

FIITJEE RET – 2

(2018 – 2020)(1ST YEAR_REGULAR)

IIT-2014 (P2)_SET-A

DATE: 18.06.2018

Time: 3 hours

Maximum Marks: 180

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 **three sections**.
8. **Section I** contains **10 multiple choice questions**. Each question has four choices (A), (B), (C) and (D) out of which **ONE** is correct.
9. **Section II** contains **3 paragraphs**. Each describing theory, experiment, data etc., **Six questions** related to three paragraphs with two questions on each paragraph. Each question to a particular passage should have **ONLY ONE correct answer** among the four given choices (A), (B), (C) and (D).
10. **Section III** contains **4 Multiple choice questions**. Each question has two lists (List-1: P, Q, R and S; List-2: 1, 2, 3 and 4). The options for the correct match are provided as (A), (B), (C) and (D) out of which **ONLY ONE is correct**.

D. Marking Scheme

11. For each question in **Section 1, 2 and 3** you will be awarded **3 marks** if you darken the bubble corresponding to the correct answer and **zero mark** if no bubble is darkened. In all other cases, **minus one (-1) mark** will be awarded.

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.

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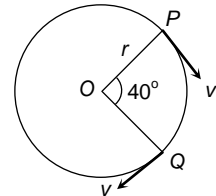
ENROLLMENT NO.:

PAPER – II
PART I: PHYSICS

SECTION – I: Single Correct Answer Type

The section contains **10 multiple choice questions**. Each question has four choices (A), (B), (C) and (D) out of which **ONLY ONE is correct**.

1. Force is $6\hat{i} + C\hat{j} - 2\hat{k}$ and displacement is $\hat{i} + 2\hat{j} + 6\hat{k}$. If the work done is 6J, the value of C is
(A) 6 (B) 4 (C) 8 (D) 9
2. Which of the following is independent of the choice of co-ordinate system
(A) $\vec{P} + \vec{Q} + \vec{R}$ (B) $(P_x + Q_x + R_x)\hat{i}$ (C) $P_x\hat{i} + Q_y\hat{j} + R_z\hat{k}$ (D) None of these
3. Following forces start acting on a particle at rest at the origin of the co-ordinate system simultaneously $\vec{F}_1 = -4\hat{i} - 5\hat{j} + 5\hat{k}$, $\vec{F}_2 = 5\hat{i} + 8\hat{j} + 6\hat{k}$, $\vec{F}_3 = -3\hat{i} + 4\hat{j} - 7\hat{k}$ and $\vec{F}_4 = 2\hat{i} - 3\hat{j} - 2\hat{k}$ then the particle will move
(A) In x – y plane (B) In y – z plane (C) In x – z plane (D) Along x – axis
4. The resultant of $\vec{A} + \vec{B}$ is \vec{R}_1 . On reversing the vector \vec{B} , the resultant becomes \vec{R}_2 . What is the value of $R_1^2 + R_2^2$
(A) $A^2 + B^2$ (B) $A^2 - B^2$ (C) $2(A^2 + B^2)$ (D) $2(A^2 - B^2)$
5. A particle is moving on a circular path of radius r with uniform velocity v . The change in velocity when the particle moves from P to Q is ($\angle POQ = 40^\circ$)
(A) $2v \cos 40^\circ$ (B) $2v \sin 40^\circ$
(C) $2v \sin 20^\circ$ (D) $2v \cos 20^\circ$



6. If $\vec{A} = 2\hat{i} + 3\hat{j} - \hat{k}$ and $\vec{B} = -\hat{i} + 3\hat{j} + 4\hat{k}$ then projection of \vec{A} on \vec{B} will be

- (A) $\frac{3}{\sqrt{13}}$ (B) $\frac{3}{\sqrt{26}}$ (C) $\sqrt{\frac{3}{26}}$ (D) $\sqrt{\frac{3}{13}}$

Space for rough work

7. Two vectors $P = 2\hat{i} + b\hat{j} + 2\hat{k}$ and $Q = \hat{i} + \hat{j} + \hat{k}$ will be parallel if
 (A) $b = 0$ (B) $b = 1$ (C) $b = 2$ (D) $b = -4$
8. A vector \vec{Q} which has a magnitude of 8 is added to the vector \vec{P} which lies along x-axis. The resultant of two vectors lies along y-axis and has magnitude twice that of P. The magnitude of \vec{P} is
 (A) $\frac{6}{\sqrt{5}}$ (B) $\frac{8}{\sqrt{5}}$ (C) $\frac{12}{\sqrt{5}}$ (D) $\frac{16}{\sqrt{5}}$
9. What is the maximum possible number of components of a vector can have?
 (A) 2 (B) 3 (C) 4 (D) any number
10. If $\vec{A} = \hat{i}A\cos\theta - \hat{j}A\sin\theta$ be any vector. Another vector \vec{B} , which is normal to \vec{A} can be expressed as
 (A) $B\cos\theta\hat{i} + B\sin\theta\hat{j}$ (B) $B\cos\theta\hat{i} - B\sin\theta\hat{j}$ (C) $B\sin\theta\hat{i} + B\cos\theta\hat{j}$ (D) $B\sin\theta\hat{i} + B\cos\theta\hat{j}$

SECTION – II: Paragraph Type

This section contains **3 paragraphs** each describing theory, experiment, data etc., **Six questions** relate to three paragraphs with two question on each paragraph. Each question of a paragraph has **only one correct answer** among the four choices (A), (B), (C) and (D).

Paragraph For Questions 11 & 12

Using the law of polygons, it can be deduced that sum of n vectors of equal magnitude and each making an angle of $\frac{2\pi}{n}$ with respect to the preceding vector is zero as the vectors could be represented by the sides of a closed polygon.

11. If there are $(n+1)$ vectors of equal magnitude each making an each making an angle of $\frac{2\pi}{n}$ with respect to the preceding vector, then the magnitude of sum of all vectors will be:
 (A) Twice the magnitude of each vector
 (B) Equal to the magnitude of each vector
 (C) Less than twice the magnitude of each vector but greater than magnitude of each vector
 (D) Can't be determined
12. If there are $(n - 1)$ vectors of equal magnitude each making an each making an angle of $\frac{2\pi}{n}$ with respect to the preceding vector, and the resultant makes an angle of 30° with the negative x-direction. Find the value of 'n', given that the first vector is aligned along +x-direction:
 (A) 6 (B) 9 (C) 12 (D) None of the above

Space for rough work

Paragraph For Questions 13 & 14

A straight rod is placed in space such that the position vector of two ends are $2\mathbf{i} + 3\mathbf{j} + 4\mathbf{k}$ and $-\mathbf{i} + 2\mathbf{j} + \mathbf{k}$ respectively. Answer following two questions based on this information.

13. If perpendicular are dropped on the x-axis from the two ends of the rods, then the distance between the foot of the perpendiculars will be:
(A) 3 (B) $\sqrt{2}$ (C) $\sqrt{3}$ (D) None
14. If perpendiculars are dropped from the two ends on x-y plane from the two ends of the rod. The distance between the foots of the perpendiculars will be:
(A) 3 (B) $\sqrt{10}$ (C) 4 (D) None

Paragraph For Questions 15 & 16

A student forgot Newton's formula for speed of sound but he knows there were speed (v), pressure (p) and density (d) in the formula. He then start using dimensional analysis method to find the actual relation.
 $v = kp^x d^y$

Where K is a dimensionless constant. On the basis of above passage answer the following questions.

15. The value of x is
(A) 1 (B) $\frac{1}{2}$ (C) $-\frac{1}{2}$ (D) 2
16. The value of y is
(A) 1 (B) $\frac{1}{2}$ (C) $-\frac{1}{2}$ (D) 2

Space for rough work

SECTION – III: (Matching List Type)

This section contains 4 questions, each having two matching lists. Choices for the correct combination of elements from List-I and List-II are given as option (A), (B), (C) and (D) out of which **ONLY ONE** is correct.

17. Match List – I with List – II and select the correct answer using the codes given by below the lists.

Column – I		Column – II	
(P)	Boltzmann constant	(1)	$[ML^2T^{-1}]$
(Q)	Coefficient of viscosity	(2)	$[ML^{-1}T^{-1}]$
(R)	Planck constant	(3)	$[MLT^{-3}K^{-1}]$
(S)	Thermal conductivity	(4)	$[ML^2T^{-2}K^{-1}]$
		(5)	None

	P	Q	R	S
(A)	1	2	3	4
(B)	2	3	5	1
(C)	4	2	1	3
(D)	3	1	2	4

18. Match the physical quantities given in Column I with dimensions expressed in terms of mass (M), length (L), time (T), and charge (Q) given in Column II and write the correct answer against the matched quantity in a tabular form in your answer book.

Column – I		Column – II	
(P)	Angular momentum	(1)	$[ML^2T^{-2}]$
(Q)	Latent heat	(2)	$[ML^2T^{-1}]$
(R)	Torque	(3)	$[ML^3T^{-1}Q^{-2}]$
(S)	Capacitance	(4)	$[M^{-1}L^{-2}T^2Q^2]$
		(5)	$[L^2T^{-2}]$

	P	Q	R	S
(A)	1	4	2	3
(B)	2	5	1	3
(C)	1	3	2	4
(D)	2	5	1	4

Space for rough work

19. For component of a vector $\vec{A} = (3\hat{i} + 4\hat{j} - 5\hat{k})$, Find the projections of \vec{A} along the entries in Column – I .
match the following table :

Column – I		Column – II	
(P)	y-axis	(1)	5 unit
(Q)	Along another vector $(2\hat{i} + \hat{j} + 2\hat{k})$	(2)	4 unit
(R)	Along $(6\hat{i} + 8\hat{j} - 10\hat{k})$	(3)	zero
(S)	Along another vector $(-3\hat{i} + 4\hat{j} + 5\hat{k})$	(4)	None
		(5)	3 unit

	P	Q	R	S
(A)	1	3	4	3
(B)	2	3	4	4
(C)	1	3	2	4
(D)	1	2	3	4

20. Match the following
 $\vec{A} = 3\hat{i} + 12\hat{j} + 4\hat{k}$, $\vec{B} = 2\hat{i} + \hat{j} + 2\hat{k}$

Column – I		Column – II	
(P)	Projection of \vec{B} on \vec{A}	(1)	$\frac{26}{3}$
(Q)	Projection of \vec{A} on \vec{B}	(2)	2
(R)	Component of \vec{B} perpendicular \vec{A}	(3)	$\frac{-25\hat{i} + 82\hat{j} - 16\hat{k}}{9}$
(S)	Component of \vec{A} perpendicular \vec{B}	(4)	$\frac{40\hat{i} - 22\hat{j} + 36\hat{k}}{13}$
		(5)	None of these

	P	Q	R	S
(A)	2	1	4	3
(B)	2	1	5	3
(C)	1	2	3	4
(D)	1	2	4	5

Space for rough work

PART II: CHEMISTRY

SECTION – I: Single Correct Answer Type

The section contains **10 multiple choice questions**. Each question has four choices (A), (B), (C) and (D) out of which **ONLY ONE is correct**.

21. What is the potential energy of an electron present in N-shell of the Be^{3+} ion ?
 (A) -3.4 eV (B) -6.8 eV (C) -13.6 eV (D) -27.2 eV
22. The kinetic and potential energy (in eV) of electron present in third Bohr's orbit of hydrogen atom are respectively:
 (A) $-1.51, -3.02$ (B) $1.51, -3.02$ (C) $-3.02, 1.51$ (D) $1.51, -1.51$
23. The distance between 4th and 3rd Bohr orbits of He^+ is :
 (A) $2.645 \times 10^{-10} \text{ m}$ (B) $1.322 \times 10^{-10} \text{ m}$
 (C) $1.851 \times 10^{-10} \text{ m}$ (D) none
24. What is the ratio of time periods (T_1/T_2) in second orbit of hydrogen atom to third orbit of He^+ ion ?
 (A) $8/27$ (B) $32/27$ (C) $27/32$ (D) none of these
25. If λ_0 and λ be the threshold wavelength and the wavelength of incident light, the velocity of photo-electrons ejected from the metal surface is:
 (A) $\sqrt{\frac{2h}{m}(\lambda_0 - \lambda)}$ (B) $\sqrt{\frac{2hc}{m}(\lambda_0 - \lambda)}$
 (C) $\sqrt{\frac{2hc}{m}\left(\frac{\lambda_0 - \lambda}{\lambda\lambda_0}\right)}$ (D) $\sqrt{\frac{2h}{m}\left(\frac{1}{\lambda_0} - \frac{1}{\lambda}\right)}$
26. Electromagnetic radiation having $\lambda = 310 \text{ \AA}$ is subjected to a metal sheet having work function = 12.8 eV . What will be the velocity of photo-electrons having maximum kinetic energy.
 (A) 0, no emission will occur (B) $4.352 \times 10^6 \text{ m/s}$
 (C) $3.09 \times 10^6 \text{ m/s}$ (D) $8.72 \times 10^6 \text{ m/s}$

Space for rough work

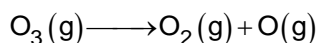
27. A light source of wavelength λ illuminates a metal and ejects photo-electrons with $(\text{K.E.})_{\text{max}} = 1 \text{ eV}$. Another light source of wavelength $\frac{\lambda}{3}$, ejects photo-electrons from same metal with $(\text{K.E.})_{\text{max}} = 4 \text{ eV}$. Find the value of work function ?
 (A) 1 eV (B) 2 eV (C) 0.5 eV (D) None of these
28. Potential energy of electron present in He^+ is
 (A) $\frac{e^2}{2\pi\epsilon_0 r}$ (B) $\frac{3e^2}{4\pi\epsilon_0 r}$ (C) $\frac{-2e^2}{4\pi\epsilon_0 r}$ (D) $\frac{-e^2}{4\pi\epsilon_0 r^2}$
29. A beam of specific kind of particles of velocity $2.1 \times 10^7 \text{ m/s}$ is scattered by a gold ($Z=79$) nuclei. Find out specific charge (charge/mass) of this particle if the distance of closest approach is $2.5 \times 10^{-14} \text{ m}$.
 (A) $4.84 \times 10^7 \text{ C/kg}$ (B) $4.84 \times 10^{-7} \text{ C/kg}$
 (C) $2.42 \times 10^7 \text{ C/kg}$ (D) $3 \times 10^{-12} \text{ C/kg}$
30. The velocity of an electron in excited state of H-atom is $1.093 \times 10^6 \text{ m/s}$. What is the circumference of this orbit ?
 (A) $3.32 \times 10^{-10} \text{ m}$ (B) $6.64 \times 10^{-10} \text{ m}$ (C) $13.30 \times 10^{-10} \text{ m}$ (D) $13.28 \times 10^{-8} \text{ m}$

SECTION – II: Paragraph Type

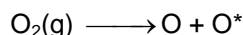
This section contains **3 paragraphs** each describing theory, experiment, data etc., **Six questions** relate to three paragraphs with two question on each paragraph. Each question of a paragraph has **only one correct answer** among the four choices (A), (B), (C) and (D).

Paragraph For Questions 31 & 32

Ozone in the upper atmosphere absorbs ultraviolet radiation which induces the following chemical reaction



O_2 produced in the above photochemical dissociation undergoes further dissociation into one normal oxygen atom (O) and more energetic oxygen atom O^* .



If (O^*) has 1 eV more energy than (O) and normal dissociation energy of O_2 is 480 kJ mol^{-1} .
 [1 eV/Photon = 96 kJ mol^{-1}]

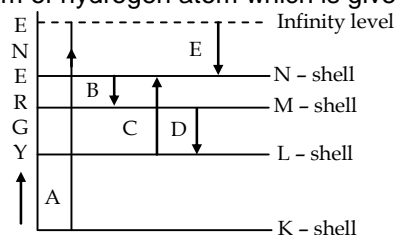
31. What is the maximum wavelength effective for the photochemical dissociation of O_2 molecule
 (A) 2440 \AA (B) 2066.67 \AA (C) 1000 \AA (D) 155 \AA

Space for rough work

32. If dissociation of O_3 into O_2 and O requires 400 kJ mol^{-1} and O_2 produced in this reaction is further dissociated to O and O^* then the total energy required to for the dissociation of O_3 into O and O^* is :
 (A) 1168 kJ/mol (B) 976 kJ/mol (C) 880 kJ/mol (D) None of these

Paragraph For Questions 33 & 34

Observe the electric energy level diagram of hydrogen atom which is given below.



33. The energy (in Joules) associated with the transition labelled by the arrow B is
 (A) $2.18 \times 10^{-18} \text{ J}$ absorbed (B) $1.06 \times 10^{-19} \text{ J}$ absorbed
 (C) $1.06 \times 10^{-19} \text{ J}$ emitted (D) $2.18 \times 10^{-18} \text{ J}$ emitted
34. The arrow representing the ionisation potential of H-atom is
 (A) A (B) B (C) C (D) D

Paragraph For Questions 35 & 36

A photon wavelength $4 \times 10^{-7} \text{ m}$ strikes on metal surface, the work function of the metal being 2.13 eV ($1 \text{ eV} = 1.602 \times 10^{-19} \text{ J}$)

35. The energy of the photon (in eV)
 (A) 0.51 (B) 1.1 (C) 2.01 (D) 3.1
36. The kinetic energy of the photo electron emitted is (in eV)
 (A) 0.97 (B) 2.5 (C) 3.1 (D) 1.97

Space for rough work

SECTION – III: (Matching List Type)

This section contains **4 questions, each having two matching lists**. Choices for the correct combination of elements from List-I and List-II are given as option (A), (B), (C) and (D) out of which **ONLY ONE** is correct.

37.

Column – I		Column – II	
(P)	$\frac{K.E.}{P.E.}$	(1)	2
(Q)	P.E. + 2K. E.	(2)	$-\frac{1}{2}$
(R)	$\frac{P.E.}{T.E.}$	(3)	-1
(S)	$\frac{K.E.}{T.E.}$	(4)	0

Code :

	P	Q	R	S
(A)	1	2	3	4
(B)	2	3	1	4
(C)	2	4	1	3
(D)	2	4	3	1

38.

Column – I		Column – II	
(P)	Lyman series	(1)	Visible region
(Q)	Humphery series	(2)	Ultraviolet region
(R)	Paschen series	(3)	Infrared region
(S)	Balmer series	(4)	Far infrared region

Code :

	P	Q	R	S
(A)	1	2	3	4
(B)	2	4	3	1
(C)	2	4	1	3
(D)	1	2	4	3

Space for rough work

39.

Column – I (Parameters fro H-like atoms)		Column – II (Dependence on n and Z)	
(P)	Radius of orbit	(1)	n^2
(Q)	Speed of electron	(2)	$1/n$
(R)	Centripetal force between electron and nucleus	(3)	$1/n^3$
(S)	Frequency of revolution of electron	(4)	$1/n^4$

Code :

	P	Q	R	S
(A)	1	2	3	4
(B)	4	2	3	1
(C)	4	2	1	3
(D)	1	2	4	3

40.

Column – I		Column – II	
(P)	Ratio of speed of electron in the fifth and third excited state of H-atom	(1)	$\frac{4}{1}$
(Q)	Ratio of wavelength of series limit of Balmer and Lyman series of H-spectrum	(2)	$\frac{2}{3}$
(R)	Ratio of wavelength of photon corresponding to 2 nd line of Lyman series and 3 rd line of Paschen series of H-spectrum	(3)	$\frac{1}{4}$
(S)	Ratio of energy difference between 3 rd and 1 st orbits of H-atom and He ⁺ ion	(4)	$\frac{3}{32}$

Code :

	P	Q	R	S
(A)	2	1	4	3
(B)	1	2	4	3
(C)	1	2	3	4
(D)	2	1	3	4

Space for rough work

PART III: MATHEMATICS

SECTION – I: Single Correct Answer Type

The section contains **10 multiple choice questions**. Each question has four choices (A), (B), (C) and (D) out of which **ONLY ONE is correct**.

41. If the p^{th} term of an A.P. be q and q^{th} term be p , then its r^{th} term will be
 (A) $p + q + r$ (B) $p + q - r$ (C) $p + r - q$ (D) $p - q - r$
42. If the ratio of H.M. and G.M. between two numbers a & b is $4 : 5$, then the ratio of two numbers will be
 (A) $1 : 2$ (B) $1 : 3$ (C) $1 : 5$ (D) $1 : 4$
43. The largest term common to the sequences $1, 11, 21, 31, \dots$ to 100 terms and $31, 36, 41, 46, \dots$ 100 terms is
 (A) 381 (B) 471 (C) 281 (D) none of these
44. If a, b, c are in A.P. b, c, d are in G.P. and c, d, e are in H.P. then a, c, e are in
 (A) AP (B) GP (C) HP (D) none
45. Number of identical terms in the sequence $2, 5, 8, 11, \dots$ upto 100 terms and $3, 5, 7, 9, 11, \dots$ upto 100 terms are
 (A) 17 (B) 33 (C) 50 (D) 147
46. The maximum value of the sum of the AP, $50, 48, 46, 44, \dots$ is
 (A) 648 (B) 450 (C) 558 (D) 650
47. An infinite GP has first term x and sum 5, then x belongs to
 (A) $x < -10$ (B) $-10 < x < 0$ (C) $0 < x < 10$ (D) $x > 10$
48. If $\log_3 2, \log_3(2^x - 5)$ and $\log_3\left(2^x - \frac{7}{2}\right)$ are in A.P., then the value of x is
 (A) 2 (B) 3 (C) 4 (D) 5
49. If $\frac{a+b}{1-ab}, b, \frac{b+c}{1-bc}$ are in AP, then $a, \frac{1}{b}, c$ are in
 (A) AP (B) GP (C) HP (D) none of these

Space for rough work

50. If $x = \sum_{n=0}^{\infty} a^n$, $y = \sum_{n=0}^{\infty} b^n$, $z = \sum_{n=0}^{\infty} c^n$ where a, b, c are in AP such that $|a| < 1$, $|b| < 1$ and $|c| < 1$, then x, y, z are in
 (A) AP (B) GP (C) HP (D) none of these

SECTION – II: Paragraph Type

This section contains **3 paragraphs** each describing theory, experiment, data etc., **Six questions** relate to three paragraphs with two question on each paragraph. Each question of a paragraph has **only one correct answer** among the four choices (A), (B), (C) and (D).

Paragraph For Questions 51 & 52

If A, G and H are respectively arithmetic, geometric and harmonic means between a and b both being unequal and positive, then $A = \frac{a+b}{2}$

$$\Rightarrow a + b = 2A, G = \sqrt{ab} \qquad \Rightarrow ab = G^2 \text{ and } H = \frac{2ab}{a+b} \qquad \Rightarrow G^2 = AH$$

51. If the geometric and harmonic means of two numbers are 16 and $12\frac{4}{5}$, then the ratio of one number to the other is
 (A) 1 : 4 (B) 2 : 3 (C) 1 : 2 (D) 2 : 1
52. The sum of the AM and GM of two positive numbers is equal to the difference between the numbers. The numbers are in the ratio
 (A) 1 : 3 (B) 1 : 6 (C) 9 : 1 (D) 1 : 12

Paragraph For Questions 53 & 54

Two arithmetic progressions have the same numbers. The ratio of the last term of the first progression to the first term of the second progression is equal to the ratio of the last term of the second progression to the first term of the first progression and is equal to 4. The ratio of the sum of the n terms of the first progression to the sum of the n terms of the second progression is equal to 2.

53. The ratio of their common difference is
 (A) 12 (B) 24 (C) 26 (D) 9
54. The ratio of their n^{th} term is
 (A) $\frac{6}{5}$ (B) $\frac{7}{2}$ (C) $\frac{9}{5}$ (D) none of these

Space for rough work

Paragraph For Questions 55 & 56

The numbers a , b and c are between 2 and 18, such that

- (i) their sum is 25
- (ii) the numbers 2, a and b are consecutive terms of an A.P.
- (iii) the numbers b , c , 18 are consecutive terms of a G.P.

55. The value of abc is
 (A) 500 (B) 450 (C) 720 (D) none of these
56. Roots of the equation $ax^2 + bx + c = 0$ are
 (A) real and positive (B) real and negative (C) imaginary (D) real and of opposite sign

SECTION – III: (Matching List Type)

This section contains 4 questions, each having two matching lists. Choices for the correct combination of elements from List-I and List-II are given as option (A), (B), (C) and (D) out of which **ONLY ONE** is correct.

57. $a, b, c \in \mathbb{R}$ and a, b, c are in A.P. Match the expression on the left with the conditions/properties on the right

Column – I		Column – II	
(P)	a^2, b^2, c^2 are in A.P	(1)	$a = b = c$
(Q)	a^2, b^2, c^2 are in G.P	(2)	$\frac{1}{2}a, b, c$ are in G.P
(R)	a^2, b^2, c^2 are in H.P	(3)	$a, b, \frac{1}{2}c$ are in H.P
(S)	$a + b + c = \frac{3}{2}$	(4)	$b = \frac{1}{2}$

Code:

	P	Q	R	S
(A)	1	2	4	3
(B)	3	3	2	4
(C)	1	1	1	4
(D)	2	1	2	3

Space for rough work

58. Match the value of x on the left with the value on the right.

Column - I		Column - II	
(P)	$5^2 5^4 5^6 \dots 5^{2x} = (0.04)^{-28}$	(1)	$3 \log_3 5$
(Q)	$x^2 = (0.2)^{\log_{\sqrt{5}} \left(\frac{1}{4} + \frac{1}{8} + \frac{1}{16} + \dots \right)}$	(2)	4
(R)	$x = (0.16)^{\log_{2.5} \left(\frac{1}{3} + \frac{1}{3^2} + \frac{1}{3^3} + \dots \right)}$	(3)	2
(S)	$3^{x-1} + 3^{x-2} + 3^{x-3} + \dots = 2 \left(5^2 + 5 + 1 + \frac{1}{5} + \frac{1}{5^2} + \dots \right)$	(4)	7

Code:

	P	Q	R	S
(A)	1	2	4	3
(B)	4	3	2	1
(C)	1	2	3	4
(D)	2	1	4	3

59.

Column - I		Column - II	
(P)	If $abc = 8$ and $a, b, c > 0$, then the minimum value of $(2+a)(2+b)(2+c)$ is $8k$, then k is	(1)	1
(Q)	A G.P consists of even number of terms. If the sum of all the terms is 5 times the sum of the terms occupying and places, then its common ratio is	(2)	4
(R)	Let S denote the sum to infinity and S_n the sum of n terms of the series $1 + \frac{1}{2} + \frac{1}{4} + \frac{1}{8} + \dots$ such that $S - S_n < \frac{1}{1000}$, then the least value of n is	(3)	8
(S)	Number of increasing geometrical progression(s) with first term unit, such that any three consecutive terms, on doubling the middle become in A.P is	(4)	11

Code:

	P	Q	R	S
(A)	3	2	4	1
(B)	4	2	4	1
(C)	1	1	3	4
(D)	4	1	2	3

Space for rough work

60. Matrix match

Column – I		Column – II	
(P)	The interior angles of a polygon are in A.P. If the smallest angle is 120° and the common difference is 5° , then the number of sides of the polygon is	(1)	6
(Q)	If a, b, c are three positive real numbers, then the minimum value of the expression $\frac{b+c}{a} + \frac{c+a}{b} + \frac{a+b}{c}$ is	(2)	7
(R)	If $\log_x y, \log_z x, \log_y z$ are in G.P., $xyz = 64$ and x^3, y^3, z^3 are in A.P., then find $2x + y - z$	(3)	8
(S)	Let $a_1, a_2, a_3, \dots, a_n$ be in A.P. and $h_1, h_2, h_3, \dots, h_{10}$ be in H.P. If $a_1 = h_1 = 2$ and $a_{10} = h_{10} = 3$, then $\frac{3}{2}(a_4 h_7) - 2$ is	(4)	9

Code:	P	Q	R	S
(A)	3	2	4	3
(B)	4	2	4	1
(C)	4	1	3	2
(D)	4	1	2	3

Space for rough work

FIITJEE RET – 2**(2018 – 2020)(1ST YEAR_REGULAR)****IIT-2014 (P2)_SET-A****DATE: 18.06.2018****ANSWERS****PHYSICS**

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

CHEMISTRY

21. D	22. B	23. C	24. B
25. C	26. C	27. C	28. C
29. A	30. C	31. B	32. B
33. C	34. A	35. D	36. A
37. C	38. B	39. D	40. A

MATHEMATICS

41. B	42. D	43. D	44. B
45. B	46. D	47. C	48. B
49. C	50. C	51. A	52. C
53. C	54. B	55. D	56. C
57. C	58. B	59. A	60. C

FIITJEE RET – 2

(2018 – 2020)(1ST YEAR_REGULAR)

IIT-2014 (P2)_SET-B

DATE: 18.06.2018

Time: 3 hours

Maximum Marks: 180

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:

12. The question paper consists of **3 parts (Physics, Chemistry and Mathematics)**. Each part consists of **three sections**.
13. **Section I** contains **10 multiple choice questions**. Each question has four choices (A), (B), (C) and (D) out of which **ONE** is correct.
14. **Section II** contains **3 paragraphs**. Each describing theory, experiment, data etc., **Six questions** related to three paragraphs with two questions on each paragraph. Each question to a particular passage should have **ONLY ONE correct answer** among the four given choices (A), (B), (C) and (D).
15. **Section III** contains **4 Multiple choice questions**. Each question has two lists (List-1: P, Q, R and S; List-2: 1, 2, 3 and 4). The options for the correct match are provided as (A), (B), (C) and (D) out of which **ONLY ONE is correct**.

D. Marking Scheme

16. For each question in **Section 1, 2 and 3** you will be awarded **3 marks** if you darken the bubble corresponding to the correct answer and **zero mark** if no bubble is darkened. In all other cases, **minus one (-1) mark** will be awarded.

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

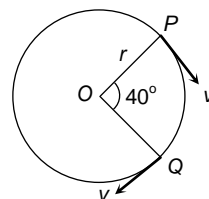
SECTION – I: Single Correct Answer Type

The section contains **10 multiple choice questions**. Each question has four choices (A), (B), (C) and (D) out of which **ONLY ONE is correct**.

1. If $\vec{A} = 2\hat{i} + 3\hat{j} - \hat{k}$ and $\vec{B} = -\hat{i} + 3\hat{j} + 4\hat{k}$ then projection of \vec{A} on \vec{B} will be
 (A) $\frac{3}{\sqrt{13}}$ (B) $\frac{3}{\sqrt{26}}$ (C) $\sqrt{\frac{3}{26}}$ (D) $\sqrt{\frac{3}{13}}$
2. Two vectors $P = 2\hat{i} + b\hat{j} + 2\hat{k}$ and $Q = \hat{i} + \hat{j} + \hat{k}$ will be parallel if
 (A) $b = 0$ (B) $b = 1$ (C) $b = 2$ (D) $b = -4$
3. A vector \vec{Q} which has a magnitude of 8 is added to the vector \vec{P} which lies along x-axis. The resultant of two vectors lies along y-axis and has magnitude twice that of P. The magnitude of \vec{P} is
 (A) $\frac{6}{\sqrt{5}}$ (B) $\frac{8}{\sqrt{5}}$ (C) $\frac{12}{\sqrt{5}}$ (D) $\frac{16}{\sqrt{5}}$
4. What is the maximum possible number of components of a vector can have?
 (A) 2 (B) 3 (C) 4 (D) any number
5. If $\vec{A} = \hat{i}A \cos\theta - \hat{j}A \sin\theta$ be any vector. Another vector \vec{B} , which is normal to \vec{A} can be expressed as
 (A) $B \cos\theta \hat{i} + B \sin\theta \hat{j}$ (B) $B \cos\theta \hat{i} - B \sin\theta \hat{j}$ (C) $B \sin\theta \hat{i} + B \cos\theta \hat{j}$ (D) $B \sin\theta \hat{i} + B \cos\theta \hat{j}$
6. Force is $6\hat{i} + C\hat{j} - 2\hat{k}$ and displacement is $\hat{i} + 2\hat{j} + 6\hat{k}$. If the work done is 6J, the value of C is
 (A) 6 (B) 4 (C) 8 (D) 9
7. Which of the following is independent of the choice of co-ordinate system
 (A) $\vec{P} + \vec{Q} + \vec{R}$ (B) $(P_x + Q_x + R_x)\hat{i}$ (C) $P_x\hat{i} + Q_y\hat{j} + R_z\hat{k}$ (D) None of these

Space for rough work

8. Following forces start acting on a particle at rest at the origin of the co-ordinate system simultaneously $\vec{F}_1 = -4\hat{i} - 5\hat{j} + 5\hat{k}$, $\vec{F}_2 = 5\hat{i} + 8\hat{j} + 6\hat{k}$, $\vec{F}_3 = -3\hat{i} + 4\hat{j} - 7\hat{k}$ and $\vec{F}_4 = 2\hat{i} - 3\hat{j} - 2\hat{k}$ then the particle will move
 (A) In $x - y$ plane (B) In $y - z$ plane (C) In $x - z$ plane (D) Along x -axis
9. The resultant of $\vec{A} + \vec{B}$ is \vec{R}_1 . On reversing the vector \vec{B} , the resultant becomes \vec{R}_2 . What is the value of $R_1^2 + R_2^2$
 (A) $A^2 + B^2$ (B) $A^2 - B^2$ (C) $2(A^2 + B^2)$ (D) $2(A^2 - B^2)$
10. A particle is moving on a circular path of radius r with uniform velocity v . The change in velocity when the particle moves from P to Q is ($\angle POQ = 40^\circ$)
 (A) $2v \cos 40^\circ$ (B) $2v \sin 40^\circ$
 (C) $2v \sin 20^\circ$ (D) $2v \cos 20^\circ$



SECTION – II: Paragraph Type

This section contains **3 paragraphs** each describing theory, experiment, data etc., **Six questions** relate to three paragraphs with two question on each paragraph. Each question of a paragraph has **only one correct answer** among the four choices (A), (B), (C) and (D).

Paragraph For Questions 11 & 12

A student forgot Newton's formula for speed of sound but he knows there were speed (v), pressure (p) and density (d) in the formula. He then start using dimensional analysis method to find the actual relation.

$$v = kp^x d^y$$

Where K is a dimensionless constant. On the basis of above passage answer the following questions.

11. The value of x is
 (A) 1 (B) $\frac{1}{2}$ (C) $-\frac{1}{2}$ (D) 2
12. The value of y is
 (A) 1 (B) $\frac{1}{2}$ (C) $-\frac{1}{2}$ (D) 2

Space for rough work

Paragraph For Questions 13 & 14

Using the law of polygons, it can be deduced that sum of n vectors of equal magnitude and each making an angle of $\frac{2\pi}{n}$ with respect to the preceding vector is zero as the vectors could be represented by the sides of a closed polygon.

13. If there are $(n+1)$ vectors of equal magnitude each making an each making an angle of $\frac{2\pi}{n}$ with respect to the preceding vector, then the magnitude of sum of all vectors will be:
 (A) Twice the magnitude of each vector
 (B) Equal to the magnitude of each vector
 (C) Less than twice the magnitude of each vector but greater than magnitude of each vector
 (D) Can't be determined
14. If there are $(n - 1)$ vectors of equal magnitude each making an each making an angle of $\frac{2\pi}{n}$ with respect to the preceding vector, and the resultant makes an angle of 30° with the negative x-direction. Find the value of 'n', given that the first vector is aligned along +x-direction:
 (A) 6 (B) 9 (C) 12 (D) None of the above

Paragraph For Questions 15 & 16

A straight rod is placed in space such that the position vector of two ends are $2\mathbf{i} + 3\mathbf{j} + 4\mathbf{k}$ and $-\mathbf{i} + 2\mathbf{j} + \mathbf{k}$ respectively. Answer following two questions based on this information.

15. If perpendiculars are dropped on the x-axis from the two ends of the rods, then the distance between the foot of the perpendiculars will be:
 (A) 3 (B) $\sqrt{2}$ (C) $\sqrt{3}$ (D) None
16. If perpendiculars are dropped from the two ends on x-y plane from the two ends of the rod. The distance between the foots of the perpendiculars will be:
 (A) 3 (B) $\sqrt{10}$ (C) 4 (D) None

Space for rough work

SECTION – III: (Matching List Type)

This section contains 4 questions, each having two matching lists. Choices for the correct combination of elements from List-I and List-II are given as option (A), (B), (C) and (D) out of which **ONLY ONE** is correct.

17. For component of a vector $\vec{A} = (3\hat{i} + 4\hat{j} - 5\hat{k})$, Find the projections of \vec{A} along the entries in Column – I. match the following table :

Column – I		Column – II	
(P)	y-axis	(1)	5 unit
(Q)	Along another vector $(2\hat{i} + \hat{j} + 2\hat{k})$	(2)	4 unit
(R)	Along $(6\hat{i} + 8\hat{j} - 10\hat{k})$	(3)	zero
(S)	Along another vector $(-3\hat{i} + 4\hat{j} + 5\hat{k})$	(4)	None
		(5)	3 unit

	P	Q	R	S
(A)	1	3	4	3
(B)	2	3	4	4
(C)	1	3	2	4
(D)	1	2	3	4

18. Match the following
 $\vec{A} = 3\hat{i} + 12\hat{j} + 4\hat{k}$, $\vec{B} = 2\hat{i} + \hat{j} + 2\hat{k}$

Column – I		Column – II	
(P)	Projection of \vec{B} on \vec{A}	(1)	$\frac{26}{3}$
(Q)	Projection of \vec{A} on \vec{B}	(2)	2
(R)	Component of \vec{B} perpendicular \vec{A}	(3)	$\frac{-25\hat{i} + 82\hat{j} - 16\hat{k}}{9}$
(S)	Component of \vec{A} perpendicular \vec{B}	(4)	$\frac{40\hat{i} - 22\hat{j} + 36\hat{k}}{13}$
		(5)	None of these

	P	Q	R	S
(A)	2	1	4	3
(B)	2	1	5	3
(C)	1	2	3	4
(D)	1	2	4	5

Space for rough work

19. Match List – I with List – II and select the correct answer using the codes given by below the lists.

Column – I		Column – II	
(P)	Boltzmann constant	(1)	$[ML^2T^{-1}]$
(Q)	Coefficient of viscosity	(2)	$[ML^{-1}T^{-1}]$
(R)	Planck constant	(3)	$[MLT^{-3}K^{-1}]$
(S)	Thermal conductivity	(4)	$[ML^2T^{-2}K^{-1}]$
		(5)	None

- | | P | Q | R | S |
|-----|---|---|---|---|
| (A) | 1 | 2 | 3 | 4 |
| (B) | 2 | 3 | 5 | 1 |
| (C) | 4 | 2 | 1 | 3 |
| (D) | 3 | 1 | 2 | 4 |

20. Match the physical quantities given in Column I with dimensions expressed in terms of mass (M), length (L), time (T), and charge (Q) given in Column II and write the correct answer against the matched quantity in a tabular form in your answer book.

Column – I		Column – II	
(P)	Angular momentum	(1)	$[ML^2T^{-2}]$
(Q)	Latent heat	(2)	$[ML^2T^{-1}]$
(R)	Torque	(3)	$[ML^3T^{-1}Q^{-2}]$
(S)	Capacitance	(4)	$[M^{-1}L^{-2}T^2Q^2]$
		(5)	$[L^2T^{-2}]$

- | | P | Q | R | S |
|-----|---|---|---|---|
| (A) | 1 | 4 | 2 | 3 |
| (B) | 2 | 5 | 1 | 3 |
| (C) | 1 | 3 | 2 | 4 |
| (D) | 2 | 5 | 1 | 4 |

Space for rough work

PART II: CHEMISTRY

SECTION – I: Single Correct Answer Type

The section contains **10 multiple choice questions**. Each question has four choices (A), (B), (C) and (D) out of which **ONLY ONE is correct**.

21. Electromagnetic radiation having $\lambda = 310 \text{ \AA}$ is subjected to a metal sheet having work function = 12.8 eV. What will be the velocity of photo-electrons having maximum kinetic energy.
 (A) 0, no emission will occur (B) $4.352 \times 10^6 \text{ m/s}$
 (C) $3.09 \times 10^6 \text{ m/s}$ (D) $8.72 \times 10^6 \text{ m/s}$
22. A light source of wavelength λ illuminates a metal and ejects photo-electrons with $(\text{K.E.})_{\text{max}} = 1 \text{ eV}$. Another light source of wavelength $\frac{\lambda}{3}$, ejects photo-electrons from same metal with $(\text{K.E.})_{\text{max}} = 4 \text{ eV}$. Find the value of work function ?
 (A) 1eV (B) 2 eV (C) 0.5 eV (D) None of these
23. Potential energy of electron present in He^+ is
 (A) $\frac{e^2}{2\pi\epsilon_0 r}$ (B) $\frac{3e^2}{4\pi\epsilon_0 r}$ (C) $\frac{-2e^2}{4\pi\epsilon_0 r}$ (D) $\frac{-e^2}{4\pi\epsilon_0 r^2}$
24. A beam of specific kind of particles of velocity $2.1 \times 10^7 \text{ m/s}$ is scattered by a gold ($Z=79$) nuclei. Find out specific charge (charge/mass) of this particle if the distance of closest approach is $2.5 \times 10^{-14} \text{ m}$.
 (A) $4.84 \times 10^7 \text{ C/kg}$ (B) $4.84 \times 10^{-7} \text{ C/kg}$
 (C) $2.42 \times 10^7 \text{ C/kg}$ (D) $3 \times 10^{-12} \text{ C/kg}$
25. The velocity of an electron in excited state of H-atom is $1.093 \times 10^6 \text{ m/s}$. What is the circumference of this orbit ?
 (A) $3.32 \times 10^{-10} \text{ m}$ (B) $6.64 \times 10^{-10} \text{ m}$ (C) $13.30 \times 10^{-10} \text{ m}$ (D) $13.28 \times 10^{-8} \text{ m}$
26. What is the potential energy of an electron present in N-shell of the Be^{3+} ion ?
 (A) -3.4 eV (B) -6.8 eV (C) -13.6 eV (D) -27.2 eV

Space for rough work

27. The kinetic and potential energy (in eV) of electron present in third Bohr's orbit of hydrogen atom are respectively:
 (A) $-1.51, -3.02$ (B) $1.51, -3.02$ (C) $-3.02, 1.51$ (D) $1.51, -1.51$
28. The distance between 4th and 3rd Bohr orbits of He⁺ is :
 (A) 2.645×10^{-10} m (B) 1.322×10^{-10} m
 (C) 1.851×10^{-10} m (D) none
29. What is the ratio of time periods (T_1/T_2) in second orbit of hydrogen atom to third orbit of He⁺ ion ?
 (A) 8/27 (B) 32/27 (C) 27/32 (D) none of these
30. If λ_0 and λ be the threshold wavelength and the wavelength of incident light, the velocity of photo-electrons ejected from the metal surface is:
 (A) $\sqrt{\frac{2h}{m}(\lambda_0 - \lambda)}$ (B) $\sqrt{\frac{2hc}{m}(\lambda_0 - \lambda)}$
 (C) $\sqrt{\frac{2hc}{m} \left(\frac{\lambda_0 - \lambda}{\lambda \lambda_0} \right)}$ (D) $\sqrt{\frac{2h}{m} \left(\frac{1}{\lambda_0} - \frac{1}{\lambda} \right)}$

SECTION – II: Paragraph Type

This section contains **3 paragraphs** each describing theory, experiment, data etc., **Six questions** relate to three paragraphs with two question on each paragraph. Each question of a paragraph has **only one correct answer** among the four choices (A), (B), (C) and (D).

Paragraph For Questions 31 & 32

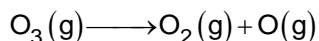
A photon wavelength 4×10^{-7} m strikes on metal surface, the work function of the metal being 2.13 eV (1 eV = 1.602×10^{-19} J)

31. The energy of the photon (in eV)
 (A) 0.51 (B) 1.1 (C) 2.01 (D) 3.1
32. The kinetic energy of the photo electron emitted is (in eV)
 (A) 0.97 (B) 2.5 (C) 3.1 (D) 1.97

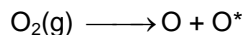
Space for rough work

Paragraph For Questions 33 & 34

Ozone in the upper atmosphere absorbs ultraviolet radiation which induces the following chemical reaction



O_2 produced in the above photochemical dissociation undergoes further dissociation into one normal oxygen atom (O) and more energetic oxygen atom O^* .

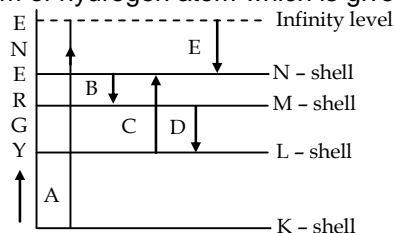


If (O^*) has 1 eV more energy than (O) and normal dissociation energy of O_2 is 480 kJ mol^{-1} .
[1 eV/Photon = 96 kJ mol^{-1}]

33. What is the maximum wavelength effective for the photochemical dissociation of O_2 molecule
(A) 2440 \AA (B) 2066.67 \AA (C) 1000 \AA (D) 155 \AA
34. If dissociation of O_3 into O_2 and O requires 400 kJ mol^{-1} and O_2 produced in this reaction is further dissociated to O and O^* then the total energy required to for the dissociation of O_3 into O and O^* is :
(A) 1168 kJ/mol (B) 976 kJ/mol (C) 880 kJ/mol (D) None of these

Paragraph For Questions 35 & 36

Observe the electric energy level diagram of hydrogen atom which is given below.



35. The energy (in Joules) associated with the transition labelled by the arrow B is
(A) $2.18 \times 10^{-18} \text{ J}$ absorbed (B) $1.06 \times 10^{-19} \text{ J}$ absorbed
(C) $1.06 \times 10^{-19} \text{ J}$ emitted (D) $2.18 \times 10^{-18} \text{ J}$ emitted
36. The arrow representing the ionisation potential of H-atom is
(A) A (B) B (C) C (D) D

Space for rough work

SECTION – III: (Matching List Type)

This section contains 4 questions, each having two matching lists. Choices for the correct combination of elements from List-I and List-II are given as option (A), (B), (C) and (D) out of which **ONLY ONE** is correct.

37.

Column – I (Parameters fro H-like atoms)		Column – II (Dependence on n and Z)	
(P)	Radius of orbit	(1)	n^2
(Q)	Speed of electron	(2)	$1/n$
(R)	Centripetal force between electron and nucleus	(3)	$1/n^3$
(S)	Frequency of revolution of electron	(4)	$1/n^4$

Code :

	P	Q	R	S
(A)	1	2	3	4
(B)	4	2	3	1
(C)	4	2	1	3
(D)	1	2	4	3

38.

Column – I		Column – II	
(P)	Ratio of speed of electron in the fifth and third excited state of H-atom	(1)	$\frac{4}{1}$
(Q)	Ratio of wavelength of series limit of Balmer and Lyman series of H-spectrum	(2)	$\frac{2}{3}$
(R)	Ratio of wavelength of photon corresponding to 2 nd line of Lyman series and 3 rd line of Paschen series of H-spectrum	(3)	$\frac{1}{4}$
(S)	Ratio of energy difference between 3 rd and 1 st orbits of H-atom and He ⁺ ion	(4)	$\frac{3}{32}$

Code :

	P	Q	R	S
(A)	2	1	4	3
(B)	1	2	4	3
(C)	1	2	3	4
(D)	2	1	3	4

Space for rough work

39.

Column – I		Column – II	
(P)	$\frac{K.E.}{P.E.}$	(1)	2
(Q)	P.E. + 2K. E.	(2)	$-\frac{1}{2}$
(R)	$\frac{P.E.}{T.E.}$	(3)	-1
(S)	$\frac{K.E.}{T.E.}$	(4)	0

Code :

	P	Q	R	S
(A)	1	2	3	4
(B)	2	3	1	4
(C)	2	4	1	3
(D)	2	4	3	1

40.

Column – I		Column – II	
(P)	Lyman series	(1)	Visible region
(Q)	Humphery series	(2)	Ultraviolet region
(R)	Paschen series	(3)	Infrared region
(S)	Balmer series	(4)	Far infrared region

Code :

	P	Q	R	S
(A)	1	2	3	4
(B)	2	4	3	1
(C)	2	4	1	3
(D)	1	2	4	3

Space for rough work

PART III: MATHEMATICS

SECTION – I: Single Correct Answer Type

The section contains **10 multiple choice questions**. Each question has four choices (A), (B), (C) and (D) out of which **ONLY ONE is correct**.

41. The maximum value of the sum of the AP, 50, 48, 46, 44, is
 (A) 648 (B) 450 (C) 558 (D) 650
42. An infinite GP has first term x and sum 5, then x belongs to
 (A) $x < -10$ (B) $-10 < x < 0$ (C) $0 < x < 10$ (D) $x > 10$
43. If $\log_3 2$, $\log_3(2^x - 5)$ and $\log_3\left(2^x - \frac{7}{2}\right)$ are in A.P., then the value of x is
 (A) 2 (B) 3 (C) 4 (D) 5
44. If $\frac{a+b}{1-ab}$, b , $\frac{b+c}{1-bc}$ are in AP, then a , $\frac{1}{b}$, c are in
 (A) AP (B) GP (C) HP (D) none of these
45. If $x = \sum_{n=0}^{\infty} a^n$, $y = \sum_{n=0}^{\infty} b^n$, $z = \sum_{n=0}^{\infty} c^n$ where a, b, c are in AP such that $|a| < 1$, $|b| < 1$ and $|c| < 1$, then x, y, z are in
 (A) AP (B) GP (C) HP (D) none of these
46. If the p^{th} term of an A.P. be q and q^{th} term be p , then its r^{th} term will be
 (A) $p + q + r$ (B) $p + q - r$ (C) $p + r - q$ (D) $p - q - r$
47. If the ratio of H.M. and G.M. between two numbers a & b is 4 : 5, then the ratio of two numbers will be
 (A) 1 : 2 (B) 1 : 3 (C) 1 : 5 (D) 1 : 4
48. The largest term common to the sequences 1, 11, 21, 31, to 100 terms and 31, 36, 41, 46, 100 terms is
 (A) 381 (B) 471 (C) 281 (D) none of these

Space for rough work

49. If a, b, c are in A.P. b,c,d are in G.P. and c,d,e are in H.P. then a,c,e are in
 (A) AP (B) GP (C) HP (D) none
50. Number of identical terms in the sequence 2, 5, 8, 11, upto 100 terms and 3, 5, 7, 9, 11, upto 100 terms are
 (A) 17 (B) 33 (C) 50 (D) 147

SECTION – II: Paragraph Type

This section contains **3 paragraphs** each describing theory, experiment, data etc., **Six questions** relate to three paragraphs with two question on each paragraph. Each question of a paragraph has **only one correct answer** among the four choices (A), (B), (C) and (D).

Paragraph For Questions 51 & 52

The numbers a, b and c are between 2 and 18, such that

- (i) their sum is 25
 (ii) the numbers 2, a and b are consecutive terms of an A.P.
 (iii) the numbers b, c, 18 are consecutive terms of a G.P.
51. The value of abc is
 (A) 500 (B) 450 (C) 720 (D) none of these
52. Roots of the equation $ax^2 + bx + c = 0$ are
 (A) real and positive (B) real and negative (C) imaginary (D) real and of opposite sign

Paragraph For Questions 53 & 54

If A, G and H are respectively arithmetic, geometric and harmonic means between a and b both being unequal and positive, then $A = \frac{a+b}{2}$

$$\Rightarrow a + b = 2A, G = \sqrt{ab} \quad \Rightarrow ab = G^2 \text{ and } H = \frac{2ab}{a+b} \quad \Rightarrow G^2 = AH$$

53. If the geometric and harmonic means of two numbers are 16 and $12\frac{4}{5}$, then the ratio of one number to the other is
 (A) 1 : 4 (B) 2 : 3 (C) 1 : 2 (D) 2 : 1
54. The sum of the AM and GM of two positive numbers is equal to the difference between the numbers. The numbers are in the ratio
 (A) 1 : 3 (B) 1 : 6 (C) 9 : 1 (D) 1 : 12

Space for rough work

Paragraph For Questions 55 & 56

Two arithmetic progressions have the same numbers. The ratio of the last term of the first progression to the first term of the second progression is equal to the ratio of the last term of the second progression to the first term of the first progression and is equal to 4. The ratio of the sum of the n terms of the first progression to the sum of the n terms of the second progression is equal to 2.

55. The ratio of their common difference is
 (A) 12 (B) 24 (C) 26 (D) 9
56. The ratio of their n^{th} term is
 (A) $\frac{6}{5}$ (B) $\frac{7}{2}$ (C) $\frac{9}{5}$ (D) none of these

SECTION – III: (Matching List Type)

This section contains 4 questions, each having two matching lists. Choices for the correct combination of elements from List-I and List-II are given as option (A), (B), (C) and (D) out of which **ONLY ONE** is correct.

57.

	Column – I	Column – II
(P)	If $abc = 8$ and $a, b, c > 0$, then the minimum value of $(2+a)(2+b)(2+c)$ is $8k$, then k is	(1) 1
(Q)	A G.P consists of even number of terms. If the sum of all the terms is 5 times the sum of the terms occupying and places, then its common ratio is	(2) 4
(R)	Let S denote the sum to infinity and S_n the sum of n terms of the series $1 + \frac{1}{2} + \frac{1}{4} + \frac{1}{8} + \dots$ such that $S - S_n < \frac{1}{1000}$, then the least value of n is	(3) 8
(S)	Number of increasing geometrical progression(s) with first term unit, such that any three consecutive terms, on doubling the middle become in A.P is	(4) 11

Code:

	P	Q	R	S
(A)	3	2	4	1
(B)	4	2	4	1
(C)	1	1	3	4
(D)	4	1	2	3

Space for rough work

58. Matrix match

Column – I		Column – II	
(P)	The interior angles of a polygon are in A.P. If the smallest angle is 120° and the common difference is 5° , then the number of sides of the polygon is	(1)	6
(Q)	If a, b, c are three positive real numbers, then the minimum value of the expression $\frac{b+c}{a} + \frac{c+a}{b} + \frac{a+b}{c}$ is	(2)	7
(R)	If $\log_x y, \log_y x, \log_y z$ are in G.P., $xyz = 64$ and x^3, y^3, z^3 are in A.P., then find $2x + y - z$	(3)	8
(S)	Let $a_1, a_2, a_3, \dots, a_n$ be in A.P. and $h_1, h_2, h_3, \dots, h_{10}$ be in H.P. If $a_1 = h_1 = 2$ and $a_{10} = h_{10} = 3$, then $\frac{3}{2}(a_4 h_7) - 2$ is	(4)	9

Code:

	P	Q	R	S
(A)	3	2	4	3
(B)	4	2	4	1
(C)	4	1	3	2
(D)	4	1	2	3

59. $a, b, c \in \mathbb{R}$ and a, b, c are in A.P. Match the expression on the left with the conditions/properties on the right

Column – I		Column – II	
(P)	a^2, b^2, c^2 are in A.P	(1)	$a = b = c$
(Q)	a^2, b^2, c^2 are in G.P	(2)	$\frac{1}{2}a, b, c$ are in G.P
(R)	a^2, b^2, c^2 are in H.P	(3)	$a, b, \frac{1}{2}c$ are in H.P
(S)	$a + b + c = \frac{3}{2}$	(4)	$b = \frac{1}{2}$

Code:

	P	Q	R	S
(A)	1	2	4	3
(B)	3	3	2	4
(C)	1	1	1	4
(D)	2	1	2	3

Space for rough work

60. Match the value of x on the left with the value on the right.

Column - I		Column - II	
(P)	$5^2 5^4 5^6 \dots 5^{2x} = (0.04)^{-28}$	(1)	$3 \log_3 5$
(Q)	$x^2 = (0.2)^{\log_{\sqrt{5}} \left(\frac{1}{4} + \frac{1}{8} + \frac{1}{16} + \dots \right)}$	(2)	4
(R)	$x = (0.16)^{\log_{2.5} \left(\frac{1}{3} + \frac{1}{3^2} + \frac{1}{3^3} + \dots \right)}$	(3)	2
(S)	$3^{x-1} + 3^{x-2} + 3^{x-3} + \dots = 2 \left(5^2 + 5 + 1 + \frac{1}{5} + \frac{1}{5^2} + \dots \right)$	(4)	7

Code:

	P	Q	R	S
(A)	1	2	4	3
(B)	4	3	2	1
(C)	1	2	3	4
(D)	2	1	4	3

Space for rough work

FIITJEE RET – 2**(2018 – 2020)(1ST YEAR_REGULAR)****IIT-2014 (P2)_SET-B****DATE: 18.06.2018****ANSWERS****PHYSICS**

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

CHEMISTRY

21. C	22. C	23. C	24. A
25. C	26. D	27. B	28. C
29. B	30. C	31. D	32. A
33. B	34. B	35. C	36. A
37. D	38. A	39. C	40. B

MATHEMATICS

41. D	42. C	43. B	44. C
45. C	46. B	47. D	48. D
49. B	50. B	51. D	52. C
53. A	54. C	55. C	56. B
57. A	58. C	59. C	60. B