - \tan x}{\sqrt{3} + \tan x}\right|$

(C) $p = 1;\ q = -\frac{2}{\sqrt{3}};\ g(x) = \ln\left|\frac{\sqrt{3} + \tan x}{\sqrt{3} - \tan x}\right|$

(D) $p = 1;\ q = -\frac{1}{\sqrt{3}};\ g(x) = \ln\left|\frac{\sqrt{3} + \tan x}{\sqrt{3} - \tan x}\right|$

7. **AD**

8. Let f(x) be a non constant twice derivable function defined on R such that f(2 + x) = f(2 - x) and $f'\left(\frac{1}{2}\right) = 0 = f'(1)$. Then which of the following is/are correct?

(a) f(-4) = f(8)

(b) Minimum number of roots of the equation $f''(x) = 0$ in (0, 4) are 4.

(c) $\int_{-\frac{\pi}{4}}^{\frac{\pi}{4}} f(2 + x)\sin x\, dx = 0$

(d) $\int_0^2 f(t)5^{\cos \pi t} dt = \int_2^4 f(4 - t)5^{\cos \pi t} dt$ x

8. ABCD

9. If $f(x) = \int_{x}^{x^2} \frac{dt}{(\log t)^2}$, $x \neq 0$, then f(x) is

(A) Monotonically increasing in (2, ∞) (B) monotonically increasing in (1, 2)
(C) Monotonically decreasing in (2, ∞) (D) monotonically decreasing in (0, 1)

9. AD

10. If $I = \int \frac{\sin x - \cos x}{(\sin x + \cos x)\sqrt{\sin x \cos x + \sin^2 x \cos^2 x}} dx = \text{cosec}^{-1}(g(x)) + c \ \forall \ x \in R$, then

(A) g(x) = 1 + sin2x (B) g(x) = 1 – sin2x
(C) $g(x) \geq 0$ (D) $-1 \leq g(x) \leq 1$

10. AC

PART – A
(Single Correct Choice Type Q. No. 11 - 16)
Comprehension Type
Paragraph for question nos. 11 – 13

Let $f(x)$ be a polynomial function of degree 2 satisfying

$\int \frac{f(x)}{x^3 - 1} dx = \ln\left|\frac{x^2 + x + 1}{x - 1}\right| + \frac{2}{\sqrt{3}} \tan^{-1}\left(\frac{2x+1}{\sqrt{3}}\right) + C$, where C is indefinite integration constant.

11. The value of $f(1)$ is equal to

(A) 1 (B) 2
(C) –1 (D) –3

11. D

12. Let $\int \frac{1 - 6\,\text{cosec}\, x}{6 + f(\sin x)} d(\sin x) = g(x) + K$, where g(x) contains no constant term. Then $\lim_{t \to \frac{\pi}{2}} g(t)$ is equal to (where K is indefinite integration constant).

(A) ln1 (B) ln2
(C) ln3 (D) ln4

12. C

13. Let $\int \frac{5 + f(\sin x) + f(\cos x)}{\sin x + \cos x} dx = h(x) + \lambda$, where $h(1) = -1$. The value of $\tan^{-1}[h(2)] + \tan^{-1}[h(3)]$ is equal to (where λ is indefinite integration constant.)

(A) $\frac{\pi}{4}$ (B) $-\frac{\pi}{4}$
(C) $\frac{3\pi}{4}$ (D) $-\frac{3\pi}{4}$

13. D

Paragraph for question nos. 14 – 16

Let $f:R\to R$ be a differentiable function such that $f(x)=x^2+\int_0^x e^{-t}f(x-t)dt$

14. f(x) increases for –
(A) x > –1 (B) x < –2
(C) x > –2 (D) None

14. B

15. y = f(x) is –
(A) injective but not surjective (B) Surjective but not injective
(C) Bijective (D) Neither injective nor surjective

15. B

16. The value of $\int_0^1 f(x)dx$ is equal to –

(A) $\frac{1}{4}$ (B) $-\frac{1}{12}$

(C) $\frac{5}{12}$ (D) $\frac{12}{7}$

16. C

PART – C

This section contains 06 **numerical type questions**

1. Let $I=\int_0^1 (1-x)\ln\left(\frac{2+\sqrt{1-x}}{2-\sqrt{1-x}}\right)dx$ and $J=\int_1^3 (x-2)^3\ln x dx$,then $\frac{I}{J}=$_____

1. **2**

2. If $f:[0,1]\to(0,\infty)$ is a continuous function such that $\int_0^1 f(x)dx=1$, then maximum value of $\left(\int_0^1 \sqrt[3]{f(x)}\,dx\right)\left(\int_0^1 \sqrt[5]{f(x)}\,dx\right)\left(\int_0^1 \sqrt[7]{f(x)}\,dx\right)$ is ____

2. **1**

3. Let $a_n=\int_0^{\pi/2}(1-\sin t)^n\sin 2t dt$, then $\lim_{n\to\infty}\sum_{n=1}^{n}\frac{2a_n}{n}$ is equal to _____

3. **1**

4. Let the fraction part of a real number a be defined by $\{a\}=a-[a]$. If

$$L=\int_0^{\pi/2}\sin 2x\left\{\ell n^3\tan x\right\}dx$$, then $\frac{2}{L}$ is

4. **4**

5. The following data set has a mean 14.7 and a variance of 10.01. 18, 11, 12, a, 16, 11, 19, 14, b, 13, then possible value of $\frac{2a+b}{23}$ can be

5. **2**

6. A vertical lamp-post, 6 m high, stands at a distance of 2 m from a wall, 4 m hight. A 1.5-m-tall man starts to walk away from the wall on the other side of the wall, in line with the lamp-post. The maximum distance to which the man can walk remaining in the shadow is k/2 then k is

6. 5

space for rough work

FIITJEE INTERNAL TEST

RANK IMPROVEMENT TEST – VIII

Batches: 1921

IIT- JEE 2021

ANSWERS

QP CODE:

SECTION – I (Chemistry)

Part – A

Part – C

SECTION – II (Physics)

Part – A

Part – C

SECTION – III (Mathematics)

Part – A

Part – C