FIITJEE RET – 6

(2017 – 2019)(2ND YEAR_CHAMPIONS)

IIT-2017 (P1)

DATE: 13.08.2018

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

INSTRUCTIONS:

A. General

1. This booklet is your Question Paper containing 60 questions.
2. Blank papers, clipboards, log tables, slide rules, calculators, cellular phones, pagers and electronic gadgets in any form are not allowed to be carried inside the examination hall.
3. Fill in the boxes provided for Name and Enrolment No.
4. The answer sheet, a machine-readable Objective Response (ORS), is provided separately.
5. DO NOT TAMPER WITH / MULTILATE THE ORS OR THE BOOKLET.

B. Filling in the OMR:

6. The instructions for the OMR sheet are given on the OMR itself.

C. Question paper format:

7. The question paper consists of **3 parts (Physics, Chemistry and Mathematics)**. Each part consists of **two sections**.
8. **Section I** contains **8 questions**. The answer to each question is a **single digit integer**, ranging from 0 to 9 (both inclusive).
9. **Section II** contains **10 multiple choice questions**. Each question has four choices (A), (B), (C) and (D) out of which **ONE or MORE** are correct.
10. **Section III** contains **2 Match the following** type questions and you will have to match entries in Column I with the entries in Column II

D. Marking Scheme

11. For each question in **Section I**, you will be awarded **4 marks** if you darken ALL the bubble(s) corresponding to the correct answer(s) **ONLY**. In all other cases **zero (0) marks** will be awarded. **No negative marks** will be awarded for incorrect answers in this section.
12. For each question in **Section II**, you will be awarded **4 marks** if you darken ALL the bubble(s) corresponding to the correct answer(s) **ONLY**. In all other cases **zero (0) marks** will be awarded. **–2 marks** will be awarded for incorrect answers in this section.
13. For each question in **Section III**, you will be awarded **2 marks** for each entry in Column I; if you darken ALL the bubble(s) corresponding to the correct answer(s) **ONLY**. In all other cases **zero (0) marks** will be awarded. **–1 marks** will be awarded for incorrect answers in this section.

Don't write / mark your answers in this question booklet.
If you mark the answers in question booklet, you will not be allowed to continue the exam.

NAME: ☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐

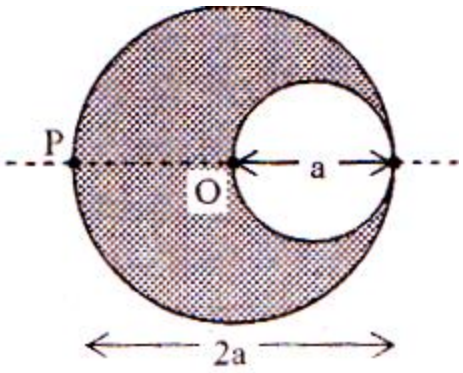
ENROLLMENT NO.: ☐☐☐☐☐☐☐☐☐☐

PAPER–I
PART I: PHYSICS
SECTION 1 (Maximum Marks: 32)

- This section contains **EIGHT** questions.
- The answer to each question is a **SINGLE DIGIT INTEGER** ranging from **0 to 9**, both inclusive.
- For each question, darken the bubble corresponding to the correct integer in the ORS.
- Marking scheme:
  - **+4** If the bubble corresponding to the answer is darkened.
  - **0** In all other cases.

1. Two parallel wires in the plane of the paper are distance X_0 apart. A point charge is moving with speed u between the wires in the same plane at a distance X_1 from one of the wires. When the wires carry current of magnitude I in the same direction, the radius of curvature of the path of the point charges is R_1. In contrast, if the currents I in the two wires have direction opposite to each other, the radius of curvature of the path is R_2. If $\frac{X_0}{X_1} = 3$, the value of $\frac{R_1}{R_2}$ is.

2. A cylindrical cavity of diameter a exists inside a cylinder of diameter 2a as shown in the figure. Both the cylinder and the cavity are infinitely long. A uniform current density J flows along the length. If the magnitude of the magnitude field at the point P is given by $\frac{N}{12}\mu_0 aJ$, then the value of N is

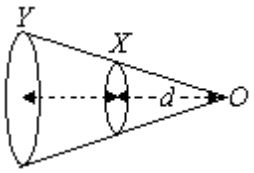


3. A steady current I goes through a wire loop PQR having shape of right angle triangle with PQ = 3x, PR = 4x and QR = 5x, IF the magnitude of the magnetic field at P due to this loop is $k\left(\frac{\mu_0 I}{48\pi x}\right)$, find the value of k.

4. A beam of protons with a velocity $4\times10^5\,m/s$ enters a uniform magnetic field of 0.3 tesla at an angle 60^0 to the magnetic field. If the radius of the helical path taken by the proton beam is given by $\left(3n\times10^{-3}\right)m$, then n is

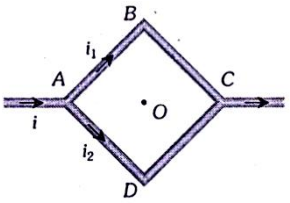
Space for rough work

5. Two circular coils X and Y have equal number of turns and carry equal currents in the same sense and subtend same solid angle at point O. If the smaller coil X is midway between O and Y, then if we represent the magnetic induction due to bigger coil Y at O as B_Y and that due to smaller coil X at O as B_X, if $\frac{B_Y}{B_X}=\frac{4}{n}$ then n is ….



6. Two very long, straight, parallel wires carry steady currents I each in opposite directions . The distance between the wires is d. At a certain instant of time, a point charge q is at a point equidistant from the two wires, in the plane of the wires. Its instantaneous velocity $\vec{\upsilon}$ is perpendicular to this plane. The magnitude of the force due to the magnetic filed acting on the charge at this instant is N times $\frac{\mu_0 Iq\upsilon}{2\pi d}$, then find N?

7. Figure shows a square loop ABCD with edge length a. The resistance of the wire ABC is r and that of ADC is 3r. The value of magnetic field at the centre of the loop assuming uniform wire is found to be k times $\frac{\sqrt{2}\mu_0 i}{6\pi a}\otimes$. Find K .



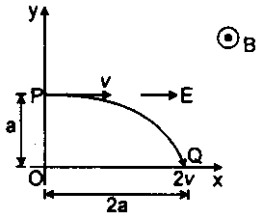
8. The magnetic field due to a current carrying circular loop of radius 3 cm at a point on the axis at a distance of 4 cm from the centre is 54 μ T. Its value at the centre of the loop is k times 50 μT, then find k?

SECTION 2 (Maximum Marks: 40)

- This section contains **TEN** questions.
- Each question has **FOUR** options (A), (B), (C) and (D). **ONE OR MORE THAN ONE** of these four option(s) is (are) correct.
- For each question, darken the bubble(s) corresponding to all the correct option(s) in the ORS.
- Marking scheme:
  - **+4** If only the bubble(s) corresponding to all the correct option(s) is (are) darkened.
  - **0** If none of the bubbles is darkened.
  - **–2** In all other cases

Space for rough work

9. 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 statements is/are correct?



(A) $E = \frac{3}{4}\left(\frac{mv^2}{qa}\right)$

(B) Rate of work done by the electric field at P is $\frac{3}{4}\left(\frac{mv^3}{a}\right)$

(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

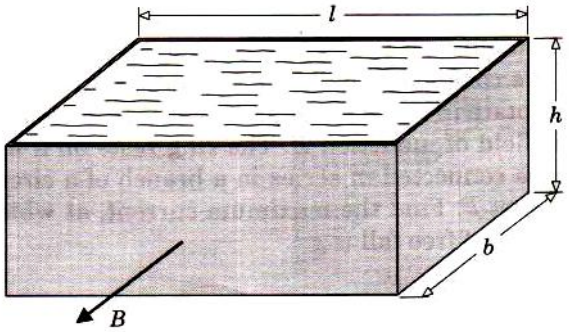
10. A thin flexible wire of length L is connected to two adjacent fixed points and carries a current I in the clockwise direction, as shown in the figure. When the system is put in a uniform magnetic field of strength B going into the plane of the paper, the wire takes the shape of circle. The tension in the wire is

(A) IBL (B) $\frac{IBL}{\pi}$

(C) $\frac{IBL}{2\pi}$ (D) $\frac{IBL}{4\pi}$

Space for rough work

11. A conducting fluid of mass density ρ_m and electrical resistivity ρ_e is kept in an insulating vessels of dimensions $\ell \times b \times h$. The vessel is placed on a horizontal floor where a uniform horizontal magnetic field of induction B is established perpendicular to the face $\ell \times h$ as shown in the figure. How much potential difference V must be applied on the liquid between the side faces designated by dimensions $b \times h$ so that the fluid pressure at the bottom of the vessel vanishes ? The acceleration of free fall is g.



(A) $V = \frac{\rho_m \rho_e g \ell}{B}$ (B) $V > \frac{\rho_m \rho_e g \ell}{B}$

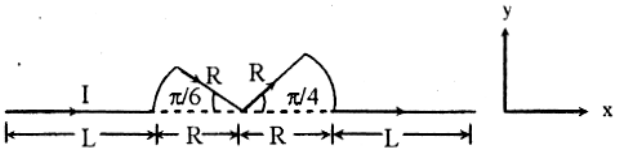
(C) $V < \frac{\rho_m \rho_e g \ell}{B}$ (D) can not be determined

12. As shown in the figure, four identical loops are placed in a uniform magnetic field B. The loops carry equal current i. $\hat{n}$ denotes the normal to the plane of each loop. Potential energies in descending order are

(A) I, II, III, IV (B) IV, II, III, I (C) I, III, II, IV (D) IV, III, II, I

Space for rough work

13. A conductor (shown in the figure) carrying constant current I is kept in the x – y plane in a uniform magnetic field $\vec{B}$. If F is the magnitude of the total magnetic force acting on the conductor, then the correct statement(s) is (are)



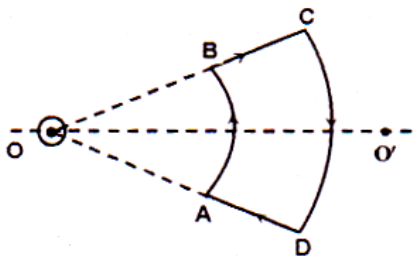
(A) If $\vec{B}$ is along $\hat{z}, F \propto (L+R)$

(B) If $\vec{B}$ is along $\hat{x}, F = 0$

(C) If $\vec{B}$ is along $\hat{y}, F \propto (L+R)$

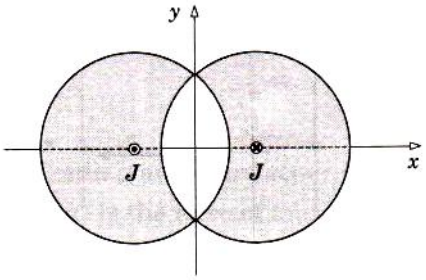
(D) If is along $\hat{z}, F = 0$

14. An infinite current carrying wire passes through point O and in perpendicular to the plane containing a current carrying loop ABCD as shown in the figure. Choose the correct option(s).



(A) Net force on the loop is zero
(B) Net torque on the loop is zero
(C)As seen from O, the loop rotates clockwise
(D) As seen from O, the loop rotates anticlockwise

15. A long straight conductor has uniform cross –section having shape of two identical overlapped circles with their center – to – center spacing a. The material from overlapped section has been removed from entire length of the conductor as shown in the figure. Now the portions on either sides of the y–z plane are split and restacked after coating their surfaces by a very thin layer of insulating paint.

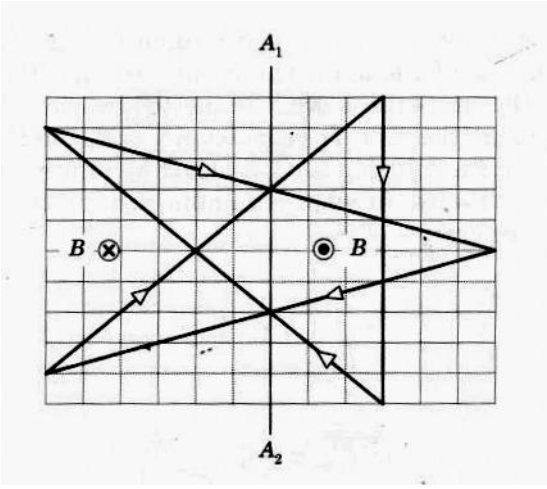


The portions of composite conductor to the left and the right side of the y–z plane carry uniform currents of current density J in the positive z and the negative z–directions respectively. The permeability of both the conductors is the same as that of vacuum.
Which one of the following statements best describes the magnetic field in the empty space inside the composite conductor.

(A) It is nonuniform and points in the positive y –direction everywhere on the y –axis
(B) It is nonuniform and points in the positive y –direction everywhere on the x and y –axis
(C) It is uniform , points every where in the positive y –direction and has magnitude $\frac{1}{2}\mu_0 Ja$
(D) It has different directions at different points but the same magnitude $\frac{1}{2}\mu_0 Ja$

Space for rough work

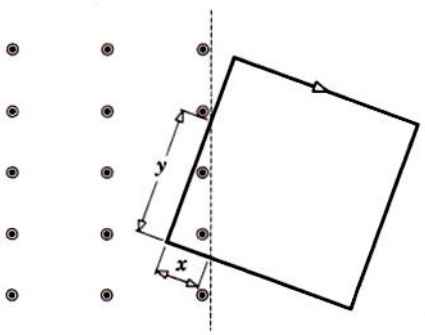
16. A hard insulated conducting wire is bent into shape of a five – pointed star like planar structure and carries current I. On the left and on the right side of the line A_1A_2, uniform magnetic fields each of induction B exists in direction perpendicularly into and perpendicularly out of the plane of the star respectively. If length of a side of a unit cell of the grid shown is ℓ, find force of interaction between the current and the magnetic field.



(A) 16IB ℓ towards the right (B)16IB ℓ towards the left

(C) 8IB ℓ towards the left (D) 8IB ℓ towards the right

17. On a frictionless horizontal tabletop is held at rest a rigid square loop of side length ℓ carrying an electric current. A uniform magnetic field pointing upwards to the left of the dashed line as shown in the figure is switched on and then the loop is released. Considering different length of the side segments x and y (x<y) shown in the figure, which of the following conclusion can you make ?



(A) If $x < \frac{\ell}{2}$ and $y = \frac{\ell}{2}$, the loop starts rotating anticlockwise

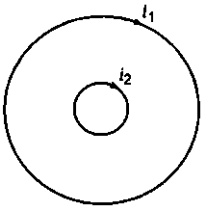
(B) If $x < \frac{\ell}{2}$ and $y = \frac{\ell}{2}$, the loop starts rotating anticlockwise

(C) If $x < \frac{\ell}{2}$ and $y > \frac{\ell}{2}$, the loop starts rotating anticlockwise

(D) If $x < \frac{\ell}{2}$ and $y > \frac{\ell}{2}$, more information is required to decide which way the loop stats rotating.

Space for rough work

18. Two concentric circular coils of radii R and r (<<R) carry currents of i_1 and i_2 respectively. If the smaller coil is rotated slightly about one of its diameter, it starts oscillating. Then which of the following statement(s) is/are correct:
(A) The oscillations are simple harmonic in nature
(B) The frequency of oscillation is proportional to product $i_1 i_2$
(C) The frequency of oscillation is inversely proportional to square root of R
(D) The frequency of oscillation is proportional to square root of R



SECTION 3 (Maximum Marks: 16)

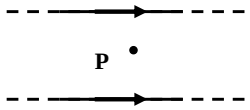
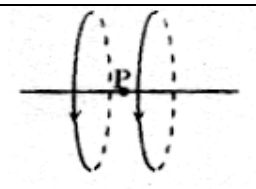
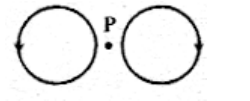
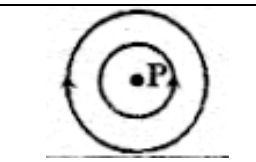
- This section contains **TWO** questions.
- Each question contains two columns, **Column I** and **Column II**
- **Column I** has **four** entries (A), (B), (C) and (D)
- **Column II** has **five** entries (P), (Q), (R), (S) and (T)
- Match the entries in **Column I** with the entries in **Column II**
- One or more entries in **Column I** may match with one or more entries in **Column II**.
- The ORS contains a 4×5 matrix whose layout will be similar to the one shown below:

(A)	(P)	(Q)	(R)	(S)	(T)
(B)	(P)	(Q)	(R)	(S)	(T)
(C)	(P)	(Q)	(R)	(S)	(T)
(D)	(P)	(Q)	(R)	(S)	(T)

- For each entry in Column I, darken the bubbles of all the matching entries. For example, if entry (A) in **Column I** matches with entries (Q), (R) and (T), then darken these three bubbles in the ORS. Similarly, for entries (V), (C) and (D).
- Marking entry in Column I.
  - **+2** If only the bubble(s) corresponding to all the correct match (s) is (are) darkened.
  - **0** If none of the bubbles is darkened.
  - **–1** In all other cases.

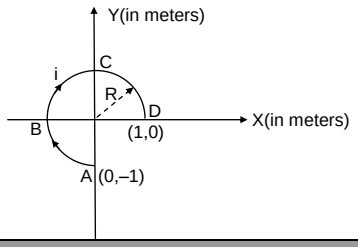
Space for rough work

19. Two wires each carrying a steady current I are shown in four configurations in column I. Some of the resulting effects are described in column II. Match the statements in column I with the statements in column II and indicate your answer by darkening appropriate bubbles in the 4 x 4 matrix given ORS

Column – I			Column – II	
(A)	Point P is situated midway between the wires		(p)	The magnetic fields (B) at P due to the currents in the wires are in the same direction.
(B)	Point P is situated at the mid-point of the line joining the centers of the circular wires, which have same radii		(q)	The magnetic field (B) at P due to the currents in the wires are in opposite directions
(C)	Point P is situated at the mid – point of the line joining the centres of the circular wires, which have same radii		(r)	There is no magnetic field at P
(D)	Point P is situated at the common center of the wires		(s)	The wires repel each other.
			(t)	None

Space for rough work

20. The wire ABCD is bent as shown in the figure and placed in xy-plane. It carries current i. A uniform magnetic field $\vec{B}$ of magnitude B_0 is applied in the region.



Column I		Column II	
(A)	If $\vec{B} = B_0\hat{j}$ the total force (in Newton) on the wire is	(p)	$iB_0\hat{k}$
(B)	If $\vec{B} = B\hat{i}$ the total force on the wire is	(q)	$-iB_0\hat{k}$
(C)	The magnetic field intensity due to current in wire ABCD at the origin is $\left(\frac{3\mu_0 i}{8}\right)(-\hat{k})$	(r)	$iB_0(\hat{i}-\hat{j})$
(D)	If $\vec{B} = B_0\hat{k}$ the total force (in Newton) on the wire is	(s)	$\frac{3\mu_0 I}{8}(-\hat{k})$
		(t)	$\frac{3\mu_0 i}{8}(\hat{k})$

PART II: CHEMISTRY

SECTION 1 (Maximum Marks: 32)

- This section contains **EIGHT** questions.
- The answer to each question is a **SINGLE DIGIT INTEGER** ranging from **0 to 9**, both inclusive.
- For each question, darken the bubble corresponding to the correct integer in the ORS.
- Marking scheme:
  - **+4** If the bubble corresponding to the answer is darkened.
  - **0** In all other cases.

21. $M(OH)_x$ has $K_{SP} = 4\times10^{-12}$ and its solubility in water is 10^{-4}M. Calculate the value of x.

22. A certain buffer solution contains equal concentration of X^- and HX. K_b for X^- is 10^{-10}. Calculate pH of buffer.

Space for rough work

23. An acid type indicator, HIn differs in colour from its conjugate base (In^-). The human eye is sensitive to colour differences only when the ratio $\left[In^-\right]/\left[HIn\right]$ is greater than 10 or smaller than 0.1. what should be the minimum change in the pH of the solution to observe a complete colour change $\left(K_a = 1.0\times10^{-5}\right)$:

24. If the equilibrium constant for the reaction of weak acid HA with strong base is 10^9, then pH of 0.1 M Na A is :

25. At what pH will a 1 x 10^{-4} M solution of an acid base indicator HIn will change its colour. K_b for In^- = 10^{-11} :

26. 0.15 mole of pyridinium chloride has been added into 500 cm^3 of 0.2 M pyridine solution. Calculate pH and hydroxyl ion concentration in the resulting solution assuming no change in volume. (K_b for pyridine = 1.5 x 10^{-9}M).

27. K_a for butyric acid is 2.0 x 10^{-5}. Calculate pH and hydroxyl ion concentration in 0.2 M aqueous solution of sodium butyrate

28. In 1L saturated solution of AgCl $\left[K_{sp}\left(AgCl\right)=1.6\times10^{-10}\right]$, 0.1 mol of CuCl $\left[K_{sp}\left(CuCl\right)=1\times10^{-6}\right]$ is added. The resultant concentration of Ag^+ in the solution is 1.6 x 10^{-x}. The value of x is :

SECTION 2 (Maximum Marks: 40)

- This section contains **TEN** questions.
- Each question has **FOUR** options (A), (B), (C) and (D). **ONE OR MORE THAN ONE** of these four option(s) is (are) correct.
- For each question, darken the bubble(s) corresponding to all the correct option(s) in the ORS.
- Marking scheme:
  - **+4** If only the bubble(s) corresponding to all the correct option(s) is (are) darkened.
  - **0** If none of the bubbles is darkened.
  - **–2** In all other cases

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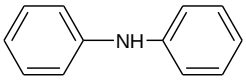
29. 100 mL 1 M weak monobasic acid (K_a = 1.74 x 10^{-5}) is mixed with 100 mL 0.2 M HCl. Then, (neglecting volume change)
(A) the pH of the resulting solution is 1
(B) the pH of the solution obtained by the addition of 30 mL 2 M NaOH is 4.95
(C) the pH of the solution obtained by the addition of 35 mL 2 M NaOH is 4.59
(D) the pH of the solution obtained by the addition of 60 mL 2 M NaOH is 9.68

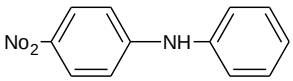
Space for rough work

30. Identify the correct statements for 2 M pyridinium acetate solution {$K_{a(acietic\ acid)}$ = 1.75 x 10^{-5}, $K_{b(pyridinium\ hydroxide)}$ = 1.5 x 10^{-9}, K_w = 1 x 10^{-14}}
(A) Hydrolysis constant is 0.38
(B) Percentage of hydrolysis is close to 43
(C) pOH of the solution is 9.03
(D) The solution is neutral

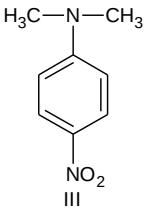
31. A set of five amines are given (I – V)



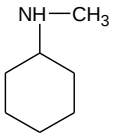
I



II



III



IV

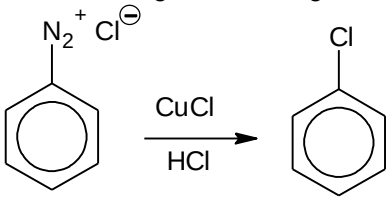
Examine the following and identify the correct statements.
(A) Between I & II, the stronger base is I.
(B) The weakest base among those listed is II and the strongest is IV.
(C) III is a weaker base than 4–nitroaniline.
(D) II is a weaker base because of more electron withdrawing and base weakening effect.

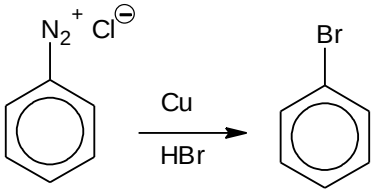
32. Four statements relating to nitrogenous compounds are given below. Choose the incorrect statements.
(A) Allyl isocyanide contains nine σ–bonds and three π–bonds
(B) Methyl isocyanide on reduction with $LiAlH_4$ gives ethylamine.
(C) m–Dinitrobenzene on reduction with NH_4HS gives m–nitro aniline.
(D) Acetaloxime on reaction with P_2O_5 gives acetonitrile.

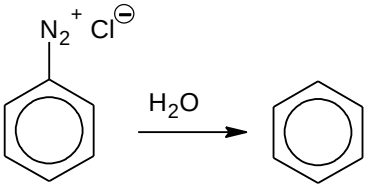
33. $A \xrightarrow{NaNO_2} B \xrightarrow{Sn+HCl} C \xrightarrow{KMnO_4} D \xrightarrow{NH_3} E \xrightarrow{P_2O_5}$
$F \xrightarrow{LIAlH_4} G \xrightarrow[alc.NaOH]{CHCl_3} CH_3 - CH_2 - CH_2(NC)$
(A) C = CH_3–CH_2–CHO
(B) 'E' undergoes Hoffmann rearrangement
(C) F = CH_3–CH_2–CN
(D) D = CH_3–CH_2–COOH

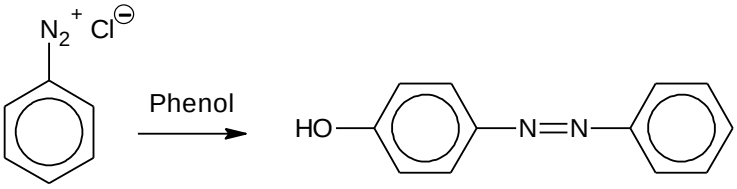
Space for rough work

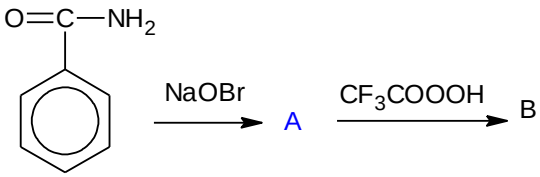
34. Correct reactions among the following are

(A) 

(B) 

(C) 

(D) 

35. 

Correct statement are

(A) 'A' doesn't give friedal craft's alkylation (B) 'A' Undergoes friedal craft's acylation

(C) 'A' undergoes friedal craft's alkylation very easily

(D) 'B' on reduction gives A

36. Benzylamine can be prepared by

(A) $C_6H_5CONH_2 \xrightarrow{NaOBr}$

(B) $C_6H_5CONH_2 \xrightarrow{LiAlH_4 \text{ / ether}}$

(C) $C_6H_5CN \xrightarrow{LiAlH_4 \text{ / ether}}$

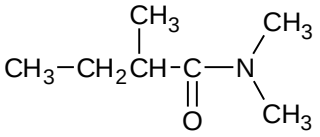
(D) Potassium phthalimide $\xrightarrow[\text{(ii) Ag / NaOH, } \Delta]{\text{(i) } C_6H_5CH_2Br}$

Space for rough work

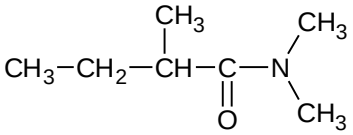
37. $H_3C-CH_2-CH(CH_3)-CO-NH_2 \xrightarrow[\Delta]{Br_2+KOH} A \xrightarrow[2.\,AgOH,\ \Delta]{1.\,CH_3I(excess)} B$

The major product (B) is :

(A) $CH_3–CH_2–CH=CH_2$

(B) 

(C) $H_3C–CH=CH–CH_3$

(D) 

38. 500 mL of a buffer solution A (0.5 M CH_3COONa + 1M CH_3COOH) is mixed with another buffer solution B(0.5 M NH_4Cl + 1 M NH_4OH). If $K_a(CH_3COOH) = K_b(NH_4OH) = 1.8 \times 10^{-5}$, then incorrect statement is/are :
(A) pH < 7.0 (B) pH $\geq$ 7.0 (C) pH = 7.0 (D) pH > 7.0

SECTION 3 (Maximum Marks: 16)

- This section contains **TWO** questions.
- Each question contains two columns, **Column I** and **Column II**
- **Column I** has **four** entries (A), (B), (C) and (D)
- **Column II** has **five** entries (P), (Q), (R), (S) and (T)
- Match the entries in **Column I** with the entries in **Column II**
- One or more entries in **Column I** may match with one or more entries in **Column II**.
- The ORS contains a 4 $\times$ 5 matrix whose layout will be similar to the one shown below:

(A)	(P)	(Q)	(R)	(S)	(T)
(B)	(P)	(Q)	(R)	(S)	(T)
(C)	(P)	(Q)	(R)	(S)	(T)
(D)	(P)	(Q)	(R)	(S)	(T)

- For each entry in Column I, darken the bubbles of all the matching entries. For example, if entry (A) in **Column I** matches with entries (Q), (R) and (T), then darken these three bubbles in the ORS. Similarly, for entries (V), (C) and (D).
- Marking entry in Column I.
  - **+2** If only the bubble(s) corresponding to all the correct match (s) is (are) darkened.
  - **0** If none of the bubbles is darkened.
  - **–1** In all other cases.

Space for rough work

39. Match the following

Column – I		Column – II	
(A)	$\left[H_3O^+\right]\left[OH^-\right]$	(p)	pH = 5
(B)	HA ($K_a = 10^{-5}$; 1 mole/L) is mixed with NaA (1 mole/L)	(q)	$K_w = 10^{-10}$ at a temperature greater than 25°C
(C)	BOH ($K_b = 10^{-4}$; 1 mole/L) is mixed with BA (1 mole/L)	(r)	pH = 10
(D)	HCl (10^{-10} M)	(s)	pH is between 6 to 7.

40. Devise a series of reactions to convert ethyl–3–oxobutanoate to (A), (B), (C) and (D). Select reagents and conditions from the following table :

(1)	Sodium ethoxide in ethanol	(2)	Ethanol + acid catalyst and heat
(3)	H_3O^+, heat	(4)	CO_2 then H_3O^+
(5)	Mg in ether	(6)	PBr_3
(7)	$NaBH_4$ in alcohol	(8)	CH_2I_2 in alcohol
(9)	$BrCH_2CO_2C_2H_5$	(10)	$(CH_3CO)_2O$ + Pyridine
Column – I		**Column – II**	
(A)	To ethyl–4–oxopentanoate	(p)	(3) then (7) then (6) then (5) then (9) then (3)
(B)	To 2–bromopropane	(q)	(1) then (9) then (3) then (2)
(C)	To 2–methyl cyclopropyl carboxylic acid	(r)	(3) then (7) then (6)
(D)	To 3–methyl butanoic acid	(s)	(7) then (3) then (8)

Space for rough work

PART III: MATHEMATICS

SECTION 1 (Maximum Marks: 32)

- This section contains **EIGHT** questions.
- The answer to each question is a **SINGLE DIGIT INTEGER** ranging from **0 to 9**, both inclusive.
- For each question, darken the bubble corresponding to the correct integer in the ORS.
- Marking scheme:
  - **+4** If the bubble corresponding to the answer is darkened.
  - **0** In all other cases.

41. If $\int \frac{x\,dx}{\sqrt{(7x-10-x^2)^3}} = \frac{\lambda\cdot(7x-20)}{\sqrt{(7x-10-x^2)}} + c$, then the value of $\left[\frac{1}{\lambda}\right]$ (where [.] denotes greatest integer function)

42. If $\int\left(\sqrt{\tan x}+\sqrt{\cot x}\right)dx = a\tan^{-1}\left(\frac{\tan x-1}{\sqrt{b\tan x}}\right)+c$, then the value of $a^2 + 2b$ must be

43. If $\int (x^9 + x^6 + x^3)(2x^6 + 3x^3 + 6)^{1/3}\,dx = \frac{1}{a}(2x^9 + 3x^6 + 6x^3)^{4/3} + c$, then the value of $\frac{a}{8}$ must be

44. If $\int \sin 4x\cdot e^{\tan^2 x}\,dx = a\cos^b x\cdot e^{\tan^2 x}+c$, then the value of a + b must be

45. The value of $\int_{-4}^{-5} e^{(x+5)^2\,dx} + 3\int_{1/3}^{2/3} e^{9\left(x-\frac{2}{3}\right)^2}\,dx$ is

46. If [.] stands for the greatest integer function, the value of $\int_4^{10}\frac{\left[x^2\right]dx}{\left[x^2-28x+196\right]+\left[x^2\right]}$ is

47. The value of the integral $I = \int_1^{\infty}\frac{\left(x^2-2\right)}{x^3\sqrt{\left(x^2-1\right)}}\,dx$ is

48. If $f(x) = \int_0^x \frac{dx}{\{f(t)\}^2}$ and $\int_0^2 \frac{dt}{\{f(t)\}^2} = \sqrt[3]{6}$, f(9) equals

Space for rough work

SECTION 2 (Maximum Marks: 40)

- This section contains **TEN** questions.
- Each question has **FOUR** options (A), (B), (C) and (D). **ONE OR MORE THAN ONE** of these four option(s) is (are) correct.
- For each question, darken the bubble(s) corresponding to all the correct option(s) in the ORS.
- Marking scheme:
  - **+4** If only the bubble(s) corresponding to all the correct option(s) is (are) darkened.
  - **0** If none of the bubbles is darkened.
  - **–2** In all other cases

49. If $\int\left(\frac{4e^{x}+6e^{-x}}{9e^{x}-4e^{-x}}\right)dx = Ax + B\log_e(9e^{2x}-4) + c$, then

(A) $A = \frac{3}{2}$ (B) $B = \frac{35}{36}$ (C) C is indefinite (D) $A + B = -\frac{19}{36}$

50. If $\int\frac{xe^{x}}{\sqrt{(1+e^{x})}}dx = f(x)\sqrt{(1+e^{x})} - 2\ln g(x) + c$, then

(A) f(x) = x – 1 (B) $g(x) = \frac{\sqrt{(1+e^{x})}-1}{\sqrt{(1+e^{x})}+1}$ (C) $g(x) = \frac{\sqrt{(1+e^{x})}+1}{\sqrt{(1+e^{x})}-1}$ (D) f(x) = 2 (x – 2)

51. If $f(x) = \lim_{n\to\infty} e^{x\tan\left(\frac{1}{n}\right)\ln\left(\frac{1}{n}\right)}$ and $\int\frac{f(x)}{\sqrt[3]{(\sin^{11}x\cos x)}}dx = g(x) + c$, then

(A) $g\left(\frac{\pi}{4}\right) = \frac{3}{2}$ (B) g(x) is continuous for all x

(C) $g\left(\frac{\pi}{4}\right) = -\frac{15}{8}$ (D) g(x) is non differentiable at infinitely many points

Space for rough work

52. If $\int$ cosec 2x dx = f{g(x)} + c, then
(A) range of g(x) = $(-\infty, \infty)$ (B) domain of f(x) = $(-\infty, \infty) - \{0\}$
(C) $g'(x) = \sec^2 x$ (D) $f'(x) = \frac{1}{x}$ for all $x \in (0, \infty)$

53. The value of $\int_0^x \frac{\left(t - |t|\right)^2}{\left(1+t^2\right)} dt$ is equal to
(A) $4(x - \tan^{-1}x)$, if $x < 0$ (B) 0, if $x > 0$
(C) $\ln(1 + x^2)$, if $x > 0$ (D) none of these

54. If $I_1 = \int_x^1 \frac{dt}{1+t^2}$ and $I_2 = \int_1^{1/x} \frac{dt}{1+t^2}$ for $x > 0$, then
(A) $I_1 = I_2$ (B) $I_1 > I_2$ (C) $I_2 > I_1$ (D) $I_2 = \cot^{-1}x - \frac{\pi}{4}$

55. Let $\int_\alpha^\beta \frac{f(\alpha+\beta-x)}{f(x)+f(\alpha+\beta-x)} dx = 4$, then
(A) $\alpha = -1, \beta = 7$ (B) $\alpha = 5, \beta = 13$ (C) $\alpha = -2, \beta = 6$ (D) $\alpha = -10, \beta = -2$

56. The value of $\int_0^2 \left|\cos\left(\frac{\pi x}{2}\right)\right| dx$ is
(A) 2π (B) $\frac{\pi}{2}$ (C) $\frac{3}{4\pi}$ (D) $\frac{4}{\pi}$

57. If $\int \cos^4 x\, dx = Ax + B \sin 2x + C \sin 4x + D$, then {A, B, C} equals
(A) $\left\{\frac{3}{8}, \frac{1}{32}, \frac{1}{4}\right\}$ (B) $\left\{\frac{3}{8}, \frac{1}{4}, \frac{1}{32}\right\}$ (C) $\left\{\frac{1}{32}, \frac{1}{4}, \frac{3}{8}\right\}$ (D) $\left\{\frac{1}{4}, \frac{3}{8}, \frac{1}{32}\right\}$

58. If $\int \frac{\left(\sqrt{x}\right)^5}{\left(\sqrt{x}\right)^7 + x^6} = \lambda \ln\left(\frac{x^a}{x^a+1}\right) + c$, then $a + \lambda$ is
(A) = 2 (B) > 2 (C) < 2 (D) = 1

Space for rough work

SECTION 3 (Maximum Marks: 16)

- This section contains **TWO** questions.
- Each question contains two columns, **Column I** and **Column II**
- **Column I** has **four** entries (A), (B), (C) and (D)
- **Column II** has **five** entries (P), (Q), (R), (S) and (T)
- Match the entries in **Column I** with the entries in **Column II**
- One or more entries in **Column I** may match with one or more entries in **Column II**.
- The ORS contains a 4 × 5 matrix whose layout will be similar to the one shown below:

(A)	(P)	(Q)	(R)	(S)	(T)
(B)	(P)	(Q)	(R)	(S)	(T)
(C)	(P)	(Q)	(R)	(S)	(T)
(D)	(P)	(Q)	(R)	(S)	(T)

- For each entry in Column I, darken the bubbles of all the matching entries. For example, if entry (A) in **Column I** matches with entries (Q), (R) and (T), then darken these three bubbles in the ORS. Similarly, for entries (V), (C) and (D).
- Marking entry in Column I.
  - **+2** If only the bubble(s) corresponding to all the correct match (s) is (are) darkened.
  - **0** If none of the bubbles is darkened.
  - **–1** In all other cases.

59. Match the integrals of f(x) if

Column I		Column II	
(A)	$f(x) = \dfrac{1}{(x^2+1)\sqrt{x^2+2}}$	p.	$\dfrac{x^5}{5(1-x^4)^{5/2}} + c$
(B)	$f(x) = \dfrac{1}{(x+2)\sqrt{x^2+6x+7}}$	q.	$\sin^{-1}\left(\dfrac{x+1}{(x+2)\sqrt{2}}\right) + c$
(C)	$f(x) = \dfrac{x^4+x^8}{(1-x^4)^{7/2}}$	r.	$-2\sqrt{1-x} + \cos^{-1}\sqrt{x} + \sqrt{x}\sqrt{1-x} + c$
(D)	$f(x) = \sqrt{\dfrac{1-\sqrt{x}}{1+\sqrt{x}}}$	s.	$-\tan^{-1}\sqrt{1+\dfrac{2}{x^2}} + c$

60. Match the following

Column I		Column II	
(A)	$\int_0^{\pi} x \log \sin x \, dx$	p.	$\dfrac{\pi}{8}\log 2$
(B)	$\int_0^{\infty} \log\left(x + x^{-1}\right)\dfrac{dx}{1+x^2}$	q.	$-\dfrac{\pi^2}{2}\log 2$
(C)	$\int_0^{\pi/4} \log(1+\tan x)\, dx$	r.	$-\pi \log 2$
(D)	$\int_0^{\pi} \log(1-\cos x)\, dx$	s.	$\pi \log 2$

Space for rough work

FIITJEE RET – 6

(2017 – 2019)(2ND YEAR_CHAMPIONS)

IIT-2017 (P1)

DATE: 13.08.2018

ANSWERS

PHYSICS

1.	**3**	2.	**5**	3.	**7**	4.	**4**
5.	**8**	6.	**0**	7.	**3**	8.	**5**
9.	**A,B,D**	10.	**C**	11.	**A,B**	12.	**C**
13 .	**A,B,C**	14.	**A,C**	15.	**C**	16.	**B**
17.	**A,B,D**	18.	**A,C**	19.	**A-q,r, B- p, C- q,r, D- q, s**		
20.	**A → p, B → q, C → s, D → r**						

CHEMISTRY

21.	**2**	22.	**4**	23.	**2**	24.	**9**
25.	**3**	26.	**5**	27.	**9**	28.	**7**
29.	**A**	30.	**A, C**	31.	**A, B, D**	32.	**B**
33.	**B, C, D**	34.	**A, B, D**	35.	**A, D**	36.	**BCD**
37.	**A**	38.	**Bonus**				
39.	**A → q ; B → p ; C → r ; D → s**						
40.	**A → q ; B → r ; C → s ; D → p**						

MATHEMATICS

41.	**4**	42.	**6**	43.	**3**	44.	**2**
45.	**0**	46.	**3**	47.	**0**	48.	**Bonus**
49.	**BCD**	50.	**BD**	51.	**CD**	52.	**Bonus**
53.	**AB**	54.	**AD**	55.	**ABCD**	56.	**D**
57.	**B**	58.	**B**	59.	**A → s; B → q; C → p; D → r**		
60.	**A → q; B → s; C → p; D → r**						