

FIITJEE RET – 5

(2018 – 2020)(1ST YEAR_REGULAR)

IIT-2017 (P1)_SET-A

DATE: 16.07.2018

Time: 3 hours

Maximum Marks: 183

INSTRUCTIONS:

A. General

1. This booklet is your Question Paper containing 54 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 & Marking Scheme

7. Each part has three sections as detailed in the following table:

Section	Question Type	Number of Questions	Category wise Marks Each Question				Maximum marks of the section
			Full Marks	Partial Marks	Zero Marks	Negative Marks	
1	One or more correct option (s)	7	+4 If only the bubble(s) corresponding to all the correct option(s) is(are) darkened	+1 For darkening a bubble corresponding to each correct option, provided NO incorrect option is darkened	0 If none of the bubbles is darkened	-2 In all other cases	28
2	Single digit integer (0-9)	5	+3 If only the bubble corresponding to the correct answer is darkened.	---	0 In all other cases	---	15
3	Single correct option	6	+3 If only the bubble corresponding to the correct option is darkened	---	0 If none of the bubbles is darkened	-1 In all other cases	18

Don't write / mark your answers in this question booklet.

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NAME:

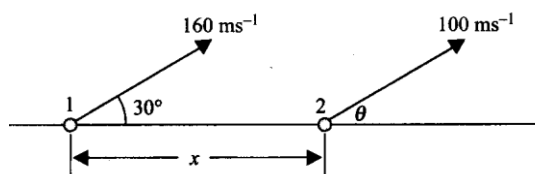
ENROLLMENT NO.:

PAPER-I
PART I: PHYSICS
SECTION 1 (Maximum Marks: 28)

- * This section contains **SEVEN** questions.
- * Each question has **FOUR** options (A), (B), (C) and (D). **ONE OR MORE THAN ONE** of these four options is(are) correct.
- * For each question, darken the bubble(s) corresponding to all the correct option(s) in the ORS
- * For example, if (A), (C) and (D) are all the correct options for a question, darkening all these three will get +4 marks; darkening only (A) and (D) will get +2 marks; and darkening (A) and (B) will get -2 marks, as a wrong option is also darkened.

1. Two cars start off to race with velocities 4 m/s and 2 m/s and travel in straight line with uniform accelerations 1 m/s^2 and 2 m/s^2 respectively. If they reach the final point at the same instant, then the length of the path is
 (A) 30 m (B) 32 m (C) 20 m (D) 24 m
2. A particle moving along a straight line with uniform acceleration has velocities 7 m/s at P and 17 m/s at Q. H is the mid point of PQ. Then
 (A) the average velocity between H and Q is 15 m/s
 (B) the ratio of time to go from P to H and that from H to Q is 3 : 2
 (C) the velocity at H is 10 m/s
 (D) the average velocity between P and H is 10 m/s

3. Suppose two particles 1 and 2 are projected in vertical plane simultaneously. Their angles of projection are 30° and θ respectively, with the horizontal. Let they collide after a time t in air. Then

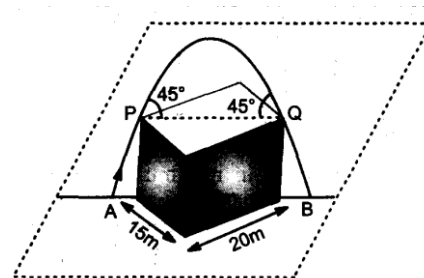


- (A) $\theta = \sin^{-1} (4/5)$ and they will have same speed just before the collision
 (B) $\theta = \sin^{-1} (4/5)$ and they will have different speed just before the collision
 (C) $x < 1280\sqrt{3} - 960\text{m}$
 (D) It is possible that the particles collide when both of them are at their highest point

Space for rough work

Paragraph (Q- 4-5)

A particle is fired from A in the diagonal plane of a building of dimension 20m (length) \times 12.5m. (height), just clears the roof diagonally and falls on the other side of the building at B. It is observed that the particle is traveling at an angle 45° with the horizontal when it clears the edges P and Q of the diagonal. Take $g = 10 \text{ m/s}^2$



4. The speed of the particle at point P will be
 (A) $5\sqrt{10} \text{ m/s}$ (B) $10\sqrt{5} \text{ m/s}$ (C) $5\sqrt{15} \text{ m/s}$ (D) $5\sqrt{5} \text{ m/s}$
5. The range that is AB will be
 (A) $5\sqrt{10} \text{ m}$ (B) $25\sqrt{3} \text{ m}$ (C) $5\sqrt{15} \text{ m}$ (D) $25\sqrt{5} \text{ m}$
6. A particle undergoes rectilinear motion along +x axis according to $v(t) = |(t - 1)| \text{ m/s}$. At $t = 0$, the particle is at origin. Choose the correct statement(s).
 (A) The average velocity of particle for first 2 seconds is 0.5 m/s.
 (B) The average speed of particle for first 2 seconds is 0.5 m/s.
 (C) The particle reverses its motion at $t = 1 \text{ sec}$.
 (D) The average acceleration for motion during first 2 seconds is zero.
7. It is known that $|\vec{a}| = |\vec{b}| = |\vec{c}| = 1$ and $\vec{a} + \vec{b} + \vec{c} = 0$. then $\vec{a} \cdot \vec{b} + \vec{b} \cdot \vec{c} + \vec{c} \cdot \vec{a} =$
 (A) 0 (B) 3 (C) -3 (D) None of these

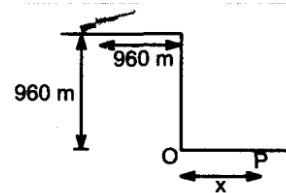
SECTION 2 (Maximum Marks: 15)

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8. The ceiling of a hall is 40 m high. For maximum horizontal distance, the angle at which the ball may be thrown with a speed of 56 m s^{-1} without hitting the ceiling of the hall is $\frac{\pi}{n}$, find the value of n?
9. The speed of a projectile at its maximum height is $\frac{\sqrt{3}}{2}$ time its initial speed. If the range of the projectile is P times the maximum height attained by it, P is equal to $n\sqrt{3}$. Find the value of n?

Space for rough work

10. A gun is mounted on a plateau 960m away from its edge as shown. Height of plateau is 960m. The gun can fire shells with a velocity of 100 m/s at any angle. Of the following choices, what is the minimum distance (OP)x from the edge of plateau where the shell of gun can reach is 160n. Find the value of n?



11. A particle moving in a straight line covers half the distance with speed of 3 m/s. The other half of the distance is covered in two equal time intervals with speed of 4.5 m/s and 7.5 m/s respectively. The average speed(in m/s) of the particle during this motion is
12. A stone is dropped from a certain height which can reach the ground in 5 sec. It is stopped after three seconds of its fall and then is again released. The total time(in seconds) taken by the stone to reach the ground will be

SECTION 3 (Maximum Marks: 18)

- * This section contains **SIX** questions of matching type.
- * This section contains **TWO** tables (each having 3 columns and 4 rows)
- * Based on the table, there are **THREE** questions
- * Each question has **FOUR** options (A), (B), (C) and (D). **ONLY ONE** of these four options is correct.
- * For each question, darken the bubble corresponding to the correct option in the ORS.

In Column – 1 represents \vec{A} , Column – 2 represents \vec{B} , Column- 3 represents a vector \vec{C} which is perpendicular to both \vec{A} and \vec{B}

Column 1 \vec{A}	Column 2 \vec{B}	Column 3 \vec{C}
(I) $\hat{i} + \hat{j}$	(i) $\hat{j} + \hat{k}$	(P) $-\hat{i} - \hat{j} + \hat{k}$
(II) $\hat{i} + \hat{j} + \hat{k}$	(ii) $\hat{i} + \hat{j}$	(Q) $\hat{i} - \hat{j} + \hat{k}$
(III) $2\hat{i} + \hat{j}$	(iii) $\hat{i} + \hat{j} - \hat{k}$	(R) $-\hat{i} + \hat{j}$
(IV) $\hat{i} + \hat{k}$	(iv) $\hat{i} + \hat{j} + 2\hat{k}$	(S) $\hat{i} - 2\hat{j} + \hat{k}$

13. Which of the following is a correct combination
 (A) I \rightarrow i \rightarrow P (B) I \rightarrow i \rightarrow Q (C) I \rightarrow i \rightarrow R (D) I \rightarrow i \rightarrow S
14. Which of the following is a correct combination
 (A) II \rightarrow ii \rightarrow P (B) II \rightarrow ii \rightarrow Q (C) II \rightarrow ii \rightarrow R (D) II \rightarrow ii \rightarrow S
15. Which of the following is a correct combination
 (A) III \rightarrow iii \rightarrow P (B) III \rightarrow iii \rightarrow Q (C) III \rightarrow iii \rightarrow R (D) III \rightarrow iii \rightarrow S

Space for rough work

The velocity of a particle at any time t (in sec) is given by $V = (t^2 - 5t + 4)$ m/s. Column -1 gives the information about sign of acceleration and velocity. Column - 2 gives the time interval (in seconds) and column - 3 gives information regarding speed of the particle.

Column 1		Column 2		Column 3	
(I)	$a > 0, V > 0$	(i)	$(4, \infty)$	(P)	Speed is decreasing
(II)	$a > 0, V < 0$	(ii)	$(\frac{5}{2}, 4)$	(Q)	Speed is increasing
(III)	$a < 0, V < 0$	(iii)	$(1, \frac{5}{2})$	(R)	Magnitude of velocity is increasing
(IV)	$a < 0, V > 0$	(iv)	$(0, 1)$	(S)	Magnitude of velocity is decreasing

16. Which of the following is **CORRECT**
 (A) I \rightarrow i \rightarrow P (B) I \rightarrow i \rightarrow S (C) I \rightarrow i \rightarrow Q (D) None of these
17. Which of the following is **CORRECT**
 (A) III \rightarrow ii \rightarrow P (B) III \rightarrow ii \rightarrow Q (C) III \rightarrow i \rightarrow Q (D) None of these
18. Which of the following is **INCORRECT**
 (A) II \rightarrow ii \rightarrow P (B) I \rightarrow i \rightarrow R (C) II \rightarrow iii \rightarrow P (D) None of these

Space for rough work

23. Variable valency is shown by
(A) S-block elements (B) P-block elements
(C) d-block elements (D) all elements
24. Which of the following affects the electronegativity of an atom.
(A) effective nuclear charge
(B) hybridization of atom
(C) oxidation number
(D) Number of neutrons in the nucleus
25. The elements which exist in liquid state at room temperature is/ are
(A) Na (B) Br₂ (C) Hg (D) Cl₂

SECTION 2 (Maximum Marks: 15)

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* For each question, darken the bubble corresponding to the correct integer the ORS.
-

26. Almost 1.985×10^{-18} J of light energy is required by the interior of the human eye to see an object. How many photons of green light (with $\lambda = 5000\text{\AA}$) are needed to generate this minimum amount of energy ?
27. Difference between n th and $(n + 1)$ th Bohr's radius of H atom is equal to its $(n - 1)$ th Bohr's radius of H atom. The value of 'n' is
28. A light source of wavelength λ illuminates a metal and ejects photo-electrons with $(KE)_{\max} = 1\text{eV}$. Another light source of wavelength $\lambda/2$, ejects photo-electrons from same metal with $(KE)_{\max} = 4\text{eV}$. Find the value of work function in eV ?
29. Electronegativity of carbon on pauling scale is 2.5. Calculate its value on mulliken scale ?
30. How many of the followings pairs show first elements with less electron affinity than second element?
(O, S), (Cl, Br) (Ar, Ne) (K, Na), (S, Se)

Space for rough work

SECTION 3 (Maximum Marks: 18)

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Column 1		Column 2		Column 3	
(I)	Atomic radius	(i)	Generally increase in periods	(P)	$C < O < N < F$
(II)	Electron affinity	(ii)	Generally decreases in periods	(Q)	$Be < B < C < N$
(III)	Electronegativity	(iii)	Generally decreases in groups	(R)	$N < P < F < Cl$
(IV)	Ionisation energy	(iv)	Generally increases in groups	(S)	$F < Li < Na < K$

31. The only **CORRECT** combination is
 (A) (I) (i) (Q) (B) (II) (iii) (P) (C) (III) (i) (Q) (D) (IV) (i) (S)
32. The only **CORRECT** combination related to trend in periods is
 (A) (I) (ii) (Q) (B) (II) (i) (Q) (C) (IV) (i) (P) (D) (III) (i) (P)
33. The only **INCORRECT** combination is
 (A) (IV) (i) (Q) (B) (I) (ii) (S) (C) (II) (i) (R) (D) (III) (i) (Q)

Space for rough work

Column 1		Column 2		Column 3 (Total spin)	
(I)	Mn ⁺²	(i)	5.9 BM	(P)	1.5
(II)	Fe ⁺²	(ii)	4.9 BM	(Q)	2
(III)	Co ⁺²	(iii)	3.9 BM	(R)	1
(IV)	Ni ⁺²	(iv)	2.9 BM	(S)	2.5

34. The only **CORRECT** combination is
 (A) (I) (iii) (S) (B) (III) (iii) (P) (C) II (ii) (R) (D) IV (iv) (Q)
35. The only **INCORRECT** combination regarding ion with 4 unpair electrons.
 (A) (III) (iii) (R) (B) (II) (ii) (S) (C) (II) (ii) (Q) (D) III((iii) (P)
36. The only **CORRECT** combination is
 (A) (I) (i) (Q) (B) (II) (ii) (P) (C) (IV) (iv) (R) (D) (III) (iii) (S)

PART III: MATHEMATICS

SECTION 1 (Maximum Marks: 28)

- * This section contains **SEVEN** questions.
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37. Possible values of 'x' for the inequality $\frac{(-x^2 + x - 1)(x + 1)^2 (x^2 - 4)^3}{(x - 2)^2 (x + 5)^5} \leq 0$
 (A) $(-5, -2] \cup (2, \infty)$ (B) $(-5, -3] \cup [3, \infty)$ (C) $(-\infty, -5) \cup [-2, 2)$ (D) $(-\infty, -5] \cup [-2, 2]$
38. If A lies between 270° and 360° and $\sin A = -\frac{7}{25}$, then
 (A) $\sin 2A = -\frac{336}{625}$ (B) $\cos \frac{A}{2} = \frac{\sqrt{2}}{5}$ (C) $\tan \frac{A}{2} = -\frac{1}{7}$ (D) $\sin \frac{A}{2} = -\frac{\sqrt{2}}{10}$

Space for rough work

39. If $\frac{\sin^2 2x + 4\sin^4 x - 4\sin^2 x \cos^2 x}{4 - \sin^2 2x - 4\sin^2 x} = \frac{1}{9}$ and $0 < x < \pi$, then the value of x is
 (A) $\pi/3$ (B) $\pi/6$ (C) $\frac{2\pi}{3}$ (D) $\frac{5\pi}{6}$
40. If the angles of a triangle are in arithmetic progression such that $\sin(2A + B) = \frac{1}{2}$, then
 (A) $A = 45^\circ$ (B) $C = 75^\circ$ (C) $\sin(B + 2C) = -1/2$ (D) $\cos 2B = -1/2$
41. Given that α, γ are roots of the equation $Ax^2 - 4x + 1 = 0$ and β, δ are roots of the equation $Bx^2 - 6x + 1 = 0$. If α, β, γ and δ are in H.P, then
 (A) $A = 5$ (B) $A = 3$ (C) $B = 8$ (D) $B = -8$
42. The sum of the numerical series $\frac{1}{\sqrt{3} + \sqrt{7}} + \frac{1}{\sqrt{7} + \sqrt{11}} + \frac{1}{\sqrt{11} + \sqrt{15}} + \dots$ upto n terms, is
 (A) $\frac{\sqrt{3+4n} - \sqrt{3}}{4}$ (B) $\frac{n}{\sqrt{3+4n} + \sqrt{3}}$ (C) less than n (D) greater than $\frac{\sqrt{n}}{2}$
43. The solution(s) of $\log_4(x - 1) = \log_2(x - 3)$ is/are
 (A) 3 (B) 2 (C) 5 (D) 4

SECTION 2 (Maximum Marks: 15)

- * This section contains **FIVE** 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 the ORS.

44. If $|x|, |x - 1|, |x + 1|$ are first three terms of an A.P., then sum of it's first 10 terms is $5k$, then k is equal
45. If A lies in the second quadrant and $3 \tan A + 4 = 0$, then the value of $\frac{10}{23} (2 \cot A - 5 \cos A + \sin A)$ is equal to
46. If the sum of first n natural numbers is $\frac{1}{5}$ times the sum of their squares, then the value of n is
47. If a, b, c are the p th, q th and r th terms respectively of a G.P, then $(q - r) \log a + (r - p) \log b + (p - q) \log c$ is equal to
48. The number of possible integral value of $|x|$ for $-3 \leq x \leq -1$.

Space for rough work

SECTION 3 (Maximum Marks: 18)

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- * For each question, darken the bubble corresponding to the correct option in the ORS.

49 – 51: By appropriately matching the information given in the three columns of the following table.

Column 1	Column 2	Column 3
(I) The number of negative terms in the sequence $3, -1, \frac{1}{3}, -\frac{1}{9}, \dots, \frac{1}{3^{13}}$ are	(i) 7	(P) Maximum of $4 \cos x + 3 \sin x + 2$
(II) Number of integral values of $ x $ for $-3 \leq x \leq -1$	(ii) 1	(Q) Solve $\log_4 64 - \frac{1}{2} \log_4 256 = 2x + 1$
(III) Solve $x^2 - 6 x - 7 = 0$	(iii) 0	(R) If $n = 2010!$ Compute the sum $\frac{1}{\log_2 n} + \frac{1}{\log_3 n} + \frac{1}{\log_4 n} + \dots + \frac{1}{\log_{2010} n}$
(IV) Number of integral values of x that satisfies $\log_{x+3}(x^2 - x) < 1$	(iv) -7	(S) Solve $\log_7 -x + \log_7 49 = 3$

49. Which of the following is the **CORRECT** combination ?
 (A) (III) (iii) (P) (B) (IV) (iii) (P) (C) (III) (i) (P) (D) (IV) (i) (P)
50. Which of the following options is **NOT CORRECT** combination ?
 (A) (III) (iii) (Q) (B) (I) (ii) (R) (C) (IV) (iv) (S) (D) (III) (iv) (S)
51. Which of the following options is **NOT** the **CORRECT** combination ?
 (A) (III) (iv) (Q) (B) (IV) (iii) (Q) (C) (II) (ii) (R) (D) (III) (iv) (S)

Space for rough work

52 – 54: By observing column 1, column 2, column 3 establish the relation and answer to the questions below:

Column 1	Column 2	Column 3
(I) The value of $\left(\frac{4 + \sec 20^\circ}{\operatorname{cosec} 20^\circ}\right)^2$ is	(i) In a triangle ABC, $2 \sum \left(\frac{\cot A + \cot B}{\tan A + \tan B}\right)$ equal to	(P) 1
(II) The minimum value of $\frac{1 + \cos 2x + 8 \sin^2 x}{2 \sin 2x}$, $x \in \left(0, \frac{\pi}{2}\right)$ is	(ii) If $x = \frac{4\lambda}{1 + \lambda^2}$ and $y = \frac{2 - 2\lambda^2}{1 + \lambda^2}$ where x is a real parameter such that $x^2 - xy + y^2$ lies between $[a, b]$, then $\frac{a+b}{2}$ is	(Q) 2
(III) The value of $\frac{8 \sin 40^\circ \sin 50^\circ \tan 10^\circ}{\cos 80^\circ}$	(iii) The value of $\frac{(1 + \tan 8^\circ)(1 + \tan 31^\circ)}{(1 + \tan 22^\circ)(1 + \tan 23^\circ)}$	(R) 3
(IV) If $\frac{\cos 5A}{\cos A} + \frac{\sin 5A}{\sin A} = a + b \cos 4A$, then $\frac{a^2}{b}$ is	(iv) The minimum value of $ \cos(\cos 3x + 3 \cos x) + 3$ is	(S) 4

52. Which of the following is the only **CORRECT** combination ?
 (A) (I) (ii) (S) (B) (III) (iii) (P) (C) (III) (ii) (S) (D) none of these
53. Which of the following is the only **INCORRECT** combination ?
 (A) (II) (ii) (S) (B) (II) (iv) (R) (C) (IV) (ii) (S) (D) (IV) (iii) (P)
54. Which of the following options is the **INCORRECT** combination ?
 (A) (IV) (ii) (S) (B) (IV) (iii) (P) (C) (I) (iv) (R) (D) none of these

Space for rough work

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(2018 – 2020)(1ST YEAR_REGULAR)

IIT-2017 (P1)_SET-B

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9. DO NOT TAMPER WITH / MULTILATE THE ORS OR THE BOOKLET.

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

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2	Single digit integer (0–9)	5	+3 If only the bubble corresponding to the correct answer is darkened.	---	0 In all other cases	---	15
3	Single correct option	6	+3 If only the bubble corresponding to the correct option is darkened	---	0 If none of the bubbles is darkened	-1 In all other cases	18

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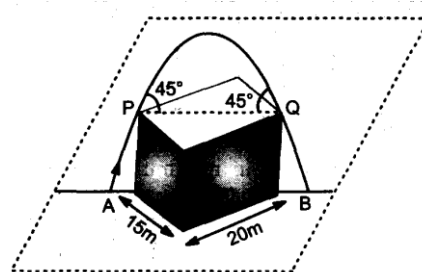
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Paragraph (Q- 1-2)

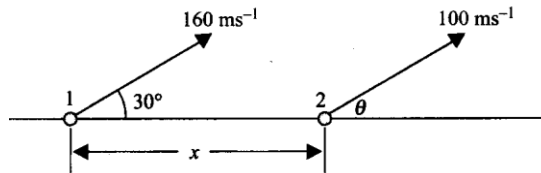
A particle is fired from A in the diagonal plane of a building of dimension 20m (length) \times 12.5m. (height), just clears the roof diagonally and falls on the other side of the building at B. It is observed that the particle is traveling at an angle 45° with the horizontal when it clears the edges P and Q of the diagonal. Take $g = 10 \text{ m/s}^2$



1. The speed of the particle at point P will be
 (A) $5\sqrt{10} \text{ m/s}$ (B) $10\sqrt{5} \text{ m/s}$ (C) $5\sqrt{15} \text{ m/s}$ (D) $5\sqrt{5} \text{ m/s}$
2. The range that is AB will be
 (A) $5\sqrt{10} \text{ m}$ (B) $25\sqrt{3} \text{ m}$ (C) $5\sqrt{15} \text{ m}$ (D) $25\sqrt{5} \text{ m}$
3. A particle undergoes rectilinear motion along +x axis according $v(t) = |(t - 1)| \text{ m/s}$. At $t = 0$, the particle is at origin. Choose the correct statement(s).
 (A) The average velocity of particle for first 2 seconds is 0.5 m/s.
 (B) The average speed of particle for first 2 seconds is 0.5 m/s.
 (C) The particle reverses its motion at $t = 1 \text{ sec}$.
 (D) The average acceleration for motion during first 2 seconds is zero.
4. It is known that $|\vec{a}| = |\vec{b}| = |\vec{c}| = 1$ and $\vec{a} + \vec{b} + \vec{c} = 0$. then $\vec{a} \cdot \vec{b} + \vec{b} \cdot \vec{c} + \vec{c} \cdot \vec{a} =$
 (A) 0 (B) 3 (C) -3 (D) None of these

Space for rough work

5. Two cars start off to race with velocities 4 m/s and 2 m/s and travel in straight line with uniform accelerations 1 m/s^2 and 2 m/s^2 respectively. If they reach the final point at the same instant, then the length of the path is
 (A) 30 m (B) 32 m (C) 20 m (D) 24 m
6. A particle moving along a straight line with uniform acceleration has velocities 7 m/s at P and 17 m/s at Q. H is the mid point of PQ. Then
 (A) the average velocity between H and Q is 15 m/s
 (B) the ratio of time to go from P to H and that from H to Q is 3 : 2
 (C) the velocity at H is 10 m/s
 (D) the average velocity between P and H is 10 m/s
7. Suppose two particles 1 and 2 are projected in vertical plane simultaneously. Their angles of projection are 30° and θ respectively, with the horizontal. Let them collide after a time t in air. Then



- (A) $\theta = \sin^{-1}(4/5)$ and they will have same speed just before the collision
 (B) $\theta = \sin^{-1}(4/5)$ and they will have different speed just before the collision
 (C) $x < 1280\sqrt{3} - 960\text{m}$
 (D) It is possible that the particles collide when both of them are at their highest point

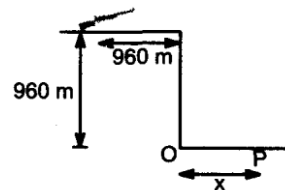
SECTION 2 (Maximum Marks: 15)

- * This section contains **FIVE** 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 the ORS.

8. A particle moving in a straight line covers half the distance with speed of 3 m/s. The other half of the distance is covered in two equal time intervals with speed of 4.5 m/s and 7.5 m/s respectively. The average speed(in m/s) of the particle during this motion is
9. A stone is dropped from a certain height which can reach the ground in 5 sec. It is stopped after three seconds of its fall and then is again released. The total time(in seconds) taken by the stone to reach the ground will be

Space for rough work

10. The ceiling of a hall is 40 m high. For maximum horizontal distance, the angle at which the ball may be thrown with a speed of 56 m s^{-1} without hitting the ceiling of the hall is $\frac{\pi}{n}$, find the value of n?
11. The speed of a projectile at its maximum height is $\frac{\sqrt{3}}{2}$ time its initial speed. If the range of the projectile is P times the maximum height attained by it, P is equal to $n\sqrt{3}$. Find the value of n?
12. A gun is mounted on a plateau 960m away from its edge as shown. Height of plateau is 960m. The gun can fire shells with a velocity of 100 m/s at any angle. Of the following choices, what is the minimum distance (OP)x from the edge of plateau where the shell of gun can reach is 160n. Find the value of n?



SECTION 3 (Maximum Marks: 18)

- * This section contains **SIX** questions of matching type.
- * This section contains **TWO** tables (each having 3 columns and 4 rows)
- * Based on the table, there are **THREE** questions
- * Each question has **FOUR** options (A), (B), (C) and (D). **ONLY ONE** of these four options is correct.
- * For each question, darken the bubble corresponding to the correct option in the ORS.

The velocity of a particle at any time t (in sec) is given by $V = (t^2 - 5t + 4)$ m/s. Column –1 gives the information about sign of acceleration and velocity. Column – 2 gives the time interval (in seconds) and column – 3 gives information regarding speed of the particle.

Column 1		Column 2		Column 3	
(I)	$a > 0, V > 0$	(i)	$(4, \infty)$	(P)	Speed is decreasing
(II)	$a > 0, V < 0$	(ii)	$(\frac{5}{2}, 4)$	(Q)	Speed is increasing
(III)	$a < 0, V < 0$	(iii)	$(1, \frac{5}{2})$	(R)	Magnitude of velocity is increasing
(IV)	$a < 0, V > 0$	(iv)	$(0, 1)$	(S)	Magnitude of velocity is decreasing

13. Which of the following is **CORRECT**
 (A) I \rightarrow i \rightarrow P (B) I \rightarrow i \rightarrow S (C) I \rightarrow i \rightarrow Q (D) None of these
14. Which of the following is **CORRECT**
 (A) III \rightarrow ii \rightarrow P (B) III \rightarrow ii \rightarrow Q (C) III \rightarrow i \rightarrow Q (D) None of these
15. Which of the following is **INCORRECT**
 (A) II \rightarrow ii \rightarrow P (B) I \rightarrow i \rightarrow R (C) II \rightarrow iii \rightarrow P (D) None of these

Space for rough work

In Column – 1 represents \vec{A} , Column – 2 represents \vec{B} , Column- 3 represents a vector \vec{C} which is perpendicular to both \vec{A} and \vec{B}

Column 1 \vec{A}	Column 2 \vec{B}	Column 3 \vec{C}
(I) $\hat{i} + \hat{j}$	(i) $\hat{j} + \hat{k}$	(P) $-\hat{i} - \hat{j} + \hat{k}$
(II) $\hat{i} + \hat{j} + \hat{k}$	(ii) $\hat{i} + \hat{j}$	(Q) $\hat{i} - \hat{j} + \hat{k}$
(III) $2\hat{i} + \hat{j}$	(iii) $\hat{i} + \hat{j} - \hat{k}$	(R) $-\hat{i} + \hat{j}$
(IV) $\hat{i} + \hat{k}$	(iv) $\hat{i} + \hat{j} + 2\hat{k}$	(S) $\hat{i} - 2\hat{j} + \hat{k}$

16. Which of the following is a correct combination
 (A) I \rightarrow i \rightarrow P (B) I \rightarrow i \rightarrow Q (C) I \rightarrow i \rightarrow R (D) I \rightarrow i \rightarrow S
17. Which of the following is a correct combination
 (A) II \rightarrow ii \rightarrow P (B) II \rightarrow ii \rightarrow Q (C) II \rightarrow ii \rightarrow R (D) II \rightarrow ii \rightarrow S
18. Which of the following is a correct combination
 (A) III \rightarrow iii \rightarrow P (B) III \rightarrow iii \rightarrow Q (C) III \rightarrow iii \rightarrow R (D) III \rightarrow iii \rightarrow S

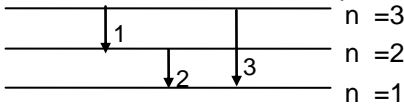
PART II: CHEMISTRY

SECTION 1 (Maximum Marks: 28)

- * This section contains **SEVEN** questions.
- * Each question has **FOUR** options (A), (B), (C) and (D). **ONE OR MORE THAN ONE** of these four options is(are) correct.
- * For each question, darken the bubble(s) corresponding to all the correct option(s) in the ORS
- * For example, if (A), (C) and (D) are all the correct options for a question, darkening all these three will get +4 marks; darkening only (A) and (D) will get +2 marks; and darkening (A) and (B) will get -2 marks, as a wrong option is also darkened.

19. The probability of finding the electron in P_x – orbital is
 (A) Maximum on two opposite sides of the nucleus along x-axis
 (B) Zero at the nucleus
 (C) Same on all sides around the nucleus
 (D) Zero on the z-axis

Space for rough work

20. Variable valency is shown by
 (A) S-block elements (B) P-block elements
 (C) d-block elements (D) all elements
21. Which of the following affects the electronegativity of an atom.
 (A) effective nuclear charge
 (B) hybridization of atom
 (C) oxidation number
 (D) Number of neutrons in the nucleus
22. The elements which exist in liquid state at room temperature is/ are
 (A) Na (B) Br₂ (C) Hg (D) Cl₂
23. Select the correct relationships for the given transitions.
- 
- (A) $\lambda_3 = \lambda_1 + \lambda_2$ (B) $v_3 = v_1 + v_2$
 (C) $\bar{v}_3 = \bar{v}_1 + \bar{v}_2$ (D) $\lambda_3 = \frac{\lambda_1 - \lambda_2}{\lambda_1 + \lambda_2}$
24. If r_n , U_n and E_n are radius of orbit, speed of electron and energy of electron in H-like atom then, which of the following are directly proportional to number of shell 'n' ?
 (A) $r_n \times E_n$ (B) $r_n \times U_n$ (C) $\frac{U_n}{E_n}$ (D) $\frac{r_n}{E_n}$
25. Select the correct statements.
 (A) 3d-orbital is more close to nucleus than 4s-orbital
 (B) 3d-orbital possesses more energy than 4s-orbital
 (C) 3d-orbitals are five fold degenerate in presence of magnetic field
 (D) The probability for finding electron between two lobes of p-orbitals is zero

Space for rough work

SECTION 2 (Maximum Marks: 15)

- * This section contains **FIVE** 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 the ORS.

26. Electronegativity of carbon on pauling scale is 2.5. Calculate its value on mulliken scale ?
27. How many of the followings pairs show first elements with less electron affinity than second element? (O, S), (Cl, Br) (Ar, Ne) (K, Na), (S, Se)
28. Almost 1.985×10^{-18} J of light energy is required by the interior of the human eye to see an object. How many photons of green light (with $\lambda = 5000\text{\AA}$) are needed to generate this minimum amount of energy ?
29. Difference between nth and (n + 1)th Bohr's radius of H atom is equal to its (n – 1)th Bohr's radius of H atom. The value of 'n' is
30. A light source of wavelength λ illuminates a metal and ejects photo–electrons with $(KE)_{\max} = 1\text{eV}$. Another light source of wavelength $\lambda/2$, ejects photo–electrons from same metal with $(KE)_{\max} = 4\text{eV}$. Find the value of work function in eV ?

SECTION 3 (Maximum Marks: 18)

- * This section contains **SIX** questions of matching type.
- * This section contains **TWO** tables (each having 3 columns and 4 rows)
- * Based on the table, there are **THREE** questions
- * Each question has **FOUR** options (A), (B), (C) and (D). **ONLY ONE** of these four options is correct.
- * For each question, darken the bubble corresponding to the correct option in the ORS.

Column 1		Column 2		Column 3 (Total spin)	
(I)	Mn ⁺²	(i)	5.9 BM	(P)	1.5
(II)	Fe ⁺²	(ii)	4.9 BM	(Q)	2
(III)	Co ⁺²	(iii)	3.9 BM	(R)	1
(IV)	Ni ⁺²	(iv)	2.9 BM	(S)	2.5

31. The only **CORRECT** combination is
 (A) (I) (iii) (S) (B) (III) (iii) (P) (C) II (ii) (R) (D) IV (iv) (Q)
32. The only **INCORRECT** combination regarding ion with 4 unpair electrons.
 (A) (III) (iii) (R) (B) (II) (ii) (S) (C) (II) (ii) (Q) (D) III((iii) (P)
33. The only **CORRECT** combination is
 (A) (I) (i) (Q) (B) (II) (ii) (P) (C) (IV) (iv) (R) (D) (III) (iii) (S)

Space for rough work

Column 1		Column 2		Column 3	
(I)	Atomic radius	(i)	Generally increase in periods	(P)	$C < O < N < F$
(II)	Electron affinity	(ii)	Generally decreases in periods	(Q)	$Be < B < C < N$
(III)	Electronegativity	(iii)	Generally decreases in groups	(R)	$N < P < F < Cl$
(IV)	Ionisation energy	(iv)	Generally increases in groups	(S)	$F < Li < Na < K$

34. The only **CORRECT** combination is
 (A) (I) (i) (Q) (B) (II) (iii) (P) (C) (III) (i) (Q) (D) (IV) (i) (S)
35. The only **CORRECT** combination related to trend in periods is
 (A) (I) (ii) (Q) (B) (II) (i) (Q) (C) (IV) (i) (P) (D) (III) (i) (P)
36. The only **INCORRECT** combination is
 (A) (IV) (i) (Q) (B) (I) (ii) (S) (C) (II) (i) (R) (D) (III) (i) (Q)

PART III: MATHEMATICS

SECTION 1 (Maximum Marks: 28)

- * This section contains **SEVEN** questions.
- * Each question has **FOUR** options (A), (B), (C) and (D). **ONE OR MORE THAN ONE** of these four options is(are) correct.
- * For each question, darken the bubble(s) corresponding to all the correct option(s) in the ORS
- * For example, if (A), (C) and (D) are all the correct options for a question, darkening all these three will get +4 marks; darkening only (A) and (D) will get +2 marks; and darkening (A) and (B) will get -2 marks, as a wrong option is also darkened.

37. If the angles of a triangle are in arithmetic progression such that $\sin(2A + B) = \frac{1}{2}$, then
 (A) $A = 45^\circ$ (B) $C = 75^\circ$ (C) $\sin(B + 2C) = -1/2$ (D) $\cos 2B = -1/2$

Space for rough work

38. Given that α, γ are roots of the equation $Ax^2 - 4x + 1 = 0$ and β, δ are roots of the equation $Bx^2 - 6x + 1 = 0$. If α, β, γ and δ are in H.P, then
 (A) $A = 5$ (B) $A = 3$ (C) $B = 8$ (D) $B = -8$
39. The sum of the numerical series $\frac{1}{\sqrt{3} + \sqrt{7}} + \frac{1}{\sqrt{7} + \sqrt{11}} + \frac{1}{\sqrt{11} + \sqrt{15}} + \dots$ upto n terms, is
 (A) $\frac{\sqrt{3+4n} - \sqrt{3}}{4}$ (B) $\frac{n}{\sqrt{3+4n} + \sqrt{3}}$ (C) less than n (D) greater than $\frac{\sqrt{n}}{2}$
40. The solution(s) of $\log_4(x - 1) = \log_2(x - 3)$ is/are
 (A) 3 (B) 2 (C) 5 (D) 4
41. Possible values of 'x' for the inequality $\frac{(-x^2 + x - 1)(x + 1)^2(x^2 - 4)^3}{(x - 2)^2(x + 5)^5} \leq 0$
 (A) $(-5, -2] \cup (2, \infty)$ (B) $(-5, -3] \cup [3, \infty)$ (C) $(-\infty, -5) \cup [-2, 2)$ (D) $(-\infty, -5] \cup [-2, 2]$
42. If A lies between 270° and 360° and $\sin A = -\frac{7}{25}$, then
 (A) $\sin 2A = -\frac{336}{625}$ (B) $\cos \frac{A}{2} = \frac{\sqrt{2}}{5}$ (C) $\tan \frac{A}{2} = -\frac{1}{7}$ (D) $\sin \frac{A}{2} = -\frac{\sqrt{2}}{10}$
43. If $\frac{\sin^2 2x + 4\sin^4 x - 4\sin^2 x \cos^2 x}{4 - \sin^2 2x - 4\sin^2 x} = \frac{1}{9}$ and $0 < x < \pi$, then the value of x is
 (A) $\pi/3$ (B) $\pi/6$ (C) $\frac{2\pi}{3}$ (D) $\frac{5\pi}{6}$

Space for rough work

SECTION 2 (Maximum Marks: 15)

- * This section contains **FIVE** 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 the ORS.
-

44. If a, b, c are the p th, q th and r th terms respectively of a G.P, then $(q - r) \log a + (r - p) \log b + (p - q) \log c$ is equal to
45. The number of possible integral value of $|x|$ for $-3 \leq x \leq -1$.
46. If $|x|, |x - 1|, |x + 1|$ are first three terms of an A.P., then sum of it's first 10 terms is $5k$, then k is equal
47. If A lies in the second quadrant and $3 \tan A + 4 = 0$, then the value of $\frac{10}{23} (2 \cot A - 5 \cos A + \sin A)$ is equal to
48. If the sum of first n natural numbers is $\frac{1}{5}$ times the sum of their squares, then the value of n is
-

Space for rough work

SECTION 3 (Maximum Marks: 18)

- * This section contains **SIX** questions of matching type.
- * This section contains **TWO** tables (each having 3 columns and 4 rows)
- * Based on the table, there are **THREE** questions
- * Each question has **FOUR** options (A), (B), (C) and (D). **ONLY ONE** of these four options is correct.
- * For each question, darken the bubble corresponding to the correct option in the ORS.

49 – 51: By observing column 1, column 2, column 3 establish the relation and answer to the questions below:

Column 1	Column 2	Column 3
(I) The value of $\left(\frac{4 + \sec 20^\circ}{\operatorname{cosec} 20^\circ}\right)^2$ is	(i) In a triangle ABC, $2 \sum \left(\frac{\cot A + \cot B}{\tan A + \tan B}\right)$ equal to	(P) 1
(II) The minimum value of $\frac{1 + \cos 2x + 8 \sin^2 x}{2 \sin 2x}, x \in \left(0, \frac{\pi}{2}\right)$ is	(ii) If $x = \frac{4\lambda}{1 + \lambda^2}$ and $y = \frac{2 - 2\lambda^2}{1 + \lambda^2}$ where x is a real parameter such that $x^2 - xy + y^2$ lies between $[a, b]$, then $\frac{a+b}{2}$ is	(Q) 2
(III) The value of $\frac{8 \sin 40^\circ \sin 50^\circ \tan 10^\circ}{\cos 80^\circ}$	(iii) The value of $\frac{(1 + \tan 8^\circ)(1 + \tan 31^\circ)}{(1 + \tan 22^\circ)(1 + \tan 23^\circ)}$	(R) 3
(IV) If $\frac{\cos 5A}{\cos A} + \frac{\sin 5A}{\sin A} = a + b \cos 4A$, then $\frac{a^2}{b}$ is	(iv) The minimum value of $ \cos(\cos 3x + 3 \cos x) + 3$ is	(S) 4

49. Which of the following is the only **CORRECT** combination ?
 (A) (I) (ii) (S) (B) (III) (iii) (P) (C) (III) (ii) (S) (D) none of these
50. Which of the following is the only **INCORRECT** combination ?
 (A) (II) (ii) (S) (B) (II) (iv) (R) (C) (IV) (ii) (S) (D) (IV) (iii) (P)
51. Which of the following options is the **INCORRECT** combination ?
 (A) (IV) (ii) (S) (B) (IV) (iii) (P) (C) (I) (iv) (R) (D) none of these

Space for rough work

52 – 54: By appropriately matching the information given in the three columns of the following table.

Column 1	Column 2	Column 3
(I) The number of negative terms in the sequence $3, -1, \frac{1}{3}, -\frac{1}{9}, \dots, \frac{1}{3^{13}}$ are	(i) 7	(P) Maximum of $4 \cos x + 3 \sin x + 2$
(II) Number of integral values of $ x $ for $-3 \leq x \leq -1$	(ii) 1	(Q) Solve $\log_4 64 - \frac{1}{2} \log_4 256 = 2x + 1$
(III) Solve $x^2 - 6 x - 7 = 0$	(iii) 0	(R) If $n = 2010!$ Compute the sum $\frac{1}{\log_2 n} + \frac{1}{\log_3 n} + \frac{1}{\log_4 n} + \dots + \frac{1}{\log_{2010} n}$
(IV) Number of integral values of x that satisfies $\log_{x+3}(x^2 - x) < 1$	(iv) -7	(S) Solve $\log_{7-x} + \log_7 49 = 3$

52. Which of the following is the **CORRECT** combination ?
 (A) (III) (iii) (P) (B) (IV) (iii) (P) (C) (III) (i) (P) (D) (IV) (i) (P)
53. Which of the following options is **NOT CORRECT** combination ?
 (A) (III) (iii) (Q) (B) (I) (ii) (R) (C) (IV) (iv) (S) (D) (III) (iv) (S)
54. Which of the following options is **NOT** the **CORRECT** combination ?
 (A) (III) (iv) (Q) (B) (IV) (iii) (Q) (C) (II) (ii) (R) (D) (III) (iv) (S)

Space for rough work

FITJEE RET – 5

(2018 – 2020)(1ST YEAR_REGULAR)

IIT-2017 (P1)_SET-A

DATE: 16.07.2018

ANSWERS

PHYSICS

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

CHEMISTRY

19. B, C	20. B, C	21. A, B, D	22. A, B, D
23. B, C	24. A, B, C	25. B, C	26. 5
27. 4	28. 2	29. 7	30. 2
31. C	32. C	33. A	34. B
35. B	36. C		

MATHEMATICS

37. A, B	38. A, C	39. B, D	40. A, B, C, D
41. B, C	42. A, B, C	43. C	44. 5
45. 1	46. 7	47. 0	48. 3
49. C	50. D (Bonus)	51. A	52. C
53. D (Bonus)	54. A or B		

FITJEE RET – 5

(2018 – 2020)(1ST YEAR_REGULAR)

IIT-2017 (P1)_SET-B

DATE: 16.07.2018

ANSWERS

PHYSICS

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

CHEMISTRY

19. A, B, D	20. B, C	21. A, B, C	22. B, C
23. B, C	24. B, C	25. A, B, D	26. 7
27. 2	28. 5	29. 4	30. 2
31. B	32. B	33. C	34. C
35. C	36. A		

MATHEMATICS

37. A, B, C, D	38. B, C	39. A, B, C	40. C
41. A, B	42. A, C	43. B, D	44. 0
45. 3	46. 5	47. 1	48. 7
49. C	50. D (Bonus)	51. A or B	52. C
53. D (Bonus)	54. A		