FIITJEE RET – 9

(2017 – 2019)(2ND YEAR_REGULAR)

IIT-2015 (P1)_SET–A

DATE: 17.09.2018

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: ☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐

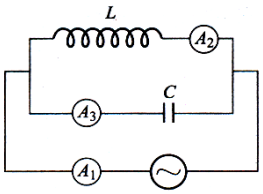
ENROLLMENT NO.: ☐☐☐☐☐☐☐☐☐☐

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

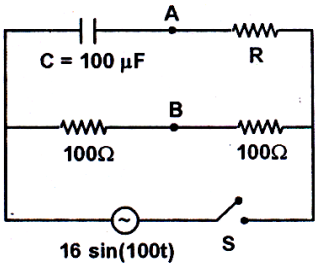
- This section contains **EIGHT** questions.
- The answer to each question is a **SINGLE DIGIT INTEGER** ranging from **0 to 9**, both inclusive.
- For each question, darken the bubble corresponding to the correct integer in the ORS.
- Marking scheme:
  - **+4** If the bubble corresponding to the answer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

---

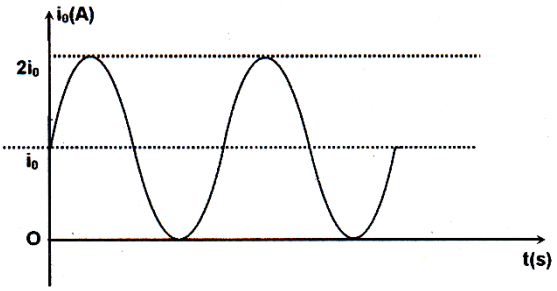
1. For the circuit shown in figure, the ammeter A_2 reads 1.6 A and ammeter A_3 reads 0.4 A and ammeter A_1 reads 0.2n A, then value of n is



2. An uncharged capacitor C = 100 μF with a resistor R is connected with AC source as shown in the figure. If R is 100 Ω and switch S is closed at t = 0, the maximum value of $(V_A - V_B)$ is $8\sqrt{K}$ volt. Calculate K.

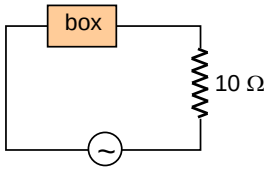


3. The current flowing in a wire fluctuates in a sinusoidal manner as described in the current (i) versus time (t) graph as shown in the diagram. The root mean square value of the current is $i_0\left(\frac{1}{\sqrt{X}}+1\right)^{1/Y}$ then X + Y =

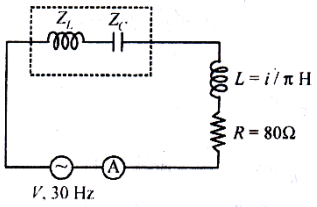


Space for rough work

4. In the circuit shown in figure power factor of box is given 0.5 and power factor of circuit is given $\frac{\sqrt{3}}{2}$. Current leading the voltage. Find the effective resistance of the box.

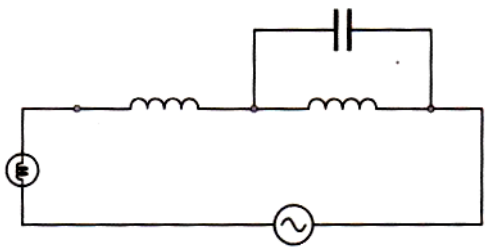


5. In figure given below if $Z_L = Z_C$ and reading of ammeter is 1A. If the source voltage is 20N, then find the value of N? (L = 1/π H)



6. A loop of resistance R_0 is placed near a coil excited by a source of unknown alternating voltage. The phase shift between the current in the coil and induced current in the loop is 45^0 and power dissipated in the loop is p_0. If the loop were replaced by another identical loop whose resistivity is η times of that of the previous loop, how much power p would be dissipated in the new loop is given by $p = \frac{k\eta p_0}{\eta^2 + 1}$ then k is

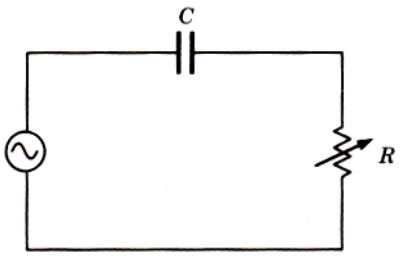
7. Two ideal inductor each of inductance L are connected in series and then a capacitor of capacitance C is connected in parallel to one of the inductors. This combination is connected across a series combination of an incandescent lamp and a variable frequency alternating voltage source as shown in the figure.



It has been observed that the lamp glow with minimum brightness at angular frequency ω_1, At angular frequency ω_2 the lamp will glow with maximum brightness . If $\omega_2 = \omega_1\sqrt{k}$. Find k.

Space for rough work

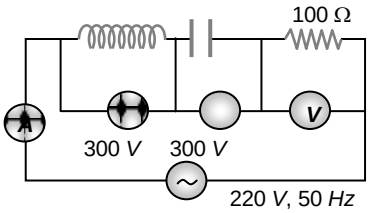
8. An alternating voltage source of peak voltage V_0 is connected across a series combination of a capacitor and a variable resistance R as shown in the figure . If the maximum power that can be obtained on the load resistance in this circuit is given by $P_{max} = \frac{V_0^2}{kR}$. Then k is__



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

9. In the circuit shown below, what will be the readings of the voltmeter and ammeter



(A) reading of the voltmeter is 220 V

(B) reading of the voltmeter is 300 V

(C) reading of the ammeter is 2.2 A

(D) reading of the ammeter is 2 A

10. For a series *RLC* circuit $R = X_L = 2X_C$.

(A) The impedance of the circuit is $\frac{\sqrt{5}R}{2}$

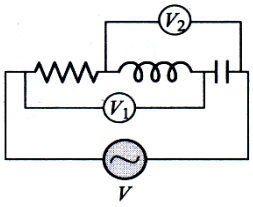
(B) The impedance of the circuit is $\sqrt{5}R$

(C) The phase difference (between) *V* and *i* will be $\tan^{-1}(2)$

(D) The phase difference (between) *V* and *i* will be $\tan^{-1}\left(\frac{1}{2}\right)$

Space for rough work

11. In an RLC series circuit shown in figure the readings of voltmeters V_1 and V_2 are 100 V and 120 V, respectively. The source voltage is 130 V. For this situation mark out the correct statement(s).



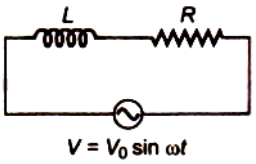
(A) Voltage across resistor is 50 V

(B) Voltage across resistor 100 V

(C) Power factor of the circuit is $\frac{5}{13}$

(D) The circuit is capacitive in nature

12. In series R– L circuit



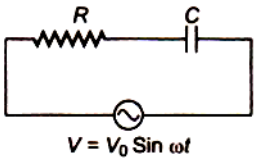
(A) Current lags the applied voltage by $\phi = \tan^{-1}\frac{\omega L}{R}$

(B) Current leads the applied voltage by $\phi < 90^0$

(C) Voltage across the inductor leads the current by 90^0

(D) $V_{L_0}^2 + V_{R_0}^2 = V_0^2$, where V_{L_0} and V_{R_0} are the maximum voltage drop across the inductor and resistor respectively.

13. In series R– C circuit



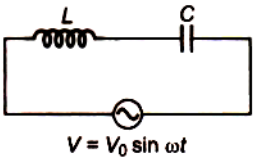
(A) Current leads the applied voltage by $\phi = \tan^{-1}\frac{1}{\omega RC}$

(B) Current lags the applied voltage by $\phi < 90^0$

(C) $V_{C_0} < V_0$, where V_{C_0} and V_0 are the maximum values of the voltage across the capacitor and applied voltage respectively

(D) applied voltage, voltage across the resistor and current are in phase

14. In series L– C circuit



(A) the voltage across inductor and capacitor oppose each other

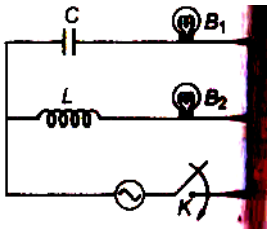
(B) V_{L_0} leads V_{C_0} by 180^0

(C) V_{C_0} leads the applied voltage by 90^0

(D) i_0 leads V_{C_0} by 90^0 and lags V_{L_0} by 90^0, but it may lead or lag the applied voltage by 90^0

Space for rough work

15. In the R–L–C circuit, the bulbs B_1 and B_2 having same resistance R change their brightness with respect to the applied frequency



(A) B_1 will glow brighter if $f < \frac{1}{2\pi\sqrt{LC}}$

(B) B_2 will glow brighter if $f > \frac{1}{2\pi\sqrt{LC}}$

(C) B_1 and B_2 will be equally bright if $f = \frac{1}{2\pi\sqrt{LC}}$

(D) B_1 and B_2 will glow with different brightness if $\neq \frac{1}{2\pi\sqrt{LC}}$

16. The average power dissipated in a

(A) pure inductor is zero (B) pure capacitor is zero

(C) pure resistor is non – zero (D) none of the above

17. For a series *RLC* circuit $R = X_L = 2X_C$.

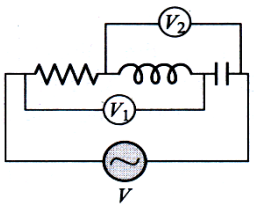
(A) The impedance of the circuit is $\frac{\sqrt{5}R}{2}$

(B) The impedance of the circuit is $\sqrt{5}R$

(C) The phase difference (between) *V* and *i* will be $\tan^{-1}(2)$

(D) The phase difference (between) *V* and *i* will be $\tan^{-1}\left(\frac{1}{2}\right)$

18. In an RLC series circuit shown in figure the readings of voltmeters V_1 and V_2 are 100 V and 120 V, respectively. The source voltage is 130 V. For this situation mark out the correct statement(s).



(A) Voltage across resistor is 50 V

(B) Voltage across resistor 100 V

(C) Power factor of the circuit is $\frac{5}{13}$

(D) The circuit is capacitive in nature

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.

19. Instantaneous voltage and instantaneous current in an L-R circuit in AC is V = 100 sin (100t) and i = 10 sin (100 t - π/4). Match the following table:

Table-1		Table-2	
(A)	R	(P)	$\frac{1}{10\sqrt{2}}$ SI unit
(B)	X_L	(Q)	$5\sqrt{2}$ SI unit
(C)	L	(R)	$10\sqrt{2}$ SI unit
(D)	average power in one cycle	(S)	None

20. In L-C-R series circuit suppose ω_r is the resonance frequency, then match the following table:

Table-1		Table-2	
(A)	If $\omega > \omega_r$	(P)	current will lead the voltage
(B)	If $\omega = \omega_r$	(Q)	current will lead the current
(C)	If $\omega = 2\ \omega_r$	(R)	$X_L = 2\ X_C$
(D)	If $\omega < \omega_r$	(S)	current and voltage are in phase
		(T)	None

Space for rough work

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. A given weak acid (0.01 M) has pKa = 6. The ph of this solution is

22. pH of 10^{-x}M HCl is 6.9586. The value of x will be

23. pH of a $Ba(OH)_2$ solution is 10. If the molarity of 100 mL of this solution is x x 10^{-x}. The value of x is

24. The dissociation constant of a substituted benzoic acid at 25°C is 1 x 10^{-4}. The pH of a 0.01 M. solution of its sodium salt is

25. 200 mg of NaOH and 185 mg of $Ca(OH)_2$ are mixed and the solution is made to 1000 ml at 298 K and 1 atm pressure. The pOH of the solution is

26. HCOOH acid and CH_3COOH acid have same pH value and ratio of K_a (CH_3COOH) to K_a (HCOOH) is 0.25. Then concentration of acetic acid must be how many times the concentration of formic acid

27. Calculate the pH at which an acid indicator HIn with concentration 0.1 M changes its colour (K_a for HIn = 1 x 10^{-5}).

28. Gold number for the protective colloid of Hemoglobin is found to be $a \times 10^{-2}$. Then a = ?

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

29. The pH of a solution of 0.10 M CH_3COOH increases when which of the following substances is added?
(A) $NaHSO_4$ (B) $HClO_4$ (C) NH_4NO_3 (D) K_2CO_3

30. A 50.00 mL sample of 0.0100 M $Ba(OH)_2$ is titrated with 0.0100 M HCl. The solution at the equivalence point is
(A) 3.33×10^{-3} M $BaCl_2$ (B) 5.00×10^{-3} M $BaCl_2$
(C) 2.50×10^{-3} M $BaCl_2$ (D) 1.00×10^{-2} M $BaCl_2$

31. For pure water at 25°C and 50°C the incorrect statement is
(A) $pH_{25^0C} = pH_{20^0C}$ (B) $pH_{25^0C} > pH_{50^0C}$
(C) $pOH_{25^0C} = pOH_{50^0C}$ (D) $pOH_{25^0C} < pOH_{50^0C}$

32. Which of the following is an amphoprotic anion
(A) HCO_3^- (B) $H_2PO_4^-$ (C) HS^- (D) HPO_3^{2-}

33. 1.25 gr of an acid is completely neutralized by 25 mL of a 0.25 M $Ba(OH)_2$ solution. Which of the following statement(s) is/are correct.
(A) If the acid is dibasic, its molar mass would be 200.
(B) If the acid is mono basic, its molar mass would be 400
(C) If it is dibasic, 0.5gr of the acid would neutralize completely 12.5 mL of a 0.4 N NaOH solution
(D) volume of base used is independent of strength of the acid.

34. Choose the correct statement(s)
(A) pH of an acidic buffer increases if more salt is added
(B) pH of a basic buffer decreases if more salt is added
(C) pKw decreases with increases of temperature.
(D) liquid ammonia acts as a protophilic solvent

Space for rough work

35. 0.1 mol of CH_3NH_2 $\left(K_b = 5\times10^{-4}\right)$ is mixed with 0.08 mol of HCl and diluted to 1 L. Which statement is correct ?
(A) The concentration of H^+ ion is 8 x 10^{-11} M
(B) The concentration of H^+ ion is 8 x 10^{-5} M
(C) the pH of solution is 9.8 (D) The pOH of solution is 10.2

36. Which of the following is (are) correct for buffer solution
(A) Acidic buffer will be effective within in the pH range $\left(p^{K_a} \pm 1\right)$
(B) Basic buffer will be effective within the pH range $\left(p^{Kw} - p^{K_b} \pm 1\right)$
(C) H_3PO_4 + NaH_2PO_4 is not a buffer solution
(D) Buffers behave most effectively when the [salt]/acid] ratio equal to 1

37. Which of the following expressions is true
(A) $[H^+] = [OH^-] = \sqrt{kw}$ for a neutral solution
(B) $\left[H^+\right] > \sqrt{Kw}$ and $\left[OH^-\right] < \sqrt{Kw}$ for an acidic solution
(C) $\left[H^+\right] < \sqrt{Kw}$ and $\left[OH\right] > \sqrt{Kw}$ for an alkaline solution
(D) $\left[H^+\right] = \left[OH^-\right] = 10^{-7}M$ for a neutral solution at all temperatures.

38. Which is correct for heterogenous catalyst.
(A) the catalyst decreases the energy of activation
(B) the surface of catalyst plays an important role.
(C) the catalyst actually forms a compound with reactants.
(D) There is no change in the energy of activation.

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.

39. Match the following

Column – I		Column – II	
(A)	$10^{-2}M(NH_4)_2SO_4$ solution	(p)	Cationic hydrolysis
(B)	10^{-2} M HCl solution	(q)	Anionic hydrolysis
(C)	10^{-2} M NH_3 solution	(r)	pH changes by one unit when diluted to one tength of its concentration
(D)	10^{-2} M CH_3COONH_4 solution	(s)	pH < 7 at 25°C

40. Match the effect of addition of 1 M NaOH to 100 mL 1 M CH_3COOH (Column-I) with pH (in Column-II)

Column – I		Column – II	
(A)	25 mL of NaOH	(p)	pKa
(B)	50 mL of NaOH	(q)	pKa + log 3
(C)	75 mL of NaOH	(r)	pKa – log 3
(D)	100 mL of NaOH	(s)	$\frac{1}{2}[pK_w + pK_a - \log 2]$

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 $\int \sin^{-1}\left(\frac{2x+2}{\sqrt{(4x^2+8x+13)}}\right) dx = (x+1)\tan^{-1}\left(\frac{2x+2}{3}\right) + \lambda \ln(4x^2 + 8x + 13) + c$, then the unit digit value of (-4λ) must be

42. If $\int\left(\frac{\cos 8x - \cos 7x}{1+2\cos 5x}\right) dx = \frac{\sin 3x}{a} - \frac{\sin 2x}{b} + c$, then the value of (2a – 3b) must be

43. $\int \frac{1}{3+5\sin x+3\cos x}\, dx = t\,\ell n\left|1+\frac{5}{2}\tan\frac{x}{2}\right| + c$, the value of 15t is

44. Let f(x) be periodic function with fundamental period 12. If $\int_{-6}^{12} f(x)\, dx = 9$ and $\int_{0}^{12} f(x)\, dx = 12$, then find the value of $\frac{\left|\int_0^6 f(x)\, dx\right|}{15}$.

45. The value of definite integral $\int_0^{\pi} \frac{x^2 \sin(2x)\sin\left(\frac{\pi}{2}\cos x\right)}{2x-\pi}\, dx$ is equal to

Space for rough work

46. Let $I_1 = \int_{1/2}^{2} \frac{x^{2012}-1}{x^{2014}+1}\,dx$ and $I_2 = \int_{2}^{4}\left(\log_x 2 - \frac{(\log_x 2)^2}{\ell n 2}\right)dx$, then find $I_1 + I_2$.

47. $\int_{0}^{\pi/2} \frac{2012\sin^{2011}x - 2008\cos^{2011}x}{\sin^{2011}x + \cos^{2011}x}\,dx = k$, then [k] =
(where [.] denotes the greatest integer function)

48. $\int_{0}^{2} \frac{x\sin^2 \pi x}{x^2-2x+3}\,dx + \int_{1}^{2} \frac{(x^2-2x+1)}{x^2-2x+3}\sin^2 \pi x\,dx = \frac{k}{2}$, then 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

---

49. Let $\int \frac{x^{1/2}}{\sqrt{(1-x^3)}}\,dx = \frac{2}{3}$ gof (x) + c, then

(A) f(x) = $\sqrt{x}$ (B) f(x) = $x^{3/2}$ (C) f(x) = $x^{2/3}$ (D) g(x) = $\sin^{-1}x$

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)

Space for rough work

51. If $\int f(x) \sin x \cos x \, dx = \frac{1}{2\left(b^2 - a^2\right)} \ln f(x) + c$, then f(x) us equal to

(A) $\frac{1}{a^2 \sin^2 x + b^2 \cos^2 x}$ (B) $\frac{1}{a^2 \sin^2 x - b^2 \cos^2 x}$

(C) $\frac{1}{a^2 \cos^2 x + b^2 \sin^2 x}$ (D) none of these

52. The value α in the interval $[-\pi, 0]$ satisfying $\sin \alpha + \int_{\alpha}^{2\alpha} \cos 2x \, dx = 0$ is

(A) $-\frac{\pi}{2}$ (B) $-\pi$ (C) $-\frac{\pi}{3}$ (D) 0

53. Let $I = \int_0^1 \sqrt{\frac{1+\sqrt{x}}{1-\sqrt{x}}} \, dx$ and $J = \int_0^1 \sqrt{\frac{1-\sqrt{x}}{1+\sqrt{x}}} \, dx$, then the correct statement is

(A) I + J = 2 (B) I – J = π (C) I = $\frac{2+\pi}{2}$ (D) J = $\frac{4-\pi}{2}$

54. Which of the following definite reduces to $\frac{\pi}{2}$?

(A) $\int_0^{\pi} \frac{dx}{1+(\sin x)^{\cos x}}$ (B) $\int_0^{\pi/2} \frac{dx}{1+(\tan x)^5}$

(C) $\int_0^{\infty} \frac{x^2+1}{x^4-x^2+1}$ (D) $\int_0^{\pi/2} \left(\ell n(\sec x)\right)\left(e^{\ell n(\ell n 2)}\right)^{-1} dx$

55. Let $f(x) = \tan x - \tan^3 x + \tan^5 x - \tan^7 x + \ldots\ldots \infty$, where $x \in \left(0, \frac{\pi}{4}\right)$, then which of the following is/are correct ?

(A) $\int_0^{\pi/6} f(x) \, dx = \frac{1}{8}$ (B) $f'\left(\frac{\pi}{12}\right) = \frac{1}{2}$ (C) $\lim_{x \to 0^+} \frac{f(x)}{x} = 1$ (D) f(x) is an odd function

Space for rough work

56. Which of the following definite integral vanishes ?

(A) $\int_{-\pi}^{\pi} \left(\cos 2x \cdot \cos 2^2 x \cdot \cos 2^3 x \cdot \cos 2^4 x \cdot \cos 2^5 x\right) dx$

(B) $\int_{-1}^{1} \ell n\left(x + \sqrt{x^2+1}\right) dx$

(C) $\int_{0}^{1} \tan^{-1}\left(\frac{2x-1}{1+x-x^2}\right) dx$

(D) $\int_{0}^{\pi/2} \ell n(\tan x)\, dx$

57. The integral $\int_{\tan^{-1}\lambda}^{\cot^{-1}\lambda} \frac{\tan x}{\tan x + \cot x} dx$, $\forall\ \lambda \in R$ can not take the value

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

58. $\int_{4}^{10} \left([x-4] + [10-x]\right) dx =$

(where [x] is the largest integer not exceeding x)

(A) 26 (B) 10 (C) 30 (D) 20

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 following lists:

Column I		Column II	
(A)	$\int_0^{\infty} e^{-4x} \sin 5x \, dx$	p.	3
(B)	$\int_2^8 \frac{\left[x^2\right] dx}{\left[x^2-20x+100\right]+\left[x^2\right]}$ (where [.] denotes the greatest integer function)	q.	$\frac{5}{41}$
(C)	$\int_0^{\pi/2} \left[x^n + n(n-1)x^{n-2}\cos x\right] dx$ (where $n \in N$)	r.	120
(D)	$\int_0^{\infty} x^5 e^{-x} \, dx$	s.	$\left(\frac{\pi}{2}\right)^n$
		t.	600

Space for rough work

60.

Column I		Column II	
(A)	$\int_0^{\pi/2} e^{\sin^2 x} \sin 2x \, dx$	p.	$\frac{\pi}{4}$
(B)	$\int_1^1 x\|x\| \, dx$	q.	e – 1
(C)	$\int_0^{\pi/2} \frac{(\sin x)^{5/2}}{(\sin x)^{5/2} + (\cos x)^{5/2}} \, dx$	r.	$\frac{\pi}{32}$
(D)	$\int_0^{\pi/2} \sin^4 x \cos^2 x \, dx$	s.	0
		t.	700

space for rough work

FIITJEE RET – 9

(2017 – 2019)(2ND YEAR_REGULAR)

IIT-2015 (P1)_SET–A

DATE: 17.09.2018

ANSWERS

PHYSICS

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

CHEMISTRY

21.	**4**	22.	**8**	23.	**5**	24.	**8**
25.	**2**	26.	**4**	27.	**5**	28.	**3**
29.	**D**	30.	**A**	31.	**A, C, D**	32.	**A, B, C**
33.	**A, C, D**	34.	**A, B, C, D**	35.	**A, C**	36.	**A, B, D**
37.	**A, B, C**	38.	**A, B, C**				
39.	**A → p, s ; B → s, r ; C → r ; D → p, q**						
40.	**A → r ; B → p; C → q ; D → s**						

MATHEMATICS

41.	**3**	42.	**0**	43.	**3 (Bonus)**	44.	**1**
45.	**8**	46.	**0**	47.	**3**	48.	**1**
49.	**BD**	50.	**BD**	51.	**A**	52.	**BCD**
53.	**BD**	54.	**AD**	55.	**ACD**	56.	**BCD**
57.	**ABD**	58.	**C**				
59.	**A → q; B → p; C → s; D → r**			60.	**A → q; B → s; C → p; D → r**		

FIITJEE RET – 9

(2017 – 2019)(2ND YEAR_REGULAR)

IIT-2015 (P1)_SET–B

DATE: 17.09.2018

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

INSTRUCTIONS:

A. General

1. This booklet is your Question Paper containing 60 questions.
6. 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.
7. Fill in the boxes provided for Name and Enrolment No.
8. The answer sheet, a machine-readable Objective Response (ORS), is provided separately.
9. 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:

14. The question paper consists of **3 parts (Physics, Chemistry and Mathematics)**. Each part consists of **two sections**.
15. **Section I** contains **8 questions**. The answer to each question is a **single digit integer**, ranging from 0 to 9 (both inclusive).
16. **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.
17. **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

18. 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.
19. 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.
20. 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: ☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐

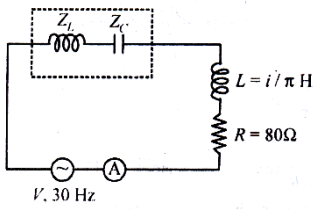
ENROLLMENT NO.: ☐☐☐☐☐☐☐☐☐☐

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.

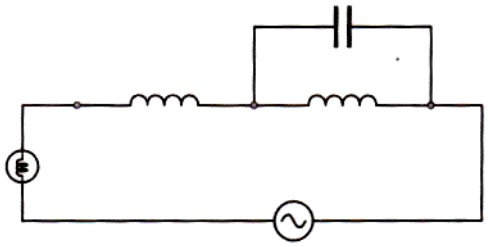
---

1. In figure given below if $Z_L = Z_C$ and reading of ammeter is 1A. If the source voltage is 20N, then find the value of N? ($L = 1/\pi$ H)



2. A loop of resistance R_0 is placed near a coil excited by a source of unknown alternating voltage. The phase shift between the current in the coil and induced current in the loop is 45^0 and power dissipated in the loop is p_0. If the loop were replaced by another identical loop whose resistivity is η times of that of the previous loop, how much power p would be dissipated in the new loop is given by $p = \dfrac{k\eta p_0}{\eta^2 + 1}$ then k is

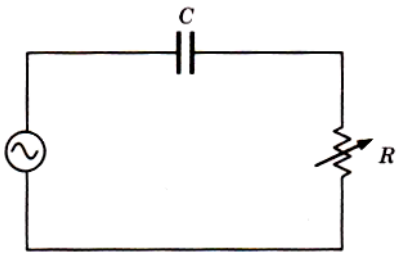
3. Two ideal inductor each of inductance L are connected in series and then a capacitor of capacitance C is connected in parallel to one of the inductors. This combination is connected across a series combination of an incandescent lamp and a variable frequency alternating voltage source as shown in the figure.



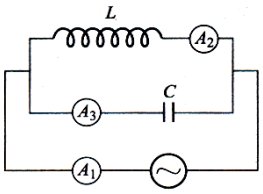
It has been observed that the lamp glow with minimum brightness at angular frequency ω_1, At angular frequency ω_2 the lamp will glow with maximum brightness . If $\omega_2 = \omega_1\sqrt{k}$. Find k.

Space for rough work

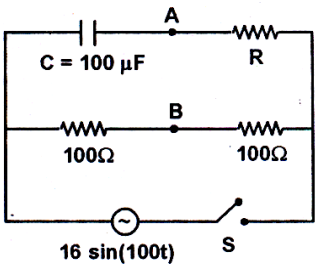
4. An alternating voltage source of peak voltage V_0 is connected across a series combination of a capacitor and a variable resistance R as shown in the figure . If the maximum power that can be obtained on the load resistance in this circuit is given by $P_{max} = \frac{V_0^2}{kR}$. Then k is__



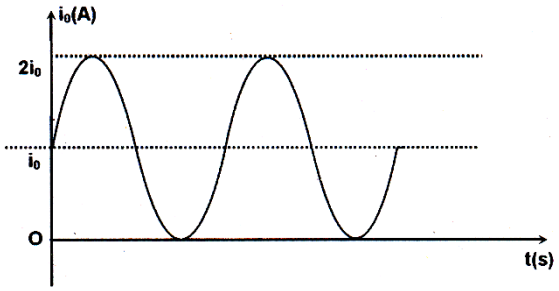
5. For the circuit shown in figure, the ammeter A_2 reads 1.6 A and ammeter A_3 reads 0.4 A and ammeter A_1 reads 0.2n A, then value of n is



6. An uncharged capacitor C = 100 μF with a resistor R is connected with AC source as shown in the figure. If R is 100 Ω and switch S is closed at t = 0, the maximum value of $(V_A - V_B)$ is $8\sqrt{K}$ volt. Calculate K.

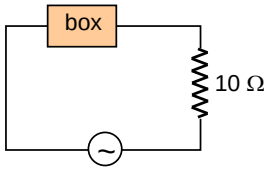


7. The current flowing in a wire fluctuates in a sinusoidal manner as described in the current (i) versus time (t) graph as shown in the diagram. The root mean square value of the current is $i_0\left(\frac{1}{\sqrt{X}}+1\right)^{1/Y}$ then X + Y =



Space for rough work

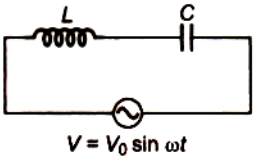
8. In the circuit shown in figure power factor of box is given 0.5 and power factor of circuit is given $\frac{\sqrt{3}}{2}$. Current leading the voltage. Find the effective resistance of the box.



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

9. In series L– C circuit



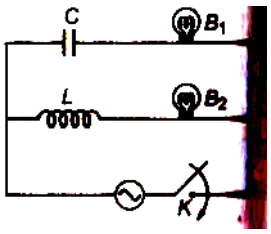
(A) the voltage across inductor and capacitor oppose each other

(B) V_{L_0} leads V_{C_0} by 180^0

(C) V_{C_0} leads the applied voltage by 90^0

(D) i_0 leads V_{C_0} by 90^0 and lags V_{L_0} by 90^0, but it may lead or lag the applied voltage by 90^0

10. In the R–L–C circuit, the bulbs B_1 and B_2 having same resistance R change their brightness with respect to the applied frequency



(A) B_1 will glow brighter if $f < \frac{1}{2\pi\sqrt{LC}}$

(B) B_2 will glow brighter if $f > \frac{1}{2\pi\sqrt{LC}}$

(C) B_1 and B_2 will be equally bright if $f = \frac{1}{2\pi\sqrt{LC}}$

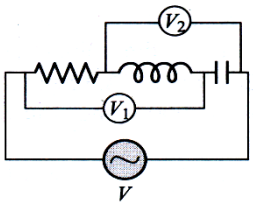
(D) B_1 and B_2 will glow with different brightness if $\neq \frac{1}{2\pi\sqrt{LC}}$

Space for rough work

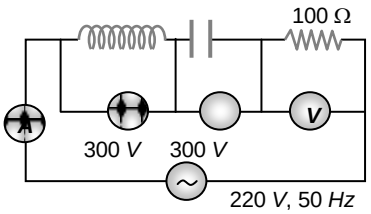
11. The average power dissipated in a
(A) pure inductor is zero
(B) pure capacitor is zero
(C) pure resistor is non – zero
(D) none of the above

12. For a series *RLC* circuit $R = X_L = 2X_C$.
(A) The impedance of the circuit is $\frac{\sqrt{5}R}{2}$
(B) The impedance of the circuit is $\sqrt{5}R$
(C) The phase difference (between) *V* and *i* will be $\tan^{-1}(2)$
(D) The phase difference (between) *V* and *i* will be $\tan^{-1}\left(\frac{1}{2}\right)$

13. In an RLC series circuit shown in figure the readings of voltmeters V_1 and V_2 are 100 V and 120 V, respectively. The source voltage is 130 V. For this situation mark out the correct statement(s).
(A) Voltage across resistor is 50 V
(B) Voltage across resistor 100 V
(C) Power factor of the circuit is $\frac{5}{13}$
(D) The circuit is capacitive in nature



14. In the circuit shown below, what will be the readings of the voltmeter and ammeter
(A) reading of the voltmeter is 220 V
(B) reading of the voltmeter is 300 V
(C) reading of the ammeter is 2.2 A
(D) reading of the ammeter is 2 A



Space for rough work

15. For a series *RLC* circuit $R = X_L = 2X_C$.

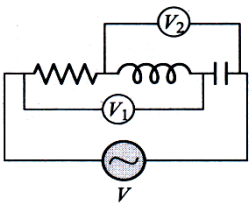
(A) The impedance of the circuit is $\frac{\sqrt{5}R}{2}$

(B) The impedance of the circuit is $\sqrt{5}R$

(C) The phase difference (between) *V* and *i* will be $\tan^{-1}(2)$

(D) The phase difference (between) *V* and *i* will be $\tan^{-1}\left(\frac{1}{2}\right)$

16. In an RLC series circuit shown in figure the readings of voltmeters V_1 and V_2 are 100 V and 120 V, respectively. The source voltage is 130 V. For this situation mark out the correct statement(s).



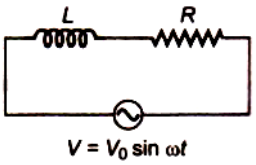
(A) Voltage across resistor is 50 V

(B) Voltage across resistor 100 V

(C) Power factor of the circuit is $\frac{5}{13}$

(D) The circuit is capacitive in nature

17. In series R– L circuit



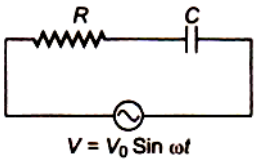
(A) Current lags the applied voltage by $\phi = \tan^{-1}\frac{\omega L}{R}$

(B) Current leads the applied voltage by $\phi < 90^0$

(C) Voltage across the inductor leads the current by 90^0

(D) $V_{L_0}^2 + V_{R_0}^2 = V_0^2$, where V_{L_0} and V_{R_0} are the maximum voltage drop across the inductor and resistor respectively.

18. In series R– C circuit



(A) Current leads the applied voltage by $\phi = \tan^{-1}\frac{1}{\omega RC}$

(B) Current lags the applied voltage by $\phi < 90^0$

(C) $V_{C_0} < V_0$, where V_{C_0} and V_0 are the maximum values of the voltage across the capacitor and applied voltage respectively

(D) applied voltage, voltage across the resistor and current are in phase

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.

19. In L-C-R series circuit suppose ω_r is the resonance frequency, then match the following table:

Table-1		Table-2	
(A)	If $\omega > \omega_r$	(P)	current will lead the voltage
(B)	If $\omega = \omega_r$	(Q)	current will lead the current
(C)	If $\omega = 2\ \omega_r$	(R)	$X_L = 2\ X_C$
(D)	If $\omega < \omega_r$	(S)	current and voltage are in phase
		(T)	None

Space for rough work

20. Instantaneous voltage and instantaneous current in an L-R circuit in AC is V = 100 sin (100t) and i = 10 sin (100 t - π/4). Match the following table:

Table-1		Table-2	
(A)	R	(P)	$\frac{1}{10\sqrt{2}}$ SI unit
(B)	X_L	(Q)	$5\sqrt{2}$ SI unit
(C)	L	(R)	$10\sqrt{2}$ SI unit
(D)	average power in one cycle	(S)	None

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. 200 mg of NaOH and 185 mg of $Ca(OH)_2$ are mixed and the solution is made to 1000 ml at 298 K and 1 atm pressure. The pOH of the solution is

22. HCOOH acid and CH_3COOH acid have same pH value and ratio of K_a (CH_3COOH) to K_a (HCOOH) is 0.25. Then concentration of acetic acid must be how many times the concentration of formic acid

23. Calculate the pH at which an acid indicator HIn with concentration 0.1 M changes its colour (K_a for HIn = 1 x 10^{-5}).

24. Gold number for the protective colloid of Hemoglobin is found to be $a \times 10^{-2}$. Then a = ?

25. A given weak acid (0.01 M) has pKa = 6. The ph of this solution is

26. pH of 10^{-x}M HCl is 6.9586. The value of x will be

27. pH of a $Ba(OH)_2$ solution is 10. If the molarity of 100 mL of this solution is x x 10^{-x}. The value of x is

28. The dissociation constant of a substituted benzoic acid at 25°C is 1 x 10^{-4}. The pH of a 0.01 M. solution of its sodium salt is

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

29. Choose the correct statement(s)
(A) pH of an acidic buffer increases if more salt is added
(B) pH of a basic buffer decreases if more salt is added
(C) pKw decreases with increases of temperature.
(D) liquid ammonia acts as a protophilic solvent

30. 0.1 mol of CH_3NH_2 $\left(K_b = 5\times10^{-4}\right)$ is mixed with 0.08 mol of HCl and diluted to 1 L. Which statement is correct ?
(A) The concentration of H^+ ion is 8 x 10^{-11} M
(B) The concentration of H^+ ion is 8 x 10^{-5} M
(C) the pH of solution is 9.8
(D) The pOH of solution is 10.2

31. Which of the following is (are) correct for buffer solution
(A) Acidic buffer will be effective within in the pH range $\left(p^{K_a} \pm 1\right)$
(B) Basic buffer will be effective within the pH range $\left(p^{Kw} - p^{K_b} \pm 1\right)$
(C) H_3PO_4 + NaH_2PO_4 is not a buffer solution
(D) Buffers behave most effectively when the [salt]/acid] ratio equal to 1

32. Which of the following expressions is true
(A) $[H^+] = [OH^-] = \sqrt{kw}$ for a neutral solution
(B) $\left[H^+\right] > \sqrt{Kw}$ and $\left[OH^-\right] < \sqrt{Kw}$ for an acidic solution
(C) $\left[H^+\right] < \sqrt{Kw}$ and $\left[OH\right] > \sqrt{Kw}$ for an alkaline solution
(D) $\left[H^+\right] = \left[OH^-\right] = 10^{-7}M$ for a neutral solution at all temperatures.

Space for rough work

33. Which is correct for heterogenous catalyst.
(A) the catalyst decreases the energy of activation
(B) the surface of catalyst plays an important role.
(C) the catalyst actually forms a compound with reactants.
(D) There is no change in the energy of activation.

34. The pH of a solution of 0.10 M CH_3COOH increases when which of the following substances is added?
(A) $NaHSO_4$ (B) $HClO_4$ (C) NH_4NO_3 (D) K_2CO_3

35. A 50.00 mL sample of 0.0100 M $Ba(OH)_2$ is titrated with 0.0100 M HCl. The solution at the equivalence point is
(A) 3.33×10^{-3} M $BaCl_2$ (B) 5.00×10^{-3} M $BaCl_2$
(C) 2.50×10^{-3} M $BaCl_2$ (D) 1.00×10^{-2} M $BaCl_2$

36. For pure water at 25°C and 50°C the incorrect statement is
(A) $pH_{25^0C} = pH_{20^0C}$ (B) $pH_{25^0C} > pH_{50^0C}$
(C) $pOH_{25^0C} = pOH_{50^0C}$ (D) $pOH_{25^0C} < pOH_{50^0C}$

37. Which of the following is an amphoprotic anion
(A) HCO_3^- (B) $H_2PO_4^-$ (C) HS^- (D) HPO_3^{2-}

38. 1.25 gr of an acid is completely neutralized by 25 mL of a 0.25 M $Ba(OH)_2$ solution. Which of the following statement(s) is/are correct.
(A) If the acid is dibasic, its molar mass would be 200.
(B) If the acid is mono basic, its molar mass would be 400
(C) If it is dibasic, 0.5gr of the acid would neutralize completely 12.5 mL of a 0.4 N NaOH solution
(D) volume of base used is independent of strength of the acid.

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.

39. Match the effect of addition of 1 M NaOH to 100 mL 1 M CH_3COOH (Column-I) with pH (in Column-II)

Column – I		Column – II	
(A)	25 mL of NaOH	(p)	pKa
(B)	50 mL of NaOH	(q)	pKa + log 3
(C)	75 mL of NaOH	(r)	pKa – log 3
(D)	100 mL of NaOH	(s)	$\frac{1}{2}[pK_w + pK_a - \log 2]$

40. Match the following

Column – I		Column – II	
(A)	$10^{-2}M(NH_4)_2SO_4$ solution	(p)	Cationic hydrolysis
(B)	10^{-2} M HCl solution	(q)	Anionic hydrolysis
(C)	10^{-2} M NH_3 solution	(r)	pH changes by one unit when diluted to one tength of its concentration
(D)	10^{-2} M CH_3COONH_4 solution	(s)	pH < 7 at 25°C

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. The value of definite integral $\int_0^{\pi} \frac{x^2 \sin(2x)\sin\left(\frac{\pi}{2}\cos x\right)}{2x-\pi}\,dx$ is equal to

42. Let $I_1 = \int_{1/2}^{2} \frac{x^{2012}-1}{x^{2014}+1}\,dx$ and $I_2 = \int_2^4 \left(\log_x 2 - \frac{(\log_x 2)^2}{\ell n 2}\right)dx$, then find $I_1 + I_2$.

43. $\int_0^{\pi/2} \frac{2012\sin^{2011}x - 2008\cos^{2011}x}{\sin^{2011}x + \cos^{2011}x}\,dx = k$, then $[k] =$
(where [.] denotes the greatest integer function)

44. $\int_0^2 \frac{x\sin^2\pi x}{x^2-2x+3}\,dx + \int_1^2 \frac{(x^2-2x+1)}{x^2-2x+3}\sin^2\pi x\,dx = \frac{k}{2}$, then $k =$

45. If $\int \sin^{-1}\left(\frac{2x+2}{\sqrt{(4x^2+8x+13)}}\right)dx = (x+1)\tan^{-1}\left(\frac{2x+2}{3}\right) + \lambda \ln(4x^2+8x+13) + c$, then the unit digit value of (-4λ) must be

Space for rough work

46. If $\int\left(\frac{\cos 8x-\cos 7x}{1+2\cos 5x}\right)dx=\frac{\sin 3x}{a}-\frac{\sin 2x}{b}+c$, then the value of (2a – 3b) must be

47. $\int\frac{1}{3+5\sin x+3\cos x}dx=t\ell n\left|1+\frac{5}{2}\tan\frac{x}{2}\right|+c$, the value of 15t is

48. Let f(x) be periodic function with fundamental period 12. If $\int_{-6}^{12}f(x)\,dx=9$ and $\int_{0}^{12}f(x)\,dx=12$, then find the value of $\frac{\left|\int_{0}^{6}f(x)\,dx\right|}{15}$.

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. Which of the following definite reduces to $\frac{\pi}{2}$?

(A) $\int_{0}^{\pi}\frac{dx}{1+(\sin x)^{\cos x}}$

(B) $\int_{0}^{\pi/2}\frac{dx}{1+(\tan x)^{5}}$

(C) $\int_{0}^{\infty}\frac{x^2+1}{x^4-x^2+1}$

(D) $\int_{0}^{\pi/2}\left(\ell n(\sec x)\right)\left(e^{\ell n(\ell n2)}\right)^{-1}dx$

Space for rough work

50. Let $f(x) = \tan x - \tan^3 x + \tan^5 x - \tan^7 x + \ldots\ldots \infty$, where $x \in \left(0, \frac{\pi}{4}\right)$, then which of the following is/are correct ?

(A) $\int_0^{\pi/6} f(x)\,dx = \frac{1}{8}$ (B) $f'\left(\frac{\pi}{12}\right) = \frac{1}{2}$ (C) $\lim_{x\to 0^+} \frac{f(x)}{x} = 1$ (D) f(x) is an odd function

51. Which of the following definite integral vanishes ?

(A) $\int_{-\pi}^{\pi} \left(\cos 2x \cdot \cos 2^2 x \cdot \cos 2^3 x \cdot \cos 2^4 x \cdot \cos 2^5 x\right) dx$

(B) $\int_{-1}^{1} \ell n\left(x + \sqrt{x^2+1}\right) dx$

(C) $\int_0^1 \tan^{-1}\left(\frac{2x-1}{1+x-x^2}\right) dx$

(D) $\int_0^{\pi/2} \ell n(\tan x)\,dx$

52. The integral $\int_{\tan^{-1}\lambda}^{\cot^{-1}\lambda} \frac{\tan x}{\tan x + \cot x} dx$, $\forall\ \lambda \in R$ can not take the value

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

53. $\int_4^{10} \left([x-4] + [10-x]\right) dx =$

(where [x] is the largest integer not exceeding x)

(A) 26 (B) 10 (C) 30 (D) 20

54. Let $\int \frac{x^{1/2}}{\sqrt{(1-x^3)}} dx = \frac{2}{3}$ gof (x) + c, then

(A) $f(x) = \sqrt{x}$ (B) $f(x) = x^{3/2}$ (C) $f(x) = x^{2/3}$ (D) $g(x) = \sin^{-1}x$

Space for rough work

55. 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) $f(x) = 2(x-2)$

56. If $\int f(x)\sin x\cos x\,dx = \frac{1}{2(b^2-a^2)}\ln f(x) + c$, then f(x) us equal to

(A) $\frac{1}{a^2\sin^2 x + b^2\cos^2 x}$ (B) $\frac{1}{a^2\sin^2 x - b^2\cos^2 x}$

(C) $\frac{1}{a^2\cos^2 x + b^2\sin^2 x}$ (D) none of these

57. The value α in the interval $[-\pi, 0]$ satisfying $\sin\alpha + \int_{\alpha}^{2\alpha}\cos 2x\,dx = 0$ is

(A) $-\frac{\pi}{2}$ (B) $-\pi$ (C) $-\frac{\pi}{3}$ (D) 0

58. Let $I = \int_0^1 \sqrt{\frac{1+\sqrt{x}}{1-\sqrt{x}}}\,dx$ and $J = \int_0^1 \sqrt{\frac{1-\sqrt{x}}{1+\sqrt{x}}}\,dx$, then the correct statement is

(A) $I + J = 2$ (B) $I - J = \pi$ (C) $I = \frac{2+\pi}{2}$ (D) $J = \frac{4-\pi}{2}$

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.

Column I		Column II	
(A)	$\int_0^{\pi/2} e^{\sin^2 x} \sin 2x \, dx$	p.	$\frac{\pi}{4}$
(B)	$\int_1^1 x\lvert x\rvert \, dx$	q.	$e - 1$
(C)	$\int_0^{\pi/2} \frac{(\sin x)^{5/2}}{(\sin x)^{5/2} + (\cos x)^{5/2}} dx$	r.	$\frac{\pi}{32}$
(D)	$\int_0^{\pi/2} \sin^4 x \cos^2 x \, dx$	s.	0
		t.	700

Space for rough work

60. Match the following lists:

Column I		Column II	
(A)	$\int_0^{\infty} e^{-4x} \sin 5x \, dx$	p.	3
(B)	$\int_2^8 \frac{\left[x^2\right] dx}{\left[x^2-20x+100\right]+\left[x^2\right]}$ (where [.] denotes the greatest integer function)	q.	$\frac{5}{41}$
(C)	$\int_0^{\pi/2} \left[x^n + n(n-1)x^{n-2}\cos x\right] dx$ (where $n \in N$)	r.	120
(D)	$\int_0^{\infty} x^5 e^{-x} \, dx$	s.	$\left(\frac{\pi}{2}\right)^n$
		t.	600

space for rough work

FIITJEE RET – 9

(2017 – 2019)(2ND YEAR_REGULAR)

IIT-2015 (P1)_SET–B

DATE: 17.09.2018

ANSWERS

PHYSICS

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

CHEMISTRY

21.	**2**	22.	**4**	23.	**5**	24.	**3**
25.	**4**	26.	**8**	27.	**5**	28.	**8**
29.	**A, B, C, D**	30.	**A, C**	31.	**A, B, D**	32.	**A, B, C**
33.	**A, B, C**	34.	**D**	35.	**A**	36.	**A, C, D**
37.	**A, B, C**	38.	**A, C, D**	39.	**A → r ; B → p; C → q ; D → s**		
40.	**A → p, s ; B → s, r ; C → r ; D → p, q**						

MATHEMATICS

41.	**8**	42.	**0**	43.	**3**	44.	**1**
45.	**3**	46.	**0**	47.	**3 (Bonus)**	48.	**1**
49.	**AD**	50.	**ACD**	51.	**BCD**	52.	**ABD**
53.	**C**	54.	**BD**	55.	**BD**	56.	**A**
57.	**BCD**	58.	**BD**	59.	**A → q; B → s; C → p; D → r**		
60.	**A → q; B → p; C → s; D → r**						