FIITJEE INTERNAL TEST

IIT – JEE 2019

PHASE – VII (CHAMPIONS)_PAPER – I

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.

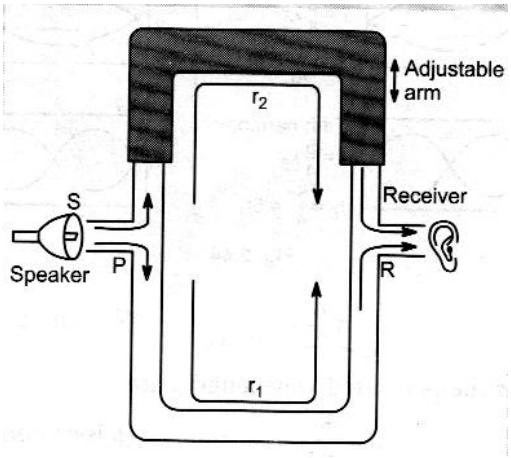
NAME: ☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐

ENROLLMENT NO.: ☐☐☐☐☐☐☐☐☐☐

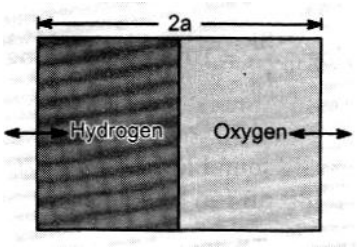
PAPER–I
PART I: PHYSICS
SECTION 1 (Maximum Marks: 32)

- 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. In a quincke's experiment shown in fig, for demonstrating interference of sound, a source of frequency 680 Hz is used. One of the arms of the tube can be adjusted. If the distance by which the sliding arm is to be drawn out to pass from one minimum to the next maximum is given by $\frac{1}{x_0}$ meter then value of x_0 is ___ Take the velocity of sound to be 340 m/s.



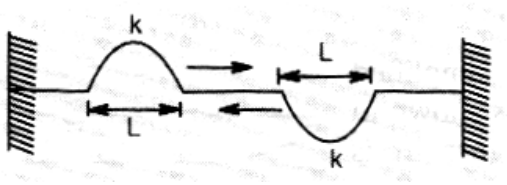
2. A cylinder of length 2a = 1m is divided by a thin, perfectly flexible diaphragm in the middle. It is closed by similar flexible diaphragms at the ends. The two chambers into which it is divided contain hydrogen and oxygen respectively. The two end diaphragms are set into vibrations of the same frequency. If the minimum frequency of these diaphragms for which the middle one will be a node is given by $n \times 412.5\text{Hz}$ then value of n is Take velocity of sound in hydrogen = 1100 m/s and that in oxygen = 300 m/s.



Space for rough work

3. A tuning fork and an organ pipe at temperature 88^0C produce 5 beats per second. When the temperature of the air column is decreased to 51^0C, the two produce 1 beat per sec. If the frequency of the tuning fork is given by $(65 + f_0)$ Hz then value of f_0 is ____

4. Two identical pulses move in opposite directions with same uniform speeds on a stretched string. The width and kinetic energy of each pulse is L and k respectively. At the instant they completely overlap, the kinetic energy of the width L of the string where they overlap is given by n_0k then n_0 is ____

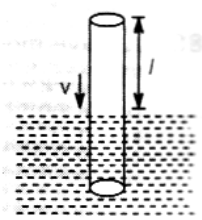


5. In the resonance tube experiment, the first resonance is heard when length of air column is ℓ_1 = 1 m and second resonance is heard when length of air column is ℓ_2 = 1.5m. What should be the minimum length of the tube (in meter) so that third resonance can also be heard.

6. An open organ pipe of length ℓ is sounded together with another open organ pipe of length $\ell + x$ in their fundamental tones. Speed of sound in air is v . If the beat frequency heard is given $\frac{vx}{\sqrt{N}\ell^2}$ then N is equal to (take $x << \ell$).

7. An object of specific gravity ρ is hung from a thin steel wire. The fundamental frequency for transverse standing waves in the wire is 300 Hz. The object is immersed in water, so that one half of its volume is submerged. The new fundamental frequency (in Hz) is given by $300\left(\frac{a\rho - 1}{b\rho}\right)^{1/2}$ then value of (a-b) is _____

8. An open pipe of sufficient length is dipping in water with a speed v vertically. If at any instant, ℓ is length of tube above water then the rate at which fundamental frequency of pipe changes is given by $\frac{cv}{K_0\ell^2}$ Then value of K_0 is ____
(c is the speed of sound in air)



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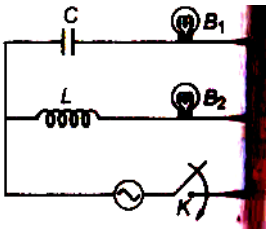
SECTION 2 (Maximum Marks: 40)

- 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 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 $\neq \frac{1}{2\pi\sqrt{LC}}$

10. Two radio stations that are 250 m apart emit radio waves of wavelength 100 m. Point A is 400 m from both the stations. Point B is 450 m from both stations. Point C is 400 m from one station and 450 m from the other. The radio stations emit in phase. Which of the following statements is/ are correct ?
(A) There will be constructive interference at A and B and destructive interference at C.
(B) There will be destructive interference at A and B and constructive interference at C
(C) There will be constructive interference at A and destructive interference at B and C
(D) There will be constructive interference at B and C and destructive interference at A.

11. As a wave propagates :
(A) The wave intensity remains constant for a plane wave
(B) The wave intensity decreases as the inverse of the distance from the source for a spherical wave
(C) The wave intensity decrease as the inverse square of the distance from the source for a spherical wave
(D) The wave intensity decreases as the inverse of the distance for a line source.

Space for rough work

12. In a resonance tube experiment, a close organ pipe of length 120 cm resonates when tune with a tuning fork of frequency 340 Hz. If water is poured in the pipe then : (given $v_{air} = 340 m/sec$)
(A) Minimum length of water column to have the resonance is 45 cm
(B) The distance between two successive nodes is 50 cm
(C)The maximum length of water column to create the resonance is 95 cm
(D) None of the above

13. A sound wave of frequency f travels horizontally to the right. It is reflected from a large vertical plane surface moving to left with a speed v. The speed of sound in medium is c.
(A) The number of waves striking the surface per second is $f\frac{(c+v)}{c}$
(B) The wavelength of reflected wave is $\frac{c(c-v)}{f(c+v)}$
(C) The frequency of the reflected wave is $f\frac{(c+v)}{(c-v)}$
(D) The number of beats heard by a stationary listener to the left of the reflecting surface is $\frac{vf}{c-v}$

14. The length, tension, diameter and density of a wire B are double than the corresponding quantities for another stretched wire A. Then
(A) Fundamental frequency of B is $\frac{1}{2\sqrt{2}}$ times that of A
(B) The velocity of wave in B is $\frac{1}{\sqrt{2}}$ time that of velocity in A
(C) The fundamental frequency of A is equal to the third overtone of B
(D) The velocity of wave in B is half that of velocity in A

Space for rough work

15. Figure shows two isotropic point sources of sound, S_1 and S_2. The source emit waves in phase at wavelength 0.50 m; they are separated by D = 1.75 m. If we move a sound detector along a large circle centered at the midpoint between the sources.

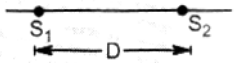
Choose the correct options

(A) Number of points waves arrives at the detector when waves are exactly in phase is 14

(B) Number of points waves arrive at the detector when waves are exactly out of phase is 14

(C) Number of points waves arrive at the detector when waves are exactly in phase is 7

(D) Number of points waves arrive at the detector when waves are exactly out of phase is 7



16. A source S of sound wave of fixed frequency N and an observer O are located in air initially at the space points A and B, a fixed distance apart. State in which of the following cases, the observer will not see any Doppler effect and will receive the same frequency N as produced by the source.

(A) Both the source S and observer O remain stationary but a wind blows with a constant speed in an arbitrary direction

(B) The observer remains stationary but the source S moves parallel to and in the same direction and with the same speed as the wind

(C) The source remains stationary but the observer and the wind have the same speed away from the source

(D) The source and the observer move directly against the wind but both with the same speed

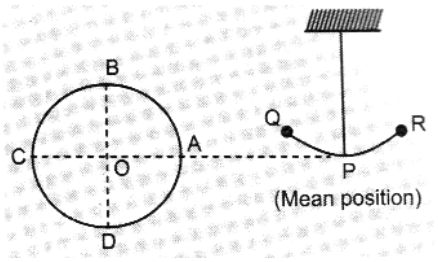
17. A sound is moving on a circular path of radius R with constant angular speed ω in anticlockwise direction and emits a frequency f_0. If an observer performs simple harmonic along the path QPR with time period $T = 2\pi/\omega$ as shown in the figure. If at t =0 source is at A and observer is at Q. Assume OP is very large as compare to radius R and QP.

(A) Observer will hear maximum frequency at P if source is at B

(B) Observer will hear maximum frequency at P if source is at D

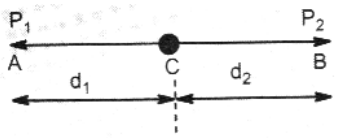
(C) Observer will hear maximum frequency at Q if source is at B

(D) Observer will hear maximum frequency at Q if source is at D



Space for rough work

18. As shown in the figure, two loudspeakers are located at point A and B. Both are vibrating in phase at a frequency and P_1 and P_2 are their respective powers. Point C lies on a line joining two loudspeaker at a distance of d_1 from A and d_2 from B. With Both speakers switched on what is the power (in W/m^2) at point C. Take velocity of sound $300 ms^{-1}$, frequency ν = 100 Hz, $d_1 = 1m$ and $d_2 = 1.5m$. $P_1 = 8\pi$ W and $P_2 = 18\pi$ W. Also assume that loudspeaker behave like isotropic source : (emit sound uniformly in all directions)



(A) $6 W/m^2$ (B) $9 W/m^2$

(C) $12 W/m^2$ (D) $15 W/m^2$

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.

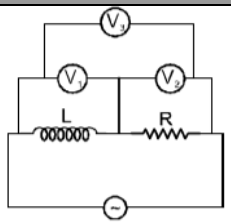
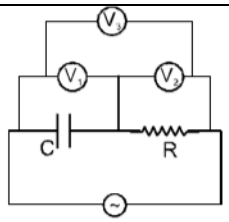
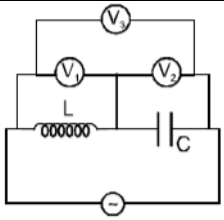
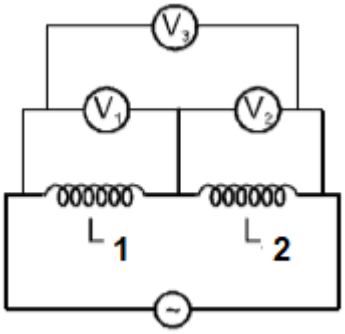
Space for rough work

19. Two waves are propagating along a taut string that coincides with the x –axis. The wave function for the two waves are $Y_1 = A\cos\left[K(x-vt)\right]$ and $Y_2 = A\cos\left[K(x+vt)+\delta\right]$ Column – I represents the condition on δ for constructive interference and destructive interference and the position x of the stationary points for constructive and destructive interference. Match the following

Column – I		Column – II	
(A)	$\delta = 2n\pi$	(p)	Stationary point
(B)	$\delta = (2n+1)\pi$	(q)	Constructive interference
(C)	$x = \frac{(2n+1)\pi/2}{K}$	(r)	Destructive interference
(D)	$x = n\pi/K$	(s)	Not a stationary point
		(t)	None of these

Space for rough work

20. All voltmeters are ideal and reading of voltmeters V_1 and V_2 are given by $v_1 = 3$ volt and $v_2 = 4$ volt in all cases. In each diagram V_1 is bottom left voltmeter , V_2 is bottom right voltmeter and V_3 is top most voltmeter. Match the following

Column – I		Column – II	
(A)		(p)	$V_3 = 5$ Volt
(B)		(q)	$V_3 = 1$Volt
(C)		(r)	$V_3 = 7$ volt
(D)		(s)	Current is lagging in phase from applied voltage
		(t)	Applied voltage is lagging in phase from current

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 0.00 1 molal solution of $[Pt(NH_3)_4Cl_4]$ in water had a freezing point depression of 0.0054°C. If Kf for water is 1.80, how many chlorines are inside the coordination sphere in the structure of this molecule?

22. How many geometrical isomers are possible for the square planar complex
$\left[Pt\ NO_2\ \ Py\ \ NH_3\ \ NH_2OH\ \right]NO_2$

23. How many of the following amino acids have aromatic ring ?
Proline, Tryptophan, Tyrosine, Phenyl alanine, threonine, cystine, Lysine.

24. How many of the following complexes have zero magnetic moment
$K_4Fe(CN)_6$, $\left[Ni(H_2O)_6\right]^{+2}$, $\left[Cr(H_2O)_6\right]^{+3}$, $K_3\left[Fe(CN)_6\right]$, $\left[Ni(CO)_4\right]$, $\left[K_3Cu(CN)_4\right]$, $\left[Co(CN)_6\right]^{-3}$, $\left[Zn(H_2O)_4\right]^{+2}$, $\left[Co(H_2O)_6\right]^{+2}$

25. How many of the following type of coordination compounds do not exhibit Geometrical isomerism. Thd–Tetrahedral Sqp = Square planar(where M = central metal atom A, B are monodentate Ligands)
MA_4–Thd, MA_3B–Thd, MAB_3–SQP, MA_2B_2–Sqp
MA_4–Sqp , MA_5B, MA_4B_2, MA_2B_2–Thd, MAB_3–Thd

26. The elevation in boiling point of one molal solution of A_xB_y is 8.4. The salt is 80% dissociated in water, then x + y is (K_b of solvent is 2K molal^{-1})

27. When 20 g of naphthoic acid ($C_{11}H_8O_2$) is dissolved in 50 g of benzene
(K_f = 1.72 K kg mol^{-1}), a freezing point depression of 2K is observed.
The Van't Hoff factor (i) is $\frac{1}{x}$ where x is ……

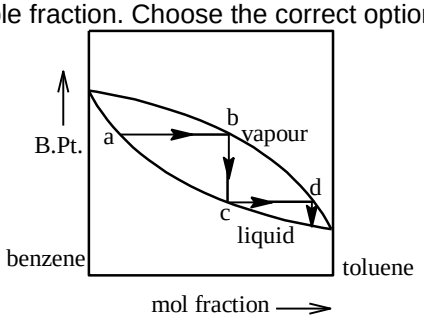
Space for rough work

28. How many of the following statements are correct :
(i) Butter is an example of a Lyophobic colloid
(ii) Soaps that form micelles at concentrations above CMC, form true solutiosn at the lower concentrations
(iii) A colloid obtained by using 'Bredigs are method' can not have negatively charged dispersed phase in general
(iv) $FeCl_3$ is a better coagulant for the human blood (a negative colloid) as compared to Na_3PO_4
(v) Delta is formed at the mouth of the river, where it meets the ocean, due to peptisation.
(vi) Enzymes are globular proteins which work over a wide range of pH and temperature.

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. A graph is plotted with temperature of a solution containing benzene and toluene as a function of mole fraction. Choose the correct options.



(A) a $\rightarrow$ b represents evaporation
(B) b $\rightarrow$ c represents condensation
(C) c $\rightarrow$ d represents evaporation
(D) c $\rightarrow$ d represents condensation

30. Select the incorrect statements
(A) Isoprene is the monomer of Neoprene
(B) Bakelite is a phenol-formaldehyde polymer
(C) On vulcanization phosphorus forms cross links at the reactive sites of double bonds.
(D) Melamine formaldehyde polymer is formed by the condensation polymerization

Space for rough work

31. Consider following solutions :
0.1 m $C_6H_5NH_3^+Cl^-$; 0.1m KCl; 0.1 m Glucose ; 0.1 m $Na_2C_2O_4$. 10 H_2O
(A) the solution with highest boiling point is 0.1 m $Na_2C_2O_4$. $10H_2O$
(B) the solution with highest freezing point is 0.1 m glucose
(C) 0.1 m $C_6H_5NH_3^+Cl^-$ and 0.1 m NaCl will have the same osmotic pressure
(D) 0.1 m glucose solution will have the lowest osmotic pressure

32. Select the correct statement
(A) $\left[Co(H_2O)_6\right]^{3+}$ is Co(III), low spin, 0 unpaired electron, diamagnetic
(B) $\left[CoF_6\right]^{-3}$ is Co(III), high spin d^6, 4 unpaired electron paramagnetic
(C) $\left[PtF_6\right]^{2-}$ is Pt(IV) low spin d^6, 0 unpaired electron diamagnetic
(D) $\left[Fe(CN)_6\right]^{-4}$ is high spin d^6, 0 unpaired electron diamagnetic

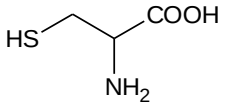
33. Which of the following is/are characteristic of a tetrahedral complex ?
(A) $d_{x^2-y^2}$ and d_{z^2} orbitals are low energy orbitals
(B) Most tetrahedral complex are high spin.
(C) Crystal field splitting is found double in octahedral complex.
(D) Splitting pattern in tetrahedral complex is just opposite of that in octahedral complexes.

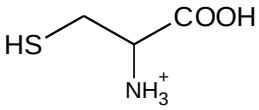
34. Which of the following statements are correct ?
(A) One mole of $pHNHNH_2$ reacts with 3 mol glucose to form osazone.
(B) One mole of D–fructose reacts with 3 mol $PhNHNH_2$ to form osazone.
(C) One mole of D–2–deoxy glucose reacts with 1 mol $PhNHNH_2$ to form phenylhydrazone.
(D) One mole of D–3–deoxy glucose reacts with 3 mol of $PhNHNH_2$ to form osazone.

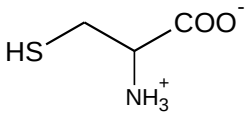
35. The term anomers of glucose does not refers to :
(A) isomers of glucose that differs in configuration at carbons one and four C–(1) and C–(4)
(B) a mixture of (D–) glucose and (L–) glucose
(C) enantiomers of glucose
(D) isomers of glucose that differ in configuration at carbon one C–(1)

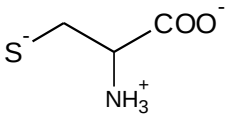
Space for rough work

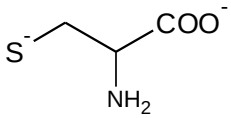
36. The pKa values of –COOH, -SH and $-\overset{\oplus}{N}H_3$ groups present in the amino acid cysteine are 1.8, 8.2 and 10.8 respectively. The structure of cysteine at a pH=5 wil be



(A) 

(B) 

(C) 

(D) 

37. What is true about glucose?
(A) Non–reducing nature
(B) Gives Molisch test
(C) Shows muta rotation
(D) Forms osazone

38. Match the following

	Solute(equimolar)	**Osmotic pressure ratio**
i)	Urea, glucose, fructose	(A) 1 : 0.8: 1
ii)	NaCl, $MgCl_2$, K_2SO_4	(B) 1 : 2 : 3
iii)	$Al_2(SO_4)_3$, Na_3PO_4, $K_4[Fe(CN)_6]$	(C) 1 : 1 : 1
iv)	Glucose, NaCl,$CaCl_2$	(D) 2 : 3 : 3

	i)	ii)	iii)	iv)
(A)	A	B	C	D
(B)	B	D	C	A
(C)	C	B	A	D
(D)	C	D	A	B

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.

Column – I		Column – II	
(A)	0.1 M $Ca_3(PO_4)_2$	(p)	Solution with highest boiling point
(B)	0.1 M NaCl	(q)	Solution with Van't Hoff factor greater than one
(C)	0.1 M glucose	(r)	Solution with lowest osmotic pressure
(D)	0.1 M $CaCl_2$	(s)	Solution with lowest freezing point

40. Match the column:

Column – I		Column – II	
(A)	Addition polymer	(p)	Buna-S
(B)	Condensation polymer	(q)	Buna-N
(C)	Homopolymer	(r)	Polythene
(D)	Copolymers	(s)	Nylon 6,6

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. z_1 and z_2 lie on a circle with centre at the origin. The point of intersection z_3 of the tangents at z_1 and z_2 is given by $\frac{kz_1z_2}{z_1+z_2}$, where k =

42. If $\omega \neq 1$ is a cube root of unity and ω, ω^2 satisfy the equation $\frac{1}{a+x}+\frac{1}{b+x}+\frac{1}{c+x}+\frac{1}{d+x}=\frac{2}{x}$, then the value of $\frac{1}{a+1}+\frac{1}{b+1}+\frac{1}{c+1}+\frac{1}{d+1}$ is

43. If $z \neq 0$ and $2 + \cos\theta + i\sin\theta = \frac{3}{2}$, then the value of $2(z+\bar{z})-|z|^2$ is

44. If $\lim\limits_{n\to\infty}\sum\limits_{r=1}^{n}\tan^{-1}\left(\frac{1}{2r^2}\right)=\frac{\pi}{k}$, then k =

45. If $z^2-z+1=0$ then the value of $\frac{1}{12}\left[\left(z+\frac{1}{z}\right)^2+\left(z^2+\frac{1}{z^2}\right)^2+\left(z^3+\frac{1}{z^3}\right)^2+.....+\left(z^{24}+\frac{1}{z^{24}}\right)^2\right]$ is equal to _____.

Space for rough work

46. Let f: R $\to$ R be a differentiable function satisfying f(x) = f(y) f(x – y) $\forall$ x, y $\in$ R and $f'(0) = \int_0^4 \{2x\}\,dx$, where {.} denotes the fractional part function and $f'(-3) = \alpha e^{\beta}$. Then $|\alpha + \beta|$ is equal to _____

47. Given a function g continuous every where such that g(1) = 5 and $\int_0^1 g(t)dt = 2$.

If $f(x) = \frac{1}{2}\int_0^x (x-t)^2 g(t)dt$ then f′′′(1) – f′′(1) is

48. The area bounded by $y = x.e^{|x|}$ and lines |x| = 1, y = 0 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

---

49. The function f(x) satisfying the equation, $f^2(x) + 4f'(x) \cdot f(x) + [f'(x)]^2 = 0$

(A) $f(x) = c.e^{(2-\sqrt{3})x}$ (B) $f(x) = c.\ e^{(2+\sqrt{3})x}$ (C) $f(x) = c.e^{(\sqrt{3}-2)x}$ (D) $f(x) = c.\ e^{-(2+\sqrt{3})x}$

50. The value of $\int_0^\infty \frac{dx}{1+x^4}$ is

(A) same as that of $\int_0^\infty \frac{x^2+1dx}{1+x^4}$ (B) $\frac{\pi}{2\sqrt{2}}$

(C)Same as that of $\int_0^\infty \frac{x^2dx}{1+x^4}$ (D) $\frac{\pi}{\sqrt{2}}$

Space for rough work

51. If $f(2 - x) = f(2 + x)$ and $f(4 - x) = f(4 + x)$ for all x and f(x) is a function for which $\int_0^2 f(x)dx = 5$, then $\int_0^{50} f(x)dx$ is equal to

(A) 125 (B) $\int_{-4}^{46} f(x)dx$ (C) $\int_1^{51} f(x)dx$ (D) $\int_2^{52} f(x)dx$

52. Which of the following definite integrals (s) vanishes

(A) $\int_0^{\pi/2} \ln(\cot x)\, dx$ (B) $\int_0^{2\pi} \sin^3 x\, dx$ (C) $\int_{1/e}^{e} \frac{dx}{x(\ln x)^{1/3}}$ (D) $\int_0^{\pi} \sqrt{\frac{1+\cos 2x}{2}}\, dx$

53. If 'A' be the area of the ellipse $\frac{(x+1)^2}{4} + y^2 = 1$ falling in the 1st quadrant, then

(A) $A = \left(\frac{\pi}{3} - \frac{\sqrt{3}}{4}\right)$ sq.units (B) $A > \left(\frac{4\pi - 3\sqrt{3}}{19}\right)$ sq.units

(C) $A < \left(\frac{4\pi - 3\sqrt{3}}{9}\right)$ sq.units (D) $A < \frac{\pi}{6}$ sq.units

54. Consider the integral $I_1 = \int_1^e (1+x)(x+\ell nx)^{100}\, dx, I_2 = \int_{\sin^{-1}\left(\frac{1}{e}\right)}^{\frac{\pi}{2}} (1+e\sin x+\ell n\sin x)^{101} \cos x\, dx.$

If $I_1 + \frac{e}{101} I_2$ is $\frac{e(1+e)^{101} - k}{101}$, then k is greater than or equal to

(A) 0 (B) 1 (C) 2 (D) –1

55. Let a function f: R $\to$ R is defined by f(x) = x + sin x and $\int_0^{\pi} f^{-1}(x)\, dx = I$, then

(A) $I > \int_0^1 \frac{1}{1+x^3}\, dx$ (B) $I < \int_0^1 e^{x^2}\, dx$ (C) $2 < I < 3$ (D) $\frac{\pi}{4} < I < \frac{\pi}{2}$

Space for rough work

56. $\frac{dy}{dx} + y = f(x)$ where y is continuous function of x with y(0) = 1 and

$f(x) = \begin{cases} e^{-x} & \text{if} \quad 0 \le x \le 2 \\ e^{-2} & \text{if} \quad x > 2 \end{cases}$, then which of following holds good.

(A) $y(1) = 2e^{-1}$ (B) $y'(1) = -e^{-1}$ (C) $y(3) = -2e^{-3}$ (D) $y'(3) = -2e^{-3}$

57. The equation of the curve passing through (3, 4) and satisfying the differential equation, $y\left(\frac{dy}{dx}\right)^2 + (x-y)\frac{dy}{dx} - x = 0$ could be

(A) x – y + 1 = 0 (B) $x^2 + y^2 = 25$ (C) $x^2 + y^2 - 5x - 10 = 0$ (D) x + y – 7 = 0

58. A parabola $y^2 = 4x$ and a circle with centre (6, 5) intersect at right angle. Possible values of points of intersection are

(A) (9, 6) (B) $2, \sqrt{8}$ (C) (4, 4) (D) $3, 2\sqrt{3}$

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

59.

	List – I		List – II
(A)	Let f(t) = $\sqrt{1-\sin t}$, then $\int_0^{2\pi} f(t)\,dt - \int_0^{\pi} f(t)\,dt$, is equal to	p.	100
(B)	If J = $\int_0^{10} \text{sgn}(\sin \pi x)\,dx$, then 10J is equal to, where sgn x denotes signum function of x	q.	4
(C)	Let f be a differentiable function on R satisfying f(x) = $x^2 + \int_1^x tf(t)\,dt$, the value of f′(1) is equal to	r.	0
(D)	If I = $\int_2^3 \left((x-1)^3 + (4-x)^3 + x\right)\cos \pi x\,dx$, then $\lvert 50\pi^2 I\rvert$ is equal to	s.	3

60. Number solutions of

	Column – I		Column – II
(A)	$z^2 + \lvert z\rvert = 0$	p.	1
(B)	$z^2 + \bar{z}^2 = 0$	q.	3
(C)	$z^2 + 8\bar{z} = 0$	q.	4
(D)	$\lvert z-2\rvert = 1$ and $\lvert z-1\rvert = 2$	r.	infinite

Space for rough work

FIITJEE INTERNAL TEST

IIT – JEE 2019

PHASE – VII (CHAMPIONS)_PAPER – I

ANSWERS

PHYSICS

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

CHEMISTRY

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

MATHEMATICS

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

FIITJEE INTERNAL TEST

IIT – JEE 2019

PHASE – VII (CHAMPIONS)_PAPER – II

Time: 3 hours **Maximum Marks: 240**

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 **8 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 paragraphs** type questions. Each paragraph describes an experiment, a situation or a problem. Two multiple choice questions will be asked based on this paragraph. One or more than one option can be correct.

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 **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.

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 – II
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. A metallic wire with tension T and at temperature 30^oC vibrates with its fundamental frequency of 1 kHz. The same wire with the same tension but at 10^oC temperature vibrates with a fundamental frequency of 1.001 kHz. The coefficient of linear expansion of the wire is $n \times 10^{-n} /^o C$. Then n = ……

2. A stationary source is emitting sound at a fixed frequency f_0, which is reflected by two cars approaching the source. The difference between the frequencies of sound reflected from the cars is 1.2% of f_0. What is the difference in the speeds of the cars (in km per hour) to the nearest integer ? The cars are moving at constant speeds much smaller than the speed of sound which is 330 ms^{-1}.

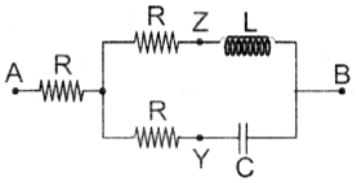
3. An observer standing at sea coast observes 54 waves reaching the coast per minute. If the wavelength of the waves is 10m, find the velocity (in m/s)

4. A source emitting sound of frequency 180 Hz is placed in front of a wall at a distance of 2 m from it. A detector is also placed in front of the wall at some distance from it. Find the minimum distance (in m) between the source and the detector for which the detector detects a maximum of sound. Speed of sound in air = 360 m/s.

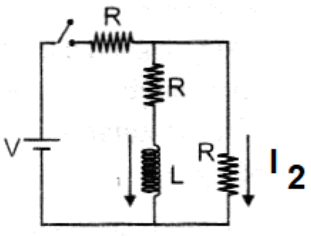
5. In a car race sound signals emitted by the two cars are detected by the detector on the straight track at the end point of the race. Frequencies observed are 300 Hz and 360 Hz and the original frequency is 300 Hz of both cars. Race ends with the separation of 100m between the cars. Assume both cars move with constant velocity and velocity of sound is 330 m/s. Find the time (in second) taken by the winning car.

Space for rough work

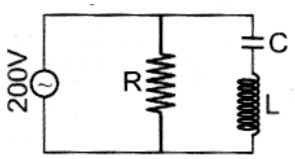
6. A voltage $V_{AB} = V_0 \cos\omega t$, is applied between the points A and B in the network shown in diagram given that $C = \frac{1}{\omega R\sqrt{3}}$ and $L = \frac{R\sqrt{3}}{\omega}$. If the total impedance between A and B is found to be a_0R then value of a_0 is ___



7. In the circuit shown in figure the inductor has a self inductance L and the three resistors have the same resistance R. The switch is closed at t =0. If expression for the current I_2 as function of time is given by $\frac{V}{a_0R}\left(1+\frac{1}{2}e^{\frac{-b_0Rt}{C_0L}}\right)$ then value of $(a_0+b_0+c_0)$ is ____



8. In the circuit diagram shown, $X_C = 100\Omega$, $X_L = 200\Omega$ and $R = 100\Omega$. If the effective current through the source is given by $\sqrt{I_0}$ ampere then I_0 is



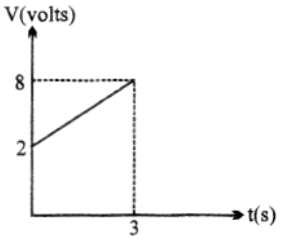
SECTION 2 (Maximum Marks: 32)

- This section contains **EIGHT** 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

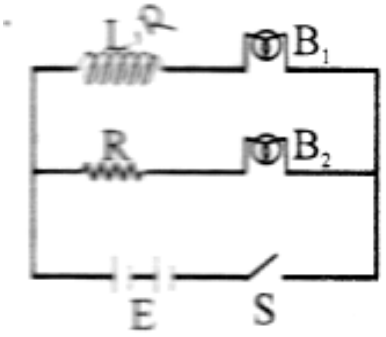
9. A circuit element is placed in a closed box. At time t =0, constant current generator supplying a current of 1 amp, is connected across the box. Potential difference across the box varies according to graph shown in figure. The element in the box is



(A) resistance of 2Ω (B) battery of emf 6 V

(C) inductance of 2 H (D) capacitance of 0.5 F

10. An inductor L, a resistance R and two identical bulbs B_1 and B_2 are connected to a battery through a switch S as shown in the figure. The resistance of coil having inductance L is also R. Which of the following statement gives the correct description of the happenings when the switch S is closed ?



(A) The bulb B_2 lights up earlier than B_1 and finally both the bulbs shine equally bright.

(B) B_1 light up earlier and finally both the bulbs acquire equal brightness

(C) B_2 lights up earlier and finally B_1 shines brighter than B_2

(D) B_1 and B_2 light up together with equal brightness all the time

11. Resonance occurs in a series L-C-R circuit when the frequency of the applied emf is 1000 Hz . Then

(A) when f = 900 Hz, the circuit behaves as a capacitive circuit

(B) the impedance of the circuit is maximum at f= 1000 Hz

(C) at resonance the voltage across L and voltage across C differ in phase by 180^0

(D) if the value of C is doubled resonance occurs at f = 2000 Hz

12. Velocity of sound in air is 320 m/s. A pipe closed at one end has a length of 1 m. Neglecting end corrections, the air column in the pipe can resonate for sound of frequency:

(A) 80 Hz (B) 240 Hz (C) 320 Hz (D) 400 Hz

Space for rough work

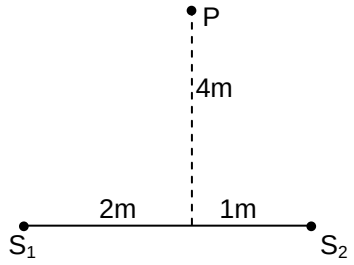
13. An air column in a pipe, which is closed at one end, will be in resonance with a vibrating tuning fork of frequency 264 Hz if the length of the column in cm is:

(A) 31.25 (B) 62.50 (C) 93.75 (D) 12.5

14. A hollow pipe of length 0.8 m is closed at one end. At its open end a 0.5 m long uniform string is vibrating in its second harmonic and it resonates with the fundamental frequency of the pipe. If the tension In the wire is 50 N and the speed of sound is 320 ms^{-1} the mass of the string is
(A) 5 grams (B) 10 grams (C) 20 grams (D) 40 grams

15. A wave disturbance in a medium is described by $y(k, t) = 0.02 \cos\left(5\pi t + \frac{\pi}{2}\right)\cos(10\pi x)$, where x and y are in meters and t is in second. Then, the correct statement is:
(A) A node occurs at x = 0.15 m. (B) An antinode occurs at x = 0.3 m.
(C) The speed of the wave is 5.0 m/s. (D) The wavelength is 0.2 m.

16. Two sound sources S_1 and S_2 emit pure sinusoidal waves in phase. If the speed of sound is 350 m/s.
(A) for frequencies 1000 Hz, 2000 Hz, 3000 Hz etc., constructive interference occurs at P
(B) for frequencies 500 Hz, 1500 Hz, 2500 Hz etc., constructive interference occurs at P
(C) for frequencies 1000 Hz, 2000 Hz, 3000 Hz etc., destructive interference occurs at P
(D) for frequencies 500 Hz, 1500 Hz, 2500 Hz etc., destructive interference occurs at P



Space for rough work

SECTION 3 (Maximum Marks: 16)

- This section contains **TWO** paragraphs
- Based on each paragraph, there will be **TWO** 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

Paragraph–1

The following equations represent two sinusoidal equations propagating along positive direction of the x–axis.

$y_1 = A\cos(0.5\pi x - 100\pi t)$

$y_2 = A\cos(0.46\pi x - 92\pi t)$

Where y_1, y_2 and x are in metres. The medium is elastic in nature and the particles of medium possess the property of inertia. Based on the above answer the questions that follow:

17. The number of times in a second a person hear a loud sound is
(A) 4 (B) 6 (C) 8 (D) 12

18. The number of times the intensity becomes zero at x = 0 in 1 second is
(A) 50 (B) 192 (C) 96 (D) 100

Paragraph–2

The linear mass density of a nonuniform wire under constant tension decreases gradually along the wire so that an incident wave is transmitted without reflection. The wire is uniform for $-\infty \le x \le 0$. In this region, a transverse wave has the form y(x, t) = 0.003 cos (25x – 50t) where y and x are in metres and t is in seconds. From x = 0 to x = 20 m the linear mass density decreases gradually from μ_1 to $\frac{\mu_1}{4}$. For $20 \le x \le \infty$, the linear mass density is $\mu = \frac{\mu_1}{4}$.

19. Find the wave velocity for large value of x
(A) 3 m/s (B) 4 m/s (C) 5 m/s (D) 6 m/s

20. Find the amplitude of the wave for large value of x
(A) 0.0042 m (B) 0.003 m (C) 0.006 m (D) $0.003\sqrt{2}$ m

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. How many of the following complex ions have dsp^2 hybridization
$\left[PdCl_4\right]^{2-}$, $\left[Ni(CN)_4\right]^{2}$, $\left[Pd(CN)_4\right]^{2-}$, $\left[NiCl_4\right]^{2-}$, Cis platin, Zeise's salt {$K[PtCl_3(C_2H_4)].H_2O$}, Willkinson's catalyst $RhCl(PPh_3)_3$, $[Cu(NH_3)_4]^{2+}$, $[Ni(Gly)_2]$, $[Ni(CO)_4]$

22. A metal complex is found to contain 4 moles of NH_3, 2 moles of Cl^- and one mole of Br^- per mole of Cr^{+3}. One mole of complex reacts with excess $AgNO_3$ to give one mole of a white precipitate readily soluble in dilute aq. NH_3. Total number of geometrical isomers possible for the complex is

23. $PtCl_4.6H_2O$ can exist as hydrated complex 1 molal aqueous solution has depression in freezing point of 3.72 0C. Assume 100% ionization and $K_f\left(H_2O\right)=1.86^0\ mol^{-1}$ kg. Then complex has how many chloride ions outside the coordination sphere?

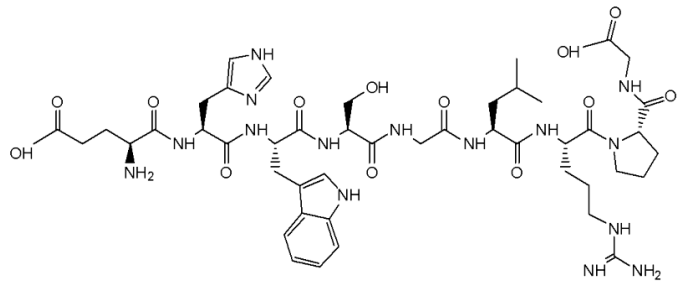
24. In water-ethanol system, the constant boiling mixture has a composition of 95.6% of ethanol by weight and boils at 78.13^0C under a pressure of one atm. How many of the following statements is true for this water-ethanol constant boiling mixture?
(A) This is called azeotropic mixture.
(B) If composition of mixture is 95.6% ethanol & this mixture is distilled, pure ethanol will be recovered.
(C) Distilling a mixture of ethanol & water containing less than 95.6% ethanol, lets us collect ethanol as a distillate and water as the residue in the boiling flask.
(D) Distilling a mixture of ethanol & water containing more than 95.6% ethanol, lets us collect water as a distillate and ethanol as the residue in the boiling flask.

Space for rough work

25. Few amino acids with their isoelectric points are given below. Identify the number of amino acids among them which show a net migration towards cathode during electrolysis when they are placed in a buffer solution of PH=5

	Amino Acid	PI
(i)	Val	5.97
(ii)	Ala	6.02
(iii)	Gly	5.9
(iv)	Asp	2.75
(v)	Len	5.98
(vi)	Lys	9.74
(vii)	Glu	3.22
(viii)	His	7.59
(ix)	Ser	5.68

26



With regards to the above structure four statements are given. How many of the given options iis/arethe correct

(A) Net charge at pH = 13 is –3.
(B) Net charge at pH = 1 is +3.
(C) On the complete hydrolysis it gives 8 distinct naturally occurring amino acids.
(D) One of the hydrolysis products is glycine

27. In the repeating unit of Nylon-66 the number of carbons, Nitrogen and Oxygen are a,b,c respectively. In the repeating unit of Nylong-6 the number of carbons, Nitrogen and Oxygen are x,y,z respectively then $\frac{a-bc}{x-yz}$ is _____

28. HCOOH and HCHO cannot be distinguished by treating with how many of the following reagents?

i) Benedict's solution ii) Tollen's reagent
iii) Felhing's solution iv) $NaHCO_3$

Space for rough work

SECTION 2 (Maximum Marks: 32)

- This section contains **EIGHT** 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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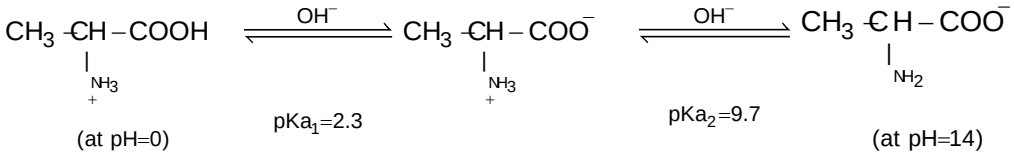
29. Alanine, an α-amino acid is existed in the following equilibrium at different pH values of the solution.



Identify the correct statements from the following:
(A) at pH=6.0 the solubility of alanine is minimum
(B) at pH=6.0 the concentration of anionic form dominating over the cationic form
(C) at pH=2.3, the concentration of dipolar ion is same as that of cationic form
(D) at pH=9.7, the concentration of dipolar ion is same as that of anionic form

30. Which of the following are outer orbital octahedral complexes?
(A) $[FeF_6]^{3-}$ (B) $[Fe(CN)_6]^{4-}$
(C) $[Fe(CN)_6]^{3-}$ (D) $[Fe(H_2O)_6]^{2+}$

31. For the complex $\left[CrCl_3\left(OH\right)_2\left(NH_3\right)\right]^{2-}$ ion the correct statement is/are
(A) It has three geometrical isomers.
(B) only one space isomer is optically active and remaining are in active
(C) There are total four space isomers
(D) the magnetic moment of complex ion is 3.89 BM

32. For 'invert sugar', the correct statement(s) is (are)
(Given : specific rotations of (+)–sucrose, (+)–maltose, L–(–)–glucose and L–(+)–fructose in aqueous solution are +66°, +140°, –52° and +92°, respectively)
(A) 'invert sugar' is prepared by acid catalyzed hydrolysis of maltose
(B) 'invert sugar' is an equimolar mixture of D–(+)–glucose and D–(–)–fructose
(C) specific rotation of 'invert sugar' is – 20°.
(D) on reaction with Br_2 water, 'invert sugar' forms saccharic acid as one of the products

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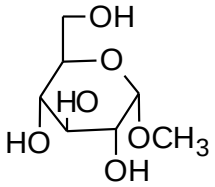
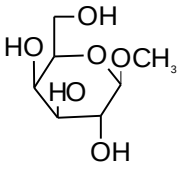
Space for rough work

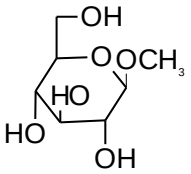
33. Identify the correct set of stereochemical relationships amongst the following: mono saccharides I-IV.



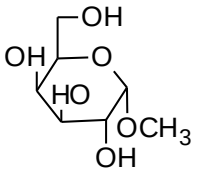
(I)



(II)



(III)



(IV)

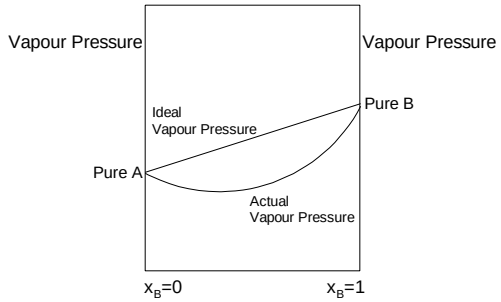
(A) III and IV are epimers
(B) I and III are epimers
(C) II and IV are anomers
(D) II and III are epimers

34. Consider 0.1 M solutions of two solutes X & Y. the solute X behaves as an univalent electrolyte while the solute Y undergoes dimerization in solution. Select the correct statement(s) regarding these solutions:
(A) The boiling point of the solution "X" will be higher than that of "Y"
(B) The osmotic pressure of the solution "X" will be higher than that of "Y"
(C) The freezing point of the solution "X" will be lower than that of "Y"
(D) The relative lowering of vapour pressure of both the solutions will be the same

35. The azeotropic solution of two miscible liquids:
(A) Can be separated by simple distillation
(B) May show positive or negative deviation from Raoult's Law
(C) Behaves as a supersaturated solution
(D) Behaves like a single component and boils at a constant temperature at a given pressure.

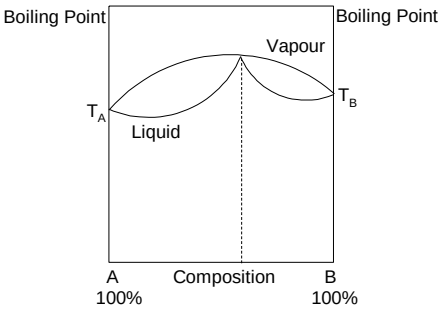
Space for rough work

36. For completely miscible binary solutions (A and B liquids) if given graph is correct for A–B binary solution

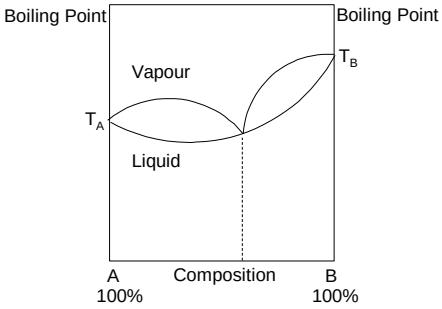


Then which among the following is untrue for above miscible binary solution.

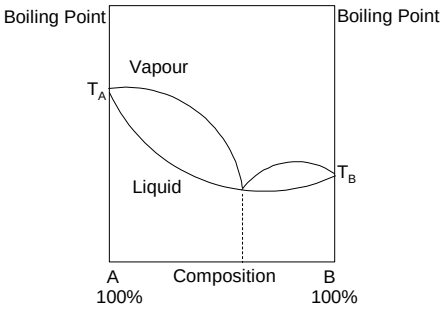
(A)



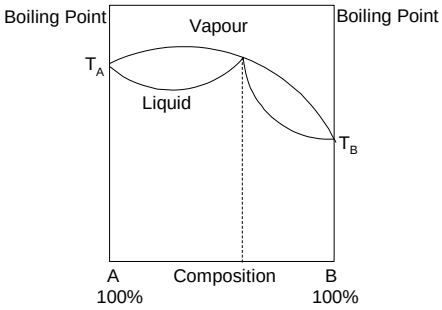
(B)



(C)



(D)



Space for rough work

SECTION 3 (Maximum Marks: 16)

- This section contains **TWO** paragraphs
- Based on each paragraph, there will be **TWO** questions
- Each question has **FOUR** options (A), (B), (C) and (D). **ONE OR MORE THAN ONE** of these four option(s) is(are) correct
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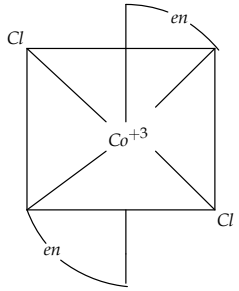
  - **–2** In all other cases

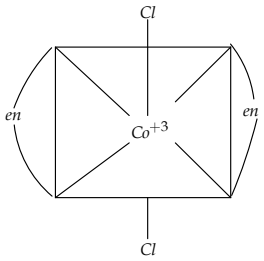
Paragraph–1

Isomerism is a phenomenon commonly found in organic compound but coordination compounds also exhibit isomerism due to difference in spacial arrangement of ligands around the central metal atom or ion. It is common in coordination no. 4 and 6.

37. Identify the correct statement(s) after observing the following four structures of $\left[Co(en)_2Cl_2\right]^+$ complex cation:



(A)



(B)

(A) a and B are identical structures
(B) a and b are epimars structures
(C) a and b are enantiomers
(D) a and b are diastereomers

38. The incorrect statements regarding $Ni(CO)_4$ is /are
(A) it is a diamagnetic complex
(B) Hybridisation of Nickel is dsp^2
(C) it is colour less complex
(D) Hybridisation of Nickel is sp^3

Space for rough work

Paragraph–2

A system of greater disorder of molecules is more probable. The disorder of molecules is reflected by the entropy of the system. A liquid vaporises to form a more disordered gas. When a solute is present, there is additional contribution to the entropy of the liquid due to increased randomness. As the entropy of solution is higher than that of pure liquid, there is a weaker tendency to form the gas. Thus, a solute (non volatile) lowers the vapour pressure of a liquid, and hence a higher boiling point of the solution.

Similarly the greater the randomness of the solution opposes the tendency to freeze. In consequence, a lower the temperature must be reached for achieving the equilibrium between the solid (frozen solvent) and the solution. Elevation of Boiling point (ΔT_b) and depression of freezing point (ΔT_f) of a solution are the colligative properties, which depend only on the concentration of particles of the solute, not their identity.

For dilute solutions, ΔT_b and ΔT_f are proportional to the molality of the solute in the solution. $\Delta T_b = k_{bm}$; $\Delta T_f = k_{fm}$.

k_b = Ebullioscopic constant. ΔT_f = cryoscopic constant.

The values of k_b and k_f depend on the properties of the solvent.

39. Dissociation of a non volatile solute in a given solution leads to the
(A) Decrease of entropy (B) Decrease in osmotic pressure
(C) Increase in tendency to pass in to the vapour phase
(D) Decrease in tendency of the liquid to freeze

40. Mixture of two immiscible liquids at a constant pressure of 1 atm boils at a temperature then the correct statement is/are
(A) Equal to the normal boiling point of more volatile liquid.
(B) Equal to the mean of the normal boiling points of the two liquids.
(C) Greater than the normal boiling point of either of the liquid.
(D) Smaller than the normal boiling point of either of the liquid.

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
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41. If $f(\pi) = 2$ and $\int_0^{\pi} [f(x) + f''(x)] \sin x \, dx = 5$, then $f(0) =$

42. If $f(x + y) = f(x) + f(y) - xy \ \forall \ x, y \in R$ and $\lim_{h \to 0} \frac{f(h)}{h} = 3$, then the area bounded by curvers $y = f(x)$ and $y = x^2$ is

43. If $f(x)$ is a continuous function in $[0, \pi]$ such that $f(0) = f(\pi) = 0$, then the value of $\int_0^{\pi/2} (f(2x) + f''(2x)) \sin x \cdot \cos x \, dx$ is equal to

44. The area bounded by $y = x^2 + 2$ and $y = 2|x| - \cos \pi x$ is equal to λ, then 3λ is

45. If $\int_0^{\sin^{-1} \pi/4} (\pi - 4\sin\theta) \sin 2\theta \ln (1 + \tan (\sin \theta)) \, d\theta$ is k, then $\frac{480k}{\pi^3 \ln 2}$ is equal to

46. If $z_1 z_2 \in C$, $z_1^2 + z_2^2 \in R$, $z_1 (z_1^2 - 3z_2^2) = 2$ and $z_2 (3z_1^2 - z_2^2) = 11$, then the value of $z_1^2 + z_2^2$ is

47. Let z_1 and z_2 be roots of the equation $z^2 + pz + q = 0$, where the coefficients p and q may be complex numbers. Let A and B represent z_1 and z_2 in the complex plane. If $\angle AOB = \alpha \neq 0$ and OA = OB, where O is the origin, then $p^2 = kq\cos^2 \frac{\alpha}{2}$, then k =

48. If $z = \frac{\sqrt{3} - i}{2}$ and $(z^{95} - i^{67})^{94} = z^n$, then sum of the digits of the smallest integral value of n is

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Space for rough work

SECTION 2 (Maximum Marks: 32)

- This section contains **EIGHT** 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
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+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 $S_1 = \left\{z \in C : \arg(z-4) = \frac{\pi}{4}\right\}$; $S_2 = \left\{z \in C : \arg\left(\frac{z-2}{z-5}\right) = \theta\right\}$

(A) $n(S_1 \cap S_2) = 2$, if $\theta = -\frac{\pi}{6}$ (B) $n(S_1 \cap S_2) = 0$, if $\theta = \frac{\pi}{6}$

(C) $n(S_1 \cap S_2) = 1$, if $\theta = -\frac{\pi}{6}$ (D) $n(S_1 \cap S_2) = 2$, if $\theta = \frac{\pi}{6}$

50. If $|z_1| = 15$ and $|z_2 - 3 - 4i| = 5$ then

(A) $|z_1 - z_2|_{min} = 5$ (B) $|z_1 - z_2|_{min} = 10$ (C) $|z_1 - z_2|_{max} = 20$ (D) $|z_1 - z_2|_{max} = 25$

51. The mirror image of the curve given by $\arg\left(\frac{z+i}{z-1}\right) = \frac{\pi}{4}$ in the line $x - y = 0$ is

(A) $\arg\left(\frac{z+i}{z+1}\right) = \frac{\pi}{4}$ (B) $\arg\left(\frac{z+1}{z-i}\right) = -\frac{\pi}{4}$ (C) $\arg\left(\frac{z-i}{z+1}\right) = \frac{\pi}{4}$ (D) $\arg\left(\frac{z+i}{z-1}\right) = \frac{\pi}{4}$

52. If $\alpha, \beta, \gamma, \delta$ are 4 complex numbers such that $\frac{\gamma}{\delta}$ is real and $\alpha\delta - \beta\gamma \neq 0$, then $z = \frac{\alpha + \beta t}{\gamma + \delta t}$, $t \in R$ may represents a

(A) circle (B) parabola (C) ellipse (D) straight line

53. If $|z_1| = |z_2| = |z_3| = 1$ and $S = |z_2 - z_3|^2 + |z_3 - z_1|^2 + |z_1 - z_2|^2$. Let α = minimum value of S and β = maximum value of S as z_1, z_2, z_3 vary on $|z| = 1$, then

(A) $\alpha = 0$ (B) $\beta = 9$ (C) $\beta = 3$ (D) $\alpha = 2$

Space for rough work

54. Let $x + iy = \sqrt{\phi + i\psi}$, where ϕ and ψ are real parameters and C_1, C_2 are real numbers

(A) $\phi = C_1$ represents a hyperbola (B) $\psi = C_2$ represents a hyperbola
(C) $\phi = C_1$ and $\psi = C_2$ intersect each other at right angles
(D) none of these

55. Let two given circles be C_1: $z\bar{z} + \bar{a}z + a\bar{z} + c = 0$ and C_2: $z\bar{z} + \bar{b}z + b\bar{z} + d = 0$, where a, b $\in$ C and c, d $\in$ R

(A) radius of circle C_1 is $\sqrt{|a|^2 - c}$

(B) C_1 and C_2 will touch externally iff $|a - b| = \sqrt{|a|^2 - c} + \sqrt{|b|^2 - d}$

(C) C_1 and C_2 will intersect orthogonally iff $a\bar{b} + \bar{a}b = c + d$

(D) Radical axis of C_1 and C_2 is $(\bar{a} - \bar{b})z + (a - b)\bar{z} + (c - d) = 0$

56. Let z_1, z_2, z_3 be complex numbers such that $|z_1| = |z_2| = |z_3| = 1$ and $\frac{z_1^2}{z_2 z_3} + \frac{z_2^2}{z_3 z_1} + \frac{z_3^2}{z_1 z_2} = -1$, then value of $|z_1 + z_2 + z_3|$ can be

(A) 1 (B) 2 (C) 3 (D) 4

Space for rough work

SECTION 3 (Maximum Marks: 16)

- This section contains **TWO** paragraphs
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  - **–2** In all other cases

Paragraph–1

If f(z) = a + ib, then $f(\bar{z})$ = a – ib

57. If $(x^2 + a^2)(x^2 + b^2)(x^2 + c^2) = \{f(x)\}^2 + \{\phi(x)\}^2$, where f(x) is a polynomial of degree 3, and a, b, c $\in$ R.
(A) $f(X) = x^3 - (ab + bc + ca)x$ (B) $f(X) = x^3 + (ab + bc + ca)x$
(C) $\phi(X) = x^2 (a + b + c) - abc$ (D) $\phi(X) = x^2 (a + b + c) + abc$

58. If $(a + ib)^{1/3} = x + iy$, then
(A) $(a - ib)^{1/3} = x - iy$ (B) $\frac{a}{x} + \frac{b}{y} = 4\left(x^2 - y^2\right)$ (C) $(a - ib)^{2/3} = (x + iy)^2$ (D) $\frac{a}{x} + \frac{b}{y} = 4(x^2 + y^2$

Paragraph–2

f(x) satisfies the relation $f(x) - \lambda \int_0^{\pi/2} \sin x \cos t\, f(t)dt = \sin x$.

59. If f(x) =2 has at least one real root, then
(A) $\lambda \in [1, 4]$ (B) $\lambda \in [-1, 2]$ (C) $\lambda \in [0, 1]$ (D) $\lambda \in [1, 3]$

60. If $\int_0^{\pi/2} f(x)dx = 3$, then value of λ is
(A) 1 (B) $\frac{3}{2}$ (C) $\frac{4}{3}$ (D) None of these

Space for rough work

FIITJEE INTERNAL TEST

IIT – JEE 2019

PHASE – VII (CHAMPIONS)_PAPER – II

ANSWERS

PHYSICS

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

CHEMISTRY

21.	**8**	22.	**2**	23.	**1**	24.	**3**
25.	**7**	26.	**4**	27.	**Bonus**	28.	**3**
29.	**A, C, D**	30.	**A, D**	31.	**A, D**	32.	**B, C**
33.	A,**B, C ,D**	34.	**A, B, C**	35.	**B, D**	36.	**A, B, C,D**
37.	**A**	38.	**B,C**	39.	**D**	40.	**Bonus**

MATHEMATICS

41.	**3**	42.	**2**	43.	**0**	44.	**8**
45.	**5**	46.	**5**	47.	**4**	48.	**1**
49.	**B, C**	50.	**A, D**	51.	**B, C**	52.	**D**
53.	**A, B**	54.	**A, B, C**	55.	**A, B, C, D**	56.	**A, B**
57.	**A, C**	58.	**A, B**	59.	**D**	60.	**C**