

FITJEE RET – 6

(2018 – 2020)(1ST YEAR_REGULAR)

IIT-2015 (P1)_SET-A

DATE: 23.07.2018

Time: 3 hours

Maximum Marks: 264

INSTRUCTIONS:

A. General

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

B. Filling in the OMR:

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

C. Question paper format:

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

D. Marking Scheme

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

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

If you mark the answers in question booklet, you will not be allowed to continue the exam.

NAME:

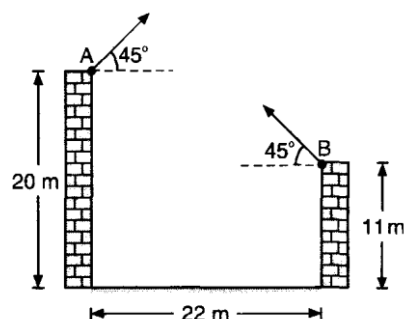
ENROLLMENT NO.:

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

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

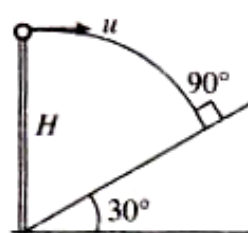
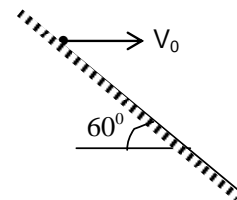
1. The ceiling of a hall is 40 m high. For maximum horizontal distance, the angle at which the ball may be thrown with a speed of 56 m s^{-1} without hitting the ceiling of the hall is $\frac{\pi}{n}$, find the value of n?
2. A person walks up a stationary 15m long escalator in 90s. When standing on the same escalator, now moving the person is carried up in 60s. The time in seconds, would it takes for the person to walk up the moving escalator is $6x$, where x is
3. A sailor in a boat, which is going due east with a speed of 8 ms^{-1} observes that a submarine is heading towards north at a speed of 12 ms^{-1} and sinking at a rate of 2 ms^{-1} . The commander of submarine observes a helicopter ascending at a rate of 5 ms^{-1} and heading towards west with 4 ms^{-1} . Find the speed of the helicopter with respect to boat, is $(10 + P) \text{ ms}^{-1}$, where P is

4. Two particles are simultaneously thrown from the roofs of two high buildings as shown in figure. Their velocities are $v_A = 2 \text{ ms}^{-1}$ and $v_B = 14 \text{ ms}^{-1}$ respectively. Calculate the minimum distance (in metre) between the particles in the process of their motion.



Space for rough work

5. Two particles P and Q move with constant velocities $v_1 = 2 \text{ ms}^{-1}$ and $v_2 = 4 \text{ ms}^{-1}$ along two mutually perpendicular straight lines towards the intersection point O. At moment $t=0$, the particles were located at distances $l_1 = 12\text{m}$ and $l_2 = 19\text{m}$ from O, respectively. Find the time when they are nearest (in seconds)
6. A train is moving along a straight line with a constant acceleration a . A boy standing in the train throws a ball forward with a speed of 10 ms^{-1} , at an angle of 60° to the horizontal. The boy has to move forward by 1.15m inside the train to catch the ball back to the initial height. The acceleration of the train, in ms^{-2} , is
7. A ball is projected horizontally from an inclined plane with a velocity v_0 as shown in the figure. It will strike the plane after a time $2\sqrt{n} \frac{v_0}{g}$. Calculate the value of 'n'
8. In fig, Find the horizontal velocity u (in ms^{-1}) of a projectile so that it hits the inclined plane perpendicularly. Given $H = 6.25 \text{ m}$

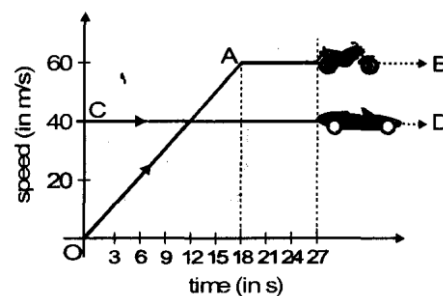


SECTION 2 (Maximum Marks: 40)

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

Space for rough work

9. At the instant a motor bike starts from rest in a given direction, a car overtakes the motor bike, both moving in the same direction. The speed time graphs for motor bike and car are represented by OAB and CD respectively. Then
- (A) at $t = 18\text{s}$ the motor bike and car are 180 m apart
 (B) at $t = 18\text{s}$ the motor bike and car are 720 m apart
 (C) the relative distance between motor bike and car reduces to zero at $t = 27\text{s}$ and both are 1080m far from origin
 (D) the relative distance between motor bike and car always remains same



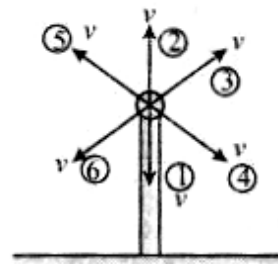
10. Ship A is located 4km north and 3km east of ship B. Ship A has a velocity of 20 kmh^{-1} towards the south and ship B is moving at 40 kmh^{-1} in a direction 37° north of east. X and Y axes are along east and north directions, respectively
- (A) Velocity of A relative to B is $-32\hat{i} - 44\hat{j}$
 (B) Position of A relative to B as a function of time is given by $\vec{r}_{AB} = (3 - 32t)\hat{i} + (4 - 44t)\hat{j}$
 (C) Velocity of A relative to B is $32\hat{i} - 44\hat{j}$
 (D) Position of A relative to B as a function of time is given by $(32t\hat{i} - 44t\hat{j})$
11. An aeroplane flies along a straight line from A to B with a speed v_0 and back again with the same speed v_0 . A steady wind v is blowing. If $AB = \ell$ then
- (A) total time for the trip is $\frac{2v_0\ell}{v_0^2 - v^2}$, if wind blows along the line AB
 (B) total time for the trip is $\frac{2\ell}{\sqrt{v_0^2 - v^2}}$, if wind blows perpendicular to the line AB
 (C) total time for the trip decreases because of the presence of wind
 (D) total time for the trip increases because of the presence of wind

Space for rough work

12. Rain appears to fall vertically to a man walking at 3 kmh^{-1} but when he changes his speed to double, the rain appears to fall at 45° with vertical. Study the following statements and find which of them are correct.
- (A) Velocity of rain is $2\sqrt{3} \text{ kmh}^{-1}$
- (B) The angle of fall of rain (with vertical) is $\theta = \tan^{-1}\left(\frac{1}{\sqrt{2}}\right)$
- (C) The angle of fall of rain (with vertical) is $\theta = \sin^{-1}\left(\frac{1}{\sqrt{2}}\right)$
- (D) Velocity of rain is $3\sqrt{2} \text{ kmh}^{-1}$
13. When a man moves down the inclined plane with a constant speed 5 ms^{-1} which makes an angle of 37° with the horizontal, he finds that the rain is falling vertically downward. When he moves up the same inclined plane with the same speed, he finds that the rain makes an angle $\theta = \tan^{-1}\left(\frac{7}{8}\right)$ with the horizontal. The speed of the rain is
- (A) $\sqrt{116} \text{ ms}^{-1}$ (B) $\sqrt{32} \text{ ms}^{-1}$ (C) 5 ms^{-1} (D) $\sqrt{73} \text{ ms}^{-1}$
14. A horizontal wind is blowing with a velocity v towards north-east. A man starts running towards north with acceleration a . The time after which man will feel the wind blowing towards east is
- (A) $\frac{v}{a}$ (B) $\frac{\sqrt{2}v}{a}$ (C) $\frac{v}{\sqrt{2}a}$ (D) $\frac{2v}{a}$
15. A stationary person observes that rain is falling vertically down at 30 kmh^{-1} . A cyclist is moving up on an inclined plane making an angle 30° with horizontal at 10 kmh^{-1} . In which direction should the cyclist hold his umbrella to prevent himself from the rain?
- (A) At an angle $\tan^{-1}\left(\frac{3\sqrt{3}}{5}\right)$ with inclined plane (B) At an angle $\tan^{-1}\left(\frac{3\sqrt{3}}{5}\right)$ with horizontal
- (C) At an angle $\tan^{-1}\left(\frac{\sqrt{3}}{7}\right)$ with inclined plane (D) At an angle $\tan^{-1}\left(\frac{\sqrt{3}}{7}\right)$ with vertical

Space for rough work

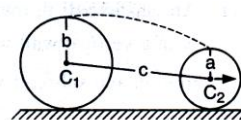
16. All the particles thrown with same initial velocity would strike the ground.
 (A) with same speed
 (B) simultaneously
 (C) time would be least for the particle thrown with velocity v downward i.e., particle 1
 (D) time would be maximum for the particle 2



17. Two particles A and B are thrown up simultaneously from the edge of a cliff with initial speeds v and $2v$. Assuming that the particle A comes to rest immediately after striking the ground, the variation in relative position of the particle B with respect to the particle A with time, till both the stones strike the ground is plotted. This variation plot is
 (A) only linear
 (B) only parabolic
 (C) first parabolic then linear
 (D) first linear then parabolic

18. The radii of the front and rear wheels of a carriage are a , b respectively and c is the distance between the centres C_1 and C_2 of the wheels. If a particle escapes from the top of a rear wheel and strikes at the top of the front wheel. Find the time of its flight is

- (A) $\sqrt{\frac{(b-a)}{2g}}$ (B) $\sqrt{\frac{2(b-a)}{g}}$
 (C) $\sqrt{\frac{4(b-a)}{g}}$ (D) $\sqrt{\frac{(b-a)}{4g}}$



Space for rough work

SECTION 3 (Maximum Marks: 16)

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

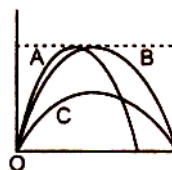
(A)	(P)	(Q)	(R)	(S)	(T)
(B)	(P)	(Q)	(R)	(S)	(T)
(C)	(P)	(Q)	(R)	(S)	(T)
(D)	(P)	(Q)	(R)	(S)	(T)

- ◆ For each entry in Column I, darken the bubbles of all the matching entries. For example, if entry (A) in **Column I** matches with entries (Q), (R) and (T), then darken these three bubbles in the ORS. Similarly, for entries (V), (C) and (D).

- ◆ Marking entry in Column I.

+2	If only the bubble(s) corresponding to all the correct match (s) is (are) darkened.
0	If none of the bubbles is darkened.
-1	In all other cases.

19. Trajectories are shown in figure for three kicked football, initial vertical and horizontal velocity components are u_y and u_x respectively. Ignoring air resistance, choose the correct statement from column - 2 for the value of variable in column - 1



Column - I		Column - II	
(A)	Time of flight	(p)	greatest for A only
(B)	u_y / u_x	(q)	greatest for C only
(C)	u_x	(r)	equal for A and B
(D)	$u_x u_y$	(s)	equal for B and C
		(t)	None

Space for rough work

20. The path of projectile is represented by $y = Px - Qx^2$

Column – I		Column – II	
(A)	Range	(p)	P/Q
(B)	Maximum height	(q)	P
(C)	Time of flight	(r)	$P^2 / 4Q$
(D)	Tangent of angle of projection is	(s)	$\sqrt{\frac{2}{Qg}}P$
		(t)	None

PART II: CHEMISTRY
SECTION 1 (Maximum Marks: 32)

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

21. How many gram ions of SO_4^{-2} are present in 1.25 mole of $\text{K}_2\text{SO}_4 \cdot \text{Al}_2(\text{SO}_4)_3 \cdot 24\text{H}_2\text{O}$.
22. For the reaction $\text{A} + 2\text{B} \rightarrow \text{C}$, 5 mole of A and 8 mole of B will produce "x" mole of C. Then 'x' is
23. If 10 mole of BaCl_2 is mixed with 2 mole of Na_3PO_4 . The maximum number of mole of $\text{Ba}_3(\text{PO}_4)_2$ that can be formed is ...
24. On analysis a certain compound was found to contain Iodine and oxygen in the ratio 254g of Iodine and 80g of oxygen. (I = 127, O = 16). The formula of compound is I_2O_x . Here x is
25. The mass of CO_2 formed by the decomposition of 1g CaCO_3 is x. Then the value of 7x is
26. The no. of protons present in 10gm CaCO_3 is $x \cdot N_A$. Then the value of x is ..
27. The mass of carbon present in 0.5 mole of $\text{K}_4[\text{Fe}(\text{CN})_6]$ is 'x'. Then $\frac{x}{9}$ is. (Atomic mass of Fe = 56)
28. Calculate the no. of mole of water in 488 g $\text{BaCl}_2 \cdot 2\text{H}_2\text{O}$ (Ba = 137)

Space for rough work

SECTION 2 (Maximum Marks: 40)

- ◆ This section contains **TEN** questions.
- ◆ Each question has **FOUR** options (A), (B), (C) and (D). **ONE OR MORE THAN ONE** of these four option(s) is (are) correct.
- ◆ For each question, darken the bubble(s) corresponding to all the correct option(s) in the ORS.
- ◆ Marking scheme:
 - +4** If only the bubble(s) corresponding to all the correct option(s) is (are) darkened.
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 - 2** In all other cases

29. Which is/are correct statements about 1.7g of NH_3 :
- (A) It contain 0.3 mol H-atom (B) It contain 2.408×10^{-23} atoms
 (C) Mass % of hydrogen is 17.65% (D) it contains 0.3 mol N-atom
30. If 27g of Carbon is mixed with 88g of Oxygen and is allowed to burn to produce CO_2 , then :
- (A) Oxygen is the limiting reagent (B) Volume of CO_2 gas produced at NTP is 50.4 L
 (C) C and O combine in mass ratio 3 : 8. (D) Volume of unreacted O_2 at STP is 11.2 L
31. For the following reaction : $\text{Na}_2\text{CO}_3 + 2\text{HCl} \longrightarrow 2\text{NaCl} + \text{CO}_2 + \text{H}_2\text{O}$
 106.0g of Na_2CO_3 reacts with 109.5g of HCl
 Which of the following is/are correct.
- (A) The HCl is in excess (B) 117.0g of NaCl is formed.
 (C) The volume of CO_2 produced at NTP is 22.4 L
 (D) None of these
32. $\text{A} + \text{B} \rightarrow \text{A}_3\text{B}_2$ (unbalanced) ; $\text{A}_3\text{B}_2 + \text{C} \rightarrow \text{A}_3\text{B}_2\text{C}_2$ (unbalanced)
 Above two reactions are carried out by taking 3 moles each of A and B and one mole of C. Then which option is/are correct?
- (A) 1 mole of $\text{A}_3\text{B}_2\text{C}_2$ is formed (B) 1/2 mole of $\text{A}_3\text{B}_2\text{C}_2$ is formed
 (C) 1/2 mole of A_3B_2 is formed (D) 1/2 mole of A_3B_2 is left finally
33. 18g of H_2O has the same number of electrons as
- (A) 20g of calcium (B) 2 moles of boron
 (C) 0.5 mole of CO_2 (D) 11.2 L of NH_3

Space for rough work

34. Total no. of neutrons present in 1.7gm of NH_3
 (A) 6.023×10^{23} (B) 6.023×10^{24} (C) 4.361×10^{23} (D) 4.361×10^{24}
35. Calculate the amount of lime that can be produced by heating 100 g of 90% pure limestone :
 (A) 50.4 g (B) 0.98 mole (C) 0.9 mole (D) 56 g
36. 1.5 g of oxygen is produced by heating KClO_3 . How much KCl is produced in the reaction ?
 (A) 3.125×10^{-2} mole (B) 2.29 g (C) 1.78×10^{-2} mole (D) 1.33 g
37. In which of the following pairs do 1g of each have an equal number of molecules ?
 (A) N_2O and CO (B) N_2 and C_3O_2 (C) N_2 & CO (D) N_2O and CO_2
38. An oxide of nitrogen has 30.43% nitrogen (At. wt. of $\text{N} = 14$) and its one molecule weighs 1.527×10^{-22} g .
 Which of the following statement regarding the oxide is (are) true?
 (A) its empirical formula is N_2O (B) Its empirical formula is NO_2
 (C) its molecular formula is N_2O_4 (D) its molecular formula is N_4O_2

SECTION 3 (Maximum Marks: 16)

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- ◆ 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.
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Space for rough work

39.

Column – I		Column – II	
(A)	Vapour density	(p)	Unitless
(B)	Mole	(q)	1 mol electrons
(C)	12g carbon	(r)	Collection of 6.023×10^{23} atoms
(D)	96500 Coulombs	(s)	Molecular mass $\times \frac{1}{2}$

40.

Column – I		Column – II	
(A)	1.6 g CH ₄	(p)	0.1 mol
(B)	1.7g NH ₃	(q)	6.023×10^{23} electrons
(C)	HCHO	(r)	40% carbon
(D)	C ₆ H ₁₂ O ₆	(s)	Vapour density = 15

PART III: MATHEMATICS

SECTION 1 (Maximum Marks: 32)

- ◆ This section contains **EIGHT** questions.
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- ◆ For each question, darken the bubble corresponding to the correct integer in the ORS.
- ◆ Marking scheme:
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41. Determine 'x' so that the line passing through (3, 4) and (x, 5) makes an angle of 135° with the positive direction of x-axis
42. The sum of squares of sides of a triangle is 8 then the sum of squares of medians of the triangle is
43. If t_1, t_2, t_3 are distinct and the points $(t_1, 2at_1 + at_1^3), (t_2, 2at_2 + at_2^3), (t_3, 2at_3 + at_3^3)$ are collinear, then the value of $t_1 + t_2 + t_3 + 1$ is
44. The vertices of a triangle are (0, 3), (-3, 0) and (3, 0). The sum of the coordinates of the orthocenter is

Space for rough work

45. Two vertices of a triangle are $(3, -2)$ and $(-2, 3)$ and its orthocenter is $(-6, 1)$. If its third vertex is (a, b) , then $a + b =$
46. A point 'A' divides the join of $P(-5, 1)$ and $Q(3, 5)$ in the ratio $k : 1$. Then the integral value of k for which the area of $\triangle ABC$, where B is $(1, 5)$ and C is $(7, -2)$, is equal to 2 units in magnitude is
47. The distance between the circumcentre and the orthocenter of the triangle whose vertices are $(0, 0)$, $(6, 8)$ and $(-4, 3)$ is L . Then the value of $\frac{2}{\sqrt{5}} L$ is
48. If the area of the triangle formed by the points $(2a, b)$, $(a + b, 2b + a)$ and $(2b, 2a)$ is 2 sq. units, then the area of the triangle whose vertices are $(a + b, a - b)$, $(3b - a, b + 3a)$ and $(3a - b, 3b - a)$ will be

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.
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 - 0** If none of the bubbles is darkened.
 - 2** In all other cases

49. A variable line through point $P(2, 1)$ meets the axes at A and B . Find the locus of the circumcentre of triangle OAB (where O is the origin)
- (A) $x - 2y - 2xy = 0$ (B) $\frac{1}{y} - \frac{2}{x} = 2$ (C) $x + 2y - 2xy = 0$ (D) $\frac{1}{y} + \frac{2}{x} = 2$
50. Find the equation to which the equation $x^2 + 7xy - 2y^2 + 17x - 26y - 60 = 0$ is transformed if the origin is shifted to the point $(2, -3)$, the axes remaining parallel to original axis.
- (A) $x^2 - 7xy - 2y^2 - 4 = 0$ (B) $x^2 + 7xy - 2y^2 - 4 = 0$
 (C) $2y^2 + 7xy - x^2 + 4 = 0$ (D) $2y^2 - 7xy - x^2 + 4 = 0$
51. Area of the parallelogram formed by the lines $y = mx$, $y = mx + 1$, $y = nx$ and $y = nx + 1$ equals
- (A) $\frac{|m+n|}{|m^2-n^2|}$ (B) $\frac{|m-n|}{|m^2-n^2|}$ (C) $\frac{1}{|m+n|}$ (D) $\frac{1}{|m-n|}$

Space for rough work

52. If $A(a, a)$, $B(-a, -a)$ are two vertices of an equilateral triangle then its third vertex is
 (A) $\left(\frac{a\sqrt{3}}{2}, \frac{-a\sqrt{3}}{2}\right)$ (B) $(-a\sqrt{3}, a\sqrt{3})$ (C) $(a\sqrt{3}, -a\sqrt{3})$ (D) $(-a\sqrt{3}, -a\sqrt{3})$
53. Medians AD and BE of the triangle with vertices $A(0, b)$, $B(0, 0)$ and $C(a, 0)$ are mutually perpendicular if
 (A) $b = a\sqrt{2}$ (B) $a = b\sqrt{2}$ (C) $b = -a\sqrt{2}$ (D) $a = -b\sqrt{2}$
54. If $(-4, 0)$ and $(1, -1)$ are two vertices of a triangle of area 4sq. units, then its third vertex lies on
 (A) $y = x$ (B) $5x + y + 12 = 0$ (C) $x + 5y - 4 = 0$ (D) $x + 5y + 12 = 0$
55. The area of triangle ABC is 20cm^2 . The coordinates of vertex A are $(-5, 0)$ and those of B are $(3, 0)$. The vertex C lies on the line $x - y = 2$. The coordinates of C are
 (A) $(5, 3)$ (B) $(-3, -5)$ (C) $(-5, -7)$ (D) $(7, 5)$
56. The points $A(0, 0)$, $B(\cos \alpha, \sin \alpha)$, and $C(\cos \beta, \sin \beta)$ are the vertices of a right-angled triangle if
 (A) $\sin \frac{\alpha - \beta}{2} = \frac{1}{\sqrt{2}}$ (B) $\cos \frac{\alpha - \beta}{2} = -\frac{1}{\sqrt{2}}$ (C) $\cos \frac{\alpha - \beta}{2} = \frac{1}{\sqrt{2}}$ (D) $\sin \frac{\alpha - \beta}{2} = -\frac{1}{\sqrt{2}}$
57. The ends of a diagonals of a square are $(2, -3)$ and $(-1, 1)$. Another vertex of the square can be
 (A) $\left(-\frac{3}{2}, -\frac{5}{2}\right)$ (B) $\left(\frac{5}{2}, \frac{1}{2}\right)$ (C) $\left(\frac{1}{2}, \frac{5}{2}\right)$ (D) none of these
58. The vertices of a variable triangle are $(3, 4)$, $(5 \cos \theta, 5 \sin \theta)$ and $(5 \sin \theta, -5 \cos \theta)$, where $\theta \in \mathbb{R}$. The locus of its orthocenter is
 (A) $(x + y - 1)^2 + (x - y - 7)^2 = 100$ (B) $(x + y - 7)^2 + (x - y - 1)^2 = 100$
 (C) $(x + y - 7)^2 + (x + y - 1)^2 = 100$ (D) $(x + y - 7)^2 + (x - y + 1)^2 = 100$

Space for rough work

SECTION 3 (Maximum Marks: 16)

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

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

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

59. Match the following

Column I		Column II	
(A)	Locus of the point $(\cos^2 t, 2 \sin t)$ where 't' is a variable is	p.	$y^2 = 4x + 1$
(B)	Locus of a point whose coordinates are given by $x = t + t^2$, $y = 2t + 1$, where 't' is a variable is	q.	$x^2 + y^2 = a^2 + b^2$
(C)	Locus of point of intersection of lines $x \cos \alpha + y \sin \alpha = a$, $x \sin \alpha - y \cos \alpha = b$, where α is variable	r.	$x^2 - y^2 = 16xy$
(D)	Locus of the point $(\tan t + \sin t, \tan t - \sin t)$ is	s.	$y^2 + 4x = 4$

60. Consider the triangle whose vertices are $(0, 0)$, $(5, 12)$ and $(16, 12)$. Match the following

Column I		Column II	
(A)	Centroid of the triangle	p.	$\left(\frac{21}{2}, \frac{8}{3}\right)$
(B)	Circumcentre of the triangle	q.	$(7, 9)$
(C)	Incentre of the triangle	r.	$(27, -21)$
(D)	Excentre opposite to vertex $(5, 12)$	s.	$(7, 8)$

Space for rough work

FITJEE RET – 6

(2018 – 2020)(1ST YEAR_REGULAR)

IIT-2015 (P1)_SET-A

DATE: 23.07.2018

ANSWERS

PHYSICS

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

CHEMISTRY

- | | | | |
|--|-------------|-------------|----------|
| 21. 5 | 22. 4 | 23. 1 | 24. 5 |
| 25. 3 | 26. 5 | 27. 4 | 28. 4 |
| 29. A, C | 30. B, C, D | 31. A, B, C | 32. B, D |
| 33. A, B | 34. C | 35. A, C | 36. A, B |
| 37. C, D | 38. B, C | | |
| 39. $A \rightarrow p, s ; B \rightarrow r ; C \rightarrow r ; D \rightarrow q$ | | | |
| 40. $A \rightarrow p, q ; B \rightarrow p, q ; C \rightarrow r, s ; D \rightarrow r$ | | | |

MATHEMATICS

- | | | | |
|---|--------|---|-------------|
| 41. 2 | 42. 6 | 43. 1 | 44. 3 |
| 45. 5 | 46. 7 | 47. 5 | 48. 8 |
| 49. CD | 50. BD | 51. AD | 52. BC |
| 53. BD | 54. CD | 55. BD | 56. A,B,C,D |
| 57. AB | 58. D | 59. $A \rightarrow s ; B \rightarrow p ; C \rightarrow q ; D \rightarrow r$ | |
| 60. $A \rightarrow s ; B \rightarrow p ; C \rightarrow q ; D \rightarrow r$ | | | |

FITJEE RET – 6

(2018 – 2020)(1ST YEAR_REGULAR)

IIT-2015 (P1)_SET-B

DATE: 23.07.2018

Time: 3 hours

Maximum Marks: 264

INSTRUCTIONS:

A. General

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

B. Filling in the OMR:

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

C. Question paper format:

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

D. Marking Scheme

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

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

If you mark the answers in question booklet, you will not be allowed to continue the exam.

NAME:

ENROLLMENT NO.:

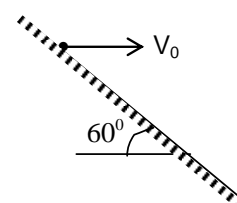
PAPER-I
PART I: PHYSICS
SECTION 1 (Maximum Marks: 32)

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

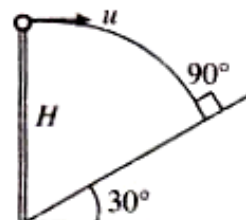
1. Two particles P and Q move with constant velocities $v_1 = 2 \text{ ms}^{-1}$ and $v_2 = 4 \text{ ms}^{-1}$ along two mutually perpendicular straight lines towards the intersection point O. At moment $t=0$, the particles were located at distances $l_1 = 12\text{m}$ and $l_2 = 19\text{m}$ from O, respectively. Find the time when they are nearest (in seconds)

2. A train is moving along a straight line with a constant acceleration a . A boy standing in the train throws a ball forward with a speed of 10 ms^{-1} , at an angle of 60° to the horizontal. The boy has to move forward by 1.15m inside the train to catch the ball back to the initial height. The acceleration of the train, in ms^{-2} , is

3. A ball is projected horizontally from an inclined plane with a velocity v_0 as shown in the figure. It will strike the plane after a time $2\sqrt{n} \frac{v_0}{g}$. Calculate the value of 'n'



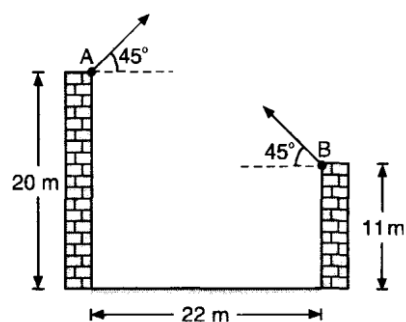
4. In fig, Find the horizontal velocity u (in ms^{-1}) of a projectile so that it hits the inclined plane perpendicularly. Given $H = 6.25 \text{ m}$



5. 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 ?

Space for rough work

6. A person walks up a stationary 15m long escalator in 90s. When standing on the same escalator, now moving the person is carried up in 60s. The time in seconds, would it takes for the person to walk up the moving escalator is $6x$, where x is
7. A sailor in a boat, which is going due east with a speed of 8 ms^{-1} observes that a submarine is heading towards north at a speed of 12 ms^{-1} and sinking at a rate of 2 ms^{-1} . The commander of submarine observes a helicopter ascending at a rate of 5 ms^{-1} and heading towards west with 4 ms^{-1} . Find the speed of the helicopter with respect to boat, is $(10 + P)\text{ms}^{-1}$, where P is
8. Two particles are simultaneously thrown from the roofs of two high buildings as shown in figure. Their velocities are $v_A = 2\text{ms}^{-1}$ and $v_B = 14 \text{ ms}^{-1}$ respectively. Calculate the minimum distance (in metre) between the particles in the process of their motion.



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. A horizontal wind is blowing with a velocity v towards north-east. A man starts running towards north with acceleration a . The time after which man will feel the wind blowing towards east is

(A) $\frac{v}{a}$ (B) $\frac{\sqrt{2}v}{a}$ (C) $\frac{v}{\sqrt{2}a}$ (D) $\frac{2v}{a}$

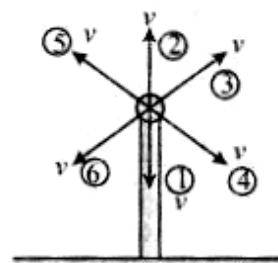
Space for rough work

10. A stationary person observes that rain is falling vertically down at 30 kmh^{-1} . A cyclist is moving up on an inclined plane making an angle 30° with horizontal at 10 kmh^{-1} . In which direction should the cyclist hold his umbrella to prevent himself from the rain?

- (A) At an angle $\tan^{-1}\left(\frac{3\sqrt{3}}{5}\right)$ with inclined plane (B) At an angle $\tan^{-1}\left(\frac{3\sqrt{3}}{5}\right)$ with horizontal
 (C) At an angle $\tan^{-1}\left(\frac{\sqrt{3}}{7}\right)$ with inclined plane (D) At an angle $\tan^{-1}\left(\frac{\sqrt{3}}{7}\right)$ with vertical

11. All the particles thrown with same initial velocity would strike the ground.

- (A) with same speed
 (B) simultaneously
 (C) time would be least for the particle thrown with velocity v downward i.e., particle 1
 (D) time would be maximum for the particle 2

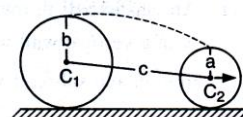


12. Two particles A and B are thrown up simultaneously from the edge of a cliff with initial speeds v and $2v$. Assuming that the particle A comes to rest immediately after striking the ground, the variation in relative position of the particle B with respect to the particle A with time, till both the stones strike the ground is plotted. This variation plot is

- (A) only linear (B) only parabolic
 (C) first parabolic then linear (D) first linear then parabolic

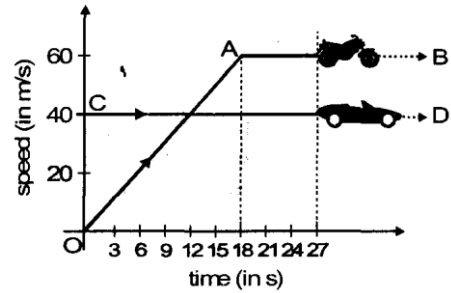
13. The radii of the front and rear wheels of a carriage are a , b respectively and c is the distance between the centres C_1 and C_2 of the wheels. If a particle escapes from the top of a rear wheel and strikes at the top of the front wheel. Find the time of its flight is

- (A) $\sqrt{\frac{(b-a)}{2g}}$ (B) $\sqrt{\frac{2(b-a)}{g}}$
 (C) $\sqrt{\frac{4(b-a)}{g}}$ (D) $\sqrt{\frac{(b-a)}{4g}}$



Space for rough work

14. At the instant a motor bike starts from rest in a given direction, a car overtakes the motor bike, both moving in the same direction. The speed time graphs for motor bike and car are represented by OAB and CD respectively. Then
- (A) at $t = 18\text{s}$ the motor bike and car are 180 m apart
 (B) at $t = 18\text{s}$ the motor bike and car are 720 m apart
 (C) the relative distance between motor bike and car reduces to zero at $t = 27\text{s}$ and both are 1080m far from origin
 (D) the relative distance between motor bike and car always remains same



15. Ship A is located 4km north and 3km east of ship B. Ship A has a velocity of 20 kmh^{-1} towards the south and ship B is moving at 40 kmh^{-1} in a direction 37° north of east. X and Y axes are along east and north directions, respectively
- (A) Velocity of A relative to B is $-32\hat{i} - 44\hat{j}$
 (B) Position of A relative to B as a function of time is given by $\vec{r}_{AB} = (3 - 32t)\hat{i} + (4 - 44t)\hat{j}$
 (C) Velocity of A relative to B is $32\hat{i} - 44\hat{j}$
 (D) Position of A relative to B as a function of time is given by $(32t\hat{i} - 44t\hat{j})$
16. An aeroplane flies along a straight line from A to B with a speed v_0 and back again with the same speed v_0 . A steady wind v is blowing. If $AB = \ell$ then
- (A) total time for the trip is $\frac{2v_0\ell}{v_0^2 - v^2}$, if wind blows along the line AB
 (B) total time for the trip is $\frac{2\ell}{\sqrt{v_0^2 - v^2}}$, if wind blows perpendicular to the line AB
 (C) total time for the trip decreases because of the presence of wind
 (D) total time for the trip increases because of the presence of wind

Space for rough work

17. Rain appears to fall vertically to a man walking at 3 kmh^{-1} but when he changes his speed to double, the rain appears to fall at 45° with vertical. Study the following statements and find which of them are correct.
- (A) Velocity of rain is $2\sqrt{3} \text{ kmh}^{-1}$
- (B) The angle of fall of rain (with vertical) is $\theta = \tan^{-1}\left(\frac{1}{\sqrt{2}}\right)$
- (C) The angle of fall of rain (with vertical) is $\theta = \sin^{-1}\left(\frac{1}{\sqrt{2}}\right)$
- (D) Velocity of rain is $3\sqrt{2} \text{ kmh}^{-1}$
18. When a man moves down the inclined plane with a constant speed 5 ms^{-1} which makes an angle of 37° with the horizontal, he finds that the rain is falling vertically downward. When he moves up the same inclined plane with the same speed, he finds that the rain makes an angle $\theta = \tan^{-1}\left(\frac{7}{8}\right)$ with the horizontal. The speed of the rain is
- (A) $\sqrt{116} \text{ ms}^{-1}$ (B) $\sqrt{32} \text{ ms}^{-1}$ (C) 5 ms^{-1} (D) $\sqrt{73} \text{ ms}^{-1}$

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.

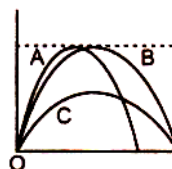
+2	If only the bubble(s) corresponding to all the correct match (s) is (are) darkened.
0	If none of the bubbles is darkened.
-1	In all other cases.

Space for rough work

19. The path of projectile is represented by $y = Px - Qx^2$

Column – I		Column – II	
(A)	Range	(p)	P/Q
(B)	Maximum height	(q)	P
(C)	Time of flight	(r)	$P^2 / 4Q$
(D)	Tangent of angle of projection is	(s)	$\sqrt{\frac{2}{Qg}}P$
		(t)	None

20. Trajectories are shown in figure for three kicked football, initial vertical and horizontal velocity components are u_y and u_x respectively. Ignoring air resistance, choose the correct statement from column – 2 for the value of variable in column – 1



Column – I		Column – II	
(A)	Time of flight	(p)	greatest for A only
(B)	u_y / u_x	(q)	greatest for C only
(C)	u_x	(r)	equal for A and B
(D)	$u_x u_y$	(s)	equal for B and C
		(t)	None

Space for rough work

PART II: CHEMISTRY
SECTION 1 (Maximum Marks: 32)

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

+4 If the bubble corresponding to the answer is darkened.
0 In all other cases.

21. The mass of CO_2 formed by the decomposition of 1g CaCO_3 is x. Then the value of 7x is
22. The no. of protons present in 10gm CaCO_3 is $x.N_A$. Then the value of x is ..
23. The mass of carbon present in 0.5 mole of $\text{K}_4[\text{Fe}(\text{CN})_6]$ is 'x'. Then $\frac{x}{9}$ is. (Atomic mass of Fe = 56)
24. Calculate the no. of mole of water in 488 g $\text{BaCl}_2 \cdot 2\text{H}_2\text{O}$ (Ba = 137)
25. How many gram ions of SO_4^{2-} are present in 1.25 mole of $\text{K}_2\text{SO}_4 \cdot \text{Al}_2(\text{SO}_4)_3 \cdot 24\text{H}_2\text{O}$.
26. For the reaction $\text{A} + 2\text{B} \rightarrow \text{C}$, 5 mole of A and 8 mole of B will produce "x" mole of C. Then 'x' is
27. If 10 mole of BaCl_2 is mixed with 2 mole of Na_3PO_4 . The maximum number of mole of $\text{Ba}_3(\text{PO}_4)_2$ that can be formed is ...
28. On analysis a certain compound was found to contain Iodine and oxygen in the ratio 254g of Iodine and 80g of oxygen. (I = 127, O = 16). The formula of compound is I_2O_x . Here x is

SECTION 2 (Maximum Marks: 40)

- ◆ This section contains **TEN** questions.
- ◆ Each question has **FOUR** options (A), (B), (C) and (D). **ONE OR MORE THAN ONE** of these four option(s) is (are) correct.
- ◆ For each question, darken the bubble(s) corresponding to all the correct option(s) in the ORS.
- ◆ Marking scheme:

+4 If only the bubble(s) corresponding to all the correct option(s) is (are) darkened.
0 If none of the bubbles is darkened.
-2 In all other cases

Space for rough work

29. Total no. of neutrons present in 1.7gm of NH_3
 (A) 6.023×10^{23} (B) 6.023×10^{24} (C) 4.361×10^{23} (D) 4.361×10^{24}
30. Calculate the amount of lime that can be produced by heating 100 g of 90% pure limestone :
 (A) 50.4 g (B) 0.98 mole (C) 0.9 mole (D) 56 g
31. 1.5 g of oxygen is produced by heating KClO_3 . How much KCl is produced in the reaction ?
 (A) 3.125×10^{-2} mole (B) 2.29 g (C) 1.78×10^{-2} mole (D) 1.33 g
32. In which of the following pairs do 1g of each have an equal number of molecules ?
 (A) N_2O and CO (B) N_2 and C_3O_2 (C) N_2 & CO (D) N_2O and CO_2
33. An oxide of nitrogen has 30.43% nitrogen (At. wt. of $\text{N} = 14$) and its one molecule weighs 1.527×10^{-22} g .
 Which of the following statement regarding the oxide is (are) true?
 (A) its empirical formula is N_2O (B) Its empirical formula is NO_2
 (C) its molecular formula is N_2O_4 (D) its molecular formula is N_4O_2
34. Which is/are correct statements about 1.7g of NH_3 :
 (A) It contain 0.3 mol H-atom (B) It contain 2.408×10^{-23} atoms
 (C) Mass % of hydrogen is 17.65% (D) it contains 0.3 mol N-atom
35. If 27g of Carbon is mixed with 88g of Oxygen and is allowed to burn to produce CO_2 , then :
 (A) Oxygen is the limiting reagent (B) Volume of CO_2 gas produced at NTP is 50.4 L
 (C) C and O combine in mass ratio 3 : 8. (D) Volume of unreacted O_2 at STP is 11.2 L
36. For the following reaction : $\text{Na}_2\text{CO}_3 + 2\text{HCl} \longrightarrow 2\text{NaCl} + \text{CO}_2 + \text{H}_2\text{O}$
 106.0g of Na_2CO_3 reacts with 109.5g of HCl
 Which of the following is/are correct.
 (A) The HCl is in excess (B) 117.0g of NaCl is formed.
 (C) The volume of CO_2 produced at NTP is 22.4 L
 (D) None of these
37. $\text{A} + \text{B} \rightarrow \text{A}_3\text{B}_2$ (unbalanced) ; $\text{A}_3\text{B}_2 + \text{C} \rightarrow \text{A}_3\text{B}_2\text{C}_2$ (unbalanced)
 Above two reactions are carried out by taking 3 moles each of A and B and one mole of C. Then which option is/are correct?
 (A) 1 mole of $\text{A}_3\text{B}_2\text{C}_2$ is formed (B) 1/2 mole of $\text{A}_3\text{B}_2\text{C}_2$ is formed
 (C) 1/2 mole of A_3B_2 is formed (D) 1/2 mole of A_3B_2 is left finally
38. 18g of H_2O has the same number of electrons as
 (A) 20g of calcium (B) 2 moles of boron
 (C) 0.5 mole of CO_2 (D) 11.2 L of NH_3

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)
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- ◆ 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)	1.6 g CH ₄	(p)	0.1 mol
(B)	1.7g NH ₃	(q)	6.023×10^{23} electrons
(C)	HCHO	(r)	40% carbon
(D)	C ₆ H ₁₂ O ₆	(s)	Vapour density = 15

40.

Column – I		Column – II	
(A)	Vapour density	(p)	Unitless
(B)	Mole	(q)	1 mol electrons
(C)	12g carbon	(r)	Collection of 6.023×10^{23} atoms
(D)	96500 Coulombs	(s)	Molecular mass $\times \frac{1}{2}$

Space for rough work

PART III: MATHEMATICS
SECTION 1 (Maximum Marks: 32)

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

+4 If the bubble corresponding to the answer is darkened.
0 In all other cases.

41. Two vertices of a triangle are $(3, -2)$ and $(-2, 3)$ and its orthocenter is $(-6, 1)$. If its third vertex is (a, b) , then $a + b =$
42. A point 'A' divides the join of $P(-5, 1)$ and $Q(3, 5)$ in the ratio $k : 1$. Then the integral value of k for which the area of $\triangle ABC$, where B is $(1, 5)$ and C is $(7, -2)$, is equal to 2 units in magnitude is
43. The distance between the circumcentre and the orthocenter of the triangle whose vertices are $(0, 0)$, $(6, 8)$ and $(-4, 3)$ is L . Then the value of $\frac{2}{\sqrt{5}} L$ is
44. If the area of the triangle formed by the points $(2a, b)$, $(a + b, 2b + a)$ and $(2b, 2a)$ is 2 sq. units, then the area of the triangle whose vertices are $(a + b, a - b)$, $(3b - a, b + 3a)$ and $(3a - b, 3b - a)$ will be
45. Determine 'x' so that the line passing through $(3, 4)$ and $(x, 5)$ makes an angle of 135° with the positive direction of x-axis
46. The sum of squares of sides of a triangle is 8 then the sum of squares of medians of the triangle is
47. If t_1, t_2, t_3 are distinct and the points $(t_1, 2at_1 + at_1^3)$, $(t_2, 2at_2 + at_2^3)$, $(t_3, 2at_3 + at_3^3)$ are collinear, then the value of $t_1 + t_2 + t_3 + 1$ is
48. The vertices of a triangle are $(0, 3)$, $(-3, 0)$ and $(3, 0)$. The sum of the coordinates of the orthocenter is

Space for rough work

SECTION 2 (Maximum Marks: 40)

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

49. If $(-4, 0)$ and $(1, -1)$ are two vertices of a triangle of area 4sq. units, then its third vertex lies on
 (A) $y = x$ (B) $5x + y + 12 = 0$ (C) $x + 5y - 4 = 0$ (D) $x + 5y + 12 = 0$
50. The area of triangle ABC is 20cm^2 . The coordinates of vertex A are $(-5, 0)$ and those of B are $(3, 0)$. The vertex C lies on the line $x - y = 2$. The coordinates of C are
 (A) $(5, 3)$ (B) $(-3, -5)$ (C) $(-5, -7)$ (D) $(7, 5)$
51. The points $A(0, 0)$, $B(\cos \alpha, \sin \alpha)$, and $C(\cos \beta, \sin \beta)$ are the vertices of a right-angled triangle if
 (A) $\sin \frac{\alpha - \beta}{2} = \frac{1}{\sqrt{2}}$ (B) $\cos \frac{\alpha - \beta}{2} = -\frac{1}{\sqrt{2}}$ (C) $\cos \frac{\alpha - \beta}{2} = \frac{1}{\sqrt{2}}$ (D) $\sin \frac{\alpha - \beta}{2} = -\frac{1}{\sqrt{2}}$
52. The ends of a diagonals of a square are $(2, -3)$ and $(-1, 1)$. Another vertex of the square can be
 (A) $\left(-\frac{3}{2}, -\frac{5}{2}\right)$ (B) $\left(\frac{5}{2}, \frac{1}{2}\right)$ (C) $\left(\frac{1}{2}, \frac{5}{2}\right)$ (D) none of these
53. The vertices of a variable triangle are $(3, 4)$, $(5 \cos \theta, 5 \sin \theta)$ and $(5 \sin \theta, -5 \cos \theta)$, where $\theta \in \mathbb{R}$. The locus of its orthocenter is
 (A) $(x + y - 1)^2 + (x - y - 7)^2 = 100$ (B) $(x + y - 7)^2 + (x - y - 1)^2 = 100$
 (C) $(x + y - 7)^2 + (x + y - 1)^2 = 100$ (D) $(x + y - 7)^2 + (x - y + 1)^2 = 100$
54. A variable line through point $P(2, 1)$ meets the axes at A and B. Find the locus of the circumcentre of triangle OAB (where O is the origin)
 (A) $x - 2y - 2xy = 0$ (B) $\frac{1}{y} - \frac{2}{x} = 2$ (C) $x + 2y - 2xy = 0$ (D) $\frac{1}{y} + \frac{2}{x} = 2$

Space for rough work

55. Find the equation to which the equation $x^2 + 7xy - 2y^2 + 17x - 26y - 60 = 0$ is transformed if the origin is shifted to the point $(2, -3)$, the axes remaining parallel to original axis.
 (A) $x^2 - 7xy - 2y^2 - 4 = 0$ (B) $x^2 + 7xy - 2y^2 - 4 = 0$
 (C) $2y^2 + 7xy - x^2 + 4 = 0$ (D) $2y^2 - 7xy - x^2 + 4 = 0$
56. Area of the parallelogram formed by the lines $y = mx$, $y = mx + 1$, $y = nx$ and $y = nx + 1$ equals
 (A) $\frac{|m+n|}{|m^2-n^2|}$ (B) $\frac{|m-n|}{|m^2-n^2|}$ (C) $\frac{1}{|m+n|}$ (D) $\frac{1}{|m-n|}$
57. If $A(a, a)$, $B(-a, -a)$ are two vertices of an equilateral triangle then its third vertex is
 (A) $\left(\frac{a\sqrt{3}}{2}, \frac{-a\sqrt{3}}{2}\right)$ (B) $(-a\sqrt{3}, a\sqrt{3})$ (C) $(a\sqrt{3}, -a\sqrt{3})$ (D) $(-a\sqrt{3}, -a\sqrt{3})$
58. Medians AD and BE of the triangle with vertices $A(0, b)$, $B(0, 0)$ and $C(a, 0)$ are mutually perpendicular if
 (A) $b = a\sqrt{2}$ (B) $a = b\sqrt{2}$ (C) $b = -a\sqrt{2}$ (D) $a = -b\sqrt{2}$

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

59. Consider the triangle whose vertices are $(0, 0)$, $(5, 12)$ and $(16, 12)$. Match the following

Column I		Column II	
(A)	Centroid of the triangle	p.	$\left(\frac{21}{2}, \frac{8}{3}\right)$
(B)	Circumcentre of the triangle	q.	$(7, 9)$
(C)	Incentre of the triangle	r.	$(27, -21)$
(D)	Excentre opposite to vertex $(5, 12)$	s.	$(7, 8)$

60. Match the following

Column I		Column II	
(A)	Locus of the point $(\cos^2 t, 2 \sin t)$ where 't' is a variable is	p.	$y^2 = 4x + 1$
(B)	Locus of a point whose coordinates are given by $x = t + t^2$, $y = 2t + 1$, where 't' is a variable is	q.	$x^2 + y^2 = a^2 + b^2$
(C)	Locus of point of intersection of lines $x \cos \alpha + y \sin \alpha = a$, $x \sin \alpha - y \cos \alpha = b$, where α is variable	r.	$x^2 - y^2 = 16xy$
(D)	Locus of the point $(\tan t + \sin t, \tan t - \sin t)$ is	s.	$y^2 + 4x = 4$

Space for rough work

FIITJEE RET – 6

(2018 – 2020)(1ST YEAR_REGULAR)

IIT-2015 (P1)_SET-B

DATE: 23.07.2018

ANSWERS

PHYSICS

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

CHEMISTRY

- | | | | |
|--------------------------------------|----------|--|-------------|
| 21. 3 | 22. 5 | 23. 4 | 24. 4 |
| 25. 5 | 26. 4 | 27. 1 | 28. 5 |
| 29. C | 30. A, C | 31. A, B | 32. C, D |
| 33. B, C | 34. A, C | 35. B, C, D | 36. A, B, C |
| 37. B, D | 38. A, B | 39. A → p, q ; B → p, q ; C → r, s ; D → r | |
| 40. A → p, s ; B → r ; C → r ; D → q | | | |

MATHEMATICS

- | | | | |
|--------------------------------|--------|--------------------------------|--------|
| 41. 5 | 42. 7 | 43. 5 | 44. 8 |
| 45. 2 | 46. 6 | 47. 1 | 48. 3 |
| 49. CD | 50. BD | 51. A,B,C,D | 52. AB |
| 53. D | 54. CD | 55. BD | 56. AD |
| 57. BC | 58. BD | 59. A → s; B → p; C → q; D → r | |
| 60. A → s; B → p; C → q; D → r | | | |